Proceedings Book
13th ICEEE-2022
International Annual Conference

"Global Environmental Development & Sustainability: Research, Engineering & Management"

November 17, 2022 – November 18 2022

Óbuda University
Budapest, Hungary

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The 13th ICEEE-2022

2-DAY EVENT Online

International Annual Conference on "Global Environmental Development & Sustainability: Research, Engineering & Management"

PROCEEDINGS BOOK

(PROGRAM, ABSTRACT & Full Papers)

Venue:
Óbuda University
Budapest, Hungary

Date:
November 18 - 19, 2021

Editor-in-Chief
Prof. Dr. Hosam BAYOUMI HAMUDA

13th ICEEE–2022 International Annual Conference on

"Global Environmental Development & Sustainability: Research, Engineering & Management"

In light of the unprecedented circumstances, and the uncertainty due to the travel restrictions imposed by different countries, the Organizing Committee has made the decision to hold the Conference virtually.

Online
November 17^{h} – 18th, 2022
RKK – Óbuda University
Budapest, Hungary

Content

INVITATION

Dear Colleagues and Friends
Welcome!
With the progress of global Environmental Innovation, and to face the global environmental problems, the ***International Council of Environmental Engineering Education (ICEEE) in cooperation with Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, as well as the Hungarian Soil Science Society – Session of Soil Biology*** cordially invites you to participate in ***13th ICEEE-2022 Online International Annual Conference*** on "***Global Environmental Development & Sustainability: Research, Engineering & Management***" at Óbuda University on November 17-18, 2022.
On behalf of the organizing committee, it is an honour to welcome you to attend this event and deliver a talk on **your research interest.**
All papers will be peer-reviewed after submission, & accepted papers will be published in Conference Proceedings Book with ISBN **978-963-449-297-9**. After publishing, all accepted papers will be submitted for indexed in **indexed scientific websites**. For more information, please visit our website: www.iceee.hu

CONFERENCE HIGHLIGHT TOPICS

Session (A) Healthcare: Risk & Management:
Session (B) Soil Biology & Land Uses
Session (C) Physicochemical Properties of Water & Sediments
Session (D) Circular Economy Strategy and Waste Management:
Session (E) Waste Management
Session (F) Atmospheric Pollution Assessment:
Session (G) Ecosystems & Landscape for Future Generations:
Session (H) Environmental Sciences:
Session (I) Natural Sciences:
Session (J) Sustainable Energy Research & Applications:
Session (K) Effects of Sustainable Development on:

Yours Sincerely

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rof. Dr. Hosam Bayoumi Hamuda
Conference Chair
President of ICEEE
Óbuda University
Budapest-Hungary
E-mail: bayoumi.hosam@rkk.uni-obuda.hu
Mobile: +36303900813

INTRODUCTION

Today despite poverty rates declining by 35% since 1990, poverty is still an issue that ravages around 10% of the world population. The United Nations estimates that more than 700 million people, or 10% of the world population, live in extreme poverty or cannot fulfill the most basic needs including health, education, access to water, and sanitation. In response to this, the goal of the UN's Sustainable Development Goal 1 is to eradicate poverty in all its forms, leaving no one behind.

As a result, the UN's Sustainable Development Goal 1 is to 'eradicate extreme poverty for all people everywhere by 2030. To solve this problem, it is important to clean the global environment (Atmosphere, Lithosphere, and Hydrosphere) from inorganic and organic pollutants and increase human healthcare.

For the UN to achieve this goal, the ICEEE organization is joining the cause, organizing international conferences and symposia, collecting research, and publishing a lot of high-quality ISBN code up-to-date International Proceedings Books since 2010, all aimed at researchers, policymakers, practitioners, and anyone else actively working towards this goal of Sustainability and Development of the environment.

This objective can be done only by joining together to secure the future for our children and the next generations and the changes can happen fast for the best through the Global Movement for Sustainable Consumption and Production against Pollution, Deforestation, and Environmental Degradation as well as the Integration between the activities of the Education, Sciences, and Economy in Modern Environment.

The Economics of Ecosystems and Biodiversity is an initiative hosted by the United Nations Environment Program that encompasses various research and capacity-building projects. Similarly, the ICEEE focuses on the holistic evaluation of environmental control, agriculture, and food systems along their value chains and including their most significant externalities. This scientific foundation addresses the core theoretical issues and controversies underpinning the evaluation of the nexus between environmental pollution, the agri-food sector, biodiversity and ecosystem services, and externalities including human health impacts from agriculture on a global scale.

We are all part of the global ecosystem. For current and future generations, this is a shared responsibility upon which we, as a global community, simply must act to better understand the impacts of environmental systems, address the most harmful practices, and indicates new positive pathways forward, together. The 13th ICEEE-2022 Conference now gives us a potent means by which to do that. It is our hope, through collective effort and broad-based support, that the 13th ICEEE-2022 Conference will realize its potential as a formidable tool for change in our urgent pursuit of ecosystems that are truly sustainable, secure, and equitable.

The world's ecosystems face two immense challenges today. The first is to produce enough food to nourish a global population of more than 7 billion people without harming the environment. The second is to make sure ecosystems deliver nutrition to everyone, particularly the world's poorest, and many of whom suffer from chronic under-nutrition and also live without a clean environment.

This Conference aims to support the design of sustainable and equitable ecosystems for the future. The way we are currently producing food and clean ecosystems is negatively impacting climate, water, top soil, biodiversity and marine environments. If we do not change course, we will seriously undermine our ability to deliver adequate food and clean environment for future populations.

In addition to the negative environmental impacts, we are struggling to deliver clean and healthy ecosystems in an equitable way. Thousands of farmers are now turning to zero-budget natural farming, replacing chemical fertilizers and pesticides with natural inputs. It is rejuvenating soil, delivers higher yields, and improves biodiversity. Re-designing clean ecosystems that do no harm to the environment, improve nutrition and good health for all, and ensure decent work, is at the heart of this scientific program. This Conference (the 13th ICEEE-2022) authored by experts from around the world, provides a clear set of recommendations on designing and evaluating environmental systems for their impact on nature and human health.

In 2015, UN Member States endorsed two global agreements: the 2030 Agenda for Sustainable Development and the Paris Agreement on Climate Change. Both agreements are highly ambitious and require far-reaching commitments and action from all countries of the world for their successful implementation. The 2030 Agenda for Sustainable Development, with its 17 Sustainable Development Goals (SDGs), states that: "All countries and all stakeholders, acting in collaborative partnership, will implement this plan. We are resolved to free the human race from the tyranny of poverty and want and to heal and secure our planet. We are determined to take the bold and transformative steps which are urgently needed to shift the world on to a sustainable and resilient path.
As we embark on this collective journey, we pledge that no one will be left behind" ("UN 2015). The Paris (2015) and Glasgow (2021) Agreements on Climate Change sets out a global action plan to limit global temperature increase to well below 2°C. Having agreed upon actions necessary to mitigate climate change and to adapt to changing climatic conditions, the Paris and Glasgow Agreements also refer to necessary financial support to developing countries and for technology transfer. Both agreements have very often been characterized as a global plan of action for people, planet and prosperity.
One thing is clear: the main messages coming out of the 2030 Agenda and the Paris and Glasgow Agreements are that business as usual is not an option! Therefore, clear strategies for transformative action towards sustainability are needed; these agreements now require implementation at all levels. When it comes to their implementation at both global and national levels, energy and food are often identified as the two most important issues which are crucial for the success or failure of these two agreements. Without transforming the way we produce energy, and the way we produce and consume food, as well as ways of earth protection, these international agendas will not be achieved. Energy and food are not only fundamental for the everyday life of every single person; they also have far reaching impacts on the human, social and environmental fabric of our planet. Regarding the future of global energy systems, a consensus is emerging that renewable energies will play a decisive role in supplying sustainable energy. There are a range of issues related to this, including complex technical questions, financing for investments, the vested interests of coal, oil and gas companies, countries with high revenues from fossil fuels which face the problem of how to generate alternative income, employment and social stability, and also issues of a geopolitical nature.
Nevertheless, it is clear that emissions from burning fossil fuels have to be cut drastically and that renewable energy sources are a key to a sustainable future. Protection of the Planet, agriculture and food production, energy, etc., however, is much more complex arena. For example, there are many different production systems, food is produced over a broad range of agroecological zones, and the cultural heritage and value of agriculture and food systems should not be underestimated. Agriculture is by far the largest employer in the world, employing more than 1.5 billion people, including landless workers, farmers, family members and migrants working to produce food. In contrast to this huge number of people earning their living through agriculture, the globalization and concentration of multinational food industry has reached an all-time high; multi-billion-dollar mergers are happening and input providers (e.g. agricultural chemicals, seeds) are becoming a dominant global power.
The impact of today's agriculture and ecosystems on natural resources is enormous: globally, agriculture is responsible for using 70% of all freshwater withdrawn from the natural cycle, for causing 60% of all biodiversity loss, and for creating large-scale land degradation. On the other hand, the world of today is

producing more food than ever to feed all people. Despite this, over 800 million are hungry and food-related lifestyle diseases such as obesity and diabetes are on the rise. At the same time, 1/3 of all agricultural produce, around 1.3 billion tons every year, ends up as food waste or loss. The SDGs will not be achieved without a transformation of the way we are producing, processing, distributing and consuming food. Humankind nourished itself for 2.5 million years by hunting wild animals and gathering plants they could find in the environment. Finally, agriculture has fundamentally altered the face of the earth. Population growth as we know it today, division of labour, development of all kinds of technologies and urbanization, would not have been possible without the agricultural revolution and environmental protection.

Today we are producing 90% of all calories from a handful of plant species based on the domestication initiated successfully by our ancestors between the years 9,500 and 3,500 BC. 10,000 years ago, only a few million sheep, cows, goats and chicken were living on the planet; today the estimate is that a billion sheep, more than a billion cows and around 25 billion chickens are reared to produce protein for more than 7.5 billion people. Producing crops and animals to feed a growing population had and still has a huge impact on our planet. The activities of humankind have already transgressed what is considered as safe operating space for humanity and the biophysical state which so far has supported our modern life.

Emissions of CO_2, biodiversity loss, N and P overload are the first areas where we are transgressing planetary boundaries. One cannot deny it: clean ecosystem and food production is one of the most important drivers of change on our planet.

The task for agriculture and food production as well as the clean ecosystems in the years to come is huge: feeding a population projected to reach 10 billion in 2050, achieving the 4 dimensions of food security (FAO 1996) for all people by providing healthy food and environment, drastically reducing the impacts of different types of agricultural production on the world's ecosystems, reducing greenhouse gas emissions to limit climate change and to adapt to it, developing rural areas to create jobs and to improve livelihoods of poor people, maintaining ecosystem services such as clean water and air for a rapidly urbanizing planet are only some of the challenges.

Tackling these challenges requires a systematic approach. So far food production has successfully been increased, but the environmental impacts have received a lot less attention. They have been either ignored or been considered as a necessary trade-off. A comprehensive analysis of the whole eco-agro-food systems including social equity and jobs, health and environmental impacts has not been developed.

We consider the 13th ICEEE-2022 International Conference is an important contribution to the transformation of agriculture and food production as well as protection of the global environment systems. In this conference, you will find the collective legacy of the broad and diverse community of experts: a systems approach for bringing together the various disciplines and perspectives related to agriculture and food production and the protection of our ecosystems, a framework for evaluation that supports the comprehensive, universal and inclusive assessment of protection of atmosphere, hydrosphere, lithosphere and biotic systems, a set of methodologies and tools for the measurement of positive and negative externalities, and a theory of change to help integrate the 13th ICEEE-2022 Conference into the wide landscape of platforms and initiatives, like the SDGs, that are tackling these complex issues.

Only on the basis of such a complex and comprehensive analysis can a transformation towards sustainable food production and protection of our ecosystems take place. We will have to radically reduce the Preface harmful environmental impacts of global ecosystems while seeking to produce healthier and more accessible healthy food production and clean environment, simultaneously improving the livelihoods and security of vulnerable people and maintaining life-supporting services for humankind.

The 13th ICEEE-2022 marks the beginning of many things: of an analysis to inform scientists researchers, civil society, healthcare specialists, environmentalists, businesses, policymakers, farmers and consumers,

of a new and unique approach for evaluating agricultural and food production, clean and clear water and air systems, of an emerging community of practice dedicated to uncovering the hidden costs and benefits, i.e. the negative as well as the positive externalities of clean environment including the agriculture and food production, and, importantly, of the timely opportunity for us to work collaboratively toward a shared set of goals and ambitions for future generations.
As the President of ICEEE and the chair of 13th ICEEE-2022 International Conference, I want to thank all my colleagues (more than 100 from over 20 countries) having worked very hard in the last months to contribute to this conference in Environment protection
Now I hope that you, the reader, will get new ideas and inspiration on how to achieve really sustainable agriculture and food production as well as the protection of ecosystems to feed a world with 10 billion people and protect their lifestyle.

I hope that it provides useful insights to national and international planners, environmentalists, farmers and agriculturists, public health and healthcare specialists, citizens, etc. thereby strengthening the links between health, prosperity and the protection of our planet.

This Proceedings Book describes the latest advances, innovations and applications in the field of environmental protection and waste management as presented by leading researchers, engineers and practitioners at the International Annual Conference on *Global Environmental Development & Sustainability: Research, Engineering & Management (*13th ICEEE-2022), held now in Budapest, Hungary during November 17-189, 2022. It providing a unique overview of new directions and opportunities for sustainable and resilient design approaches to protect the environment, it discusses diverse topics related to environmental protection and management of waste, through the eco-friendly re-use and processing of waste materials, the management and disposal of residual wastes, to water treatments and technologies. It also encompasses strategies for reducing waste through better design, improved recovery, re-use, more efficient resource management and the performance of materials recovered from wastes. The contributions were selected by means of a rigorous peer-review process and highlight many exciting ideas that will spur novel research directions and foster multidisciplinary collaboration among different waste management specialists.

I hope that this event will make a fruitful discussion within the participants and you are the support and cooperation of all.
Let us hope to meet personally in VII. International Symposium-2023 during May 4 – 5, 2023 and in the 14th ICEEE-2023
Budapest: 17th of November 2022.

Prof. Dr. Hosam Bayoumi Hamuda
Editor-in-Chief & Chairman, ICEEE

BIBLIOGRAPHIC INFORMATION

Editor and affiliation	Prof. Dr. Hosam E.A.F. Bayoumi Hamuda President of ICEEE Institute of Environmental Engineering & Natural Sciences Óbuda University
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Contact us	Prof. Dr. Hosam E.A.F. Bayoumi Hamuda President of ICEEE Institute of Environmental Engineering & Natural Sciences Óbuda University E-mail: bayoumi.hosam@uni-obuda.hu WhatsApp/viber/messenger: +36-30-390-0813

Organization

After a great successful of the last International Annual Conferences of ICEEE, with the progress of global Environmental Innovation, and to face the global environmental problems, the ***International Council of Environmental Engineering Education (ICEEE) in cooperation with Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, as well as the Hungarian Soil Science Society – Session of Soil Biology*** cordially invites you to participate in ***13th ICEEE-2022 Online International Annual Conference*** on "***Global Environmental Development & Sustainability: Research, Engineering & Management***" at Óbuda University on November 17-18, 2022.
On behalf of the organizing committee, it is an honour to welcome you to attend this event and deliver a talk on **your research interest.** Your prompt reply will be highly. All papers will be peer-reviewed after submission, & accepted papers will be published in Conference Proceedings Book with ISBN **978-963-449-297-9**. After publishing, all accepted papers will be submitted for indexed in **indexed scientific websites**. For more information, please visit the website: www.iceee.hu

The Conference is carrying out under the auspices of:

Prof. Dr. Levente KOVÁCS	Rector, Óbuda University
Presidency of the Conference	
Dr. László KOLTAI	Dean, Rejtő Sándor Faculty of Light Industry & Environmental Engineering
Dr. Rita BODÁNÉ-KENDROVICS	Director, Institute of Environmental Engineering & Natural Sciences
Prof. Dr. Hosam BAYOUMI HAMUDA	President, International Council of Environmental Engineering Education Chairman of Conference

Organising Committee
- Prof. Dr. Hosam BAYOUMI HAMUDA (Óbuda University, Hungary)
- Dr. Rita BODÁNÉ-KENDROVICS (Óbuda University, Hungary)
- Dr. Ágnes BÁLINT (Óbuda University, Hungary)
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- Ms. Júlia KASZÁS (Óbuda University, Hungary

Scientific Committee

CONFERENCE HIGHLIGHT TOPICS

Form the above mentioned reasons, the special 13th. International Conference ICEEE-2022 on Environmental Sustainability and Development aims to provide a comprehensive perspective on changes in environmental quality affecting ecosystem & human health adopting global perspective concepts of climate change, modelling, & ecosystem services. For this purpose, valuable studies were gathered together for the special ICEEE-2022. The majority of the selected papers will be focused on the quality of environmental elements (air, landscape, soil, water, food, health, waste, & economics) as well as treatment & systems of management.

The Organizing Committee takes the honour to welcome all participants from pure & applied Environmental and Natural sciences to take part in this event. During the Conference, we intend to devote special interest to the following topics:

Session (A) Healthcare: Risk & Management:

– Bioengineering & Healthcare
– Clean Technologies for Healthy Biosphere
– Climate Change & Ecological Migration & Human Health
– COVID-19, Pandemic & Their Global Effects
– Environmental Epigenetics & Human Healthcare
– Health & Nutritional Therapy
– Infection & Drug Resistance
– Integrated disease management
– Obesity, Metabolic Syndrome, and Prediabetes
– Probiotics & Human Health
– Probiotics & COVID-19, HIV infection, Anti-carcinogenic Diseases
– Prevalence, Knowledge & Potential Determinants of COVID-19
– Risk Management: Healthcare & Environmental Problems
– Vaccines Research & Development
– Vitamin D & Immunity Science

Session (B) Soil Biology & Land Uses

– Agricultural Activity Enhances CO_2 & CH_4 Emissions
– Detection & Analysis of Pesticides & Mycotoxins
– Dynamics Nutrient Cycling in Agroecosystems
– Effect of mycorrhizae on the plant growth
– Environmental Impact Assessment on Soil Pollution
– Fundamental Aspects of PGPR in Soil Quality
– Impacts of Biochar, Sewage Sludge & Compost on Soil Fertility & Plant Growth
– Impacts of Heavy Metals on Soil Biology & Crop Production
– Microbial Communities & Bioremediation of Oil-Contaminated Agricultural Soils
– Mobility of heavy metals & metalloids on Soil Biology
– Organic & Inorganic Pollutants in Soil
– Physicochemical Properties & Fertility Assessment of Soils
– Phytoremediation of Contaminated Soils

- Pollutants in the Plant – Rhizosphere System
- Soil Biological & Physical Properties & Ecosystem Processes
- Soil Biota, Ecosystem Services & Land Productivity
- Soil Carbon & Nitrogen Stocks & Storage of Soil Microbiome
- Soil Quality, Biocontrol & Produ
- Waste & wastewater management in agroecosystem using soil biotechnological aspects for soil protection, security, sustainable, health and biodiversity
- Xenobiotic Metabolism in Plants – Rhizosphere System

Session (C) Physicochemical Properties of Water & Sediments

- Assessment of Groundwater Hydrogeochemistry & Quality
- Assessment of Running & Potable Water Quality Parameters
- Biological & Microbiological Assessment of Surface & Groundwater
- Bioremediation of Water Sectors
- Chemical & Microbial Analysis of Potable Water
- Desalination & Water Treatment
- Environmental Factors & Phytoplankton in Surface Water
- Distribution Pattern of Metals in Water & Sediment
- Faecal Pollution in Water Bodies
- Heavy Metals in Surface Water & Their Ecotoxicological Implications
- Hydrobiology Sustainability
- Hydrogeological Engineering & Physicochemical Parameters in Surface Water
- Macro- & Microplastics in Running Water
- Membrane Technology, Process & System Design
- Multivariate Approaches & Water Quality
- Phosphorus & Nitrogen in Water Body
- Techniques to Recycle Wastewater
- Water Footprints
- Water & Wastewater Management
- Water Pollution & Treatment Technology
- Water Resources Planning & Management

Session (D) Circular Economy Strategy and Waste Management:

- Bioeconomy Industry
- Environmental Economics, Policy, Resources & Strategy
- Financial Globalization, Economic Growth & Environmental Sustainability
- Humanities & Social Science in Environment
- Sustainable Consumption & Education
- Consumer Packaged Goods
- Socioeconomic Risks of Extreme El Niño Event-Related Road Damages
- Social Innovation Ecosystems

Session (E) Waste Management

- Biogenic Municipal Waste & Biofuel Production
- Bioremediation & Management of Hazardous & Radioactive Waste

- Circular Economy Potential of Urban Organic Waste
- Ecotoxicological Evaluation & Treatment of wastewater
- Microbial Systems & Technology for Pollutant Removal
- Municipal Wastewater Treatment Plants & Environmental Management
- Residues of Biomass. Environmental Impact & Recycling
- Socio-Environmental Conflict: Mining & Industrial Wastes
- Sustainable Use & Waste Management of Plastics
- Textile Wastewater Treatment
- Waste Management (Air, Water, Soil, Industrial, etc.)

Session (F) Atmospheric Pollution Assessment:

- Assessment of Air Quality
- Effect of Transportation on air quality & Mobility
- Greenhouses & Gas Emissions
- Keeping Planet Clean: Contamination Control in the Industrial Environment
- Lichenoindication & Evaluation of Air Quality

Session (G) Ecosystems & Landscape for Future Generations:

- Food web biodiversity and community structure in Water Body
- Landscape Functional Zoning of Urban Protected Areas
- Landscape & Nature Protection
- Landscape Composition, Biodiversity & Natural Pest Control
- Landscape-Moderated Biodiversity Effects of Agri-Environmental Management
- Linking Agricultural Practice to Insect & Bird Populations
- Natural Resource & Biodiversity
- Nexus between Indigenous Ecological Knowledge & Ecosystem Services
- Society, Economy, & Sustainable Development
- Socio-Ecological Analysis for Sustainable Ecosystem Management
- Species Distribution Modelling under Global Climate Change
- Strategy for Conservation of Biodiversity & Landscape
- Urban ecosystems & ecosystem services

Session (H) Environmental Sciences:

- Artificial Intelligence in Environment
- Biomonitoring of Diesel-Contaminated Soil
- Civil, Structural, & Environmental Engineering
- Climate Change & Environmental Sustainability
- Desertification & drought
- Environmental Education
- Environmental Engineering, Sustainable Production & Eco-Innovations
- Environmental Degradation & Composting
- Environmental Management, Strategy, Standards & Social Responsibility
- Environmental Monitoring & Assessment
- Environmental Modelling & Assessment
- Environmental Pollution & Bioremediation

- Geosciences & Mining
- Man-Made & Natural Environmental Problems
- Meteorological Patterns & Environmentally Stress
- Sustainable Technologies for Energy & Environment

Session (I) Natural Sciences:
- Activity of Microbiomes in Food
- Applications of Biochemistry & Biotechnology
- Assessment of Algal Biomass: A Sustainable Approach
- Biomass Conversion & Biorefinery
- Biomaterials & Bioscience
- Biosecurity Strategy for Agricultural & Food Industry
- Biotechnology & Bioscience
- Environmental Application of Microbial Electrochemical Technologies
- Environmental Chemistry and Ecotoxicology
- Environmental Criteria of Biofuel Sustainability
- Food Waste Generation & Prevention Measurement
- Life Sciences
- Mathematical Models & Computational Techniques in Science & Engineering
- Microbiology for Human Health & Survival on Planet
- Nanotechnology
- Ornamental Plants
- Spoilage Behaviour of Microbial Populations in Foodstuff
- Sustainable Food Processing

Session (J) Sustainable Energy Research & Applications:
- Biogas Recovery in Municipal Solid Waste
- Energy & Materials
- Energy Footprints
- Energy From Biomass
- Energy Resources
- Environmental Criteria of Biofuel Sustainability
- Low Carbon Fuels
- Non-Renewable & Renewable Energy
- Renewable and Sustainable Energy
- Sustainable Energy Strategies

Session (K) Effects of Sustainable Development on:
- Agricultural Management & Soil Conservation
- Applied & Natural Sciences
- Bio/Nano-(Bio)Technology
- Energy Use & Global Climate Change
- Environmental Engineering
- Healthcare
- Land, Water, Energy & Natural Resources

- Role of National & International Agencies
- Society & Environmental Interactions
- Sustainability Indicators
- Tourism & Environment

ACKNOWLEDGMENT

Dear Guests and Colleagues

Thank you very much for your attendance in the 13th ICEEE-2022 International Annual Conference dealing with the Global Environmental Development & Sustainability: Research, Engineering & Management which was in Budapest during November 17-18, 2022 online in Budapest at Óbuda University, Hungary.

13th ICEEE-2022 is a conference where researchers, environmentalists, scientists, scholars and students, share their ideas, experiences, advancements, and research results. There were plenty of opportunities for organisations, projects and consortia to hold side events (meetings, seminars and workshops) on the Conference site to draw insights and encourage collaboration from many topics, disciplines, and backgrounds, promoting research and education to build a fair global community and more sustainable societies.

The purpose of the 13th ICEEE-2022 Conference deals with „Global Environmental Development & Sustainability: Research, Engineering & Management". Environmental Sustainability is projected to harm human health through adverse changes in security of the life-style.

The 13th ICEEE-2022 Conference bring together keynote, invited speakers and international researchers from academia, authorities and industry, to communicate and share a wide range of highlighting potential issues and paths towards the environmental health and the sustainable due to climate change at present and future. The following core conference themes reflect an integrated approach to identifying solutions to the complex global challenge of environmental quality.

As a part of the framework of the Hungarian Scientific Season in Budapest, Hungary and after a great successful of the last International Annual Conferences of ICEEE during the period between 2010 and 2020, which brought together the world's professions and practitioners from different fields of applied sciences and environmental engineering, the International Council of Environmental Engineering Education (ICEEE) with the cooperation with the Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering (RKK), Institute of Environmental Engineering and Natural Sciences had the great pleasure to welcome all of you as a speaker and contributor for our conference **the *13th ICEEE-2022*** International Annual Conference on "*Global Environmental Development & Sustainability: Research, Engineering & Management*" which is going online here in Budapest today November 17th to 18th 2022 in Hungary.

The main goals of the conference are: to promote research and developmental activities in Environmental Protection and different fields of Natural Science; and to promote scientific information interchange between researchers, developers, engineers, students, and practitioners working in and around the world.

This conference was provided the opportunities for the delegates to exchange new ideas and application experiences face to face, to establish business or research relations and to find global partners for future collaboration.

Here, the organizing committee of the conference identify opportunities for international, civil society, global partners, and researchers to contribute to a high quality of global effort towards environmental health systems.

The organizing committee of the conference has the opportunity to thanks the contributors and the reviewers for their activities and their work to review the manuscripts of the participants.

At the end, the organizing committee of the conference wish all the best for all the participants and thank their attendance.

Organizing Committee
of the Conference

IMPRESSUM

For the Program, Abstracts and the Proceedings Book of the papers of the 13th ICEEE-2022 International Annual Conference titled: "*Global Environmental Development & Sustainability: Research, Engineering & Management*"

– The official language was English.
– The Program, Abstracts and Full papers of the Conference is provided to all registered participants in online (electronic) form.
– All the received papers were reviewed by two of the members of the International Committee of the Conference.
– All reviewed papers for the 12th ICEEE-2021 International Annual Conference are published in the Conference Proceedings Book with the ISBN **978-963-449-297-9**. in CD-ROM format and online (electronic) in the website of ICEEE: www.iceee.hu
– The selected high quality manuscripts will be also published in the online journal.
– The scientific information and quality of the manuscript is due to the corresponding author of the paper.
– Individual authors at their manuscripts shell be responsible for any possible errors
– The Publisher of the Program, Abstracts and the Proceedings Book of the International Annual Conference is the ICEEE, Institute of Environmental Engineering and Natural Sciences, Sándor Rejtő Faculty of Light Industry and Environmental Engineering and Natural Sciences, Óbuda University, Budapest, Hungary.
– Publication year of the Proceedings is 2022.
– Important Website: www.iceee.hu
– The Conference is organised in the framework of the Hungarian Scientific Season (Hungarian Scientific Festival).
– The publication policy of the ICEEE offer you a chance to publish your full paper in **Euro-Mediterranean Journal for Environmental Integration** or which is related to Springer publishing house (https://www.springer.com/journal/41207) which is an indexed journal or **Desalination and Water Treatment Journal** (https://www.deswater.com)
– You can submit your paper (with max. 20% of similarity) to this journal and they well have a direct connection with you. But you have to mention your wish to us.

November, 2022.

Prof. Dr. Hosam Bayoumi Hamuda
President of ICEEE, Conference Chairman
Óbuda University
Budapest-Hungary
E-mail: bayoumi.hosam@uni-obuda.hu
Mobile: +36(30)390-0813

Important deadline:

- **For registration and submission of the abstract is 15th of October 2022.**
- **For submission of the full manuscript is 07th of November 2022.**

The full manuscript should be organized in the following manner:

- Title
- Names of the Authors
- Name of the Institution
- Abstract
- Keywords (Up To Six)
- Introduction and Aim
- Materials and Methods
- Results and Discussion
- Conclusions
- Acknowledgements
- References.

The author should fill the abstract and full manuscript in the given templates (in separate attachments)
For more information, please kindly visit the website: www.iceee.hu
Please you are being kind to register for the Conference and confirm your presence.

Yours Sincerely,

AWARDS of CONFERENCE
AWARDS of the BEST PRESENTATION, POSTER & MUNSCRIPTS

This award recognizes individuals from poster presenters who have display their outstanding research & findings for an innovative future. Recipients of the award are considered to be the Best Poster Presenter of the 13th International Annual Conference ICEEE-2022.

Criteria:

- All presented abstracts will automatically be considered for the Award.
- All the presentation will be evaluated in the conference venue
- All the awards will be selected by the judges of the award category
- The winners will be formally announced during the closing ceremony.
- The winners will receive award certificate.
- The awards will be assessed as far as plan & format, intelligence, argumentation & approach, familiarity with work, engaging quality, message & primary concerns, parity of content visuals & by & large impression.

13th International Annual Conference ICEEE-2022 Excellence Awards for best papers & presentation was instituted sine the year 2010 & have been given to the researchers for significant papers, to municipalities, temples, industries for their significant achievement in environmental health, quality, safety, etc. as well as the protection of the environment from pollution. The awards of the 13th International Annual Conference ICEEE-2022 given to the most outstanding researchers of the symposium under below three categories.

SELECTION PROCESS

1. CRITERIA FOR THE SESSION'S BEST PRESENTATION AWARD

Each & every presentation was evaluated by two evaluators & the average mark of both evaluators was taken as the final mark. The best presentation from sessions was selected based on the final mark received from the evaluators & the final decision was given by the Symposium's Chair. Below criteria were taken into consideration for this award & marks are given out of 100.

- **Value of the Content (30%)**
- **Clarity of Presentation (20%)**
- **Appropriate Audio Visual Aids (20%)**
- **Ability to Connect with the Audience (10%)**
- **Proper Timing (20%)**

2. CRITERIA FOR THE BEST POSTER PRESENTATION AWARD

Every poster presentation is evaluated by a special evaluator based on below criteria & the presentation with the highest mark was selected as the best poster presentation award. The final mark is given out of 100.

- **Depth of Content (40%)**
- **Introduction & Abstract (15%)**

- **Content knowledge & organization (20%)**
- **Poster Design & Overall Visual Appeal (10%)**
- **Verbal Interaction (15%)**

3. CRITERIA FOR THE OVERALL BEST PRESENTATION AWARD & BEST STUDENT PRESENTATION AWARD

Presentations of each technical session with the highest marks were recommended for these two awards. They were evaluated by a special committee headed by the Symposium's Chair according to the below criteria.

- **Total Marks gained in the presentation (100%)**
- **Significance of the paper to the field (30%)**
- **Theoretical contribution (15%)**
- **The ability of practical implementation (20%)**
- **Use of appropriate methodological rigor (20%)**
- **Originality (15%)**

The organizing committee is waiting for your join the atmosphere of the VIth. International Symposium-2022 in Budapest & contribute to these exciting debates on the Biosphere & Environmental Safety in order to shape the future of our biotic & abiotic factors in our planet!

Based on the huge success of last events, I am strongly confident that the VI.th Symposium-2022 will be a great success & meet our expectations. Moreover, the VI.th Symposium-2022 offers a valuable platform to create new contacts in the field of Traditional & Alternative technologies, by providing valuable networking time for you to meet great personnel in the field.

In case you might have any queries or requirements please do not hesitate to contact me by replying to this e-mail.

I sincerely look forward to meet you & your colleagues in this event.

Yours Sincerely,

Best regards,

Prof. Dr. Hosam Bayoumi Hamuda
President of ICEEE, Symposium Chairman

AWARDS CEREMONY

List of the Best participation in 13th International Annual Conference ICEEE-2022.

Congratulations to all our participants and the
Awards winners in ICEEE-2022

A. PROFESSIONAL RESEARCHERS

1. **Bhanu Singh PANWAR**
PROTECT SOIL FOR SURVIVAL OF MANKIND

2. **Lyudmyla SYMOCHKO1,2**
CONCEPT «ONE HEALTH»: SUSTAINABILITY AND BIOSECURITY IN ECOSYSTEMS

3. **Olena MITRYASOVA**
PROGNOSIS MODELS OF NITRATES AND ORTHOPHOSPHATES CONTENT IN SURFACE WATERS

4. **Sándor KUKOVICS**
MEAT OR MEAT-TO-BE-PLANT-BASED VS MEAT-BASED PROTEIN

5. **Károly PENKSZA**
CONSERVATION MANAGEMENT AND RESTAURATION OPEN SANDY GRASSLAND THE HOMOKTÖVIS CONSERVATION AREA IN BUDAPEST

6. **Saad K. EL EBAIDI**
EVALUATIONS OF THE EOCENE APOLLONIA FORMATION IN KARSAH REGION, CYRENAICA, LIBYA, FOR CEMENT MANUFACTURE

B. PhD STUDENTS

The most outstanding presentations presented by a participant who has registered under the Ph.D. student. The winner Ph.D. students were:

7. **Kamelia HESNI BENOTMANE[1]**

IMPACT OF WILD BOAR (SUS SCROFA) ROOTING ON THE PHYSICO-CHEMICAL PROPERTIES OF SOIL IN THE EDOUGH FOREST (NORTHEAST, ALGERIA)

8. **Shraddha JOSHI1**
SMART NANO-SENSORS FOR FUTURISTIC AGRICULTURE LEADING TOWARDS ENVIRONMENT SUSTAINABILITY & NUTRITION SECURITY

9. **Fatima ELLAMTI**
HYGIENIC AND PHYSICOCHEMICAL QUALITY AND RESEARCH OF ANTIBIOTIC RESIDUES IN MILK MARKETED IN TETOUAN, MOROCCO

10. **Youssra BELHADJ**
MICROBIOLOGICAL CHARACTERIZATION OF DIFFERENT OF FRESH AND PROCESSED FRUIT PRODUCTS MARKETED IN THE MARKETS OF THE PROVINCE OF TETOUAN

11. **Laila FAROUK1**
PHENOTYPIC PROFILE OF ENTEROBACTERIACEAE ISOLATED AT THE PROVINCIAL HOSPITAL OF TETOUAN

12. **Haimei CHEN**
URBAN WOODY PLANT'S BENEFITS IN HEAVY METAL POLLUTION MONITORING AND REDUCTION

13. **Lara Rúbia BORGES SILVA**
RECYCLING OF ORGANIC WASTE: AN OVERVIEW OF PÁLINKA DISTILLERY MASH COMPOSTING

Budapest, 18th of November 2022.

Prof. Dr. Hosam E.A.F. Bayoumi Hamuda
President of ICEEE
Chair, VIth International Symposium-2022
Institute of Environmental Engineering & Natural Sciences
Óbuda University
E-mail: bayoumi.hosam@uni-obuda.hu
WhatsApp/viber/messenger: +36-30-390-0813

The certificates will be sent to all the awardees in e-mail by September 2021. In case of non-receipt of the certificate, please write to us with your contact details to: bayoumi.hosam@uni-obuda.hu

The 13th ICEEE-2022

The 13th ICEEE-2022

ONLINE

SCIENTIFIC PROGRAM

17th – 18th of November 2022

Attention:

The Conference will be held through **Microsoft Teams**.

To join the Conference:

There is a short guide with useful information about how to use the Microsoft Teams during the Conference

Each one of the participant you have the link of the conference by e-mail

The time of the Conference is related to the **Hungarian time**.
Please check the time with your time at home

Time of Oral and poster Presentations Online (Microsoft Teams)

Presentation Type:	Total Allotted Time:
• Plenary speaker	25 min
• Keynote speaker	20 min
• Featured speaker	10 min
• Poster	5 min

The time is very limited
The official language of all the presentations including oral or poster speaker is English

SCIENTIFIC PROGRAM

17th of November 2022 (Thursday)

09:00 a.m. – 09:30 a.m.

Opening Ceremony

Prof. Dr. Hosam BAYOUMI HAMUDA
President, International Council of Environmental Engineering Education
Conference Chair

Dr. Rita BODÁNÉ-KENDROVICS
Director, Institute of Environmental Engineering & Natural Sciences

Dr. László KOLTAI
Dean, Rejtő Sándor Faculty of Light Industry & Environmental Engineering

Prof. Dr. László Gulácsi
Vice-Rector, Óbuda University

Prof. Dr. Sadhan Kumar Ghosh
Prof. Dr. Borbála Biro
Honour Guests of the Conference

09:30 – 10:20 *Plenary Session*

Chair of the Session: Rita BODÁNÉ-KENDROVICS

09:30 – 09:55

SADHAN KUMAR GHOSH
Centre for Sustainable Development & Resource Efficiency Management, Faculty council of Engineering and Technology; Jadavpur University, Kolkata - India
ACHIEVING SDGS THOUGH WASTE MANAGEMENT IN ASIA PACIFIC.

Borbála BIRÓ[1], Zsolt KOTROCZÓ[1], Hosam E.A.F. BAYOUMI HAMUDA[2]
[1]*Deparment of Agri-Environmental Studies, Hungarian University of Agriculture and Life Sciences, Budapest - Hungary,*
[2]*Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest - Hungary*
REVITALIZATION OF DEGRADED/CONTAMINATED SOIL AND DEVELOPMENT OF APPROPRIATE SOILBIOLOGICAL CHARACTERISTICS – A CASE STUDY

Bhanu Singh PANWAR[1], S.K. VARSHNEY[2], Hosam E.A.F. BAYOUMI HAMUDA[3], Borbála BIRÓ[4]
[1]*Department of Soil Sciences, CCS Haryana Agricultural University, Hisar - India*
[2]*Ministry of Science and Technology, Government of India, Department of Science and Technology, Technology Bhawan, New Mehrauli Road, New Delhi - India*
[3]*Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest - Hungary*
[4]*Hungarian University of Agriculture and Life Sciences, Budapest - Hungary*
PROTECT SOIL FOR SURVIVAL OF MANKIND

Technical Session MICROBIOLOGY, SOIL BIOLOGY, SOIL QUALITY A Session (A)

Chairman: ***Borbála BIRÓ***
10:30 – 11:50

Oral:

Kamelia Benotmane HESNI[1], Mehdi BOUKHEROUFA[2], Imene KAHLI[1], Rached HADIBY[3], Feriel Sakraoui[2]
[1]Soil and Sustainable Development Laboratory, Department of Biology, Faculty of Science, Badji Mokhtar Annaba University, Annaba - Algeria
[2]Eco biology Laboratory for Marine Environments and Coastal Areas, Faculty of Sciences, Badji Mokhtar Annaba University, Annaba - Algeria
[3]Laboratory Ecobiology of Marine and Coastal Environments, Annaba - Algeria
IMPACT OF WILD BOAR (SUS SCROFA) ROOTING ON THE PHYSICO-CHEMICAL PROPERTIES OF SOIL IN THE EDOUGH FOREST (NORTHEAST, ALGERIA)

Shraddha JOSHI[1], Jyoti UPADHYAY[1], Souradeep ROY[2], Aashish MATHUR[2]
[1]Department of Allied Sciences, School of Health Sciences and Technology, University of Petroleum and Energy Studies, Dehradun - India
[2]Centre for Interdisciplinary Research and Innovations (CIDRI), University of Petroleum and Energy Studies, Dehradun - India
SMART NANO-SENSORS FOR FUTURISTIC AGRICULTURE LEADING TOWARDS ENVIRONMENT SUSTAINABILITY & NUTRITION SECURITY

Emőke IMRE[1], Miklós JUHÁSZ[1], Ágnes BÁLINT[3]
[1]Bánki Donát Faculty, Óbuda University, and EKIK Hydro-Bio-Mechanical Systems Research Center, Budapest - Hungary
[2]Debrecen University, Debrecen - Hungary
[3]Institute of Environmental Engineering and Natural Sciences, Óbuda University, Budapest, Hungary, and EKIK Hydro-Bio-Mechanical Systems Research Center, Budapest - Hungary
COMPARING SALINE AND QUICK CLAYS

Poster:

Ádám FEHÉR, Natalia PITTA-OSSES, Krisztián KATONA, Csaba CENTERI
Department of Wildlife Biology and Management, Institute for Wildlife Management and Nature Conservation, University of Agriculture and Life Sciences, Gödöllő - Hungary
COMPARISON OF WILD BOAR EFFECTS ON SOIL THICKNESS IN FORESTS

Máté HORVÁTH, Hosam E.A.F. BAYOUMI HAMUDA
Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest – Hungary
DETERMINATION THE IMPACTS OF MUNICIPAL SEWAGE SLUDGE TREATMENTS USED FOR GROWING COMMON BEAN AND SOME ESSENTIAL PLANT NUTRIENT CONTENTS IN SLIGHT ACIDIC SOIL

Albert ONDRIK, Hosam E.A.F. BAYOUMI HAMUDA
Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest – Hungary
COMPARATIVE STUDIES ON SOIL BIOLOGICAL ASSESSMENT: PESTICIDE SENSITIVITY OF MICROORGANISMS MEASURED UNDER LABORATORY CONDITIONS

Mikhailo SLIVKA[1,2], Olexander MOYZESH[1], Hanna GRYGORKA[1], Nataliya KOROL[1], Maksym FIZER[3], Ruslan MARIYCHUK[2]
[1]*Uzhhorod National University, Uzhhorod - Ukraine*
[2]*University of Presov, Presov - Slovak Republic*
[3]*Institute of Chemistry Slovak Academy of Sciences, Bratislava - Slovak Republic*
SUSTAINABLE REAGENTS FOR PRODUCTION OF FUSED HETEROCYCLES VIA ELECTROPHILIC HETEROCYCLIZATION

Mikhailo SLIVKA[1,2], Olexander MOYZESH[1], Hanna GRYGORKA[1], Nataliya KOROL[1], Maksym FIZER[3], Ruslan MARIYCHUK[2]
[1]*Uzhhorod National University, Uzhhorod - Ukraine*
[2]*University of Presov, Presov - Slovak Republic*
[3]*Institute of Chemistry Slovak Academy of Sciences, Bratislava - Slovak Republic*
COMFA STUDY AS AN EFFICIENT APPROACH FOR THE DESIGN OF BIOLOGICALLY ACTIVE BIS-1,2,4-TRIAZOLES

Asmaa Lotfi ALALLAF[1], Metwally KOTTB[2], Ahmed K. EL-SAYED[3], Hesham Mohamed SHAFIK[1]
[1]*Botany Department, Faculty of Science, Port Said University, Port Said - Egypt*
[2]*Botany Department, Faculty of Science, Suez Canal University, Egypt*
[3]*Botany and Microbiology Department, Faculty of Science, Damietta University, Damietta - Egypt*
ANTIFUNGAL ACTIVITY OF VOLATILES EMITTED FROM LIVING CULTURES OF CHLORELLA VULGARIS, DESERTIFILUM THARENSE, AND NAVICULA ARENARIA

Technical Session MICROBIOLOGY, SOIL BIOLOGY, SOIL QUALITY A Session (B)

Chairman: ***Hosam E.A.F. BAYOUMI HAMUDA***
12:00 – 13:20

Keynote:

Lyudmyla SYMOCHKO[1,2]
[1]Coimbra University, Coimbra-Portugal, [2]Uzhhorod National University, Uzhhorod - Ukraine
CONCEPT «ONE HEALTH»: SUSTAINABILITY AND BIOSECURITY IN ECOSYSTEMS

Sándor KUKOVICS[1,2], Ferenc KUKOVICS[1], Zoltán NAÁR[3]
[1]Hungarian Sheep and Goat Dairying Public Utility Association, Herceghalo - Hungary
[2]Sheep and Goat Products' Board, Várpalota - Hungary
[3]Tokaj-Hegyalja University, Sárospatak - Hungary
MEAT OR MEAT-TO-BE-PLANT-BASED VS MEAT-BASED PROTEIN

Oral:

P. SENTHILVALAVAN[1], M.V. SRIRAMACHANDRASEKHARAN[1], R. MANIVANNAN[1], C. RAVIKUMAR[2]
[1]Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University Annamalainagar, Tamilnadu - India
[2]Department of Agronomy, Faculty of Agriculture, Annamalai University Annamalainagar, Tamilnadu - India
RESTORATION OF PROBLEM SOILS USING BIOCHAR: A COMPLETE NATURAL THROGUHPUT FOR SUSTAINABLE LAND AND CROP PRODUCTIVITY

Lamia BOULAOUIDAT, Chaouki BENABBAS
Research Centre for Spatial Planning, 1-University of Jijel, Jijel - Algeria
RECENT AND CURRENT TECTONICS IN THE TELL NORD CONSTANTINOIS: IMPACTS ON THE STABILITY OF THE LAND

Poster:

Viktor GRÓNÁS, Csaba CENTERI, Márk PÁLFI
Institute of Wildlife Management and Nature Conservation, Hungarian University of Agriculture and Life Sciences, Gödöllő - Hungary
SOIL ASPECTS OF A BIODIVERSITY MANAGEMENT PLAN FOR A SOLAR PARK

Fatima ELLAMTI, Zakaria MENNANE, Noureddine ELMTILI
Laboratory of Biology and Health, Department of Biology, Faculty of Sciences, Abdelmalek Essaadi University, M’hanech II, Tetouan – Morocco
HYGIENIC AND PHYSICOCHEMICAL QUALITY AND RESEARCH OF ANTIBIOTIC RESIDUES IN MILK MARKETED IN TETOUAN, MOROCCO

Mostafa AHMED[1,2], Diaa ATTIA[3], Nadia MOHAMED[2], Ebtesam ABDELMONEEM[2], Mohamed ABDEL-SHAKUR[2], Kincső DECSI[4], Zoltán TÓTH[5]
[1]Festetics doctoral school, Hungarian University of Agriculture and Life Sciences, Georgikon Campus, Keszthely - Hungary
[2]Biochemistry Department, Faculty of Agriculture, Cairo University, Cairo - Egypt
[3]Food Toxicology and Contaminants Department, National Research Centre, Dokki, Cairo - Egypt
[4]Department of Plant Physiology and Plant Ecology, Campus Keszthely, Hungarian University of Agriculture and Life Sciences Georgikon, Keszthely - Hungary
[5]Institute of Agronomy, Hungarian University of Agriculture and Life Sciences, Georgikon Campus Keszthely - Hungary
ANTIOXIDANT ACTIVITY OF Azadirachta indica LEAF SUCCESSIVE EXTRACTS AND THE SUSCEPTIBILITY OF DIFFERENT PATHOGENIC BACTERIA AND MYCOTOXIGENIC FUNGI TO ITS GREEN-CHEMICALLY SYNTHESIZED SILVER NANOPARTICLES AND VARIOUS EXTRACTS

Youssra BELHADJ, Zakaria MENNANE, Noureddine ELMTILI
Food and Health, Laboratory: Biology and Health, Department of Biology, Faculty of Sciences, Abdelmalek Essaadi University, M’hanech II, Tetouan - Morocco
MICROBIOLOGICAL CHARACTERIZATION OF DIFFERENT OF FRESH AND PROCESSED FRUIT PRODUCTS MARKETED IN THE MARKETS OF THE PROVINCE OF TETOUAN

Dominika SZŰCS, Hosam E.A.F. BAYOUMI HAMUDA
Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest – Hungary
THE EFFECT OF UREA AND UREASE ENZYME INHIBITOR ON THE FUNCTIONAL DIVERSITY OF THE SOIL MICROBIAL COMMUNITY

Technical Session MICROBIOLOGY, SOIL BIOLOGY, SOIL QUALITY A Session (C)

Chairman: Lyudmyla SYMOCHKO
13:30 – 14:20

Keynote:

Hosam E.A.F. BAYOUMI HAMUDA[1], Lyudmyla SYMOCHKO[2,3]
[1]Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest – Hungary
[2]Coimbra University, Coimbra-Portugal, [3]Uzhhorod National University, Uzhhorod - Ukraine
SOIL MICROBIOMES AND PROTECTION OF SOIL QUALITY

Oral:

Hassni BELAIDI[1], Saida KITOUNI[2], Smaine CHELLAT[1]
[1]Geology and Environment Laboratory, University of Constantine 1, Constantine – Algeria
[2]Department of Process Engineering, Faculty of Process Engineering, University Salah Boubnider Constantine 3, Constantine - Algeria
PROSPECTIVES, CHALLENGES AND CONDITION FOR THE USE OF FELDSPAR CONTENT IN IGNEOUS ROCKS AS SOURCE OF POTASSIUM (K) USING IN AGRICULTURE

Bhanu Singh PANWAR[1], Olha A. KHLIESTOVA[2,3], Katarzyna Ewa BUCZKOWSKA[2,4], Baturalp YALCINKAYA[2], Milan BOUSA[2]
[1]Department of Soil Sciences, CCS Haryana Agricultural University, Hisar - India
[2]Department of Material Science, Faculty of Mechanical Engineering, Technical University of Liberec, Liberec - Czech Republic
[3]Department of Primary Science Institute of Modern Technologies, Pryazovskyi State Technical University, Dnipro –Ukraine
[4]Department of Materials Technology and Production Systems, Faculty of Mechanical Engineering, Lodz University of Technology, Lodz - Poland
PREVENTIVE APPLICATION OF UNTREATED CITY SEWAGE/SEWER WATER FOR IRRIGATION IN CEREAL CROPS AVOIDING HEAVY METALS POLLUTION IN SOIL-PLANT ECOSYSTEM

Adebayo-ADEWUNMI, Raimot ADEJUMOKE
Department of Biology Education, School of Science Education,
Federal College of Education (Technical) Akoka- Yaba, Lagos State - Nigeria
ORNAMENTAL PLANTS: ECONOMIC IMPORTANCES AND COMMON TYPES FOUND IN NIGERIA

Gayatri KUMARI[1], Sarita DEVI[1] and SATPAL[2]
[1]Department of Botany & Plant Physiology
[2]Department of Agronomy
CCS Haryana Agricultural University, Hisar, Haryana, India
SORGHUM: A POTENTIAL CROP UNDER SALT AFFECTED AREAS

Seema GARG
Department of Chemistry, Amity University, Sector-125, Noida, Uttar Pradesh, India
BIOX AND ITS COMPOSITES AS EFFICIENT VISIBLE ACTIVE PHOTOCATALYSTS

Poster:

Csaba CENTERI[1], Viktória VONA[2], Márton VONA[3], Zsolt BIRÓ[1]
[1]Institute for Wildlife Management and Nature Conservation, Hungarian University of Agriculture and Life sciences, Gödöllő - Hungary
[2]Faculty of Agricultural and Food Sciences, Széchenyi István University, Mosonmagyaróvár-Hungary, H-9200, Mosonmagyaróvár - Hungary
[3]Csernozjom Ltd., Nagykörű - Hungary
EFFECTS OF MOLES ON SOIL PROPERTIES ON GRASSLANDS

Csaba CENTERI[1], Viktória VONA[2], Márton VONA[3], Eszter TÓTH[4], Zsolt BIRÓ[1], Alfréd SZILÁGYI[1]
[1]Institute for Wildlife Management and Nature Conservation, Hungarian University of Agriculture and Life Sciences, Gödöllő- Hungary
[2]Faculty of Agricultural and Food Sciences, Széchenyi István University, Mosonmagyaróvár - Hungary
[3]Csernozjom Ltd., Nagykörű - Hungary
[4]Institute for Rural Development and Sustainable Management, Hungarian University of Agriculture and Life Sciences, Budapest - Hungary
DEVIATION OF SOIL NUTRIENT CONTENT ON A PERMACULTURE FARM KÓSPALLAG, HUNGARY

Monsif ELMADANY[1, 2], Mustapha HASSOUN[3], Noureddine ELMETILI[1]
[1]Laboratory of Food Science and health, Department of Biology, Abdelmalek Essaadi University, Tetouan - Morocco
[2]National Institute of Fisheries Research, M'diq - Morocco
[3]Applied Phycology-Mycology Group, Ecology, Biodiversity and Environment Laboratory, Department of Biology, Faculty of Sciences, Abdelmalek Essaâdi University, M'Hannech II, Tétouan - Morocco
TOTAL CARBOHYDRATE CONTENT EXTRACTION FROM RUGULOPTERYX OKAMURAE SEAWEED IN THE MOROCCAN COAST: OPTIMIZATION USING RESPONSE SURFACE METHODOLOGY

Laila FAROUK[1,2], Zakaria MENNANE[1], Amale MOUJAHID[2], Noureddine ELMTILI[1]
[1] *Laboratory of Biology and health, Department of Biology, Faculty of Sciences, Abdelmalek Essadi University, Tetouan - Morocco*
[2] *Medical analysis laboratory, Bacteriology Department, Provincial Hospital of Tetouan, Tetouan - Morocco*
PHENOTYPIC PROFILE OF ENTEROBACTERIACEAE ISOLATED AT THE PROVINCIAL HOSPITAL OF TETOUAN

Sanaa TAHIRI[1,2], F. ELAAMRI[2], H. LOULAD[2], N. ELMTILI[1]
[1] *LFHS, Laboratory of Food and Health Sciences, Science Department, Abdelmalek Essaadi University, Tetouan - Morocco*
[2] *Shellfish Farming Station, INRH, National Institute of Fisheries Research, Amsa - Morocco*
EFFECT OF DIFFERENT CULTURE MEDIA ON THE CELLS GROWTH OF TETRASELMIS SUECICA

Malihe MASOUDI[1], Csaba CENTERI[1]*, Viktória VONA[2], Márton VONA[2], Gergely JAKAB[3]
[1] *Institute of Natural Resources Management, the Hungarian University of Agriculture and Life Sciences, Gödöllő - Hungary*
[2] *Geographical Institute, Research Centre for Astronomy and Earth Sciences, Budapest - Hungary*
[3] *Csernozjom Ltd., Nagykörű - Hungary*
ASSESSMENT OF SOIL PROPERTIES UNDER DIFFERENT TILLAGE OPERATIONS

WATER AND WATER TREATMENT

Hosam E.A.F. BAYOUMI HAMUDA

Keynote:

Kshitij NAIKADE; Sujata ARYA
Symbiosis Law School, Symbiosis International University, Pune - India
WATER IN FUTURES MARKET: SMART CAPITALISM OR TOXIC DISDAIN FOR HUMAN RIGHTS?

Oral:

Csenge NAGY-MEZEI[1,2], Anikó BEZSENYI[2], Imre GYARMATI[2], Magdolna MAKÓ[2], Levente KARDOS[1]
[1]Department of Floriculture and Dendrology, Institute of Landscapes Architecture, Urban Planning and Garden Art, Hungarian University of Agriculture and Life Sciences, Budapest - Hungary
[2]Budapest Sewage Works Pte Ltd., Budapest - Hungary
THE ROLE, THE PERFORMANCE AND THE OPERATIONAL EXPERIENCES OF THE NITROGEN REMOVAL FIXED-FILM BIOLOGICAL STAGE OPERATING AT THE SOUTH-PEST WASTEWATER TREATMENT PLANT

Fouzia HIZIR[1], A. KRIKA[2], F. KESSASRA[1]
[1]Geological Engineering Laboratory, University of Mohamed Seddik Benyahia, Jijel - Algeria
[2]Laboratory of Biotechnology, Environment and Health, University of Mohamed Seddik Benyahia, Jijel - Algeria
USE OF ORGANIC POLLUTION INDICES IN THE EVALUATION OF THE PHYSICO-CHEMICAL QUALITY OF THE SURFACE WATERS OF WADI KEBIR-RHUMEL (NORTH-EAST ALGERIA)

Rima KIFOUCHE, F. BOUAICHA, O. BOUTERAA
Geology and Environment Laboratory, Constantine University 1, Route Ain El Bey Zouaghi Slimane Constantine - Algeria
ENVIRONMENTAL EFFECTS OF THERMAL WATER IN THE REGION OF GUELMA, ALGERIA

Amal FOUGHALIA[1], F. KESSASRA[1,2], L. ALILICHE[2], S. GUERDOUH[2], D. BENABBES[1]
[1]Laboratory of Geological Engineering, Team 3 "Geology", University of Jijel, Central Campus, Jijel - Algeria
[2]Department of Earth and Universe Sciences, University of Jijel, Central Campus, Jijel – Algeria
METALLIC TRACE ELEMENT CONTAMINATION IN SURFACE WATER AND SOIL AROUND TWO ACTIVE AND OLD ABANDONED QUARRIES. CASE STUDY IN CHEKFA-JIJEL AND AKBOU, NORTH EAST OF ALGERIA: COMPARATIVE STUDY

P. SENTHILVALAVAN[1], A. MATHESH[1], K. ARIVAZHAGAN[1], M.V. SRIRAMACHANDRASEKHARAN[1], R. MANIVANNAN[1], S. NATARAJAN[2], C. RAVIKUMAR[2]
[1]Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalainagar, Tamilnadu - India
[2]Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalainagar, Tamilnadu - India
EUTROPHIC WATER QUALITY ASSESSMENT AND REMOVAL OF PHOSPHORUS USING NANO BIOCHAR

Fouzia HIZIR[1], A. KRIKA[2], F. KESSASRA[1]
[1]Geological Engineering Laboratory, University of Mohamed Seddik Benyahia, Jijel - Algeria
[2]Laboratory of Biotechnology, Environment and Health, University of Mohamed Seddik Benyahia, Jijel - Algeria
LEVEL OF CONTAMINATION BY THE TRACE METAL ELEMENTS OF WADI KEBIR-RHUMEL (NORTH-EAST ALGERIA)

Boualem BOUSELSAL[1], Smaine CHELLAT[2]
[1]Laboratory of underground reservoirs oil and gas and aquifers, Department of Earth and Universe Sciences, University of Kasdi Merbah, Ouargla - Algeria
[2]Geology and Environment Laboratory, University of Constantine 1, Constantine - Algeria
HYDROGEOLOGICAL STUDY OF THE AQUIFER SYSTEM OF NORTHERN SAHARA (SASS): CASE OF THE REGION OF EL-OUED (SOUTH-EAST ALGERIA)

Ágnes BÁLINT[1], Tibor DEMÉNY[2], Xuechu WANG[3], Csaba MÉSZÁROS[4]
[1]Institute of Environmental Engineering and Natural Sciences and Hydro-Bio-Mechanical Systems Research Center, Óbuda University, Budapest - Hungary
[2]Pro-mees Ltd. Job safety & environmental protection consultant, Vác - Hungary
[3]Doctoral School of Environmental Sciences, Hungarian University of Agriculture and Life Sciences, Gödöllő – Hungary
[4]Institute of Mathematics and Basic Sciences, Hungarian University of Agriculture and Life Sciences, Gödöllő - Hungary
HEAVY METAL CONCENTRATIONS IN SOIL, SLUDGE, WATER AND PLANT SYSTEMS ALONG THE LEFT BANK OF THE DANUBE BETWEEN RIVER KILOMETRES 1653 AND 1655

Poster:

Olena MITRYASOVA[1], Ruslan MARIYCHUK[2], Alla SHYBANOVA[3], Elvira DZHUMELIA[3]
[1]*Ecology Department, Petro Mohyla Black Sea National University, Mykolaiv - Ukraine*
[2]*Faculty of Humanities and Natural Sciences University of Presov, Prešov - Slovakia*
[3]*Department of Ecological Safety and Nature Protection Activity, Lviv Polytechnic National University, Lviv - Ukraine*

PROGNOSIS MODELS OF NITRATES AND ORTHOPHOSPHATES CONTENT IN SURFACE WATERS

Attila FŰRÉSZ[1], Gabriella FINTHA[2], Szilárd SZENTES[3], Zsombor Wagenhoffer[4], Márta BAJNOK[3], Ferenc SZALAI[5], Károly PENKSZA[1]
[1]*Hungarian University of Agriculture and Life Science, Institute of Agronomy, Gödöllő - Hungary*
[2]*Hungarian University of Agriculture and Life Science, Doctoral School of Biological Sciences, Gödöllő - Hungary*
[3]*Hungarian University of Agriculture and Life Science, Institute of Animal Science, Gödöllő - Hungary*
[4]*Animal Breeding, Nutrition and Laboratory Animal Science Department, University of Veterinary Medicine Budapest, Budapest - Hungary*
[5]*The Water Buffalo Reserve of Mátra, Szurdokpüspöki, Hungary*

COENOLOGICAL COMPARISON AND GRASSLAND MANAGEMENT ANALYSIS OF DOMESTIC WATER BUFFALO PASTURES AT SZURDOKPÜSPÖKI

Roquia RIZK[1,2], Tatjána JUZSAKOVA[1], Hesham M. SHAFIK[3], Ákos RÉDEY[1]
[1]*Research Centre for Biochemical, Environmental and Chemical Engineering, Sustainability Solutions Research Lab, University of Pannonia, Veszprém - Hungary*
[2]*Biochemisrty Department, Faculty of Agriculture, Cairo University, Cairo - Egypt*
[3]*Botany Department, Faculty of science, Port Said University, Port Said - Egypt*

MONITORING OF THE HEAVY METAL CONTENT OF FISH SAMPLES OF LAKE BALATON, HUNGARY

Technical Session ***ENVIRONMENTAL INVESTIGATIONS AND MONI SESSION (A)***

Chairman: ***Ruslan MARIYCHUK***
10:30 – 11:35

Keynote

Mythili MADHUSUDHAN
School of Architecture, Meenakshi College of Engineering, Chennai, Tamil Nadu - India
ECOSYSTEMS AND LANDSCAPE FOR THE FUTURE GENERATIONS

Lydia SOBOTOVA, Tibor DZURO, Miroslav BADIDA
Department of Environmental Engineering, Institute of Industrial Engineering, Management and Environmental Engineering, Faculty of Mechanical Engineering, Technical University of Košice, Košice - Slovakia
WATER JET AND ITS ENVIRONMENTAL PROBLEMS

Oral:

Haimei CHEN[1,2], Levente KARDOS[2], Magdolna Sütöriné DIÓSZEGI[1], Veronika SZABÓ[1]
[1]*Department of Floriculture and Dendrology, Institute of Landscapes Architecture, Urban Planning and Garden Art, Hungarian University of Agriculture and Life Sciences, Budapest - Hungary*
[2]*Institute of Environmental Science, Department of Agro-environment Studies, Hungarian University of Agriculture and Life Sciences, Budapest - Hungary*
URBAN WOODY PLANT'S BENEFITS IN HEAVY METAL POLLUTION MONITORING AND REDUCTION

Rudolf SZABÓ[1], Lóránt SZABÓ[2]
[1]Rejtő Sándor Foundation, Budapest - Hungary
[2]*Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of LightIndustry and Environmental Engineering, Óbuda University, Budapest - Hungary*
COMPOSITES MATERIALS, PROCESSES, PROPERTIES AND APPLICATIONS

Haya ALTALEB[1], Soufyane Ahmad HAFED[2], Zoltán RAJNAI[1]
[1]*Doctoral School on Safety and Security Sciences, Óbuda University, Budapest - Hungry,* [2]*DONÁT BÁNKI Faculty of Mechanical and Safety Engineering, Óbuda University, Budapest - Hungary,* [3]*Doctoral School on Safety and Security Sciences, Óbuda University, Budapest – Hungry*
COMPARISON BETWEEN VARIOUS MPPT TECHNIQUES (FUZZY LOGIC, P&O, HYBRID SYSTEM (FUZZY LOGIC, P&O))

Lara Rúbia BORGES SILVA, Levente KARDOS
Department of Floriculture and Dendrology, Institute of Landscapes Architecture, Urban Planning and Garden Art, Hungarian University of Agriculture and Life Sciences, Budapest - Hungary
RECYCLING OF ORGANIC WASTE: AN OVERVIEW OF PÁLINKA DISTILLERY MASH COMPOSTING

Saad K. EL EBAIDI, Ahmed M. MUFTAH, Mohammed H. AL RIAYDH
Department of Earth Sciences, Faculty of Science, University of Benghazi, Benghazi - Libya
EVALUATIONS OF THE EOCENE APOLLONIA FORMATION IN KARSAH REGION, CYRENAICA, LIBYA, FOR CEMENT MANUFACTURE

Poster:

Károly PENKSZA, Norbert PÉTER, Attila Fűrész, Eszter Saláta-FALUSI, Zoltán BAJOR
Hungarian University of Agriculture and Life Science, Institute of Agronomy, Gödöllő - Hungary
CONSERVATION MANAGEMENT AND RESTAURATION OPEN SANDY GRASSLAND THE HOMOKTÖVIS CONSERVATION AREA IN BUDAPEST

Technical Session *ENVIRONMENTAL INVESTIGATIONS AND MONI SESSION (B)*

Chairman: *Lydia SOBOTOVA*
11:45 – 13:20

Keynote:

Csaba LENTNER[1], Sándor J. ZSARNÓCZA[1,2]
[1]University of Public Service, Faculty of Governmental and International Studies, Kálmán Széll Public Finance Pub, Budapest - Hungary
[2]University of Public Service, Faculty of Governmental and International Studies, Kálmán Széll Public Finance Pub, Budapest - Hungary, Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest - Hungary
FINANCIAL AND ECONOMIC POSITIONS OF PORTUGAL AT THE TURN OF 2020S

Csaba MÉSZÁROS[1], István Róbert NIKOLÉNYI[1], Ágnes BÁLINT[2]
[1]Institute of Mathematics and Basic Sciences, Hungarian University of Agriculture and Life Sciences, Gödöllő - Hungary
[2]Institute of Environmental Engineering and Natural Sciences and Hydro-Bio-Mechanical Systems Research Center, Óbuda University, Budapest - Hungary
NEW SYMMETRY METHODS FOR QUANTUM-MECHANICAL MODELLING OF PROMISING PHOTOVOLTAIC MATERIALS OF INFINITE CHAIN-TYPE AND LAYER-TYPE ATOMIC SYSTEMSTITLE

Oral:

Deepa JOSHI[1], Thipendra P. SINGH[2]
[1,2]School of Computer Science, University of Petroleum and Energy Studies, Energy Acres, Bidholi, Dehradun- Uttarakhand – India
NOVEL USE OF A DEEP CONVOLUTION ARCHITECTURE PRE-TRAINED ON SURFACE CRACK DATASET TO LOCALIZE AND SEGMENT WRIST BONE FRACTURES

Mohamed Sabri BENSAAD[1,2], Saliha DASSAMIOUR[2], Leila HAMBABA[2], Mohamed Amine KAHOUL[3]
[1]Laboratory of Cellular and Molecular Physio-Toxicology-Pathology and Biomolecules, Department of Biology of Organisms, Faculty of Natural and Life Sciences, University Batna 2, Fesdis, Batna - Algeria
[2]Laboratory of Biotechnology of Bioactive Molecules and Cellular Physiopathology, Department of Microbiology and Biochemistry, Faculty of Natural and Life Sciences, University Batna 2, Fesdis, Batna – Algeria, [3]Laboratory of Food Sciences, Institute of Agriculture and Veterinary Sciences, University Batna 1, Batna – Algeria
EVALUATION OF THE ANALGESIC CAPACITY OF THE N-BUTANOLIC EXTRACT OF CENTAUREA TOUGOURENSIS BOISS & REUT

Saliha DASSAMIOUR[1], Mohamed Sabri BENSAAD[1,2]
[1]*Laboratory of Biotechnology of Bioactive Molecules and Cellular Physiopathology, Department of Microbiology and Biochemistry, Faculty of Natural and Life Sciences, University Batna 2, Fesdis, Batna - Algeria*
[2]*Laboratory of Cellular and Molecular Physio-Toxicology-Pathology and Biomolecules, Department of Biology of Organisms, Faculty of Natural and Life Sciences, University Batna 2, Fesdis, Batna - Algeria*
TEST OF BIOLOGICAL ACTIVITIES OF SYRUPS ELABORATED FROM WASTE DATES

Zoubir BELHIMER, Azzedine BOUZENOUNE, Abdelhakim BOUCHAIR
Geological Engineering Laboratory, University of Mohamed Seddik Benyahia, Jijel - Algeria
IRON MINERALIZATIONS OF BABORS REGION (NORTHEASTERN ALGERIA)

Osamah J. AL-SAREJI[1,2], Mónika MEICZINGER[2], Raed A. AL-JUBOORI[3,4], Viola SOMOGYI[2], Miklós JAKAB[5]
[1]*Environmental Research and Studies Center, University of Babylon, Al-Hillah - Iraq*
[2]*Sustainability Solutions Research Lab, Faculty of Engineering, University of Pannonia, Veszprém - Hungary*
[3]*NYUAD Water Research Center, New York University-Abu Dhabi Campus, Abu Dhabi, Abu Dhabi - United Arab Emirates*
[4]*Water and Environmental Engineering Research Group, Department of Built Environment, Aalto University, Aalto, Espoo - Finland*
[5]*Research Centre of Engineering Sciences, Department of Materials Sciences and Engineering, University of Pannonia, Veszprém - Hungary*
ENZYME IMMOBILIZATION ON DATE STONES FOR REMOVING POLLUTANTS

Kshitij NAIKADE
DAAD Scholar, Berlin School of Economics and Law, Berlin, Germany
Symbiosis Law School, Pune, India
SUSTAINABLE UTILIZATION OF WILDLIFE (SUW): NEED OF THE HOUR TO UNDERSTAND THIS GREY AREA UNDER CITES FOR A SUSTAINABLE FUTURE

Poster:

Károly PENKSZA[1], Zsuzsanna SUTYINSZKI[1], Attila FŰRÉSZ[1], Dénes SALÁTA[2], Szilárd SZENTES[3]
[1]*Hungarian University of Agriculture and Life Science, Institute of Agronomy, Gödöllő - Hungary*
[2]*Hungarian University of Agriculture and Life Science, Institute for Wildlife Management and Nature Conservation, Gödöllő - Hungary*
[3]*Hungarian University of Agriculture and Life Science, Institute of Animal Scienc, Gödöllő - Hungary*
VERGES AS FRAGMENTS OF THE WESTERNMOST OCCURRENCES OF FOREST GRASSLAND IN THE CARPATHIAN BASIN AND THEIR FESTUCA SPECIES

Technical Session ***ENVIRONMENTAL INVESTIGATIONS AND MONI***
SESSION (C)

Chairman: ***Csaba MÉSZÁROS***
13:30 – 15:05

Keynote:

Ruslan MARIYCHUK
Department of Ecology, Faculty of Humanities and Natural Sciences, University of Presov, Presov - Slovakia

RECENT ADVANCES IN THE GREEN SYNTHESIS OF BIOCOMPATIBLE NANOPARTICLES

Hosam E.A.F. BAYOUMI HAMUDA
Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest - Hungary

PROTECTION THE PLANET: GLOBAL ECOSYSTEM PROBLEMS AND CLIMATIC CHANGES

Oral:

Ákos MALATINSZKY, Csilla FICSOR
Hungarian University of Agriculture and Life Sciences, Gödöllő - Hungary

HORSE-POWERED LOGGING FOR THE PROTECTION OF HUNGARIAN FORESTS

Virág NÉMETHY
Institute of Product Design, Rejtő Sándor Faculty of Light Industry and Enviromental Engineering, Óbuda University, Budapest – Hungary

7TH INTERNATIONAL CEEPUS WINTER SCHOOL DESIGN WEEK 2022

Oumeima BENMEBAREK, Azzedine BOUZENOUNE
Geological Engineering Laboratory, University of Mohammed Seddik Benyahia, Jijel - Algeria

POLYMETALLIC MINERALIZATION (FE, CU, PB, ZN, BA) OF THE TELLIAN DOMAIN (JIJEL PROVINCE, NE ALGERIA): MICROSCOPIC AND MINERALOGICAL CHARACTERIZATION

Mark Gabriel Wagan AGUILAR[1], Jayson Nual OLAYTA[2]
[1]Emilio Aguinaldo College, Cavite - Philippines,
[2]Laguna State Polytechnic University, Laguna - Philippines

ENVIRONMENTAL ATTITUDE VERSUS BEHAVIOUR OF TOURISM MANAGEMENT STUDENTS IN SELECTED COLLEGES AND UNIVERSITIES IN REGION IV-A, PHILIPPINES: A BASIS FOR EDUCATIONAL PLANNING AND DEVELOPMENT

Ákos BORBÉLY
Rejtő Sándor Faculty of LightIndustry and Environmental Engineering, Óbuda University, Budapest - Hungary

COLORIMETRIC INVESTIGATION OF FALL FOLIAGE

Poster:

Tareq IRHAYYIMA, Mohamed Ali RAWASH
Department of Animal Science, Georgikon Faculty, Hungarian University of Agricultural and Life Science, Keszthely - Hungary

CLIMATE CHANGE AND AGRICULTURE SECTOR IN EGYPT: EFFECTS AND ADAPTATION

Technical Session *ENVIRONMENTAL INVESTIGATIONS AND MONI SESSION (D)*

Chairman: *Hosam E.A.F. BAYOUMI HAMUDA*
15:05 – 16:30

Keynote:

Tatjana JUZSAKOVA, Ali Dawood SALMAN, Béla VARGA, Gvendolin KULCSÁR, János LAUER, Tamás PAP
Research Centre for Biochemical, Environmental and Chemical Engineering, University of Pannonia, Veszprém - Hungary
RARE EARTH METALS SEPARATION FROM BAUXITE WASTE BY ION EXCHANGE AND SOLVENT EXTRACTION TECHNIQUES

Oral:

Ali Dawood SALMAN[1,2], Tatjána JUZSAKOVA[1], Moayyed G. JALHOOM[2], Sebestyen VIKTOR[1], Endre DOMOKOS[1]
[1]Sustainability Solutions Research Lab, University of Pannonia, Veszprém - Hungary [2]Department of Chemical and Petroleum Refining Engineering /College of Oil and Gas Engineering, Basra University [3]Department of Production Engineering and Minerals, University of Technology Baghdad - Iraq
SYNTHESIS AND SURFACE MODIFICATION OF MAGNETIC Fe3O4@SiO2-EDTA NANOPARTICLES AND ITS APPLICATION IN UPTAKE OF NICKEL(II) IONS FROM AQUEOUS MEDIA

Natalia PITTA-OSSES, Csaba CENTERI, Krisztián KATONA
Institute for Wildlife Management and Nature Conservation, Department of Wildlife Biology and Management, Gödöllő - Hungary
POPULATION CONTROL OF HIGH IMPACT MAMMALS: COMPARISON OF METHODS FOR WILD HIPPOS IN COLOMBIA AND WILD BOAR IN EUROPE

Xuechu WANG
Environmental Sciences Doctoral School, Hungarian University of Agriculture and Life Sciences, Gödöllő - Hungary
THE CORPORATE ASPECTS OF CLIMATE CHANGE ACTION

Zakaria MENNANE, Jamal ABRINI, Noureddine ELMTILI
[1]Food and Health Team; Laboratory of Biology and Health, Faculty of Sciences, Abdelmalek Essaidi University, Tetouan - Morocco

PHYSICO-CHEMICAL AND MICROBIOLOGICAL CHARACTERISTICS OF TRADITIONAL AND INDUSTRIAL FIGS TAKEN FROM THE MARKETS OF TETOUAN IN MOROCCO

Abdelhakim BOUCHAIR, Azzedine BOUZENOUNE, Yasser MAHAMDIOUA, Yasser KEMEL, Zoubir BELHIMER
Geological Engineering Laboratory, University of Mohamed Seddik BenYahia, Jijel - Algeria

DISTRIBUTION AND PETROGRAPHY OF EOCENE OOIDAL IRONSTONES FROM KEF IN NSOUR DEPOSIT (TEBESSA, NORTH-EASTERN ALGERIA)

Malak SHATNAWI, Haya ALTALEB, Zoltán RAJNAI
Doctoral School on Safety and Security Sciences, Óbuda University, Budapest - Hungry

NATURAL DISASTERS IMPACTS; RISK ASSESSMENT AND SUSTAINABILITY SOLUTION

Technical Session *AIR QUALITY, ENERGY AND RENEWABLE ENERGY*

Chairman: *Csaba ÁGOSTON*
13:30 – 15:00

Keynote:

Edmond HOXHA
Faculty of Geology and Mining, Polytechnic University of Tirana - Albania
"GREEN ENERGY" AS CHALLENGE AND OPPORTUNITY IN ALBANIA

Oral:

Bushra ATFEH, Róbert MÉSZÁROS
Department of Meteorology, Institute of Geography and Earth Sciences, Eötvös Loránd University, Budapest - Hungary
APPLICATION OF LOW-COST SENSORS FOR INDOOR AIR QUALITY MONITORING IN BUDAPEST, HUNGARY

Sara ALKHALDI[1], Katalin A. FŐGLEIN[2], Krisztina DEMÉNY[1]
[1]Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest - Hungary
[2]KTI Institute for Trapnsport Sciences, Non-Profit LTD. Research Centre For Sustainable Transport, Department for Air Quality and Propulsion Systems, Budapest – Hungary
A MORE SUSTAINABLE TRANSPORT: REVIEW OF ELECTRIC CARS

Lily TANUI[1], Emőke IMRE[2]
[1]Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest - Hungary
[2]Óbuda University, Bánki Donát Faculty, and EKIK Hydro-Bio-Mechanical Systems Research Center, Budapest – Hungary
SOLAR AND WIND POWER INSTALLATION ON PUZSTAZAMOR LANDFILL SITE

Csaba ÁGOSTON
Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest - Hungary
LOCAL ENRICHMENT OF AIR POLLUTANTS IN A PRACTICAL EXAMPLE

Poster:

Doris STOJILKOVIC, Hosam E.A.F. BAYOUMI HAMUDA
Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest – Hungary

AIR QUALITY AND DISTRIBUTION OF LICHENS AS BIOMONITORS IN SOME SERBIAN AND HUNGARIAN TERRITORIES

Emőke IMRE[1], Paulo COMBACAU, Khalil BEN KHALED
[1]Bánki Donát Faculty, Óbuda University, and EKIK Hydro-Bio-Mechanical Systems Research Center, Budapest - Hungary

WIND ENERGY MEASUREMENT IN A LANDFILL SITE

Emőke IMRE, Tibor PÁLINKÁS, Péter FELKER, Martin MAYER, Gábor MILE, Tibor FIRGI, Gábor TELEKES, Zsolt HORTOBÁGYI, Lily TANUI, Ulsbold AYURZANA, Parvesh TANEJA, Delphin KABEY, Ágnes BÁLINT
Bánki Donát Faculty, Óbuda University, and EKIK Hydro-Bio-Mechanical Systems Research Center, Budapest - Hungary

DEVELOPMENT OF A DATA ACQUISITION SYSTEM, DAS, FOR MEASURING SOLAR IRRADIANCE USING PYRANOMETER IN THE PUSZTAZAMOR LANDFILL SITE

Day 2 – November 18, 2022 (Friday)

09 – 10:30

Continuing the remaining part of the Conference

Closing Ceremony

*****Good Luck*****

Abstracts of Plenary Session

REVITALIZATION OF DEGRADED/CONTAMINATED SOIL AND DEVELOPMENT OF APPROPRIATE SOILBIOLOGICAL CHARACTERISTICS – A CASE STUDY

Borbála BIRÓ[1*], Zsolt KOTROCZÓ[1], Hosam E.A.F. BAYOUMI HAMUDA[2]

[1]*Deparment of Agri-Environmental Studies, Hungarian University of Agriculture and Life Sciences, Budapest - Hungary,*
[2]*Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest* - *Hungary E-mail:* biro.borbala@gmail.com

Abstract
A pot experiment was set up to investigate the revitalization potential of selected treatments on a highly contaminated/degraded soil. In the experiment 6 factors and 7 treatments were used, each in 4 replicates, using rape (Brassica napus) as test plant. During the time period of the experiment continuous observations and measurements were conducted, plant and soil analyses – chemical and microbiological – were made to establish the main effects and results of the used treatments. Among them compost+soil-inoculum addition proved to be the best for the revitalization. This fact shows that the compost in a good quality, and the compost enriched with microbes, or the inoculation with compost extracted microbes can play the most important role in the revitalization of contaminated soils. Manure, and the manure+inoculums can also be used as a prominent treatment in the restoration of soils, so as to increase the organic matter content and the microbial activity in one step. The single alga- and microbial inocula treatment was not fully successful, therefore, their use –without adding any parallel organic matter– cannot be fully recommended. The clay-additive ont he other hand could increase persistency and activity of the applied microbes during the revitalization. Application of organic additives supplemented with microbial inoculums can be suggested, as appropriate treatments of degraded/contaminated soils, of rather missing soil-biological activity.

Keywords*: manure, compost, microbes, inoculation, revitalization, restoration*

Biography

Prof. Dr. Borbála BIRÓ is a soil-biologists, terrestris ecologist, the doctor of Hungarian Academy of Sciences (DSc) and professor emerita at the Hungarian University of Agriculture and Life Sciences, Dept. of Agri-environmental Studies, Budapest, Hungary. She is the member of Doctor's School of Horticulture and She is the current supervisor of 4 PhD students. Her main scientific expertise is covering of the beneficial microorganisms in soil-plant-environment systems and the use them in the soil/rhizo/biotechnology. The application of biofertilizers/biopesticides and the use them in agri- and horticultural ecosystems. B. Biró was invited expert in the Horizon 2020 program of European Commission at the Mission of "Soil Health and Food".

PROTECT SOIL FOR SURVIVAL OF MANKIND

Bhanu Singh PANWAR[1], S. K. VARSHNEY[2], Hosam E.A.F. BAYOUMI HAMUDA[3], Borbála BIRÓ[4]

[1]*CCS Haryana Agricultural University, Hisar, India*
[2]*Ministry of Science and Technology, Government of India, Department of Science and Technology Technology Bhawan, New Mehrauli Road, New Delhi. India*
[3]*Institute of Environmental Engineering & Natural Sciences, Óbuda University. Budapest, Hungary*
[4]Hungarian University of Agriculture and Life Sciences, Budapest, Hungary
panwarbss@gmail.com

Abstract
If we are what we eat, we are only as healthy as the soil that produces our food. Healthy food smells good and so does healthy soil. You don't always need expensive lab tests to determine if the soil is healthy or not; instead, use your sniffing skills and you won't go wrong. Leaving soil without any green cover ends up killing its essential micronutrients and microfauna, in addition to disintegrating it to the point of no water retention capacity. Tillage creates and enhances many serious environmental impacts, such as increasing carbon emissions germination level plant grows in the moon soil. Lunar soil contains elements such as Fe and Mg. But it lacks most of the minerals found on Earth. it has a harder texture and contains a lot of small, sharp pieces. It contains fragments of microscopic glass left over from meteorite impacts. It's as if the world has come to an end to the land, Agricultural research in lunar conditions after Mars. Reducing cadmium (Cd) content in cereals and fodder crops is a public concern for food safety and security. Heavy metal toxicity and the danger of their bioaccumulation in the food chain represent one of the major environmental and health problems of our society. Primary sources of pollution is from the burning of fossil fuels, mining and smelting of metallic ferrous ores, municipal wastes, fertilizers, pesticides, and sewage sludge. The most common contaminants are Cadmium, Chromium, Copper, Mercury, Lead, Nickel and Zinc. Soil treatment using inorganic and organic amendments is considered as a cost-effective approach in immobilizing soil heavy metals and reducing metal uptake by crops. Contamination by heavy metals is a significant issue worldwide. In recent decades, soil heavy metals pollutants in Asia had adverse impacts on soil quality and threatened food security and human health. Anthropogenic inputs mainly generate heavy metal contamination in Asia. In this article, the approaches were used in these investigations, focusing on geochemical strategies and metal isotope methods, particularly useful for determining the pathway of mining and smelting derived pollution in the soil. Our findings indicate that heavy metal distribution substantially impacts topsoil around mining and smelting sites, which release massive amounts of heavy metals into the environment. Furthermore, heavy metal contamination and related hazards posed by Pb, Cd, As, and Hg are more severe to plants, soil organisms, and humans. It's worth observing that kids are particularly vulnerable to Pb toxicity. And this article also provides novel approaches to control and reduce the impacts of heavy metal pollution.

Keywords*: Soil, natural body, heavy metals, pollution, Phytoremediation*

Biography

Professor Dr. B.S. Panwar

Ph.D. (Soil Science), specialized in "Soil and Environmental Sciences" from CCS, Haryana AgriculturalUniversity, Hisar (India) in 1994. M.Sc. (Soil Science & Agricultural Chemistry), specialized in "Dynamics of major nutrient in soil-plantsystems" from Agricultural University, Udaipur in 1979. International Intensive Tempus Course: "Soil, water and Environment: Soil pollution" at Agricultural University of Debrecen, Debrecen, Hungary, in 1997.

Position held:

Professor, Senior Soil Scientist – Environmental research on toxic heavy metals in soil/plant system. Professional Societies:Active member of Indian Society of Soil Science. Member in Editorial Advisory Board of International Journal 'GREEN FARMING".

Total Research Experience:

35 years on Environmental sciences specialized in fate of toxic metals in soil-plant-water ecosystems.

Research Areas:

The fate of toxic metals in soil-plant eco system. Speciation, availability and mobility. The impact of organic bi-product, compost, sewer, sludge, FYM application to polluted, waste land soils. Characterization of soil pollution, developing risk assessment methodology and phytoremediation technologies.

Projects

Interactive study of major plant nutrients, fertility status, saline & alkaline soils reclamations – 1980-1985.

Impact of applied high doses of Agro-chemicals, pesticides and fertilization on soil-plant-water ecosystem, toxic metals in canal/underground, sewer water and industrial effluent applied vegetable growing areas in vicinity of cities and agricultural soil – 1986-1990.

Detoxification/mobility of toxic heavy metal (cadmium) in legume crop species affected by farm yard manure and phosphorus application in soils – 1991-1994.

Land use planning – Land capability classification, detail soil survey of desert / waste / polluted soils – 1995-2003

Natural Resource Management for Sustainable Agriculture- 2004-2008.

Site Specific Nutrients Management-2009

Soil Test Crop Responses-2008-2015

Soil Environment Consultant: Free lancer

International and Collaborative Scientific Research Projects:

I. Sustainable plant nutrient under different climatic condition and the fate of pollutants in agriculturalsystems.

Institutes: RISSAC-HAS, Budapest, HungaryCCS HAU, Hisar – India

Nodel Financial agencies: INSA, New Delhi and HAS, Budapest (Period: 1997-2002 (Five Years)

Project Co-ordinator:

(Hungarian) Prof. Tamas Nemeth (Director, RISSAC-Budapest) (Indian) Dr. B.S. Panwar (Senior Soil Scientist, CCS HAU, Hisar)

. Phytoremediation of potentially toxic heavy metals contaminated soils by agricultural crop genotypes. Nodal Financial agencies: DST, New Delhi and MOE- HAS, Budapest

Period: 2006-08 (Two Years)

Project Co-ordinator:

(Hungarian) Dr. Marton Laszlo, (Senior Scientist, RISSAC-Budapest)

(Indian) Dr. B.S. Panwar (Senior Soil Scientist, CCS HAU, Hisar)

***Visiting Scientist**: ETH, Zurich, Switzerland, MSU, Moscow, Russia, PSTU, Mariupol, Ukraine,*

ABSTRACTS OF MICROBIOLOGY, SOIL BIOLOGY, SOIL QUALITY AND PLANT SESSION

IMPACT OF WILD BOAR (*SUS SCROFA*) ROOTING ON THE PHYSICO-CHEMICAL PROPERTIES OF SOIL IN THE EDOUGH FOREST (NORTHEAST, ALGERIA)

Kamelia HESNI BENOTMANE[1], Mehdi BOUKHEROUFA[2], Imene KAHLI[1], Feriel SAKRAOUI[2]

[1]Soil and Sustainable Development Laboratory, Department of Biology, Faculty of Science, Badji Mokhtar Annaba University, Annaba, Algeria, kameliabenotmane@gmail.com , 0662278216
[2]Eco biology Laboratory for Marine Environments and Coastal Areas, Faculty of Sciences, Badji Mokhtar Annaba University BP 12, 23 200, Annaba, Algeria, f.sakraoui@gmail.com ,0782302092

Abstract
In Algeria, the wild boar sus scrofa is a very controversial species, which displays high densities leading to a necessary regulation of natural populations by hunting. However, this "ecosystem engineer" is a purely forest species that has an impact on soil aeration, through rooting. In this study, we were interested in the effect of the rooting of the species on the physico-chemical quality of soils in forest ecosystems. The resulting study was conducted at a locality in the Edough forest massif, through the analysis of some physico-chemical parameters on rooted soils and control soils. We chose 5 roots, which we geolocated, measured (depth, length and width) and on which we sampled from the soil in the internal part (IN), in the peripheral ring (RING) and a non-rooted control zone (OUT). The results obtained highlight a potential effect on the physico-chemical properties of the soil in natural environments, which reinforces its role and its importance on an ecological scale.

***Keywords**: Sus scrofa, rooting, soils, physico-chemical properties, Edough forest massif*

Biography

Kamelia Hesni Benotmane, PhD student, member of DAFEC Research Team (Animal Diversity and Ecosystem Functioning). affiliated with laboratory of "Soil and Sustainable Development" Department of Biology/Faculty of Sciences Badji Mokhtar University.

SMART NANO-SENSORS FOR FUTURISTIC AGRICULTURE LEADING TOWARDS ENVIRONMENT SUSTAINABILITY & NUTRITION SECURITY

Shraddha JOSHI[1*], Jyoti UPADHYAY[1], Souradeep ROY[2], Aashish MATHUR[2*]

[1]Department of Allied Sciences, School of Health Sciences and Technology, University of Petroleum and Energy Studies, Dehradun, India. shraddha20december@gmail.com2
[3]Centre for Interdisciplinary Research and Innovations (CIDRI), University of Petroleum and Energy Studies, Dehradun, 248007, India, ashish.mathur@ddn.upes.ac.in

Abstract
Global efforts continue to lose ground for achieving second sustainable development goal of "Zero Hunger" by 2030, as according to the recently- released 2022 "State of Food Security and Nutrition in The World (SOFI)" report 828 million people were facing hunger in 2021 and it also projects that nearly 670 million people will still be affected by hunger in 2030. India also has a serious level of hunger and in the 2022 Global Hunger Index, India ranks 107 out of 121 countries. Despite profound and robust efforts by government to mitigate hunger, malnutrition and low nutrition security; grain sufficiency has been achieved up to a certain level, but micro-nutrient deficiency is still prominent in the country. Nutrition security & micro nutrient malnutrition can be exacerbated by nutrient dense food crops. To ensure this it is important to analyse the quality of soil for desired crop production in terms of NPK levels, moisture content, pH, temperature , level and effect of pesticides as soil quality is directly linked to food quality. Nanotechnology has enormous potential to solve these agriculture-related problems like decline in soil quality, low crop productivity, food security, and nutrient deficiency in soil, crops and eventually in humans. The traditional agricultural practices must be reinforced with modern/ultra-modern techniques in order to significantly eradicate hunger. This can be achieved by implementing nano-biosensing technology for the analysis of physiochemical properties and fertility assessment of soil to avoid deficiency; which otherwise can lower the quantity and nutritional quality of crops produced on it. These sensors are envisaged to ensure rapid diagnostic tests and results whereas nano fertilizers may help in improving soil-fertility, reducing nutrient loss, increasing crop yield and ensure environmental sustainability. Therefore, the rational and efficient use of this emerging technology is essential to ensure the desired levels of nutrients in soil prior to crop production and any deficiency found should be treated with hybrid fertilizers empowered with desired nutrient-rich nanoparticles..

***Keywords**: Sustainable Agriculture, Smart Agriculture, Global Hunger Index, Food Security, Nanotechnology, Biosensors.*

Biography

Ms. Shraddha Joshi is currently pursuing her PhD in Food and Nutrition Sciences in the School of Health Sciences and Technology, University of Petroleum and Energy Studies (UPES), Energy Acers, Dehradun, Uttarakhand. Her areas of interest are nutrition security, public health nutrition, eradicating malnutrition, nanotechnology, biosensors and sustainable agriculture.

COMPARING SALINE AND QUICK CLAYS

Emőke IMRE[1], Miklós JUHÁSZ[2], Ágnes BÁLINT[3]

[1]Bánki Donát Faculty, Óbuda University, and EKIK Hydro-Bio-Mechanical Systems Research Center, Budapest, Hungary, e-mail: imre.emoke@uni-obuda.hu, mobile: +36202892656; ORCID: 0000-0001-6746-027X, [2]Debrecen University, Debrecen, top@taupe.hu; [3]Institute of Environmental Engineering and Natural Sciences, Óbuda University, Budapest, Hungary, and EKIK Hydro-Bio-Mechanical Systems Research Center, Budapest, Hungary e-mail: balint.agnes@rkk.uni-obuda.hu, mobile: +36303721342,

Abstract

In the last few decades, about fifty modern municipal landfill sites have been established in Hungary. Considering the 5, 10 or 15 km vicinity of these municipal landfills, the 24%, 44% and 60% of the total population are found here within the 16%, 37% and 53% of the villages and cities, so a large, decentralised energy system could be made by using all landfills. The meteorological data available show that at the relative altitude of 100 m excellent wind energy potential does exist nearly everywhere in Hungary, practically independently of the geographical location. In addition, on the artificial landfill hills – due to the cross sectional area at a hill altitude of around 60 m – an additional increase in the wind velocity can be expected (Tóth, 2014). Solar panels can be used after the closure of the landfills on large areas, in inclined slopes. In the frame of a research on the complex energy utilization of the Pusztazámor MSW landfill hill (gas, solar and wind units), wind velocity measurements has been started to be made at the top with of the ~ 60 m high landfill hill with a 18 m high pole. In this part of the research wind energy measurement is extended to the bottom of the pole. A meteorological station is planned to be used for the wind velocity measurement. The data storage and data transfer is designed by raspberries. In parallel, some independent data sets are processed and compared with the actually measured data.

Keywords*: pore water pressure and cone resistance dissipation tests, creep, consolidation, compression, saline, quick clay*

Biography

COMPARISON OF WILD BOAR EFFECTS ON SOIL THICKNESS IN FORESTS

Ádám FEHÉR[1], Natalia PITTA-OSSES[1], Krisztián KATONA[1], Csaba CENTERI[1]

Department of Wildlife Biology and Management, Institute for Wildlife Management and Nature Conservation, Hungarian University of Agriculture and Life Sciences, 2100-H, Gödöllő, Páter K. u. 1., Hungary, e-mail: nata.pitta@gmail.com

Abstract

Wildlife plays an important role in forest ecosystems. Still, a limited information is available about the depth and areal distribution of these effects. The importance of the description of wild boar is huge because of the interconnection of conflicts between farmers, foresters, hunters, wildlife biologist and nature conservationists, just to mention some of the stakeholders. In the recent paper two areas are compared, one in the Gödöllő Hillside and one at the foot of the Mátra Mountain. Deep rootings were analysed where the center of the rooting is deep (40 cm<) while the ring of the rooting is 20+ cm higher than the nearby control area. The results show that boar rooting has very heterogeneous impact on topsoil humus thickness. One of the sites of the Gödöllő Hillside had significant results while the inclusion of another site resulted no significance. It means that the site selection has a tremendous effect on the significance levels. It can be the effects of other inputs but it need further investigations.

Keywords: *wildlife, deep rooting, nature conservation area, comparative analyses*

Biography

Ádám Fehér is an independent researcher, currently working as a freelance and in collaboration with the Institute for Natural Resources Management of the Hungarian University of Agricultural and Life Sciences (MATE), Hungary. He received his master's degree in wildlife management engineering in 2013, and his doctoral degree in 2019. Simultaneously, he obtained a certification as a forestry and nature conservation technician. He studied the effects of forest management techniques on ungulate impact and forest habitat quality in his thesis.

DETERMINATION THE IMPACTS OF MUNICIPAL SEWAGE SLUDGE TREATMENTS USED FOR GROWING COMMON BEAN AND SOME ESSENTIAL PLANT NUTRIENT CONTENTS IN SLIGHT ACIDIC SOIL

Máté HORVÁTH, Hosam E.A.F. BAYOUMI HAMUDA

[1]*Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest – Hungary*
e-mail: bayoumi.hosam@uni-obuda.hu

Abstract

The pot experiment was conducted out to investigated the growth and development of the common bean plant under different application ratios of soil-sewage sludge (Nyíregyháza, Hungary) mixture (0, 7.5, 15, 30 and 45%). The experoment investigated the effect of sewage sludge on treated non-rhizosphere (control) and rhizosphere soils. Different parameters were investigated: physical (soil moisture), chemical (pH, plant macro- and micronutrients), as well as biological: (some special groups of microorganisms and somepotential activities of some soil enzymes) and plant growth and development (growth parameters, chlorophyll intensity). I examined the brown forest soil, mixed with municipal sewage sludge from. According to high organic organic content in the wastewater sludge and may contains very low level of heavy metals, in this condition it can be suggested as organo-fertilizer or for land. The beneficial effect of municipal sewage sludge was shown, as the results of all tests supported that sewage sludge can be a soil improving material. It is true that this largly depends on the heavy metal concrentration of the sewage sludge, which can be different depending on the location. Compeared to control bean plants, the tested values of bean plants treated with sewage sludge were higher in all cases. The most optional dose was 45% (w/w) in all cases except for the mangenese content result. With this dose, It was achieved the highest efficiency in order to increase the given values and concentrations. The pH- value of the soil became almost neutral from acidic, which is better for the cultivation of the bean plant, the soil moisture lost smaller amount as a result of the sewage sludge treatmend compared to the soil moisture of the control plant. The essential macro-nutrients (K, Na, Ca, Mg) and micro-nutrients (Fe, Mn, Zn) also achieved the highest concentration increase with the highest dose of sewage sludge, with the exception of the already mentioned manganese, since the most ideal for manganese was the 30% (w/w) the most effective dose. This can also be said for the total carbon, nitrogen and the phosphorus content, as thanks to this large dose, their concentration became several times higher than the concentrataion of these elements in the control plants. This increasing trend was continued by the healthy chrolophyll intensity essential for growing plants. After these plant natures, It was examined the microbial content living in the rhizosphere. Namely, CO2 emissions int he rhizosphere, FDA activity, Phosphate solubilizers, and the microbial count of cellulose decomposers both on the control plant and ont he soil-plant treated with sewage sludge were examined. In all cases, the result showed that the bean plant treated with sewage sludge was more effective, specially the highest doseI used, which was 45 % (w/w). It would recommend further tests with this research topic, as it was shown, great potential in its agricultural use. For this reason, it would be recommending that further research be started, which will map the effect of sewage sludge applied to other soil types. At the same time, Furthermore, it would be worthwhile to make the doses denser, so that it can be find the *most optimal concentration for the cultivation of each plant. It was found that the highest dose was 45% (w/w), but in most of the results, this dose was the most effective rate for the growth of bean plants. It would be worthwhile to test even with higher doses to see where the limit is, where the sewage sludge concentration in the soil becomes toxic. It was already mentioned that proposal that it would be worthwhile to conduct further research from other locations and on other types of plants. At the same time, it may be worthwhile to use municipal sewage sludge from several locations for further experiments, in order to assess the most effective ones, It was shown that the great potential in the large-scale use of sewage sludge, in many places, it is stored as waste, which (in ouropinion) is the most wasteful situation possible, since it can be reused, which in today's world should/should be one of the main goals to help our planet from unnecessary exploitation and pollution.*

Keywords:

Biography

COMPARATIVE STUDIES ON SOIL BIOLOGICAL ASSESSMENT: PESTICIDE SENSITIVITY OF MICROORGANISMS MEASURED UNDER LABORATORY CONDITIONS

Albert ONDRIK, Hosam E.A.F. BAYOUMI HAMUDA

[1]*Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest – Hungary*
e-mail: bayoumi.hosam@uni-obuda.hu

Abstract
In pot experiment, acidic sandy brown forest soil (from Gödöllő, Hungary) was used to study the effect of different pesticides (Fungicides: Kolfugo 25 WP, CKaptan 50 WP, and Thiram, herbicides: Ro-neet and Vernolate, Zoocides: Phosphotion and Rogorat three rates as half and double rates of the recommended officially on the microbial communities in an agroecosystem. This study explains that agriculture and crop production play a major role in spraying large amounts of agrochemical such as pesticides or injected into the soil. However, choosing this topic made it clear to that what we are doing to nature and the ecosystem. We also saw from the results that in many cases the fungicides, herbicides and zoocides had a positive effect on the soil and the microorganisms living in it. However, in many cases, half the dose (1/2X) would have been sufficient for some bacteria. Also, it could see that even the dosage with the recommended (X) concentration did not have a negative effect on these soil microbiotas, so it did not inhibit, but if it is used with recommended half of the dosage, we would have received the most optimal activities of the microorganisms and the soil. For example, for the effect on phosphate solubilizers, half the dose (1/2X) is sufficient for each of the fungicides, and even better than the mixture with the recommended concentration. It should be added that Thiram is one of the most dangerous drugs used, as it is highly toxic to humans. It was found that this occurred because in some cases the effect of this fungicide was not significant on soil activity. In the case of soil enzymes, it was realized a positive significant result. But, it managed to improve the amount of dehydrogenase and β-glucosidase in the soil, but in contrast, improper use, for example the double dose we described or in the case of Kaptan, sometimes even the recommended dose had a destructive effect, so it inhibits the enzyme activity in the soil. This greatly damages the soil and sooner or later it loses its productivity, not to mention that it also destroys the agroecosystem of the soil and the living organisms there. The fungicide called Kaptan had an inhibitory and also destructive effect on phosphate solubilizers and cellulose decomposers. The results also show that the populations of phosphate solubilizers under the treatment of soil with Kaptan decreased from 1.7 to 0.21. In terms of cellulose decomposers, it was decleased from 1.19 to 0.61. Finally, the experiment supports the application of the tested pesticides at normal recommended rates have no negative impats on soil biological properties where half of these rates can improves the biocharacterizations of the agroecosystem. The next step is to examine different soils, as they often differ in phyiscochemical and biological properties and composition. It is important not only to test in laboratory conditions, but also to conduct research in the open field, since the two measurements may differ from each other or the concentration of the given microorganisms may not be the same. In the future, it would be worthwhile to conduct an interview with farmers to find out what and how much and at what intervals they use herbicides, fungicides, or zoocides. If these measurements were carried out, we would have a

much greater insight into correct or incorrect use. In Hungary, to a lesser extent, agriculture still dominates, so it would be worthwhile to continue to deal with the topic at home.

***Keywords**:* comparative studies, soil biological assessment, pesticide sensitivity, microbial populations, laboratory conditions

Biography

SUSTAINABLE REAGENTS FOR PRODUCTION OF FUSED HETEROCYCLES VIA ELECTROPHILIC HETEROCYCLIZATION

Mikhailo SLIVKA[1,2], Olexander MOYZESH[1], Hanna GRYGORKA[1], Nataliya KOROL[1], Maksym FIZER[3], Ruslan MARIYCHUK[2]

[1]*Uzhhorod National University, Uzhhorod, Ukraine, mikhailo.slivka@uzhnu.edu.ua, +380999408740*
[2]*University of Presov, Presov, Slovak Republic, ruslan.mariychuk@unipo.sk*
[3]*Institute of Chemistry Slovak Academy of Sciences, Bratislava, Slovak Republic, mmfizer@gmail.com*

Abstract

Condensed heterocycles are well known due their excellent biological activity and have indisputably importance for organic chemistry. Electrophilic cyclization reactions (ECR) are widely used for production of the mono-heterocyclic compounds. It should be noted that despite the versatility of ECR and their ease of implementation, the classical reagents of the electrophilic heterocyclization are quite toxic, which limits their application. Therefore, the search for sustainable and non-toxic electrophilic reagents with is a point of special interest. In this study, the attempt of replace such toxic classical electrophilic reagents as bromine and tellurium tetrabromide with less toxic reagents using the unsaturated 1,2,4-triazole derivatives is presented. 3-Alkenylthioethers of 4,5-disubstituted 1,2,4-triazoles and 4-alkenyl-5-substituted 1,2,4-triazole-3-thiones were used as starting compounds. In the investigation of bromine-induced electrophilic heterocyclization was performed with the use of bromine, which was formed directly in a reaction mixture from less toxic hydrogen bromide and hydrogen peroxide. The yields of the target thiazolotriazoles were 72-84%, and the physicochemical characteristics fully correspond to the corresponding analogues obtained by the traditional bromination technique. The possibility of obtaining the above mentioned toxic electrophilic reagent from less toxic tellurium dioxide and a 6-fold excess of hydrogen bromide were studied for studying of ECR with the participation of tellurium tetrabromide. When isolating the target thiazolotriazoles and establishing their structure (via using a complex of spectral methods, XRD), the formation of products of proton-induced electrophilic heterocyclization was unexpectedly noted. Presumably, under the conditions of the reaction in the reaction mixture, the formed tellurium tetrabromide is in equilibrium with hexabromotelluridic acid, which entered the ECR to form condensed thiazolotriazolium hexabromotellurides. Thus, as a result of the performed research, we showed the possibility of using sustainable electrophilic reagents in ECR for the synthesis of condensed heterocycles, which significantly expands the scope of practical application of the specified method.

***Keywords**: Electrophilic Heterocyclization, Sustainable Reagents, Thiazolo-s-triazoles, Eco-friendly procedures.*

Biography

Mikhailo Slivka was born in Uzhhorod, Ukraine in 1974. He graduated with honors from Uzhhorod National University in 1996 and obtained his Ph.D. in organic chemistry at Institute of Organic Chemistry in Kyiv (Ukraine), in 2001. His Dr.Sc. thesis is devoted to electrophilic cyclization reaction of 1,2,4-triazoles. At present, he is Professor and research group leader at Uzhhorod National University (Uzhhorod, Ukraine). His scientific interests include synthesis of functional and condensed heterocycles via intramolecular electrophilic cyclization via green approaches, investigations of the reactivity of fused heterocycles and their application.

CoMFA STUDY AS AN EFFICIENT APPROACH FOR THE DESIGN OF BIOLOGICALLY ACTIVE BIS-1,2,4-TRIAZOLES

Mikhailo SLIVKA[1,2], Olexander MOYZESH[1], Hanna GRYGORKA[1], Nataliya KOROL[1], Maksym FIZER[3], Ruslan MARIYCHUK[2]

Uzhhorod National University, Uzhhorod, Ukraine, mikhailo.slivka@uzhnu.edu.ua, +380999408740
[2]University of Presov, Presov, Slovak Republic, ruslan.mariychuk@unipo.sk
[3]Institute of Chemistry Slovak Academy of Sciences, Bratislava, Slovak Republic, mmfizer@gmail.com

Abstract

Computational approaches became an efficient and a suitable technique for the design of significant compounds with valuable properties, prediction of interaction particularities and could calculate lot of other important values. CoMFA (Comparative molecular field analysis) study is an advance that develops and compars the steric and electrostatic interaction fields in the 3D space around set of aligned congeneric molecules and correlating this comparison with variation in their biological activity. Using the example of the series of prenyl-alkylated bis-1,2,4-triazole derivatives, the theoretical investigations included CoMFA studies for the target compounds were carried out. For this purpose, an online tool https://www.3d-qsar.com was used. The r^2 for steric model field was 0.665, for the electrostatic – 0.363. The q^2 are -0.425 and -0.572 corresponding. The common values of r^2 and q^2 for both model fields are 0.697 and -0.646. Obtained statistical results for both steric and electrostatic model fields and based on these data, we got predicted activities and built the corresponding correlation curve with the existing experimental results. The generated electrostatic contour maps demonstrated that electronegative substituents are proper in the region of triazole ring or terminal methyl group of prenyl substituent and electropositive substituents are satisfied in the field of double bond of prenyl group, aromatic substituents and C6 in the cases of alkyl groups in the 4th position of triazole ring. The generated steric contour maps demonstrated that bulky substituents are proper in the region of triazole rings and prenyl groups and are not satisfied to be added into the substituents in the 4th position. Thus, as the result of current study, we determine the best directions for functionalization of novel series of bis-1,2,4-triazoles, which would increase the biological activities of target compounds.

Keywords*: Synthetic Design, CoMFA, bis-Triazoles, Eco-friendly Approaches.*

Biography

Mikhailo Slivka was born in Uzhhorod, Ukraine in 1974. He graduated with honors from Uzhhorod National University in 1996 and obtained his Ph.D. in organic chemistry at Institute of Organic Chemistry in Kyiv (Ukraine), in 2001. His Dr.Sc. thesis was devoted to electrophilic cyclization reaction of 1,2,4-triazoles. At present, he is Professor and research group leader at Uzhhorod National University (Uzhhorod, Ukraine). His scientific interests include synthesis of functional and condensed heterocycles via intramolecular electrophilic cyclization via green approaches, investigations of the reactivity of fused heterocycles and their application.

ANTIFUNGAL ACTIVITY OF VOLATILES EMITTED FROM LIVING CULTURES OF CHLORELLA VULGARIS, DESERTIFILUM THARENSE, AND NAVICULA ARENARIA

Asmaa Lotfi ALALLAF[1], Metwally KOTTB[2], Ahmed K. EL-SAYED[3], Hesham Mohamed SHAFIK[1]*

[1]Botany department, Faculty of science, Port Said University, Egypt,
***** heshamshafik@yahoo.co.uk, *+36(20)2104939*
[2]Botany Department, Faculty of Science, Suez Canal University, Egypt.
[3]Botany & Microbiology Department, Faculty of Science, Damietta University, Egypt.

Abstract
Algae, plants, fungi, bacteria able to produce a wide spectrum of volatile organic compounds (VOCs) including terpenes, alkanes, alkenes, alcohols, ketones, aldehydes, benzenoids, esters, and sulfo compounds. The antifungal activity of volatiles emitted from D. tharense, C. vulgaris and N. arenaria were evaluated against M. phaseolina and F. oxysporum under living conditions through a system which allow the exchange of VOCs between algae and phytopathogenic fungi without physical contact between them. Volatiles released from C. vulgaris and D. tharense cultures cause a significant growth reduction to F. oxysporum and M. phaseolina, and the highest activity was recorded by C. vulgaris. Volatiles of C. vulgaris which exhibited the highest antifungal activity was collected under natural living conditions by headspace method and analyzed by GC/MS. GC/MS analysis of C. vulgaris volatiles proved that a complex mixture of bioactive and inactive natural compounds were produced by this alga. The identified compounds produced by C. vulgaris cells were belonging to different chemical classes such as; alkanes, cyclic alkanes, phenols, halogenated compounds, amides, acids, alcohols, ketones, lactones, fatty esters, fatty acid methyl esters, phthalic acid derivatives, and alcohols. The antifungal activity of C. vulgaris is attributed to the synergetic effect between all potent antifungal compounds that are produced by the alga cells.

***Keywords**: Antifungal activity, volatile organic compounds (VOCs), D. tharense, C. vulgaris, N. arenaria.*

Biography

Hesham Mohamed Shafik is a Professor in Botany department, Faculty of science, Port Said University, Egypt. He is also Academic staff member in PE Doctoral School of Chemistry and Environmental Sciences and PE Chemical Engineering and Material Sciences Doctoral School. He is also member in Hungarian academy of sciences. Prof. Hesham has remarkable researches in reputed journals in Limnology, Phycology and biological science.

CONCEPT «ONE HEALTH»: SUSTAINABILITY AND BIOSECURITY IN ECOSYSTEMS

Lyudmyla SYMOCHKO

Coimbra University, Coimbra, Portugal
Uzhhorod National University, Uzhhorod, Ukraine
lyudmilassem@gmail.com

Abstract
One Health concept is an integrated, unifying approach to balance and optimize the health of people, animals and the environment. One Health involves the public health, veterinary, and environmental sectors. The One Health approach is particularly relevant for food and water safety and biosecurity, nutrition, the control of zoonoses, pollution management, and combatting antimicrobial resistance (the emergence of microbes that are resistant to antibiotic therapy). Biosecurity is a strategic and integrated approach that encompasses the policy and regulatory frameworks for analysing and managing relevant risks to humans, health, and associated risks to the environment. Thus biosecurity is a concept of direct relevance to the sustainability of agriculture, and wide-ranging aspects of public health and protection of the environment, including biological diversity. The overarching goal of biosecurity is to prevent and control risks to life and health as appropriate to the particular biosecurity sector. Biosecurity covers food safety, which is one of the priorities according to sustainable development goals. In this area is very important to manage and control the biocontamination of ecosystems, especially agroecosystems by antibiotic-resistant bacteria. The World Health Organization has identified antibiotic resistance as a serious threat to human health across the world. The soil microbiome plays an important role in the development and spread of antibiotic resistance in humans. The aim of this study was monitoring of spreading antibiotic-resistant bacteria, which included: detection of antibiotic-resistant bacteria in agroecosystems and risk assessment for human health. Isolated total 244 dominating bacteria in 2015 year, among them 53 antibiotic-resistant bacteria. All isolates were multi-drug resistant, of which greater than 62,3% were resistant to 9 antibiotics. In 2021 number of antibiotic-resistant bacteria increased practically twice and was 98 and 78,7% of them were characterized by a high level of resistance. Monitoring antibiotic resistance in ecosystems is an additional tool for controlling and managing biosecurity which is very important for the implementation «One Health» concept.

Keywords: *health, antibiotic resistance, microorganisms, ecosystem, sustainability.*

Biography

Lyudmyla Symochko got her Master's degree in Ecology and Environment Protection in 2000. Doctor's degree (Ph.D.) by Specialty - 03.00.16 Ecology in 2005. She is Associate Professor in Biodiversity conservation since 2008. Symochko Lyudmyla – a specialist in environmental microbiology and ecology. Since 2010 she has focused on autecology and synecology researches of soil and water microbiota. Explores the environmental resistome and the role of natural and transformed ecosystems as a reservoir of antibiotic-resistant microorganisms. Detects antibiotic-resistant opportunistic pathogens in the environment and provide they risk assessment to human health. Author of over 200 scientific publications, including 5 books.

MEAT OR MEAT-TO-BE - PLANT-BASED VS. MEAT-BASED PROTEIN

Sándor KUKOVICS[1,2], Ferenc KUKOVICS[1], Zoltán NAÁR[3]

[1]Hungarian Sheep and Goat Dairying Public Utility Association, Herceghalom, Hungary;
e-mail: mjkkhe@gmail.com
[2] Sheep and Goat Products' Board, Várpalota, Hungary; e-mail: juhtermektanacs@gmail.com
[3] Tokaj-Hegyalja University, Sárospatak, Hungary, e-mail: naar.zoltan@unithe.hu

***Abstract**:*
There are many criticisms of meat consumption and animal husbandry, and it is considered that priority should be given to the consumption of vegetable protein in nutrition.
In our work, we analysed the area occupied by animal husbandry, the proportion of greenhouse gases emitted by them, the nutrient content of food, the amount of water needed for meat production, the amount of nutrients needed to produce one kg of meat, as well as the composition of meat and plant-based meat substitutes, as well as the role played by meat in human nutrition.
Based partly on our own investigations and partly on the processing of literary data, we found that the land demand for livestock farming is lower than what is indicated in fashionable publications. The GHG they emit is a fraction of the entire emission, the water requirement of meat production is far overestimated, amount of nutrients required to produce 1 kg of meat depends on many factors and has drastically decreased in recent decades. Meat and plant-based meat substitutes not only differ in ingredients, but the latter can also result in unexpected health effects.

***Keywords**: used land, GHG emission, meat, water used, nutrient density, meat substitutes*

Biography

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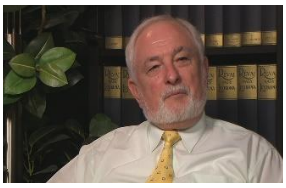
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Prof. Dr. Sándor Kukovics spent 40 years in Research Institute for Animal Breeding and Nutrition (Herceghalom, Hungary) being responsible for small ruminants sector, edited 35 books, published more than 1,100 articles, having licences for 4 products. Beside research work he has been taking part in under- and further education of various universities in Hungary. Since 1996 he has been working as president of Hungarian Sheep and Goat Dairying Public Utility Association, and as the executive manager of Sheep and Goat Products' Board (Hungary) since 2010.
Between 2015 and 2019 he served as vice president of EU COPA-COGECA Working Party on Sheep and Goats and he has been acting as member of Board of Directors within International Goat Association since 2016.

RESTORATION OF PROBLEM SOILS USING BIOCHAR : A COMPLETE NATURAL THROGUHPUT FOR SUSTAINABLE LAND AND CROP PRODUCTIVITY

P. SENTHILVALAVAN[1]*., M.V. SRIRAMACHANDRASEKHARAN[1], R. MANIVANNAN[1], C. RAVIKUMAR[2]

[1] *Department of Soil Science and Agricultural Chemistry*
[2] *Department of Agronomy*
Faculty of Agriculture, Annamalai University
Annamalainagar-608002, Tamilnadu, India
Corresponding author email: senvalavan_m2002@yahoo.co.in

Abstract
Soil with poor properties prevents the growth and development of crop plants. There is an urgent need to improve and recover these soils productive and increasing cultivable area toface the foodsecurity of global population. Biochar is a pyrogenic carbon or biomass substance produced from carbon rich materials. Biochar quality is based on feed stocks and production technologies used. As a multi-beneficial recycled material, biochar is reasonable and reliable to be employed as an amendment for soil remediation. In problem soils biochar acts as growth promoter, soil conditioner and soil protectant. The application of biochar in problem soils like acidic, saline and alkaline soils can improve the soil structure and soil physico-chemical properties. Also, biochar application improves crop productivity through enhancing water holding capacity, CEC, adsorption of plant nutrients and creates suitable condition for soil micro organisms. Biochar significantly reclaim the degraded soil by increasing soil C and essesntial macrontrients to the plants thus crop yield can be maximized in problem soils. A proper biochar recommendation can help in managing different soil constraints based on the properties of problem soils. With these preview, a short review of literature which focuses on the effects of biochar in managing problem soils. The review is intended to present an overview on problem soils, how biochar works as functional materials and its mechanisms of amending problem soils and make them productive.

Keywords*: Biochar, carbon accural capacity,crop productivity, physico-chemical properties, problem soils*

Biography

Dr.P.Senthilvalavan is a Soil Scientist and working as Assistant professor in Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Tamilnadu, India . He has published more than 80 papers in SCI journals and has been serving as an editorial board member/reviewer of reputed national and international SCI Journals. He worked with radio-isotopes like ^{137}Cs, ^{131}I, ^{60}Co, ^{90}Sr related to phyto-extraction and transfer co-efficiency in different food crops. Certain projects completed funded by IPNI, TENMA. Presently, working with Soil fertility & Biology, Waste recycling, Soil-Water Pollution and Conservation, and Problem Soils (P & Zn nutrition).

RECENT AND CURRENT TECTONICS IN THE TELL NORD CONSTANTINOIS: IMPACTS ON THE STABILITY OF THE LAND

Lamia BOULAOUIDAT, Chaouki BENABBAS

University of Jijel, Algeria, l.boulaouidat@gmail.com,
Research Centre for Spatial Planning, Algeria, chaoukibenabbas03@gmail.com

***Abstract**:*
Erosion in general, soil degradation and gravity movements in particular currently represent a real obstacle to the development of Algeria's northern regions. Indeed this scourge, which is poorly understood because it is very complex, poses enormous problems for the creation of the infrastructures necessary for the country, such as urban, extensions ,roads,motorways,dams,etc. The Tell Nord of Constantinois is an active region interms of dynamics, this region covers a large part of the internidian-externidian buffer zone, which in fact constitutes a geosuture that has always been active and unstable. This position makes the area vulnerable to various natural hazards (seismic, gravity, and water). The main objective of this study is to highlight the importance and the role played by recent and current tectonics in the establishment and evolution of the different forms of erosion and instability in the Tell Nord of Constantinois region through case studies. The preliminary results obtained show that the Geodynamic activity (recent and current) in this region would be responsible for the setting up of neo structures and the reactivation of morphological structures. The survey and fine analysis of morphological and structural features through direct and indirect indicators helps to identify and better understand the active dynamique context of this study area. Moreover, this active dynamic context seems to control and explain the distribution of disorders and instabilities that are very present in this region

Keywords: *Erosion, The Tell Nord of Constantinois,recent and current tectonics,infrastructure,morphological structure*

Biography

SOIL ASPECTS OF A BIODIVERSITY MANAGEMENT PLAN FOR A SOLAR PARK

Viktor GRÓNÁS, Csaba CENTERI, Márk PÁLFI

Department of Wildlife Biology and Management, Institute for Wildlife Management and Nature Conservation, Hungarian University of Agriculture and Life Sciences,
2100-H, Gödöllő, Páter K. u. 1., Hungary, e-mail: gronas.viktor.peter@uni-mate.hu

Abstract

Solar energy has begun to gain ground in Hungary in recent years. The total installed capacity of solar power plants exceeded 3,000 MW in April 2022. 98.6% of the installed capacity was realized as green field investment, typically areas withdrawn from agricultural production. It resulted significantly reduction in biological activity and diversity of these areas. Numerous studies pointed out that careful planning can help to improve these activities and these areas can also play an important role as habitats, besides producing energy. Since solar parks cover a significant surface, their soils and soil properties can influence the biodiversity management plan. After all, one of the important steps in habitat development is the planting of plants that adapt to the technical parameters and environmental conditions. In the recent study comparison of soil properties were done by a Near Infrared device. Soil organic matter of the examined site was between 0.8–4.2%, pH(H_2O) 7.5–8.2, total N 0.4–2.4g/kg, P-content 17.1–68.8ppm, exchangeable K 1.9–6.9mmol/kg, clay content 12–29% and soil moisture content 1.6–13.1%. The deviation of the soil properties was quite high that leads to the assumption that there is a great variety of habitats for plants and animals, or, there is a possibility to offer a variety of these habitats in biodiversity management plans of this and similar solar plants.

Keywords*: solar energy, biodiversity management plan, pedology, soil properties, comparative analyses*

Biography

Viktor Gronas is an associate professor at the Dept. of Nature Conservation and Landscape Management of the Hungarian University of Agriculture and Life Sciences in Gödöllő. His main research area is the investigation of the role of agricultural environmental management measures in the protection of biodiversity and the nature conservation aspects of technologies utilizing renewable energy sources.

HYGIENIC AND PHYSICOCHEMICAL QUALITY AND RESEARCH OF ANTIBIOTIC RESIDUES IN MILK MARKETED IN TETOUAN, MOROCCO

Fatima ELLAMTI, Zakaria MENNANE, Noureddine ELMTILI

Laboratory of Biology and health, Department of Biology, Faculty of Sciences, Abdelmalek Essaâdi University, M'hanech II, PO. box 2121 Tetouan 93000, Morocco
Fatimaellamti16@gmail.com+212 619 78 37 36

Abstract
The aim of this study was the microbiological characterization of milk, including the total number of bacteria; Total Coliforms, Staphylococcus aureus, Total Aerobic Mesophilic Flora, Yeasts and Lactic Bacteria, and the physicochemical property, as well as the search for antibiotic residues (beta-lactams, Tetracyclines and desfuroylceftiofurs) in milk, using Beta Star S Combo screening kit; antibiotic residues (beta-lactam, tetracyclines and desfuroylceftiofurs), in milk, using the Beta Star S Combo screening kit. A total of 52 samples of milk were collected in different outlets or supermarkets in the city of Tetouan, of which 4 samples are raw cow's milk, 16 samples of UHT milk and 32 samples of pasteurized milk. The raw milk showed an average load in LV, BL and FMAT exceeding 10^6 CFU/ml, while the average in CT varies between 0 and $9.25.10^4$ CFU/ml, and in SA between 0 and $3.75.10^4$ CFU/ml, the pH and titratable acidity of raw milk recorded respectively 6.53 and 20 °D. Antibiotic residues were detected in some brands of pasteurized milk at 18% and 3.12%, respectively for betalactamine and/or Tetracycline. The microbial contamination of the raw milk, testifies the non-respect of the hygienic conditions during the milking. The presence of antibiotic residues in the pasteurized milk shows that the farmers do not respect the prescriptions related to the use of antibiotics.

***Keywords**: Milk, Antibiotic, Pasteurized milk, hygienic quality, Beta-lactamin, Tétracycline*

Biography

I'm Fatima Ellamti, I'm 26 y.o,
I'm PhD student in food microbiology
at Abdelmalek Essaadi university of Tetouan, Morocco

ANTIOXIDANT ACTIVITY OF *AZADIRACHTA INDICA* LEAF SUCCESSIVE EXTRACTS AND THE SUSCEPTIBILITY OF DIFFERENT PATHOGENIC BACTERIA AND MYCOTOXIGENIC FUNGI TO ITS GREEN-CHEMICALLY SYNTHESIZED SILVER NANOPARTICLES AND VARIOUS EXTRACTS

Mostafa AHMED[1,2*], Diaa ATTIA[3], Nadia MOHAMED[2], Ebtesam ABDELMONEEM[2], Mohamed ABDEL-SHAKUR[2], Kincső DECSI[4], Zoltán TÓTH[5]

[1]Festetics doctoral school, Hungarian University of Agriculture and Life Sciences (MATE), Georgikon Campus, Keszthely, Hungary, mostafa.ahmed.abdelmagid@agr.cu.edu.eg, +36(70)7916703
[2]Biochemistry Department, Faculty of Agriculture, Cairo University, Egypt, dr_n_m2008@yahoo.com, orched_ebt601@hotmail.com, mohamed_soliman@cu.edu.eg
[3]Food Toxicology and Contaminants Department, National Research Centre, Dokki, Cairo, Egypt, diaamm80@hotmail.com
[4]Department of Plant Physiology and Plant Ecology, Campus Keszthely, Hungarian University of Agriculture and Life Sciences Georgikon, Keszthely, Hungary, szaszkone.decsi.eva.kincso@uni-mate.hu
[5]Georgikon Campus Keszthely, Institute of Agronomy, Hungarian University of Agriculture and Life Sciences, 2100 Gödöllö, Hungary, Toth.zoltan@uni-mate.hu

***Abstract**:*
Background: Azadirachta indica is a stunning tree, with numerous pharmacological properties; especially the leaves are used in folk medicine. Because of its medicinal properties, it has been used in Ayurvedic medicine for over 4000 years. Methodology: This research aimed to investigate different biological activities of Neem successive, crude extracts and Neem green-chemically synthesized Ag-NPs. The investigated successive extracts were screened for polyphenolic burden by determining the TPCs and TFCs. Results: The antioxidant activity was determined by DPPH, ABTS, and FRAP assays, and the antimicrobial activity was determined against seven strains of food-borne pathogenic bacteria and eight species of mycotoxigenic fungi. At 1000 µg/mL, Neem leaves showed enhanced antioxidant activity for ethanolic and aqueous extracts with 80.10% and 69.41% in DPPH assay, 71.42%, and 74.61% in ABTS assay respectively, compared to 93.58% with the standard BHT. At 800 µg/mL, both extracts also revealed antioxidant activity with 57.52 µM and 57.87 µM in FRAP assay, compared to 139.97 µM with the standard Ascorbic acid. The results also indicated that both extracts showed antimicrobial activities with 0.02 to 0.35 mg/mL, 0.03 to 2.17 mg/mL as antibacterials, 0.04 to 0.42 mg/mL and 0.42 to 1.17 mg/mL as antifungals, respectively. Neem Ag-NPs showed the lowest MIC values with 0.05 to 0.07 mg/mL and 0.07 to 0.20 mg/mL as antibacterial and antifungal agents respectively, compared to Neem crude extract with 0.15 to 0.83 mg/mL and 0.42 to 1.17 mg/mL, respectively. Conclusions: Neem Ag-NPs and Neem crude extract may be used to enhance antioxidant and antimicrobial features.

***Keywords**: Ag-NPs, Antibacterial, Antifungal, Antioxidant, Azadirachta indica, Polyphenols*

Biography

Mostafa Ahmed is a PhD candidate at Festetics doctoral school, Hungarian University of Agriculture and Life Sciences (MATE), Keszthely, Hungary, and an assistant lecturer of Agricultural Biochemistry at the Faculty of Agriculture, Cairo University, Egypt. He completed his MSc in 2021 from Cairo University, Agricultural Biochemistry Department. He has published his first research article in a reputed journal and has been serving as an editorial board member of a reputed Egyptian Journal. He is interested in green nanotechnology, natural products, environmental sciences, and the molecular biology of the abiotic stress of plants.

MICROBIOLOGICAL CHARACTERIZATION OF DIFFERENT OF FRESH AND PROCESSED FRUIT PRODUCTS MARKETED IN THE MARKETS OF THE PROVINCE OF TETOUAN

Youssra BELHADJ., Zakaria MENNANE, Noureddine ELMTILI

Team: Food and Health, Laboratory: Biology and Health, Faculty of Sciences Tetouan, University Abdelmalek Essaadi, E-mail:belhadjyoussra@gmail.com, 0623610883
Department of Chemistry, Amity University, Sector-125, Noida, Uttar Pradesh, India
sgarg2@amity.edu

Abstract

The production of red fruits in Morocco concerns two significant regions: Loukos/Gharb and Souss. The area intended for red fruits during the 2018/2019 campaign was estimated at 8403 ha.
The research was carried out on total aerobic mesophilic (TAM), total and fecal coliform (CT, CF), lactic acid bacteria (LAB), Staphylococcus aureus (SA) and molds and yeasts (M&Y).
The results of the 39 fruit products analyzed show that 66.66% of strawberries were contaminated by CT, 23.07% CF, 57.14% TAM, and 50% by M&Y. 33.33% of raspberries were contaminated by CT, 14.28% CF, 42.85% MAT, and 100% by M&Y. 25% of blueberries are loaded by CT, 50% TAM, and 50% by M&Y and 100% of the cherries were contaminated by M&Y. For jams are 100% uncontaminated.
From these preliminary results, concluded that the contamination of red fruits could be linked to factors such as temperature, humidity, and fruit life after harvest. For a good preservation of these products, we recommend the use of specific food packaging and storage in places with an adequate temperature.

Keywords*: Red fruits, quality, contamination, microbiology.*

Biography

My name is BELHADJ Youssra, I'm 30 years old. I'm from Morocco. I'm PhD Student University Abdelmalik Essaadi, Faculty of Sciences of Tetouan, discipline Biology, specialtyin Biotechnology vegetal, and Microbiology. My subject under thetheme characterization of red fruits and molecular identification of pathogens.

THE EFFECT OF UREA AND UREASE ENZYME INHIBITOR ON THE FUNCTIONAL DIVERSITY OF THE SOIL MICROBIAL COMMUNITY

Dominika SZŰCS, Hosam E.A.F. BAYOUMI HAMUDA

[1]*Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest – Hungary*
e-mail: bayoumi.hosam@uni-obuda.hu

Abstract
Nitrogen-based fertilizers (e.g. urea-based fertilizers) are often used in agricultural soils, but excessive fertilization can often lead to the accumulation of toxic nitrate through nitrification. For this reason, various inhibitors are often used to control nitrification in soils. Urease inhibitors can indirectly inhibit nitrification by reducing ammonia levels in the soil. In my thesis, I investigated sandy soils treated with urea and urease enzyme inhibitors. Soil sampling for the measurements was carried out in Őrbottyán, Hungary, on two dates, in March and June, 2 and 12 weeks after the application of the treatments. Urea fertiliser treatments were applied to the soil samples at two different doses (120 kg/ha or 150 kg/ha). In this experiment, the effect of fertilizer treatments on the functional diversity of the soil microbiota was investigated using the MicroResp^{TM} method. The results were evaluated by principal component analysis. In the pairwise comparison, the control was significantly different from all but one of the other treatments, but no significant difference was found between the other treatments in the pairwise comparison. The results obtained indicate that the inhibitors used in the experiment do not inhibit the metabolic activity of soil microbial communities.

Keywords*:* effect of urea, urease enzyme, inhibitor, functional diversity, soil microbial community

Biography

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SOIL MICROBIOMES AND PROTECTION OF SOIL QUALITY

Hosam E.A.F. BAYOUMI HAMUDA[1], Lyudmyla SYMOCHKO[2,3]

[1]Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest – Hungary
[2]Coimbra University, Coimbra-Portugal, [3]Uzhhorod National University, Uzhhorod - Ukraine
e-mail: bayoumi.hosam@uni-obuda.hu

Abstract
Increasing the global human population needs more food and the world population will rise to about 9.5 billion by 2050. Implementing safe and environmental friendly technology would be viable solution for achieving sustainable restoration of degraded soils. Worldwide, phytopathogenic fungi constitute a big problem because they affect a large number of crop species of economic importance causing multiple damages and diseases in agroecosystems. The aim of present work is to illustrate the comparison between the rates of antagonistic activity of various rhizobacterial potential (isolated from sewage sludge treated soil) to antagonise some phytopathogenic fungi under various environmental factors such as NaCl, $CdCl_2$, $ZnCl_2$, pH 8.3 and 35°C incubation temperature. All antagonists assigned to show different patterns of antagonistic activity against different phytopathogens like Alternaria sp., Fusarium oxysporum, F. solani, Pythium sp., Rhizoctonia solani and Sclerotinia sp. Application of Pseudomonas, Burkholderia cepacia, Enterobacter sp. and Bacillus cells showed a significant reduction in the growth of phytopathogens in vitro experiments. However, P. fluorescens strongly inhibited the growth of phytopathogens more than the action of other antagonists due to production rates of allelochemicals that include metabolites, siderophores, antibiotics, volatile metabolites, cyanide and hydrolytic enzymes. This study will help to optimize the application strategies of P. fluorescens, Burkholderia cepacia and B. subtilis as biocontrolling agents or their metabolites as biopesticides. Finally, biocontrolling is an alternative, environmentally friendly and relatively cost-effective to conventional biological soil treatment technique.

***Keywords**: Biocontrol agent, PGPR, Phytopathogens, Environmental factors, Hydrolytic enzymes*

Biography

*am Bayoumi Hamuda is working at Óbuda University. He is Microbiologist and Soil Biotechnologist dealing with the interactions crobiomes and the environment for increasing soil quality and saving llutants in the agriculture. His investigations are on the role of waste oil quality, fertility, the crop production and environmental impacts plication of organic wastes; measurements soil microbial biomass and ities in wastewater sludge amended soils; and roles of engineered metal rticles in biosphere. **Research Interest**: Waste management; Protection; Sustainable; PGPR; Microbial inoculants; gut d human health and modern biology*

PROSPECTIVES, CHALLENGES AND CONDITION FOR THE USE OF FELDSPAR CONTENT IN IGNEOUS ROCKS AS SOURCE OF POTASSIUM (K) USING IN AGRICULTURAL

Hassni BELAIDI[1], Saida KITOUNI[2], Smaine CHELLAT[1]

[1]*Geology and Environment Laboratory, University of Constantine 1, Road Ain El Bey Zouaghi Slimane Constantine 25 000, Algeria. hassnibelaidi@gmail.com and smaine.chellat@gmail.com*
[2]*Department of Process Engineering, Faculty of Process Engineering. University Salah Boubnider Constantine 3, Algeria. souad0714@gmail.com*

Abstract
Potassium (K) with nitrogen (N) and phosphorus (P) are the three major elements for better growth of plants. Potassium (K) has a well-established role in agriculture, as well as in maintaining human and animal health. Currently, 184.4 million tonnes of nitrogen, phosphorus, and potassium fertilizers are used worldwide, with 18% of those tonnes being potassium. Potassium sulfate (K2SO4) and muriate of potash are the two forms of K input in agriculture that are most frequently used. These naturally occurring potassium fertilizers, known as sylvite or complex K-Mg chlorides and sulfate, are extracted from sedimentary potash (K-salt) sources. During the last year, as the demand for potassium increases, the search for the iron has become in many sources, especially in igneous rock. The agricultural trials showed that, particularly in heavily worn acid soils, feldspar, mica, glauconite, nepheline, and schoenite are good suppliers of K for crops. However, some researchers claim that using feldspar or granite stones to crops has no positive effects on agronomy. Feldspar is widely distributed in the earth's crust, and could play a significant role in maintaining soil fertility for the poorest farmers.

Keywords*: Agriculture, Feldspar, fertility, igneous rock, Potassium*

Biography

In 2018 I have completed my license in the geology of mineral resources at the age of 21 years from Jijel University, in 2020 I have got a master's degree of 23 years in mineral resources, geomaterials and the environment from Jijel University, in 2021 I started my PhD at the University of Constantine 1. I'm interested to research in all geologicalfields, especially those attached to minerals and natural resources.

PREVENTIVE APPLICATION OF UNTREATED CITY SEWAGE/SEWER WATER FOR IRRIGATION IN CEREAL CROPS AVOIDING HEAVY METALS POLLUTION IN SOIL-PLANT ECOSYSTEM

Bhanu Singh PANWAR[1], Olha.A. KHLIESTOVA[2,3], Katarzyna Ewa BUCZKOWSKA[2,4] Baturalp YALCINKAYA[2] Milan BOUSA[2]

[1]Department of Soil Sciences, CCS Haryana Agricultural University, Hisar
[2]Department of Material Science, Faculty of Mechanical Engineering, Technical University of Liberec, Liberec, Czech Republic.
[3]Department of Primary Science Institute of Modern Technologies, Pryazovskyi State Technical University, Dnipro, Ukraine.
[4]Department of Materials Technology and Production Systems, Faculty of Mechanical Engineering, Lodz University of Technology, Poland.
[1]Corresponding author: panwarbss@gmail.com

Abstract

The sewage and non-sewage water quality were tested fit out for irrigation purposes. The pH, EC, calcium carbonate, CEC, exchangeable cations, micronutrients and available NPK were higher in the soils irrigated with sewage water than in soils irrigated with non-sewage water. The heavy metals (Cd, Ni and Pb) of sewage-irrigated soil were more than non-sewage irrigated soil during both years. Irrigation with wastewater increased Ni content in sewage-irrigated soil compared to non-sewage irrigated soil. Heavy metals, Cd, Ni, and Pb uptake in plant grain and straw were higher in the soils irrigated with sewage water than in non-sewage water irrigation. This might be due to the fact that the heavy metals present in the sewage water were in a higher amount which the plants extracted through the soil water continuum. Long-term application of sewage water on agricultural fields often increases the levels of macro-micronutrients and heavy metals in soils. There are various sources through which heavy metals get to the soil, including industrial, urban or agricultural wastes, sewage waste, industrial waste and gases emitted by vehicles and industries. The heavy metals (Cd, Ni and Pb) detected were found below the permissible limit in the rice-wheat and pearl millet-wheat cropping system. Therefore, it can be concluded that in the scarcity of irrigation water, sewage water can be used in the critical period of growth for the life-saving of the crops, and the savings in terms of micro-nutrient deficiency amelioration practices can be done without expending on expensive nutrient supplements in plants both in wheat and pearl millet-wheat cropping system. There was no excess heavy metal toxicity in the produces as well as in soils from sewer/sewage sources of irrigation water.

Keywords*: Sewer water, heavy metals , wheat, pearl millets, cropping system*

Biography

Professor Dr. B.S. Panwar (R)
Soil Environment Consultant: Freelancer, Haryana Agricultural University, Hisar, India
Visiting Scientist: ETH, Zurich, Switzerland, MSU, Moscow, Russia, PSTU, Mariupol, Ukraine,

Doc. Dr. Olha Khliestova
Olha Khliestova is a researcher at the Technical University in Liberec, Faculty of Mechanical Engineering, Department of Material science and Cand. of Eng. Sciences, Associate Professor, Head of the Department of Labor protection and environment State Higher Educational Institution "Priazovskyi State Technical University", Dnipro, Ukraine. She received his PhD in improving the efficiency of transport and technological scheme blast furnace at the Dnepropetrovsk National University of Railway Transport named after Academician V. Lazaryan in Dnipro,Ukraine. Her research interests were mainly: Resource-saving technoecology and environment protection against hazardous discharges, energy resource management, alternative energy sources.

Ing. Katarzyna Buczkowska Ph.D.
Katarzyna Buczkowska (Female), is a researcher at the Technical University of Liberec at the Faculty of Mechanical Engineering and the Lodz University of Technology at the Faculty of Mechanical Engineering. She completed doctoral studies at the Faculty of Mechanical Engineering of the Lodz University of Technology in the field of Materials Science. Currently, she is the head of the geopolymer composites laboratory at the Technical University of Liberec. Her research interests include: innovation management, environmental aspects and material engineering - composite materials, in particular geopolymer composites reinforced with short fibers and 3D printing for geopolymers and foundry technologies. She has experience in coordinating national and international projects (mERA-NET, ERASMUS+). Participates in EU and national projects, including Era.Net. She has been working on 16 projects, including 3 international projects. Management in 2 international projects, in 10 national projects as principal investigator. She is an expert for AMF - French National Research Agency. Reviewer for journals including JCR list: Archives of Civil Engineering, ISSN 1230-2945, Technical Transactions, ISSN: 0011-4561, Reviews on Advanced Materials Science, ISSN: 1606-5131, Sustainability ISSN 2071-1050, Buildings ISSN 2075-5309, Continuum Mechanics and Thermodynamics, ISSN 0935-1175, Applied Sciences, ISSN 2076-3417, Polymers, ISSN: 2073-4360, Processes, ISSN: 2227-9717, Materials, ISSN: 1996-1944, Minerals, ISSN: 2075-163X, Crystals, ISSN: 2073-4352, Energies, ISSN: 1996-1073, Engineering Proceedings, ISSN: 2673-4591. Editor-in-Chief of the journal: Journal of Biomedical Research and Environmental Sciences. Permanent member of the scientific council of the International Boleslaw Krzysztofiak Symposium AQUA since 2021. Author or co-author of 9 patents, 7 utility models and 1 industrial design. Scientific promoter of 6 PhD theses of which 4 were defended. Author of 23 publications, of which 11 in departmental journals in Q1 and Q2. Participation in 15 international conferences. Organisation of 8 international conferences in the cycle "Optimisation of production systems in foundries". International cooperation in the field of research into the properties of building materials and geopolymers with, among others, Poland, Germany, France, Estonia, Greece, Italy. Former member of Management Board Member Association of Polish Teachers at the Lodz University of Technology. The founder and tutor "Students Scientific Society Foundry and Plastics Processing"

MSc. Baturalp Yalcinkaya, Ph.D.

Baturalp Yalcinkaya is a researcher at the Technical University in Liberec, Faculty of Mechanical Engineering, Department of Material science. He has graduated from the textile engineering department with bachelor and master's degrees in Turkey. Then he completed his Ph.D. degree in the Nonwoven and Nanofibrous materials department at the Technical University of Liberec. His ten years of experience in nanofibers and textile material engineering opened the doors of the first real working opportunity at Nafigate corporation a.s. He has been working as a Chief of Scientist in Nafigate corporation a.s. He worked as an R&D Specialist in NafigatePark s.r.o., responsible for air/liquid filtration projects. Furthermore, he led a project so-called Bed linen and pillowcase development consisting of the nanofibrous layer in July 2021 and completed it successfully in two weeks. In the period of his work, it has been developed nanofibrous facial masks and respirators during the high pandemic period, and it has been certificated and sold for more than 50.000 m2.

RNDr. Milan Bouša, Ph.D

Milan Bouša is a researcher at the Technical University in Liberec, Faculty of Mechanical Engineering, Department of Material science. He received his Ph.D. in Inorganic Chemistry at Charles University in Prague, Faculty of Science, Department of Inorganic chemistry. 2010-2021 he worked at the Academy of Sciences of the Czech Republic, J. Heyrovsky Institute of Physical Chemistry. His research interests were mainly: the preparation and characterization of nanomaterials, carbon nanomaterials (graphene, carbon nanotubes, fullerenes, transition metals dichalcogenides, scanning electron microscopy, transmission electron microscopy, Raman and infrared spectroscopy, and electrochemistry. He was a participant, and researcher, in many national and international projects, e.g. Graphene-Based Revolutions in ICT And Beyond-Graphene Flagship (2014-2016). From 2018 deputy head of the projects (Neuron, GA CR). Responsible for μ-droplet spectroelectrochemistry instrumentation, leader of the minor international scientific group of students and researchers. He was the principal lector of internal and external projects for students and young scientists focused on various topics (preparation and characterization of 2D nanomaterials, SEM, TEM, Raman spectroscopy, electrochemistry). In 2018, he studied substrate-graphene interactions by time-resolved Raman spectroscopy during a foreign postdoc internship (mobility of researchers) at the Institute of Chemical Engineering Sciences, Foundation for Research and Technology (FORTH-ICEHT), Greece. From 2022 he is employed at the Department of Material Science, Technical University of Liberec, the Czech Republic as a researcher in the field of geopolymer science, heavy metal filtering, and thin surface coating. Now, he is a deputy researcher in the M-ERA.NET project MarWreck (see below). During 2010-2022, he published 38 articles in impacted international journals (Publons ResearcherID: F-5135-2014).

ORNAMENTAL PLANTS: ECONOMIC IMPORTANCES AND COMMON TYPES FOUND IN NIGERIA

Adebayo-ADEWUNMI, Raimot ADEJUMOKE

Department of Biology Education, School of Science Education
Federal College of Education(Technical) Akoka- Yaba, Lagos State, Nigeria
Email: princess64raheemat@gmail.com.Tel: +2347030316062

Abstract

Ornamental plants are plants that are grown for decorative purposes in garden and landscape design projects. The scientific study of ornamental plants is called floriculture. The person who grows or sells flower is called a florist. There is need to educate the populace on the valuable impact of these plant species in the society. The presentation involves meaning of ornamental plants, common features of ornamental plants such as such as leaves, scent, fruit, stem, bark, Cultivation of ornamental, Classification of ornamental plants, Economic importance of ornamental plants such as add beauty to any garden or landscape, Common types of ornamental plants found in Nigeria, Advantage of planting ornamental plants, Ways to take care of ornamental plants. Several recommended were made among which are: Botanical Society of Nigeria (BOSON) should create more awareness on economic importances of Ornamental plants, Awareness programme on catch them young on botany courses should be done from secondary school level to tertiary institutions, Government should assist in funding the Agricultural sector both commercial and subsistence agriculture toward exhibit their tasks in planting system, Also, researchers should be sponsor attending semina , conference and workshop on Plants exhibition.

***Keywords**: Ornamental plants , Economic importances, Common types*

Biography

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SORGHUM: A POTENTIAL CROP UNDER SALT AFFECTED AREAS

Gayatri KUMARI[1], Sarita DEVI[1] and SATPAL[2]

[1]Department of Botany & Plant Physiology
[2]Department of Agronomy
CCS Haryana Agricultural University, Hisar, Haryana, India
E-mail: ydvgayatri714@gmail.com
Mobile: +91 8396948217

Abstract

The growth of robust agriculture is hindered due to climate change by affecting the crop phenology and yield by intensifying the frequency and extent of numerous biotic and abiotic stresses. Salinity is one of the major abiotic stresses that has affected the agricultural land especially in drier parts of the world. So, development of tolerant varieties is one of the finest ways to increase the production under saline areas. Sorghum is a nutraceutical crop which is used as food and fodder in arid and semi-arid regions and is considered tolerant up to 6-8 dS m $^{-1}$ of salt stress and also has phytoremediation potential to improve contaminated soils. So, a screen house experiment was carried out during the summer season of 2021 to find out a tolerant variety under salt stress. Before sowing, the desired levels of salt stress (control, 5, 8 and 10 dS m^{-1}) were maintained. Six varieties of Sorghum bicolor (HC-136, HC-171, HC-260, HC-308, HJ-513 and HJ-541) were grown in pots under controlled conditions. All the varieties survived well upto 8 dS m^{-1} and only one variety (HJ-541) maintained its growth upto 10 dS m^{-1} of salt stress. Sampling for germination and growth parameters was made at 30 DAS, 60 DAS and at 50% flowering stage. Both germination and growth parameters were negatively correlated with the salt stress. Maximum germination percentage was observed in HJ-541 (85%) followed by HJ-513 (81.3%) while minimum was observed HC-260 (63.3%) at 8 dS m^{-1} of salt stress. Similarly, under 8 dS m^{-1} of salt stress highest fresh weight was maintained by HJ-541 (4.6 g/plant, 28.1 g/plant, 30.2 g/plant) while minimum was observed in HC-171 (2.6 g/plant, 15.4 g/plant, 24.7 g/plant) respectively at 30, 60 DAS and at 50% flowering. Based on the germination and growth parameters, it was concluded that HJ 541 performed relatively better than others, hence it could be a promising cultivar for salt tolerance.

***Keywords**: Sorghum bicolor, 50% flowering, salt tolerance, summer season*

Biography

Gayatri Kumari

BIOX AND ITS COMPOSITES AS EFFICIENT VISIBLE ACTIVE PHOTOCATALYSTS

Seema GARG

Department of Chemistry, Amity University, Sector-125, Noida, Uttar Pradesh, India
sgarg2@amity.edu

Abstract
Bismuth oxyhalides (BiOX, X= Cl, Br and I) and their composites have been successfully synthesized using different leaf extracts. Leaf extract is known to possess anti-oxidant and stabilizing properties that aids in the immediate reduction and stabilization of the metal ions into their corresponding nanostructures. To obtain a better understanding of the results, the BiOX and their composites were also synthesized by hydrolysis method (without leaf extract) followed by their immobilization on Alumina (Al2O3)-based ceramic fiber sheet and activated carbon block as supporting material. The main objective of the present work was to eliminate the separation problem of the powder photocatalysts from the aqueous medium and evaluate their efficacy for the photocatalytic disintegration of organic contaminants in the long run. The synthesized photocatalyst was characterized using SEM, XRD, FTIR, UV-vis DRS etc, which suggested that the BiOX were successfully embedded in the host matrix of ceramic fibers and carbon block. The results revealed that the higher pH value was more favorable for bisphenol A (BPA) and Ampicillin (AMP) degradation, while the MO was completely degraded at all pH range. Moreover, the stability test was performed, and high stability of the immobilized samples was observed for five cycles without leaching out in the aqueous medium. The present study could offer new outcomes for advancing the large-scale applications of supported materials for environmental remediation.

Keywords*: BiOX, Photocatalysts, plant extract, SEM, IR, XRD.*

Biography

Seema Garg completed her PhD in 2003 from Dr B. R. Ambedkar University, Agra, UP, India. She is the Head, Student affairs and Professor of Amity University, Noida, India. She has extensive teaching and research experience of more than 20 years. She has over 50 publications that have been cited over 565 times, and her publication H-index is 14 and i10 index is 17 and has been serving as an editorial board member of reputed Journals.

EFFECTS OF MOLES ON SOIL PROPERTIES ON GRASSLANDS

Csaba CENTERI[1], Viktória VONA[2], Márton VONA[3], Zsolt BIRÓ[1]

[1]Institute for Wildlife Management and Nature Conservation, Hungarian University of Agriculture and Life sciences, Gödöllő, Hungary; centeri.csaba@uni-mate.hu
[2]Faculty of Agricultural and Food Sciences, Széchenyi István University, Mosonmagyaróvár-Hungary, H-9200, Mosonmagyaróvár, Lucsony u. 15-17., Hungary; vonaviki@gmail.com
[3]Csernozjom Ltd., 5065 Nagykörű, Arany J u 10 Hungary

Abstract
Mole activity is one of the main soil biological activities and plays an important role during soil formation. The purpose of this paper is to investigate mole activities on the soil properties under grasslands. Based on the mixing of lower soil horizons with the upper ones might lead one to the assumption that molehills and the nearby areas are different. The compared areas were grasslands, one in the Gödöllő Hills Landscape Protection District, the other one is on a pasture in Karcag, both are in Hungary. The comparison was based on the measurements of soil organic matter, pH, N, P, K, Ca, Al, Fe, clay and soil moisture by a Near Infrared Device of Agrocares Ltd. (Nl). Shapiro-Wilk, Duncan post-hoc and Kruskal-Wallis tests were used for statistical analyses. The results proved that mole hills are quite similar to their control areas in Karcag and they are significantly different in the Gödöllő site. We can conclude that moles have significant effects on the surface soils in some of the cases but these effects do not always appear between the burrow and the control.

Keywords*: soil nutrients, pH, soil organic matter, comparative analyses*

Biography

Csaba Centeri is an associate professor at the Dept. of Nature Conservation and Landscape Management at the Szent István Campus of the Hungarian University of Agriculture and Life Sciences in Gödöllő. He has published more than 21 papers in D1, Q1 and Q2 journals and has been serving as a chief editor in the Hungarian Journal of Landscape Ecology, guest editor of special issues in the journal of Water, Sustainability, Forest and Remote Sensing. His main research interest is soil water erosion, soil erosion modelling, land-use change, ecosystem services, soil-plant, soil-wildlife and other soil-zoology interactions, with special emphasis on nature conservation and landscape related issues.

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DEVIATION OF SOIL NUTRIENT CONTENT IN A PERMACULTURE FARM, KÓSPALLAG, HUNGARY

Csaba CENTERI[1], Viktória VONA[2], Márton VONA[3], Eszter TÓTH[4], Zsolt BIRÓ[1], Alfréd SZILÁGYI[1]

[1]Institute for Wildlife Management and Nature Conservation, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary; centeri.csaba@uni-mate.hu
[2]Faculty of Agricultural and Food Sciences, Széchenyi István University, Mosonmagyaróvár-Hungary, H-9200, Mosonmagyaróvár, Lucsony u. 15-17., Hungary; vonaviki@gmail.com
[3]Csernozjom Ltd., 5065 Nagykörű, Arany J. u. 10. Hungary
[4]Institute for Rural Development and Sustainable Management, Hungarian University of Agriculture and Life Sciences, Budapest, Hungary; toth.eszter9011@gmail.com

Abstract
The philosophy of permaculture farms seems like a solution for many recent problems related to agricultural production. Permaculture farms lay big emphasis on environmental issues, nature conservation issues, sustainability issues and also, on reducing the ecological footprint of agricultural production. Still, there are very scarce data on the analyses of environmental effects, including soil, water and air. The present study wishes to give an overview on soil nutrient content of the plots of a permaculture farm in Kóspallag, Hungary. The comparison of the upper few centimetres of soils of 12 plots was based on the measurements of soil organic matter, pH, N, P, K, Ca, Al, Fe and clay by a Near Infrared Device of Agrocares Ltd. (Nl). The order of the nutrient content of the parcels shows that there is a considerable increase towards the highest nutrient content, the different parcels are having different position in the order of certain soil nutrient parameters, e.g., Parcel No. 1. has the lowest P content while Parcel No. 6. has the highest, Parcel No. 8. has the lowest K content while Parcel No. 11. has the highest, etc. The trendline has a good R^2 value, in case of P content it is 0.9077, in case of K it is 0.9701.

Keywords*: soil nutrients, order of plots, differences of plots, comparative analyses*

Biography

Csaba Centeri is an associate professor at the Dept. of Nature Conservation and Landscape Management at the Szent István Campus of the Hungarian University of Agriculture and Life Sciences in Gödöllő. He has published more than 21 papers in D1, Q1 and Q2 journals and has been serving as a chief editor in the Hungarian Journal of Landscape Ecology, guest editor of special issues in the journal of Water, Sustainability, Forest and Remote Sensing. His main research interest is soil water erosion, soil erosion modelling, land-use change, ecosystem services, soil-plant, soil-wildlife and other soil-zoology interactions, with special emphasis on nature conservation and landscape related issues.

TOTAL CARBOHYDRATE CONTENT EXTRACTION FROM *RUGULOPTERYX OKAMURAE* SEAWEED IN THE MOROCCAN COAST: OPTIMIZATION USING RESPONSE SURFACE METHODOLOGY

Monsif EL MADANY[1, *], Fatima EL AAMRI[2], Mustapha HASSOUN[3], Noureddine EL METILI [1]

[1] *Laboratory of Food Science and health, Department of Biology, Abdelmalek Essaadi University, PO Box 2121, 93002 Tetouan, Morocco*
[2] *National Institute of Fisheries Research (INRH), BP 31 M'diq, Morocco*
[3]*Applied Phycology-Mycology Group, Ecology, Biodiversity and Environment Laboratory, Department of Biology, Facultyof Sciences, Abdelmalek Essaâdi University, 93000, BP. 2121, M'Hannech II, Tétouan, Morocco.*
[*] Corresponding author at: *Laboratory of Food Science and health, Department of Biology, Abdelmalek Essaadi University, PO Box 2121, 93002 Tetouan, Morocco*
E-mail address: monsifmadany2015@gmail.com (M. EL MADANY).

Abstract
In recent times (2015–2022), the massive accumulations biomass of the invasive brown seaweed Rugulopteryx okamurae is considered one of the most important bioresource marine of carbohydrates so it has great potential to be used for the production of fuels such as biodiesel and bioethanol. In the present study, response surface methodology (RSM) based on Box-benkhen design (BBD) was used to define the best combination of extraction temperature (20–90 °C), % NAOH 1N concentration (10–40 %) and extraction time (20–60 min) for maximum yield of total carbohydrate content (TCC). Results showed that the optimal value of total carbohydrate (50,8 % w/w of dry matter) from R. okamurae was obtained with 10 % NAOH 1N at 90˚C for 60 min. The experimental results were fitted to a second-order quadratic polynomial model, and they have shown a good fit to the proposed model (R^2 = 0.87). Determined optimized conditions for maximizing yield of TCC were within the experimental range.

Keywords: *Macroalgae, Rugulopteryx okamurae, Total carbohydrate content, Response surface methodology*

Biography

MONSIF EL MADANY, PhD student at the faculty of sciences of Tetouan, Morocco. My research focuses on the study of the invasive seaweed *Rugulopteryx okamurae* in the Moroccan coast

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PHENOTYPIC PROFILE OF *ENTEROBACTERIACEAE* ISOLATED AT THE PROVINCIAL HOSPITAL OF TETOUAN

Laila FAROUK[1,2*], Zakaria MENNANE[1], Amale MOUJAHID[2], Noureddine ELMTILI[1]

[1]Laboratory of Biology and health, Department of Biology, Faculty of Sciences, Abdelmalek Essadi University, Tetouan, Morocco
[2]Medical analysis laboratory, Bacteriology Department, Provincial Hospital of Tetouan, Morocco
[*]Corresponding author. E-mail address: laila.farouk@etu.uae.ac.ma, Telephone: +212 6 02 86 86 97

Abstract

***Introduction**: Urinary tract infections represent the first cause of reported nosocomial infections. The aim of this study is to identify the resistance phenotypes of Enterobacteriaceae isolated from urinary tract infections at the Provincial Hospital of Tetouan.*
***Material and method:** Analysis of the sensitivity to antibiotics of 91 strains of Enterobacteriaceae responsible for urinary infections from January 2022 to October 2022.*
***Results:** Enterobacteriaceae represented the majority of the isolated germs (78.4%) and Escherichia coli (69.2%) ranked first, followed by Klebsiella spp (16.5%). Other germs were isolated with variable frequency: Enterobacter spp (7.7%), Proteus spp (5.5%), Serratia spp (1%). Resistance to Enterobacteriaceae was 74.7%, 66.9%, 13.1%, 12%, 2.2% for Amoxicillin, Amoxicillin+Clavulanic acid, Ceftriaxone, Ceftazidime and Imipenem respectively. The prevalence of ESBL was 3.3%.*
***Discussion:** It is quite alarming to note that the Enterobacteriaceae included in this study show a worrying resistance to Amoxicillin and Amoxicillin+ Clavulanic Acid. Indeed, the major cause of this antibiotic resistance is the misuse of antibiotics. Therefore, the sensitivity of the population to the good practice of antibiotic use and the control of antibiotic residues in meat and milk and the bacteriological diagnosis of urinary tract infections are the most effective means to fight against this problem.*

***Keywords**: Enterobacteriaceae, urinary tract infection, antibiotics, bacterial resistance.*

Biography

My name is Laila Farouk. I am from Morocco. I am a PhD candidate at Abdelmalek Essadi University, Faculty of Science of Tetouan, Morocco.
My field of research is Microbiology and Molecular biology. My thesis topic is about drug resistance especially the resistance of Enterobacteriaceae in urinary tract infections.

EFFECT OF DIFFERENT CULTURE MEDIA ON THE CELLS GROWTH OF TETRASELMIS SUECICA

Sanaa TAHIRI[1,2*], F. EL AAMRI[2], H. LOULAD[2], N. ELMTILI[1]

[1]LFHS, Laboratory of Food and Health Sciences, Science Department, Abdelmalek Essaadi University, Tetouan, Morocco
[2]Shellfish Farming Station, INRH, National Institute of Fisheries Research, Amsa, Morocco

Abstract
The present study aimed to select the appropriate culture medium to support the best growth of Tetraselmis suecica, within the Amsa shellfish station. This species was cultured in three replicates using seven culture media commonly used in hatcheries for the cultivation of microalgae, including culture media of F/2 Guillard, Conway, Kw-21, MAP, NPK, NP and CE fertilizers. This study was conducted in 20 L polycarbonate aquariums including 15 L of culture under standard experimental conditions. The performance evaluation of Tetraselmis suecica was made based on cell concentration, growth rate, division rate, doubling time and cell biovolume. The results showed that the different types of culture medium had a significant effect (p<0,05) on the cell concentration of the species studied, and that the best cell concentrations were obtained under the culture medium based on CE fertilizer. In terms of the other parameters, it turned out that under the conditions tested, the factors studied have a significant effect (p<0,05) on these parameters, except the biovolume, where it shows no significant effect at the phase stationary. In this sense, the use of agricultural fertilizers is a viable alternative to reduce mass production costs.

Keywords*: Microalgae, culture medium, Growth, Tetraselmis suecica.*

Biography

***SANAA TAHIRI PhD student, University** ABDELMALEK ESSAADI - **Faculty** of Sciences of TETOUAN - MOROCCO. **Name of the reception structure**: Food Science and Health Team and Shellfish Station at Amsa.*
***Establishment hosting the host structure**: UAE Faculty of Sciences in Tetouan and Shellfish Station at Amsa (SCA), under the Specialized Center in Zootechnics and Marine Aquaculture Engineering at M'diq (CSZIAM) of the National Institute of Fisheries Research (INRH), Tetouan, Morocco.*
***Title of the thesis**: Study and optimization of breeding and production conditions in the hatchery of the local clam, Ruditapes decussatus (Linné, 1758).*
***Speciality**: shellfish "Conchyliculture".*
Av. Bni Hdifa Street 13 n. 18 - TETOUAN - MOROCCO
+212 671-891354
+212 539-991484
sanaa.tahiri@etu.uae.ac.ma
***Thesis director:** ELMTILI NOUREDINE*
+212 666-284207
elmtili@hotmail.com

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ASSESSMENT OF SOIL PROPERTIES UNDER DIFFERENT TILLAGE OPERATIONS

Malihe MASOUDI[1], Csaba CENTERI[1*], Viktória VONA[2], Márton VONA[2], Gergely JAKAB[3]

[1]Institute of Natural Resources Management, the Hungarian University of Agriculture and Life Sciences, Páter K. u. 1, 2100 Gödöllő, Hungary, e-mail: Masoudim65@gmail.com, Centeri.Csaba@szie.hu
[2]Csernozjom Ltd., 5065 Nagykörű, Arany János u. 10. Hungary, e-mail: vonaviki@gmail.com, vona.marton@gmail.com
[3]Geographical Institute, Research Centre for Astronomy and Earth Sciences, Budaörsi út 45. 1112 Budapest, Hungary, e-mail: jakab.gergely@csfk.org

Abstract
Different land-use management (e.g. agricultural, forest) influences soil properties and eventually soil quality. In this study, we tested a Near-Infrared Spectrometer to estimate soil properties in six different tillage systems (disking, shallow tine cultivation, no-till, deep tine cultivation, ploughing, loosening) and a natural land use management (natural tree line). A total of 48 soil samples were taken from 0 to 10 cm in a small region of Hungary's Józsefmajor. We estimated the pH, organic matter (OM) content, total N, total P, exchangeable K, clay content, and cation exchange capacity of the soil using a mobile agro scanner (CEC). The effects of various land-use management techniques on soil characteristics were measured using one-way analyses of variance (ANOVAs). Based on the results, there is a significant difference between a natural tree line and the six tillage operations for pH, OM, P, total N, and clay content, and the ratio of C/N. The measurement revealed that across all tillage systems, the tree line had the highest concentrations of OM, P, total N, and C/N. The pH and proportion of clay were the lowest. However, for these properties, we were unable to identify any differences in the various tillage techniques except for the quantity of clay (ploughing showed higher clay content than no-tillage, disking and shallow cultivation). Additionally, plowing and disking had a greater C/N ratio than no-tillage. For exchangeable K, a comparison is made between the tree line, loosening, deep and shallow cultivation, and plowing. This soil property also demonstrates differences in tillage practices, such as plowing and no-tillage loosening. For CEC, there were differences between ploughing and no-tillage, disking, also the tree line shows differences with ploughing and loosening. The tree line had the highest value of exchangeable K compared to other managements, but CEC had the highest value under ploughing. The study demonstrates land management can significantly affect soil properties and soil quality

***Keywords**: soil properties, land use management, soil quality, spectroscopy*

ABSTRACTS OF WATER AND WATER TREATMENT SESSION

WATER AS A STOCK MARKET COMMODITY: SMART CAPITALISM OR TOXIC DISDAIN FOR HUMAN RIGHTS?

Kshitij NAIKADE[1], Sujata ARYA[2]

[1]DAAD Scholar, Berlin School of Economics and Law, Berlin, Germany, Assistant Professor, Symbiosis Law School, Pune, India, kshitij.naikade@symlaw.ac.in, +91-9619292797
[2]Symbiosis Law School, Pune, India, sujataarya@symlaw.ac.in, +91-9011018412

Abstract
The 21st century has seen over 2/3rd of the globe suffer from severe water scarcity for at least one month in a year. As per the IPCC report in 2022, it is going to get worse from here on and by 2040, we might see massive migration, continental conflict and even wars over control over water resources. However, ironically, capitalists have sought an opportunity in this crisis and have converted this scarce resource into a lucrative commodity. By launching "water trading" or "water futures" on the stock exchange, water has become a contested product which puts the life of citizens (since water is essential for life) in the hands of market manipulators, investors and stock market financial institutions. The trend, which was restricted to the developed countries has reached the developing and underdeveloped countries as well, with India, one of the most water stressed countries in the world has launched public consultation to bring water in the commodities market. This paper will critically analyze the case studies of Australia, Iran, Chile and compare the successful and unsuccessful implementation of stock market trading of water on fixed variables and parameters. The author will analyze whether leaving a basic life source like water in the hands of speculative market forces has helped in the sustainable distribution and conservation of water resources. The paper aims to analyse the rationality and feasibility of trading water in the context of sustainability of the ecosystem. Access to safe drinking water is a non-negotiable right according to the United Nations. Has this right been safeguarded by the markets? The paper will like to conclude by giving recommendations and cautionary warnings to the developing countries like India who aspire to let go of the value of water as a public good in combating climate change adaptation mechanisms.

***Keywords**: IPCC, Water Trading, Climate Change, Sustainability , Water Scarcity*

Biography

Prof. Kshitij Naikade is an Assistant Professor at Symbiosis Law School, Pune, India. He is currently undergoing his PhD Fellowship at Berlin School of Economics and Law,Berlin, Germany. He specializes in Political Science, International Relations and Public Policy and Governance. He has written and published over 20 research papers and book chapters in various international and national publications. His PhD theme is on the 'Politics of Microfinance in India'. An avid sportsman and a nature lover, Prof. Kshitij has been involved in various environmental conservation & sustainability efforts in India in collaboration with the Indian
Dr. Sujata Arya is an Assistant Professor at Symbiosis Law School, Pune, India. She has over 20 years of teaching experience. Her PhD thesis was on Climate Change: Threat to Regional Peace and Security She specializes in EU Environmental Law, Environmental Law, Humanitarian and Refugee Law. Her specific areas of scholarly interest are Sustainability and Energy Law, Climate Change and Refugee Crisis. She is a polyglot with mastery over Spanish, French and German in addition to

English. She is currently leading the EU Climate Change Project at Symbiosis International (Deemed University)

THE ROLE, THE PERFORMANCE AND THE OPERATIONAL EXPERIENCES OF THE NITROGEN REMOVAL FIXED-FILM BIOLOGICAL STAGE OPERATING AT THE SOUTH-PEST WASTEWATER TREATMENT PLANT

Csenge NAGY-MEZEI[1,2], Anikó BEZSENYI[2], Imre GYARMATI[2], Magdolna MAKÓ[2], Levente KARDOS[1]

[1]Department of Agro-Environmental Studies, Insitute of Environmental Sciences, Hungarian University of Agriculture and Life Sciences, Budapest - Hungary
[2]Budapest Sewage Works Pte Ltd., Budapest - Hungary
pribelszkycs@fcsm.hu, +36 20 450 1814

Abstract
Biological nitrogen removal is difficult to realize in high-load activated sludge wastewater treatment systems, since nitrifying bacteria are only able to grow in the biomass in the case of a low organic matter load or a high sludge age. By using biofilm technologies that enable the selective growth of nitrogen-removing microorganisms, nitrogen removal can be achieved with significantly higher performance/speed, even in compact reactors. The activated sludge technology of the South-Pest Wastewater Treatment Plant is only capable to remove the organic carbon compounds with the applied high organic load and low sludge age. The nitrification and the majority of denitrification take place in the biofiltration stage (BIOFOR™). An additional carbon source (methanol) is added for post-denitrification. A smaller proportion of the nitrate formed in the nitrification filters is returned to the pre-denitrification reactors of the activated sludge system. In our article, we describe the microbiological and technological aspects of nitrification and denitrification, with particular regard to the need for an additional carbon source (methanol) for post-denitrification and its selective effect on the microorganism community. We present our operational experience resulting from the technological peculiarities of the two-step biological stage of the treatment plant.

Keywords: *wastewater treatment, biofilm, biofilter, biological nitrogenre moval, methanol, BIOFOR™*

USE OF ORGANIC POLLUTION INDICES IN THE EVALUATION OF THE PHYSICO-CHEMICAL QUALITY OF THE SURFACE WATERS OF WADI KEBIR-RHUMEL (NORTH-EAST ALGERIA)

Fouzia HIZIR*[1], A. KRIKA[2], F. KESSASRA[1]

[1]*Geological Engineering Laboratory (LGG), University of Mohamed Seddik Benyahia, Jijel, Algeria*
[2]*Laboratory of Biotechnology, Environment and Health, University of Mohamed Seddik Benyahia, Jijel, Algeria, Address: B.P.98 Ouled Aissa, 18000 Jijel, Algeria*
e –mail:aminajijel18000@gmail.com, Phone: + 213 0790 18 14 56

Abstract
Surface waters are subject to high anthropic pressure due to the development and expansion of agricultural activities as well as industrial and domestic activities. Pollution is a major environmental problem due to discharges into watercourses and the excessive use of agricultural fertilisers and discharges from urban and industrial sources. The objective of this study is to evaluate the quality and the state of organic pollution of the surface water of the wadi Kébir Rhumel which is considered as one of the most important wadis of the Algerian East and which is subjected to very strong demographic and industrial pressures, based on the organic pollution index (IPO) from the parameters determined during a sampling campaign carried out in July of the year 2020. Eight stations were studied along the wadi. The results obtained from this study indicate that the values of the organic pollution index show a high contamination at site (S8,S7and S6) and a very high contamination in the majority of the stations (S1, S2, S3, S4, S5). This anthropic degradation of the environment recorded much more in the four urban communes (El Milia, El Anser, Ain Smara and Constantine) would come from the use of nitrogen and phosphate agricultural fertilisers and especially from the discharge of untreated domestic and industrial wastewater from these communes.

Keywords*: Oued Kébir Rhumel, Surface water, Algeria, Organic pollution index (IPO), Urban wastewater, Pollution*

Biography

Fouzia Hizir is currently a PhD student in hydrogeology at the Geological Engineering Laboratory (LGG), Department of Earth and Universal Sciences, Faculty of Natural and Life Sciences, Mohamed Seddik-Benyahia University - Jijel (Algeria). My thesis subject is entitled "Spatial and temporal characterization of the water and sediments of the Kébir-Rhumel wadi in front of pollution problems" under the supervision of Dr. A. Krika and Dr. F. Kessasra

ENVIRONMENTAL EFFECTS OF THERMAL WATERS IN THE REGION OF GUELMA ALGERIA

Rima KIFOUCHE*, F. BOUAICHA, O. BOUTERAA

Laboratoire de géologie et environnement, Université Constantine 1, Route Ain El Bey Zouaghi Slimane Constantine 25 000.
**Corresponding author: kifouche.rima@gmail.com*
rima.kifouche@doc.umc.edu.dz

Abstract
A hydrochemical characterization of the waters of the Guelma region (North-East Algeria) was carried out following samples taken at 14 thermal springs and their effluents during the months of May 2022. The analysis of the waters allowed to establish the chemical facies and their classification according to the Stuyfzand's abacus and to deduce the aptitude of these waters for irrigation and the risks of salinity. Q-mode cluster analysis was applied to the thermal water quality data sets, and generated three (3) groups clusters. Group 1 dominated by sulfates and sodium. Group 2 represent a group of waters with low salinity dominated by Ca - HCO_3; Group 3 is dominated by sulfate, bicarbonate and magnesium. Stuyfzand's classification indicated that the waters are fresh with moderate alkalinity. Taking into account the classification of Richards, we were able to identify the presence of the C3S1 class for the majority of the stations. The C3S1 class designates waters that can be used without any particular control for the irrigation of crops that are moderately tolerant to salts, on well drained or well permeable soils. These waters have average EC values of 1437.57µS/cm allowing their use in a less restrictive way for irrigation, except for the region of Guerfa and downstream of Bouhamdane wadi where these sites present a C4S2 class which indicates that the water quality is poor. Potential environmental effluents from the thermal spas could pollute both irrigation and drinking water, which represents a danger to the health of the region's inhabitants.

Keywords*: thermal water, hydrothermal effluents, chemical facies, Stuyfzand classification, salinity, Guelma*

Biography

Rima Kifouche, PhD student; research assistant;
Université frères Mentouri Constantine 1. Department of geology. Laboratoire de géologie et Environnement (LGE) ;
Hydrogeologist, Master in Environmental Geology;
Currently, my research focuses are on geothermal energy and resources, factors of pollution of water resources and their impact on the environment. I am also working on pollution of surface water and their impact on the environment. The methods used relate to the collection of samples and their chemical analysis as well as the use of appropriate software for interpretation.
Skills and experience: Hydrogeology, water quality, water chemistry, ground water chemistry, water resources, environmental pollution, geothermal energy, geothermal resources, Geostatistical Analysis and SIG.

METALLIC TRACE ELEMENT CONTAMINATION IN SURFACE WATER AND SOIL AROUND TWO ACTIVE AND OLD ABANDONED QUARRIES. CASE STUDY IN CHEKFA-JIJEL AND AKBOU, NORTH EAST OF ALGERIA: COMPARATIVE STUDY

Amel FOUGHALIA[1], F. KESSASRA[1,2], L. ALILICHE[2]; S. GUERDOUH[2], D. BENABBES[1]

[1]*Laboratory of Geological Engineering (LGG), Team 3 "Geology", University of Jijel, Central Campus, BP 98, 18 000 Jijel, Algeria*
[2]*Department of Earth and Universe Sciences, University of Jijel, Central Campus, BP 98, 18 000 Jijel, Algeria, E-mail: foughaliaamel@gmail.com*

Abstract
Mining and quarrying industries represent one of the oldest and the most important human activities but they affect largely the environment quality. The aim of this comparative study is to define the impact produced by the aggregate quarries in environmental components, such as water, stream sediments and soils and to assess the persistence of contaminants in that environment. Tow quarries located in the North-East of Algeria, the old abandoned quarry is located in Akbou (Bejaia), and Chekfa aggregate quarries in Jijel are investigated. The assessment of the physico-chemical parameters and heavy metals contents in the all three environmental components located near this extractive industry, are used to compare the negative effect between the two careers over time and evaluate their influence according to time. Seventy-eight samples were collected including 32 surface water and groundwater, 21 stream sediments, and 25 toposoil at different parts of study areas. They have been monitored on 2019-2021 during the four seasons. In old quarry of Akbou, water present: an alkaline pH, a high conductivity and high levels of calcium and chloride about 1510,21 and 8875 mg/l, they exceed the required standards; heavy metal concentrations reveal the presence of low-level of copper and zinc; measured respectively about 43,6 µg/l and 833 µg/l. They do not exceed European guidelines and WHO standards (2000-3000 µg/l); lead and cadmium concentrations show a peak at 613 and 43µg/l, greatly exceeding European and WHO standards fixed at 10 µg/l. On the other hand, the Hydrogeochemical results of Chekfa recent quarries present: an alkaline pH, low conductivity and concentrations of major elements not exceeding the required standards; low-level copper and zinc; with concentrations measured about 236, 7 µg/l and 751 µg/l respectively. This load does not exceed European guidelines and WHO standards; the maximum cadmium and lead concentrations are 57,9 µg/l and 572 µg/l , these concentrations exceed largely the European and WHO standards fixed at 10 µg/l. These high concentrations could be due both to geogenic factors that favor the release of metals into water and anthropogenic wastes.

Keywords*: Impact, Assessment, Surface water, Soil, heavy metals, quarries, Algeria*

Biography

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EUTROPHIC WATER QUALITY ASSESSMENT AND REMOVAL OF PHOSPHORUS USING NANO BIOCHAR

P. SENTHILVALAVAN[1]*, A. MATHESH, K. ARIVAZHAGAN, M.V. SRIRAMACHANDRASEKHARAN[1], R. MANIVANNAN[1], S. NATARAJAN[2], C. RAVIKUMAR[2]

[1] Department of Soil Science and Agricultural Chemistry
[2] Department of Agronomy
Faculty of Agriculture, Annamalai University
Annamalainagar-608002, Tamilnadu, India
Corresponding author email: senvalavan_m2002@yahoo.co.in

Abstract

The eutrophication of freshwater causes several problems in its usage due to excessive phosphorus accumulation. To reduce the phosphatic level and environmental causes need to have significant as well as sustainable solutions. Therefore, we took this work to assess the quality of eutrophicated water, removal, and recovery of phosphorus(P) using newly developed nano biochars from water hyacinth and tapioca stem waste feedstocks. Water samples were collected from the wetland area of Annamalai University, Uppanar canal, and Temple pond of Annamalainagar. Freundlich adsorption isotherm model was used to determine the phosphorus removal rate(PRR). PRR was tested through batch tests to compare two types of ball-milled nano biochars. The tapioca stem waste nanobiochar (NBC_{TSW}) proved its superiority by removing 0.62 mg Pg-1over water hyacinth nanobiochar(NBC_{WH}) which removes 0.51 mg Pg-1. Quality parameters assessed before and after treatment with nanobiochars. Nanobochars showed significant differences in water quality especially reduction in turbidity, total dissolved solids, Total N (TN), and Total P(TP). Both nanobiochar tested significantly improved the water quality status and P removal. However, NBC_{TSW} was found to be the best option for recycling eutrophic water and P removal.

Keywords: *Eutrophic water, Freundlich adsorption, Nano biochar, phosphorus removal,tapioca stemwaste*

Biography

Dr.P.Senthilvalavan is a Soil Scientist and working as Assistant professor in Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Tamilnadu, India . He has published more than 80 papers in SCI journals and has been serving as an editorial board member/reviewer of reputed national and international SCI Journals. He worked with radio-isotopes like ^{137}Cs, ^{131}I, ^{60}Co, ^{90}Sr related to phyto-extraction and transfer co-efficiency in different food crops. Certain projects completed funded by IPNI, TENMA. Presently, working with Soil fertility & Biology, Waste recycling, Soil-Water Pollution and Conservation, and Problem Soils (P & Zn nutrition).

LEVEL OF CONTAMINATION BY THE TRACE METAL ELEMENTS OF WADI KEBIR-RHUMEL (NORTH-EAST ALGERIA)

Fouzia HIZIR[1]*, A. KRIKA[2], F. KESSASRA[1]

[1]Geological Engineering Laboratory (LGG), University of Mohamed Seddik Benyahia, Jijel, Algeria
[2] Laboratory of Biotechnology, Environment and Health, University of Mohamed Seddik Benyahia, Jijel, Algeria, Address: B.P.98 Ouled Aissa, 18000 Jijel, Algeria
e –mail:aminajijel18000@gmail.com, Phone: + 213 0790 18 14 56

Abstract
The pollution of the aquatic environment by toxic substances of anthropic origin, in particular of Heavy Metal, is one of the major problems facing society today. These pollutants contaminate aquatic systems from point and non-point sources (drainage water, wastewater, industrial and agricultural effluents) because they constitute a danger to water, living species and human health. The objective of this study is to assess the level of the metallic contamination (Pb, Cu and cd) of sediments of Kebir-Rhumel Wadi, considered as one of the most important wadis of eastern Algeria, and who is subject to very high demographic and industrial pressures. Studied trace metals were measured using flame atomic absorption spectrophotometer. The intensity of sediment contamination was estimated from the calculation of two indices, contamination factor (CF) and geoaccumulation index (Igeo). The sediment samples were collected at eight (08) sites along the Wadi. The results obtained indicate that the Igeo values for Cd and Pb show moderate contamination at site S5 (1.14) and site S4 (1.01) respectively and not contaminated in all stations for Cu. Those of the CF, reveal a considerable contamination noted at the sites S2, S5 and S7 for Cd and almost sites for Pb (except for site S8) and also a moderate contamination for Cu in 60% of the stations (S1, S3, S5, S7, S8). These results confirmed that the sediments of the Kebir-RhumelWadi are contaminated with Pb and Cd of essentially anthropic origin..

***Keywords**: Heavy Metal, Pollution, sediment, Algeria, Kebir-Rhumel Wadi.*

Biography

Fouzia Hizir is currently a PhD student in hydrogeology at the Geological Engineering Laboratory (LGG), Department of Earth and Universal Sciences, Faculty of Natural and Life Sciences, Mohamed Seddik-Benyahia University - Jijel (Algeria). My thesis subject is entitled "Spatial and temporal characterization of the water and sediments of the Kébir-Rhumel wadi in front of pollution problems" under the supervision of Dr.Krika A and Dr.Kessasra F.

HYDROGEOLOGICAL STUDY OF THE AQUIFER SYSTEM OF NORTHERN SAHARA (SASS): CASE OF THE REGION OF EL-OUED (SOUTH-EAST ALGERIA)

Boualem BOUSELSAL[1], Smaine CHELLAT*[2]

(1) *Laboratory of underground reservoirs oil and gas and aquifers. Department of Earth and Universe Sciences. University of Kasdi Merbah. Ghardaia Road, BP. 511, 30000 Ouargla. Algeria.*
bousboualem@gmail.com
(2) ** Geology and Environment Laboratory, University of Constantine 1, Road Ain El Bey Zouaghi Slimane Constantine 25 000, Algeria.* smaine.chellat@gmail.com

Abstract
The Northern Sahara Aquifer System (SASS) has a large water resource to meet the needs of the population. Which the city of El Oued is part of. A variety of vertical electrical soundings (S.E.V) and hydrogeological sections were made and interpreted, based on drilling logs, this data shows three aquifers; the shallow aquifer consisting essentially of sand and sandstone, it is limited at its base by a clay layer. Its average depth is of the order of 60 m. The unsaturated zone shows a significant soluble content of 16 % to 25%. This presents corrosion at the level of infrastructure anchored in a region threatened by the upwelling of the open water. The aquifer of the terminal complex (CT) encompasses permeable soils; the first two are sandy-sandstone of Mio-Pliocene age CT_1 and CT_2, the last CT_3 is composed of limestone and dolomite of lower Senonian-Eocene age. At the end of the aquifer of continental intercalary (CI); encountered in boreholes at a depth of 1450 meters and a thickness that varies from 400 m to 460 m. it is represented by sandy-sandstone, sandy-clay and limestone deposits of Lower Cretaceous age.

Keywords*: El Oued, SASS, Continental Intercalary, Terminal Complex, Drilling*

Biography

CHELLAT Smaine Professor at the University of Constantine 1, Faculty of Earth Sciences, Geography and Spatial Planning, Department of Geological Sciences, between 1999 and 2009 has been as a state engineer in geotechnics as a supervisor in national and international companies. Since 2009 to date, he has held the position of university professor, specializing in geology, sedimentology, Quaternary geology, pollution and environment, geological and archaeological heritage. Been involved in several research projects, responsible for the doctoral training team since 2020. Currently he leads a project on the interest of feldspars in northern Algeria, in 2021 member in a European project of indexing old and recent foraminiferous databases.

HEAVY METAL CONCENTRATIONS IN SOIL, SLUDGE, WATER AND PLANT SYSTEMS ALONG THE LEFT BANK OF THE DANUBE BETWEEN RIVER KILOMETRES 1653 AND 1655

Ágnes BÁLINT[1*], Tibor DEMÉNY[2], Xuechu WANG[3], Csaba MÉSZÁROS[4]

[1*]*Institute of Environmental Engineering and Natural Sciences and Hydro-Bio-Mechanical Systems Research Center, Óbuda University, Budapest, Hungary, e-mail: balint.agnes@uni-obuda.hu, mobile: +36303721342,*
[2]*Pro-mees Ltd. Job safety & environmental protection consultant, Vác, Hungary, e-mail: demeny.tibor.lajos@gmail.com, mobile: +36 30 605 0284*
[3]*Doctoral School of Environmental Sciences, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary, e-mail: victorwxch@gmail.com*
[4]*Institute of Mathematics and Basic Sciences, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary, e-mail: Meszaros.Csaba@unimate.hu*

Abstract
There are many pollutants that threaten our environment, with environmental damage caused by heavy metals putting a heavy burden on soil, plant, water and air systems. All heavy metals are naturally occurring without anthropogenic interference. Heavy metal concentrations have been determined along the Danube coastline. The following heavy metals were measured in the water and sludge in the "Újpest" Bay: Mn, Fe, Cu, Zn, Cd, Pb. The second sample area was "Palota" Island, where, in addition to the above mentioned, the concentrations of Al, Ni and Cr were also measured in soil, water and plant samples. The samples were prepared in a Milestone 1200 mega microwave shredder. The samples taken in the Bay were analysed with an ATI 939 UNICAM FAAS instrument in absorption mode. Samples from Island were measured by Jobin-Yvon 24 ICP-OES. In the bay, the concentrations of copper and zinc in the sludge exceeded the contamination limit at one point and two points respectively. The concentrations of heavy metals in the water samples were below the detection limit of the measurement technique used. In the soil samples taken at the island, zinc concentrations exceeded the contamination limit at point T16 and chromium concentrations exceeded the contamination limit at points T15 and T16. In water samples, iron and chromium concentrations were below the detection limit. Cadmium and lead were the most abundant elements in the water samples. It was also investigated whether the heavy metal concentrations in plants were correlated with the soil heavy metal concentrations. A positive correlation was found for iron, aluminium and manganese. From the results, it can be concluded that a good proportion of the heavy metals in the soil are in forms that are not taken up by plants.

Keywords*: contamination, Danube, heavy metal, sediment, water sample, plant samples*

Biography

Dr. Ágnes Dr. habil. Mészáros-Bálint (Ágnes Bálint is the author's name); Education: MSc, Chemistry and Physics; Bsc, Software Information Technologist, Eötvös University, Budapest, Hungary, PhD; habilitation from Szent István University, Gödöllő, Hungary. She is Associate Professor at Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural

Sciences, and Hydro-Bio-Mechanical Systems Research Center, +36303721342; Specialty: Inorganic chemistry, environmental analytics, colloid chemistry, Development and application of chromatographic methods for soil/plant, polymer, amino acids and food analysis, Nitrogen transformation in soil/plant/atmosphere system, application of stable isotope tracers, as fertilizer, and Experimental and theoretical modelling of transport processes.

PROGNOSIS MODELS OF NITRATES AND ORTHOPHOSPHATES CONTENT IN SURFACE WATERS

Olena MITRYASOVA[1], Ruslan MARIYCHUK[2], Alla SHYBANOVA[3], Elvira DZHUMELIA[3]

[1]*Ecology Department, Petro Mohyla Black Sea National University, Mykolaiv, Ukraine,*
e-mail: lesya.solis28@gmail.com;+380952880479
[2]*Faculty of Humanities and Natural Sciences University of Presov, Prešov, Slovakia,*
e-mail: ruslan.mariychuk@unipo.sk; +421517570312
[3]*Department of Ecological Safety and Nature Protection Activity, Lviv Polytechnic National University, Lviv, Ukraine, e-mail: ashybanova16@gmail.com, +380964579604*

***Abstract**:*
The dynamics of hydro-chemical parameters, such as nitrates, and orthophosphates, of surface waters of Inhul river basin (Ukraine) during years 2008−2020 are considered. The regression analysis methods of the Windows Excel CurveExpert software were used for evaluation of the empirical dependencies and search for relations and interconnections. Against the background of high regulation of the Inhul river basin (Ukraine) due to the presence of 770 ponds and an irrigation system on 33 hectares, water use is carried out by more than 20 enterprises, the periodic nature of changes in hydrochemical parameters was observed. Based on the obtained functions, prognoses for 2021−2030 on annual averages were developed. Regression analysis allows obtaining a sinusoidal dependence on the orthophosphate content, which demonstrates a period of fluctuation of 13 years. The study is the basis for determining the mathematical model of natural fluctuations of the research indicators. Regression analysis allows obtaining a sinusoidal dependence on the orthophosphates content, which demonstrates 13 years fluctuation (R=0.90). An 11-year sinusoidal wave with a period of 10 years and fairly high representativeness (R=0.85) for nitrate content was observed. The determined sinusoidal dependences of the integrated indicators of water quality allowed determining the average time of fluctuations concerning the processes of self-organization of river waters, which is about 11 years, and confirms the theory of "waves of life". The surface waters of the river are capable of self-renewal and their hydrochemical status has not yet reached a critical point, after which irreversible changes in the river ecosystem may occur.

***Keywords**: nitrates, phosphates, prognosis models, water security, the prognosis of the environment state*

Biography

Olena MITRYASOVA - Professor, DSc, Professor of the Ecology Department of the Petro Mohyla Black Sea National University, Mykolaiv, Ukraine. Graduate with honors of the chemical faculty (diploma in organic chemistry) of the Mechnykov Odessa National University, Odessa, Ukraine. The author about 350 scientific works, including: 19 monographs and chapters of monographs, 14 textbooks on general chemistry, organic chemistry, history of chemistry, chemical ecology, environmental monitoring, water security for students. She has experience in coordinating international projects on internationalization of higher education and water security.

COENOLOGICAL COMPARISON AND GRASSLAND MANAGEMENT ANALYSIS OF DOMESTIC WATER BUFFALO PASTURES AT SZURDOKPÜSPÖKI

Attila FŰRÉSZ[1]*, Gabriella FINTHA[2], Szilárd SZENTES[3], Zsombor WAGENHOFFER[4], Márta BAJNOK[3], Ferenc SZALAI[5], Károly PENKSZA[1]

*[1]Hungarian University of Agriculture and Life Science, Institute of Agronomy, Gödöllő, Hungary, *furesz.attila.zoltan@phd.uni-mate.hu, [2]Hungarian University of Agriculture and Life Science, Doctoral School of Biological Sciences, Gödöllő, Hungary*
[3]Hungarian University of Agriculture and Life Science, Institute of Animal Science, Gödöllő, Hungary
[4] University of Veterinary Medicine Budapest, Animal Breeding, Nutrition and Laboratory Animal Science Department, Budapest, Hungary
[5]The Water Buffalo Reserve of Mátra, Szurdokpüspöki, Hungary

Abstract
Nowadays, due to effects of the climate change, the sustainability of agricultural areas has become a significant issue. In order to sustain these areas, grazing livestock, such as domestic water buffalo, can be very important. Based on this, the following research questions have been formed: Considering nature conservation, coenology and grassland management, in which direction does the vegetation evolve with the grazing? Was the grazing with water Buffalo successful? Our aim of this research was to compare data from several years of vegetation in the buffalo area of the Szurdokpüspöki through coenological surveys, monitoring the change in vegetation according to relative ecological indicators of plants, values of nature conservation and following the differences in the feed values of the grassland. In addition, we studied biomass amount and bryophyte flora of the surveyed grassland. Surveys were carried out on three sample plots, where there have been 2, 4 and 6 years of scrub removals. The number and the cover of economically important grass taxa and legumes have increased. The main change was a shift from a high ratio of shrubs to grassland species. The dominant taxon was Festuca valesiaca. Based on the life form system of Pignatti, the area was not overgrazed. Based on nature conservation values, cover of the taxa of natural grasslands increased. Based on the results, the grazing with domestic water Buffalo was successful by both nature conservational and economical means. Supported by the ÚNKP-22-3-I-MATE/2 New National Excellence Program of the Ministry for Culture and Innovation from the source of the National Research, Development and Innovation Fund, and AKGF-119-1-202.

***Keywords**: fescue, relative ecological indicators, pasture, moss*

Biography

I am a PhD student at the Hungarian University of Agriculture and Life Science. I graduated both Bsc and Msc in nature conservation engineering. My scientific field of research is vegetation mapping and studies of dry grasslands dominated by Festuca species. My present phd research topic is to clarify the taxonomic position of Festuca species of sandy grasslands along the Danube, to reveal their content values and to study their other features.

MONITORING OF THE HEAVY METAL CONTENT OF FISH SAMPLES OF LAKE BALATON, HUNGARY

Roquia RIZK* [a,b] , Tatjána JUZSAKOVA [a] , Hesham M SHAFIK [c], Ákos RÉDEY [a]

[a]*Research Centre for Biochemical, Environmental and Chemical Engineering, Sustainability Solutions Research Lab, University of Pannonia, Egyetem str. 10, H-8200 Veszprém, Hungary*
[b]*Biochemisrty Department, Faculty of Agriculture, Cairo University, Egypt*
[c]*Botany department, Faculty of science, Port Said University, Egypt,*
***mailto:roquia.rizk@mk.uni-pannon.hu** *+36(31)7898610*

***Abstract**:*
Heavy metals cause deleterious effects on human health and drastically alter the biogeochemical cycles within freshwater habitats. Analytical investigations were carried out around Lake Balaton to determine the heavy metal concentrations of water and fish samples. A correlation was set up between the level of heavy metals accumulated in the organs of common fish species and the pollution level in the investigated surface water bodies. This work has been carried out to assess the concentrations of various heavy metals such Cd and Pb and their distribution in different basins of Lake Balaton. Heavy metals concentrations were measured in water samples taken at different sites and bream (Abramis brama L.) fish tissue and liver. The accuracy of the analytical procedure was crosschecked by analyzing the Canadian standard reference materials obtained for both muscle and liver of fish. Heavy metals were highly accumulated in gills and livers and least in muscles. The obtained results have been compared with the previous year data and limit values. The possible sources of heavy metal pollution of the Lake are discussed. The results obtained on the content of heavy metals of Lake Balaton has been utilized in mathematical model development for assessment of environment status of surface water bodies including physical-chemical parameters and specific pollutants such heavy metals.

***Keywords**: Heavy metal assessment, Lake Balaton, Biomonitoring, integrated spatial assessment.*

Biography

Roquia Rizk is an assistant lecturer in Biochemistry department, Faculty of agriculture, Cairo University, Egypt. She is also a PhD student at PE Chemical Engineering and Material Sciences Doctoral School. Roquia has remarkable researches in reputed journals in biochemistry, sustainable development and biological science.

ABSTRACTS OF ENVIRONMENTAL INVESTIGATIONS AND MONITORING SESSION

ECOSYSTEMS AND LANDSCAPE FOR THE FUTURE GENERATIONS

Mythili MADHUSUDHAN

School of Architecture, Meenakshi College of Engineering, Chennai, Tamil Nadu – India

***Abstract**:*
In India, there are varying water scenarios. In fact, most resources that we depend upon are getting depleted at an alarming rate. The global system is entering a new epoch—the Anthropocene—which is characterized by significant global environmental impacts mainly driven by human activities. Since the advent of the industrial revolution approximately two centuries ago, the world population has increased exponentially, technological advances have mushroomed and the overall material well-being has improved substantially.
However, it is this spectacular success that has, perhaps unnecessarily, resulted in the many pressing environmental problems troubling the world today— biodiversity loss, ecosystem degradation, and climate change, to name a few.

WATER JET AND ITS ENVIRONMENTAL PROBLEMS

Lydia SOBOTOVA, Tibor DZURO, Miroslav BADIDA

Technical University of Košice, Faculty of Mechanical Engineering, Košice, Slovakia,
e-mail: lydia.sobotova@tuke.sk, tibor.dzuro@tuke.sk, miroslav.badida@tuke.sk ,
telephone: +421 55 602 2793, +421 55 602 2673, +421 55 602 2716

Abstract
The presentation deals with water jet and abrasive water jet technologies. The maintenance and garnet and impurities removal after cutting operations are factors that also influence on environment.
Common methods of garnet removal include expensive pump trucks, manual dig outs employing labour and shovels, mini-excavators, and back hoes. Alternatively, an investment in a garnet removal system can reduce many of the high costs associated with some of these cleaning methods and allows the waterjet operator to gain control over when and how frequently the garnet removal process will be performed. The environmental problems as noise, vibration, consumption of energy is known. The presentation gives us an overview of possibilities for removing waste from the production process. There are presented various methods for abrasive and water cleaning.

Keywords*: water jet, abrasive, impurity removal, environment*

Biography

Assoc. Prof. Dr. Lydia Sobotova, PhD, Eng. Tibor Dzuro, PhD. and Dr.h.c. mult. Full Prof. Eng. Miroslav Badida, PhD. All are the members of Technical University of Košice, Faculty of Mechanical Engineering, Department of Environmental Engineering. They participate in teaching subjects in the study programs of Environmental Engineering. The research activities are focused on technology of environmental protection, analysis, measurement and monitoring of work, environmental policy, engineering production and its impact on the environment, as well as recycling of materials.
Within the framework of their scientific and professional activities is devoted to publishing works and solve tasks in frame of grant projects. Area of operation is focused on the development and verification of physical parameters in environment; they are interested in the area of recycling of materials. Recognition by the scientific and professional community is confirmed by citations of works in domestic published documents, citations of works in foreign published documents according to the SCI and unregistered foreign citation indices.

URBAN WOODY PLANT'S BENEFITS IN HEAVY METAL POLLUTION MONITORING AND REDUCTION

Haimei CHEN [1,2], Levente KARDOS[2], Magdolna Sütöriné DIÓSZEGI[1], Veronika SZABÓ[1]

[1] Hungarian University of Agriculture and Life Sciences, Institute of Landscapes Architecture, Urban Planning and Garden Art, Department of Floriculture and Dendrology, Villanyi ut, 29-43, 1118, Budapest, Hungary*
[2] Hungarian University of Agriculture and Life Sciences, Institute of Environmental Science, Department of Agro-environment Studies, Villanyi ut, 29-43, 1118, Budapest, Hungary
e-mail: ellenchm@yahoo.com, Telephone +36 303231996;

Abstract.
U Urban green infrastructure planning plays an important role in aspects of pollution reduction, such as heavy metal trapping. However, the reduction effects are both influenced by the different pollution conditions in each city and the species-specific interactions of trees and pollution. Herein, we investigated three common urban woody plants (Acer platanoides L., Fraxinus excelsior L. Westhof's Glorie, and Tilia tomentosa Moench) in Budapest to compare their heavy metal trapping abilities from the airborne in leaf dust deposits and leaves. All samples were deconstructed by a wet digestion method, and heavy metal contents were determined by using an atomic absorption spectrometer (AAS). The investigated results indicate that woody plants are ideal candidates for heavy metal pollution monitoring, as Zn < Cu < Pb < Ni were found in all species, with the highest percentage of total metal concentration in the summer season as traffic emissions main sources of particulate matter. Among the species selected, the highest amount of dust was loaded in T. tomentosa during all sampling times, with a significant correlation between metal contents in the dust deposit and leaf found in T. tomentosa (0.926 at a $p<0.01$ level). Therefore, we suggest T. tomentosa, which has better atmospheric trace element capturing capacity than A. platanoides and F. excelsior and thus is a better option for pollution reduction in the urban area.

***Keywords**: Woody plant, Particulate matter, Heavy metals, Tilia tomentosa,*

Biography

Haimei CHEN

South China Agriculture University BSc. Agronomy 2007.09-2022.06
Szent Istvan Unviersity MSc. Horticultural Engineering 2018.09-2020.06
Migration of Rare Earth Elements in the Topsoil of Abandoned Mines under Rainfall Leaching
2021 http://doi.org/10.1007/s10967-021-07741-9
Journal of Radioanalytical and Nuclear Chemistry
A Review of In-situ Phytoextraction of Rare Earth Element from Contaminated Soils
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COMPOSITES MATERIALS, PROCESSES, PROPERTIES AND APPLICATIONS

Rudolf SZABÓ[1], Lóránt SZABÓ[2]

[1] *Rejtő Sándor Foundation, Budapest, Hungary, ingtex@t-online.hu, +36309245612*
[2] *Institute of Environmental Protection Engineering and Natural Sciences, Budapest, Hungary, szabo.lorant@rkk.uni-obuda.hu,+36303865097*

Abstract
Composites have been found to be the most promising material available in this century. Presently, composites reinforced with fibers of synthetic or natural materials are gaining more importance as demands for lightweight materials with high strength for specific applications are growing in the market. Fiber-reinforced polymer composite offers not only high strength to weight ratio, but also reveals exceptional properties such as high durability; stiffness; damping property; flexural strength; and resistance to corrosion, wear, impact, and fire. Performance of composite materials predominantly depends on their constituent elements and manufacturing techniques, therefore, functional properties of various fibers available worldwide. Their classifications, and the manufacturing techniques used to fabricate the composite materials need to be studied in order to figure out the optimized characteristic of the material for the desired application.

Keywords*: fiber-reinforced polymer, specific properties, composites productions, applications.*

Biography

Rudolf SZABÓ[1], He was born in 1950. He taught at the Óbuda University. He is currently retired. His research fields are textile technology and energy management. He has published more than 120 papers in different journals.

Lóránt SZABÓ[2], In 2012, he completed his PhD at the age of 50 years from Nyugat-Magyarországi Egyetem (University of West Hungary). He has published more than 100 papers in different journals. His research fields are air-jet looms, acoustics, technical mechanics, and renewable energies. He is assistant professor at the Óbuda University.

COMPARISON BETWEEN VARIOUS MPPT TECHNIQUES (FUZZY LOGIC, P&O, HYBRID SYSTEM (FUZZY LOGIC, P&O))

Haya ALTALEB[1], Hafed Ahmad SOUFYANE[2], Zoltán RAJNAI[3]

[1]*Doctoral School on Safety and Security Sciences, Óbuda University, Budapest, Hungary, Haya.altaleb@uni-obuda.hu, +36204107793.*
[2]*DONÁT BÁNKI Faculty of Mechanical and Saftey Engineering, Óbuda University, Budapest, Hungary, Hafedahmed@stud.uni-obuda.hu, +36204875179.*
[3]*Doctoral School on Safety and Security Sciences, Óbuda University, Budapest, Hungary, Rajnai.zoltan@bgk.uni-obuda.hu, + 3616665401.*

Abstract
Maximum PowerPoint Tracker (MPPT), is a component found in most current photovoltaic inverters (usually a DC to DC converter). Its task is to extract the most possible power from the arrays of solar panels attached to it at any given time. This paper will discuss three solar systems' maximum power point tracker (MPPT) control algorithms: Perturb and Observe (P&O), Fuzzy Logic (FL), and Hybrid System. MATLAB/Simulink has conducted a thorough analysis of the three methods. The simulation took insulation and temperature change into account. The PVs arrays model is connected to a DC-DC boost converter that operates depending on the MPPT block's output pulses in order for the PV system to run at MPP. The simulation findings for the three methods demonstrate reliability in all scenarios tested, with the FLFuzzy Logic method exhibiting greater efficiency than the other two.

***Keywords**: PV systems, MPPT techniques, P&O, Fuzzy Logic, Hybrid Systems, DC-DC boost Converter*

Biography

***Eng. Haya Altaleb** is a Doctoral Researcher at Óbuda University (Budaopest) . Currently, she is pursuing her doctoral degree in the Doctoral School of Safety and Security Sciences. Ms. Altaleb is working as a lecturer at Bánki Donát Faculty of Mechanical and Safety Engineering at Óbuda University (Budapest), where she completed her master's in Mechatronics engineering with the first-ranked honors (summa cum laude). She has worked in the field of renewable energy as a photovoltaic design engineer to promote clean energy in Jordan. Ms. Altaleb's research interests include risk management, safety and security science, industrial control systems, protection of critical infrastructure, information security, autonomous vehicle systems, and exploring the cultural and innovative boundaries between data and society. Ms. Altaleb is a member of the Association of Energy Engineers and a Member of CEDS Advisory Board, she models excellence as an early career woman in science by expanding her professional skill set and area of expertise above and beyond her graduate school program.*

RECYCLING OF ORGANIC WASTE: AN OVERVIEW OF PÁLINKA DISTILLERY MASH COMPOSTING

Lara Rúbia BORGES SILVA[1]*, Levente KARDOS[2]

[1, 2]Department of Agro-Environmental Studies, Institute of Environmental Sciences, Hungarian University of Agriculture and Life Sciences, Budapest, Hungary
[1]borgesrubialara@gmail.com, +36706164888, [2]kardos.levente@uni-mate.hu

Abstract
Organic waste generation has been extending to an alarming level in most areas of the world, and its sustainable management is required. In Hungary, the amount of organic waste is increasing significantly, especially in Pálinka manufacturing - a Hungarian hard liquor - producing a great quantity of mash residue, mostly grape pomace spent wash, a non-hazardous food waste that is a suspension left over by the distillation of fermented spirits. Around two hundred thousand tons of fruit waste are generated annually, and its full recycling and legal disposal are unprecedented in Hungarian distilling plants, threatening the environment if disposed of incorrectly. In this paper, we focused on reviewing the Pálinka mash composting, where the biggest challenge for its treatment is its initial pH, around 4, which can be successfully neutralized with mineral additives. The applied additives were chosen by their beneficial physical, chemical, and biological qualities. Accordingly, andesite and alginite were employed in the experimental composting. The results of our observation have confirmed that the mineral additives can establish valuable compost or fertilizer, favourably altering the dynamics of the decomposition and synthesis reactions. As an experiment on mash composting technology, we also tested the mature mash compost in culture vessel experiments for heavy metal adsorption capacity of the ma tube mash compost using lettuce (Lactuca sativa) and tomato (Solanum lycopersicum) as test plants. The plants were irrigated with lead (Pb), and iron (Fe) contaminated water, and then it was determined the metals accumulation capacity of the plants and growing media with an Atomic Absorption Spectrometer (AAS). The study could compare the rate of heavy metal accumulation by different plant parts and ratios of Pálinka mash compost in the growing media.

***Keywords**: organic waste, Pálinka mash residue, composting, heavy metal accumulation*

Biography

Lara Rúbia, Ph.D. candidate in Environmental Sciences at the Hungarian University of Agriculture and Life Sciences; B.Sc. in Environmental Engineering, Brazil, researched the Application of Ecosystem Services on a Landfill's Environmental Assessment. In 2014, got a scholarship for an exchange program at the University of Montana, USA and a summer internship at Cornell University focused on Sustainable Bioenergy. After graduating, she got a scholarship for a M.Sc. in Environmental Science at ELTE, Hungary where she started researching Pálinka waste composting which is still her Ph.D. project, aiming to improve the technological conditions for Pálinka distillery mash composting.

EVALUATIONS OF THE EOCENE APOLLONIA FORMATION IN KARSAH REGION, CYRENAICA, LIBYA, FOR CEMENT MANUFACTURE

Saad K. EL EBAIDI, Ahmed M. MUFTAH, Mohammed H. AL RIAYDH

University of Benghazi, Faculty of Science, Department of Earth Sciences, Benghazi, Libya.

This paper provides a more detailed lithological description aimed to assess the Apollonia Formation in Wadi Bin Jibarah and Wadi Attir 8 km west Karsah village. Seventeen Samples were collected from both wadies, were then made into thin sections, stained with Alizarin Red and examined using a petrographic microscope. Elemental analysis of major oxides (wt. %) of the Eocene limestone samples have been performed through X-Ray Fluorescence (XRF). The geochemical composition of the whole rock reveals that the SiO_2/MgO ratio is (0.01:0.04) in Wadi Attir, which is much lower than Wadi Bin Jibarah (0.04:0.08), and MgO is < 3 %. Apollonia at these two measured sections made of 160 to 180 m, thickly bedded limestones that are alternating by thinly bedded chalky limestones and highly chalky. It consists primarily of white to cream, hard, mudstone to wackestone, locally chertified, with chert nodules at some levels of variable sizes, with few mollusks and extensive bioturbation at local levels. Petrographically, mudstone is the dominant facies containing few to rare planktonic foraminifers and other shell fragments. There are someevidences of reworked stromatolites which is appearing at specific levels. The Apollonia Formation is used in the production of cement, which is the goal of this study, but it may also be used to make dimension stones, decorative walls, aggregate for roads, concrete, irons, and steels, weighting agents for drilling mud fluids, carpet packing, and fillers for other industrial products.

***Keywords**: Eocene, Wadi Bin Jibarah, chert, Apollonia Formation, Wadi Attir*

Biography

The National Libyan Chapter of the International Association for Geoethics (IAGETH).
http://www.icog.es/iageth/index.php/national-chapters/
July 2007 – Present: Professor in Industrial Geology, Earth Sciences Department, Faculty of Science, University of Benghazi, Benghazi-Libya.

1990 - JULY 2007 JOWFE CO. FOR OIL TECHNOLOGY (CONTRACTOR)

Worked as a Mud Engineer in Mud Engineering Department; Geologist in Research Department; a position of Research Department Supervisor; Field Equipment Coordinator, responsible for four (4) departments are: Surface Equipment Department, included the followed divisions; Tubular Casing, Pipe Inspections, Solid Control Equipment; Subsurface Department included the divisions of; Wireline Slickline, Drill Stem Testing (D.S.T), Production Testing and Fishing; Mud Logging Department; and Electrical and Maintenance Department; Material Manager; and Operation Manager.

1986 – 1990 WATER AND SOIL DEPARTMENT

Geologist in Water and Soil Authority, a governmental department

CONSERVATION MANAGEMENT AND RESTAURATION OPEN SANDY GRASSLAND THE HOMOKTÖVIS CONSERVATION AREA IN BUDAPEST

Károly PENKSZA*, Norbert PÉTER, Attila FŰRÉSZ, Eszter SALÁTA-FALUSI, Zoltán BAJOR

Institute of Agronomy, Hungarian University of Agriculture and Life Science, Gödöllő, Hungary,
**penksza.karoly@uni-mate.hu*

Abstract

The examined territory, since 2006 long term reconstructions of the habitats have been ongoing which strive for the decrease of the invasive woody species on the territory and the insurance of the habitat of the sandy lawn, as well as the long term conservation of the fragments of the lawn and the creation of the natural sandy lawn. The effects of the interventions on the vegetation were conducted on 7 sample areas, on 10-10 quadrats by examining the coenological entries, therefore we were able to provide the effects of the reconstruction of the habitats 16 years retrospectively. During the past years, due to the systematic planning on the fragments of the habitats, 9 hectares of new surface could be opened. Due to this, more than 40% of the entire protected area could become an area of lawn. To better understand the changes, we demonstrated them on a map and we compared with the soil science data of this surface. In the central part of the area where there has always been natural, open sandy lawn, the dominant species of grass is Festuca vaginata. However, in the areas of killed shrubs, the dominant species of Festuca was the Festuca pseudovaginata. It was especially outstanding that for the science a new species: Festuca tomanii. The work has been supported by OTKA K-125423..

***Keywords**: Protected species, Festuca pseudovaginata, Festuca vaginata, Festuca tomanii.*

Biography

Professor Károly Penksza the head of department of Botany, Agrobotany group on Hungarian University of Agronomy and Life Sciences, Institute of Crop Production. Courses taught: Courses of Plant Taxonomy and Phytoconology, Vegetation mapping, Landscape Ecology, Medical, Poisonous and Invasive Plants. Research: Flora and vegtation researches of Hungary and Middle European Country, coenologycal investigations of grasslands, taxonomical investigations of Festuca genus (Grasses), grasslands management. Publications: 899, Citation 2310.

FINANCIAL AND ECONOMIC POSITIONS OF PORTUGAL AT THE TURN OF 2020S

Csaba LENTNER[1], Sándor J. ZSARNÓCZAI[1,2]

1University of Public Service, Budapest, Faculty of Governmental and International Studies, Kálmán Széll Public Finance Pub, Ludovika tér 2., H-1083 Budapest, Hungary
e-mail: dr.lentnercsaba@mail.com, lentner.csaba@uni-nke.hu,
2Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering Institute of Environmental Engineering, Doberdó u. 6, H-1034 Budapest, Hungary, e-mail: zsarnoczai@yahoo.co.uk

Abstract
For Portugal, the stability of its financial and economic situation is important by increasing domestic investments and standing fixed capital investments and thus preserving jobs. Investments can further stimulate market conditions, financial stability, which must be associated with a reduction in the deficit of general government budget balance, government debt and the deficit of the balance of payments. The research period was between 2018 and 2022. In 2020, the pandemic caused a serious decline, resulting in 8.4% decline in real GDP. The gross domestic investment retained its 18.8% growth rate, which was unbroken after 2020. Through the statistical analysis method, the data of economic variables was processed. There is a need to increase the competitiveness of businesses in the domestic, EU and international markets, a positive balance of the country's foreign trade balance, which can increase the country's net international investment positions.

Keywords: *Fixed capital investments, government budget, government debt, competitiveness, statistics.*

Biography

Csaba Lentner is full professor in Public Finance, head of Széll Kálmán Public Finance Lab at National University of Public Service, Faculty of Governmental and International Studies. Professor Lentner was educated by Corvinus University of Budapest. Later he was awarded the degree of Candidate of Economics at the Hungarian Academy of Sciences, then habilitated in public finance. His main research interests are public finance, banking regulation, fiscal and monetary policy. Lentner is the recipient of several state and scientific awards for example: Wekerle Sándor Scientific Lifetime Achievement Award (in 2013), Hungarian Order of Merit Cross of Honour (2018), Zoltán Magyary Memorial Medal for Public Administration (2021).

Sándor J. Zsarnóczai CSc, economic sciences, Hungarian Academy of Sciences, Scientific Qualified Committee, Budapest in 1991 and Dr. of University, World Economics, Budapest Corvinus University of Economics in 1991. Habilitate Doctor, in social sciences, in Management and Business Administration, Kaposvár University, in Kaposvár in 2017. Between 1987-2017 work at University of Agricultural Sciences, then at Szent István University in Gödöllő. From 2017 work at Óbuda University. Participation at Doctoral School of Economics and Regional Sciences.

The research areas: Economics, Business and Management, International Regional Economic Integration, EU Study, Regional economics, Rural Development, Environmental economics. He published 207 publications with 257 *independent citation count, of which 189 foreign language citations. His publications were published in Arab, English, Spanish and Russian foreign languages. International scientific conferences in Turkey, Canada, Moldavia, Czech Republic, Slovakia, Lithuania, Romania and Russia. Research project in Finland, Sweden, Denmark, Italy, Spain, France.*

NEW SYMMETRY METHODS FOR QUANTUM-MECHANICAL MODELLING OF PROMISING PHOTOVOLTAIC MATERIALS OF INFINITE CHAIN-TYPE AND LAYER-TYPE ATOMIC SYSTEMSTITLE

Csaba MÉSZÁROS[1]*, István Róbert NIKOLÉNYI[1], Ágnes BÁLINT[2]

[1]*Institute of Mathematics and Basic Sciences, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary, e-mail: Meszaros.Csaba@unimate.hu*
[2]*Institute of Environmental Engineering and Natural Sciences and Hydro-Bio-Mechanical Systems Research Center, Óbuda University, Budapest, Hungary, e-mail: balint.agnes@uni-obuda.hu,mobile: +36303721342*

Abstract
It is well-known, that the detailed experimental and theoretical investigation of basic structural-, microscopic- and macroscopic properties of the regular-, but very various type chain-type and layer-type infinite atomic and molecular systems are playing a role of continuously increasing importance in quantum physics of such types of coherent condensed matter systems, because of their very probable wide-range photovoltaic-type applications in the global solar energetics, too. Among them, the very powerful symmetry methods based on the representation theory of symmetry groups of the ideal stereoregular polymers is accepted as the most relevant one. The quantum mechanical analysis of the relevant collective elementary excitations was realized and developed here via detailed and novel-type applications of the representation theory of line groups and layer groups. In order to illustrate the expectable crucial future application fields of this already contemporary research area, we decided to describe them more accurately, as it is usual, in order to give new, original significant contributions to the theoretical modelling of the basic optical properties of the stereoregular polymers and carbon nanotubes at quantum mechanical level.

***Keywords**: Alternative energetic materials, nanotechnology, symmetry theory, infinite chain-type and layer-type systems*

Biography

Dr. habil. Csaba Mészáros (Csaba Mészáros is the author's name). Highest educational degree: MSc Physics, Faculty of Natural Sciences, Novi Sad, Former Yugoslavia, Scientific degree: PhD in the field: Physics, ELTE, Budapest; Habilitation, in the field: Agricultural Engineering, SZIE, Gödöllő, Hungary, Department: Institute of Mathematics and Basic Natural Sciences. Phone: +36 28 522000/1553. Position: Associate Professor. Specialties: Experimental and theoretical determination of ordinary crystal structures and incommensurately modulated ones. Experimental and theoretical modelling of transport processes

NOVEL USE OF A DEEP CONVOLUTION ARCHITECTURE PRE-TRAINED ON SURFACE CRACK DATASET TO LOCALIZE AND SEGMENT WRIST BONE FRACTURES

Deepa JOSHI[1*], Thipendra P SINGH[2]

[1,2]School of Computer Science, University of Petroleum and Energy Studies (UPES), Energy Acres, Bidholi. Dehradun- 248007, Uttarakhand, India
deepa.joshi117@gmail.com

Abstract
In this day and age, X-rays are the principal instruments for assessing suspected fractures in humans. Expert radiologists are required to suspect the fractures by manually inspecting them, which is a time-consuming process. Automatic detection is beneficial, especially in under-resourced areas where scarce resources and experienced radiologists are observed. Wrist Fracture Dataset (WFD) and Surface Crack Dataset (SCD) were developed to detect and segment wrist bone fractures automatically. The number of wrist fracture images obtained from the Indian hospitals is 315, having 733 annotations/cracks, which is insufficient to produce accurate results using deep learning techniques. As a result, we included SCD for improved model generalization. WFD consists of 3,000 images collected by capturing the minute cracks from road, pavement, and walls, which has similar patterns as the bone fracture cracks. The proposed architecture is a modified version of mask-RCNN architecture where the surface crack dataset's weights are transferred to the wrist X-ray dataset for better model convergence. The results are compared based on two levels: First, the ground truth annotations provided by the expert radiologist were examined to compare the outcomes produced by the proposed model. Second, results obtained from the modification done at the sub-architecture level (levels 1 and 2) are examined. Combining the modifications proposed at level 1 and level 2, we have obtained improved results against the standard mask-RCNN model for the wrist fracture dataset. We achieved an average precision of 92.278% and 79.003% for fracture detection and 77.445 and 52.156% for fracture segmentation on 50^0 and 75^0 scales, respectively.

***Keywords**: Deep Learning; radiology; medical imaging, convolutional neural networks; X-rays*

Biography

Deepa Joshi is currently Research Scholar in Department of Computer Science and Engineering at University of Petroleum & Energy Studies, Dehradun, UK, India. She obtained her B. Tech degree in Computer Science and Engineering from UTU (Uttarakhand) in 2012 and Master of Engineering in Computer Engineering from GBPUAT, Pantnagar, India. Her research interests include medical image processing, sentiment analysis, natural language processing, and data mining

EVALUATION OF THE ANALGESIC CAPACITY OF THE N-BUTANOLIC EXTRACT OF *CENTAUREA TOUGOURENSIS* BOISS. & REUT

Mohamed Sabri BENSAAD[1,2], Saliha DASSAMIOUR[2], Leila HAMBABA[2], Mohamed Amine KAHOUL[3]

[1]Laboratory of Cellular and Molecular Physio-Toxicology-Pathology and Biomolecules (LPTPCMB), Department of Biology of Organisms, Faculty of Natural and Life Sciences, University Batna 2, Fesdis, Batna 05078, Algeria. m.bensaad@univ-batna2.dz

[2]Laboratory of Biotechnology of Bioactive Molecules and Cellular Physiopathology (LBMBPC), Department of Microbiology and Biochemistry, Faculty of Natural and Life Sciences, University Batna 2, Fesdis, Batna 05078, Algeria. s.dassamiour@univ-batna2.dz ; l.hambaba@univ-batna2.dz

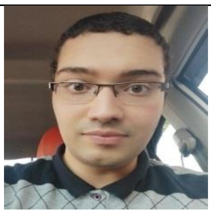
[3]Laboratory of Food Sciences (LSA), Institute of Agriculture and Veterinary Sciences, University Batna 1, Batna 05000, Algeria. aminekahoul@gmail.com

Abstract

Nowadays, many pharmaceutical industries are aware of the pharmacological potential of plants and a well-known species named Papaver somniferum has been considered from a long time as an important source of morphine and thus a significant contribution in the development of opioid analgesic drugs. In this context, the purpose of this work was to evaluate the possible analgesic effect of the n-butanol (n-BuOH) extract of Centaurea tougourensis using Eddy's hot plate method and thus to estimate the effects of this organic extract on the threshold for detecting pain. Mice were used as experimental model and subdivided as follow; Group 1: served as negative control and received 0.9% isotonic saline solution (10 mL/kg), Group 2: served as positive control and received the standard aspirin (10 mg/kg, body weight) at a volume of 10 mL/kg. Groups 3 and 4 received respectively the n-butanol extract at the doses of 200 and 400 mg/kg (volume of 10 mL/kg). The n-BuOH extract showed the maximum antinociceptive effect at 120 min after treatment (15.33±1.33 sec) which was found significant (P<0.05) compared to control group, while the dose of 200 mg/kg gave a shorter time (10.42 ± 1.14 sec). However, the tolerance and reaction time of aspirin group was significantly prolonged and considered as the best among the tested groups (18.26 ± 0.71 sec). These results revealed the capacity of the highest concentration of n-BuOH extract (400 mg/kg) to extend the duration and resistance of mice to painful thermal stimuli but also revealed that C. tougourensis could contain active compounds with analgesic properties.

***Keywords**: Active compounds, analgesic, aspirin, Centaurea tougourensis, n-butanol*

Biography



Mohamed Sabri Bensaad graduated with a PhD degree in Biological Sciences from the university Batna 2. He is specialized in Animal Physiology and his research focuses on Cell Biology, Physiology, Histology and Traditional medicine. His current project is "Chemical and biological investigation of some endemic plants species of the Aures region".

TEST OF BIOLOGICAL ACTIVITIES OF SYRUPS ELABORATED FROM WASTE DATES

Saliha DASSAMIOUR[1], Mohamed Sabri BENSAAD[1,2]

[1]*Laboratory of Biotechnology of Bioactive Molecules and Cellular Physiopathology (LBMBPC), Department of Microbiology and Biochemistry, Faculty of Natural and Life Sciences, University Batna 2, Fesdis, Batna 05078, Algeria.* s.dassamiour@univ-batna2.dz

[2]*Laboratory of Cellular and Molecular Physio-Toxicology-Pathology and Biomolecules (LPTPCMB), Department of Biology of Organisms, Faculty of Natural and Life Sciences, University Batna 2, Fesdis, Batna 05078, Algeria.* m.bensaad@univ-batna2.dz

Abstract

Loss of dates (Phoenix dactylifera L.) occurs when fruits lose their appreciation by the consumer; thus their market value due to the hardening, darkening or pest infestation. In order to valorize this waste fruit, the elaboration of syrups from three varieties of dates (Deglet Noor, Ghars and Mech Degla) after impairment of quality and the study of their hemostatic and antibacterial activities were carried out. Syrups were prepared by decoction and concentration to 70 ° Brix. The method of plasma recalcification was used in the test of hemostatic activity; the disk diffusion method on agar plates was used for the study of the antibacterial activity to test the sensitivity of strains: Staphylococcus aureus ATCC 25923, Pseudomonas aeruginosa ATCC 27853, Escherichia coli ATCC 25922, Klebsiella pneumoniae, Streptococcus agalactiae and Bacillus spp. Determination of total phenolics and tannins contents was also performed. The test of hemostatic activity revealed permanent anticoagulant power syrups of the three date varieties studied contrast to control plasma that have coagulated after a few minutes of re-calcification. Susceptibility testing of the studied bacterial strains to these syrups gave inhibition zones diameters ranging between 8.2 and 15.6 mm, depending on the variety and strain. The assays have demonstrated the richness of these preparations in phenols and condensed tannins, alongside reducing sugars. The results obtained in this study allow highlighting an important anticoagulant effect of the three date varieties syrups in addition to their significant antibacterial activity which encourages to value waste dates.

Keywords*: Waste date, hemostatic activity, antibacterial activity, phenolics, valorization*

Biography

Saliha Dassamiour currently works at the department of microbiology and biochemistry, University Batna 2. She graduated with a PhD degree in Biological Sciences from the university Batna 2. She is specialized in biochemistry and her research focus on food & nutrition chemistry, food preservation, nutritional analysis of date fruits and Traditional medicine. her current project is "Chemical and biological investigation of some endemic plants species of the Aures region".

IRON MINERALIZATIONS OF BABORS REGION (NORTHEASTERN ALGERIA)

Zoubir BELHIMER, Azzedine BOUZENOUNE, Abdelhakim BOUCHAIR

Geological Engineering Laboratory (LGG), University of Mohamed Seddik Benyahia, Jijel, Algeria, belhimerzbr@gmail.com , (+213)6 59 10 47 85

Abstract

The Babors region is located between Jijel and Bejaia towns, in northeastern Algeria. It is part of the Tellian domain of the Maghrebian chain. In this region, the Jurassic carbonate rocks form extruded chains within the Cretaceous cover. These carbonate rocks host a large number of mineralized occurrences, mainly of iron. The iron ores of Babors region are mainly hosted by limestones, dolomitic limestones and dolomites of Jurassic (Liassic) age. Some mineralizations, less important, are hosted by dolerites of unknown age packed in the Triassic formations marking the basal contacts of the Jurassic ranges. These mineralizations, regardless of the host rock, are often accompanied by copper mineralization. Iron ore hosted by carbonate rocks (Jebel Hadid, Tazeguezaout, Timezrit, Bou Amrane, ...etc.) are constituted by iron carbonates (siderite, ankerite), iron sulphides (pyrite) and iron oxides and hydroxides (hematite, goethite, limonites, lepidocrocite). These mineralizations are associated with a calcite and/or quartz gangue. They show a multitude of morphologies of orebodies: filling of fissures, clusters, lodes, veinlets, lenses, ... etc. The mineralizations hosted by dolerites are constituted by varieties of hematite disseminated in the host rocks: specularite (Oued Taza), oligiste (Beni Felkai) and martite (Tadergount). The available data of differential thermal and chemical analyses, on the ores related to the carbonate rocks, highlighted the presence of siderite as a "protore" with iron grades in the range of 41 to 43 %. These grades are enriched by oxidation to reach grades in the range of 60 to 62 % in hematite. Most of the iron mineralizations in the Babors region are replacement deposits in carbonate rocks. They are enriched by the supergene oxidation of the protore (siderite and sometimes pyrite). The intimate association of the iron mineralizations of the Babors region with the carbonate rocks of Liassic age and the doleritic green rocks allows to qualify the latter as metallotects.

Keywords*: Babors, carbonate rocks, Lias, dolerite, oxidation.*

Biography

Zoubir Belhimer is a third year PhD student in geology at the faculty of natural and life sciences in the university of Mohamed Seddik Benyahia of Jijel, Algeria. Zoubir works currently on polymetallic mineralizations hosted by Jurassic carbonate rocks of the eastern Babors region in northeastern Algeria.
He can be contacted at:
zoubir.belhimer@univ-jijel.dz.

ENZYME IMMOBILIZATION ON DATE STONES FOR REMOVING POLLUTANTS

Osamah J. AL-SAREJI[a,b,*], Mónika MEICZINGER[b], Raed A. AL-JUBOORI[c,d], Viola SOMOGYI[b], Miklós JAKAB[e]

[a] Environmental Research and Studies Center, University of Babylon, Al-Hillah, Iraq
[b] Sustainability Solutions Research Lab, Faculty of Engineering, University of Pannonia, Egyetem str. 10, Veszprém H, 8200, Hungary
[c] NYUAD Water Research Center, New York University-Abu Dhabi Campus, Abu Dhabi, P.O. Box 129188, Abu Dhabi, United Arab Emirates
[d] Water and Environmental Engineering Research Group, Department of Built Environment, Aalto University, P.O. Box 15200, Aalto, FI-00076, Espoo, Finland
[e] Research Centre of Engineering Sciences, Department of Materials Sciences and Engineering, University of Pannonia, P.O. Box 158, H-8201 Veszprém, Hungary

***Abstract**:*
Enzymatic remediation has gained significance in recent years for the bioremediation of recalcitrant substances. However, high solubility and poor stability are some drawbacks of enzyme immobilization. Prior to the process of immobilization and in order to overcome these limitations, the enzyme can be loaded on a solid carrier. Date stones as a carrier for enzyme immobilization can be exploited since they are an eco-friendly, inexpensive, and efficient natural adsorbent. The study tests different parameters such as laccase storage, pH, and temperature stability of immobilized enzyme on date stones with conducting side experiments for free enzyme. The system will be examined for pharmaceutical compounds removal from a batch system utilizing synthetic water. The study is introducing an environmentally friendly system for pharmaceutical compound removal.

***Keywords**: Date stones, Enzyme, Immobilization, Pharmaceutical degradation.*

Biography

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SUSTAINABLE UTILIZATION OF WILDLIFE (SUW): NEED OF THE HOUR TO UNDERSTAND THIS GREY AREA UNDER CITES FOR A SUSTAINABLE FUTURE

Kshitij NAIKADE

DAAD Scholar, Berlin School of Economics and Law, Berlin, Germany
Assistant Professor, Symbiosis Law School, Pune, India
kshitij.naikade@symlaw.ac.in, +91-9619292797

Abstract
SUW refers to the policymaking approach where on one side, countries implement measures to protect the environmental ecosystem from further degradation but on the other hand, also promotes sustainable exploitation of the same flora and fauna to cater to the larger socio-economic needs of the ever-increasing global population. It's the grey area which flirts with the thin line of conservation of various species of birds and animals but at the same time, promotes international trade and commerce of the same species for generating awareness and incentivizing its existence. This thin line has been crossed several times in the recent times for gross commercialization and exploitation, thus putting at risk the very existence of the important species in the food chain. Rampant corruption, lack of knowledge, tools and guidance for effective utilization has threatened the sustainability of the whole biodiversity. The CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), which was launched with much fanfare has failed to provide governance tools to underdeveloped and developing countries to address the global challenge of sustainability. Thus, the old CITES needs to be relooked at with modern solutions to address modern problems. Ahead of the very crucial 19th meeting of the CITES which is due to be held in Panama in November, 2022, this paper will look at the structural demands from countries like Namibia, Botswana, South Africa, Zimbabwe and multiple other countries who are increasingly demanding sustainable trade of banned flora and fauna for generating revenue for conservation. The demand for pragmatism needs to be given due attention. The suggestions and recommendations from this paper can be taken up for a more practical approach towards environmental conservation by the CITES and various bilateral and multilateral commitments for a time bound impact.

***Keywords**: CITES, Sustainable Utilization of Wildlife, Wildlife, Environment, Sustainability.*

Biography

Dr. Kshitij Naikade is an Assistant Professor at Symbiosis Law School, Pune, India. He is currently undergoing his PhD Fellowship at Berlin School of Economics and Law,Berlin, Germany. He specializes in Political Science, International Relations and Public Policy and Governance. He has written and published over 20 research papers and book chapters in various international and national publications. His PhD theme is on the 'Politics of Microfinance in India'. An avid sportsman and a nature lover, Prof. Kshitij has been involved in various environmental conservation & sustainability efforts in India in collaboration with the Indian Government.

VERGES AS FRAGMENTS OF THE WESTERNMOST OCCURRENCES OF FOREST GRASSLAND IN THE CARPATHIAN BASIN AND THEIR FESTUCA SPECIES

Károly PENKSZA[1]*, Zsuzsanna SUTYINSZKI[1], Attila FŰRÉSZ[1], Dénes SALÁTA[2], Szilárd SZENTES[3]

[1]*Institute of Agronomy, Hungarian University of Agriculture and Life Science, Gödöllő, Hungary, *penksza.karoly@uni-mate.hu*
[2]*Institute for Wildlife Management and Nature Conservation, Hungarian University of Agriculture and Life Science, Gödöllő, Hungary*
[3]*Institute of Animal Scienc, Hungarian University of Agriculture and Life Science, Gödöllő, Hungary*

Abstract
Verge, in Hungary it is important to know what kind of vegetation can develop on these secondary habitats. The aims of our study were to date the age of the sample verges. Which of the taxonomically important species of Festuca? The studies were carried out in 3 areas. We examined the age of the verges and their natural condition. Floristic and coenological surveys were applied to analyse the diversity of the verges. Inflorescence morphological analysis of the Festuca species was carried out. Our results showed that not only the vegetation of primary verges was valuable and natural. Most of the loess species did not appear in one of the old verges. Based on the coenological data, there were two types of verges, which were the interspaced verge and the border verge. The interspaced verge showed the highest diversity value. Festuca pseudovina was separated clearly as a homogeneous group. Overall, in contrast to the previous hypothesis, the age of the grassland fragments is not the most important factor, but rather their location and size and the number of species and the diversity are adapted to them. This research was supported by the OTKA K-125423.

Keywords*: landscape history, South Transdanubia, loess verges, natural condition, protected plant species, Festuca rupicola.*

Biography

Professor Károly Penksza the head of department of Botany, Agrobotany group on Hungarian University of Agronomy and Life Sciences, Institute of Crop Production. Courses taught: Courses of Plant Taxonomy and Phytoconology, Vegetation mapping, Landscape Ecology, Medical, Poisonous and Invasive Plants. Research: Flora and vegtation researches of Hungary and Middle European Country, coenologycal investigations of grasslands, taxonomical investigations of Festuca genus (Grasses), grasslands management. Publications: 899, Citation 2310.

RECENT ADVANCES IN THE GREEN SYNTHESIS OF BIOCOMPATIBLE NANOPARTICLES

Ruslan MARIYCHUK

Department of Ecology, Faculty of Humanities and Natural Sciences, University of Presov, Presov, Slovakia, ruslan.mariychuk@unipo.sk, +421517570312

Abstract

The synthesis and application of new nanomaterials have become a key technology for many fields, like electronics, engineering, optics, computer science, sensors, and biomedicine. Therefore, there is an interest in new cost-, energy-, and time-effective methods for preparation of new nanomaterials. However, biomedical application of advanced nanomaterials is limited not only by control over their size and morphology but also by their biocompatibility due to utilization of toxic reducing agents (sodium borohydride, methoxy polyethylene glycol, potassium tartrate, etc.) and capping agents (sodium dodecyl benzyl sulphate, polyvinyl-pyrrolidone, etc.). In this study, we analyse the recent reports and evaluation of perspectives for the development of green methods of metal nanoparticles for biomedical applications. There are many signs that some extracts of selected plants (juniper, goldenrod, spearmint, lemon balm etc.) and their components can be successfully used for preparation of biocompatible plasmonic materials with response in the infrared region, which make them attractive to nanomedicine.

Keywords*: nanomaterials, plasmonic nanoparticles, biosynthesis, phytosynthesis*

Biography

Ruslan MARIYCHUK - Dr. PhD., Associate Professor at the Department of Ecology, Faculty of Humanities and Natural Sciences, University of Presov, Presov, Slovakia.
PhD degree in Inorganic chemistry in 2000 at the Taras Shevchenko National University of Kyiv, Ukraine. Associate Professor in Ecology and Environment Protection at Uzhhorod National University, Ukraine in 2009.
Author of more 200 scientific publications, including 60 papers in reputed journals, 3 handbooks and 3 patents.
Research interests: green technologies, green chemistry, and nanomaterials.

PROTECTION THE PLANET: GLOBAL ECOSYSTEM PROBLEMS AND CLIMATIC CHANGES

Hosam E.A.F. BAYOUMI HAMUDA

Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest – Hungary
e-mail: bayoumi.hosam@uni-obuda.hu

Abstract
Pollution is one of the major problems persisting in our environment causing an increase in the morbidity and mortality, which ultimately affects the economic growth of a world. Therefore, environment quality sensing tools have become inevitable in everyday life. Environmental health concerns are a critical issue nowadays that needs joint efforts from multiple sectors to achieve better public health outcomes. The holistic approach, relevant to food safety and control of diseases (e.g. Covid-19) through usage of green technologies should be considered. The application of cleaner and effective technologies can be expanded to management and control, pollution mitigation and valorization of waste. The potential topics from the following research areas are expected: Global environmental health; Environmentally friendly processes and their effects on human health; Outdoor air quality, surface and ground water quality improvements; Toxic substances and hazardous wastes reduction from clean technologies. Growing awareness and an increased attention on environmental issues such as climate change, energy use, and loss of non-renewable resources have carried out a superior quality for research that provides potential solutions to these problems. Emerging microbiome approaches potentially can significantly increase agriculture productivity and human healthcare and henceforth can contribute to meet several sustainable development goals. The aim of this study is to illustrate the novel research contributions on innovative approaches to manage, mitigate and valorize wastes produced by different sectors, with the aim of transforming our society towards a sustainable and circular bioeconomy. Hence, research activities of the environmental Biotechnology are comprehensively focused up on major sectors e.g., bioremediation of organic and inorganic pollutants, environmental risk analysis of microbiomes, environmental assessment using microbial indicators, enzymes for environment, food and industrial applications, nanomaterials and nontoxicity, sustainable ecobiotechnology. The present study discussed aspects including risk factors in atmospheric, soil and water environment, public health improvement, changes of food trend, and living environment to elucidate the importance of environmental allergen as well as the global environmental protection and public health

***Keywords**:*

Biography

*Prof. Dr. Hosam Bayoumi Hamuda is working at Óbuda University. He is Environmental Microbiologist and Soil Biotechnologist dealing with the interactions between the microbiomes and the environment for increasing soil quality and saving the soil from pollutants in the agriculture. His investigations are on the role of waste management, soil quality, fertility, the crop production and environmental impacts related to the application of organic wastes; measurements soil microbial biomass and enzymatic activities in wastewater sludge amended soils; and roles of engineered metal oxide nanoparticles in biosphere. **Research Interest**: Waste management; Biotechnology; Protection; Sustainable; PGPR; Microbial inoculants; gut microbiomes and human health and modern biology*

HORSE-POWERED LOGGING FOR THE PROTECTION OF HUNGARIAN FORESTS

Ákos MALATINSZKY, Csilla FICSOR

Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary,
malatinszky.akos@uni-mate.hu, +36-30-566-3869

Abstract

Transporting the harvested wood logs out from the forests sensitively affects the soil, the remaining trees, the forest floor vegetation, and the saplings everywhere in forested areas under management. This step of forest management can be done with heavy machines or horses, and it requires attention to the wood stand, the saplings, and the topsoil, in order to minimize erosion and not influence the hydrological regime. Before the mechanization of timber harvesting, animal power had been extensively used. Since the 1990's however, it has almost disappeared. Our goal was to explore its current frequency in the Hungarian state-owned forest districts (n=116) and its benefits for the forests, especially in areas under nature conservation. We conducted interviews with loggers and foresters. Horses are used mostly for thinning and selection works in young tree stands, in hilly areas rather than on plains. Our field interviews revealed that using animal power for logging causes less harm to the topsoil as a horse maneuver easier than a machine. Another environmental benefit is the no direct use of fossil fuels. The use of horses is especially efficient on steep terrain.

***Keywords**: animal logging, draft horse, forest district, log skidding, nature conservation area.*

Biography

Ákos Malatinszky is habilitated associate professor and leader of the BSc course in nature conservation. He has published more than 70 papers in reputed journals and has been serving as an editorial board member of scientific journals on landscape ecology and nature conservation. Research interest: conservation management, adaptation to climate change, environmental education. Csilla Ficsor has graduated with a BSc in Nature Conservation and Agricultural Engineer MSc and is currently a Ph.D. student in the Doctoral School of Environmental Sciences at the MATE..

7TH INTERNATIONAL CEEPUS WINTER SCHOOL DESIGN WEEK 2022

Virág NÉMETHY

Rejtő Sándor Faculty of Light Industry and Enviromental Engineering
Institute of Product Design
Phone: +36 20 314 7814, E-mail: nemethy.virag@uni-obuda.hu

Abstract:
In my article you can read a journal of the CEEPUS Winter School Design Week 2022, held between 16.10.2022 and 22.10.2022, which was organized by Prof. Jelka Geršak PhD, professor at the University of Maribor. Professors and students from seven different European countries attended the event, creating a very diverse atmosphere culturally. In addition to getting to know novelties and innovative technologies, we were able to gain significant professional experience because of the event, by getting to know different perspectives and design approaches.

Keywords: *Erasmus mobility, international relations*

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POLYMETALLIC MINERALIZATION (FE, CU, PB, ZN, BA) OF THE TELLIAN DOMAIN (JIJEL PROVINCE, NE ALGERIA). MICROSCOPIC AND MINERALOGICAL CHARACTERIZATION

Oumeima BENMEBAREK, Azzedine BOUZENOUNE

Geological Engineering Laboratory, University of Mohammed Seddik Benyahia, Jijel, Algeria
o.benmebarek@univ-jijel.dz, +213-540-671-894

Abstract
Cluster iron deposits of the Tellian domain are associated with fissural polymetallic mineralization (Cu, Ba, Zn-Pb-Fe) are commonly hosted within uplifted limestones of Liassic age. About twenty polished sections of the ore deposits were analyzed using metallographic microscope. Qualitative study was also carried out using X-ray diffractometer in order to determine mineral phases of selected ore samples. Hence, the aim of this work is to use geological observations, petrographic, and mineralogical features to discuss the nature and paragenetic succession of the mineralization deposition. Mineralization is mainly composed of hematite, goethite, and limonite deriving from an iron carbonate protore, most likely siderite. It is usually associated with tetrahedrite which is frequently altered to malachite, azurite, and covellite. Tetrahedrite is also dominant in the epigenetic iron mineralization hosted within carbonate rocks in northern Algeria's geological domains. Moreover, galena (partially altered into cerussite), sphalerite, pyrite, and calamine, are locally related to iron ore and are observable within narrow veins and limited clusters. Barite, calcite, dolomite, and scarce quartz represent the common gangue minerals. Macroscopic and microscopic analysis revealed the following paragenetic sequences: a-Formation of barite; b- Polymetallic sulfides (Cu, Zn, Pb); c- Iron primary mineralization; d- White coarse calcite formation; and e-Supergene ore enrichment. The investigated ore deposits are polyphase mineralization that represent hydrothermal replacement deposits.

Keywords*: Iron ore, Jijel province, epigenetic mineralization, Liassic limestones, Tellian domain*

Biography

I am a PhD student in Mineral resources, Geo-materials, and Environment at the Department of Earth and Universe Sciences / Faculty of Nature and life Sciences /University Mohammed Seddik Benyahia of Jijel, where I graduated and completed my Master Degree in Mineral resources, Geo-materials ranking first. I Worked on a doctoral project research during five years at the Faculty of Earth Sciences, Geography, and territory management / University of Sciences and Technologies Houari Boumediene/Algiers. The Research interests were petrology, structure, and geochemistry of internal metamorphic basement in the Maghrebide Chain. Currently, my research focuses on geologic, metallogenetic, and geochemical traits of the hydrothermal polymetallic mineralization hosted within Jurassic carbonates in the western part of the Numidic chain (NE Algeria). It involves petrography, mineralogy, major and trace elements geochemistry, along with fluid inclusions analysis

ENVIRONMENTAL ATTITUDE VERSUS BEHAVIOUR OF TOURISM MANAGEMENT STUDENTS IN SELECTED COLLEGES AND UNIVERSITIES IN REGION IV-A, PHILIPPINES: A BASIS FOR EDUCATIONAL PLANNING AND DEVELOPMENT

Mark Gabriel Wagan AGUILAR, [1] , Jayson Nual OLAYTA, [2]

[1]*Emilio Aguinaldo College, Cavite, Philippines, markgabrielaguilar@gmail.com, +639266329096*
[2]*Laguna State Polytechnic University, Laguna, Philippines, jaysonolayta24@gmail.com, +639053154485*

Abstract
Environmental management is critical in ensuring a sustainable future as recent evidences indicate that environmental degradation caused by resource depletion, ecosystem devastation, and biota extinction has a substantial impact on earth's dynamics, including how humans live. Climate change, particularly global warming has been documented across time, resulting in more frequent and stronger coastal storms, sea level rise, unpredictable weather patterns, drought, species migration, and disease outbreaks, among other occurrences. Aside from this, pollution of various types can be observed everywhere, with major consequences on human health, wild and marine life, and on the land that humans use for agricultural purposes. Studies suggest that these environmental emergencies are caused by human activities such as but not limited to burning of fossil fuels, deforestation, utilization of fluorinated gas filled products, and irresponsible disposal of all kinds of wastes, therefore, people's environmental knowledge and behavior are important in the process of achieving environmental sustainability; if people possess a negative perception and have low environmental engagement, these activities will continue to destroy the environment and the success of sustainability programs won't be guaranteed. For this reason, the researchers attempted to measure the levels of environmental knowledge and behavior of people, particularly 392 tourism management students in selected colleges and universities in Region IV-A, Philippines, using a descriptive research design and a quantitative research approach, given that Environmental Conservation and Ecotourism are courses included in their curriculum, and the fact that the Philippines' most popular tourism attractions are nature-based. To present a clearer picture of the case, the significant relationship between the students' knowledge and behavior levels toward the environment, as well as its significant difference when grouped based on their demographic profile in terms of college/university enrolled at, age, and sex, have been determined. The findings of this study will serve as the foundation for efforts to improve environmental education programs offered in universities and colleges that would help in enhancing students' environmental awareness and involvement.

Keywords*: Environmental Knowledge, Environmental Behaviour, Tourism Students, Sustainability, Environmental Education*

Biography

Mark Gabriel Wagan Aguilar is an Asst. Professor IV at Emilio Aguinaldo College in the Philippines and a former School Director of ABE International Business College-Fairview Campus. Tourism and Hospitality Management, Business and Organizational Administration, Education, Environmental Conservation and Sustainability, Community Development, and Research are among his specialties. In addition to being an educator, he is a dedicated researcher with more than 26,000 reads in ResearchGate and a speaker who have presented in a number of international and local conferences and seminars, as well as a registered Writer/Author, Editor, Educational Technologist, and Publishing Specialist with the National Book Development Board, Philippines.

Jayson Nual Olayta is the Director for Student Affairs and Services at the Laguna State Polytechnic University, Philippines. He has a Master's degree in Rural Development, with a specialization on agriculture and tourism development. He is currently pursuing his PhD in Agriculture, which is awaiting conferment. Prof. Olayta is a licensed agriculturist with experience in teaching, research, extension, and production projects. He has published several research articles related to agriculture and social science in peer-reviewed journals as a result of his hard work. With his passion in what he does, he continuously contribute to the growth of his institution, community, and country.

COLORIMETRIC INVESTIGATION OF FALL FOLIAGE

Ákos BORBÉLY

Óbuda University, Budapest, Hungary, borbely.akos@rkk.uni-obuda.hu

Abstract

It is an incredible time of the year when colors vibrantly flood temperate deciduous forests as the leaves gradually change color and finally fall off in the autumn. The green color of the leaves is due to chlorophyll, which is the key component in a plant's ability to turn sunlight to chemical energy. The degradation of chlorophyll during leaf senescence is responsible for the change of color; carotenoids and anthocyanins start to become visible and dominate light reflected from the leaves contributing to the spectacular multicolor appearance of forest at fall. Chlorophyll reflects the middle part of the spectrum appearing green to a human observer, anthocyanins and other pigments increase reflectance mostly in the longer wavelength range of the reflectance spectrum making the hue of the leaves vary along a green-yellow-red scale. This study focuses on the colorimetric characterisation of the above process. Leaf colors of various tree species were measured at different stages of senescence by a spectrophotometer with directional geometry and the results were analysed in a standard three dimensional perceptually uniform color space.

Keywords*: fall foliage, spectral measurement, colorimetric analysis*

Biography

CLIMATE CHANGE AND AGRICULTURE SECTOR IN EGYPT: EFFECTS AND ADAPTATION

Tareq IRHAYYIM, Mohamed Ali RAWASH*

Department of Animal Science, Georgikon Faculty, Hungarian University of Agricultural and Life Science, Keszthely 8630, Hungary
**mohamedali@post.agr.cu.edu.eg +36(31)7805901*

Abstract:
*The **present** study aims to give an overview about the impacts of climate change on agriculture sector in Egypt and the adaptation options in order to overcome these impacts. Egypt is more likely to be vulnerable to climate change in the future. The main changes in the Egyptian climate would be an increase in temperature, evapotranspiration and sea level. Simulation studies show that reduce production, increase water demands of crops and lose agricultural lands are likely to be the main impacts of climate change on Egyptian agriculture sector. The impacts of climate change on aquaculture can affect natural resources that are necessary for aquaculture productions such as water availability, land, seed, feed and energy inputs. However, different adaptation options involve that improving the technical water application efficiency and water conservation, as well as selection and breeding tolerant crops to heat, salinity and water use efficiency. Developing new crop models, changing the time of sowing and management practices, encouraging farmers to adopt cops that high return and water conserving can be considered other agricultural options for adapting climate change. The government should take extreme efforts to maximise the productivity of the agriculture sector and minimise the risks of climate change impacts.*

Keywords: climate change, Egyptian agriculture, Nile delta, vulnerability

Biograp

hy

Mohamed is a nutritionist. He has MS.c in Animal nutrition, PhD position for broilers nutrition, Faculty of Georgikon, Szent István University. He has a deep experience in feed lab analysis and management particularly feed additives.

RARE EARTH METALS SEPARATION FROM BAUXITE WASTE BY ION EXCHANGE AND SOLVENT EXTRACTION TECHNIQUES

Tatjana JUZSAKOVA, Ali Dawood SALMAN, Béla VARGA, Gvendolin KULCSÁR, János LAUER, Tamás PAP

Research Centre for Biochemical, Environmental and Chemical Engineering, University of Pannonia, Veszprém, Hungary, e-mail: yuzhakova@almos.uni-pannon.hu
Department of Chemistry, Amity University, Sector-125, Noida, Uttar Pradesh, India
sgarg2@amity.edu

Abstract
Bauxite residue, known as red mud, is a highly alkaline waste sludge that is generated in the industrial production of alumina. The red mud contains several valuable metals, including iron oxide (33-40%), titania (4-6%), vanadia 0.2-0.4%), rare earth elements, REEs (2000-2500 ppm), etc. Therefore, it can be considered as a potential secondary metals resource. From an economic point of view, it is necessary to consider the complex processing of red mud. The recovery of the rare metals such as Sc, Y, La should be combined with the separation of Fe main element as well as minor ones Ti, Ga, Mn, V from red mud.
Currently used techniques for metals recovery from solid industrial waste mainly involve leaching (acid digestion), solvent extraction, ion exchange extraction and precipitation. The major elements of red mud such as iron can be efficiently separated by organic solvent extraction with diethyl ether. Many commercially available organophosphorus extractants (e.g. di-(2-ethylhexyl) phosphoric acid, tributyl phosphate) are recommended to separate the rare earth elements including scandium from the aqueous phase. The cation exchange procedure is also widely used for the separation of rare earth elements from each other and from the main red mud elements. Due to the limited capacity of the resin, the ion exchange method is recommended for the final and fine purification step, when the major such as Fe, Na, Al, Ca, Si have been mostly removed and the solution mainly contains the target metals. This work deals with the separation and purification methods of REEs, using selective acidic metals leaching, liquid-liquid extraction with acidic, basic, neutral extractants and ion exchange applying strong acidic cation exchange resin (e.g. AmberChrom 50WX8).
Acknowledgments
This work was supported by the Hungarian GINOP-2.2.1-15-2017-00106 project “Complex utilization of red mud and recovery of rare earth metals from red mud”

***Keywords**: rare earth metals, red mud waste, solvent extraction, cation exchange technique.*

Biography

Dr. habil. Tatjána Juzsakova, is an associate professor at the Sustainability Solutions Research Lab, University of Pannonia. Her main field of interest is heterogeneous catalysis, focused on environmentally improved catalytic processes for diminishing/removal of hazardous gases such NOx, hydrocarbons from tail gases. Recently she has been studying the utilization of the red mud as secondary raw material and recovery of rare earth elements from the red mud.

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SYNTHESIS AND SURFACE MODIFICATION OF MAGNETIC $Fe_3O_4@SiO_2$-EDTA NANOPARTICLES AND ITS APPLICATION IN UPTAKE OF NICKEL(II) IONS FROM AQUEOUS MEDIA

Ali Dawood SALMAN[1,2]*, Tatjána JUZSAKOVA[1], Moayyed G. JALHOOM[2], Sebestyen VIKTOR[1], Endre DOMOKOS[1]

[1]Sustainability Solutions Research Lab, University of Pannonia, Veszprém, Hungary
[2]Department of Chemical and Petroleum Refining Engineering /College of Oil and Gas Engineering, Basra University
[3]Department of Production Engineering and Minerals, University of Technology Baghdad-Iraq

Abstract

The objective of this research is to develop hybrid nano adsorbents that can separate nickel metal ions Ni(II) from an aqueous phase. The SBA-15 mesoporous silica and $Fe_3O_4@SiO_2$ magnetic nanoparticles were synthesized. Furthermore, the nanoparticles were modified with a spacer of (3-aminopropyl) triethoxysilane and a ligand of ethylene-diamine-tetraacetic acid (EDTA). Because of the Ni(II) affinity towered oxygen and nitrogen donors in the EDTA ligand, the modified hybrid nanoparticles were used as a nanoadsorbent for Ni(II) from aqueous solutions. The characterization results showed that the SBA-15 mesoporous silica and $Fe_3O_4@SiO_2$ magnetic nanoparticles were successfully synthesized and functionalized with -NH_2 and –COO groups. The adsorption equilibrium was represented with Langmuir and Freundlich isotherm models. The correlation coefficient value of the Freundlich model was found to be in good agreement with experimental results for $Fe_3O_4@SiO_2$-EDTA and a good deal with the Langmuir model for SBA-15-EDTA. Furthermore, two kinetic models were applied, and the adsorption process follows pseudo-second-order and pseudo-first-order kinetics for SBA-15-EDTA and $Fe_3O_4@SiO_2$-EDTA, respectively.

***Keywords**: Nickel adsorption, Magnetic nanoadsorbents, EDTA, SBA-15*

Biography

Ali Dawood Salman completed his Master of Chemical Engineering studies at University of Technology Baghdad, Iraq. Since 2016 he has been working as assistant lecturer at the College of Oil and Gas Engineering Basra University, Iraq. Currently he is involved in PhD studies and he is researcher in Laboratory for Surfaces and Nanostructures (LASUNA), Faculty of Engineering, University of Pannonia, Veszprem, Hungary.

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POPULATION CONTROL OF HIGH IMPACT MAMMALS: COMPARISON OF METHODS FOR WILD HIPPOS IN COLOMBIA AND WILD BOAR IN EUROPE

Natalia PITTA-OSSES[1], Csaba CENTERI[1], Krisztián KATONA[1]

Institute for Wildlife Management and Nature Conservation, Department of Wildlife Biology and Management, Gödöllő, Hungary, nata.pitta@gmail.com

***Abstract**:*
Both the African common hippo (Hippopotamus amphibius) and the wild boar (Sus scrofa) are ecosystem engineers in their natural ranges, where population sizes are sustained on the basis of climatic regimes. However, in recent decades the populations of both species have increased disproportionately in specific locations, due to more available feeding resources, better climatic conditions, and lack of effective methods of population control. In Europe, the dramatic growth of wild boar populations in their native range could be observed in the last decades related to warmer winters, due to the climate change phenomena, as well as higher availability of crops, and a decrease in the number of hunters or hunting pressure. In Colombia, in the non-native range of hippos, three individuals escaped in the late 90s, the population now is estimated at more than 100 individuals, due to the favorable conditions for a species naturally found in much more extreme climatic regimes. Changes in the population size and density of these high impact species affect the vegetation cover, soil microtopography, soil water retention, water quality, and density and composition of plant and animal species; therefore, completely able to transform the ecosystem. Consequently, population control mechanisms are in place for both species: European countries have implemented strategies focused on the trapping and hunting of wild boars, and even translocation of individuals, in order to keep the population numbers down. On the other hand, the authorities in Colombia, where hunting is illegal, opted for fertility control methods. We analyzed the different alternatives for population control reportedly used for both species, considering not only their effectiveness, but also their application ratio based on the economic and social costs. We found that there is not one-size-fits-all solution to control the populations, but rather that an effective alternative must include a combination of different methods.

***Keywords**: Big mammals, Hippopotamus amphibius, Wild boar, Sus scrofa, Population control*

Biography

	Natalia Pitta-Osses is an environmental engineer, and is currently a Ph.D. student at Magyar Agrár és Élettudományi Egyetem – MATE. She received her master's degree in wildlife management engineering in 2020 at MATE, with the study of wild boar rooting in forested areas. https://www.researchgate.net/profile/Natalia-Pitta-Osses/research

THE CORPORATE ASPECTS OF CLIMATE CHANGE ACTION

Xuechu WANG

[1*] *Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary, e-mail: victorwxch@gmail.com, telephone:+36309333290*
Department of Chemistry, Amity University, Sector-125, Noida, Uttar Pradesh, India
sgarg2@amity.edu

Abstract

The population has increased dramatically, forests have been deforested, a large number of cities and factories have been expanded, and grasslands have become desertified. The current climate warming trend is fast. Will bring serious consequences to the global environment. Faced with the severe concerns of global warming, how should companies deal with global warming? How to live in harmony with nature without sacrificing economic development? We should study the laws of nature and accurately grasp the relationship between commercial activities and climate change, which is the basis for promoting harmony between man and nature. China is a developing country vulnerable to climate change and energy stress. At present, China is in the process of rapid industrialization dominated by the heavy chemical industry, and the road to low-carbon economic development is bound to undergo a more severe test. This requires the development of science and technology, and vigorously develop low-carbon technology. Formulate and establish corresponding policies and institutional systems. This paper lists some of the best practices of international leading companies in the oil and gas industry in terms of corporate governance, strategy and risk, climate investment and emissions reduction actions.

***Keywords**: challenge; climate change; countermeasures and suggestions, low carbon economy; opportunity;*

Biography

***Name**: Xuechu Wang*
***Institution**: Hungarian University of Agriculture and Life Sciences*
***Phone**: +36309333290*
***E-mail**: victorwxch@gmail.com*
***Specialty and publications**: Environmental Engineering, Environmental Science and Regional and Environment Economic Management Studies*
BSc thesis:The impact of FeCl3 on the wastewater treatment process
Msc thesis: The corporate aspects of climate change action

PHYSICO-CHEMICAL AND MICROBIOLOGICAL CHARACTERISTICS OF TRADITIONAL AND INDUSTRIAL FIGS TAKEN FROM THE MARKETS OF TETOUAN IN MOROCCO

Zakaria MENNANE, Jamal Abrini; Noureddine ELMTILI

Equipe alimentation et santé; Laboratoire de biologie et santé, Faculté de Sciences Tétouan ;Morocco.
Université Abdelmalek Essaidi
menzakaria@hotmail.com

Abstract

50 samples of figs and their derivatives were taken from various sites in the city of Tetouan, which are either prepared by cooperatives, sold in bulk or of industrial origin, and subjected to microbiological analysis of total aerobic mesophilic flora (TMAF), total coliforms (TC), lactic acid bacteria (LBC), yeasts (LEV), molds (M) and staphylococcus aureus (SA). The chemical analyzes sought were pH, Oxydoreducing potential (POR) and total dry extract (TSE). The results show that the pH and EST of the samples of the cooperatives are successively 4.6 and 82.7% on average and the POR of fig pastes (148 mv) is greater than that of dried figs (104 mv). For fig jam, the national samples have a pH of 4.5 and the POR is 134mv, but the marks imported from Egypt were very acidic (3.4) with a high PRO (189mv). microbiological analysis showed that products prepared by cooperatives (dried figs and fig paste) were at 93% compliant, while products sold in bulk were 58.5% contaminated and jam samples were at 85% compliant. The conformity of the products of the cooperatives can be explained by the involvement of the majority of these organizations in the health safety system supervised by the authorities. As well, 58% of the fig products sold in bulk were found to be of poor quality because they were exposed to risk (contact with hands, insects, sometimes rats), which requires awareness of the importance of labeled and referenced packaged products among sellers and consumers. For industrial fig jam, 15% of the samples were loaded by yeasts, which requires the use of good quality fruit and sufficient heat treatment.

Keywords*: figs, microbiological, quality, contamination, cunsumers.*

Biography

I' m a researcher in Microbiology and Biotechnology, Abdelmalek Essaâdi University, Faculty of Sciences, Department of Biology, Morocco.

DISTRIBUTION AND PETROGRAPHY OF EOCENE OOIDAL IRONSTONES FROM KEF IN NSOUR DEPOSIT (TEBESSA, NORTH-EASTERN ALGERIA)

Abdelhakim BOUCHAIR, Azzedine BOUZENOUNE, Yasser MAHAMDIOUA, Yasser KEMEL, Zoubir BELHIMER

Geological Engineering Laboratory (LGG), University of Mohamed Seddik BenYahia, Jijel, Algeria, *Hakimegeol@gmail.com, +213669449690*

Abstract

Kef En Nsour Ironstone deposit is located in the northeast of Algeria; 55 km south-west of Tébessa town, is part of the municipality of Télidjene. it is a part of the Eastern Saharan Atlas, in the South West of the Ain Babouche syncline. The Tébessa region contains the geological formations that form a thick sedimentary series exceed 6000 m whose stratigraphy goes from the Trias to the Quaternary. The lithological formations of Kef En Nsour started from the Upper Cretaceous to the Miocene, most of these formations are marls and limestones. The mineralization appears in the Eocene formations (Lutetian) (Vila, 1997) that it is a series of marls and green clays with Oysters containing intercalations of marl-limestones and ooidal iron ore and ending with levels containing past of well bedded gypsum. The Ain Babouche syncline can be subdivided according to morphological and tectonics characters into three compartments, the NE compartment which contains the two sides dj Boukemmech NE and Kef En Nsour NW, a median compartment formed by the depression of Oum Khaled, the SW compartment encompassing Djabel Dhar which also contains mineralized layers and Draa El Melah. The three compartments are delimited by two NW-SE faults. Ooidal iron ore appears in the form of layers of metric thickness, it is composed mainly of granular constituents (oolites, granules) of generally spherical shape which does not exceed 2 mm. Quartz or goethite grains and oolite fragmant compose their nucleus and concentric envelopes of varied mineralogical composition (goethite, hematite) form the cortex. The matrix of these granules at Kef En Nsour is generally ferruginous or clayey with the presence of some grain of quartz. Sedimentary structures such as cross-bedding, channels and grading and the presence of fractures affecting the oolites and the presence of oolite fragments as nuclei, militate for a relatively agitated depositional environment marked by multiple reworkings. In sum, the ooidal iron ore is distributed spatially in two sides of the Ain Babouche syncline, and temporally in the middle Eocene (Lutetian), and the most of it composed of goethite.

***Keywords**: Ironstones, Ooidal, Iron ore, Eocene, goethite*

Biography

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NATURAL DISASTERS IMPACTS; RISK ASSESSMENT AND SUSTAINABILITY SOLUTION

Malak SHATNAWI[1*], Haya ALTALEB[2], Zoltán RAJNAI [3]

[1]*Doctoral School on Safety and Security Sciences, Óbuda University, Budapest, Hungry, Malak.shatnawi@uni-obuda.hu, +3625143327.*
[2]*Doctoral School on Safety and Security Sciences, Óbuda University, Budapest, Hungry, Haya.altaleb@uni-obuda.hu +36204107793.*
[3] *Doctoral School on Safety and Security Sciences, Óbuda University, Budapest, Hungry, Rajnai.zoltan@bgk.uni-obuda.hu + 3616665401.*

***Abstract**:*
Abstract: Disaster management and crisis action planning play a primary role in disaster avoidance, mitigation response, and recovery. According to the research, effective disaster management is largely dependent on the efforts of emergency response organizations. There are disaster risk management problems concerning the communication process, the development of coordination, and the exercise of authority. This paper will overview and asset the risk management for various types of disasters which are classified into five main parts: Geophysical, Hydrological, Climatological, Meteorological, and Biological. Biological disasters are two types in origin namely, Calamities which are produced in crops by certain animals, and pandemics which are caused by the spread of infectious diseases among large numbers of people, and this kind of crisis creates new risks that needed to be identified. The investigation in this research will identify the risk concept that comes from natural disasters and prepare the plans and set priorities to respond effectively where and when needed, by implementing the risk assessment. However, the similarities are significant concerning the health, social, economic, and environmental aspects of all types of disasters, COVID-19 pandemic was the complete opposite from an environmental and social point of view i.e., but highly affected the death rate and urban health.

***Keywords:** Disasters impacts, sustainability solutions, Crisis management, Pandemics, Risk management.*

ABSTRACTS OF AIR QUALITY, ENERGY AND RENEWABLE ENERGY SESSION

"GREEN ENERGY" AS CHALLENGE AND OPPORTUNITY IN ALBANIA

Edmond HOXHA

Workplace, city, country, e-mail, telephone

Abstract
Albania is a small country where the main economy is services, some industry and agriculture and where there are many challenges caused by climate changes. For a long time the main problems have been heavy floods and landslides, extreme weather, floods, drought, waves, rainfall, etc. The paper is based on information of Climate Change in Europe and Albania. It offers information on how climate change impacts resources and infrastructure, obstacles in Albania and the ways to overcame them. The paper ends with conclusion and recommendations especially on: Public awareness; Regional cooperation; Decarbonisation impact and challenges; Supporting families and Cooperation with University.

***Keywords**: Albania, Green Energy, Climate Neutrality*

Biography

***Edmond Hoxha** received his PhD degree on Geosciences and Environment at the Polytechnic University of Tirana, Faculty of Geology and Mining. He also studied "Leaders on Development" at Harvard University, USA. He has considerable experience working with the Government of Albania and International Institutions such as the World Bank, European Union, GIZ and so on. During 2009-2013, he was Deputy Minister for European Integration of Albania. He is founder of the Albanian Centre of Excellence, the National Mining Surveyors and Geomatics Association and publisher of the scientific journal "Albanian Excellence". He is a member of: Eurosciences; International Association of Sciences, Technology and Development; World Academy of Sciences, Engineering and Technology; as well as the International Society for Mines Surveying. He is founder of the Western Balkan Conference on GIS, Geodesy and Mine Surveying. He speaks English. Currently he is Full Professor in the Faculty of Geology and Mining, Polytechnic University of Tirana, teaching GIS Technology, Mine Modelling and Project Management.*

APPLICATION OF A LOW-COST SENSORS FOR INDOOR AIR QUALITY MONITORING IN BUDAPEST, HUNGARY

Bushra ATFEH, Róbert MÉSZÁROS

Department of Meteorology, Eötvös Loránd University, Pázmány Péter sétány 1/A, 1117 Budapest, Hungary; bushra.at@hotmail.com
meszaros.robert@ttk.elte.hu

Abstract

In the last few years, indoor air quality monitoring by using low-cost sensors (LCSs) has gained popularity. This study presents indoor air quality measurements accomplished in one of the cosmetic salons in the center region of Budapest city. One AirVisual Pro air quality monitor was used during the period from the 12th to the 23rd of May 2022. This sensor is competent to capture the concentration of small aerosol particles (particle size smaller than 2,5μm -$PM_{2.5}$) and carbon-dioxide (CO_2) besides temperature and relative humidity. High $PM_{2.5}$ concentrations may be harmful to human health, while changes in CO_2 concentration may indicate human presence or ventilation. The aim of this study was to evaluate the indoor air quality at the salon by analysing the high temporal resolution time series of $PM_{2.5}$ and CO_2 concentrations. The hourly and daily averages of $PM_{2.5}$ concentrations were also compared with the data measured at the nearest outdoor air quality monitoring station. The result of this study indicates the lack of sufficient ventilation inside the salon. The indoor $PM_{2.5}$ concentrations showed high variability and were generally higher than the outdoor $PM_{2.5}$ concentration during the opening hours. The exposure to such poor indoor air quality environment can have a long-term impact on the health of the salon staff and can cause serious health problems that could be reduced by proper ventilation.

Keywords: *$PM_{2.5}$, Budapest, Indoor air quality, beauty salon*

Biography

Bushra Atfeh received her BS in Environmental Sciences at Damascus University in the Syrian Arab Republic, in 2013. She received her master's degree in Environmental Sciences at Eötvös Loránd University, in Budapest, Hungary, in 2018. Currently, she is a ph.D. students at Eötvös Loránd University, in the Environmental Sciences Doctoral school. Her research interests include indoor air quality assessment by using low-cost sensors in different indoor environments..

A MORE SUSTAINABLE TRANSPORT: REVIEW OF ELECTRIC CARS

Sara ALKHALDI*, Katalin A. FŐGLEIN, Krisztina DEMÉNY

*Óbuda University, Budapest, Hungary,*sara.alkhaldi01@gmail.com, +36706577973*

Abstract

The idea of conserving the resources and Earth for future generations is becoming more popular. With climate change and increasing temperatures globally, the stability of life for future generations is affected. Thus, sustainability and sustainable development are hot topics nowadays. One of the basic principles of sustainable development is that, with a complex approach, it simultaneously takes into account the expectations of environmental issues, social needs, and the needs of economic development. Climate change has been accelerated in the past couple of years by anthropogenic factors. An example of these factors is the widespread transport that uses fuel, and emits greenhouse gases and air pollutants. However, we cannot simply stop using transport as it is important for social and economic development. One of the ways that have been suggested to reduce the emissions from transport is the use of different technologies of decreased or zero emission like hybrid and electric vehicles. This paper takes a deeper dive into the sustainable world of transport electrification and reviews the current literature of this growing industry

***Keywords**: HEV, BEV, PHEV, transport, sustainability, greenhouse gases, air pollutants, emission.*

Biography

Sara Alkhaldi
"I am an environmental engineering student in her last year at Óbuda University. I am enthusiastic about sustainability and clean energy

SOLAR AND WIND POWER INSTALLATION ON PUZSTAZAMOR LANDFILL SITE

Lily TANUI*, Emőke IMRE

Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University,, Budapest, Hungary
lily.tanui@stud.uni-obuda.hu, imreomok@gmail.com

Abstract
Closed landfills have been used for placement of renewable energy in recent years, due to their potential for redevelopment. Hungary has over 2,000 landfills with only 70% of them complying with the EU standards. Additionally, about fifty modern municipal landfill sites have been established in Hungary in the last few decades. Considering the 5, 10 or 15 km vicinity of these municipal landfills, the 24%, 44% and 60% of the total population are found here within the 16%, 37% and 53% of the villages and cities, so a large, decentralized energy system could be made by using all landfills. Available meteorological data demonstrate that excellent wind energy potential does exist almost everywhere in Hungary, essentially regardless of the geographic location, at a relative altitude of 100 m. In addition, an extra increase in wind velocity can be anticipated on the artificial landfill hills due to the cross-sectional area at a hill altitude of about 60 m (Tóth, 2014). By extending wind energy measurements and beginning solar intensity measurements on the various slopes of the landfill, we will further this research. Using a pyranometer, we will record solar intensity measurements at different sides of the slopes. In parallel, we will process some independent data and compare it with the actual measured data.

***Keywords**: CITES, Sustainable Utilization of Wildlife, Wildlife, Environment, Sustainability.*

Biography

Lily Tanui is a Bachelor of Environmental Engineering student. Her research concerns redevelopment of Pusztazámor Landfill Site after closure to be suitable for placement of renewable energy. She is also an environmental enthusiast and has worked on restoration projects and environmental conservation education in Rift Valley, Kenya.

LOCAL ENRICHMENT OF AIR POLLUTANTS IN A PRACTICAL EXAMPLE

Csaba ÁGOSTON

Institute of Environmental Engineering and Natural Sciences Óbuda University, Budapest, Hungary,
e-mail: agoston.csaba@rkk.uni-obuda.hu

Abstract

Inversion temperature atmospheric stratification can help local atmospheric emissions stay in place, and through this, the formation of immission states with high local concentrations. In the case of settlements located in basins and valleys, this effect may increase. The burning of green garden waste by the population can result in extremely high local air pollution levels in settlements located in basins. If residential incineration is only allowed during certain periods, the local effect of incineration can be studied by means of simultaneous ambient air measurements on the site and in a reference area. The results of the test series can be used in many ways in environmental engineering training. Theoretical knowledge can be deepened and gain a deeper meaning during the exploration of a specific problem and formulation of solution proposals

Keywords*: inversion atmospheric stratification, incineration, pool situation, PM10, environmental engineer training*

Biography

AIR QUALITY AND DISTRIBUTION OF LICHENS AS BIOMONITORS IN SOME SERBIAN AND HUNGARIAN TERRITORIES

Doris STOJILKOVIC, Hosam E.A.F. BAYOUMI HAMUDA

Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest – Hungary
e-mail: bayoumi.hosam@uni-obuda.hu

The objective of this diploma work was to indicate the importance of epiphytic symbiotic relationship between the unicellular green algae or cyanobacteria and filamentous fungal species belonging to Ascomycota or Basidiomycota in term of lichens as a biological indicator of the quality of air. Recently and now a day, the degrees of quality, healthy and clean air are still belonging to the global environmental crisis because of the activities of human, traffic motions as well as manufacturing activities which increase the air pollution. The investigations and analysis of air content become obligate to establish the degree of air pollution and search for reducing the sources of this pollution. Quality of the atmosphere is one of the targets related to human health especially with the respiratory system. Biological monitoring is an analysis require to detect and investigating the variations of the bio-organizational system and distribution of the communities of biotas under the impacts of air pollution. It was found that not all epiphytic lichen species are uniformly indicating various levels of atmospheric contamination. The evaluation of lichen biological diversity was focused on the calculating process of lichen abundance indices. The main aim of this study work using lichens as a biological indicators of the quality of air also, this study was carried out from different regions in Serbia and Hungary too. It was demonstrated the similarity between the quality of air, and distributions of lichens as a biological indicator for the atmospheric quality, in some locations of Serbia and Hungary such as in the cities of Sremska Mitrovica, Fruska Gora mountine, Palic Lake Silver Lake, and as in various regions in Budapest. The biological analysis of the samples from studied areas shows the presence of various lichen types, which indicates that these areas containing huge numbers of lichens. The highly distribution of lichens in relation to air quality index of Zrenjanin city as an example of the Serbian locations, and Budapest as Hungarian are depended on the chemical pollutants, climate changes. Also, this research indicates the distribution of the lichens in the examined areas. The lichens growth demonstrates that the air in this area is clean or with very low pollution degree: Sremska Mitrovica city, Fruska Gora mountine, Palic Lake and Silver Lake is quite good. But, in Budapest, the growth and appearance of lichens is varied, depending of the investigated region. Finally, this study pointed out that the occurrence of epiphytic lichens plays an important role in monitoring the atmospheric pollution in those areas. The most dominant lichen types were Rhizocarpon geographicum, Lecanora muralis, Lecanora muralis, Rhizocarpon geographicum,Xanthoria parietina and Xanthoria Candelaria, Physcia adscendens, Flavoparmelia caperata, Physcia caesia, and Phaeophyscia orbicularis.

***Keywords**: air quality, distribution of lichens, biomonitors, Serbian and Hungarian territories*

Biography

DEVELOPMENT OF SOLAR IRRADIANCE AND WIND MEASURING SYSTEMS IN THE PUSZTAZAMOR LANDFILL SITE

Emőke IMRE[1,2], Tibor PÁLINKÁS[1], Péter FELKER[1], Martin MAYER[3], Gábor MILE[4], Tibor FIRGI[5], Gábor TELEKES[5], Zsolt HORTOBÁGYI[6], Lily TANUI[7], Ulsbold AYURZANA[7], Parvesh TANEJA[1], Delphin KABEY[8], Ágnes BÁLINT [2,7]

[1]Óbuda University, Bánki Donát Faculty of Mechanical and Safety Engineering, Budapest, Hungary
[2]Óbuda University, EKIK Hydro-Bio-Mechanical Research Centre, Budapest, Hungary
[3]BME, Energy Department, Budapest, Hungary
[4]FKF Zrt, Budapest, Hungary
[5]Óbuda University, Ybl Miklós Faculty, Budapest, Hungary
[6]BME Civil Engineering Faculty, Budapest, Hungary
[7]Óbuda University, Rejtő Sándor Faculty, Budapest, Hungary
[8]Óbuda University, AIAM Doctoral School, Budapest, Hungary

Abstract.
The meteorological data available show that at the relative altitude of 75 to 100 m excellent wind energy potential does exist nearly everywhere in Hungary, practically independently of the geographical location. In addition, on the artificial landfill hills – due to the cross-sectional area at a hill altitude of around 60 m – there is an additional increase in the wind velocity can be expected. Solar panels can be used after the closure of the landfills on large areas, in inclined slopes. In the frame of a research on the complex energy utilization of the Pusztazámor MSW landfill hill (gas, solar and wind units), wind velocity and solar intensity measurements are starting for the prediction of the energy hill. Some thermopile Pyranometers are used for the intensity measurement, based on a series of thermoelectric junctions (multiple junctions of two dissimilar metals) to provide the output signal. Black surface uniformly absorbs solar radiation across the solar spectrum. It accurately captures the sun's global solar radiation because its special black absorptive surface uniformly responds to most of the solar spectrum's energy. The data storage is designed by raspberries. In parallel, some independent data sets are processed by the Faster Research group of MTA-BME and compared with the measured data. First results are presented concerning the hill-effect on wind speed.

***Keywords**: hill-effect, solar irradiance, thermopile Pyranometers, wind speed*

Manuscripts of the Accepted Papers
Manuscripts of the Plenary Lectures
Manuscripts of the Keynote Lectures
Manuscripts of the Lecturers
Manuscripts of the Posters

DEVELOPMENT OF SOLAR IRRADIANCE AND WIND MEASURING SYSTEMS IN THE PUSZTAZAMOR LANDFILL SITE

Emőke IMRE[1,2], Tibor PÁLINKÁS[1], Péter FELKER[1], Martin MAYER[3], Gábor MILE[4], Tibor FIRGI[5], Gábor TELEKES[5], Zsolt HORTOBÁGYI[6], Lily TANUI[7], Ulsbold AYURZANA[7], Parvesh TANEJA[1], Delphin KABEY[8], Ágnes BÁLINT [2,7]

[1]Óbuda University, Bánki Donát Faculty of Mechanical and Safety Engineering, Budapest, Hungary
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[3]BME, Energy Department, Budapest, Hungary
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***Keywords**: hill-effect, solar irradiance, thermopile Pyranometers, wind speed*

INTRODUCTION

A previous Jedlik and Norwegian research [1, 2] of the BME, SZIE and ELTE created a database of municipal landfills in Hungary. The result of the research is that a decentralized energy system can be created near the larger landfills, so that the necessary facilities do not occupy valuable cropland. According to a survey of the larger municipal landfills in the 12 domestic landscape units, in 2005 there were 125 medium-sized landfills that were operating. About 60 larger landfills are operating after 2009. If landfill gas is utilized at the larger domestic landfills, the 15 km buffer zone will affect approximately 2,000 settlements and approximately 60% of the population (Figure 1). The areas where the average annual wind speed is greater than 5 m/s (at a height of 75 m) can be considered for the installation of a wind power plant. If the wind speed measured at a height of 75 m, the wind energy potential is uniform and excellent (Figure 2).

Thus, wind turbines (and solar energy units) can be advantageously installed on municipal solid waste landfill hills. Based on the results of the research, it can be established that the 41 TWh/year of electrical energy used in Hungary in 2009 was approx.

A proportion of 2-6% can be produced from landfill gas, depending on the selection of parameters. In the case of combined energetic utilization of the waste (combination with a wind power plant), the above value can be doubled at least. The domestic energy management does not count on this potential [3], it can be a significant reserve in the future, some elements of which can be switched on at any time due to its decentralized nature. The first energy hill publications can be found in [4-6]. In any case, it is a positive effect if the need for an energy storage solution can be triggered. More information can be found in Renewable energy sources. in a university note [7]. The main publications of the research can be found under [8-20], the continuing of the research is a starting wind velocity and solar radiation measurement.

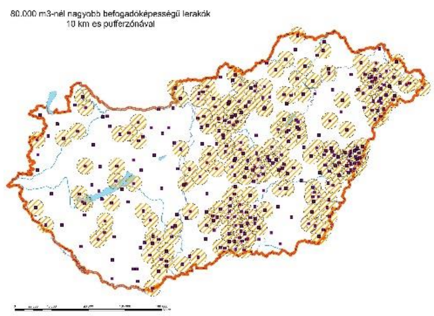

Figure 1. 15 km buffer zone in Hungary

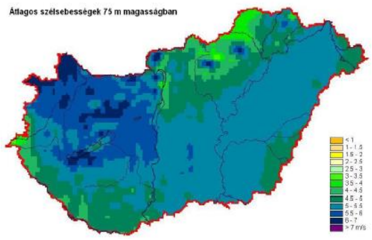

Figure 2. The wind map at 75 m relative height [9]

The first device used to measure wind speed was a rotary spoon anerometer. As part of the thesis [14], the bucket anemometer installed on the hilltop was installed on an 18 m high pole.

RESULTS AND DISCUSSION

According to the first results, the daily average ratio of wind speed at the top of the hill to the bottom was about 1.6. At a relative level of 25-30m, it will be 5.3-5.4 m/s.

Based on the calculations evaluating the wind measurement, the data in Table 1 are the benchmarks. The 1000 kW turbine must be installed with a column at least 75 m high and therefore its shaft height will be 140 m from the ground level, the 750-kW turbine must be installed with a column 65 m high and therefore its shaft height will be at least 130 m from the ground level. With these: 1000kW: the wind speed is 6.2 m/s. 750kW: the wind speed is 6.0 m/s (see Table 1).

Table 1. Results of calculations based on the first wind measurement in the case of the Pusztazámor landfill

wind turbine	kWh/year	#	kWh/year
1000 kW	2200000	2	4400000
750 kW	1575000	2	3150000
30 kW	46000	7	322000

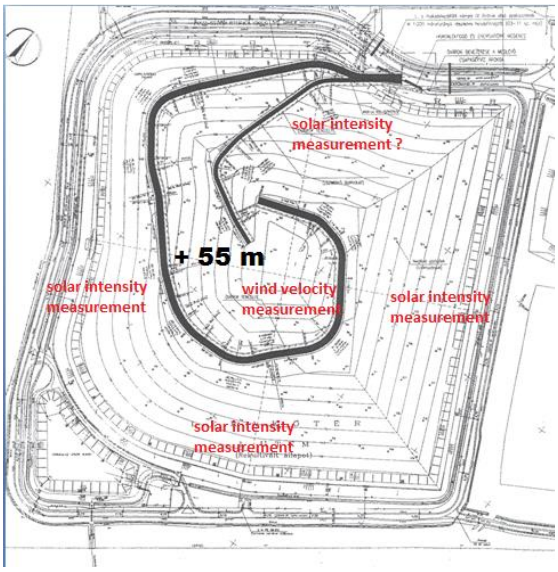

Figure 3. Installation plan

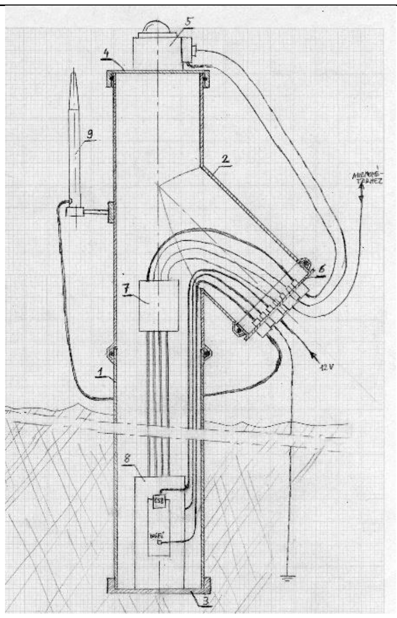

Figure 4. Unit of measurement

Figure 5. A fixed Pyranometer

Figure 6. A fixed wind velocity measuring device (anemometer)

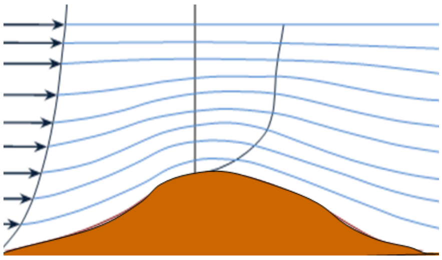

Figure 7. The hill-effect increases the wind speed

CONCLUSIONS AND RECOMMENDATIONS

The last decade has seen a dynamic growth of photovoltaic power generation and the wind energy units to meet Europe's energy decarbonization targets. However, this technology is weather-dependent, volatile generation behaviour creates many challenges for grid operators. This research aims to forecast the production of small-scale solar PV and wind units without real-time measurements at the regional level.

The wider research aims to explore the temporal-spatial correlations of the global irradiance parameter describing the variation of photovoltaic power generation with a strong correlation using geostatistical methods, moreover, to explore the predictability of wind energy production on landfill hills.

The research work is carried out with the Faster MTA-BME research group including the interpolation of solar radiation intensity and cloudiness data for the territory of the country. The students - who perform solar radiation intensity measurements at some landfills - receive the raw meteorological data and the forecast data series for a given of this landfill. They collect data from other databases and evaluate the measurement data.

The actual aim of the research is to study the effect of local geometry of a landfill hill on solar and wind measurement, and to compare real-time measuring data with one-day prediction data and meteorological data.

For this, in situ solar radiation and wind velocity measurements have been started to be made which will last for several years. First results indicate that wind velocity is acceptable at the landfill top.

ACKNOWLEDGMENTS

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EVALUATIONS OF THE EOCENE APOLLONIA FORMATION IN KARSAH REGION, CYRENAICA, LIBYA FOR CEMENT MANUFACTURE

Saad K. EL EBAIDI, Ahmed M. MUFTAH, Mohammed H. AL RIAYDH

University of Benghazi, Faculty of Science, Department of Earth Sciences, Benghazi-Libya.

***Abstract**:*
This paper provides a more detailed lithological description aimed to assess the Apollonia Formation in Wadi Bin Jibarah and Wadi Attir 8 km west Karsah village. Seventeen Samples were collected from both wadies, were then made into thin sections, stained with Alizarin Red and examined using a petrographic microscope. Elemental analysis of major oxides (wt. %) of the Eocene limestone samples have been performed through X-Ray Fluorescence (XRF). The geochemical composition of the whole rock reveals that the SiO2/MgO ratio is (0.01:0.04) in Wadi Attir, which is much lower than Wadi Bin Jibarah (0.04:0.08), and MgO is < 3 %. Apollonia at these two measured sections made of 160 to 180 m, thickly bedded limestones that are alternating by thinly bedded chalky limestones and highly chalky. It consists primarily of white to cream, hard, mudstone to wackestone, locally chertified, with chert nodules at some levels of variable sizes, with few mollusks and extensive bioturbation at local levels. Petrographically, mudstone is the dominant facies containing few to rare planktonic foraminifers and other shell fragments. There are someevidences of reworked stromatolites which is appearing at specific levels. The Apollonia Formation is used in the production of cement, which is the goal of this study, but it may also be used to make dimension stones, decorative walls, aggregate for roads, concrete, irons, and steels, weighting agents for drilling mud fluids, carpet packing, and fillers for other industrial products.

***Keywords**: Eocene, Wadi Bin Jibarah, chert, Apollonia Formation, Wadi Attir*

INTRODUCTION

The present paper deals with the study of the lithological and geochemical characters of the Eocene carbonate rocks exposed at Wadi Bin Jibarah and Wadi Attir, northeastern Libya. Between latitude 32° 35’ 46″ N and longitude 22° 43’ 21″ E of about 8 km west of Karsah village (Fig. 1). The Eocene succession in two wadies is only represented the Apollonia Formation.

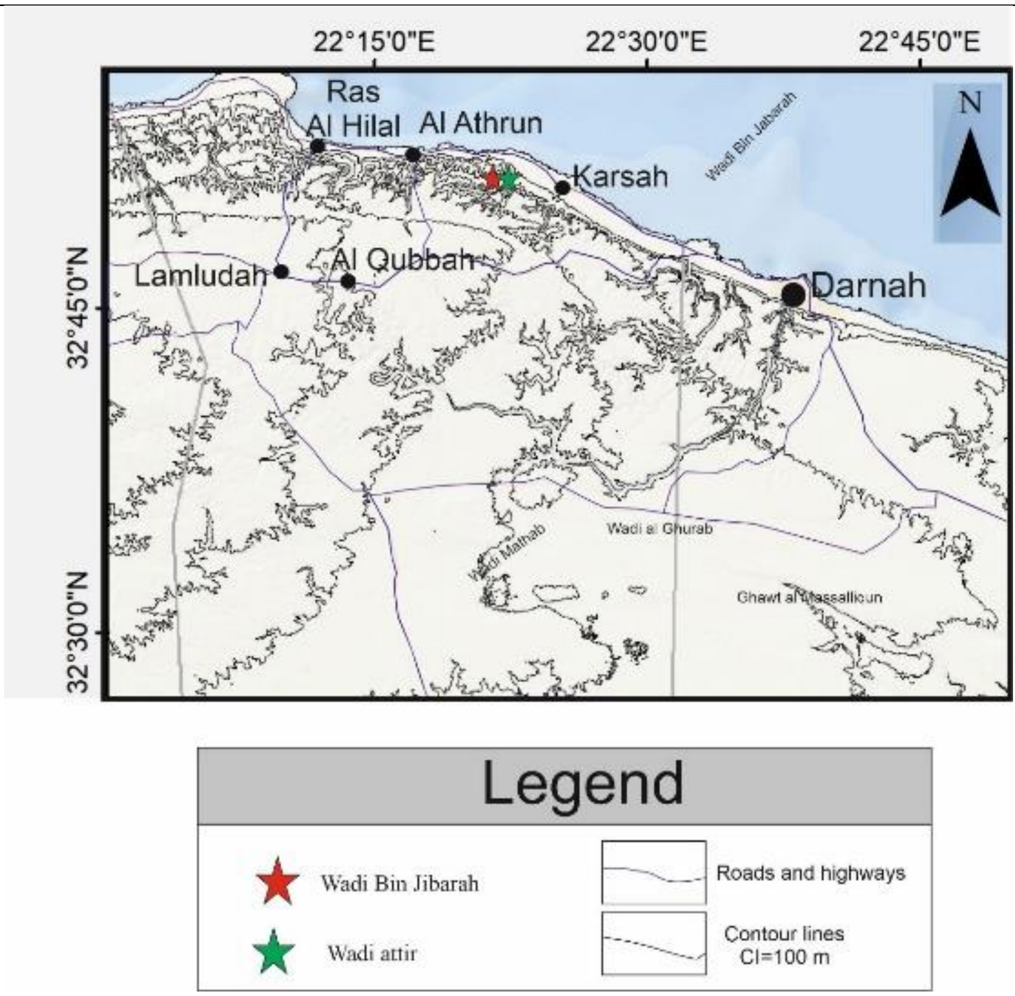

Fig. 1: Location map of the study area

OBJECTIVES

The objectives of this study is to; i) determine the vertical and lateral changes in lithology; ii) to infer the depositional environment of the Apollonia Formation; iii) to give a detailed diagenetic history. The results of this study will be able to address whether there are any significant differences between lithologies of the Apollonia Formation limestones at Al Jabal Al Akhdar area; iv) to determine the oxides in weight percent (wt. %), the rock type of the Apollonia Formation.

MATERIAL AND METHOD

X-ray fluorescence (XRF)

Exposed lithologic sections in Wadi Bin Jibarah and Wadi Attir of the Apollonia Formation were well described. Seventeen fresh samples of carbonate rocks were collected for the petrographic analysis and major elements determination. Seventeen samples were selected from thin sectioning. Each sample was smoothened and mounted on a glass slide using Canada balsam and then polished with carborundum thin sections were stained using Alizarin Red. The slides were studied under petrographic polarizing microscope. The limestone textures are classified using Dunham (1962) technique. Seven samples were prepared and carried out using XRF technique analysis to determine the bulk chemical composition for the Eocene carbonate rocks of the Apollonia Formation, chert and calcarenite.

Background

El Khoudary, (1976) established the planktonic foraminiferal biozones of Apollonia Formation at Al Bakur road cut section. Elwerfalli and Stow (2004) studied the early Paleogene carbonates in NE Libya from five outcrops and number of wells in the surrounding area. They recognized three facies associations, these are slope facies, shallow marine facies and lagoonal facies, and they related the changes of lithological facies to eustatic sea level changes. El Hawat et al., (2008) conducted a detailed analysis (facies, sequences, biostratigraphical and paleo-environmental with attention to unconformities, where they concluded that these unconformities represent signatures of compressive inversion events of Al Jabal al Akhdar anticlinorium and overprinted the early Lutetian eustatic sea level rise. Moody et al., (2008) in their work on the deposition, distribution and stratigraphy of the Eocene-Oligocene of the Soluq Basin and Al Jabal al Akhdar regions, have stated that the Eocene deposits of Al Jabal al Akhdar can be divided into eighteen laterally equivalent microfacies. These are constrained within an inner ramp (Al Himadah Formation – Newly established) to middle ramp (Darnah Formation) to outer ramp-Basin (Apollonia Formation) depositional model. In the subsurface of Al Jabal al Akhdar and Cyrenaica, Yanilamz, et al., (2004) described Middle to Late Eocene to represent a NS trending preitidal area centered over the Cyrenaica platform which was surrounded by low-energy lagoonal marine sediments that extending over the rest of the Cyrenaica platform and on over parts of Al Jabal al Akhdar, Soluq Depression and Marmarica. High energy nummulitic shoals (equate to Darnah Formation) fringed the lagoon, giving way offshore to carbonate ramp setting and ultimately to pelagic carbonate. In the subsurface of Sirt Basin Wennekers, et.al., (1996) described widespread shallow marine limestone of the nummulitic Gailo Formation, which pass vertically and laterally in the Ajdābiyā trough into shale of Augila Formation.

STRATIGRAPHY

Al Jabal al Akhdar is a huge anticlinorium with ENE-WSW trending axis. The exposed carbonate rocks in the area are ranging in age from Late Cenomanian to Late Miocene (Fig. 2).

The regional tectonic conditions during the Eocene period produced a shallowing up cycles throughout North Africa, El Hawat (1997). The Apollonia and Darnah formations forming the Eocene sequence in Al Jabal al Akhdar form a diachronous relationship as the shallower nummulitic Darnah facies passes laterally into deeper water facies of Apollonia Formation.

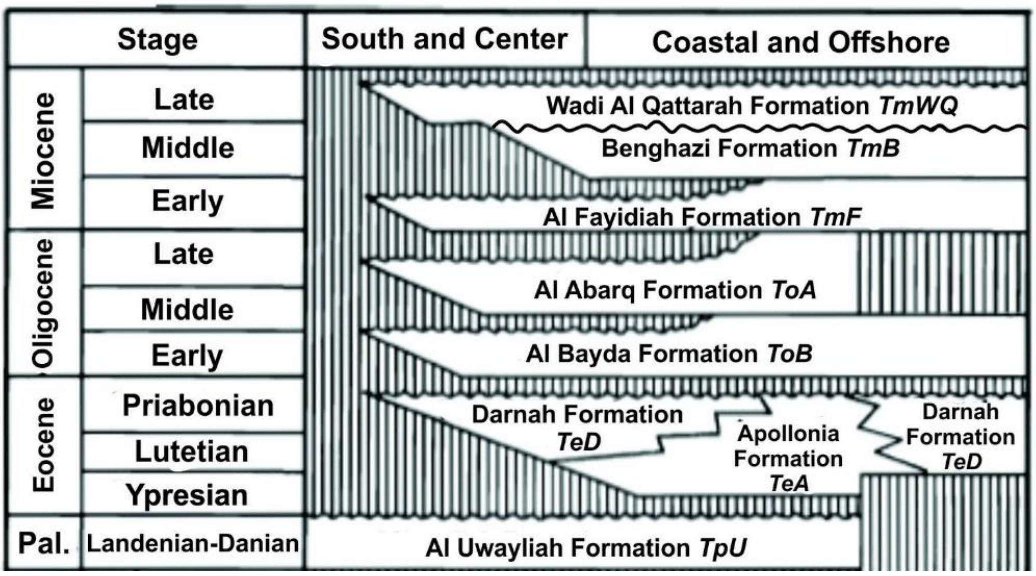

Fig. 2: Stratigraphical chart of northern Cyrenaica (Source Röhlich, 1974; modified later by El Hawat and Shelmani 1993).

Apollonia Formation:

The term Apollonia Formation was introduced by Gregory (1911) as Apollonia Limestone, after ancient Greek settlement Apollonia, now called Susah in the Al Bayda Sheet area Northern Cyrenaica (Banerjee, 1980). The term Apollonia Formation was introduced by Pietersz (1968). It consists of light colored massive, mudstone, bituminous smell when struck by hammer, with chert nodules at some levels. The limestone is chalky and rarely marly on local basis. A rhythmic alternation of mudstone/wackestone to packstone textures. Apollonia Formation pinches out southwards against the slop of the inversion structure as the Darnah Formation unconformably on the Upper Cretaceous Wadi Dukhan Formation or the Paleocene Al Uwayliah Formation at Marsa al Hilal region (Wadi al Qalah and Wadi Al Athrun sections). The Apollonia and Darnah formations forming the Eocene sequence in Al Jabal al Akhdarwith a diachronous relationship as the shallower nummuliticDarnah facies passes laterally into deeper water facies of Apollonia Formation (El-Hawat, 1986a,b).

Three measured sections at the vicinity of Karsah area, namely Wadi Bin Jibarah, the mouth of Wadi Bin Jibarah Gargaresh Calcarenites, and Wadi Attir (Fig. 4) are described petrographically and analyzed geochemically using X-Ray Fluorescence (XRF).

Fig. 4: Panorama view of the studied area showing Wadi Bin Jibarah and WadiAttir, at Karsah area, (looking South).

Wadi Bin Jibarah Section

This section is represented by only Apollonia Formation disconformably overlain by Quaternary deposits. Apollonia at this section made of 160 m thick sequence of thickly bedded limestones (Fig. 5), characterized by white to cream, hard, wackestone, locally chertified, with chert nodules at some levels of variable sizes (Figs. 6, 7, and 8), with few mollusks. This limestone exhibit extensive jointing system of three trends. This thickly bedded limestones are alternating by thinly bedded limestones, white, medium hard, mudstone texture and highly chalky (Fig. 9).

Fig. 5: Wadi Bin Jibarah side displaying the rhythmic alternation of thickly bedded and thinly bedded limestones.

Fig. 6: Alternation of thickly bedded and thinly bedded limestones in Wadi Bin Jibarah.

Fig. 7: Fractured chert nodule in Apollonia Limestones at Wadi Bin Jibarah.

Fig. 8: Chertified in Apollonia Limestone in Wadi Bin Jibarah.

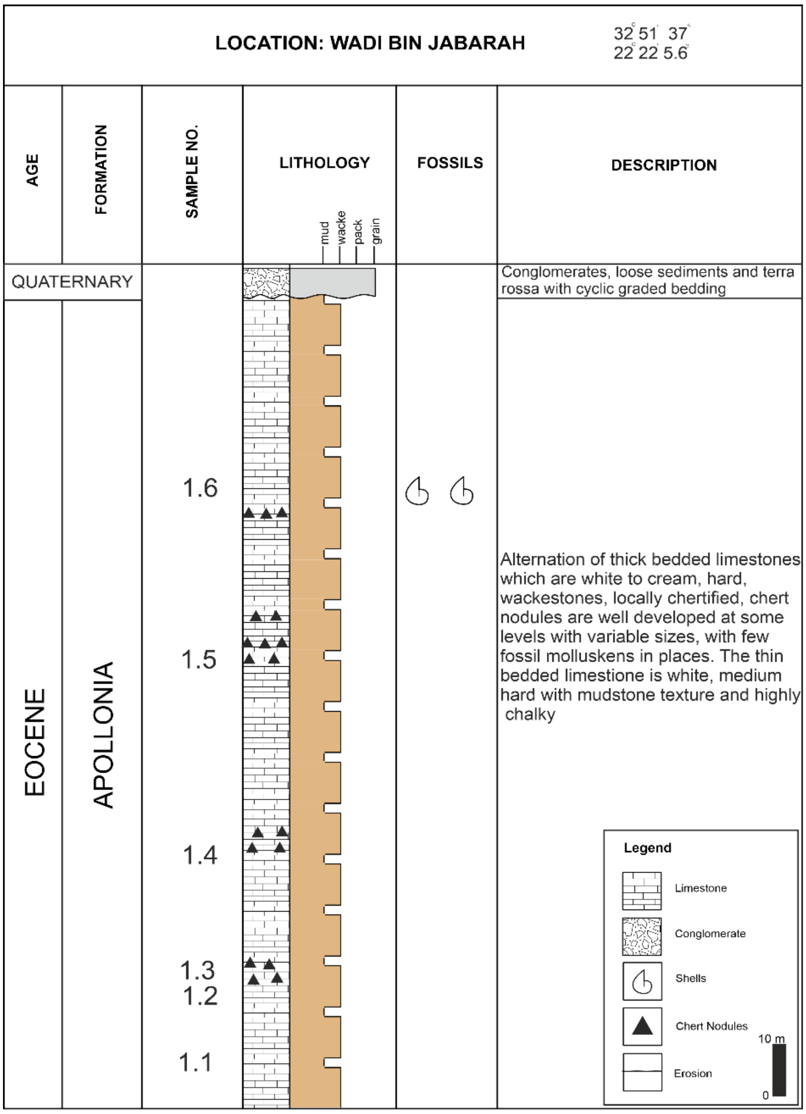

Fig. 9: Stratigraphic columnar section of Wadi Bin Jibarah.

Petrographically, Mudstone is the dominant texture containing few to rare planktonic foraminifers and other undifferentiated shell fragments. The dolomite crystals is locally recognized in some parts of Apollonia limestone (Fig. 10).

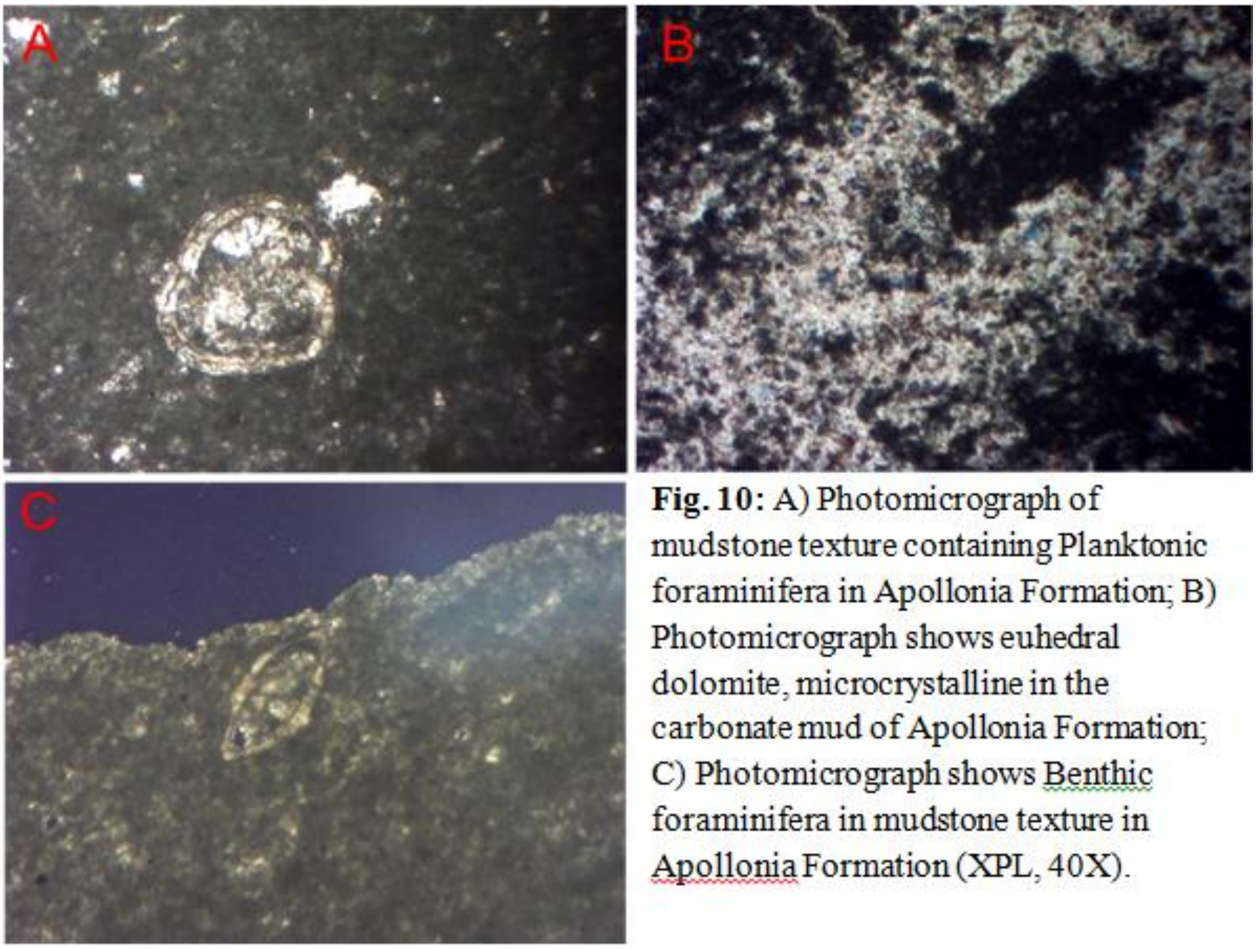

Fig. 10: A) Photomicrograph of mudstone texture containing Planktonic foraminifera in Apollonia Formation; B) Photomicrograph shows euhedral dolomite, microcrystalline in the carbonate mud of Apollonia Formation; C) Photomicrograph shows Benthic foraminifera in mudstone texture in Apollonia Formation (XPL, 40X).

Mouth of Wadi Bin Jibarah Section

This section is represented by only Apollonia Formation which is made of 28 m thick sequence of thickly bedded limestones, characterized by white to cream, hard, wackestone, locally chertified, with cluster aggregation of small size chert nodules in local place (Fig. 11).It exhibits extensive joints of different trends. This thickly bedded limestones are alternating by thinly bedded limestones, white, medium hard, mudstone and highly chalky. Apollonia Formation at this section is disconfomably overlain by Gargaresh Calcarenites deposit (Figs.12,13).

The Gargaresh Calcarenites deposit is characterized by creamish brown, grainstone to packstone exhibiting planner cross bedded (Fig. 14), with common root casts at the upper part of the section. Petrographically, this facies is dominated by packstone - grainstone texture, composed of peloids, algae with foraminifera fragments and meniscus micro-stalactitic cement type. (Fig. 15).

Fig. 11: Cluster of small-sized Cherts nodules and joints system in Apollonia Limestones at Wadi Bin Jibarah Calcarenite section.

Fig. 12: Cross bedded Gargaresh Calcarenites at Wadi Bin Jibarah.

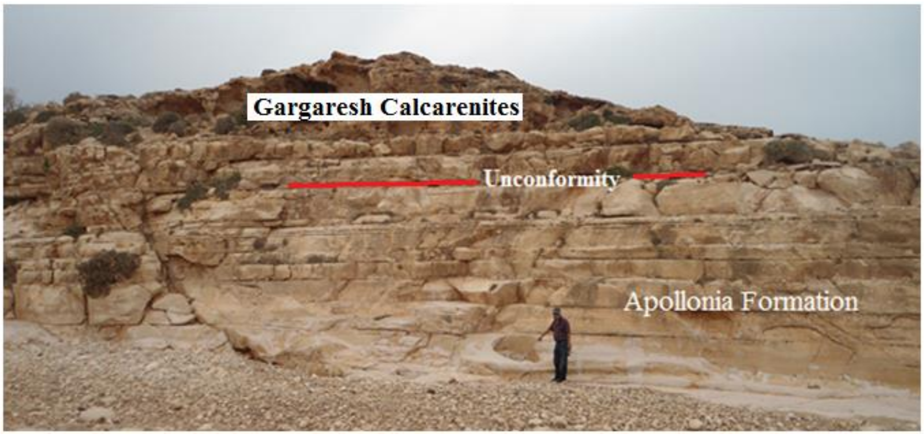

Fig. 13: Unconformity surface separating Apollonia Formation from the overlying Gargaresh Calcarenites at Wadi Bin Jibarah Calcarenite section.

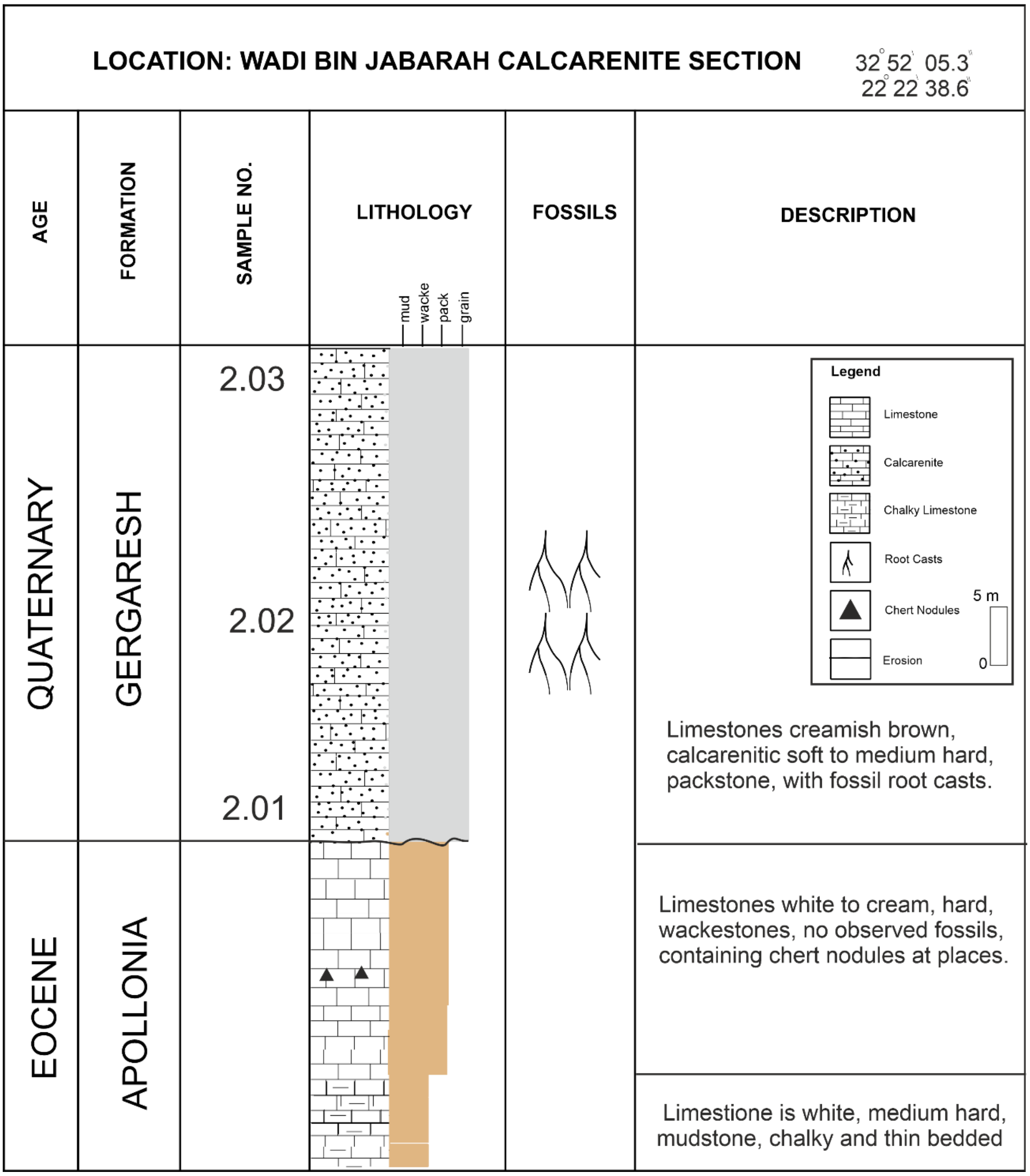

Fig. 14: Stratigraphic columnar section of Wadi Bin Jibarah.

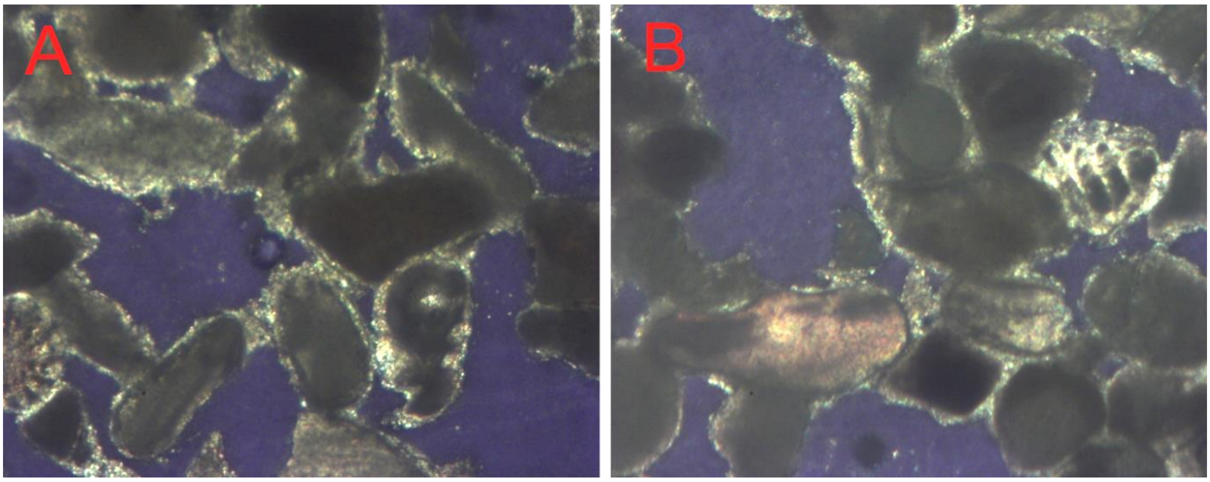

Fig. 15: Photomicrographs (A and B) packstone - grainstone texture in the Gargaresh calcarenites at the mouth Wadi Bin Jibarah section. Shows common algal peloids, foraminifera fragments and meniscus cement type (XPL, 40X).

Wadi Attir section

This section is represented by only Apollonia Formation which is disconformably overlain by Quaternary deposits. Apollonia at this section made of 180 m thick sequence of alternating thickly bedded limestones and chalky limestone (Figs. 16, 21), characterized by white to cream, hard, wackestone, locally, with chert nodules at some levels of variable sizes with few mollusks and extensive bioturbation (Fig. 17), this limestone exhibits common joints of three trends. There are some evidences of reworked stromatolites in local places, which attributed to the effect of debris flow (Fig. 18). Also clear white quartz and calcite crystals are found in round geodes that resemble the calcareous concretion in size and shape. at elevations 70 m.a.s.l., it may formed from the dissolved silicates and carbonates in hydrothermal fluids (Fig. 19).

Fig. 16: Wadi Attir side displaying the rhythmic alternation of thickly bedded and thinly bedded limestone.

Fig. 17: Bioturbated bed in thinly bedded limestone, at Wadi Attir.

Fig. 18: A) Displaced *Stromatolites* bed in Apollonia Limestones at Wadi Bin Jibarah. B) Photomicrograph of *Stromatolites*, PPL.

Fig. 19: Clear white quartz and calcite crystals are found in round geodes

Petrographically, Mudstone is the dominant texture containing few to rare planktic foraminifers and leached miliolids in some placeswith undifferentiated shell fragments. (Fig. 20). The dolomite crystals is locally recognized some parts of Apollonia limestone.

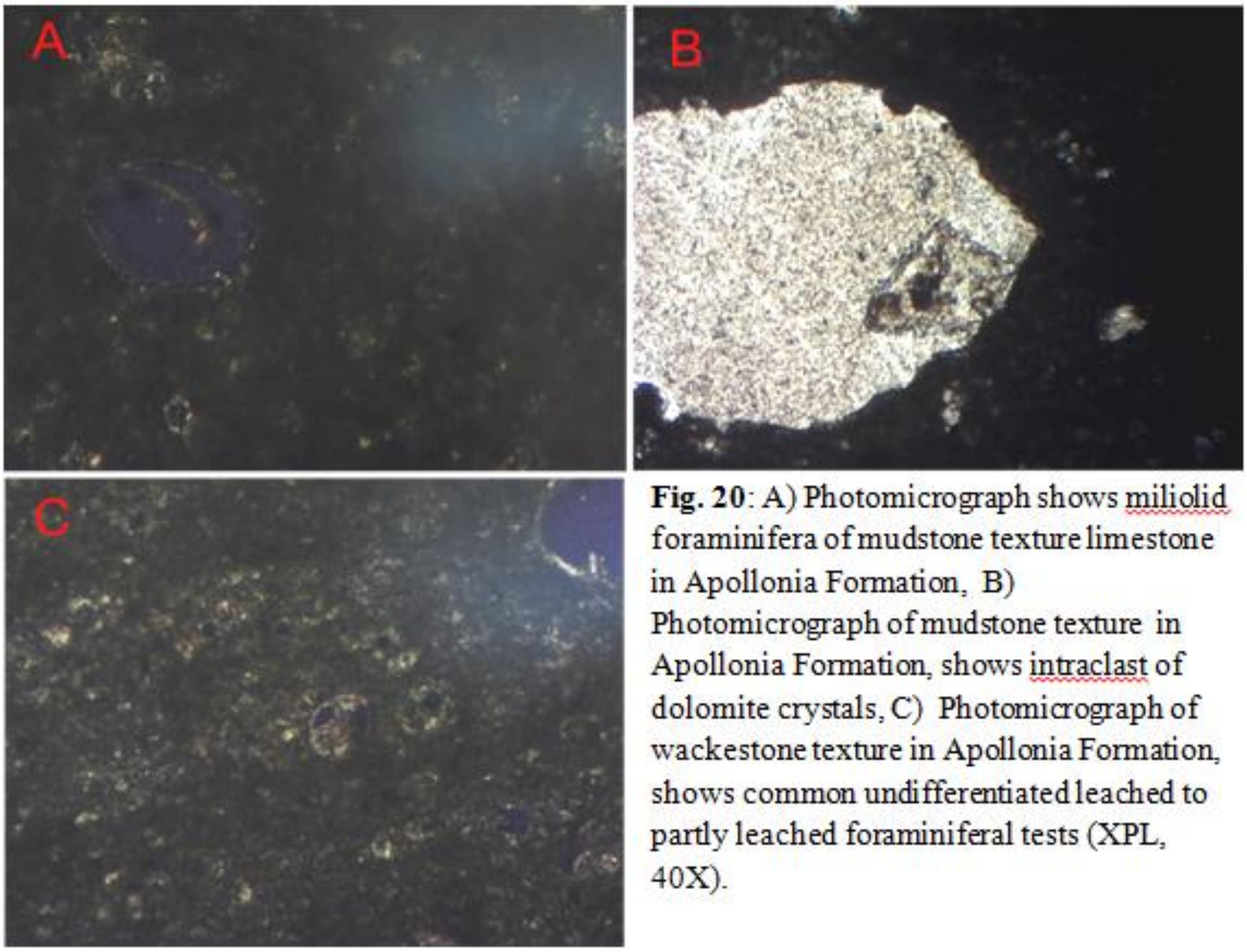

Fig. 20: A) Photomicrograph shows miliolid foraminifera of mudstone texture limestone in Apollonia Formation, B) Photomicrograph of mudstone texture in Apollonia Formation, shows intraclast of dolomite crystals, C) Photomicrograph of wackestone texture in Apollonia Formation, shows common undifferentiated leached to partly leached foraminiferal tests (XPL, 40X).

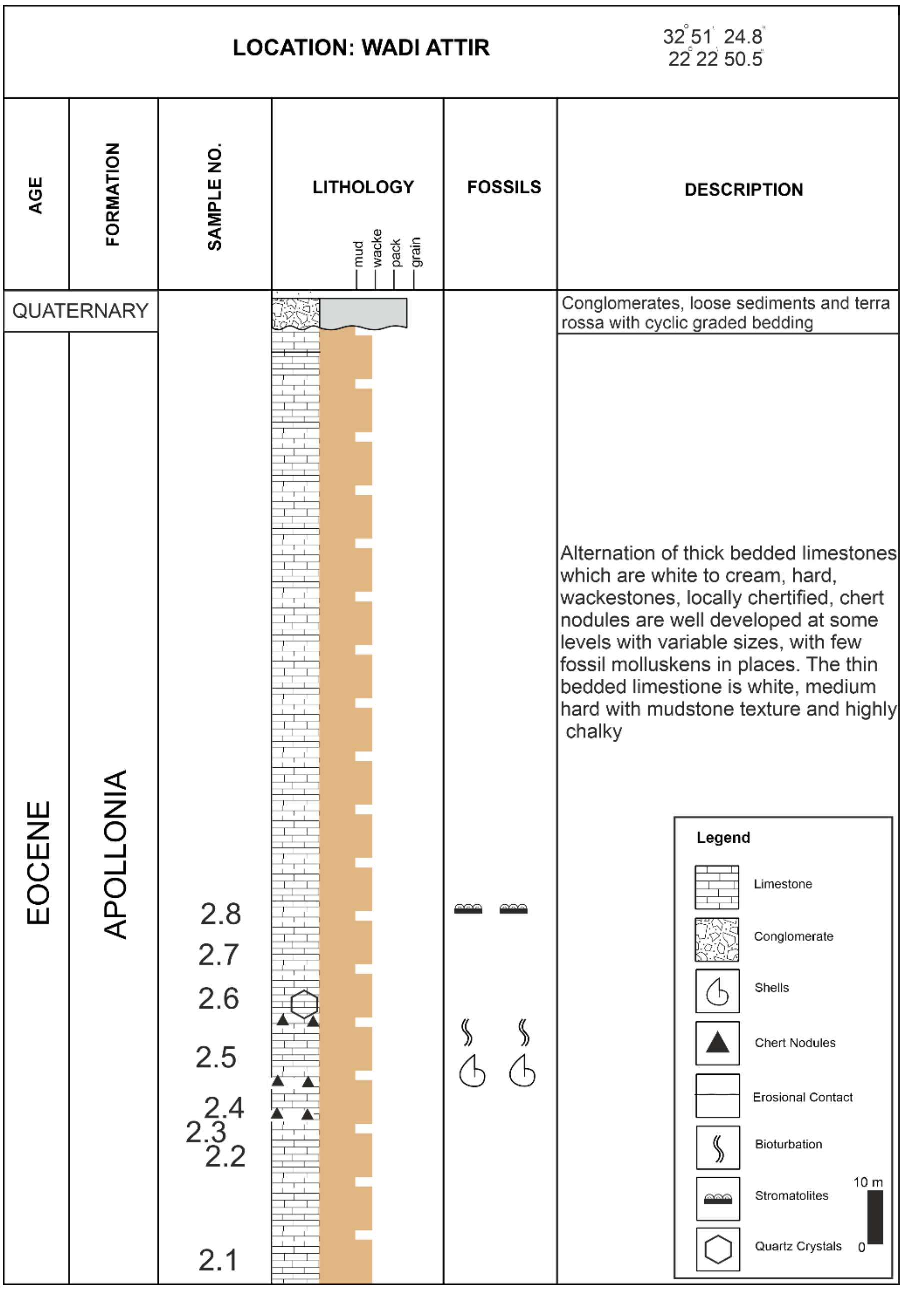

Fig. 21: Stratigraphic columnar section of Wadi Attir.

GEOCHEMICAL ANALYSIS

The main impurities such as dolomite, quartz and clay (rare) throughout Apollonia limestone deposit were found in some places with variable amounts. Their distributions are very important factors in grade control for production of very high or low purity limestone. Harries (1979) classified the limestones according to purity

(Table 1). Apollonia limestone covers a huge area from the south of Karsah village. Generally the bedding planes is nearly horizontal with commonly bed thickness ranged from 20 - 50 cm.

However, the thickness is increase up to 1 m thick contains chert nodules, sometimes discontinuous cherts are documented in the thinly beds at different levels. It consists of light coloured massive, mudstone, bituminous smell when struck by hammer. A rhythmic with chalk intercalations with hard limestone of mudstone/wackestone texture to not often packstone texture. Darnah Formation is widen and huge to the southern border, it does not exist in the study area and conformably overlying Apollonia Formation. Limestone consists primarily of calcite ($CaCO_3$). It is commonly contaminated with other carbonate minerals which may present including dolomite $CaMg(CO_3)_2$, less commonly magnesite ($MgCO_3$) and siderite ($FeCO_3$), and non carbonate minerals such as quartz and other silicate minerals. Chemical analyses of the major oxides were carried out using X-ray fluorescence (XRF). The results of the analysis for the major oxides of the selected samples are presented in Table 2.

Table 1: Harries (1979) classification the limestones ($CaCO_3$%) according to purity

Categories of limestone	Composition % $CaCO_3$
Very high purity	> 98.5
High purity	97 - 98.5
Medium purity	93.5 - 97
Low purity	85 - 93.5
Impure	< 85

The Apollonia Formation in the study area vary from low purity to high purity limestone. Apollonia limestone with less than 3 % of MgO, dolomite is present in different amounts.

Major Elements Geochemistry

The results of the analysis for the major oxides of the selected samples are presented in Table 2. CaO (42.1 – 54.64 %) constitutes the major oxide and in the limestone, others are Fe_2O_3 (0.48 – 4.41 %), MgO (0.57– 4.87 %), Al_2O_3 (0.27 – 2.98 %) and SiO_2 (0.64 – 15.04%). The values indicate that the limestone is calcitic and non-dolomitic. The CaO and MgO values are lower in samples from the base than from the top of the formation, probably reflecting the sandy nature of this part of the formation.

The significant amount of SiO_2 and Al_2O_3 confirm the presence of non-carbonate detritus especially at the base. The result of the Ternary plot of SiO_2-$CaCO_3$-$MgCO_3$ reveals that the limestone of the Apollonia Formation is low to high purity (Fig. 22). Wadi Attir records high purity of $CaCO_3$with lower weight percent in MgO and SiO_2 in comparison to Wadi Bin Jibarah (Fig. 23).

Table 2: Summary data for the major oxides (wt. %) of Apollonia Formation and Gargaresh Calcarenite

Major Oxides (wt. %)	Raw Material types						
	Limestone					Limestone	Limestone
	Selected Samples						
	1.1	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**
SiO_2	0.765	2.48	3.018	0.58	0.00	0.30	74.97
Al_2O_3	0.291	0.17	0.038	0.25	0.026	0.16	0.42
Fe_2O_3	0.043	0.03	0.01	0.06	0.00	0.09	0.68
CaO	54.15	51.79	51.73	53.41	54.96	52.83	14.40
MgO	0.822	0.57	2.136	0.60	1.085	1.26	6.84
Cl	0.177	0.34	0.145	0.25	0.145	0.14	0.15

SO_3	0.253	0.18	0.155	0.11	0.074	0.36	0.12
Na_2O	0.773	0.77	0.773	0.770	0.773	0.77	0.77
K_2O	-		-	-	-	-	-
TiO_2	-		-	-	-	-	-
MnO	-		-	-	-	-	-
P_2O_5	0.065	0.07	0.073	0.07	0.060	-	0.07
LOI	-		-	-	-	-	-
Total	-		-	-	-	-	-
$CaCO_3$	96.64	92.43	92.326	95.32	98.082	94.29	25.69
$MgCO_3$	1.70	1.20	4.468	1.26	2.270	2.65	14.31

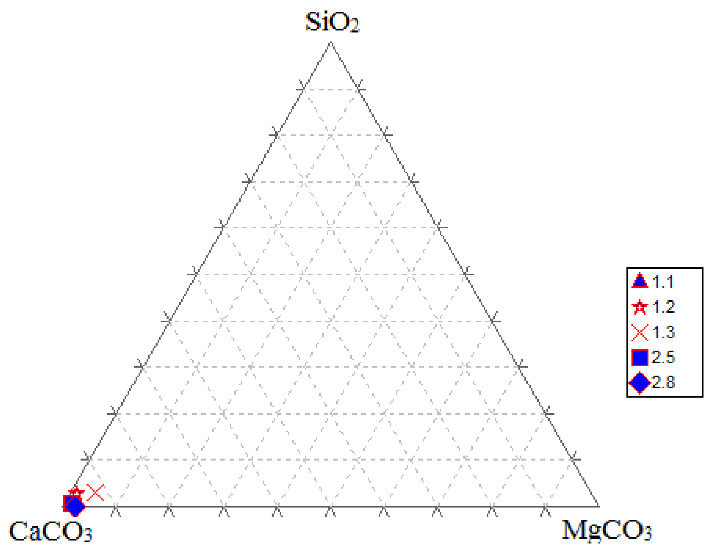

Fig. 22: SiO_2-$CaCO_3$-$MgCO_3$ Ternary diagram (wt. %) of the Apollonia Formation

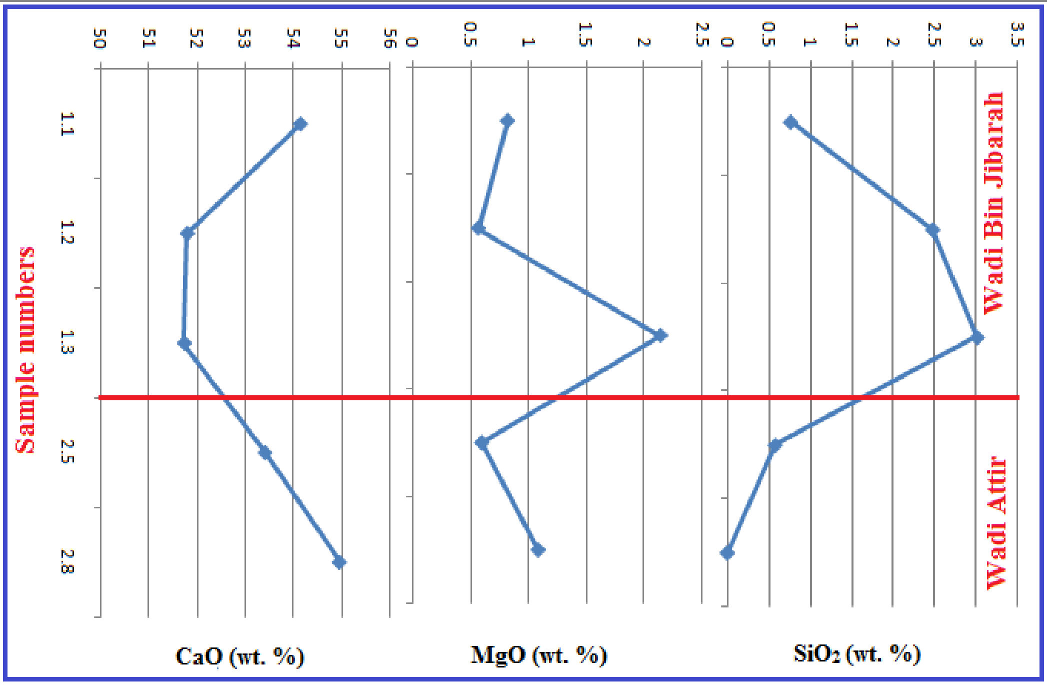

Fig. 23: Comparison graph of selected oxides between Wadi Attir and Wadi Bin Jibarah

CONCLUSION

– The SiO_2/MgO ratio in limestone of Apollonia Formation is (0.01:0.04) in Wadi Attir, which is much lower than Wadi Bin Jibarah (0.04:0.08).
– The limestone percent ($CaCO_3$ %) of Apollonia Formation in Wadi Bin Jibarah isclassified as low to medium purity while in Wadi Attir is medium to high purity. In addition to calcite, the limestone of Apollonia Formation contains other carbonate minerals such as dolomite (MgO % is < 3 %), and even non carbonate minerals such as quartz.
– The possible applications of Apollonia Formation are: Cement, dimension stones, decoration walls, aggregate in road stones, concretes, irons and steels, weighting agent in drilling mud fluids, carpet packing and a fillers in other industrial products.

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POLYMETALLIC MINERALIZATION (FE, CU, PB, ZN, BA) OF THE TELLIAN DOMAIN (JIJEL PROVINCE, NE ALGERIA). MICROSCOPIC AND MINERALOGICAL CHARACTERIZATION

Oumeima BENMEBAREK, Azzedine BOUZENOUNE

Geological Engineering Laboratory, University of Mohammed Seddik Benyahia, Jijel, Algeria
o.benmebarek@univ-jijel.dz, +213-540-671-894

***Abstract**:*
Cluster iron deposits of the Tellian domain associated with fissural polymetallic mineralization (Cu, Ba, Zn-Pb-Fe) are commonly hosted within uplifted limestones of Liassic age. About twenty polished sections of the ore deposits were analyzed using metallographic microscope. Qualitative study was also carried out using X-ray diffractometer in order to determine mineral phases of selected ore samples. Hence, the aim of this work is to use geological observations, petrographic, and mineralogical features to discuss the nature and paragenetic succession of the mineralization deposition. Mineralization is mainly composed of hematite, goethite, and limonite deriving from an iron carbonate protore, most likely siderite. It is usually associated with tetrahedrite which is frequently altered to malachite, azurite, and covellite. Tetrahedrite is also dominant in the epigenetic iron mineralization hosted within carbonate rocks in northern Algeria's geological domains. Moreover, galena (partially altered into cerussite), sphalerite, pyrite, and calamine, are locally related to iron ore and are observable within narrow veins and limited clusters. Barite, calcite, dolomite, and scarce quartz represent the common gangue minerals. Macroscopic and microscopic analysis revealed the following paragenetic sequences: a-Formation of barite; b- Polymetallic sulfides (Cu, Zn, Pb); c- Iron primary mineralization; d-White coarse calcite formation; and e-Supergene ore enrichment. The investigated ore deposits are polyphase mineralization that represent epithermal deposits.

***Keywords**: Iron ore, Jijel province, epigenetic mineralization, Liassic limestones, Tellian domain*

INTRODUCTION

The Tellian domain is part of the allochthonous nappes of the Maghrebides chain in North Algeria (Fig. 1). It contains Triassic to Quaternary sedimentary series deposited in the north African paleomargin of the Tethysian basin.
The most important hydrothermal mineralization known in the Tellian zone are related to limestones and dolomites of Jurassic age that are uplifted due to tectonic events related to Africa-Europe convergence during Eocene [1]. In addition, some polymetallic mineralization can be associated to Cretaceous formations that consists of black marls, marl-limestone alternations, and clays [2].
The studied mineralization is hosted within Liassic limestones that display as Jurassic anticlines, oriented in E-W direction. The host rocks crop out in Jijel province (NE Algeria) which is part of the western portion of the Numidic chain's geological framework [1] (Fig. 1).
The ore deposits of this specific zone of the Tellian domain have been subject of a few metallogenetic studies. Petrographic features of Liassic host rocks and the mineralization (Fe, Cu, Ba, Pb) [3, 4, 5, 6,7, 8] with scarce mineralogical characterization of merely iron ore deposits [7, 8]. As a matter of fact, the zinciferous mineralization has not been precisely clarified until this time by no research study. The general mineral form of zinc has been revealed to be calamine [9, 15]. Hence, polymetallic mineralization of the Tellian is being subject of research [10].

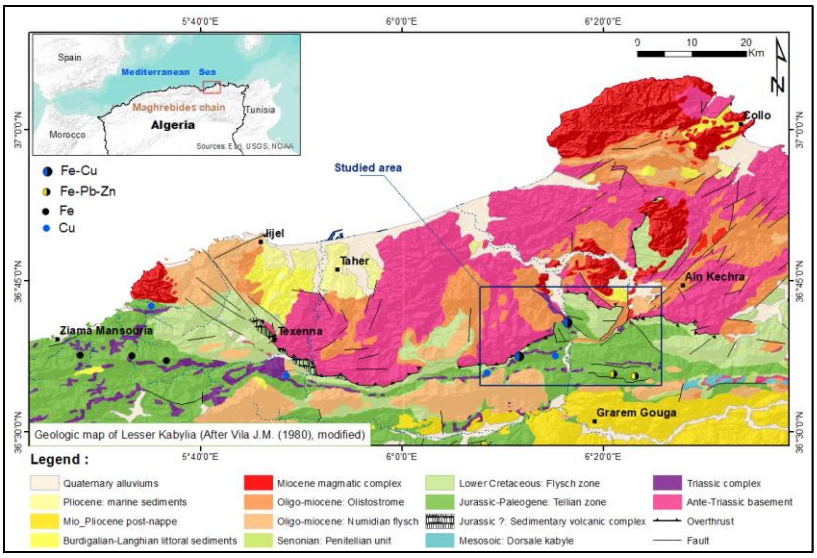

Figure 1: The studied ore deposits location (into blue square) in the Numidic chain western part of the Tellian domain (NE Algeria) (After [11], Modified)

On the other hand, geological traits of the investigated area have been described by multiple studies that clearly elucidate lithostratigraphic and structural aspects of the Numidic chain [1, 11, 12, 13]. As for the deposition conditions (T, P, and salinity) of the mineralization, they are not precisely distinguished. Only one isotopic analysis study (carbon and oxygen) had been carried out on this zone of the Numidic chain [6, 14].

MATERIALS AND METHODS

In this contribution, investigated hydrothermal mineralization samples were collected at surface from different ore outcrops. The sampling sites belong to Sidi Marouf region which is situated in southeastern of Jijel province (Fig. 1). They consist of Kef Dardja, Djebel Sidi Marouf, Djebel M'cid Aicha, and Kef Boulahmem where the ore-bearing carbonate display as Jurassic anticline hosting cluster and vein type mineralization (Fig. 2).

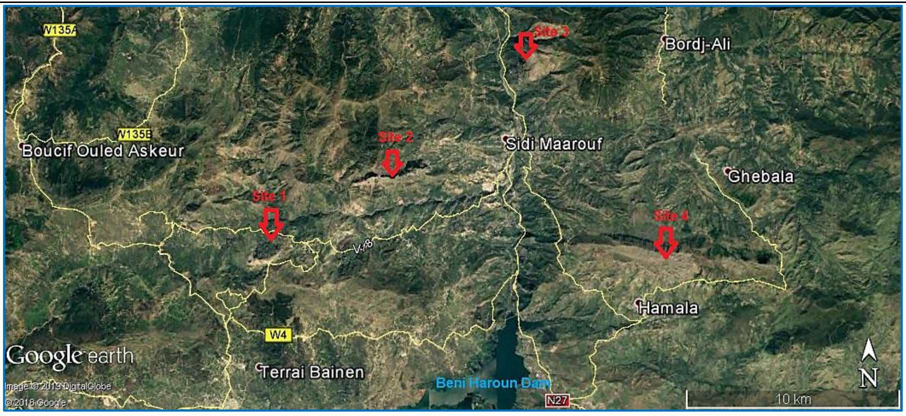

Figure 2. Situation of the sampling sites in SE Jijel province. Site 1: Kef Dardja, site 2: Djebel Sidi Marouf, Site 3: Kef Boulahmem, site 4: Djebel M'cid Aicha

Microscopic analysis was carried out on around twenty polished sections using reflected light microscopy at the Department of Earth and Universe Sciences, University of Jijel, Algeria. Some minerals of selected ore samples were identified or confirmed using a powder X-ray diffractometer (XRD) Rigaku Miniflex 600 at the University of Tlemcen, Algeria.

RESULTS AND DISCUSSION

The iron and polymetallic mineralization of the studied area had been mined since 1910 by some national and foreign exploitation compagnies [15, 16]

The mineralization cropping out in the different studied sites (Kef Dardja, Djebel Sidi Marouf, Kef Boulahmem, and Djebel M'cid Aicha) (Fig. 2) is formed mainly by massive hematite of dark grey and reddish color (Fig. 3C). It is rich in iron with a grade around 50% [16]. In addition, iron hydroxides such as powdery yellowish limonite and botryoidal goethite of a blackish color (Fig. 3A and B) are also present. These oxides and hydroxides, confirmed by microscopic observations and x-ray diffraction analysis, outcrop under different morphologies, metric clusters, vein-ore, lens-like veins, and ore-breccia. The gangue minerals related to iron mineralization are mainly barite and calcite. Microscopically, hematite shows white-grey tone with red internal reflections in polarized light. Goethite has in general a collomorphic texture and low reflectivity in greyish color (Fig. 3D).

Regarding the possible protore of the hydrothermal iron mineralization, it could be an iron carbonate (maybe siderite) that has been altered during a supergene enrichment phase.

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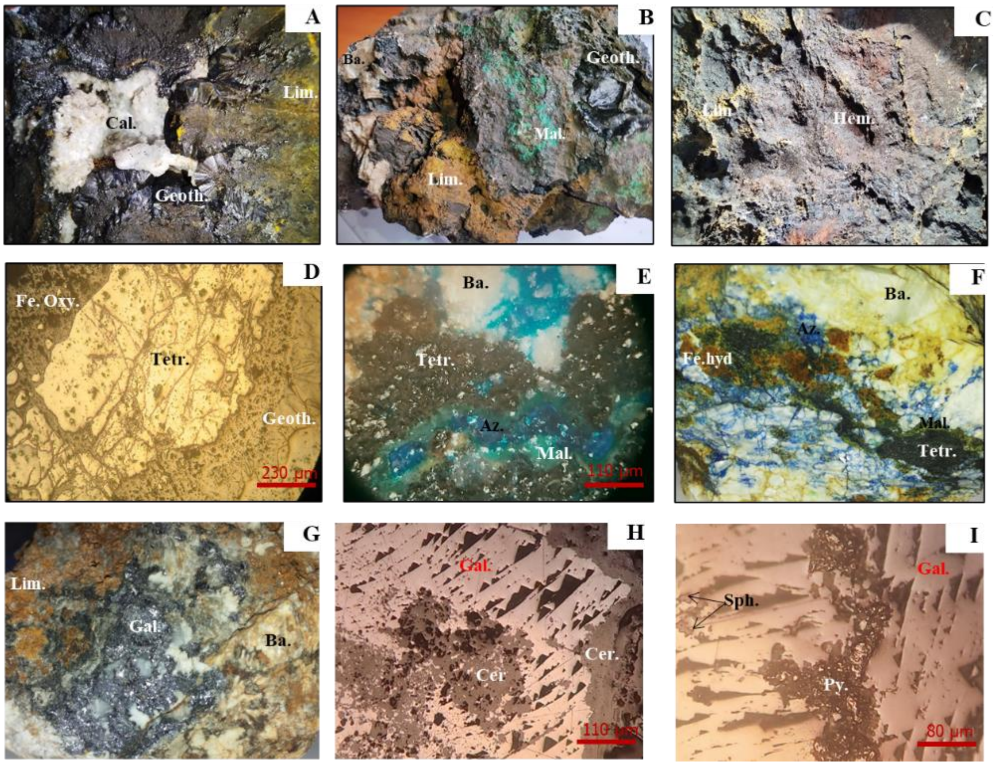

Figure 3: Macro and microphotographs of the studied polymetallic mineralization. Abbreviations: Cal.: calcite, Lim.: limonite, Geoth.: geothite, Hem.: hematite, Mal.: malachite, Ba.: barite, Tetr.: tetrahedrite, Fe oxy. And hyd: iron oxide and hydroxide, Az.: azurite, Gal.: galena, Cer.: cerussite, Sph.: Sphalerite

Furthermore, the iron ore is commonly associated to polymetallic mineralization, it consists of sub-automorphic tetrahedrite, massive galena of metallic luster (Fig. 3G), sphalerite, pyrite, and calamine that occur as millimetric to centimetric open spaces. So far, sphalerite and pyrite are only found in Djebel M'cid Aicha and they have been merely observed as xenomorphic to automorphic inclusions in galena (Fig 3I). Microscopically, galena is white showing triangular pullout and is partially altered into cerussite (Fig. 3H). Similarly, for calamine, which is a zinc carbonate exclusively observed within Liassic limestones of M'cid Aicha. The specific form of calamine has not been distinguished and yet speculated to appear just as smithsonite without any scientific data [17]. On the other hand, tetrahedrite is present in approximately all the studied area but rarely is under its original form. It appears within massive barite and iron oxides (Fig. 3B, D, E, F) and is often altered into green malachite, blue azurite (Fig. 3E and F), and light blue covellite. The macroscopic and microscopic features of our polymetallic ore samples revealed paragenetic sequences that begin with formation of gangue minerals then main ore deposition which consist of polymetallic sulfides formation before the iron mineralization and at last a supergene ore enrichment phase.

CONCLUSIONS AND RECOMMENDATIONS

Liassic carbonates of Tellian domain located in southeastern of Jijel province are bearing polyphase hydrothermal mineralization. It is constituted of iron oxides and hydroxides that are often associated to anterior polymetallic sulfides. The iron protore is believed to be an iron carbonate mineral that has been altered during a supergene enrichment phase. The morphology of the ore bodies appears as clusters and veins.

All the studied sites seem to show a comparable host petrography characteristics and mineralization paragenesis content, except for Djebel M'cid Aicha which is different to some extent because of the presence of calamine, galena, and sphalerite.

Metallogenetic traits of the ore deposits are strongly linked to the structural evolution in this part of the Maghrebides chain. Thus, further analysis approaches are needed in order to elucidate the physico-chemical conditions of mineralizing process and the geological factors that were involved.

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LOCAL ENRICHMENT OF AIR POLLUTANTS IN A PRACTICAL EXAMPLE

Csaba ÁGOSTON[1]

[2]*Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest - Hungary*
e-mail: *agoston.csaba@rkk.uni-obuda.hu*

Abstract
Inversion temperature atmospheric stratification can help local atmospheric emissions stay in place, and through this, the formation of immission states with high local concentrations. In the case of settlements located in basins and valleys, this effect may increase. The burning of green garden waste by the population can result in extremely high local air pollution levels in settlements located in basins. If residential incineration is only allowed during certain periods, the local effect of incineration can be studied by means of simultaneous ambient air measurements on the site and in a reference area. The results of the test series can be used in many ways in environmental engineering training. Theoretical knowledge can be deepened and gain a deeper meaning during the exploration of a specific problem and formulation of solution proposals.

Keywords inversion atmospheric stratification, incineration, pool situation, PM10, environmental engineer training

FOREWORD

Ambient air is the only environmental element with which we are constantly in contact, because breathing is a basic necessity. For this reason, the ambient air must be suitable for inhalation wherever people are present. As a result of human activity, substances that cause air pollution entering the ambient air (atmospheric emission) can lead to the formation of concentrations that show significant differences in time and space (atmospheric immission). Air pollution and atmospheric concentrations of pollutants are primarily determined by the characteristics of the emitting sources, the meteorological characteristics of the atmosphere and topographical factors. [1]
The state of the ambient air in Hungary is checked with the help of measurement data provided by measuring stations that are part of the National Air Pollution Measurement Network (OLM) supervised by the National Meteorological Service. [2] The stations that make up the Network are located at great distances from each other, so the measured values are not suitable for assessing the air pollution affecting a small area as a result of local emissions in settlements located at a distance of up to tens of kilometers from the nearest measuring station. However, local effects can be significant in special cases and thus have a significant impact on the health status of the population living in the affected area. The local nature of air pollution can be particularly strong if the three determining factors, the nature of the emitting sources, the meteorological condition and the topography, all contribute to the enrichment of air pollutants in a narrower area and in a thinner air layer. These conditions exist in a settlement located in a basin or in a valley in windless weather. [3]
An important aspect of modern environmental engineering training is that students can deepen their theoretical knowledge through practical examples and see examples of the environmental engineering way of thinking.

To this end, the analysis of a series of measurements examining the effects of residential waste burning in a settlement with an inverted atmospheric stratification can be an outstanding student task. [4]

Inversion atmospheric stratification

In calm weather, persistent cloud cover, or foggy weather, solar radiation does not reach the earth's surface, so the heating of the soil and the air layers near the soil is inhibited. In this state, the temperature of the air layer near the ground is lower than that of the air layers located above it, and therefore its density is higher. The whole of Hungary is located in one basin, the Carpathian Basin, as a result of which the phenomenon can even extend to the entire country ("cold pillow"), see first figure. [5]

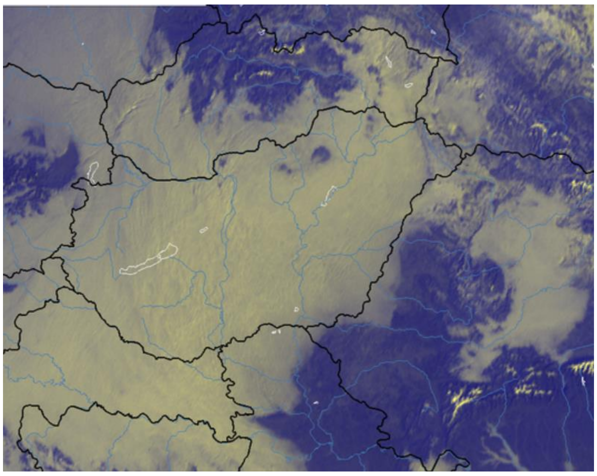

Figure 1: *Inversion atmospheric stratification over Hungary (so called „Cold pillow")* [5]

The inversion atmospheric stratification can develop locally, covering a smaller area, for a shorter period of time in windless weather. It is often observed in the early morning hours (Figure 2)

Figure 2: *Inversion atmospheric stratification over Hatvan town, Nagygombos district, at 8 a.m., 13 October 2022*

The inversion atmospheric temperature stratification results in air pollutants entering the near-surface air layers being enriched there and remaining there, resulting in significant near-surface pollutant concentrations. For example, the phenomenon can even be observed with the naked eye due to the airborne dust entering the ambient air as a result of residential solid burning. Although the extent of the inversion atmospheric stratification extends beyond the boundaries of the settlement, the emissions from the activity (heating) carried out in the settlement remain in place and take the form of a "pillow" that can be seen with the naked eye over the settlement (Figure 2).

Smaller basins and river valleys can promote the formation of local inversion temperature distribution and the retention of harmful substances entering the air environment due to local emissions, therefore the local residential air pollution is of increased importance in the case of settlements with basins.

CHARACTERISTICS OF SÜLYSÁP TOWN

The town of Sülysáp is located in the Gödöllő hills. The settlement is located in a valley surrounded by hills, which opens towards the Hungarian liwlands in the southwest direction. There are no significant sources of industrial air pollution in the settlement, most of the local emissions can be attributed to residential activities. There is no traffic passing through the part of the settlement chosen as the site of the measurement series, so the traffic emissions are not significant. The heating habits of the population are average, the majority use natural gas heating, the proportion of those using solid fuels is negligible. [4]

Local characteristics of incineration of garden green waste

At the time of the test series, the local ordinance of the Municipality permits the open burning of dry garden green waste on one occasion, between 8 a.m. and 7 p.m. on Fridays, only in calm weather. According to experience, a small number of cinders and green waste were burned on occasion, typically at 2-4 locations.

TESTING OF AMBIENT AIR

In the months of March-April and October-November 2017, KVI-PLUSZ Kft. carried out measurements in Sülysáp, in order to investigate the effects of residential garden green waste burning. The sampling point was selected in the yard of a residential building. Continuous measurement of the PM10 fraction of nitrogen oxides ($NO/NO_2/NOx$), carbon monoxide (CO), sulfur dioxide (SO_2), ozone (O_3), BTEX (benzene, toluene, ethylbenzene, xylenes), airborne dust, furthermore, 24-hour sampling and analysis of the PM10 fraction of the dust (mass, PAH), as well as odor sampling and analysis were carried out. During the spring and autumn periods of the test series, burning of green garden waste took place on Fridays. [4]

Figure 3: *incineration of garden green waste in Sülysáp town on 13th March 2017* [4]

TEST RESULTS

The impact of local emissions on air quality can be evaluated by comparing the concentration values measured at Sülysáp with the public data [6] measured by the OLM. Among the OLM measuring stations, Budapest, XVIII. district Gilice Squer measuring station is located in a residential area with family houses, about 30 km away from the measuring point established in Sülysáp. In addition, at the time of the investigation, the burning of green garden waste was already prohibited in Budapest, so we do not have to reckon with the possible effects of this, disturbing the comparison. Among the examined parameters, the concentration of ozone showed fluctuations depending on the time of day characteristic of the parameter in both examined periods. The data measured on Sülysáp and Gilice Square in Budapest showed good agreement (Figure 4). This can be explained by the fact that the resulting ozone concentrations can primarily be linked to the intensity of solar radiation, which effect was similar at both measuring points, and the burning of green waste has no significant effect on it.

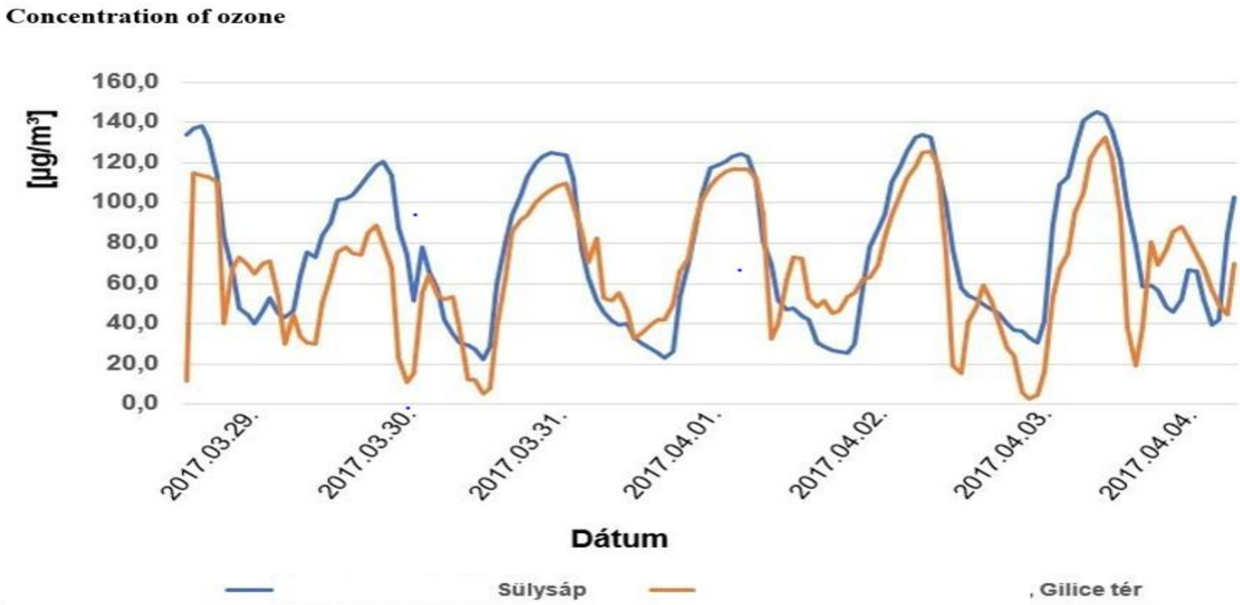

Figure 4: Concentrations of ozone in Sülysáp and in Gilice Square (Budapest) [4]

Due to the low flame temperature and uneven oxygen supply during the outdoor burning of green garden waste, we can assume a significant emission of solid particles. In accordance with this, the results of the series of tests show the impact of local emissions on air quality most strongly in the case of PM10 data. The PM10 data of the spring test period can be seen in Figure 5.

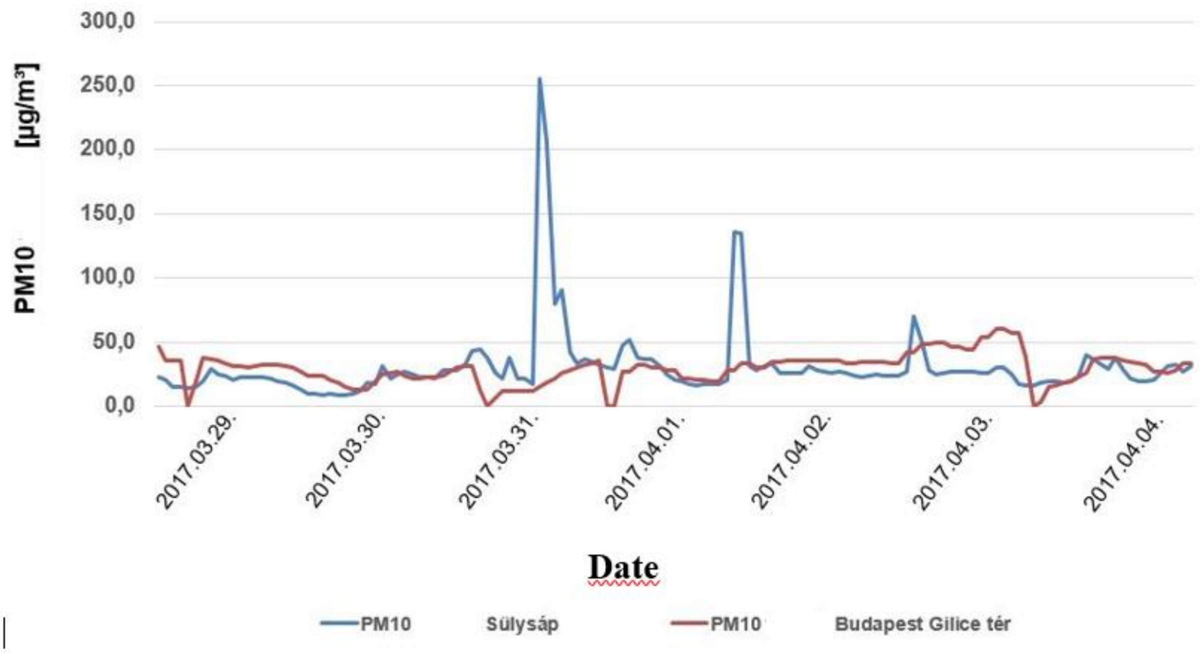

Figure 5: Concentrations of PM10 in Sülysáp and in Gilice Square (Budapest) [4]

It can be seen in the fifth figure that the PM10 values measured in Sülysáp show good agreement with the measured data of the Gilice tér measuring station located about 30 km away for most of the examined period, but the values measured on Friday, March 31, 2017 differ significantly. The exceptionally high PM10 concentration measured in the Sülysáp area on Friday can clearly be linked to the burning of green garden waste in otherwise windless weather.

Public opinions on open air burning of garden green waste

At the same time as the series of tests, a social debate broke out in Sülysáp regarding the burning of green garden waste. Part of the population initiated a complete ban on the burning of garden waste due to the inconvenience caused by the air pollution associated with the activity (clothes spread out will smell, you cannot stay in the garden on Friday afternoon).

The initiative provoked fierce protests from another segment of the population. In their opinion, the complete ban is unreasonably restrictive, and they are not aware of any other feasible options for disposing of garden waste. [7] The municipality of the settlement conducted a non-representative vote on the issue in the form of a questionnaire that can be filled out freely on the Internet.

The majority of respondents did not support the complete ban on burning green waste in the garden on Fridays (Table 1), therefore the regulations did not change substantially at that time.

Table 1: Reults of non representative vote in Sülysáp on burning of green garden waste

Quastions	Vote (Head)
Smoking on Fridays should be banned, as you can suffocate on Fridays from the smoke. Composting or using the "green route", i.e. transporting garden waste, may be a suitable solution.	206
It is still necessary to be able to burn dry garden waste once a week.	209
Burning should be allowed every day, so the smoke would not be unbearable on Fridays, it would be better distributed, there would only be a little smoke in the settlement every day	68

Using of case of Sülysáp in environmental engineer training

The primary goal of environmental engineering training is to train professionals who can apply the acquired knowledge independently and creatively. One of the tools for this can be if we confront the students with professional problems that exist in reality, and in the course of learning about them and then solving them individually or in small groups, they have to apply what they have learned in a complex way. Application in training can take place in three steps that build on each other:

Problem posing, analysis

We give information about burning of green garden waste in a small town. We explain the arguments and reasons of certain groups of the population. Together, we interpret the public debate from an environmental protection point of view. After that, the students should prepare a sampling and measurement plan during homework, knowing the specific settlement, which may be suitable for revealing the true extent of the problem.

EVALUATION

The completed sampling plans are interpreted and discussed together, and then the implemented sampling plan and the measurement results are presented to the students. We interpret the test results together.

formulation of proposals, reasoning

As part of their homework, the students formulate proposals with the help of which the activity (burning waste) can be stopped. After that, we will discuss the proposals together. Convincing the public can also be part of the task, so the proposals must be supported by understandable arguments for the students.

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HEAVY METAL CONCENTRATIONS IN SOIL, SEDIMENTS, WATI AND PLANT SYSTEMS ALONG THE LEFT BANK OF THE DANUE BETWEEN RIVER KILOMETRES 1653 AND 1655

Ágnes BÁLINT[1]*, Tibor DEMÉNY[2], Xuechu WANG[3], Csaba MÉSZÁROS[4]

[1]**Institute of Environmental Engineering and Natural Sciences and Hydro-Bio-Mechanical Syster Research Center, Óbuda University, Budapest, Hungary, e-mail: balint.agnes@uni-obuda.hu, mobile: +36303721342,*
[2]*Pro-mees Ltd. Job safety & environmental protection consultant, Vác, Hungary, e-mail: demeny.tibor.lajos@gmail.com, mobile: +36 30 605 0284*
[3]*Doctoral School of Environmental Sciences, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary, e-mail: victorwxch@gmail.com*
[4]*Institute of Mathematics and Basic Sciences, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary, e-mail: Meszaros.Csaba@unimate.hu*

Abstract.
There are many pollutants that threaten our environment, via environmental damage caused by heavy metals putting a heavy burden on soil, plant, water, and air systems. All heavy metals are naturally occurring without anthropogenic interference. Heavy metal concentrations have been determined along the Danube coastline. The following heavy metals were measured in the water and sludge in the Újpest Bay: Mn, Fe, Cu, Zn, Cd, Pb. The second sample area was Palotai Island, where, in addition to the above-mentioned ones, the concentrations of Al, Ni and Cr were also measured in soil, water and plant samples. The samples were prepared in a Milestone 1200 mega microwave shredder. The samples taken in the Újpest Bay were analysed with an ATI 939 UNICAM FAAS instrument in absorption mode. Samples from Island were measured by Jobin-Yvon 24 ICP-OES. In the Bay, the concentrations of copper and zinc in the sludge exceeded the contamination limit at one point and two points, respectively. The concentrations of heavy metals in the water samples were below the detection limit of the measurement technique used. In the soil samples taken at the island, zinc concentrations exceeded the contamination limit at point T16, and chromium concentrations exceeded the contamination limit at points T15 and T16. In water samples, iron and chromium concentrations were below the detection limit. Cadmium and lead were the most abundant elements in the water samples.
It was also investigated whether the heavy metal concentrations in plants were correlated with the soi metal concentrations. A positive correlation was found for iron, aluminium, and manganese. From the it can be concluded, that a good proportion of the heavy metals in the soil are in forms that are not t by plants.

***Keywords**: contamination, Danube, heavy metal, sediment, water sample, plant samples*

INTRODUCTION

The population of the Earth is unavoidably growing [1]. For the population's supply it is necessary to manufacture increasingly more foods, but this is not at all an easy task. Unfortunately, universally can be related, that the soils are worn out because of the human irresponsibility primarily, eroded or they will be more contaminated.

The technique developed nowadays, that certain plants can be produced without soils, but there are same basic plants, which could not be economical in this manner to produce. Therefore, it is necessary to estimate, preserve the condition of the soils and improve its quality, but the prevention is the most important.

The soil, plant, and water systems make up our natural environment [2]. Water is essential for life and soil provides nutrients for plants, without which our planet would become uninhabitable. The earth is one of our most important treasures, so it is our responsibility to look after it. The Native American saying that "The earth is not a gift from our parents, but a loan from our children" is the best way to express the right attitude towards the environment.

There are many pollutants that threaten our environment, with heavy metals [3] causing environmental damage to soil, plant, water, and air systems. All heavy metals are naturally occurring without anthropogenic interference. However, human impact often drastically alters the quantities of these substances, especially along industrial sites and in densely populated areas. Naturally occurring levels can also be harmful in some cases and there is hardly possible to find a place on earth today where some form of anthropogenic pollution or a harmful process triggered by human activity cannot be detected.

The first and most important problem is the direct adverse health effects of pollution in our environment, which are mostly long term and thus go unnoticed. Cases where the harmful effects occur in large numbers of people in a brief period of time are written about in textbooks and history books as cautionary tales. Harmful substances can be lurking in our immediate environment without our even noticing. But they do have harmful effects. That is why it is important to look more closely at our environment. In this way, we can prevent ourselves from living in an unhealthy environment without knowing it. It is also possible that the company or individual polluting the environment is unaware of the risks of their activities. In such cases, the priority is to inform them of the possible consequences and, if they do not stop polluting of their own volition, to force them to do so. The key of the solution is prevention, where the foresight and careful planning are essential, as it is easier not to spill a glass of water than to wipe it up after it has been spilled.

The health damaging effects of heavy metals [4] were known early in the medieval gold mines, where mercury was used to extract gold. The average age of gold miners at that time was 20-30 years. The industrial revolution saw a rapid increase in the production and use of heavy metals [5]. Since then, a series of major industrial disasters have taught humankind that if we do not deal responsibly with the large quantities of hazardous substances produced by industry, we will pay a high price. In addition, heavy metals are also characterised by accumulation [6], which can result in serious long-term health damage from prolonged exposure to ridiculously tiny amounts.

Recreational and sporting activities take place in Újpest Bay (e.g. Budapest Rowing Association, anglers) and we wanted to know how contaminated the area is with heavy metals. The Újpest Bay [7] has been building and repairing boats since 1856. That used to mean wooden boats, but nowadays the old workshops are for boat repair. This activity is clearly visible from the water when rowing. Most strikingly, when the old hull is being polished below the waterline, you can see the dust rising from a distance. We were interested to see whether this dust would release heavy metals into the water and what would settle out into the sediment.

With the second sample site (Palotai Island [8]), the aim was to investigate the impact of the North Pest WWTPs (Wastewater Treatment Plants) on the water, soil, and vegetation in its immediate vicinity. This site was also chosen because a cenological survey had already been conducted in the same area and we were curious to see whether the area was contaminated in any way with heavy metals and to what extent these heavy metals had accumulated in the local vegetation. It is also important to note that the area is visited by quite many people.

MATERIALS AND METHODS

Sampling area and sampling

The Újpest Bay

Pictures of the area are shown in Figures 1-3. The area where the training sessions are held by the water sports clubs in the area is marked with a red line. The pictures clearly show that most of the sampling points coincide with the area used for training. The additional sampling locations were justified by the accessibility and frequent use of the back of the Bay by water sports enthusiasts, as well as the presence of a winter marina and a major boat repair facility. The aim of sampling the back of the Bay was to prove the hypothesis that the heavy metals found in the Bay are mainly from the back of the Bay, where there is a boat repair workshop.

In addition to the workshop, other sources of pollution could be the ships that use this area as a winter berth. Substances from ships entering the water can also settle and accumulate in the mud. The other ship repair service in the Bay is located at the head of the Bay about 200 m NW (North-West) of sampling point 1, but it is smaller in size and as the service is on a floating platform, we were unable to sample in its immediate vicinity.

These repair workshops only deal with metal hull vessels. From a simple passenger ferry to a barge, one of which hit a bridge some years ago at Dunaföldvár. Transport can be another source of pollution. Fortunately, there is truly little car traffic on People's Island, but much more on the western side of the Bay. In places, the Váci road is less than 5 to 10 m from the open water surface. Air pollution from vehicles can easily leach into the water of the Bay. In connection with vehicles, it should be mentioned that there are two motorboat moorings in the Bay. One is directly to the west of the entrance to the Bay, the other is at the western foot of the North Link Bridge that crosses the Bay. Because of this, the speedboat traffic in summer is significant.

Figures 1, 2, 3 show the sampling points, distinguishing between mud and water sampling locations. Unfortunately, it was not possible to take mud samples at all the sites where water samples were taken, the main reason being that the water was too deep, and we could not reach the riverbed (no sampling device was available to allow this). The sampling was done according to the Hungarian standard (MSZ 1484-3:2006).

Samples were taken from a boat. Water samples were taken in 500 ml plastic bottles, which were soaked in a 1:9 dilution of nitric acid solution for 24 hours prior to sampling. The samples were then filtered through a membrane filter with a pore diameter of 0,45 µm, 5 ml of nitric acid (1:1 dilution) and were added to the samples and all were then cooled. Sludge samples were also taken from a boat using a long-handled plastic sampler. The sludge samples were placed in 750 ml plastic containers.

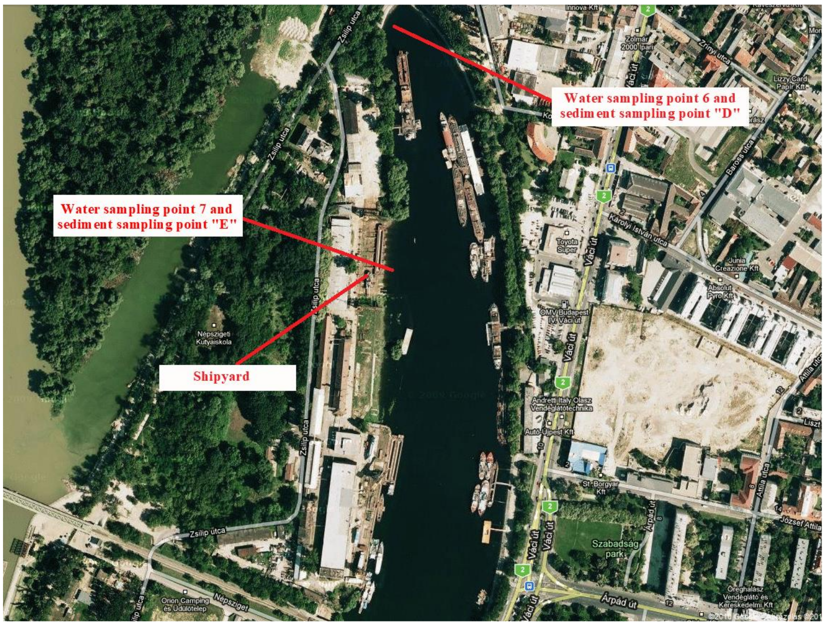

Figure 1. The northern part of the Bay with the sampling points [9]

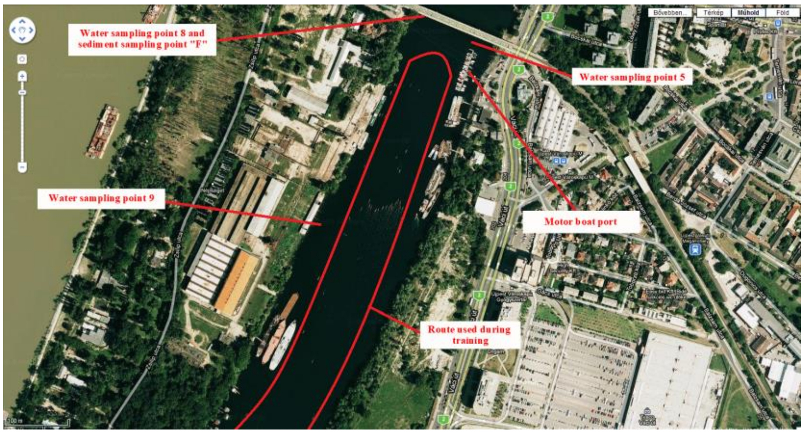

Figure 2. The central part of the Bay with the sampling points [9]

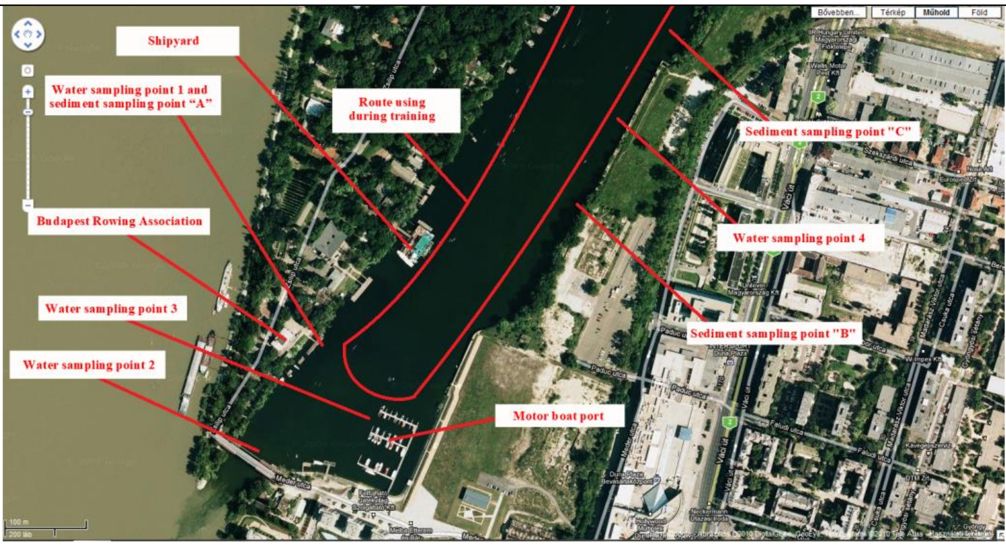

Figure 3. Southern part of the Bay with sampling points [9]

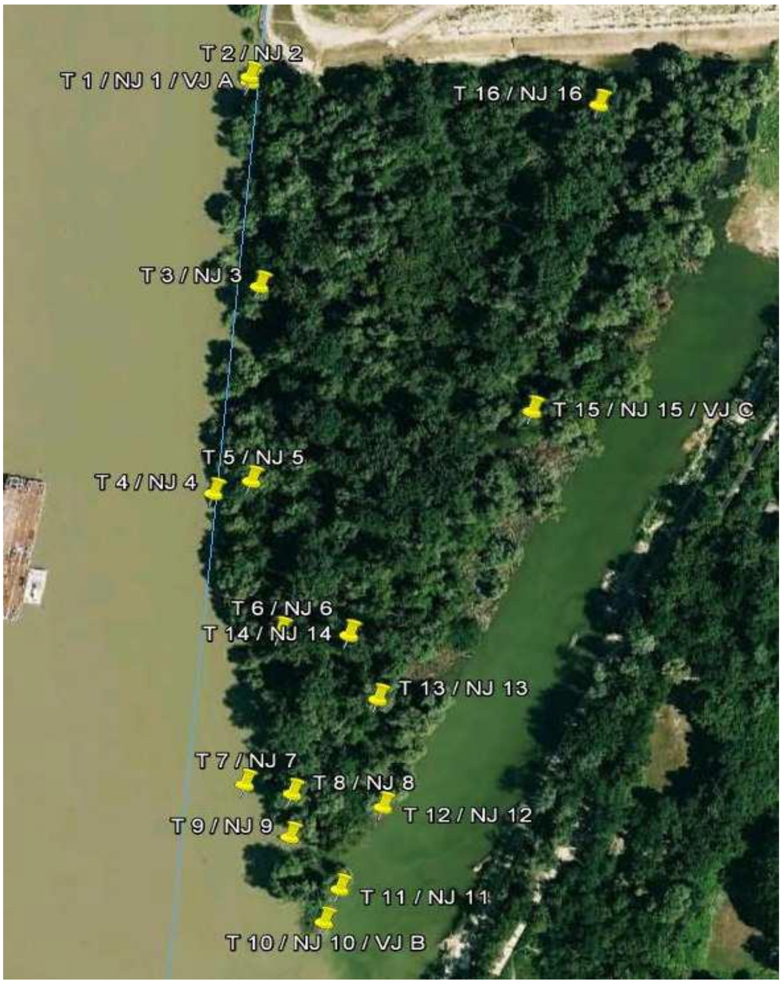

Figure 4. Sampling points in Palotai Island [9]

The Palotai Island

Palotai Island is far from all sources of pollution, apart from the North Pest water treatment plant and the rubbish people bring there. Quite a few people visit the island and use the area for recreation. They also often fish here. The sampling sites were randomly selected. The first criterion

for the selection was that the sampling point should be accessible, i.e., not too densely vegetated. The second criterion was to be able to take soil and plant samples at all sites, where the height of trees was limited in some places, and water samples were also taken at 3 sites. The third aspect was to cover the whole island, but special attention was paid to areas closer to the water, because of the higher frequency of water cover and the higher frequency of sedimentation of pollutants. The exact location of the sampling points was recorded using a global positioning device. Figure 4 clearly shows the sampling points and Palotai Island.
Soil samples were taken in plastic bags from the top 0-10 cm layer of soil. More were brought into the laboratory on the day of sampling, and each was placed on a separate plastic tray to air dry. Plant samples were taken from willow trees. The fresh shoots of the trees were removed (last 20-30cm). The shoot ends were rolled up and placed in the same plastic bag as for the soil samples. Plant samples were also brought into the laboratory on the day of sampling. In the laboratory, the samples were stored frozen until processing.

For water samples, plastic containers were used for sampling. The vessels were filled with a 1:9 solution of nitric acid: distilled water was kept in the vessels for 24 hours prior to sampling, to remove any heavy metals that might be present in the bottles. Nitric acid of 65 % analytical purity and twice distilled water were used for the solution. Before sampling, the contents of the bottles were emptied. Water samples were taken half a metre from the shore. The sample containers with the sample were washed once with the sample and then filled. The water samples were also brought to the laboratory on the day of sampling. In the laboratory, samples were filtered using a 0.45μm pore diameter (Millipore HAWG047S6 cellulose ester) membrane filter. To the filtered water samples, 1 ml of a 1:1 nitric acid, distilled water solution was added per 100 cm^3 to preserve the samples. Again, the above-mentioned quality materials were used for the solution. After preservation, the samples were stored in a refrigerator until use. Water samples were taken three times.

Sample preparation, digesting

Digestion was conducted in a Milestone 1200 mega microwave digestion unit. The method consists of saving the heavy metals bound in organic form in the sample by digesting the organic compounds. Nitric acid and hydrogen peroxide are added to the sample, which is then heated by microwaves and the process converts the organics to carbon dioxide, metals, and non-metals to nitrates and Si to dissolved silica in the medium. In selecting the amount to be digested, the size of the vessel used for digestion should be considered and the analytically purest solutions should be used.

Digestion of water samples

The samples arrived in the laboratory already prepared as described in the sampling section, preparation consisted only of heating to room temperature. Approximately 5 g of the samples (i.e., about 5 cm^3) were added to the Teflon flasks, 5 cm^3 nitric acid and 1 cm^3 hydrogen peroxide were added and sealed. The flasks were then placed in the digester for about half an hour and cooled for about 30 minutes after the end of the program.

After the samples had been cooled, they were opened in a room equipped with an extractor hood. The digested suspension was filtered into a 25 cm^3 standard flask and made up to 25 cm^3 twice with distilled water. Samples were stored in the refrigerator until use.

Digestion was performed according to the appropriate recipe in the Milestone mega 1200 "Cook-book", which is shown in Table 1.

Table 1. Digestion program for water samples

Step	Time	Power
	minutes	W
1.	0:06:00	250
2.	0:06:00	400
3.	0:06:00	650
4.	0:06:00	200
Ventilation: 00:05:00 Rotorctrl: on Twist: on		

Digestion of sediment samples

Once the sediments samples were brought into the laboratory, they were placed on drying trays to air dry, this took approximately two weeks. External matter - plant parts, shells, etc. - was then removed from the samples, which were crushed in a mortar and sieved through a sieve with a hole diameter of 0.32mm.

From the previously sieved mud samples, approximately 0.5g was measured into the bombs. Then, 2cm^3 of hydrogen peroxide and 5cm^3 of nitric acid were added and the bombs were sealed and placed in the destructor for about half an hour. At the end of the digestion, the bombs were placed in a water bath for 30 minutes and, when cool, were opened under an extractor hood. The shattered suspension was filtered into a 25cm^3 standard flask and then made up to 25cm^3 twice with distilled water. The samples were stored in a refrigerator until use. Digestion was conducted according to the corresponding recipe in the Milestone mega 1200 "Cook-book", which is shown in Table 2.

Table 2. Digestion program for sediments

Step	Time	Power
	minutes	W
1.	0:06:00	250
2.	0:02:00	0
3.	0:06:00	400
4.	0:06:00	650
5.	0:06:00	250
Ventilation: 00:05:00 Rotorctrl: on Twist: on		

Digestion of soil samples

The foreign materials - plant parts, stones, etc. - were removed from the samples and then crushed in a mortar and sieved through a sieve with a 2mm and 0.2 mm hole diameter. From the previously sieved soil samples, 0.5g was measured into Teflon bombs. Then 2cm^3 of hydrogen peroxide and 5cm^3 of nitric acid were added, the bombs were left to stand for half an hour and then placed in the digestion unit for about half an hour. At the end of the digestion, the bombs were placed in a water bath for 30 minutes and when they had cooled down, they were opened under a hood. The shattered suspension was filtered into a 25cm^3 standard flask and then made up to 25cm^3 twice with distilled water. The samples were stored in a refrigerator until use. Digestion was carried out according to the corresponding recipe in the Milestone mega 1200 "Cookbook", which is shown in Table 3.

Table 3. Digestion program for soil samples

Step	Time	Power
	minutes	W
1.	0:05:00	250
2.	0:02:00	0
3.	0:05:00	400
4.	0:05:00	250
5.	0:07:00	700
Ventilation: 00:05:00 Rotorctrl: on Twist: on		

Digestion of plant samples

After the plant samples were taken to the laboratory, they were frozen until use. Preparation started by taking the samples out of the freezer. After warmed to room temperature, branches and leaves were cut up with scissors and put into Petri dishes. The samples were then dried at 70°C for 72 hours. After drying, the samples were placed in an exicator and weighed after cooling. The samples were then rubbed in an agate mortar and sieved through a 0.2 mm sieve. The sieved samples were re-dried at 70°C for 24 hours. Approximately 0.5g of the redried plant samples were weighed into Teflon bombs. Then, 1cm^3 of hydrogen peroxide and 6cm^3 of nitric acid were added, left to stand for half an hour and placed in the destructor for about half an hour. At the end of the destruction, the bombs were placed in a water bath for 30 minutes, and when cooled, they were opened under a fume hood.

The shattered suspension was filtered into a 10 cm^3 standard flask and then made up to 10 cm^3 twice with distilled water. The samples were stored in a refrigerator until use. Digestion was conducted according to the corresponding recipe in the Milestone mega 1200 "Cookbook", which is shown in Table 4.

Table 4. Digestion program for plant samples

Step	Time	Power
	minutes	W
1.	0:02:00	250
2.	0:02:00	0
3.	0:06:00	250
4.	0:05:00	400
5.	0:05:00	600
Ventilation: 00:05:00 Rotorctrl: on Twist: on		

Determination of the dry matter content of sediment samples from air-dry samples

Approximately 5 g of air-dry sludge sample was weighed from the sieved sludge samples into containers with polished covers. The mass was measured using an analytical balance. The contaminant concentration was converted to dry matter content by a factor obtained from the ratio of air-dry to 105°C dried soil.

Measurement of heavy metal concentrations in sediment and water samples from Újpest Bay

The measurement was performed with an ATI 939 UNICAM AAS instrument in atomic absorption mode. First, a calibration series of solutions of known concentration (Table 5.) was prepared and recalibrated with these solutions every forty measurements and then the absorbance of the samples was measured. Based on the calibration, the specific value of the concentration of the samples was determined according to the Lambert-Beer law. The concentration of the sludge samples was converted to mg/kg and the concentration of the water samples was expressed in mg/L. The standard solution series and instrument settings shown in the table below were used for the different substances.

Table 5. Concentrations and wavelengths of the calibration solutions used for the test substances.

Name of material	Concentrations of solutions used for calibration (ppm)	Wavelength (nm)
Zinc (Zn)	0.5; 1; 2; 4	213.9
Cadmium (Cd)	0.5; 1; 2; 4; 6	228.8
Manganese (Mn)	0.5; 1; 2; 4; 6	279.5
Lead (Pb)	2; 4; 8; 16	283.3
Copper (Cu)	1; 2; 4; 8	324.8
Iron (Fe)	1; 2; 4; 8; 16	248.3

Measurement of heavy metal concentrations in soil, sediment, plant, and water samples from Palotai Island

Measurements were performed on a Jobin-Yvon 24 ICP-OES instrument. The instrument is a sequential spectrometer of scanning type, and high resolution. The spectrometer has a holographic grating (3600lines/mm), a focal length of 640nm, a resolution of 0.013nm and a linear dispersion of 0.40nm/mm. The instrument gave the concentrations of the samples evaluated, corrected for sample preparation.

STATISTICAL ANALYSIS

For the evaluation of the results, simple calculations were performed using Microsoft Excel 2003 version of the Microsoft Office suite. The same program was also used to produce the charts. Other statistical calculations were performed using the statistical software package SPSS 19.0 for Windows.

RESULTS AND DISCUSSION

The Újpest Bay

Water samples

All water samples taken in the Bay are below the detection limit of the instrument used in the concentrations of all heavy metals analysed.

Sediment samples

The locations of the sediment samples sampling points are shown in Figures 1, 2 and 3. The sediment samples sampling points are marked with the letters A, B, C, D, E, F. Based on a survey carried out in 2001 in which the following materials were sampled: Al, As, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ni, Zn, sediment and suspended sediment from the Danube in the 1800s river kilometre in the 1800s. Towards river kilometre 1000 where the Iron Gate reservoir is located, there is an increasing trend in heavy metal concentrations [10].

Manganese

The results for manganese are presented in Figure 5. The current legislation does not currently set a contamination limit for manganese in soil medium, and sediment is part of the soil medium. The measured results are shown in Figure 5. The observations were supported by an analysis of variance (ANOVA).

A 1-factor random order analysis of variance was performed, as the sampling location was chosen randomly. ANOVA revealed that manganese concentration was significantly dependent on sampling site ($LSD_{5\%}$=47.677). Pairwise comparison showed that the thirty samples tested 22 of the 30 correlations showed a significant difference and 8 showed no significant difference. Most strikingly, sample B had significantly higher concentrations than samples A, C, D, E, F.

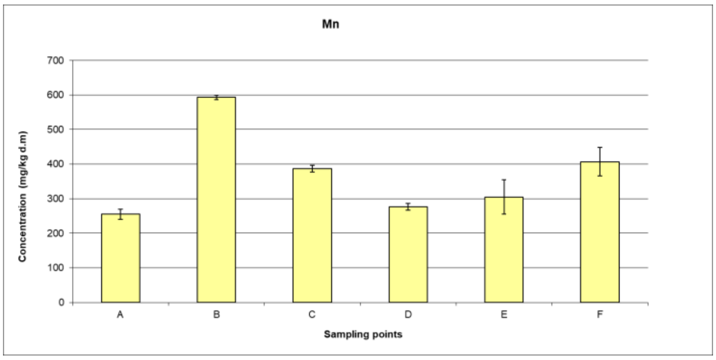

Figure 5. Manganese concentrations measured in Újpest Bay.

Iron

The results for iron are shown in Figure 6. The current regulations do not set a pollution limit value for iron in the soil medium. The measurement results were supported by performing ANOVA. A one-way ANOVA random analysis was performed, as the sampling site selection was random. ANOVA showed that iron concentration was significantly dependent on the sampling site ($LSD_{5\%}$=7195.191). The results of the pairwise comparison showed that the thirty samples' correlations, 10 showed a significant difference and 20 no significant difference. A most striking is that sample E has significantly higher concentrations than samples A, D, F samples.

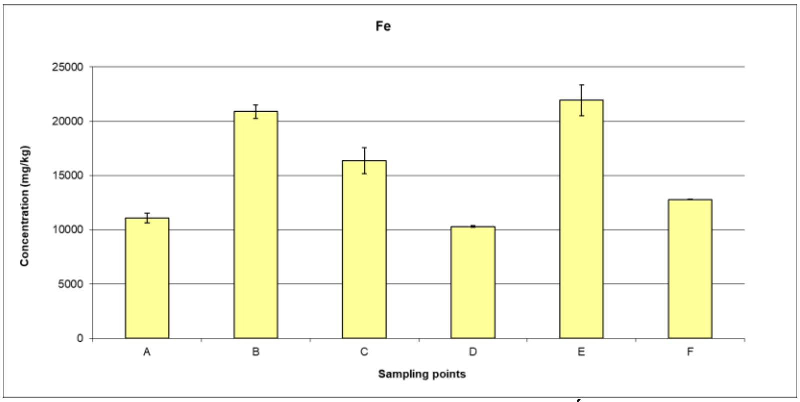

Figure 6. Iron concentrations measured in Újpest Bay.

Copper

The measured results are shown in Figure 7. The specified contamination limit for copper is 75g/kg in the soil medium according to Hungarian legislation (6/2009 (IV. 14.) KvVM-EÜMFVM). The amount of copper in the sediment exceeds the contamination limit at sampling point E. Point E is approximately 10m from the larger ship repair workshop at the back of the Bay, so the activity of the workshop is an expected cause of the pollution. The copper concentrations measured at the other points are below the pollution limit. The observations were corroborated by performing an analysis of variance. A one-way random order analysis of variance was performed, as the sampling location was chosen randomly. ANOVA showed that copper concentration was significantly dependent on sampling location ($LSD_{5\%}$=93.912). Pairwise comparisons showed that 10 of 30 correlations evaluated had significant differences and 20 had no significant differences. A most striking is that sample E has significantly higher concentrations than samples A, C, D, E, F samples.

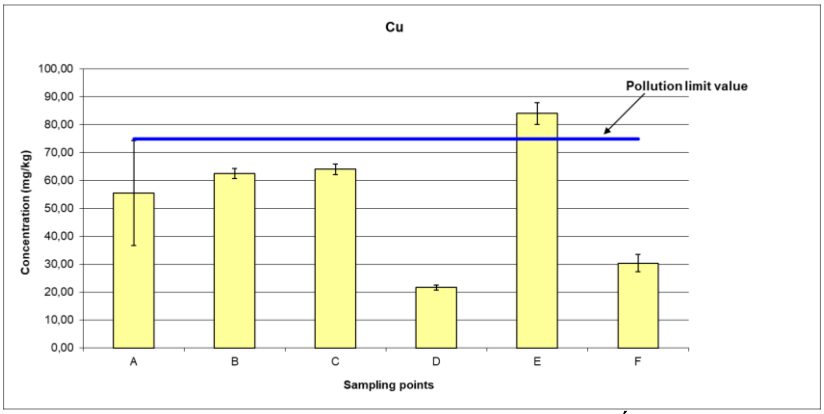

Figure 7. Copper concentrations measured in Újpest Bay.

Zinc

The results for zinc are shown in Figure 8. The contamination limit for zinc is 200mg/kg in the soil medium according to Hungarian legislation (6/2009 (IV. 14.) KvVM-EÜM-FVM). The amount of zinc exceeds the contamination limit at the points E and F in the points investigated. The concentration of zinc at points E and F is strikingly higher than at the other points. The observations were subjected to analysis of variance. A 1-factor random order analysis of variance was performed, as the sampling location was chosen randomly. ANOVA revealed that zinc concentration was significantly dependent on sampling location ($LSD_{5\%}$=19.684). The results of the pairwise comparison showed that of the thirty correlations tested, 26 had significant differences and 4 had no significant differences. Most strikingly, samples E and F had significantly higher concentrations than samples A, C, D, E, F.

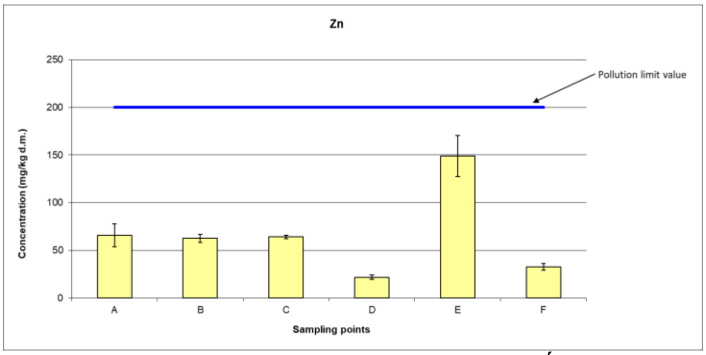

Figure 8. Zinc concentrations measured in Újpest Bay.

Cadmium
In Újpest Bay, cadmium concentrations were below the detection limit of the method used at all points evaluated.

Lead
Lead concentrations in Újpest Bay were below the detection limit of the method used at all points assessed.

Summary
Overall, the results of the sludge samples show that the heavy metal concentrations in the Bay are below the contamination limits in all but three areas, which is better than expected but not reassuring. Further testing would be worthwhile to ascertain the extent of copper and zinc contamination and where its originated from. Several heavy metals are well detected in the sediments, so it is possible that these metals are enriched in aquatic organisms. The results for water are encouraging, as this is the medium most aquatic athletes meet, so it is good news that no contamination has been found.

Palotai Island

Water samples
The water sampling points are shown in Figure 4. The water samples are marked with V indicates that it is a water sample. The letters A, B, C, indicate the sampling location. The concentrations of the analytes in the samples are, with few exceptions, below the detection limit of the method used and therefore statistical analysis of these results could not be performed.

The existing values were compared with the values given in the Hungarian standard (MSZ 12749) and the results were used to assess the water quality of the Danube. In all cases, only values above the detection limit were considered and where there were several valid parallel measurements for the same sample. According to the standard, if less than 12 samples are taken in a year, samples are taken from a given point, the highest value is taken as the standard. The water quality classes at the different sampling points are shown in Figure 9.

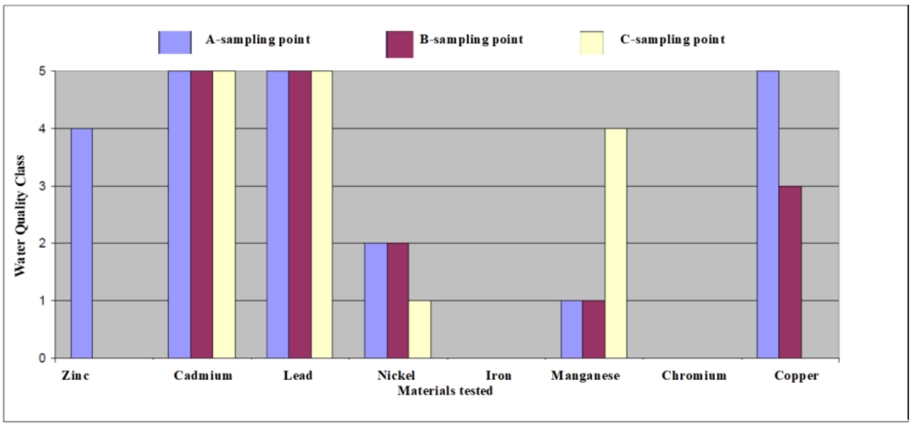

Figure 9. Water quality classes of water sampling points.

Soil

The soil sampling points are shown in Figure 4. Soil samples are marked with a T to indicate that they are soil samples. The first number indicates the sampling location. The second number is the replicate number. The samples taken from Palotai Island were compared with the results of the Hungarian legislation (6/2009 (IV. 14) KvVM-EÜMFVM of 6.6.2009 (VIVA)). For soil samples, in general it is observed that samples from T1 to T10 have lower concentrations of heavy metals than in samples T11 to T16. The contamination limit values are exceeded in only a few cases, of which the highest is the chromium content in sample T15, which is more than six times the contamination limit value. Further studies are needed to explain why the T16 point concentration is so high for chromium.

Aluminium

The aluminium concentrations measured on Palotai Island are extremely high, mainly due to the soil-forming clay deposits contain high amounts of aluminium. One of the basic building blocks of the clay formations is the octahedral arrangement surrounded by six oxygen species (Al^{3+}). Current legislation does not set a contamination limit for aluminium in the soil medium. Among the samples, it can be observed in Figure 10. that T11 and the following are significantly higher than those before. The observations were supported by performing analysis of variance. 1-factor randomization analysis of variance was performed, as the sampling locations were chosen randomly. Aluminium concentration was significantly dependent on sampling location ($LSD_{5\%}$=2844.810). Pairwise comparisons were performed for 140 of the 240 correlations evaluated, one hundred had no significant difference. Most strikingly, there were no significant differences between the T11, T12, T13, T14, T15, T16 have significantly higher concentrations than T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

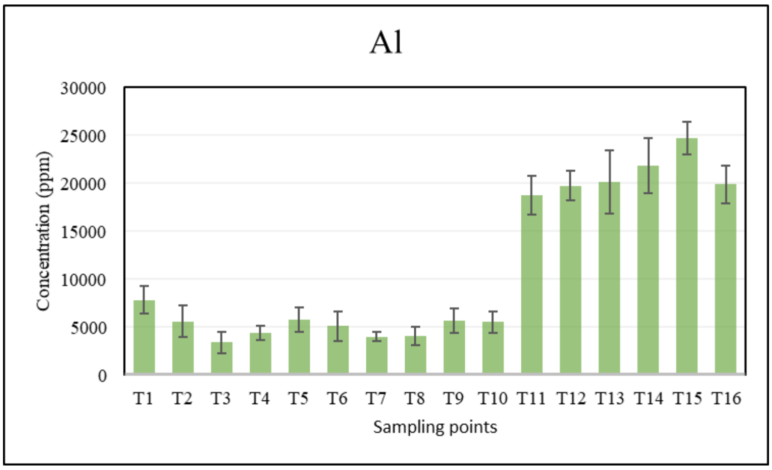

Figure 10. Aluminium concentrations in the different soil sampling points.

Manganese

The current legislation does not set a pollution limit value for manganese in the soil medium. Among the samples, it can be observed on the Figure 11 that the manganese concentrations in samples T1 to T10 are significantly lower than in samples T11 to T16. The observations were corroborated by performing analysis of variance. A 1-factor random order analysis of variance was performed since the selection of the sampling location was random. ANOVA showed that manganese concentration was significantly dependent on sampling location ($LSD_{5\%}$=64.155). The result of pairwise comparison showed that 146 out of 240 correlations evaluated were significantly dependent on sampling location ($LSD_{5\%}$=64.155), 94 had no significant difference. Most noticeable, there were no significant differences between T11, T12, T13, T14, T15, T16 have significantly higher concentrations than T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

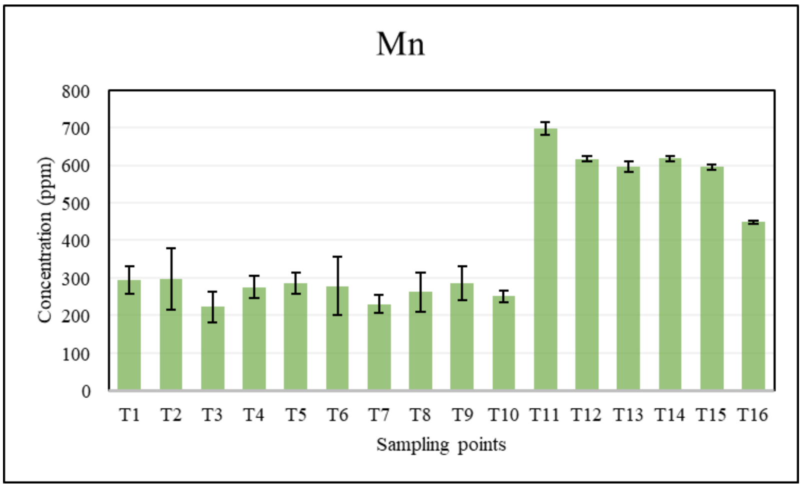

Figure 11. Manganese concentration in different soil sampling points.

Iron

Current legislation does not set a pollution limit value for iron in the soil medium. Among the samples, it can be observed on the Figure 12. that the iron concentrations in samples T1 to T10 are significantly lower than in samples T11 to T16.

The observations were supported by performing analysis of variance. 1-factor random analysis of variance was performed since the selection of the sampling site is random was random. ANOVA showed that iron concentration was significantly dependent on sampling location ($LSD_{5\%}$=1545.695). Pairwise comparisons showed that 158 of the 240 correlations evaluated had significant differences and 82 had no significant differences. Most strikingly, samples T11, T12, T13, T14, T15, T16 had significantly higher concentrations than T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

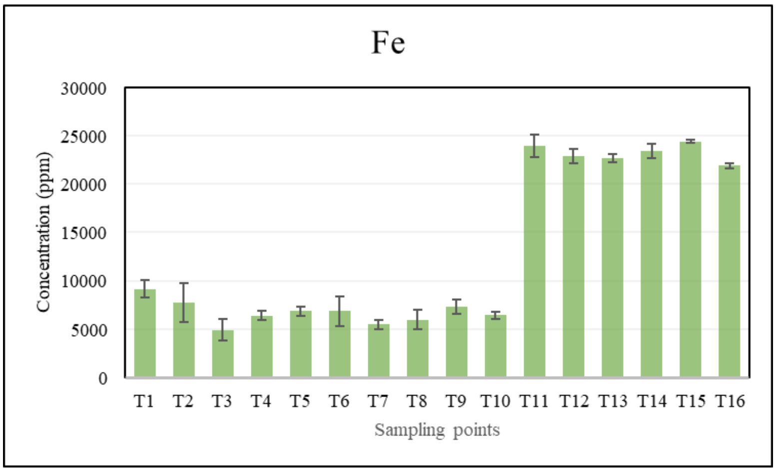

Figure 12. Iron concentration in different soil sampling points.

Copper

The current legislation sets a contamination limit of 75 ppm for copper in the soil medium, indicated by the horizontal red line on the Figure 13. Among the samples, it can be observed on the Figure 13 that the concentrations of samples T1 and T2 are slightly higher than the concentrations of samples T3 to T10. The copper concentration of samples from T11 to T14 is visibly higher than that of samples from T1 to T10. At points T15 and T16, the measured copper concentrations are exceptionally high. The observations were corroborated by performing analysis of variance. 1-factor random order analysis of variance was performed since the sampling location selection was random. ANOVA showed that copper concentration was significantly dependent on sampling location ($LSD_{5\%}$=2.078). The results of the pairwise comparison showed that 202 of the 240 correlations assessed had significant differences and 38 had no significant differences. Most strikingly, the samples T11, T12, T13, T14, T15, T16 had significantly higher concentrations than samples T1, T2, T3, T4, T5, T6, T7, T8, T9, T10.

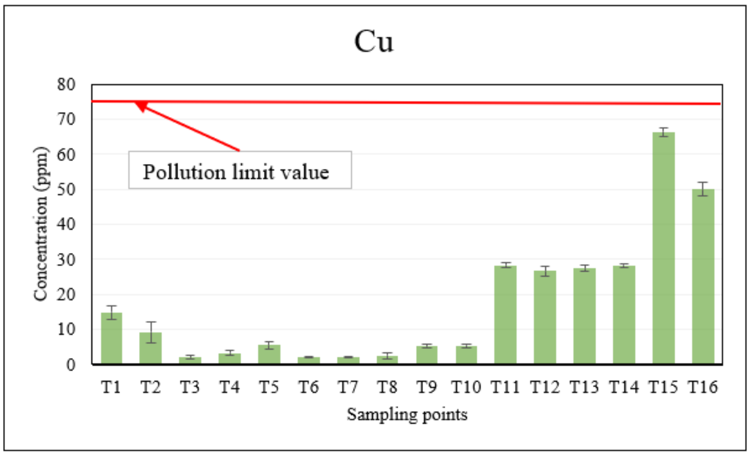

Figure 13. Copper concentration in different soil sampling points.

Zinc

The current regulations set a contamination limit of 200ppm for zinc in the soil medium, indicated by the horizontal red line on the Figure 14. Among the samples, it can be observed on the Figure 14. that the samples from T1 to T10 show a small variation, whereas the zinc concentration in these samples is clearly higher in the samples from T11 to T14. The zinc content measured at T15 and T16 is prominently high compared to the other folds. The observations were supported by performing analysis of variance. 1-factor random order analysis of variance was performed since the sampling location selection was random. ANOVA showed that zinc concentration was significantly dependent on sampling location ($LSD_{5\%}$=5.890). Pairwise comparisons showed that from 240 examined relationships, 206 confirmed significant differences and thirty-four did not. Most remarkable is that samples T11, T12, T13, T14, T15, T16 have significantly higher concentrations than samples T1, T2, T3, T4, T5, T6, T7, T8, T9, T10. The concentration of the sample taken at point T16 exceeds the contamination limit and the others are below the limit.

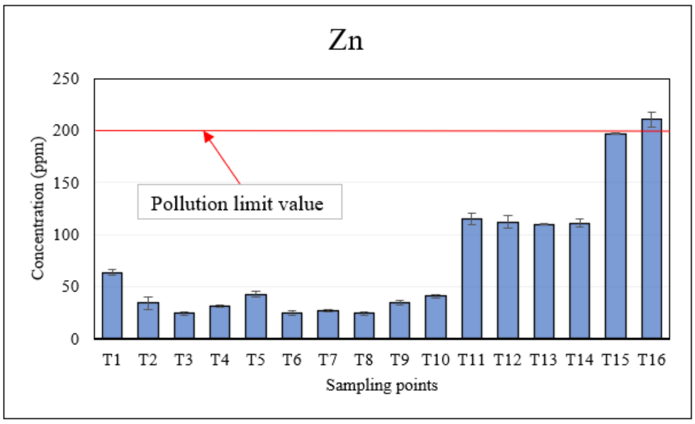

Figure 14. Zinc concentration in different soil sampling points.

Cadmium

Current regulations set a contamination limit of 1 ppm for cadmium in the soil medium. Among the samples, it is observed that only in samples T11 (0.4922±0.0897 ppm) and T12 (0.2145±0.0786 ppm), measurable cadmium concentrations were measured.

In the other cases, the measured concentrations are below the detection limit of the method used. All sampling points have cadmium concentrations below the contamination limit.

Lead

The current regulations set a contamination limit for lead in the soil medium of 100 ppm, indicated by the horizontal red line on the Figure 15. On the Figure 15., it can be observed that the concentrations are lowest in samples T2 to T10, with higher concentrations at T1, T11, T12, T13 and T14. The lead concentrations in the samples taken at points T15 and T16 are exceptionally high compared to the others. The observations of the immersion results were supported by performing analysis of variance. A 1-factor random-design analysis of variance was performed, as the sampling location was chosen randomly. ANOVA showed that lead concentration was significantly dependent on sampling location ($LSD_{5\%}$=4.360). Pairwise comparisons showed that of the 240 correlations evaluated, 160 had significant differences and 80 had no significant differences. Most strikingly, samples T1, T11, T12, T13, T14, T15 and T16 had significantly higher concentrations than the other samples, with higher concentrations in samples T15 and T16. All sampling points have lead concentrations below the contamination limit.

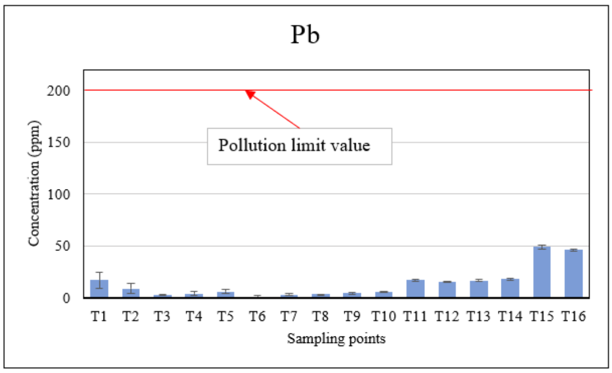

Figure 15. Lead concentration in different soil sampling points.

Nickel

The current regulations set a contamination limit of 40 ppm for nickel in the soil medium, indicated by the horizontal red line on the Figure 16. Among the samples, it can be observed on the Figure 16. that the concentrations of nickel in samples T1 to T10 are slightly higher than in samples T1, T5 and T9, and that the concentrations of nickel in samples T11 to T16 are significantly higher than in these samples. The observations of the measured concentrations were supported by performing analysis of variance. A 1-factor random-design analysis of variance was performed, as the sampling location was chosen randomly. ANOVA showed that nickel concentration was significantly dependent on sampling location ($LSD_{5\%}$=3.643). The results of the pairwise comparison showed that 158 of the 240 correlations assessed had significant differences and 82 had no significant differences. Most impressively, the concentrations in samples from T1 to T10 were significantly lower than the nickel concentrations in samples from T11 to T16. The nickel concentrations at all these points are below the contamination limit.

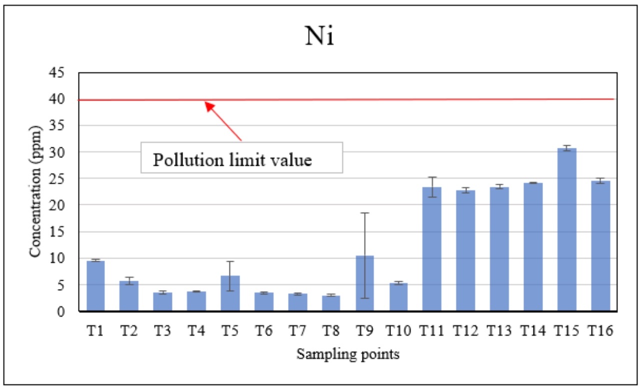

Figure 16. Nickel concentration in different soil sampling points.

Chrome

The current regulations set a soil contamination limit of 75ppm for chromium, indicated by the horizontal red line on the Figure 17. It can be observed on the Figure 17. that the chromium concentrations in samples T1 to T10 are slightly higher than in samples T11 to T14. Compared to the total measured values, the chromium concentrations measured at points T15 and T16 are extremely high. Sample T15 has several times the concentration of sample T16. Our observations were supported by performing analysis of variance. A 1-factor random order analysis of variance was performed, as the sampling location was chosen randomly. ANOVA showed that chromium concentration was significantly dependent on sampling location ($LSD_{5\%}$=6.918). Pairwise comparisons showed that 144 of the 240 correlations evaluated had a significant difference and ninety-six had no significant difference. Most significantly, the concentrations in samples from T1 to T10 were lower than the chromium concentrations in samples from T11 to T16. The chromium concentration at point T16 exceeds the contamination limit value and the concentration at point T15 is more than six times the contamination limit value. These two concentrations are above the national limit values. The values measured at the other points are below the pollution limit values.

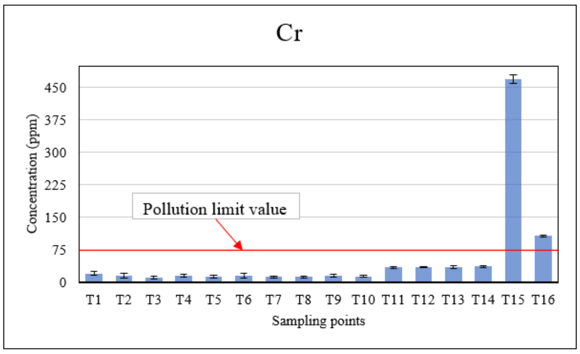

Figure 17. Chrome concentration in different soil sampling points.

Plant samples

The plant sampling points are shown on the Figure 3. The initial letter N in the plant sample labels indicates that it is a plant sample. The first number indicates the sampling location. The second number is the replicate number. There are no contamination limits for heavy metals in plants under current regulations, so no such comparison was made for these samples.

Aluminium

It can be observed on the Figure 18. that the highest concentrations of aluminium in plants are associated with points NJ13, NJ14 and NJ16. The aluminium concentrations of samples from NJ12 to NJ16 were all high. Observations were supported by performing analysis of variance. 1-factor random order analysis of variance was performed since the sampling location selection was random. ANOVA showed that aluminium concentration was significantly dependent on sampling location ($LSD_{5\%}$=244.113). Pairwise comparisons showed that 146 of the 240 correlations evaluated had a significant difference and 94 had no significant difference. Most importantly, the concentrations of the samples from T12 to T16 were in most cases significantly higher than the aluminium concentrations of the other samples.

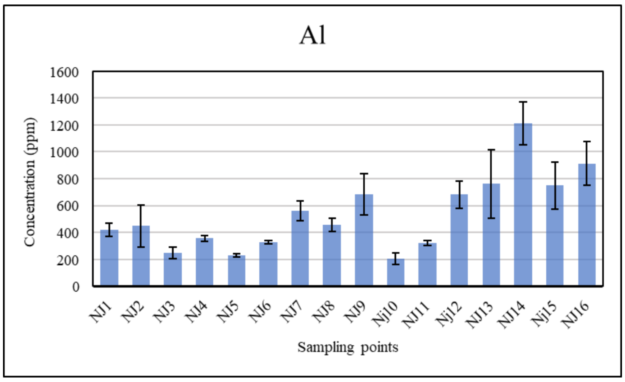

Figure 18. Aluminium concentration in different plant sampling points.

Manganese

It can be observed on the Figure 19. that the manganese concentrations measured in plants are in the same range, except for one. The manganese concentration of the plant sample taken at NJ14 is outstandingly high. Our observations were supported by performing an analysis of variance. A 1-factor random order analysis of variance was performed since the sampling location was chosen randomly. ANOVA showed that manganese concentration was significantly dependent on sampling location ($LSD_{5\%}$=19.441). The results of the pairwise comparison showed that out of 240 correlations assessed, 210 had significant differences and 30 had no significant differences. Most strikingly, the manganese concentration of sample NJ14 is significantly higher than all other samples. Furthermore, the manganese concentrations of samples NJ1, NJ2, NJ3, NJ13, NJ14, NJ15 and NJ16 are significantly higher than the other samples in most cases.

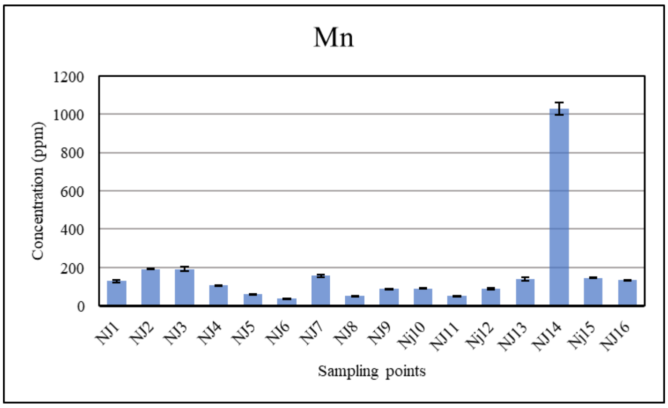

Figure 19. Manganese concentration in different plant sampling points.

Iron

It can be observed on the Figure 20. that the iron concentration in plants increases gradually from sample NJ10 to NJ14. The highest concentration of iron was at NJ14. An increasing trend is also observed from NJ5 to NJ7, followed by a slight decrease at sample NJ8 and a similar iron concentration at sample NJ9 to that at NJ7. The observations were supported by performing analysis of variance. 1-factor random order analysis of variance was performed as the sampling location was chosen randomly. ANOVA showed that iron concentration was significantly dependent on sampling location ($LSD_{5\%}$=167.760). Pairwise comparisons showed that 166 of the 240 correlations assessed had a significant difference and 74 had no significant difference. Most noticeably, the iron concentrations of samples NJ12, NJ13, NJ14, NJ15 and NJ16 were significantly higher in most cases compared to the other samples.

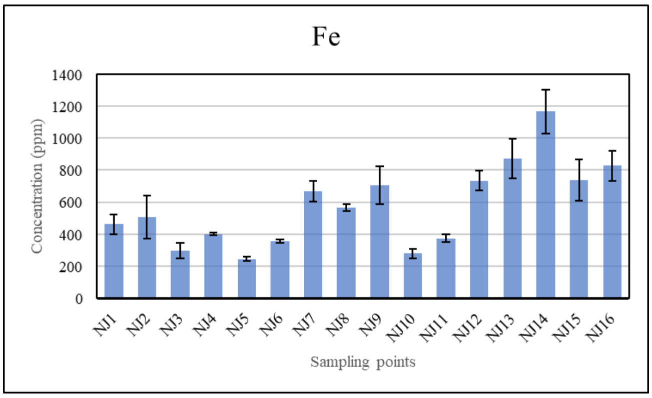

Figure 20. Iron concentration in different plant sampling points.

Copper

It can be observed on the Figure 21. that the highest concentrations of copper in plants were found at points NJ9 and NJ10. The lowest concentrations were measured at points NJ14 and NJ5. The observations were corroborated by performing analysis of variance. 1-factor random order analysis of variance was performed since the sampling location was chosen randomly. ANOVA showed that copper concentration was significantly dependent on sampling location ($LSD_{5\%}$=2.213). Pairwise comparisons showed that 214 of the 240 correlations evaluated had a significant difference and 26 had no significant difference. Copper concentrations in samples NJ9, NJ10 and NJ11 were significantly higher than those measured in the other samples.

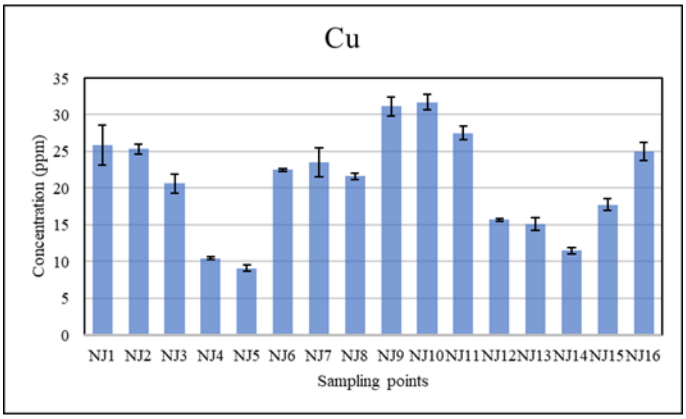

Figure 21. Copper concentration in different plant sampling points.

Zinc

It can be observed on the Figure 22. that among the zinc concentrations measured in plants, the highest concentrations were found at points NJ, NJ2 and NJ5 and the lowest concentrations at point NJ14. The observations were corroborated by performing analysis of variance. 1-factor random order analysis of variance was performed since the sampling site selection was of random character. ANOVA showed that zinc concentration was significantly dependent on sampling location ($LSD_{5\%}$=54.403). Pairwise comparisons showed that 228 of the 240 correlations assessed had significant differences and 12 had no significant differences. The zinc concentration of samples NJ13 and NJ14 was significantly lower than all other samples.

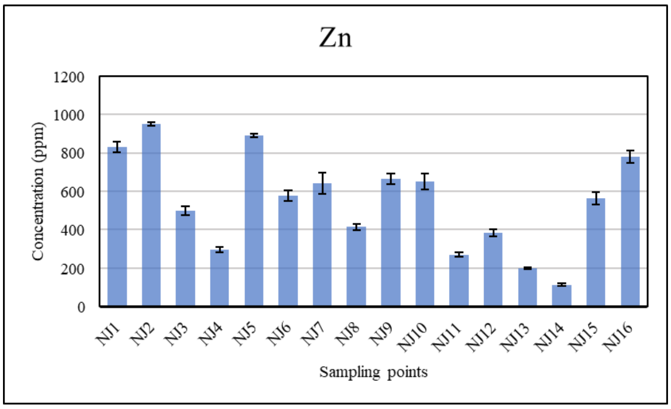

Figure 22. Zinc concentration in different plant sampling points.

Cadmium

It can be observed from Figure 23. that the highest concentration of cadmium in plants was found in point NJ15 and the lowest concentration in points NJ13 and NJ14. A decreasing and then an increasing trend from point NJ1 to point NJ6 is observed, and then the same is repeated until point NJ15. The observations were corroborated by performing analysis of variance. 1-factor random order analysis of variance was performed since the sampling location was chosen randomly. ANOVA showed that cadmium concentration was significantly dependent on sampling location ($LSD_{5\%}$=2.346). Pairwise comparisons showed that 122 of the 240 correlations tested had a significant difference and 118 had no significant difference. In most cases, the cadmium concentrations of samples NJ1, NJ6, NJ15 and NJ16 were significantly higher than those of the other samples.

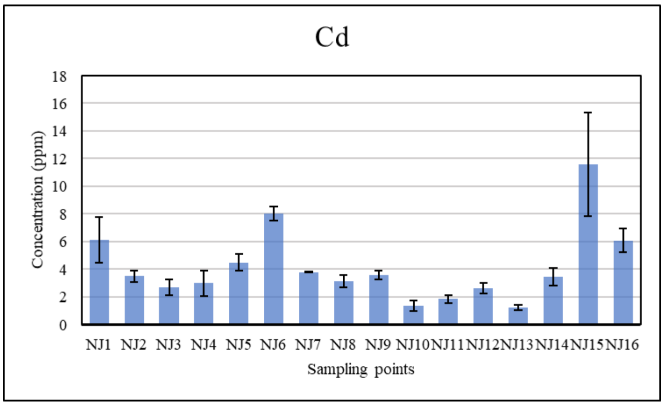

Figure 23. Cadmium concentration in different plant sampling points.

Lead

It can be observed on the Figure 24. that the highest concentrations of lead in plants were found at NJ7 and NJ8, while NJ1, NJ2, NJ4, NJ10 and NJ11 were below the detection limit. The observations were corroborated by performing analysis of variance. 1-factor random order analysis of variance was performed since the sampling location was randomly selected. ANOVA showed that lead concentration was significantly dependent on sampling location ($LSD_{5\%}$=9.127). Pairwise comparisons showed that forty of the 240 correlations tested had significant differences and 210 had no significant differences. For lead, only very few sites showed significant differences between the measured concentrations. The lead concentrations of samples NJ8, NJ12, NJ15 and NJ16 were significantly higher than the other samples.

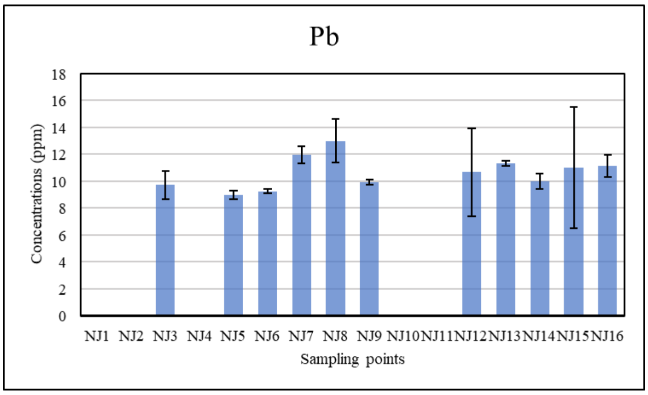

Figure 24. Lead concentration in different plant sampling points.

Nickel

It can be observed on the Figure 25. that among the nickel concentrations measured in plants, the highest concentrations were found at NJ10 and the lowest at NJ4. For the samples between points NJ2 and NJ10, first a decreasing and then an increasing trend can be observed. The observations were supported by performing analysis of variance. 1-factor random order analysis of variance was performed since the sampling location was chosen randomly. ANOVA showed that nickel concentration was significantly dependent on sampling location ($LSD_{5\%}$=1.263). The results of the pairwise comparison showed that 196 of the 240 correlations evaluated had a significant difference and 44 had no significant difference. Nickel concentrations of samples NJ4 and NJ5 were significantly lower than all other samples.

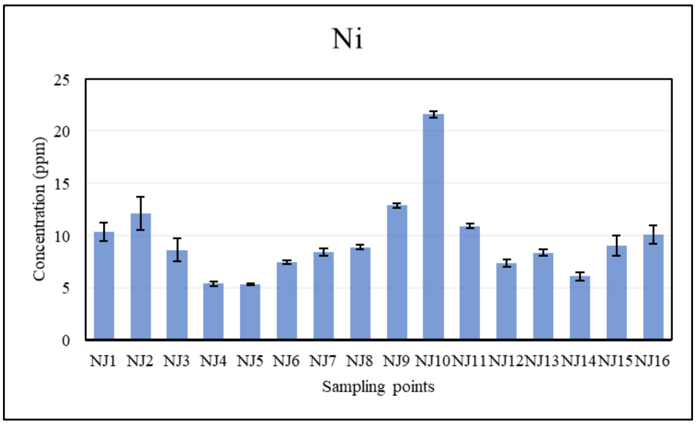

Figure 25. Nickel concentration in different plant sampling points.

Chrome

It can be observed on the Figure 26. that several of the chromium concentrations measured in plants are below the detection limit. Points NJ2, NJ7 and NJ12 have the highest concentrations above the detection limit, while points NJ3 and NJ11 have the lowest concentrations above the detection limit. The observations were corroborated by performing analysis of variance. 1-factor random order analysis of variance was performed since the sampling location selection was random. ANOVA showed that chromium concentration was significantly dependent on sampling location ($LSD_{5\%}$=8.094). Pairwise comparisons showed that 126 of the 240 correlations assessed had a significant difference and 114 had no significant difference. For chromium, the concentrations of samples at NJ2, NJ7, NJ12 were significantly higher than the concentrations measured at NJ6, NJ9, NJ13, NJ14, NJ15 and NJ16.

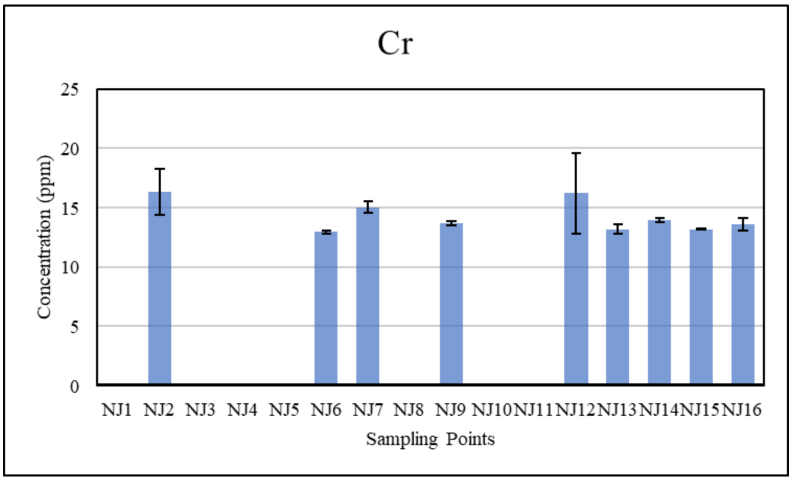

Figure 26. Chrome concentration in different plant sampling points.

Investigating the relationship between Plant and Soil Samples
Plant and soil samples were taken from the same sampling points, and statistical analysis was conducted to determine whether there was a correlation between the concentrations of heavy metals in soil and plants for each substance.
The results of the study are presented in Table 5. Table 5 shows whether the amount of heavy metals in plants depends on the heavy metal content of the soil.
In the case of iron, aluminium, and manganese, it can be stated with a probability of error of 5%, that the heavy metal content of the plant depends in direct proportion on the concentration in the soil. In the other soils tested, high concentrations were measured in several cases, but the variation was not uniformly structured. From the results, it can be concluded that a good part of the heavy metals in the soil are in a form that cannot be taken up by the plants.

Table 5. Result of the pairwise comparison of heavy metal content in soil and plants.

Materials tested	Number of samples compared	Correlation	Sig.
1. pair Zn soil & plant	45	-0,099	0,517
2. pair Cd soil & plant	45	0,104	0,495
3. pair Pb soil & plant	45	0,187	0,218
4. pair Ni soil & plant	45	-0,075	0,625
5. pair Fe soil & plant	45	0,747	0,000
6. pair Mn soil & plant	45	0,349	0,019
7. pair Cr soil & plant	45	0,241	0,111
8. pair Cu soil & plant	45	-0,102	0,504
9. pair Al soil & plant	45	0,754	0,000

CONCLUSIONS AND RECOMMENDATIONS

Most of the measured concentrations in Újpest Bay and on Palotai Island are below the pollution limit values. However, concentrations above the limit values for certain elements were found at several points in both sample areas and it would be worthwhile to map and eliminate these pollutants more precisely.

Újpest Bay
The concentrations of copper and zinc in the Bay were above the pollution limit values. Copper at point E and zinc at points E and F. Both points are outside areas used for aquatic sports training. However, people were often seen fishing just a few metres from point F. The source of the pollution in the Bay around both points should be investigated and subsequently remediated. One obstacle to this is that in the immediate vicinity of both points there are isolated areas, specifically factories, where measurements can only be taken with the consent of the owners.

Palotai Island
Before carrying out the tests, it was thought that the main source of pollution on Palotai Island was the North Pest sewage treatment plant. This assumption has not been confirmed by the tests, even though concentrations of certain substances above the contamination limit have been found at several

points. The choice of sampling points was intended to confirm that pollution increases or decreases downstream of the treatment plant depending on the extent of sedimentation, but no such trend was observed. The results of the samples suggest that heavy metal concentrations increase away from the Danube, in the soil, but the current sampling point locations do not allow to confirm this. It would be worthwhile, however, to conduct a more thorough survey of the interior of the island and to identify the sources of the pollution found so far and to clean up the contamination. Extremely high chromium concentrations were measured at point T15. It would be useful in the future to investigate the distribution of chromium contamination around this sampling point.
Many studies have been conducted worldwide to detect heavy metal contamination, such as on Reunion, a volcanic island in the southern Indian Ocean, where heavy metal levels in the soil have been measured. The mean value of nickel concentrations in soil there was 146.1 mg/kg [11].
Natural zeolite is one of the suitable materials for the disposal of heavy metals in soil [12].

Surprisingly, elevated levels of heavy metals have been found in surface water. Since the measurements were made in running water, it would be worthwhile to investigate the stability of the values over time by more sampling over a longer period and using more sensitive measurement techniques, and if they occur regularly, it would be important to identify and eliminate the source of contamination.

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HORSE-POWERED LOGGING FOR THE PROTECTION OF HUNGARIAN FORESTS

Ákos MALATINSZKY, Csilla FICSOR

Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary,
malatinszky.akos@uni-mate.hu

Abstract
Transporting the harvested wood logs out from the forests sensitively affects the soil, the remaining trees, the forest floor vegetation, and the saplings everywhere in forested areas under management. This step of forest management can be done with heavy machines, cable yarders, or horses, and it requires attention to the wood stand, the saplings, and the topsoil, in order to minimize erosion and not influence the hydrological regime. Before the mechanization of timber harvesting, animal power had been extensively used. Since the 1990's however, it has almost disappeared. Our goal was to explore its current frequency in the Hungarian state-owned forest districts (n=116) and its benefits for the forests, especially in areas under nature conservation. We conducted interviews with loggers and foresters. Horses are used mostly for thinning and selection works in young tree stands, in hilly areas rather than on plains. Our field interviews revealed that using animal power for logging causes less harm to the topsoil as a horse maneuver easier than a machine. Another environmental benefit is the no direct use of fossil fuels. The use of horses is especially efficient on steep terrain.

Keywords*: animal logging, draft horse, forest district, log skidding, nature conservation area*

INTRODUCTION

Throughout the forests in the world, log skidding affects the topsoil, the wood stand, and the saplings. Horse logging is considered to be less harmful to these environmental elements [1–4] and it should be especially considered for forest works in protected areas.
However, fully mechanised harvesters and forwarders have almost completely ousted the draft horse from the forests [5]. Horses had been extensively used for skidding logs throughout Hungary before the mechanization of the timber harvesting industry (i.e., the 1950s).
Since the 1990's however, this century-old method has almost disappeared [6], such as almost everywhere in the world [2]. The Hungarian national park directorates are in charge to coordinate conservation management in protected natural areas. They usually emphasize the use of those methods that cause less disturbance and degradation of the forest environment.
According to the relevant national and European Union-wide legislation, the condition (state of naturalness) of forests must not decay, and it should be subordinated to nature conservation goals in national parks and landscape protection areas (i.e., IUCN Categories II and V), as well as on Natura 2000 sites. The Hungarian Nature Conservation Act (LIII./1996.) declares that in strictly protected areas (IUCN Cat. Ia), only conservation management is permitted, which is without any economic aim. These protected areas definitely need the less harmful methods that are applicable, for example, during forest habitat restoration works.
This is why we aimed to explore the occurrences of horse-powered logging in Hungarian forests that are owned by the state, and compile its main characteristics, advantages and disadvantages.

MATERIALS AND METHODS

Altogether 116 so-called Forest Districts manage the majority of the National Forest Estate in Hungary. We made interviewed all of them by telephone between February and October 2013. Besides basic data (operational area, nature conservation areas within that, etc.), we asked them about using horses for skidding, and whether they owned a horse stock for this purpose, or involved private contractors. We also interviewed those teams that applied horses for forest works (n=17, Figure 1). Their names and addresses were provided by the Forest Districts during their phone call. Our interviews were semi-structured, and based on open-ended questions [7]. The questions covered the following topics:
why do they skid with horses,
where do they work with the horses,
what kind of equipment do they use,
what are the advantages and disadvantages of using horses for logging?

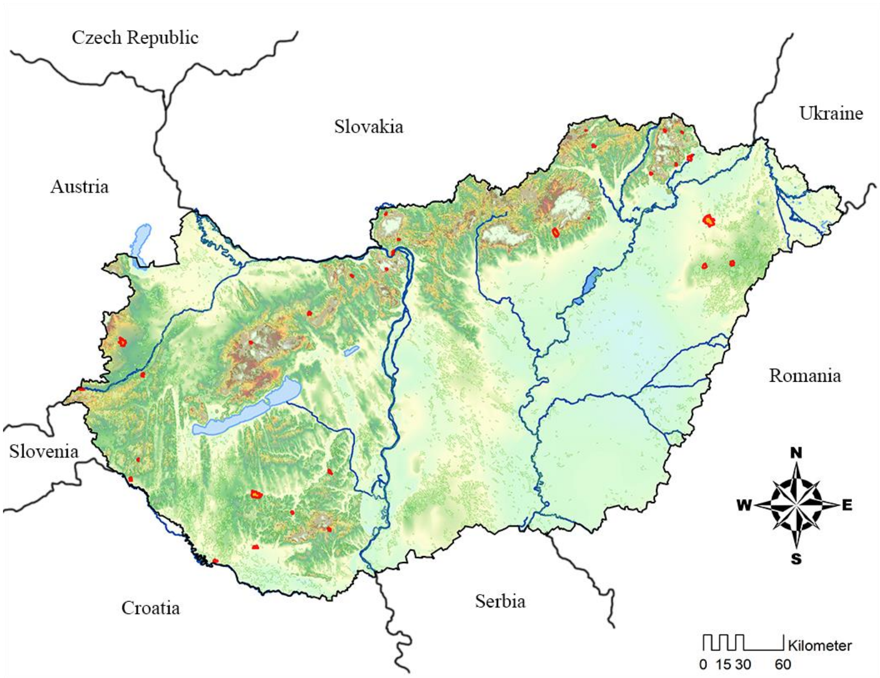


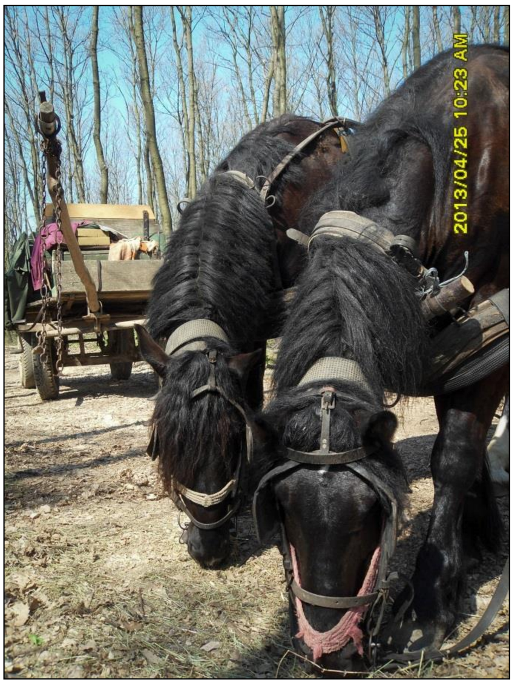
Figure 1. Sites of on-the-spot interviews.

RESULTS AND DISCUSSION

Altogether 33.63% of the Forest Districts used horses for log skidding somewhere within their operational area (not for every logging work, of course), either regularly or occasionally. Only 2.59% of them worked with their own horses, while the majority hired private enterprises. Another 2.59%, although maintaining their own horse stock, did not use their horses for skidding, but for winter feeding of games or for hunting.

The draft horses (Figures 2 and 3) usually worked in forest thinning and selection works, sometimes after clearcutting, in various forest stands, such as beech or beech–hornbeam mixed forests, Turkey oak–sessile oak, Sessile oak–hornbeam, European black pine, Norway spruce, and black locust stands.

The presence of draft horses was dominant in those forest patches where the priority is the protection of natural values, but basically not for continuous cover forestry (CCF) purposes, because the very heavy logs could not have been moved by animals. The most common situation was thinning in young tree stands (10 to 50 years old), which is too dense for machines without causing significant harm.
Several enterprises emphasized that using horses is less harmful to the soil (see compaction, [8]) and the forest floor (vegetation), and is possible in almost any kind of weather condition (except for heavy rainstorms and thick snow). It also causes less noise than the machines.



Figures 2 and 3. Horses may work in pairs. This increases the efficiency, but needs great experience from the loggers.

CONCLUSIONS AND RECOMMENDATIONS

The greatest benefit of using horses for log skidding comes from its less harm to the remaining trees and forest floor vegetation (Figures 4, 5 and 6), as well as being environmentally conscious due to the lack of fossil fuel use [5, 9] and no potential oil spill. The lack of mechanized installations means labour-intensive operation [2] and thus, it creates jobs in rural areas, which is beneficial seeing the de-populating trend in distant Hungarian areas.

Figures 4, 5 and 6. Considering their impacts on the soil and forest floor, the differences between horses and machines are visible.

We recommend the application of horse skidding for deployment in conservation areas with strict environmental constraints (such as [10]). The new Hungarian Forest Act (adopted in 2009) prescribes the conversion of forest management towards continuous cover forestry (CCF) in state forest areas, which means harvests that use selective thinnings. These low-intensity cuts claim for slighter methods and create space for traditional small-scale harvesting alternatives leading to a new flourish of draft horse logging. Considering small forest patches to be skidded, mechanized harvesting would be too costly to be applied, making horses to be cost-effective, especially in those places where skidding trails are not available. Several loggers reported that the use of horses is an especially efficient tool for log extraction on steep terrain, which was also stated by [11].

The most important factor to applying horses instead of harvesters is the terrain conditions and the constraints by nature conservation authorities ([3] strengthened this argument).

Only a few people work currently with draft horses or have experience in this field, and all of them consider it a hard way of life. They have to find another job for the vegetation period when logging is prohibited by the forest act.

Our further recommendation is to improve the equipment of horse logging, as most interviewees used almost century-old tools and devices, and it would increase the efficiency as well, reducing the differences in the amount logged compared to the harvester machines.

This historical way of logging started to disappear from the Hungarian forests 2 to 4 decades ago, despite the fact that it could play a crucial role in the preservation of native horse breeds such as the Hungarian cold-blooded and Muraközi as well, which are especially suitable for work as they are characterized as being resistant and calm

ACKNOWLEDGMENTS

We are grateful for the representatives of the Forest Districts and the horse-loggers for their participation in our interviews.

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NEW SYMMETRY METHODS FOR QUANTUM-MECHANICAL MODELLING OF PROMISING PHOTOVOLTAIC MATERIALS OF INFINITE CHAIN-TYPE AND LAYER-TYPE ATOMIC SYSTEMS

Csaba MÉSZÁROS[1]*, István Róbert NIKOLÉNYI[1], Ágnes BÁLINT[2]

[1]*Department of Mathematics and Basic Natural Sciences, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary, e-mail:* Meszaros.Csaba@uni-mate.hu Nikolenyi.Istvan.Robert@uni-mate.hu

[2]*Institute of Environmental and Natural Sciences, Óbuda University, Budapest, Hungary, e-mail:* balint.agnes@uni-obuda.hu

Abstract.
It is well-known, that the detailed experimental and theoretical investigation of basic structural-, microscopic- and macroscopic properties of the regular-, but very various type chain-type and layer-type infinite atomic and molecular systems are playing a role of continuously increasing importance in quantum physics of such types of coherent condensed matter systems, because of their very probable wide-range photovoltaic-type applications in the global solar energetics, too. Among them, the very powerful symmetry methods based on the representation theory of symmetry groups of the ideal, and infinitesimally long discrete chain-type subsystems accepted as the relevant ones. The adequate quantum mechanical analysis of the collective elementary excitations was developed by applications of the representation theory of line groups. In order to apply our own earlier theoretical results in this contemporary research area, we decided to extend them in more details, in order to give new, original significant contributions to the theoretical modelling of the basic optical properties of the stereoregular polymers and carbon nanotubes at the quantum-level.

Keywords: *Alternative energetic materials, nanotechnology, symmetry theory, infinite chain-type and layer-type systems*

INTRODUCTION

The applications of the projective representations [1] of crystallographic groups in solid state physics are known for decades but they are absent even from the most complete recent works about applications of line groups in various types of structural investigations of condensed matter systems [2]. These seemingly purely theoretical studies in the condensed matter physics may have promising future applications in the field of solar energetics, too. Therefore, we decided to fill this gap, and have succesfully introduced the concept of the projective representations of line groups (= symmetry groups of discrete, chain-type molecular systems, usually called quasi-one-dimensional (*Q1D*) systems in the literature) together with some basic applications into theory of the incommensurately modulated crystal structures. In the present work, we will demonstrate explicitly the applicability of the same technique in the cases of optical scattering processes in incommensurate systems, including multiple-type Raman processes.
According to the definition, the complete set of symmetry transformations leaving invariant a *Q1D* system belongs to one of the (discrete) infinitely many line groups gathered into 13 families.

The irreducible representation $D^{(\mu)}(L)$ of a full line group *L* can be obtained from the irreducible representation of symmetry groups (concretely: point groups) of the motifs: $D^{(\nu)}(P)$. The construction of the complete irreducible representation matrices is usually realized by use of the induction technique elaborated in the group representation theory for decades, and widely applied in solid state physics (e.g. [2]), usually denoted by $D^{(\mu)}(L)=D^{(\nu)}(P)\uparrow L$). From the point of view of the applications in this study, we point out here the importance of the basic (helical) line group $Ln_p=(n/r)\otimes C_q^a$, on the base of which the irreducible representations of its can be directly obtained as a product of the irreducible representations of the constitutive subgroups, i.e. of the cyclic discrete rotational point group: $A_m\left(C_q^s\right)=e^{ims\alpha}$ (where "α" is the discrete-valued, elementary, smallest rotation around the main axis of the actual *Q1D* system) and of the subgroup of generalized translations n/r is given by: $D\left(R\middle|v_R\right)\equiv {}_kA\left(\left(C_n^r\middle|v\right)^t\right)=e^{ikt\zeta}$, where $k\in\left(-\frac{\pi}{\zeta},+\frac{\pi}{\zeta}\right]$, and ζ is the distance between nearest-neighbour scattering centre motifs in the given actual helical system.

On the base of this formalism (according to which the irreducible representation matrix of the relevant general line group element can be given as ${}_kA_m\left(\left(C_n^r\middle|v\right)^t C_q^s\right)=e^{ikt\zeta}e^{ims\alpha}$), the formulae necessary for quantum-mechanical selection rules between an initial (*i*) and a final (*f*) state in chain-type systems are (*k* denotes the absolute value of a wave vector, *j* is an integer number of the possible allowed integer translations along the main axis of a *Q1D* system being investigated) [2]:

$$\Delta k\equiv k_f-k_i=k+j\frac{2\pi}{\xi},\left(j\in\mathbb{Z}\right). \tag{1}$$

Furthermore, it is a unique feature of the representation theory of line groups, that analogous relations expressing conservation of quasi-angular momenta during propagation of collective excitations along the main axis of the actual chain-type system must also be respected [3], i.e.:

$$\Delta m\equiv m_f-m_i=m+zq, \tag{2}$$

where the symbol *m* denotes one of the possible discrete momentum values, *z* is an integer number again, while *q* is the order of a simple cyclic rotation group, also characterizing allowed integer translations along the main axis of the system. In the present study, all these selection rule relations will be generalized within frame of the projective representations of line groups relevant for incommensurately modulated structures and incorporated into correlation functions necessary for comparison of experimentally measured-, and theoretically derived light scattering intensity curves. From newest applications of the representation theory of line groups in the condensed matter physics, relevance of this powerful symmetry method in the rigid-layer dynamics with applications in the Raman-, and infrared activity [4] must be particularly pointed out, because it may induce further novel-type experimental methods in this rapidly developing experimental research area, according to the relevant recent review articles. Finally, it must also be emphasized here, that by applications of the contemporary theory of the irreducible representations of line groups, the modulation types characterized by both rational-, and irrational $\vec{k}$ -s in the first Brillouin zone, can be equally treated.

The basic information summarized in the previous sections will be applied in detail by a new formalism presented in this section. The most essential feature of the forthcoming calculations is the following: the very basic-type selection rules of type (1) and (2) will be directly incorporated into the matrix elements of types (4), relevant for the Raman-type optical scattering processes of emission-, or absorption characterized by the frequency change Ω. (At this point, relevance of the basic results published already in [1,2] must be particularly pointed out, because they also represent in detail the irreducible representations of polar vectors, which are necessary for systematization of the perturbation matrix elements at optical absorption processes in dipole approximation.) Besides, as it has been mentioned in the introductory part of this paper, the useful applications of the projective representations will also be emphasized, wherever possible – on the base of our own, original results from this theoretical physics area [5,6].
Then, as it is known, at the case of the inelastic light scattering processes from crystals, the basic relations relevant for the phonon impulse-, and energy changes, are the following ones:

$$\begin{aligned} &\vec{k}_0 \pm \vec{k} = \vec{q}, \\ &\omega_0 - \omega = \mp \Delta\omega, \end{aligned} \tag{3}$$

where $\vec{k}_0$ and $\vec{k}$ are the wave vectors of the incident-, and scattered polarized monochromatic light beam, and $\pm\vec{q}$ is the wave-vector change in the given scattering process. Similarly, the symbols $\omega_0, \omega, \mp\Delta\omega$ denote relevant frequency (and the: adequate energy-) changes in the same light beam. It must be emphasized, that the wave-vector change expression in (8) is a relation of basic importance, and for an adequate, accurate descriptions of the light-scattering processes, the orthogonal-type transformations of the wave vectors must also be applied, for obtaining correct selection formulae relevant for them. Then, the dipole moment component in the ground state is [2,4]:

$$p_i(t) = \langle 0|p_i|0\rangle + \sum_j \left\{ \alpha_{ij}(\Omega) E_{+j} \cdot e^{i\Omega t} + \alpha_{ij}(-\Omega) E_{-j} \cdot e^{-i\Omega t} \right\}, \tag{4}$$

where $\alpha_{ij}(\Omega)$ denotes the (-Hermitian – type-) polarizability tensor, and $E_{\pm}$ are the electric field components of the polarized light beam. Accordingly, we have:

$$\hat{\sigma}_{\pm} = (\beta)\vec{E} \cdot e^{\pm i\Omega t}, \tag{5}$$

where β is an electro-elastic tensor, equivalent to the polarization tensor in isotropic active optical media. Then, in order to realize this analysis in the case of the incommensurately modulated crystal structures, we will here firstly summarize all the expressions, which are accepted as the basic quantum-mechanical tools necessary for an accurate description of the Raman-scattering processes. Accordingly, at the optical transitions, related to the initial-, and scattered electromagnetic waves polarized along the relevant unit vectors $\vec{e}_i$ and $\vec{e}_j$ correspond to $p_i = \vec{e}_i \cdot \vec{p}, p_j = \vec{e}_j \cdot \vec{p}$. Then, the relevant total perturbation expression is given by $p_f R^{fi} p_i$, where R^{fi} denotes a component of the actual Raman-tensor.

The basic selection rules in this type of scattering processes is related to examination of the direct product

$$D^P(L) \otimes D^P(L) \otimes D^{\left(k_i^{ph} m_i^{ph} \Pi_i^{ph}\right)}(L), \tag{6}$$

according to which [2], the decomposition of (6) must contain the identity representation too, in order to the given quantum transition to be possible. For an accurate, precise description of the new method of modelling calculations to be realized in this study, the results originally published in [3] and [6] are to be applied here, too. In general case, the quasi-impulse conservation law can be written as [2,6]:

$$\vec{w}_1{}' + \hat{\alpha}_0 \vec{w}_1 = \vec{K}, \tag{7}$$

where $\hat{\alpha}$ denotes a general orthogonal symmetry transformation operator, and the reciprocal space vectors $\vec{w}_i\,(i = \pm 1, \pm 2, \ldots)$ are related to the actual phonon modes of crystals and/or actual subsystems of them containing finite atomic and molecular *Q1D* chains incorporated into (in-)finite two-dimensional (*2D*) nanolayers.

RESULTS AND DISCUSSION

The experimental and theoretical foundations of this formalism are known in the literature for decades, and the basic relation relevant for the periodic lattice distortions inducing incommensurate structures are given by:

$$\langle f | H_{E-P} | i \rangle = \left\langle f \left| \hat{b}_{\vec{w}t} \hat{H}_{\vec{w}t} \right| i \right\rangle. \tag{8}$$

Here the symbol H_{E-P} denotes the electron-phonon interaction operator, and the general form of the electron-phonon interaction in linear approximation is given by:

$$H_{E-P} \approx \sum_{\vec{w}} \sum_{t} \left\{ b_{\vec{w}t} H_{\vec{w}t}(\vec{r}) + h.c. \right\}, \tag{9}$$

where inside a bracket the operator product terms are summarized with their own hermitically conjugated operator product pair elements.
In order to demonstrate the representation theory of line groups for an effective symmetry analysis of collective elementary excitations, we will follow here again our own modelling methods [6] based on the projective representations of symmetry transformations. For novel-type symmetry analyses of Raman scattering processes in incommensurately modulated crystal structures, we will also apply here the commonly accepted dipole-approximation, i.e.:

$$\left\langle \vec{k}' \upsilon' \right| \hat{\vec{p}} \left| \vec{k}\, \upsilon \right\rangle, \tag{10}$$

where $\vec{p}$ .is the dipole moment induced on an ion, while the notations $\vec{k}\upsilon$ and $\vec{k}'\upsilon'$ correspond to the initial-, and final states between which the transition is realized (i.e. in a general sense: $\vec{k}$ is the wave vector related to the actual state, while ν is the relevant band index).

For an atom positioned in a 3*D* crystal structure by $\vec{R}+\vec{\tau}_s+\vec{u}^s_{\vec{R}}$ (where $\vec{R}$ denotes a basic vector from the actual Bravais-lattice, $\vec{\tau}_s$ is a fractional translation corresponding to an atomic scattering centre in the basic asymmetric unit in the unit cell and $\vec{u}^s_{\vec{R}}$ is an instantaneous elongation (with respect to its equilibrium position determined by the ideal crystal symmetry) vector of the atom determined by the two previously determined vectors, under the general-type transformation operation allowed within the given crystal's Euclidean group-type symmetry operation $a\equiv\left(\hat{\alpha}\middle|\vec{a}\right)$), we obtain: $a\left(\vec{R}+\vec{\tau}_s\right)=a\vec{R}+a\vec{\tau}_s\equiv\hat{\alpha}\vec{R}+\vec{R}\left(s,a\right)+\vec{\tau}_{s_0(s,\hat{\alpha})}$.

The most essential feature of the forthcoming future calculations is the following: the very basic-type selection rules of type (1) and (2) will be directly incorporated into the matrix elements of types (4), relevant for the Raman-type optical scattering processes of emission-, or absorption characterized by the frequency change Ω (as it has been very accurately described e.g. in [2] and [7-8]).
Then, as it is known, at inelastic light scattering processes from crystals, the basic relations relevant for the phonon impulse-, and energy changes, are the following ones:

$$\begin{aligned}&\vec{k}_0\pm\vec{k}=\vec{q},\\&\omega_0-\omega=\mp\Delta\omega,\end{aligned}\tag{11}$$

where $\vec{k}_0$ and $\vec{k}$ are the wave vectors of the incident-, and the scattered polarized monochromatic light beams, respectively and $\pm\vec{q}$ is the wave-vector change in the given scattering process. Similarly, the symbols $\omega_0,\omega,\mp\Delta\omega$ denote the relevant frequency (<=> energy) changes of the same light beam. It must be emphasized, that the wave-vector change expression in (11) is a very basic-type relation, and for an adequate, accurate descriptions of the light-scattering processes, the orthogonal-type transformations of the wave vectors must also be applied, in order to obtain correct selection formulae relevant for them.

CONCLUSIONS AND RECOMMENDATIONS

In the present study, a detailed calculation method, necessary for elaborating of more advanced modelling applications of the light-matter interactions at quantum mechanical level has been proposed. The fundamental mathematical tools emanating from the representation theory of the symmetry groups of infinitesimally long discrete chain-type systems have been applied in a novel manner. On the base of this new – type mathematical concept, the quantum-mechanical selection rules relevant for incommensurately modulated 3-dimensional crystal systems have been successfully incorporated into the already developed formalisms in this research field. By this way, a new mathematical research tool has been introduced, whose applicability limits may be to be far beyond of the problem solution area indicated by this paper.

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THE ROLE, THE PERFORMANCE AND THE OPERATIONAL EXPERIENCES OF THE NITROGEN REMOVAL FIXED-FILM BIOLOGICAL STAGE OPERATING AT THE SOUTH-PEST WASTEWATER TREATMENT PLANT

Csenge NAGY-MEZEI[1,2], Anikó BEZSENYI[2], Imre GYARMATI[2], Magdolna MAKÓ[2], Levente KARDOS[1]

[1]Department of Agro-Environmental Studies, Insitute of Environmental Sciences, Hungarian University of Agriculture and Life Sciences, Budapest - Hungary
[2]Budapest Sewage Works Pte Ltd., Budapest - Hungary
pribelszkycs@fcsm.hu, +36 20 450 1814

Abstract
Biological nitrogen removal is difficult to realize in high-load activated sludge wastewater treatment systems, since nitrifying bacteria are only able to grow in the biomass in the case of a low organic matter load or a high sludge age. By using biofilm technologies that enable the selective growth of nitrogen-removing microorganisms, nitrogen removal can be achieved with significantly higher performance/speed, even in compact reactors. The activated sludge technology of the South-Pest Wastewater Treatment Plant is only capable to remove the organic carbon compounds with the applied high organic load and low sludge age. The nitrification and the majority of denitrification take place in the biofiltration stage (BIOFOR™). An additional carbon source (methanol) is added for post-denitrification. A smaller proportion of the nitrate formed in the nitrification filters is returned to the pre-denitrification reactors of the activated sludge system. In our article, we describe the microbiological and technological aspects of nitrification and denitrification, with particular regard to the need for an additional carbon source (methanol) for post-denitrification and its selective effect on the microorganism community. We present our operational experience resulting from the technological peculiarities of the two-step biological stage of the treatment plant.

Keywords: *wastewater treatment, biofilm, biofilter, biological nitrogen removal, methanol, BIOFOR™*

ABBREVIATIONS

AOA	Ammonia-Oxidizing Archaea
AOB	Ammonia-Oxidizing Bacteria
BOD_5	Biological Oxygen Demand
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
EPS	Extracellular Polymeric Substances
NOB	Nitrite-Oxidizing Bacteria
OUR	Oxygen Uptake Rate
PE	Population Equivalent
Q	Flow
RSD	Ráckevei-Soroksári-Danube
TKN	Total Kjeldahl Nitrogen
TSS	Total Suspended Solids

INTRODUCTION

Since its commissioning in 1966, the South-Pest Wastewater Treatment Plant has been cleaning the capital's wastewater, generated in districts 18th, 19th, 20th and 23th both mechanically and biologically. As a result of the improvements the hydraulic capacity of the treatment plant increased from the initial 30 000 m^3/day to 80 000 m^3/day (~300 000 Population Equivalent, PE). The hydraulic load of the treatment plant has been almost constant in previous decades at ~60 000 m^3/day. Until 1999, biological treatment consisted exclusively of the biodegradation of organic pollutant components using high-load activated sludge technology.
The Ráckevei-Soroksári-Danube (RSD), which receives the cleaned wastewater and is gated at both ends with sluices, is significantly more sensitive due to its small water flow (on average, its water volume of 40 million m^3 is replaced in 1.5-2.5 weeks in the summer and in 3-5 weeks in the case of operational water replacement) for receiving of eutrophication-causing plant nutrients (N and P), like the main branch of the Danube. For this reason, it became necessary to modernize the treatment plant's technology, as a result of which, in 1999, the previous technology was supplemented with a second biological purification stage, which primarily ensures the biological conversion and removal of the nitrogen content. The second biological stage was implemented in the form of a two-stage biofilter technology (nitrification + post-denitrification) (BIOFOR^{TM}, Figure 1). In order to ensure effective post-denitrification, an easily biodegradable external organic substrate (methanol) is added.

Figure 1. BIOFOR^{TM} nitrification (left) and post-denitrification (right) biofilters – own picture

Phosphorus is removed chemically by chemical precipitation, basically during pre- and post-sedimentation. The applied iron(III)chloride is dosed before the settling basins. In the biofiltration stage (before post-denitrification), there is still the possibility of chemical dosing in order to keep the effluent total phosphorus concentration low.

THE SCIENTIFIC BACKGROUND AND THE MOST IMPORTANT INTERRELATIONS OF NITRIFICATION AND DENITRIFICATION

Nitrogen flow through the wastewater treatment process

The steps of the natural nitrogen cycle also take place in the wastewater treatment process. Nitrogen removal is based on these natural processes, but the individual steps are not of equal importance. Ammonification, nitrification and denitrification play a prominent role in nitrogen removal. (Figure 2)

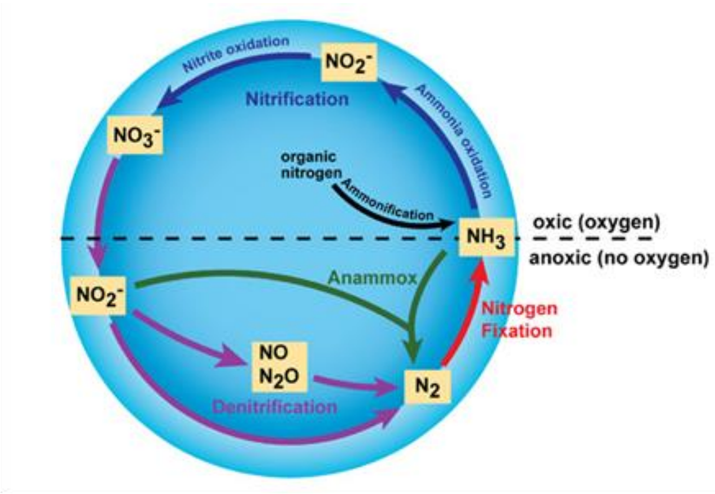
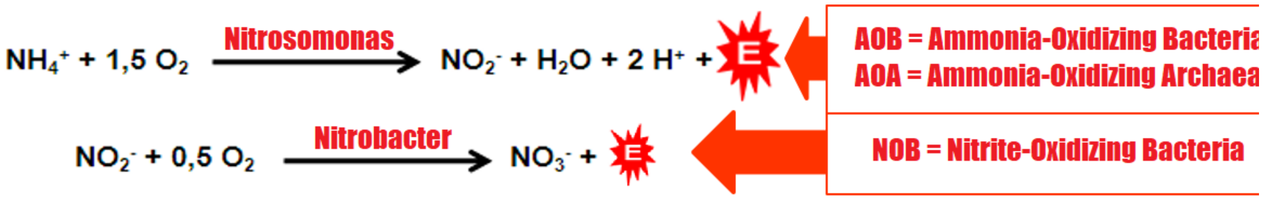


Figure 2. Major transformations in the nitrogen cycle (Bernhard 2010)

During ammonification, the microorganisms - through the general decomposition processes - release the nitrogen built into the organic bonds in the form of ammonia. Just as the organic matter content of wastewater decreases as it passes through the wastewater treatment system, the role of ammonification in wastewater treatment also decreases.

In the next step, the nitrifiers oxidize the ammonia content of the wastewater in two steps. Ammonia is converted into nitrite by ammonia-oxidizing bacteria (AOB = Ammonia-Oxidizing Bacteria; AOA = Ammonia-Oxidizing Archaea), and then nitrite is oxidized to nitrate by nitrite-oxidizing bacteria (NOB = Nitrite-Oxidizing Bacteria) as follows:



Archaea were initially classified as bacteria, but due to their special characteristics, they are now referred to as an independent group (Kingdom/Domain).

More energy can be obtained from the first reaction, i.e. the oxidation of ammonium is more favorable in terms of energy production than the oxidation of nitrite. In addition to ammonium, nitrifiers also require a separate carbon source, since they do not consume organic material. The carbon source is carbon dioxide, which is utilized in the form of bicarbonate (HCO_3^-). So ammonia functions as an energy source and carbon dioxide as a carbon source for the production of organic matter in the cell (similar to plants). Meanwhile, they respirate oxygen, i.e. they are aerobic (Figure 3), so the reactor zone of nitrification must be aerated.

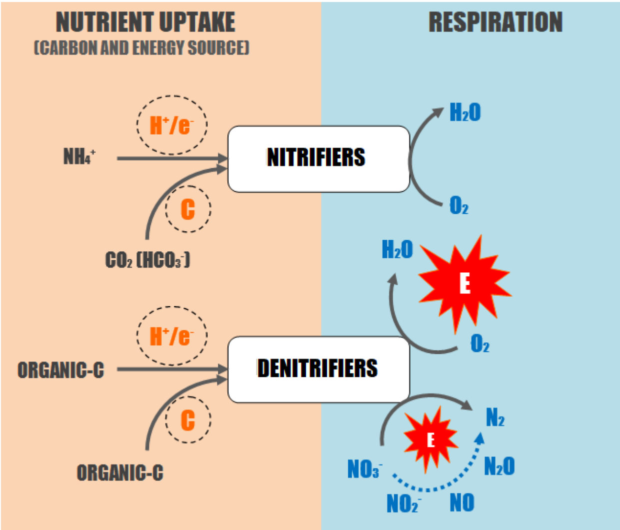


Figure 3. Explanation of the cellular physiological processes of nitrifying and denitrifying microorganisms – own editing

Denitrifying microorganisms reduce nitrate to molecular nitrogen via nitrite in an O_2-deficient (anoxic) environment. (Figure 2) At the end of the nitrogen-forming process, the inert gas escapes into the atmosphere, this also happens with gaseous intermediates. Heterotrophic and organotrophic organisms, i.e. they use organic matter as both a carbon source and an energy source (Figure 3). Nitrate is transformed during respiration. Oxygen has an inhibitory effect on the enzymes of denitrification (enzymesynthesis), and aerobic decomposition (with oxygen) is energetically more favorable for bacteria. They switch to nitrate respiration in an oxygen-deficient environment, i.e. they are facultative anaerobes. Facultative anaerobes are bacteria that respirate oxygen in the presence of oxygen, but are able to respirate other molecules (NO_3^-, SO_4^{2-}) in the absence of oxygen. In the case of denitrifiers the other molecule is nitrate. The synthesis of the enzymes required for denitrification is inductive, that is, it takes place under the necessary environmental conditions. The presence of nitrate/nitrite is not necessary in all cases for the start of enzyme production, often the anaerobic environment alone can be sufficient, but in fact the production of enzymes is based on a complex regulation system that differs from microorganism to microorganism (Carreira et al. 2018, Hong et al. 2019, Moir et al. 1995).

It follows from the above that if we want to remove nitrogen from wastewater with the help of denitrifiers, it is forbidden to aerate the reactor space and simple organic compounds must be used as nutrients. The latter can come from both internal and external sources. The internal carbon source is usually organic matter present in raw wastewater or formed during the hydrolysis of sewage sludge, and the external carbon source is some kind of industrial residue (from breweries, dairies, sugar industry) or industrial product (methanol, ethanol, acetic acid).

Residence time and bacterial growth

Nitrifying bacteria obtain a relatively small amount of energy from the oxidation of ammonium and nitrite, so their reproduction/generation time is quite long, they reproduce slowly, and therefore their population size remains small. Compared to organotrophs that reproduce on organic matter, the population size is particularly small. In general, in municipal and industrial waste water, carbon-containing impurities appear in much higher concentrations than nitrogen-containing ones. So more nutrients are always available for the growth of organotrophic bacteria. In addition, organotrophic bacteria gain more energy during the processing of their nutrients than nitrifying bacteria, so they reproduce significantly faster.

The generation time of organotrophic bacteria is typically between 15 and 30 minutes, while that of nitrifying bacteria can be between 48 and 72 hours, if the conditions are favorable. In activated sludge systems, a relatively high (minimum 6-8 days depending on the operating temperature) sludge residence time (sludge age) must be maintained. These way nitrifying bacteria, which grow or multiply slowly and have a weak ability to form flocs, have the opportunity to multiply and enrich (Gerardi, 2002).

Biofilm systems provide much more favorable conditions for autotrophic nitrifying bacteria than activated sludge technology. In principle, the more limited diffusion of nitrification-inhibiting substances (e.g. phenol) and the fact that the matrix of extracellular polymeric substances (EPS), also known as mucus, prevents the overgrowth of faster-reproducing heterotrophic/organotrophic organisms due to spatial limitations can be an advantage in biofilm systems (Székely, 2008).

There is also a difference between the population size of the two types of nitrifying bacteria. Ammonium oxidation is more favorable in terms of energy production than nitrite oxidation, so ammonia oxidizers (AOB, AOA) multiply faster and their population is larger. So, in activated sludge technologies, the ammonia oxidation capacity is more significant than the nitrite oxidation capacity. Under unfavorable operating conditions, this is the reason for the periodic accumulation of nitrite. Unfavorable conditions can be low temperature, sludge washout due to hydraulic overload, low dissolved oxygen concentration, toxic event, or even the inflow of a shock-like, readily biodegradable carbonload (Gerardi, 2002).

Ammonia oxidizers and nitrite oxidizers form tight aggregates in the EPS matrix of flocs and biofilms. Nitrite oxidizers are found in the deeper layers of the biofilm, ammonia oxidizers closer to the surface. So the two groups position themselves in the aggregates according to the sequence of chemical processes (Székely, 2008).

Providing the physiological needs of nirifying and denitrifying microorganisms

In the case of nitrifiers, the inflow ammonia concentration is a given, but adequate oxygen intake must be ensured. Since bicarbonate is used as the carbon source, it is necessary to ensure that adequate bicarbonate alkalinity is available. In order to be absorbed, carbon dioxide must be converted into bicarbonate in the water, which can occur at a pH above 7.0. At temperatures between 10 and 20˚C, a pH value of 7.0-8.5 is typical for most communal wastewater treatment technologies, so this condition is usually fulfilled. The missing bicarbonate alkalinity can be replaced with different carbonate/bicarbonate compounds (e.g. calcium bicarbonate). Of course, there are also factors that we cannot influence during operation. Such are the temperature and the presence of inhibitor/toxic compounds in the wastewater, even though these factors are also critical for nitrifiers.

In addition to consuming organic matter, denitrifying organisms respirate nitrate, so they are "multifunctional" organisms from the point of view of wastewater treatment, since they also contribute to nitrogen removal in addition to breaking down organic matter. However, for this, it is necessary to prevent oxygen from entering the system, because - as mentioned earlier - oxygen respiration is energetically much more favorable than nitrate (chemically bound oxygen) respiration. During post-denitrification, there is not enough biodegradable organic matter in the wastewater, so the use of an external carbon source is essential for nitrate removal at a suitable rate, i.e. the bacteria must be "fed" in order to respirate nitrate.

In the denitrification stage of the BIOFOR™ technology installed at the South-pest Wastewater Treatment Plant, methanol is fed, since the organic matter content of the nitrified wastewater is not sufficient for the denitrification processes (post-denitrification).

If sufficient organic matter (in this case methanol) is not available for the microbiological process, and/or dissolved oxygen is present, which inhibits the process, then the reaction does not go to the end, which results in the enrichment of nitrite. The real methanol demand therefore basically depends on the availability (excess) of methanol, the presence of dissolved oxygen, the temperature of the medium, and the type of technology used (activated sludge system or fixed-film system).

Based on these, it is clear that an effort should be made to dose the carbon source in excess of the stoichiometric one, but an important aspect of post-denitrification is the minimization of the residual organic matter content. (Dholakia et al. 1970).
When methanol is used, denitrification can be described by the following stoichiometry (Dholakia et al. 1970):

$$(1)\quad NO_3^- + 1/3\ CH_3OH \longrightarrow NO_2^- + 1/3\ CO_2 + 2/3\ H_2O$$

$$(2)\quad NO_2^- + 1/2\ CH_3OH \longrightarrow 1/2\ N_2 + 1/2\ CO_2 + 1/2\ H_2O + OH^-$$

Based on the reaction equations, theoretically 5/6 mol of methanol is needed to reduce 1 mol of nitrate (26.7 g methanol/14 g nitrogen; 1.9 g methanol/g nitrogen; 0.43 g methanol/g nitrate) (Dholakia and et al. 1970, Bitton 2005).
Addition of any organic carbon source in the last stage of the technology involves a high risk, since in the case of an excessive dosage, an increase in the oxygen demand (BOD_5, COD) of the effluent from the post-denitrification biofilters must be expected, and in the case of insufficient dosage, the nitrate reduction is expected to be partial. In the latter case, for example, nitrite accumulation must be expected. This can be eliminated by appropriate modification of the carbon-nitrogen ratio, i.e. by increasing the methanol dosage (Rocher et al. 2015). Only an external substrate with a constant composition, free of impurities and components that are difficult to break down biologically, can be used for post-denitrification.
During denitrification, the accumulation of nitrite can be caused not only by the distortion of the C/N ratio, but also by the type of organic carbon source used. The accumulation of nitrite-N compared to the removed nitrate-N is higher in the case of carbohydrates and carboxylic acids (0.12 – 0.34 g/g), while it is relatively lower in the case of alcohols, and the most favorable in the case of methanol (0. 05 g/g), although methanol is not considered outstanding in terms of specific nitrate removal rate (Rocher et al. 2015) (Figure 4).

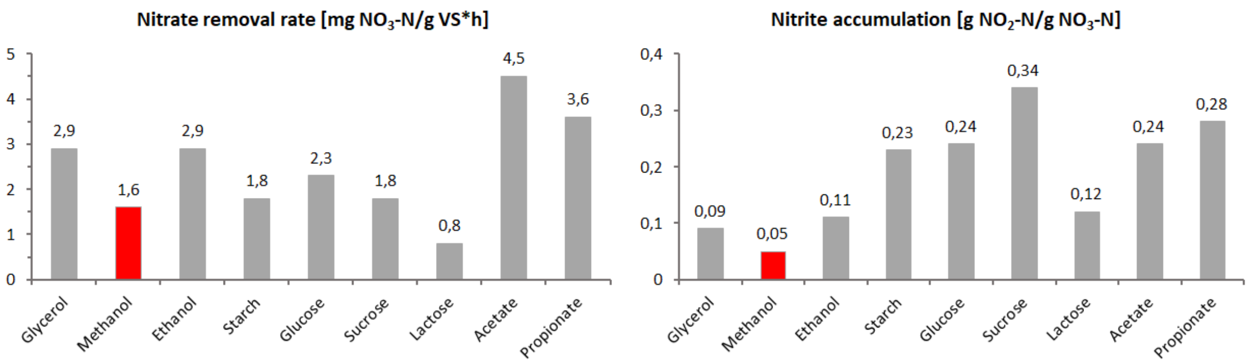


Figure 4. Denitrification rates (left) and nitrite accumulation (right) achieved using different organic carbon sources during laboratory experiments (Rocher et al. 2015)

In denitrification filters of the BIOFOR^{TM} a less diverse culture is maintained compared to the heterotrophic microorganism community of the treatment plant's high-load activated sludge system, since only methanol is available as a carbon source.
Methanol dosing actually means one-sided feeding of the community. For this reason, those microorganisms that can utilize the carbon source multiply in the biofilm. The so-called methylotrophic microorganisms can utilize the methanol. The community formed in this way has a special spectrum of substrate utilization, compared to activated sludge.

Substrate utilization can be examined with a simple respiration test, during which the oxygen uptake of the two cultures (activated sludge and denitrifying biofilm) is measured using a dissolved oxygen measuring electrode, while different simple organic substrates are added. While the activated sludge utilizes more organic compounds with similar intensity, the biofilm consumes methanol, ethanol and ethylene glycol intensively, and formic acid and acetic acid less efficiently (Figure 5).

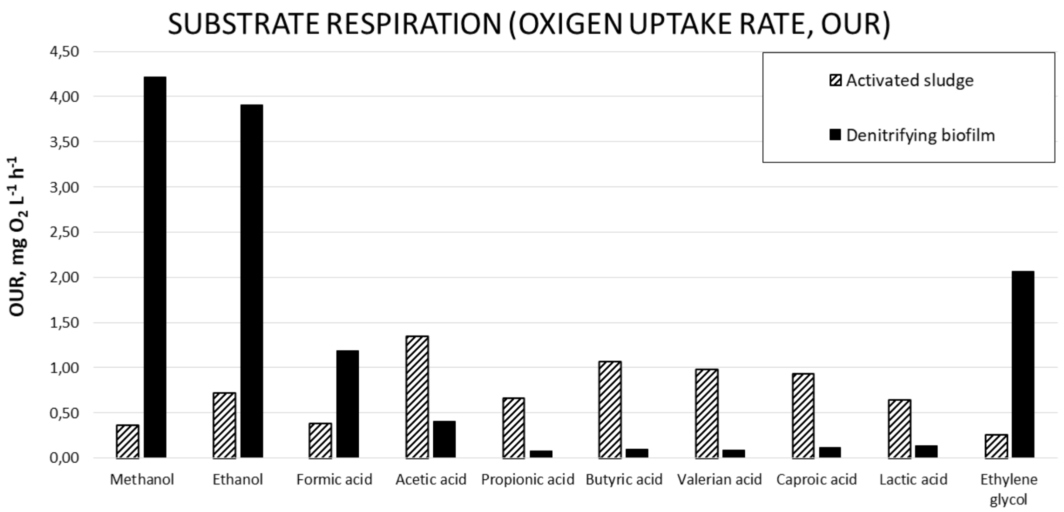


Figure 5. The substrate spectrum of the high load activated sludge and the denitrification biofilm based on the respiration tests. During respiration tests, the Oxygen Uptake Rate (OUR) can be determined. The biomass's own oxygen consumption is endogenous respirationis endogenous respiration, while the respiration intensity increases with the addition of usable substrate. In the figure, the OUR values are corrected by the value of endogenous respiration – own editing

Based on Figure 5, the higher the respiration intensity, i.e. the Oxygen Uptake Rate (OUR), the more favorable is the utilization of the given substrate for the microorganisms. Since we are examining a complex community of bacteria in the case of activated sludge and biofilm, we can also infer the proportion of microorganisms, able to utilize the given substrate by comparing the respiration intensity values. The biofilm system can only efficiently utilize certain substrates (methanol, ethanol, formic acid, acetic acid and ethylene glycol). (Bezsenyi et al. 2019). The respiration intensity values were corrected by the endogenous respiration of the respective cultures (only the biomass without substrate).

TECHNOLOGICAL DESIGN OF THE BIOFILTER SYSTEM

The flow of post-settled wastewater leaving the activated sludge stage through the two-stage, upward-flowing biofilter unit (BIOFOR™, Figure 6) is ensured by the potential energy created by lifting the wastewater. The ammonia content of the waste water is oxidized to nitrate by the microorganisms attached to the filling material of the oxic biofilters (nitrification). A certain proportion of the nitrified water (24 000 m^3/day) is returned to the pre-denitrification reactor (25% of the total activated sludge reactor volume) in the activated sludge stage (nitrate water recirculation), where the nitrate content is converted to elemental nitrogen by the microorganisms to which the easily decomposable organic fraction of the pre-settled wastewater is utilized as a carbon source. The operating cost of the recirculation between the two biological stages is significantly lower than the resulting savings from the reduction in the need for additional carbon source (methanol) during the operation of the denitrifying filters.

Under the anoxic conditions provided in the post-denitrification biofilters, the microorganisms utilize the added easily decomposable organic material (methanol) for denitrification. The removal of microorganism reproduction and the prevention of clogging of the filling material can be achieved by regularly backwashing the filter units. This is done by passing high-yield air and nitrificated water. The entire amount of the washed out sludge, together with the nitrate water recirculation, is returned to the pre-denitrification unit of the activated sludge reactor.

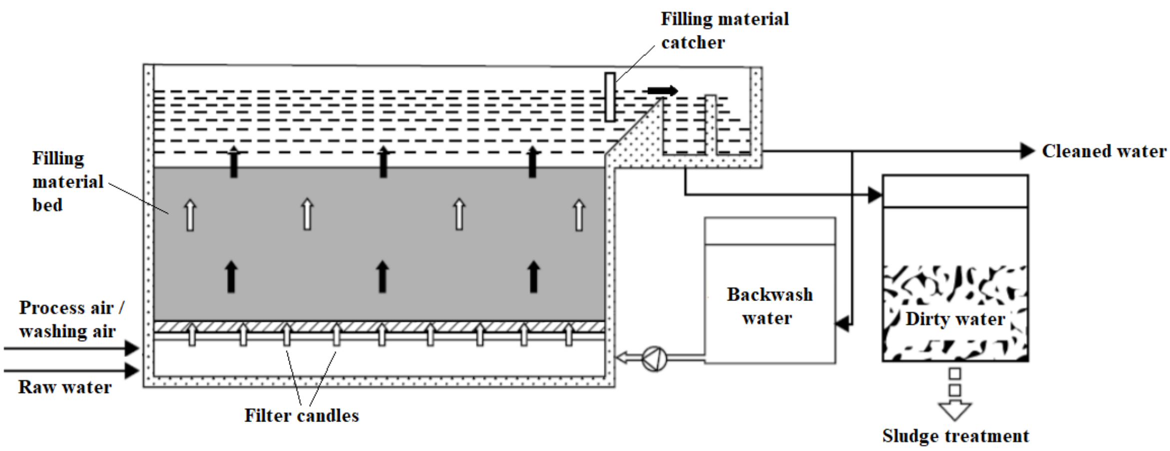


Figure 6. Operation figure of an upflow biofilter system (after WEF 2010)

The architectural and mechanical design of biofilters is almost identical regardless of their function (Table 3). Process air (for nitrification units), wastewater to be cleaned and in the case of backwashing the filters, the nitrified water and washing air are introduced into the distribution space below the reinforced concrete filter bottom, from where a large number of filter candles screwed into the filter bottom lead it to the upper filter space. In the nitrifying filters, the uniform distribution of the introduced air and raw water along the surface of the filter bottom is ensured by the bottom 30 cm deep layer of river gravel, while the adhesion of the biofilm required for nitrification is ensured by the 2.5-5.0 mm irregularly shaped, crushed and burnt clay particles placed as a filling layer with thickness of 4.2 m (Filtralite™) (Figure 7). In the post-denitrification filters, the thickness of the filling layer is 3.0 m and the diameter of the particles is in the range of 4-8 mm. Their shape is rounded, so a larger pore volume is available for the reproduction of heterotrophic organisms operating with a higher sludge yield. Due to the larger grain size, the installation of a lower layer of river gravel is not justified.

The specific surface area of the smaller, crushed filling material of the nitrification filters is 1400-1600 m^2/m^3, which is ~1000 m^2/m^3 for the larger, rounded filling material of the denitrification units. Although the specific weight of the particles is greater than the water's (1.5-1.6 kg/dm^3), in filtration mode the bed becomes expanded – depending on the degree of clogging and the yield of the wastewater and process air passed through. During backwashing, the entire bed is mixed, the significant amount of the biofilm adhering to the particles breaks off and is washed out of the pores.

The structures of the BIOFOR™ biofiltration stage were originally designed for a load of 120 000 m^3/day, but in 1999 they only have built a mechanical capacity of 80 000 m^3/day. Of the 10 oxic and 6 anoxic biofilters built, 7 and 4 were put into operation.

The peculiarity of the South-pest Wastewater Treatment Plant's technology is that the biological reduction of nitrate to elemental nitrogen, with the exception of the recirculation of nitrate water into the activated sludge reactors, basically takes place in the last step of the wastewater cleaning sequence (post-denitrification),

where there are only biologically difficult decomposable organic nutrients available for the microorganisms in the wastewater and in limited quantity. In order to ensure denitrification at an adequate speed and with a suitable degree of efficiency, it is necessary to add an organic carbon source that can be easily (highly) utilized biologically. For this purpose, methanol is used at the Sewage Treatment Plant in South-Pest.

Figure 7. Burnt clay filling material and filter candles of BIOFOR™ nitrification (left) and denitrification (right) biofilters (www.filtralite.com)

THE RESULTS OF THE BIOFILTRATION TECHNOLOGY

In the period following the implementation of the biofilters in 1999, the complex technology of the wastewater treatment was able to maintain a stable effluent water quality corresponding to design emission values that is significantly stricter than the national legal regulations (Table 1).

Table 1. The designed emission limit values of the BIOFOR™ unit, and the final emission limites prescribed by the authority (COD: Chemical Oxygen Demand, BOD_5: Biological Oxygen Demand, TSS: Total Suspended Solids)

Parameters		Discharge limits (designed)	Discharge limits (permitted)
COD	mg/l	50	80
BOD_5	mg/l	10	25
TSS	mg/l	35	35
NH_4-N	mg/l	2	2* 4**
Total-N	mg/l	10	15* 20**
Total-P	mg/l	1.8	1.8
Comment:	*	*V.1. - XI.15.*	
	**	*XI.16. - IV.30.*	

During the two decades that have passed since the BIOFOR™ unit was put into operation, the load of the wastewater treatment plant has changed significantly, as a result of the following factors:

- Parallel to the increase in the level of sewerage, the yield of raw sewage remained almost constant, while the concentrations of the pollutants increased significantly. The most probable explanation for this is the change in water usage habits and the spread of water-saving equipment. Regarding the inluent nitrogen (TKN), the increase is almost 60%, i.e. compared to the planned value of 40 mg/L, an average of 65 mg/L of nitrogen comes from the sewer network.
- Only 30-35% of the electricity demand of the treatment plant can be covered by the energetic utilization of the biogas formed during the anaerobic fermentation of the separated primary and biological excess sludge. In order to increase the energy self-sufficiency, the co-fermentation technology was developed for the biodegradation a high organic content wastes from external sectors (mainly the food industry) together with own sewage sludge. Depending on the quantity and quality of the utilized organic waste (co-substrates), the wastewater treatment plant can now cover its entire energy demand by utilizing the biogas produced during co-fermentation. The electrical energy produced in excess is fed into the national electricity grid. The consequence of achieving energy self-sufficiency is that co-substrates generally contain more nitrogen than sewage sludge, which is converted into dissolved ammonia during anaerobic biodegradation. The leachate produced during the dewatering of the digested sludge is returned to the wastewater treatment technology, where it causes a significant excess load of ammonia and orthophosphate. The technological design calculated only ~9% TKN internal load, this value is currently close to 30%.

Table 2. Important technological parameters of the BIOFOR™ biofiltration stage in the case of designed capacities and different levels of construction
(N: Nitrifying Biofilter, DN: Denitrifying Biofilter, Q: Waterflow)

Parameters		A Designed (80 000 m^3/d) 7 N + 4 DN	B Designed (120 000 m^3/d) 10 N + 6 DN	C until 2016 (60 000 m^3/d) 7 N + 4 DN	D 2016-2022 (60 000 m^3/d) 7 N + 6 DN	E from 2022 (60 000 m^3/d) 10 N + 6 DN
NITRIFYING BIOFILTERS						
Q Wastewater	m^3/d	80 000	120 000	60 000	60 000	60 000
Q recirculation (backwash + nitrified water)	m^3/d	8 000	12 000	24 000	24 000	24 000
Q influent	m^3/d	**88 000**	**132 000**	**84 000**	**84 000**	**84 000**
N influent (NH_4-N)	kg N/d	2 812	4 222	3 780	3 780	3 780
N removed with excess sludge	kg N/d	92	191	84	84	94
N to be nitrified	kg N/d	2 456	3 635	3 528	3 528	3 602
Number of operating filters (n)	db	7	10	7	7	10
Total volume of filling material (for n unit)	m^3	2 357	3 367	2 357	2 357	3 367
NH_4N specific load (for n unit)	kg N/m^3d	**1.19**	**1.25**	**1.60**	**1.60**	**1.12**
Nitrification performance (for n unit)	kg N/m^3d	**1.04**	**1.08**	**1.5**	**1.5**	**1.1**
Average filtration rate (for n unit)	m/h	**6.5**	**6.9**	**6.2**	**6.2**	**4.4**
Maximal filtration rate (for n-1 unit)	m/h	12.9	11.9	8.9	8.9	6.0
DENITRIFYING BIOFILTERS						
Q influent	m^3/d	**80 000**	**120 000**	**60 000**	**60 000**	**60 000**
N influent (NO_3-N)	kg N/d	2 233	3 305	2 520	2 520	2 573
N to be denitrified	kg N/d	1 833	2 705	1 860	2 040	2 093
Number of operating filters (n)	db	4	6	4	6	6
Total volume of filling material (for n unit)	m^3	703	1055	703	1055	1055
NO_3-N specific load (for n unit)	kg N/m^3d	**3.18**	**3.13**	**3.58**	**2.39**	**2.44**
Denitrification performance (for n unit)	kg N/m^3d	**2.61**	**2.56**	**2.6**	**1.9**	**2.0**
Average filtration rate (for n unit)	m/h	**14.2**	**14.2**	**10.7**	**7.1**	**7.1**
Maximal filtration rate (for n-1 unit)	m/h	31.9	17.1	14.2	8.5	8.5
Methanol demand	kg/d	**4 875**	**7 202**	**4 960**	**5 404**	**5 535**

As a result of the increase in the external and internal load of the wastewater treatment plant, the ammonia-N concentration of the waste water fed to the nitrifying biofilters increased from the planned 32 mg/L to 45 mg/L, which resulted in a proportional increase in the specific loads of the operating oxic and anoxic filters, respectively from 1.2 to 1.6 kg NH_4-N/m^3/day, and from 3.1 to 3.6 kg NO_3-N/m^3/day (Table 2, column C). (Due to the uncertainty of the specific surface area of the filling material, the load of biofilters is usually given as a function of the load of the substrate relative to the volume of the filling material.) In the period of filter backwashing and in the case of peak nitrogen loads, a significantly higher specific load, than the above values, were also formed,

The unfavorable effect of the overloading was shown in the periodic increase of ammonia and nitrate concentrations in the filtered water. The more critical effect was observed in post-denitrification, operating with only 4 parallel filter units, since the stoppage of any unit resulted in a load increase of ~30% in the filters that remained in operation (the same value for nitrification is only 17%).
In 2016, 2 more denitrification filters (built for the 120 000 m^3/day wastewater flow) were put into operation. As a result of the capacity expansion, the process stabilized, the specific nitrogen load decreased to an average of 2.4 kg NO_3-N/m^3/day, and the NO_3-N concentration of the treated wastewater was reduced by an average of ~4 mg/L (requirement of additional carbon source used for this ~ 440 kg/day) (Table 2, column D).
Regarding this operating condition, Figure 8 illustrates the evolution of the average concentrations of the different nitrogen forms along the profile of the wastewater treatment technology. The increase in TKN concentration during the mechanical pre-treatment indicates the effect of the internal load brought back by the leachate from the sludge treatment and co-fermentation.

The reduction of TKN in activated sludge biological treatment reflects the diluting effect of the return of nitrified water and the incorporation of nitrogen into the sludge cells of the high-load system. At the same time, the low concentration of nitrate indicates adequate efficiency of pre-denitrification.

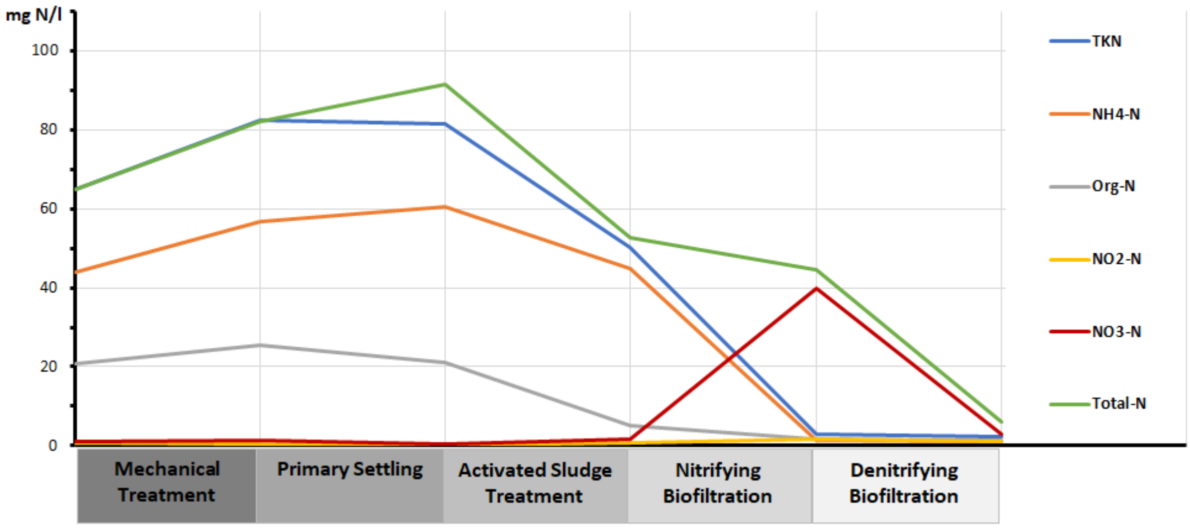


Figure 8. Changes in the concentration of N forms (using 2019 annual results)

Based on literature datas, Table 3 contains the typical load values and expected cleaning efficiencies that can be used for the technological sizing of expanded bed up-flow biofilters (e.g. BIOFOR^{TM}) that follows the secondary (biological) treatment.

Table 3. Sizing parameters of biofiltration (BOD_5: Biological Oxygen Demand, TSS: Total Suspended Solids) (deBarbadillo et al. 2010, WEF 2010, Tastekin 2016)

NITRIFICATION:		**POST-DENITRIFICATION:**	
Specific load:		Specific load:	
BOD_5	≤ 1 – 2 kg/m³d	NO_3-N	0.8 – 5.0 kg/m³d
TSS	≤ 1.0 – 1.6 kg/m³d		
NH_4-N	≤ 0.5 – 1.0 kg/m³d (at 10 °C)		
	≤ 1.0 – 1.6 kg/m³d (at 20 °C)		
Hidraulic load:		Hidraulic load:	
	3 – 20 m³/m²h		10 – 35 m³/m²h
Treatment efficiency:		Treatment efficiency:	
BOD_5	40 – 75 %	NO_3-N	75 – 95 %
TSS	40 – 75 %		
NH_4-N	75 – 95 %		

Although the average load of 1.6 kg NH_4-N/m^3/day is the upper value of the usual application range of nitrification (especially overloaded at low water temperatures), nevertheless the average efficiency of nitrification is maximal (~95%). As a result of the expansion of the denitrification capacity, the efficiency of nitrate reduction is also high (90%), with the load reduced to an average of 2.4 kg NO_3-N/m^3/day. The result of unfavorable climate change and the increase in the capital's asphalted surfaces is the significant increase in the intensity and duration of rains following periods of drought.

The sewer network of the capital is a combined system, with the exception of the peripheral districts. During rainstorms, the proportion of diluted wastewater that exceeds the hydraulic capacity of the treatment plant is still separated in the sewer network and bypassed directly into the receiving surface water. In order to protect the RSD, full mechanical filtration and sedimentation of the stormwater will be realized, according to the plans. The treatment of the sludge phase, separated in the stormwater storage tanks, with the return of the concentrated leachate into the main stream of the wastewater treatment technology, will cause a significant additional load for the treatment plant in terms of all pollutants, mainly in the periods following the rains.

The capacity expansion of the nitrifying biofilters, which are overloaded by 35-40% even in the dry weather at low operating temperatures, is therefore inevitable. The additional nitrification demand can be met by mechanical, electrical and informatical commissioning of the 3 nitrifying filters that have been built but are not in operation. After the nitrification capacity expansion, the average volumetric NH_4-N load of the filter is decrease from the current 1.6 kg/m^3/day to the expected value of 1.1 kg/m^3/day, almost to the designed value (Table 2, column E).

OPERATIONAL EXPERIENCES

Nitrification at low sludge age

The technological peculiarity of the South-Pest Wastewater Treatment Plant is that the activated sludge stage, operating with a high load and a low sludge age (1.5-1.8 days) is also capable of nitrification to a certain extent, especially in the case of summer operating temperatures exceeding 22 °C, due to the autotrophic microorganisms that grow selectively in the nitrifying filters and are recirculate regularly into the activated sludge system with the backwash water (reinoculation). In this case, the NO_3-N concentration in the effluent water of the activated sludge unit can reach up to 8-10 mg/L. At the same time, the NH_4-N load of the oxic filters decreases.

Nitrification at low operating temperatures

The microorganisms attached to the carrier material of the fixed-film biofilter are able to ensure more stable nitrification compared to an activated sludge technology, since the chemolithotrophs bound to the surface (here: nitrifiers use ammonia as an energy source) are not washed out from the system despite their lower growth rate. However, especially in the case of lower wastewater temperatures (<16 °C), when the growth rate of microorganisms is slower anyway, the degradation efficiency of organic matter in the activated sludge system and efficiency of the phase separation in the final settling tanks also decrease, thus increasing the load of organic matter and suspended matter on the oxic (nitrifying) biofilters. This primarily results the retention of heterotrophic biomass from the high-load activated sludge system in the filter bed. In the presence of excess organic matter, these heterotrophic organisms compete for oxygen with the nitrifying autotrophs, partially "pushing" them away from the filling material. As a result of these factors, in winter the residual NH_4-N concentration after nitrification approaches the current emission limit value (4 mg/L).

The effect of oxygen intake on nitrogen removal and its methanol demand

Keeping the nitrification efficiency high and the effluent ammonia concentration low can only be achieved by ensuring high-speed material transport, which requires increased oxygen intake, i.e. overaeration of the filters. As a result, the dissolved oxygen concentration of nitrified wastewater is typically 5-7 mg/L, but especially at low operating temperature, DO can even approach the saturation value. The nitrified water is fed to the post-denitrification filters, with this high dissolved oxygen concentration.

The real anoxic conditions induce the formation of nitrate/nitrite reductase enzymes, which are essential for nitrate/nitrite utilization. Heterotrophic organisms prefer dissolved oxygen over nitrate/nitrite, because by using DO, they can remove the readily biodegradable organic compounds at a higher rate (actually with a higher energy gain) than when using nitrate. The presence of dissolved oxygen in the anoxic reactor, in addition to the higher organic substrate demand, inhibits the formation of nitrate reductase enzyme therefore the denitrification process. The degree of inhibition basically depends on the type of the technology used (Metcalf & Eddy 2013).

According to our calculations, the high dissolved oxygen concentration of the nitrified water, fed into the anoxic filters, causes a 7-8% increase in the methanol demand of denitrification. In other words, high DO reduces the amount of biomass that can be used for denitrification, i.e. reduces the useful reactor volume, since the biodegradation of methanol takes place with dissolved oxygen in the lower parts of the denitrification filter beds.

The effective backwashing of the biofilters

One of the most important limiting factors of the biofiltration process is the clogging of the filter bed, due to the suspended solids filtered from the wastewater and the biological growth formed during the biological

processes and attached to the particles of the carrier. Improving and uniformizing the flow through the filter bed and prevent complete clogging the suspended solids (biomass) must be removed from the filter bed at regular intervals by backwashing the given unit with increased quantity of air and nitrified water. However, as a result of the backwashing, it must be ensured that the microorganisms are still available in sufficient quantities attached to the surface of the filter media, in order to maintain the necessary biological activity. According to the literature, of the BIOFOR^{TM} technology, the amount of retained suspended solids can be 2.5 to 4.0 kg TSS/m^3/day based on the filter volume (WEF 2010). Unfortunately, the literature does not detail the difference between nitrifying and denitrifying filters, and the influence of operating temperature or nitrogen load.
According to the original engineering design, the biofilters are backwashed with the operating air blowing equipment (HV-Turbo KA10, maximum operating pressure 1000 mbar) of the nitrification process, via the operating airline system. In order to ensure the backwashing air demand (5500 m^3/h for nitrifying filters, 6500 m^3/h for denitrifying units), the process control had to increase the pressure of the air blowers to 980 mbar, which approaches the maximum value, for the duration of the washing program. The differences in the hydraulic and the aerodynamic resistance between the washed filter and the currently operating nitrification units results significant pressure fluctuations. This regulation was not successful in those periods when the separation efficiency of the final clarifiers was lower, thereby increasing the retention of suspended solids in the biofilters. In such cases, it was often unsuccessful to achieve the demands of washing water and air the backwashing was only partial. In more critical cases, the operating pressure suddenly rose above the tolerance limit of the blowers, as a result of this they stopped and the backwash was interrupted, so it had to be repeated. At the same time, nitrification was also interrupted too. The repetitions of backwashing often led to congestion, undesired prolongation of filtration cycles, which further increased the clogging of filter units.
The balanced operation of the biofilter system was achieved by separating the air intake systems of the nitrification process and the filter backwashes, by installing a separate air blower (HV-Turbo KA5, maximum operating pressure 1200 mbar) and associated separate piping system and fitting for backwashing.

SUMMARY

At the South-Pest Wastewater Treatment Plant the nitrogen content of the wastewater is basically removed by a compact, two-stage (nitrification + post-denitrification) biofiltration stage (BIOFOR^{TM}) connected after the high-load activated sludge treatment unit that performs the biodegradation of organic matter. A smaller proportion of the nitrified water is returned to the pre-denitrification zone of the activated sludge system. Post-denitrification stage with adequate speed and efficiency requires the addition of an external carbon source (methanol). Since the installation of biofiltration, the external and internal load of the sewage treatment plant has increased significantly, so it became necessary to expand the already overloaded post-denitrification capacity, which was achieved by installing additional biofilters.
Adequate speed and efficiency of post-denitrification can only be ensured by dosing an external organic substrate with a constant composition, free of impurities and components that are difficult to break down biologically. In the treatment plant, high-purity methanol is dosed for this purpose. Overdosing the methanol in the last unit of the technology results an increase in the oxygen demand (BOD_5, COD) of the effluent treated wastewater, while underdosing results a partially realized nitrate reduction and an increase in the effluent nitrite concentration. The level of nitrite accumulation, which also depends on the type of carbon source used, is relatively low in the case of alcohols, the lowest with methanol, although methanol is not considered outstanding in terms of specific nitrate removal.
The technological peculiarity of the treatment plant is that even the high-load activated sludge system is capable of a certain amount of nitrification (mainly at higher operating temperature) as a result of the regular

recirculation (reinoculation) of the biomass washed out of the nitrifying filters. Compared to the activated sludge system, biofiltration stage is more efficient and capable of more stable nitrification but can be significantly weakened by the load transferred from the activated sludge system (excess organic matter and suspended solids resulting from its reduced biological activity and phase separation efficiency due to the low operating temperature). High-efficiency nitrification can only be achieved by ensuring high-speed material transport (overaeration of the nitrifying filters). The high dissolved oxygen content of the wastewater passed through the post-denitrification filters inhibits the production of nitrate reductase enzymes, its consumption entails an additional methanol demand and an increased filter load. One of the most important factor of the biofiltration process, the increased air demand for the backwashing of the filters was achieved reliably by installing a high-performance air blower independent of the nitrification operating air supply.

The nitrogen removal biofilm system also operating in the treatment plant can play a particularly effective role in the biodegradation of organic micropollutants (e.g. pharmaceutical residues) through co-metabolic processes due to the special enzymes of the microorganisms (ammonia oxidizers, methylotrophs) that selectively multiply on it.

The technology of the South-Pest Wastewater Treatment Plant in the period since the construction of the nutrient removal stage, despite the significantly increased loads, with the necessary improvements continuously ensures the perform of the emission limit values prescribed for the receiving the RSD, as an especially sensitive water body.

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EFFECTS OF MOLES ON SOIL PROPERTIES ON GRASSLANDS

Csaba CENTERI[1], Viktória VONA[2], Márton VONA[3], Zsolt BIRÓ[1]

[1] Institute for Wildlife Management and Nature Conservation, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary; centeri.csaba@uni-mate.hu, biro.zsolt@uni.mate.hu*
[2]Faculty of Agricultural and Food Sciences, Széchenyi István University, Mosonmagyaróvár-Hungary, H-9200, Mosonmagyaróvár, Lucsony u. 15–17., Hungary; vonaviki@gmail.com
[3]Csernozjom Ltd., 5065 Nagykörű, Arany J u 10 Hungary

***Abstract**:*
Mole activity is one of the main soil biological activities and plays an important role during soil formation. The purpose of this paper is to investigate mole activities on the soil properties under grasslands. Based on the mixing of lower soil horizons with the upper ones might lead one to the assumption that molehills and the nearby areas are different. The compared areas were grasslands, one in the Gödöllő Hills Landscape Protection District, the other one is on a pasture in Karcag, both are in Hungary. The comparison was based on the measurements of soil organic matter, pH, N, P, K, Ca, Al, Fe, clay and soil moisture by a Near Infrared Device of Agrocares Ltd. (Nl). Shapiro-Wilk, Duncan post-hoc and Kruskal-Wallis tests were used for statistical analyses. The results proved that mole hills are quite similar to their control areas in Karcag and they are significantly different in the Gödöllő site. We can conclude that moles have significant effects on the surface soils in some of the cases but these effects do not always appear between the burrow and the control.

***Keywords**: soil nutrients, pH, soil organic matter, comparative analyses, soil biology*

INTRODUCTION

The biological activity of soils on Earth has very limited knowledge, e.g. only 5–10 % of soil fungi is estimated to be known so far. On the other hand, some of the macro vertebrates are considered as enemy among city dwellers having a garden, or especially lawn. The mole (*Talpa europea*) is one of these vertebrates. As we stated before (Centeri et al. 2022), the quantity of the publications related to the mole activities and their affect on soil properties is very limited (Platt et al. 2016).

In our former investigation forested areas were compared, on of them in the same Babat area, the other was in the Bükk Mountain, in the Bükk National Park (Centeri et al. 2022). Based on the t test, the pH, the Fe and the clay content are similar in the burrows and in the control areas, while carbon content, total N, P, Ca and Mg, CEC, total Al show significant differences between the control and the burrows in the Babat area. In case of the K content, there are significant differences between the burrows and the control areas ($U=25$; $n1=n2=5$; $p=0.08$) in the Babat area. These results prove our null hypotheses about the differences (Centeri et al. 2022).

There were significant differences between the burrows and controls in case of SOM, P, total N and potentially mineralizable N in the Bükk area. In case of the Mg ($U=5$; $n1=n2=3$; $p=1$) and clay ($U=9$; $n1=n2=3$; $p=0,1$) there were no significant differences in the Bükk area.

In the recent research mole burrows found on grasslands were evaluated. There was a huge expectation to find differences on grasslands, based on the former results with the high amount of differences in the forested area. The main hypothesis was that differences between burrows and grasslands are going to be significant in case of many soil parameters.

MATERIALS AND METHODS

The compared areas were grasslands, one in the Gödöllő Hills Landscape Protection District, the other one is on a pasture in Karcag, both are in Hungary. The comparison was based on the measurements of soil organic matter, pH, N, P, K, Ca, Al, Fe, clay and soil moisture by a Near Infrared Device of Agrocares Ltd. (Nl).
In the Babat area a sandy soil was examined with shallow humus layer. The soil of the Karcag area is a clayey meadow soil where the thickness of the humus-rich horizon is thicker. Both areas are flat. The precipitation is bigger in the Babat area while the evaporation is higher in the Karcag area. The Karcag area is warmer, the Babat area is cooler.

STATISTICAL ANALYSIS

Shapiro-Wilk, Duncan post-hoc and Kruskal-Wallis tests were used for statistical analyses.

RESULTS AND DISCUSSION

The analyses of all groups by ANOVA showed significant differences between all groups (Karcag and Babat) as follows:

pH: $F_{3,16}$=7.531, p=0.002
P: $F_{3,16}$=3.703, p=0.034
K: $F_{3,16}$=253.882, p=0.000
Ca: $F_{3,16}$=33.745, p=0.000
Mg: $F_{3,16}$=64.53, p=0.000
A_N_PMN: $F_{3,16}$=14.491, p=0.000
CEC: $F_{3,16}$=52.921, p=0.000
Al: $F_{3,16}$=299.492, p=0.000
A_H_2O_2MM105: $F_{3,16}$=39.114, p=0.000

Based on the Duncan range test, the following differences could be proven:
the lowest values are in the grasslands of Babat, except phosphorous that is smaller in case of Karcag,
the Babat and the Karcag area is different in case of Phosphorous content,
in many cases the control areas of the Babat grassland represent an intermediate state between the Babat mole burrows and the values measured in Karcag,
the control and the burrow in Karcag almost always have the same values, except the Al content.

There were four parameters (SOM, N, Fe and clay) with non-normal distribution where the Kruskal-Wallis test was used with Dunn's post-hoc test, and resulted significant differences between the groups (Table 1).

Table 1. The results of the statistical analyses in case of soil organic matter, N, Fe and clay

Hypothesis Test Summary				
	Null Hypothesis	**Test**	**Sig.**	**Decision**
1	The distribution of SOM is the same across categories of 1=babat control, 2=babat grassland, 3=karcag control, 4=karcag grassland.	Independent-Samples Kruskal-Wallis Test	.003	Reject the null hypothesis.
2	The distribution of N is the same across categories of 1=babat control, 2=babat grassland, 3=karcag control, 4=karcag grassland.	Independent-Samples Kruskal-Wallis Test	.003	Reject the null hypothesis.
3	The distribution of Fe is the same across categories of 1=babat control, 2=babat grassland, 3=karcag control, 4=karcag grassland.	Independent-Samples Kruskal-Wallis Test	.001	Reject the null hypothesis.
4	The distribution of Clay is the same across categories of 1=babat control, 2=babat grassland, 3=karcag control, 4=karcag grassland.	Independent-Samples Kruskal-Wallis Test	.000	Reject the null hypothesis.
Asymptotic significances are displayed. The significance level is 0.05.				

Evaluation of the soil organic matter content

The Babati grassland has significant difference against the control of Babat and also the control of Karcag (Figure 1): KW=13.985, df=3, p=0.003 (Figure 1).

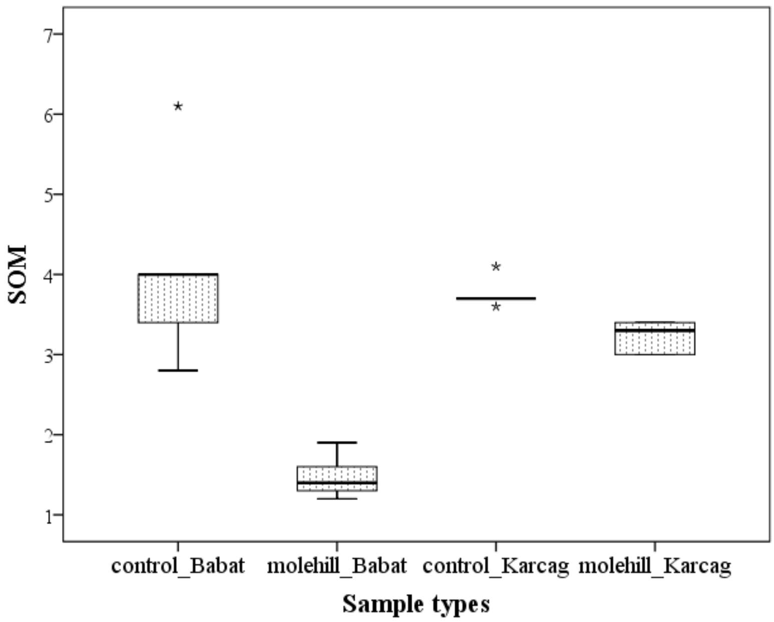

Figure 1. Evaluation of the grasslands' soil organic matter content in Babat and Karcag

Evaluation f the nitrogen-content

The grassland of Babat has significantly lower N than the control of Karcag but all other groups are the same: KW=13.671, df=3, p=0.003 (Figure 2.).

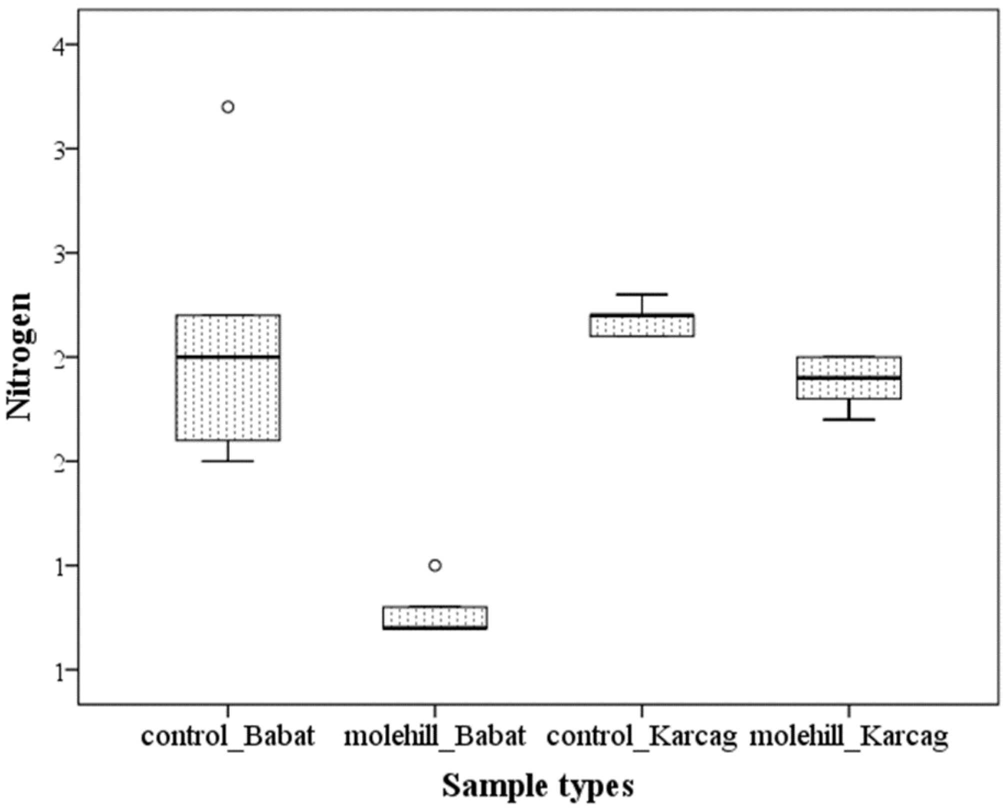

Figure 2. Evaluation of the grasslands' nitrogen-content in Babat and Karcag

Evaluation of the Fe-content

The grassland in Karcagi has a asignificantly higher Fe-content then the grassland in Babat. The burrows of Karcag do not differ from the controls of Karcag. The lowest value is in Babat: KW=16.903, df=3, p=0.001 (Figure 3.).

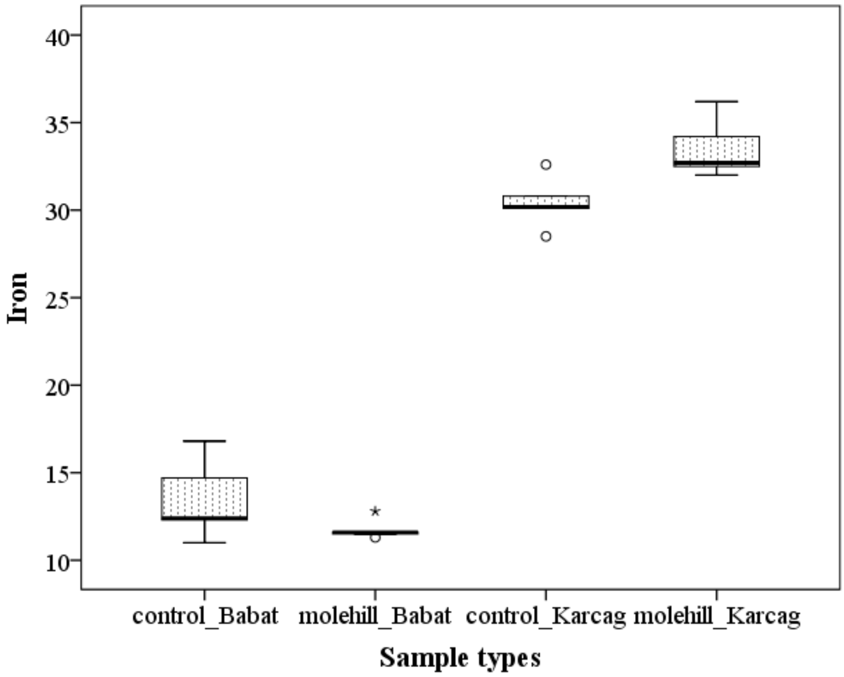

Figure 3. Evaluation of the grasslands' iron-content in Babat and Karcag

Evaluation of the clay content

The grassland of Karcag has significantly more iro the the Babat sampling area. The burrows of Karcag do not differ from the controls of Karcag. The lowest values were also found on the Babat grassland and has a significant difference compared to the control of Karcag: KW=17.952, df=3, p=0.000 (Figure 4.).

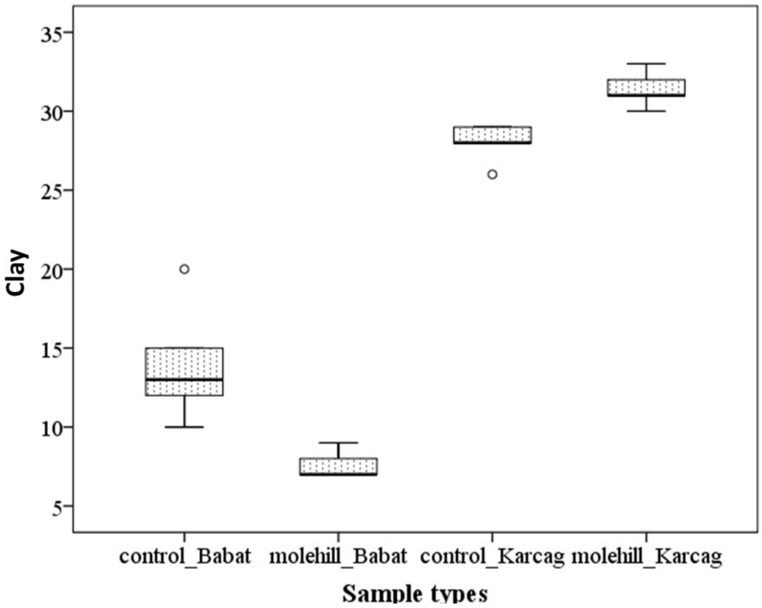

Figure 4. Evaluation of the grasslands' clay-content in Babat and Karcag

The reason of the similarities in case of the Karcag area can originate from the soil thickness and/or the burrow activity of the moles. If the disturbed soil originates from the close-to-the surface area, it makes no differences. Or, if the humus rich horizon is very shallow and the parent material is close to the surface, then the differences are more obvious.
The other reason can be the moving of mole, if they burrowing paralell to the surface and not far from the surface, they just mix the same horizon and burrow it on the surface as well, so the difference is small or not significantly different.

CONCLUSIONS

Based on the results we can conclude that there can be big differences, depending of the geographical location of the mole burrows. While the burrows and their control are different in case of the Babat area, they are similar in the Karcag area.
Furthermore, it is not only that the control and the burrow differ in the Babat area, and similar in the Karcag area but there are sometimes differences and there are overlapping between the two sites.

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SOIL ASPECTS OF A BIODIVERSITY MANAGEMENT PLAN FOR A SOLAR PARK

Viktor GRÓNÁS, Csaba CENTERI, Márk PÁLFI

Institute of Wildlife Management and Nature Conservation, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary country, e-mail: centeri.csaba@uni-mate.hu

***Abstract**:*
Solar energy has begun to gain ground in Hungary in recent years. The total installed capacity of solar power plants exceeded 3,000 MW in April 2022. 98.6% of the installed capacity was realized as green field investment, typically areas withdrawn from agricultural production. It resulted significantly reduction in biological activity and diversity of these areas. Numerous studies pointed out that careful planning can help to improve these activities and these areas can also play an important role as habitats, besides producing energy. Since solar parks cover a significant surface, their soils and soil properties can influence the biodiversity management plan. After all, one of the important steps in habitat development is the planting of plants that adapt to the technical parameters and environmental conditions. In the recent study comparison of soil properties were done by a Near Infrared device. Soil organic matter of the examined site was between 0.8–4.2%, pH(H_2O) 7.5–8.2, total N 0.4–2.4g/kg, P-content 17.1–68.8ppm, exchangeable K 1.9–6.9mmol/kg, clay content 12–29% and soil moisture content 1.6–13.1%. The deviation of the soil properties was quite high that leads to the assumption that there is a great variety of habitats for plants and animals, or, there is a possibility to offer a variety of these habitats in biodiversity management plans of this and similar *solar plants.*

***Keywords**: solar energy, biodiversity management plan, pedology, soil properties, comparative analyses*

INTRODUCTION

Renewable energy plays a crucial role in combating climate change (Malatinszky et al. 2013a,b, Frantál and Prousek 2016, Martinát et al. 2016), reaching energy union and deal with social issues. Among renewable energy technologies, solar parks are growing at an unprecedented rate in the world, as solar photovoltaic energy (PV) has the greatest potential for electricity generation of all renewable energy (Pogson et al., 2013). In addition to the many advantages of the technology, more and more research is drawing attention to the importance of studying, among other things, the negative effects on soils (e.g. changes in ecological and microclimatic conditions of soils in addition to soil loss, affecting hydrological, vegetative and carbon dioxide dynamics) (Choi et al., 2020, Armstrong et al., 2016). Soils are under permanent scope as they play an important role in climate change through carbon sequestration (Adiyah et al. 2021). Furthermore, landscape quality is another issue raised by many scientists (Slámová et al. 2015).
One of Hungary's most important (conditionally renewable) natural resources and its most significant national assets (about 26 %) is agricultural land (Orosz, 2018), so its quantitative and qualitative protection is of paramount importance. Land protection, which provides quantitative protection of agricultural land, aims to ensure that as little farmland as possible is permanently taken out of cultivation (Csirszki and Hornyák, 2022). Despite this, 2 thousand hectares of farmland are

permanently withdrawn from agricultural cultivation annually in Hungary (Garaguly, 2016). Industry, mining, transport, commercial and residential buildings, as well as other facilities, cover an increasing number of valuable lands practically irrevocably. Between 2012 and 2018, the largest proportion of artificial surfaces formed by industrial or commercial areas increased in addition to the contiguous settlement structure (by 17% and 16%, respectively). (KSH, 2019). Among the accelerating pace of greenfield investments, the problem of land occupation caused by solar panels has also appeared in Hungary in a way that follows the world trend.

While in Hungary the total installed capacity of solar power plants was still a single MW in 2010, in April 2022 this value exceeded 3000 MW, but an additional 5000 megawatts of connection needs are recorded. This also means that solar energy already accounts for almost 26% of the gross installed capacity of the Hungarian electricity system (10,419 MW) (Major, 2022).

Going forward, Hungary has set itself the goal of achieving a 20% share of renewable energy in its energy strategy by 2030, in which it relies heavily on solar energy. As a result, 6645 MW of solar panels are projected and are projected to achieve installed power by 2030 (ITM, 2020). Based on some expert estimates (Bartek-Lesi et al., 2019), the average area requirement of the specific capacity of domestic solar parks is 2.4 hectares / MW, which takes into account the unshielded placement of modules, the area requirements of service roads and other equipment (substation, service buildings). On this basis, if the planned capacity expansion until 2030 (additional 3645 MW) it would be realized exclusively with the inclusion of new land and built directly on the land, then its additional area requirement would be around 9000 ha.

In 2020, 98.6 percent of the projects authorized by the Hungarian Energy and Public Utility Regulatory Authority, out of the 210 MW installed capacity, 207 MW were greenfield investments. Thus, large-scale solar parks are almost exclusively planted in open air, typically areas taken out of agricultural production, while brownfield investments (former industrial sites, abandoned mining areas and tailings dumps, landfills, etc.) would also be more desirable due to land use, environmental protection and easier grid connections (Szolidáris Gazdaság Központ, 2021).

In the so-called Metár system developed to support solar power plants in Hungary, the additional scoring of "brownfield" investments has not so far provided a competitive advantage for applicants in any case (Munkácsy 2021). Other countries are trying to slow down the withdrawal of territory by various means. Among other things, they use the upper size limit set at auctions (e.g. France 8 MW, Germany 10 or 20 MW, Greece 20 MW) or territorial restrictions (e.g. in Germany a solar power plant can only be built on agricultural land with an exceptional permit) or auctions are only announced for predetermined connection points (Portugal) (Varga, 2020).

During the installation of the panels, significant loads are placed on the original soils (landscaping, placement of modular structures, cable laying, fencing, installation of service roads and equipment, etc.), such interventions to varying degrees, but modify, the physical, chemical and biological properties of the soils, thus their ecosystem service capacity.

Although less than 5% of the area of solar parks is physically installed (Takács, 2022), the parts of the area shaded by panels can cover 25–47% of the total area of the solar park depending on its technical design (Ong, 2013). Here, special microclimatic and soil moisture conditions are formed, which must be taken into account when planting plants (Barron-Gafford et al., 2016, Lambert, 2021). However, the conditions of the remaining areas (non-built-up and non-shaded) can be improved after careful planning and, for example, native plants can play an important role as habitats after planting (Fthenakis, 2011, Hernandez et.al., 2019, Blaydesa et.al. 2021).

In the recent study, a descriptive soil chemical analyses is given, based on the soils around the solar park and the nearby semi-natural area. The aim of the research was to show horizontal and vertical the differences of the soil parameters, if any, concerning the solar parks' areas.

MATERIALS AND METHODS

When selecting the sample area, the following aspects were taken into account:
1. it should be in the green field investment garden of the solar park,
2. it should be on the outskirt area of a settlement,
3. it should be in an agricultural environment and,
4. it should be located near valuable natural areas.

Based on the above criteria, two realized investments (one with an area of 4.4 and one with an area of 1.2 ha) were selected (Figure 1., Table 1.).

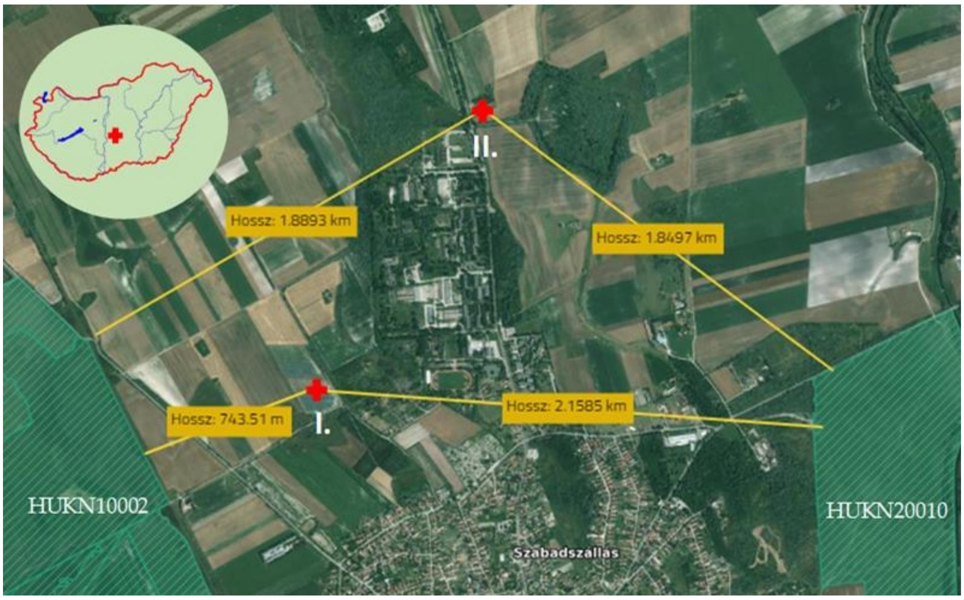

Figure 1. Situation of the two solar panel parks near Szabadszállás, Hungary and their distance from the nearby Natura2000 sites

Table 1
The main technical data of the sample areas

Technical data	Sample area No. 1.	Sample area No. 2.
Location	Szabadszállás, Hungary	Szabadszállás, Hungary
Start date	2019	2022
Installed capacity (kWp)	4 x 607.75	652
Output capacity of the inverter (Kva)	4 x 499	498
Total area (ha)	5.3	1.3
Area of the PV park (ha)	4.4	1.2
Target area of habitat development (ha)	2.3	0.5

In the next step, taking into account international and domestic recommendations (BRE, 2014, Bennun et al., 2021, Takács 2022),

habitat mapping and use analysis will be carried out in a radius of 1 km surrounding the investment using map databases (Ministry of Agriculture, 2019) and field visits followed. When analyzing the wildlife, we used the maintenance plans of the two nearby Natura 2000 areas (HUKN10002, HUKN20010) as a basis (Krāll, 2016, MME, 2015). Taking into account the habitat map, typical land use, and Natura 2000 maintenance plans, the range of possible interventions can be determined. The solutions selected in this way, which prove to be beneficial from the point of view of the living world, are further narrowed down by taking into account the physical and topological features of the solar park and the undisturbed requirements of solar energy production. The sample areas are located at a distance of 0.7–2.1 km from the Kiskunság saline lakes and the Turjánvidék (HUKN10002) and the Szabadszállás grassland of ground squirrels (HUKN20010) Natura 2000 areas. The HUKN10002 area is an important bird habitat of the Danube watershed both during the migration and the breeding season, and the HUKN20010 area is the habitat of the socially important ground squirrel (*Spermophilus citellus*).

Soil sampling and soil analyses

Soil samples were collected alongside the fence (Figure 2.), on undisturbed ground (non-affected by construction work, one sample was from a nearby semi-natural area), in five replicates from three depths, 0–20, 20–40 and 40–60 cm.
Soil chemical characteristics pH (H_2O), carbon content, total N, P, exchangeable K, Ca and Mg, CEC (Cation Exchange Capacity), total Al and Fe are the parameters that we can measure with the device. NIR spectrometer is using a wavelength range of 1300–2600nm (MEMS technology). It is produced by the AgroCares company and works with the SoilCares mobile application.

Figure 2. Sample Area No. 1. (left) and Sample Area No. 2. (right)

Sample areas can be easily distinguished by their size and shape (Area No. 1. is larger).

RESULTS AND DISCUSSION

Soil parameters of Sample Area No. 1.

Considering all layers and sampling spots, soil pH was very similar, ranging from 8.0 to 8.1.
The soil organic matter content showed a little bit bigger deviation, ranging from 1.8%

(in the deepest analysed layer of Sample 4.) to 4.2% (in the uppermost analysed layer of Sample 5.). Sample 4 and 5 can be considered the least affected areas by the possible disturbance due to the construction of the fences and the park. Comparing the upper 0–20 cm layer of the sampling points, those closer to the fence all have lower amount of soil organic matter. This tendency is also reflected in both the amount of total and the possibly mineralizable nitrogen content, plus the exchangeable K-content, the total Fe-content and the soil moisture content and partly in the exchangeable Mg-content. The other parameters are more variable, tendencies were not found.

The vertical tendencies are also visible, following the expected variance, e.g. the 0–20 cm layers have the highest amount of soil organic matter while the deeper horizons have lower amounts. It was also expected that there should be e decreasing tendency downwards but most likely due to former disturbance of agricultural production (soil tillage) and/or the disturbance during the construction of the park, the layers are sometimes more humus-rich in the deepest layer (40–60 cm) than in the middle layer (20–40 cm).

Soil parameters of Sample Area No. 2.

Considering all layers and sampling spots, soil pH was very similar, however, its range was a little larger than in Sample Area No. 1., as here the lowest pH was 7.5 and the highest was 8.2.
The soil organic matter content was smaller here than in Sample Site No.1. The lowest amount was 0.8% while the highest was 2.8%. However, the highest amounts are also in the upper 0–20 cm layer, except sample point No. 3.
The tendency of lowering amount of soil organic matter is following our zero hypothesis, so the deeper we go, the lower the amount of soil organic matter is, again, except in sample point No. 3. (it is the opposite, it shows an increase with depth). In case of organic carbon, the data is a little sporadic, there are only 2 sampling point where the data is available but sampling point 5 is showing a very nice decreasing tendency with increasing depth. This tendency is also visible, however it magnitude is smaller in case of sampling point 4.
This situation is similar in case of the total and potentially mineralizable N: there is a nice lowering tendency downwards with the same exception of sample No. 3.
In case of P, there were "only" two lowering tendencies, in case of sample No. 2 and No. 5.
In case of exchangeable K, sample No. 3 shows a nice increasing tendency towards the deeper layer, all other sampling points are showing different tendencies.
In case of exchangeable Ca-content, only sample No. 2. followed the hypothesis about the lowering amounts.
In case of exchangeable Mg, there is an increase with the depth in sampling point 1 and 3, the other point behaves differently.
The Cation Exchange Capacity is showing an obvious decrease in case of sampling point 2 but this tendency is not that straightforward in the other points.
The soil moisture content is expected to increase with depth. This increase is only visible in sampling point 1, also in sampling point 2 but only in between the 0–20 cm and 20–40 cm layers.

CONCLUSIONS AND RECOMMENDATIONS

We can conclude that there are differences between soil parameters of the two solar parks. Furthermore, there are not only differences but also there are different tendencies with depth. This can lead us to the conclusion that the effect of a solar park construction on soil properties can be

different. The soil properties of the nearby area where the construction of the solar parks had no affect did not differ more than the sampling points alongside the fence did, so we can conclude that from a pedological point of view, no degradation could be detected.
Further investigations needed to analyse the effects in more depth.

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DEVIATION OF SOIL NUTRIENT CONTENT IN A PERMACULTURE FARM, KÓSPALLAG, HUNGARY

Csaba CENTERI[1], Viktória VONA[2], Márton VONA[3], Eszter TÓTH[4], Zsolt BIRÓ[1], Alfréd SZILÁGYI[1]

[1]Institute for Wildlife Management and Nature Conservation, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary; centeri.csaba@uni-mate.hu
[2]Faculty of Agricultural and Food Sciences, Széchenyi István University, Mosonmagyaróvár-Hungary, H-9200, Mosonmagyaróvár, Lucsony u. 15–17., Hungary; vonaviki@gmail.com
[3]Csernozjom Ltd., 5065 Nagykörű, Arany J. u. 10. Hungary
[4]Institute for Rural Development and Sustainable Management, Hungarian University of Agriculture and Life Sciences, Budapest, Hungary; toth.eszter9011@gmail.com

***Abstract**:*
The philosophy of permaculture farms seems like a solution for many recent problems related to agricultural production. Permaculture farms lay big emphasis on environmental issues, nature conservation issues, sustainability issues and also, on reducing the ecological footprint of agricultural production. Still, there are very scarce data on the analyses of environmental effects, including soil, water and air. The present study wishes to give an overview on soil nutrient content of the plots of a permaculture farm in Kóspallag, Hungary. The comparison of the upper few centimetres of soils of 12 plots was based on the measurements of soil organic matter, pH, N, P, K, Ca, Al, Fe and clay by a Near Infrared Device of Agrocares Ltd. (Nl). The order of the nutrient content of the parcels shows that there is a considerable increase towards the highest nutrient content, the different parcels are having different position in the order of certain soil nutrient parameters, e.g., Parcel No. 1. has the lowest P content while Parcel No. 6. has the highest, Parcel No. 8. has the lowest K content while Parcel No. 11. has the highest, etc. The trendline has a good R^2 value, in case of P content it is 0.9077, in case of K it is 0.9701.

***Keywords**: soil nutrients, order of plots, differences of plots, comparative analyses*

INTRODUCTION

Permaculture farming practice seems the most promising solution for multiple arising problems that are all connected: energy crisis, environmental pollution, nature conservation issues (e.g. loss of habitats, loss of biodiversity, severe pressure on remaining natural areas, etc.), high fertilizer prices, drought, floodings, etc. The majority of the world's problem is – we need to face it – are related to agricultural production, as the growing population of Earth needs an increasing amount of food. So, the problems are related to agricultural production, e.g. environmental protection, nature conservation, landscape quality, just to mention a few. Permaculture can be a part of the solution of related problems (Hathaway 2015), take some of the pressures off of agriculture, nature (Kremen and Miles 2012) and environment. Furthermore, permaculture can also be an answer to numerous social problems, as permaculture is practiced mostly in small scale, and also offered for family size farms or even household-size areas, even for a small yard, not bigger than 10 m^2. There are a wide range of information available about the philosophy of permaculture farms and the methods used.

However, there is very little information on soils (Tombeaur et al. 2018, Szilágyi et al. 2022) of these permaculture farms, especially how the soils are changing or what were the major characteristics of the soil properties before and during the production of agricultural products.
This is why a Hungarian permaculture farm was chosen to provide information on soil parameters in such a permaculture farm, and more.

MATERIALS AND METHODS

Description of the analysed permaculture farm

Pallagvölgyi Biokert is a micro farm in the northern part of Hungary, appr. 50 kms from Budapest. It was established in 2020 by four enthusiastic young farmer-to-be professionals. The garden's first season was in 2021 after six months of preparation and designing. The main goal is to produce high quality, organic, fresh vegetables for a CSA (Community Supported Agriculture) vegetable box scheme.
The farm works with regenerative agroecological principles and practices, integrates the ethics and design methods of permaculture, builds on the overall principles and long-term experiences and know-how of organic farming and uses the biointensive, market gardening tools&methods&practices. The farm has been designed using permaculture design methods, and principles from the beginning, which concerns not only the agro-professional planning but also the social-community aspects. One of the farm managers is a founding member of the Hungarian Permaculture Association, he also works as a permaculture teacher and designer, thus the farm operates in close connection with the permaculture association (venue for PDCs, demonstration farm etc.).
The garden's production site is 5500 m^2, encompassing 625 m^2 polytunnels (5 tunnels), around 1000 m^2 deep mulch area, and fixed, open field beds on the remaining area.
More than 60 cultivated plant species, and a huge variety of cultivars (3-4 cultivars on average per crops).
Vegetable crops: more than 60 different crops, various cultivars
Animals: Indian runner ducks, various wild species: birds, lizards, hedgehogs, slow worms, etc.
Soil quality: brown forest soil type, very clayey, acidic with shallow humus layer, therefore special focus on soil amendment
Altitude: 258–268 m
Rainfall: average 600–700 mm
Temperature: average 9°C

Although the farm is not certified organic due to its scale, special marketing channel and administrative issues, it adheres to the organic standards thus there is no use use of synthetic inputs. An important focus is given to improve the quality of the soil and increase the ecosystem services of the area by minimum tillage, the use of compost and other organic materials and mulches, the application of a diverse crop rotation, and the introduction of bee pastures.
Soil nutrient management is carried out without the use of artificial fertilizers, with local horse manure, pelleted organic manure and compost from green wastes. In accordance with the approach of ecological plant protection, we implement a complex crop rotation in the area, with a continuous change of plant cultures. To reduce fossil fuel use, the majority of our tool park consists of mechanical hand tools. There are various soil management scenarios on the farm depending on the plant culture.

One main strategy is building deep mulch beds, which means a 60-80 cm deep layer of mixed organic materials (fresh manure, straw, green wastes from local gardens, tree leaves and crop residues) laid down during autumn and renewed during springtime before planting out the seedlings to these beds. There is no soil cultivation at all, the seedlings are planted into the decaying material, or into holes filled with compost.

The other main strategy is having fixed beds (90 cm wide, 30 cm wide paths) where soil is loosened with broad fork than the upper 5–10 cm is cultivated (small hand-driven rotary hoe), a 5–10 cm deep compost layer and manure pellet are applied and then mixed with the upper layer. Compost and manure pellet application depends on the state of the soil, the needs of the coming crop, the success of previous crop, and on the soil test results (in general, not for every beds).

Cultivation also depends on the coming plant culture, as the ones with small seeds need better prepared seed beds, while sometimes for seedlings or bigger seeded crops there is no mechanic cultivation, instead a 30 cm deep mulch is applied and used similarly to the deep mulch beds. Therefore, there are overlaps sometimes between the two main strategy, and there are multiple ways of mulching on the farm, e.g.: only straw is applied, or tree leaves, or fresh compost, or fresh stable manure, or grass clippings or a mixture of those. Ramial wood chips are applied to the paths when available.

Compost tea and manure extracts are applied in springtime also nettle and comfrey extracts to the developing plants. Algae and microbial products are also used to enhance plant development. Plots where soil samples were taken covers all this type of cultivation. Some were taken from freshly cultivated fixed beds, some from the deep mulch beds, one from the green waste originated compost.

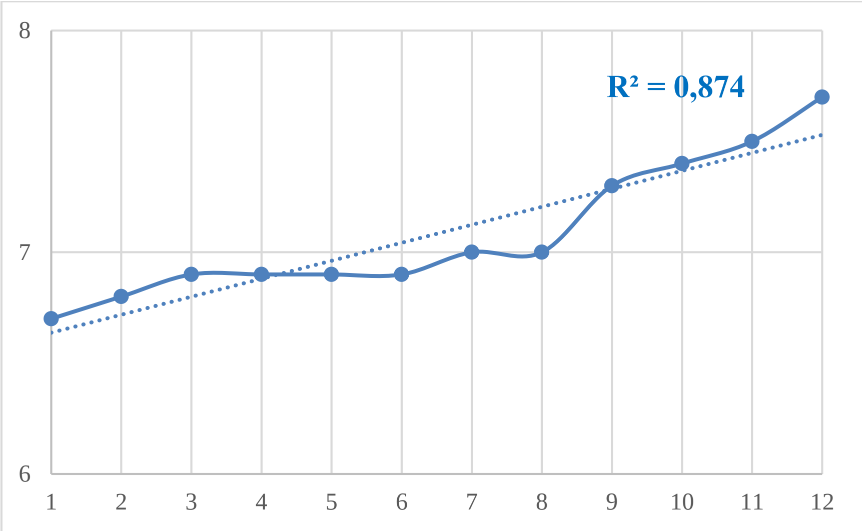
STATISTICAL ANALYSIS

There was a basic statistical analysis done by MS Excel, R^2 values were evaluated along with the trendlines of soil data.

RESULTS AND DISCUSSION

Results show a nice increasing trend when we make an ordered list of sampling points from the lowest to the highest values. Regardless of the small area of the farm, the pH of the sampled plots differs tremendously from 6.7 to 7.8 (Figure 1.).

This already proved that there are huge deviations in soil properties, even in a small area like this.

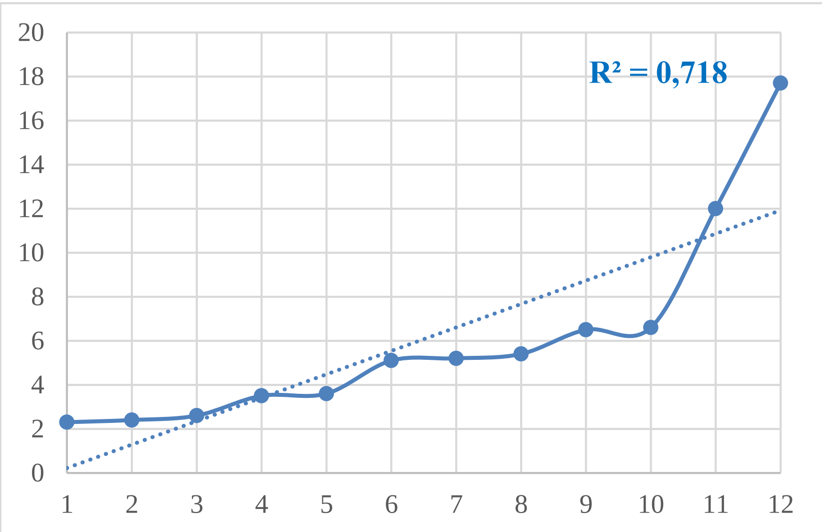


X-axis, sampling points:

1	kpallag2
2	kpallag1
3	kpallag4
4	kpallag6
5	kpallag7
6	kpallag8
7	kpallag10
8	kpallag3
9	kpallag9
10	kpallag5
11	kpallag11
12	kpallag12

Figure 1. The pH of the examined soils (smallest to highest), Kóspallag, Hungary

Besides pH, the other important indicator of soils is soil organic matter (SOM). In the present case SOM also showed big deviations (Figure 2), changing from 2.3 to 17.7 %)



X-axis show sampling points:

1	kpallag1
2	kpallag8
3	kpallag6
4	kpallag2
5	kpallag9
6	kpallag3
7	kpallag11
8	kpallag4
9	kpallag5
10	kpallag7
11	kpallag12
12	kpallag10

Figure 2. The soil organic matter content (%) of the examined soils (smallest to highest), Kóspallag, Hungary (Y axis: SOM (%)

The next 3 parameters are normally the most important in agriculture as a whole and especially in horticultural production, these are the macro nutrients: nitrogen (total N (Figure 3) and mineralizable (Figure 4) N), phosphorous (P) and potassium (K).

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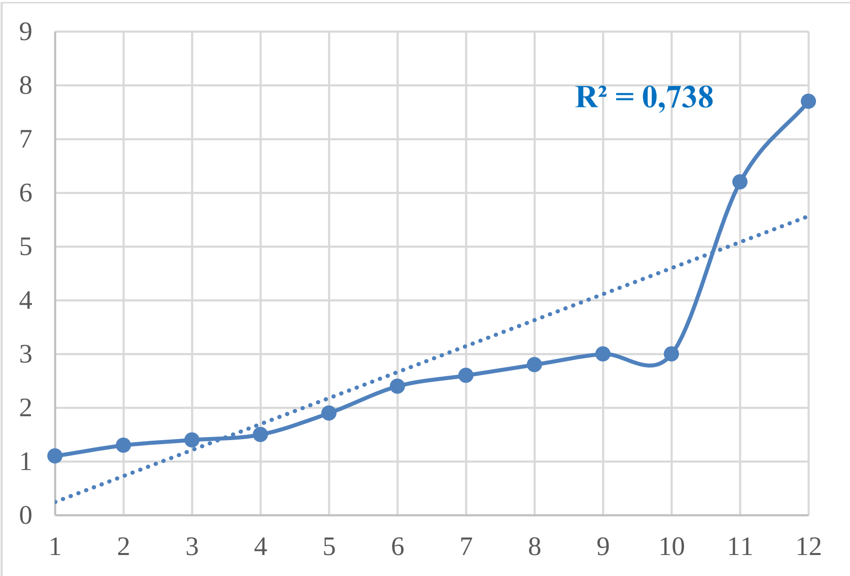


X-axis, sampling points:

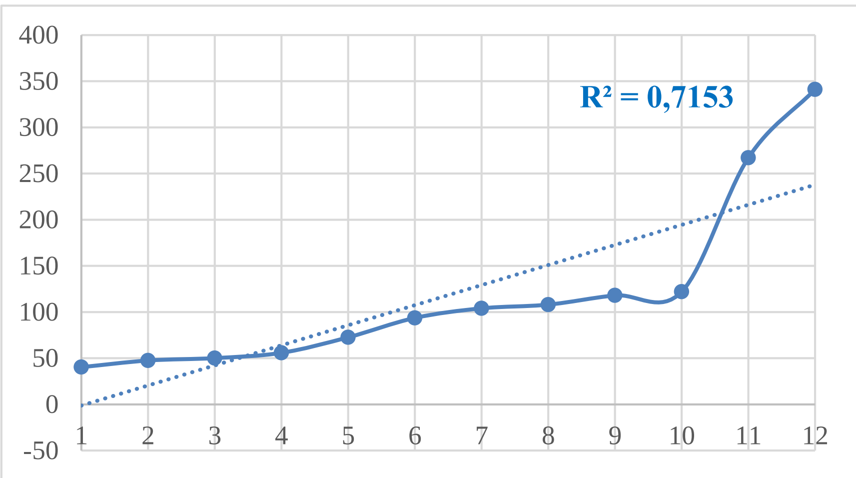
1	kpallag1
2	kpallag8
3	kpallag6
4	kpallag2
5	kpallag9
6	kpallag3
7	kpallag4
8	kpallag11
9	kpallag5
10	kpallag7
11	kpallag12
12	kpallag10

Figure 3. The total N-content (g/kg) of the examined soils (smallest to highest), Kóspallag, Hungary (Y axis: total N (g/kg))

The curve of total N is very similar to the curve of SOM, however, the order of sampling point is a little bit different, sample No. 11 and 4 changed their places in the order, sample No. 4. had more SOM than sample 11, and sample 11 had more total N-content than sample 4.

This order is even showing more deviation compared to the order of the pH of the sampling points, however sampling point 12 is always one of the points having the highest values.

Further information can be found in the mineralizable N-content (Figure 4.).



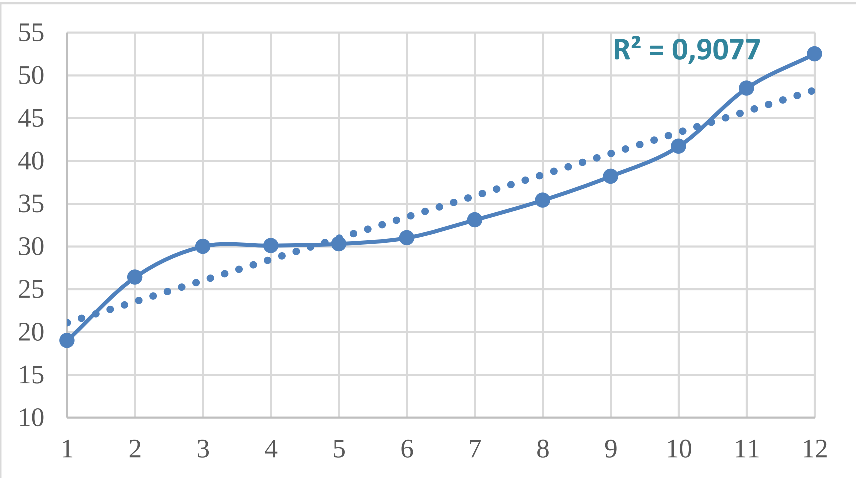
X-axis, sampling points:

1	kpallag1
2	kpallag8
3	kpallag6
4	kpallag2
5	kpallag9
6	kpallag3
7	kpallag4
8	kpallag11
9	kpallag7
10	kpallag5
11	kpallag12
12	kpallag10

Figure 4. The mineralizable N-content (g/kg) of the examined soils (smallest to highest), Kóspallag, Hungary (Y axis: total N (g/kg))

The curve of the mineralizable N-content is also similar to the SOM and total N curves but the R^2 value is smaller and the order of the sampling points also shows differences.

The next parameter is the phosphorous content (Figure 5.).



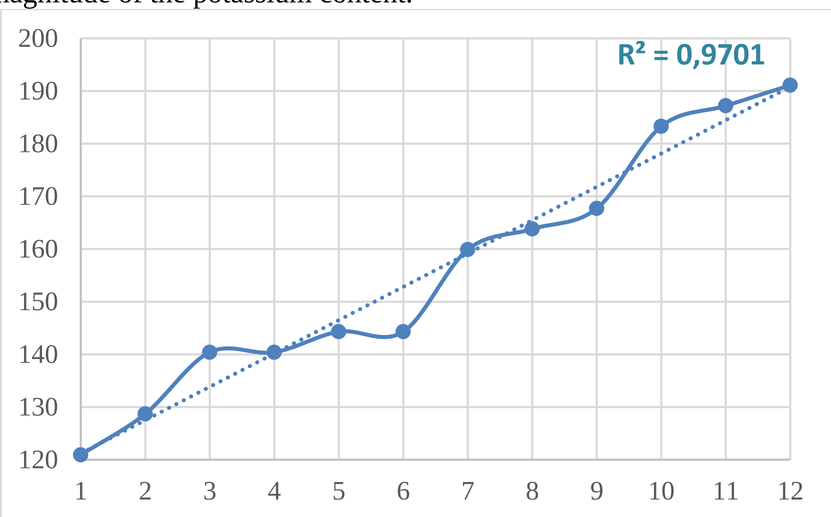
X-axis, sampling points:

1	kpallag10
2	kpallag2
3	kpallag3
4	kpallag4
5	kpallag11
6	kpallag1
7	kpallag9
8	kpallag5
9	kpallag7
10	kpallag8
11	kpallag12
12	kpallag6

Figure 5. Phosphorous content of the soils (smallest to highest), Kóspallag, Hungary (Y axis: total P (mg/kg))

The R^2 value of the P-content is bigger, due to the missing two last points which had a much higher value in case of SOM, total and mineralizable N.

The last macro nutrient is the potassium. Figure 6 shows the order of sampling points due to their magnitude of the potassium content.



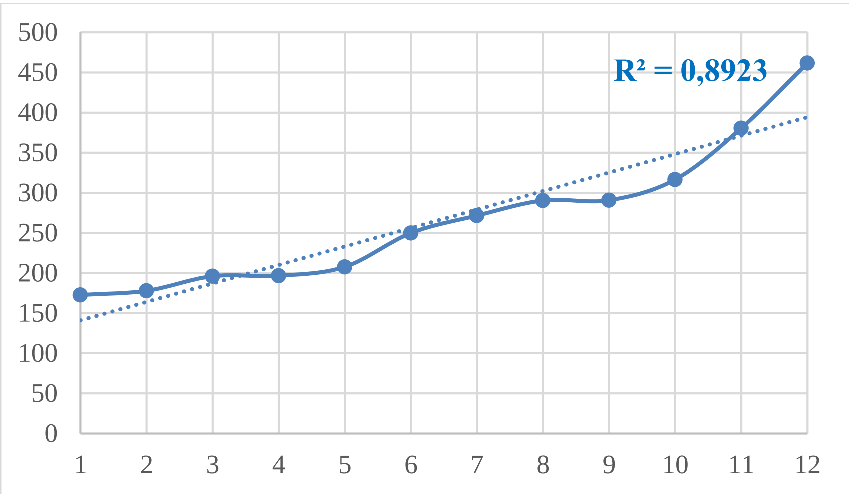
X-axis, sampling points:

1	kpallag8
2	kpallag6
3	kpallag10
4	kpallag9
5	kpallag4
6	kpallag5
7	kpallag3
8	kpallag7
9	kpallag2
10	kpallag1
11	kpallag12
12	kpallag11

Figure 6. Potassium content of the soils (smallest to highest), Kóspallag, Hungary (Y axis: K (mg/kg))

The K-content curve has an even higher R^2 value than the P-content curve. This shows the magnitude of the deviation of the K-content of the sampling points and thus the diverse nature of

soil properties on the farm. Needed to be mentioned that the order of the sampling points is different again that proves the diversity of the properties. Finally, a meso-nutrient, the Ca-content can be seen on Figure 7.



X-axis, sampling points:

1	kpallag1
2	kpallag6
3	kpallag4
4	kpallag2
5	kpallag8
6	kpallag9
7	kpallag3
8	kpallag11
9	kpallag5
10	kpallag7
11	kpallag10
12	kpallag12

Figure 7. Exchangeable Ca-content of the soils (smallest to highest), Kóspallag, Hungary (Y axis: Ca (mmol/kg))

Ca-content also has a different R^2 value and also proves the differences of the farm.

CONCLUSIONS AND RECOMMENDATIONS

We can conclude that soils have a high variation even in a permaculture horticulture farm. The reason behind this is the small differences in the amount of mulch and fertilizers applied, the crops planted, the small deviation in slope angle, differences in microclimate, minor differences in irrigation and maybe, minor differences in infiltration capacity. The revealed differences can lead us to recommend detailed soil analyses of these farms.

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COLORIMETRIC INVESTIGATION OF FALL FOLIAGE

Ákos BORBÉLY

Obuda University, Budapest, Hungary, borbely.akos@rkk.uni-obuda.hu

***Abstract*:**
It is an incredible time of the year when colors vibrantly flood temperate deciduous forests as the leaves gradually change color and finally fall off in the autumn. The green color of the leaves is due to chlorophyll, which is the key component in a plant's ability to turn sunlight to chemical energy. The degradation of chlorophyll during leaf senescence is responsible for the change of color; carotenoids and anthocyanins start to become visible and dominate light reflected from the leaves contributing to the spectacular multicolor appearance of forest at fall. Chlorophyll reflects the middle part of the spectrum appearing green to a human observer, anthocyanins and other pigments increase reflectance mostly in the longer wavelength range of the reflectance spectrum making the hue of the leaves vary along a green-yellow-red scale. This study focuses on the colorimetric characterisation of the above process. Leaf colors of various tree species were measured at different stages of senescence by a spectrophotometer with directional geometry and the results were analysed in a standard three dimensional perceptually uniform color space.

***Keywords*:** *fall foliage, spectral measurement, colorimetric analysis*

INTRODUCTION

When the color of the leaves start to change it is a dividing line between two stages of the life in the forest and other habitat of deciduous plants. The degenerative process of leaf senescence enables the breakdown, transport and recycling of nutrients in plant reproduction. The most influential factor triggering this event is the duration of daylight. Other environmental variables – such as temperature, precipitation, nutrition supply – which may vary in a wide range, contribute to the timing of this phenophase. According to a recent study daily average air temperature, global radiation, and vapor pressure are the most important factors in setting the senescence transition date, [1] but extreme conditions like insect, viral and drought stress may also have a significant effect [2].
The spectral distribution of light – the color – reflected by leaves depends on the illumination and the optical properties of the leaf structure. The culticule and the epidermis of the leaf are transparent to allow light penetration into the mesophyll, where cells containing chloroplasts are abundant. Chloroplasts contain phtotosynthetic pigments, such as chlorophyll, the primary role of which is to absorb energy for the process of photosynthesis. Among the several types chlorophylls type a and b contribute to photosynthesis, mainly chlorophyll A. Chlorophyll b is not necessary to occur; its role is to expand the absorption spectrum (e.g. plants that receive less sunlight can have more chlorophyll B in their chloroplasts).
Besides chlorophyll, other photosinthetic pigments, carotenoids are also present in the chloroplasts. These pigments also contribute to a broader spectral absorbance of sunlight, and have a photoprotective function as well. The two classes of carotenoids are carotenes and xantophylls.
Chlorophyll absorbs most of the energy from the violet-blue and red-orange parts of the spectrum and reflects what appears to us as a green color. Carotenoids absorb in the blue and blue-green part of the

spectrum; the light that is reflected is orange in the case of carotenes and more yellowish in the case of xantophylls.

The pigments responsible for the red coloration of the leaves are mostly anthocianins. These non-photosynthetic red pigments can be found in certain species during the lifetime of the leaf, but many deciduous trees develop it only during the senescing autumn foliage.
The final stage of leaf development is senescence, a genetically regulated process during which nutrients are relocated from the leaves. The degeneration of chloroplasts together with catabolic processes make the mobilized nutrients migrate to other developing organs [3]. The breakdown of chlorophyll allows for other pigments to play a significant role in determining the light spectrum reflected by the leaf at a spectacular extent.

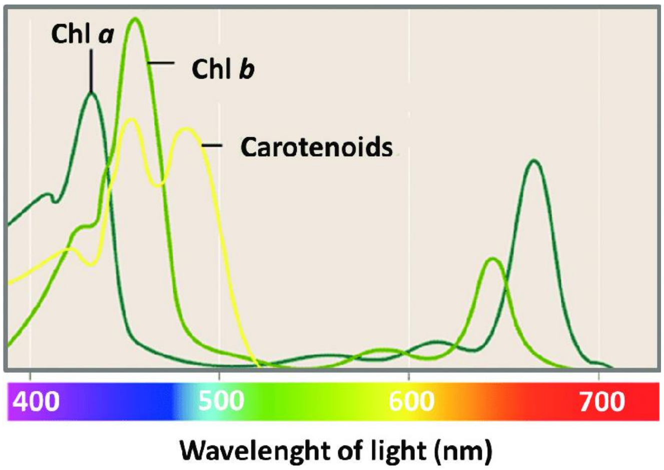

Figure 1. Chlorophyll a, b and carotenoids absorbance spectra [4]

CIE color spaces

A color space maps a range of physically produced colors (the spectral composition of the color) to an objective description of color sensations evoked in the human eye, in terms of tristimulus values. The tristimulus values in a color space represent amounts of three primary colors in a tri-chromatic, additive color model. However, in the CIE XYZ space, the primary colors used are not real colors, but "imaginary" primaries because the color-matching functions x(λ) y(λ) and z(λ) were derived by linear transformation of real color matching functions determined in a series of visual experiments [5]. The tristimulus values for a color are given by:

$$X = k \sum S(\lambda)\cdot\beta(\lambda)\cdot x(\lambda)\, d\lambda, \qquad Y = k \sum S(\lambda)\cdot\beta(\lambda)\cdot y(\lambda)\, d\lambda, \qquad Z = k \sum S(\lambda)\cdot\beta(\lambda)\cdot z(\lambda)\, d\lambda\,,$$

where $S(\lambda)$ is the emission spectrum of the illumination, $\beta(\lambda)$ is the spectral reflectance of the sample, $x(\lambda)$ $y(\lambda)$ and $z(\lambda)$ are the color matching functions and k is a scaling factor.
The CIE XYZ color space is perceptually non-uniform; in order to evaluate the color data in dimensions that correlate with the visual appearance (like hue, lightness and chroma) tri-stimulus values have to be converted to the CIE L*a*b* color space. The three values in this color space represent the lightness of

the color (L*), its position along a red - green (a*) and its position along a yellow – blue axis (b*) of opponent colors.

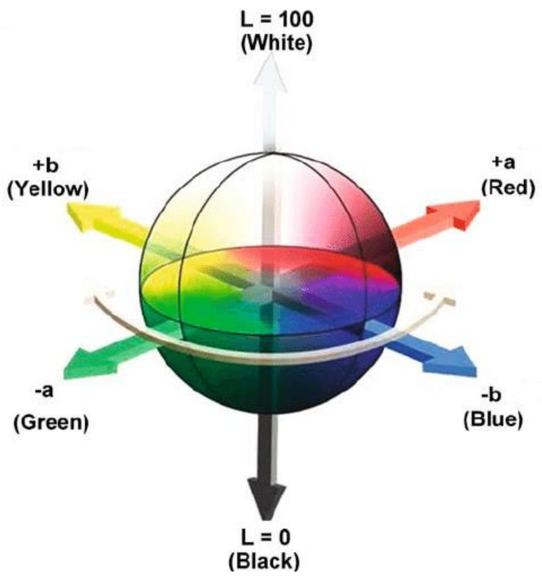

Figure 2. Illustration of the CIE Lab color space with the acromatic (L*) and the two chromatic (a*, b*) axis

Furthermore, the distance from the L* axis represents the chroma (C*), or saturation of the color, and the angle between the +a* axis and the direction of the point of the measured color represents the hue (h*):

$$C^{*}= (a^{*2}+b^{*2})^{½}, \qquad h^{*}=atan(b^{*}/a^{*}).$$

The perceptual uniformity of the color space allows for a color difference metric, which is calculated as the distance between the two points representing the colors in the color space:

$$\Delta E^{*}_{ab}=((L^{*}_{1}-L^{*}_{2})^{2}+ (a^{*}_{1}-a^{*}_{2})^{2}+ (b^{*}_{1}-b^{*}_{2})^{2})^{½} .$$

The visual interpretation of ΔE^{*}_{ab} (Delta E) is the measure of change in visual perception of two colors. The threshold value is 1; color differences less than 1 are not perceptible by the human observer [6]. The above formula was developed in 1976, since then other formulas were issued by the CIE that can predict visual differences more accurately, still ΔE^{*}_{ab} is a usable representation of the unit color difference.

MATERIALS AND METHODS

The spectral reflectance curves of the leaves were measured by an X-rite Exact handheld spectrophotometer. This instrument measures light reflected at a fixed 45˚ angle to the sample, in compliance with the CIE 45˚:0˚ geometry with ring illumination [7]. The spectrum was recorded in the 400 nm - 700 nm wavelength range with 10mm interval and the aperture applied in the measurement was 4mm in diameter. Spots of measurement were selected so that the spot color was homogenous and represented overall leaf color. Leaves of seven deciduous trees and plants were chosen (maple, cherry, medlar, walnut, pear, spiraea and peony). Common-, or garden peony (Paeonia officinalis) is native to mainly mountainous areas of Southern Europe, its leaves become light green, yellow and red during senescence.

Figure 3 shows the spectral reflectance curves of the leaves of peony going through these stages of coloration starting with the green prior to the degradation chlorophyll.

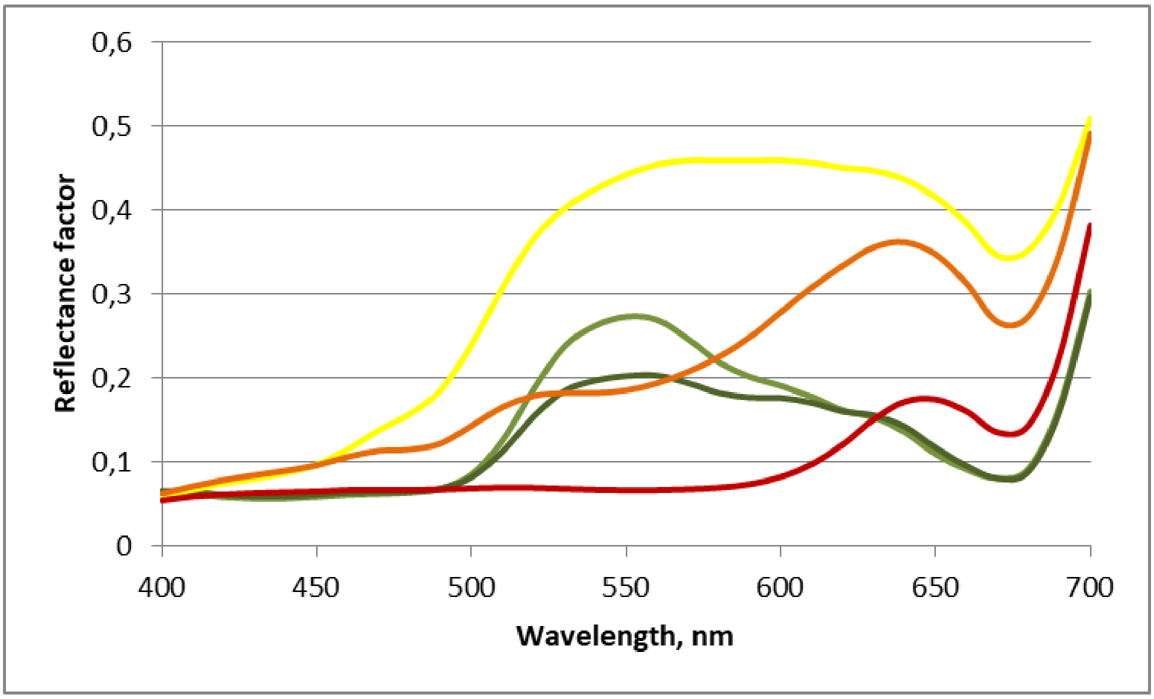

Figure 3. Reflectance spectrum of common peony leafs at different stages of leaf coloration. Line color represents the actual leaf color

RESULTS AND DISCUSSION

In order to obtain tri-stimulus values one has to combine reflectance spectra with the spectrum of a standard illuminant. Autumn foliage is generally seen outdoors in natural light; the D (daylight) series of illuminants provide illumination conditions for outdoor locations. D65 is recommended by the CIE as it represents the average daylight illumination [8], this standard illuminant was chosen to compute the tri-stimulus values with. CIE L*a*b* values were also calculated using D65 white point.

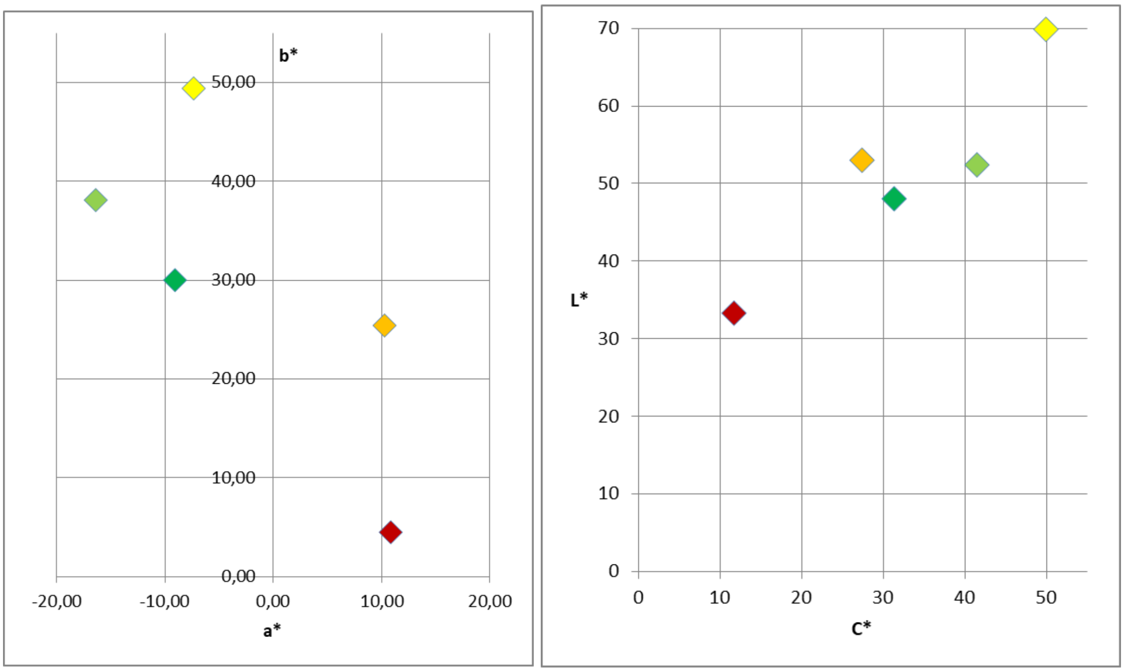

Figure 4. Color coordinates of common peony leafs at different stages of leaf coloration in the a*, b* diagram (left) and in the L*, C* diagram (right)

The analysis of the results gains visual meaning in dimensions that correspond to the perceptual attributes of human color vision such as hue, lightness and chroma. The most apparent changes occur in the hue of leaf color, this can be followed on the a*b*-plane of figure 4, as the leaf of the peony (and the color of the data point) turns light green, yellow, orange and then red. Chroma (C^*_{ab}, the distance of the color point from the origin) also changes during this process, it increases until the yellow stage than it starts to decrease. The lightness (L*) of the leaves change correspondingly; this behavior of both perceptual properties is in accordance with the visual experience of the attentive observer.
When lightness values are plotted as a function of chroma (figure 4) the trend becomes apparent. The relationship was specified by calculating the correlation coefficient (Pearson´s *r*) between the L* and C^*_{ab} values. The coefficients were determined for all specimen and are shown in table 1.

Table 1. Correlation of CIE lightness (L*) and chroma (C^*_{ab}) values of the various specimen

Plant	Maple	Spiraea	Peony	Cherry	Medlar	Walnut	Pear
Pearson *r*	0.915	0.965	0.951	0.996	0.971	0.975	0.994

The coefficients above confirm that there is a strong positive linear correlation between the CIE lightness (L*) and chroma (C^*_{ab}) of leaves at different stages of coloration.

CONCLUSION

The subject of this study was to investigate autumn leaf color using quantitative methods of CIE

colorimetry. Seven deciduous plants were chosen, leaf specimen were taken at different stages of coloration. Leaf color samples were measured by a spectrophotometer with directional geometry. Colorimetric data were obtained with D65 standard illuminant. Strong positive linear correlation was found between the values of CIE lightness (L*) and chroma (C^*_{ab}) color properties of leaves at different stages of coloration (mean $r = 0.967$).

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ISO: Photography and graphic technology — Density measurements

COMPARISON OF WILD BOAR EFFECTS ON SOIL THICKNESS IN FORESTS

Ádám FEHÉR, Natalia PITTA-OSSES, Krisztián KATONA, Csaba CENTERI

Institute for Wildlife Management and Nature Conservation, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary; e-mail: nata.pitta@gmail.com

Abstract
Wildlife plays an important role in forest ecosystems. Still, a limited information is available about the depth and areal distribution of these effects. The importance of the description of wild boar is huge because of the interconnection of conflicts between farmers, foresters, hunters, wildlife biologist and nature conservationists, just to mention some of the stakeholders. In the recent paper two areas are compared, one in the Gödöllő Hillside and one at the foot of the Mátra Mountain. Deep rootings were analysed where the centre of the rooting is deep (40 cm<) while the ring of the rooting is 20+ cm higher than the nearby control area. The results show that boar rooting has very heterogeneous impact on topsoil humus thickness. One of the sites of the Gödöllő Hillside had significant results while the inclusion of another site resulted no significance. It means that the site selection has a tremendous effect on the significance levels. It can be the effects of other inputs but it needs further investigations.

Keywords*: wildlife, deep rooting, nature conservation area, comparative analyses*

INTRODUCTION

The landscape shape and composition heavily influence the land-use management and any related decision-making processes; therefore, understanding the nature, severity, and frequency of changes that occur within a specific area can lead to more efficient use of the available natural resources [1].

This statement applies for all stakeholders related to the land, mainly those who are directly affected by it, such as farmers, forest managers, wildlife managers, rangers, and the general public. One of the main factors influencing land use changes currently ongoing in Hungary is the presence of wild boar (*Sus scrofa*) in different types of forested areas [2].
Wild boar is an ecosystem engineer, which means that its behaviour affects the functioning and dynamics of organic and inorganic components of the range it occupies [2], the most evident of which is the rooting, a feeding behaviour that implies digging at varying depths to find roots, insects, seeds, or any other feeding resource on the soil, thus causing considerable changes in the soil microtopography.

Considering the related impact of a steadily increasing population of wild boar in Hungary, our aim was to analyse the effect of its rooting behaviour on the soil horizons, based on soil profile analyses performed on rooted plots in forested areas. We hypothesized that the topsoil (A) horizon, as well as the humus-rich transitional horizon (AB) are thicker in areas undisturbed by wild boar, whereas the opposite is true in the deepest part of the rootings, as well as on their immediate surrounding area.

MATERIALS AND METHODS

Study area

The dry-mesic oak forest is situated in Babat-valley, Gödöllő Hillside, Pest County near the city of Gödöllő (47°36'56.61"N, 19°22'50.40"E) while the black locust forest is located at the SW edge of the

Mátra Mountains, near to the village of Apc (Figure 1) in Heves County (47°48'22.36"N, 19°41'50.96"E), Hungary.

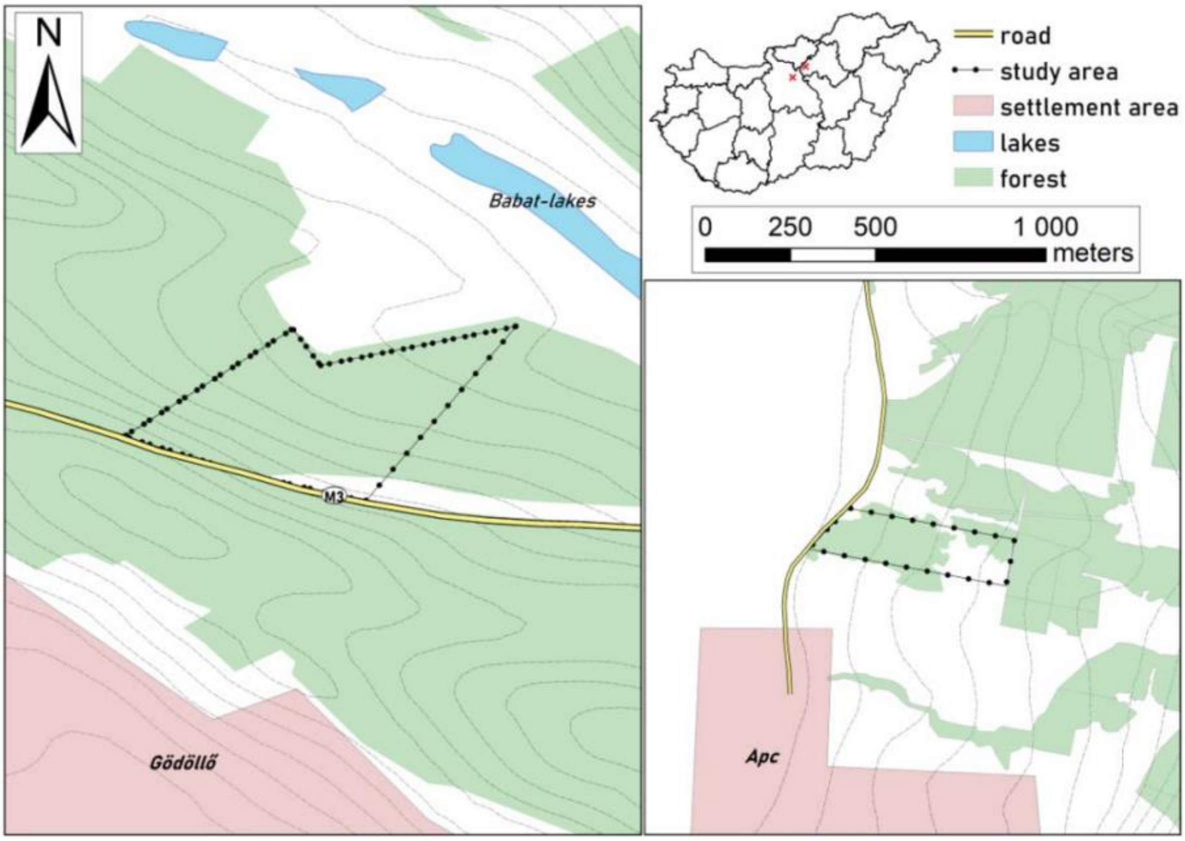

Figure 1. Map of the study area in Gödöllő Hillside (left) and the SW edge of Mátra Mountains (Source: Fehér et al., 2022).

The Babat Valley, located in the Gödöllő Hillside, is a landscape protection area. The region serves a transitional area between the Great plain and the Northern Central Mountains. Construction of man-made structures has accelerated ongoing erosion processes, as a result of which gullies have formed in the Babat Valley, and sedimentation is taking place.

On the other hand, the area close to Apc selected for this study belongs to the Zagyva Valley, near the foothills of the Mátra Mountains to the east. Like the Babat Valley, it also has a high erosion rate, currently affecting the soil composition [3].

Soil samples

Soil profiles were obtained and described on the field using a Pürckhauer soil core sampler up to 1m depth. We took soil samples as follows: 1) from inside the rooting (called rooting); 2) from the edge of the rooting where the soil was redistributed from the center of the rooting (called ring); 3) from the intact control area located at least 1 but no more than 3m from the rooting edge (called control). The samples were evaluated on the field: the thickness of the actual horizons (in cm), soil texture (clay – loam – sand) and test for lime with 10% hydrochloric acid [3]. Thickness data of main and transitional soil horizons were documented separately.

The depth of humus-rich horizons was expressed by taking the mean of the summarized topsoil (A) and related transitional (e.g., AE, AB, AC) horizon thickness data grouped by sampling location (rooting vs. ring vs. control) and study site (Gödöllő vs. Apc).
Field studies conducted twice in Babat Valley (August 2020: N=6 and November 2021: N=5) and once in Apc (November 2021: N=5). Data collected from Babat were compared separately (only 2020: N=6) and together with the 2021 dataset (N=6+5) to the Apc data (N=5), to evaluate the impact of sampling size on statistical inference.

STATISTICAL ANALYSIS

The thickness of the humus-rich horizons was statistically evaluated as a function of the rooting and study site. Since the soil attributes are not independent between observations within the sampling plots and thickness data were not normally distributed, we implemented a generalized linear mixed model in R [4] with the package *lme4* [5].

RESULTS AND DISCUSSION

The GLMM model shows an important change in statistical significance when different sample sizes from the Babat Valley were compared with the data collected in Apc:, if the datasets from Babat are combined (August 2020 + November 2021), , there is no difference between sites, only the redistributed soil (ring) had thicker humus-rich layers (Table 1).

Table 1
Coefficients (Beta) of the generalized linear mixed model with their 95% confidence intervals and p-values.

		Beta	95% CI (lower)	95% CI (upper)	p	
Rooting effect	Intercept (Control)	-0.48	-1.18	0.23	0.16	ns
	Ring	0.44	0.29	0.59	<0.001	***
	Rooting	0.05	-0.09	0.2	0.47	ns
Site effect	Oak-forest	0.58	-0.26	1.43	0.15	ns

Variance of random effects: 0.55 (48 observations from 16 plots)

However, if the first year's data from Babat (August 2020) was used only in the model, both site- and wild boar related factors turn out as a significant, humus richness-modifying factors (Table 2). The oak-forest in the Babat Valley had significantly thicker humus layer in this comparison, even though its lower confidence interval was approximated to zero.

Table 2

Coefficients (Beta) of the generalized linear mixed model with their 95% confidence intervals and p-values.

		Beta	95% CI (lower)	95% CI (upper)	p	
Rooting effect	Intercept (Control)	-0.62	-1.18	-0.05	0.02	*
	Ring	0.71	0.54	0.89	<0.001	***
	Rooting	0.19	0.02	0.37	0.03	*
Site effect	Oak-forest	0.81	0.05	1.57	0.02	*

Variance of random effects: 0.322 (33 observations from 11 plots)

It is worth noting that the differences found might be due to several factors which are yet to be considered, such as the climatic regime, seasonal changes, and site selection, the latter being of higher prominence given the direct effect it has on the soil composition (Figure 2).

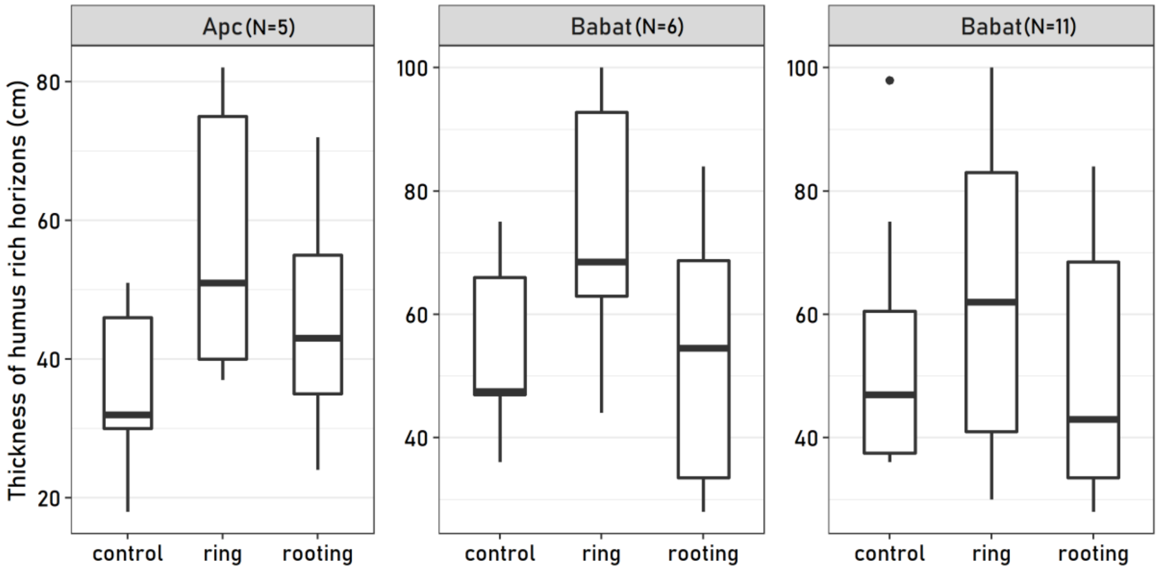

Figure 2. Thickness of humus-rich horizons as a function of sample size in Babat (middle and right) compared to samples collected in Apc (left).

As noted before, the Babat Valley is currently undertaking an erosion and sedimentation process, which has a higher influence on the soil type than other factors [6]. Our preliminary results suggest that the positive/negative nature of rooting impact of wild boar can be highly dependent on site-heterogeneity, which can change in very small spatial scale, and therefore requires a meticulous sampling design.

Consequently, these differences are evident when comparing the results obtained in the profile description from the Babat Valley and the Apc: the samples from 2020 show significant differences because the location of the sampling points is an area heavily affected by sedimentation, contrary to the site selection in the same Babat Valley for the 2021 samples.

It is then crucial that for future analyses of soil changes caused by big animals in forested areas, additional factors influencing the landscape (such as erosion processes) are taken into consideration in the discussion.

CONCLUSIONS AND RECOMMENDATIONS

The thickness of the humus-rich horizon of the soil is a reliable indicator of an area's suitability to sustain vegetation in an area. The thickness of soil horizons is highly dependent on large-scale events such as landslides, floods, sedimentation, and erosion. Although the potential impact of large mammals can be estimated based on the evaluation of selected points of disturbance, the nature of the location can also affect the results, therefore a high number of repetitions in different locations within the same geographic range can provide a better understanding of the factors affecting the heterogeneity of the soil horizon composition and distribution. Further analyses are recommended to better identify such factors.

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ENVIRONMENTAL ATTITUDE VERSUS BEHAVIOUR OF TOURISM MANAGEMENT STUDENTS IN SELECTED COLLEGES AND UNIVERSITIES IN REGION IV-A, PHILIPPINES: A BASIS FOR EDUCATIONAL PLANNING AND DEVELOPMENT

Aguilar, Mark Gabriel Wagan[1], Olayta, Jayson Nual[2]

[1]Emilio Aguinaldo College, Cavite, Philippines,
markgabrielaguilar@gmail.com, +639266329096
[2]Laguna State Polytechnic University, Laguna, Philippines,
jaysonolayta24@gmail.com, +639053154485

Abstract:
Environmental management is critical in ensuring a sustainable future as recent evidences indicate that environmental degradation caused by resource depletion, ecosystem devastation, and biota extinction has a substantial impact on earth's dynamics, including how humans live. Climate change, particularly global warming has been documented across time, resulting in more frequent and stronger coastal storms, sea level rise, unpredictable weather patterns, drought, species migration, and disease outbreaks, among other occurrences. Aside from this, pollution of various types can be observed everywhere, with major consequences on human health, wild and marine life, and on the land that humans use for agricultural purposes. Studies suggest that these environmental emergencies are caused by human activities such as but not limited to burning of fossil fuels, deforestation, utilization of fluorinated gas filled products, and irresponsible disposal of all kinds of wastes, therefore, people's environmental attitude and behavior are important in the process of achieving environmental sustainability; if people possess a negative perception and have low environmental engagement, these activities will continue to destroy the environment and the success of sustainability programs won't be guaranteed. For this reason, the researchers attempted to measure the levels of environmental attitude and behaviour of people, particularly 392 tourism management students in selected colleges and universities in Region IV-A, Philippines, using a descriptive-correlational research design and a quantitative research approach, given that Environmental Conservation and Ecotourism are courses included in their curriculum, and the fact that the Philippines' most popular tourism attractions are nature-based. To present a clearer picture of the case, the significant relationship between the students' attitude and behaviour levels toward the environment has been determined, and a comparative analysis of the attitude and behaviour of the respondents was performed in terms of their age, sex, and type of institution enrolled at, identifying which age, sex and institution type groups have a more positive or negative environmental attitude, and a higher or lower level of environmental engagement compared with other groups. The findings of this study serve as the foundation for efforts to improve environmental education programs offered in universities and colleges that would help in enhancing students' environmental awareness and involvement.

***Keywords**: Environmental Attitude, Environmental Behaviour, Tourism Students, Sustainability, Environmental Education*

INTRODUCTION

Aside from the COVID-19 pandemic, one of the emergencies that the world faces is the continuous deterioration of nature caused by human activities, which results in a variety of phenomena such as, but not limited to, frequent and extreme coastal storms, sea level rise, unpredictable weather patterns, drought, species migration and extinction, disease outbreaks, and pollution of various types. Many studies have shown that this is an issue that must be addressed in order for the world to remain sustainable. Climate change has been one of the biggest, if not the biggest environmental problems over many decades, and it really has affected the planet with the changes it has brought. According to Evans (2019), the effects of climate change are expected to significantly alter global ecological and social systems, resulting in fundamental changes in human behaviour. Meanwhile, the complexity of global climatic systems makes precise prediction of climate change implications difficult (Rogelj et al., 2018). According to the Canadian Institute of Actuaries (2015), climate change is more than just global warming; thus, rising average temperatures are only one indicator of broader changes that include extreme temperatures, drought, flooding, storms, rising sea levels, effects on food production, and infectious diseases. The National Oceanic and Atmospheric Organization (2021) were able to observe the effects of climate change on the world. Global temperatures climbed roughly 1.8°F between 1901 and 2020, and sea level rise has accelerated from 1.7 mm/year for much of the twentieth century to 3.2 mm/year since 1993. Moreover, glaciers are receding, with the average thickness of 30 well-studied glaciers decreasing by more than 60 feet since 1980, and the area covered by sea ice in the Arctic at the end of summer declining by roughly 40% since 1979. It was also discovered that the quantity of CO2 in the atmosphere has increased by 25% since 1958 and by approximately 40% during the Industrial Revolution. Climate change definitely poses as great threat, but in order to address it, it is important to know what causes it. Literature suggests climates change is a result of many human activities such as deforestation, rapid population growth, and pollution among others, but aside from climate change, these also have other consequences. According to The Human League (2022), deforestation disrupts ecosystems that are crucial to both wildlife and humans; lush green forests provide a home for numerous wild creatures as well as innumerable unique varieties of plants. Forests, like the ocean, absorb excess atmospheric carbon dioxide, providing a much-needed buffer against irreversible climate change; nevertheless, if people continue to destroy forests at their current rate, forests may reach their breaking point. Meanwhile, Mittal & Mittal (2013) explains that the consumption, overuse, and misuse of physical resources has increased dramatically as the human population has grown, because the more people there are, the greater the demands on natural resources. It was also asserted that in order to maintain the expanding population, forests are being destroyed at an alarming pace, many non-renewable resources are depleting due to unrestricted use of fuel and energy, and many parts of the world are suffering from food and water shortages. Along with these problems, there is resource depletion and biodiversity loss, waste production, and the degradation of natural habitat for human advantage. Pollution, on the other hand, causes a slew of issues; Dahms (2014) contends that marine debris, which signals water pollution, is an increasing worldwide issue that poses a hazard to a range of marine organisms via toxic action of nanoparticles, particle ingestion, and entanglement. Plastics, the most frequent kind of marine debris that account for between 60 and 80% of all marine debris and more than 90% of all floating particles, are of concern since they may be consumed by a variety of marine species and perhaps transported throughout food webs, which would result to marine life endangerment and eventually extinction. Similarly, air pollution causes substantial environmental issues such as acid rain, haze, ozone layer thinning, and eutrophication, all of which constitute a significant hazard to all living things, including people (Manisalidis et al, 2020). Air pollution also causes respiratory and cardiovascular illness, reproductive and central nervous system malfunction, and cancer, among other things.

Analysing these phenomena, it is clear that humans are the main perpetrators. While it is true that the activities causing these situations are for their advantage, it is also noticeable that humans are the most negatively affected. Therefore, problems in the environment lead to problems encountered by humans, indicating that there is a need to have these solved to ensure a sustainable future for humankind. As human activities have been found be the cause of these emergencies, it is critical that people possess a

positive attitude towards environment, as well as a high level of engagement or involvement on environmental-friendly practices, not just to stop the destruction of ecosystems, but also to contribute to the conservation and sustainability of it. With this reason, the researchers have decided to conduct this study with an aim to determine the levels of environmental attitude and behaviour of people, starting with 392 tourism management students in selected colleges and universities in Region IV-A, Philippines, provided the fact that environmental conservation and ecotourism are courses included in their curriculum and most popular tourism attractions in the Philippines are nature-based, which are seen as a career option for these students in the future.

The researchers have attempted to accomplish the following specific research objectives:

To determine the environmental attitude and behaviour of tourism management students in selected higher education institutions in Region IV-A, Philippines in terms of solid waste management, energy and water consumption, transportation, purchase and use of products, and actual participation.

To determine the relationship between environmental attitude and behaviour of tourism management students.

To determine what age group, sex group, and students enrolled in certain type of institution have a more positive and negative environmental attitude, and a higher and lower level of environmental engagement compared with other groups.

Grbac et al (2013) discovered that visitors from the United Kingdom and the Netherlands, as well as those with higher incomes, had lower environmental views, whereas Russian tourists had stronger environmental attitudes. Moreover, persons with positive environmental views were more inclined to suggest the tourism place they visited to their friends and relatives, while it was also shown that visitors who had a better overall experience of having value for money and higher overall happiness with their vacation have a more environmentally conscious mind-set. Meanwhile, in a research involving tourism students, Mckercher et al (2012) discovered that students are typically worried about environmental degradation, feel informed about climate change, and are concerned that it will become an even greater issue in the next 5 years. They also recognize that tourism contributes significantly to carbon emissions, and as a result, 70% have adjusted their behaviour in the last three years to lessen their environmental effect. However, understanding of the causes of climate change was limited, which is indicative of a general lack of comprehensive information about environmental deterioration, which translates into fairly generic behaviour changes. Most notably, less than 13% of students have modified their holiday routines due to environmental concerns, with just a tiny minority planning to change their travel patterns in the future. Students at a Chilean university, on the other hand, have a positive attitude toward the environment, notably in terms of recycling, water, and energy usage (Heyl et al, 2013). Overall, the students have a good environmental attitude since they care about nature and are aware of the reasons of its deterioration; however, this is not reflected in their actions, notably in the regularity with which they engage in conservation-related activities and events. Abun and Racoma (2017) investigated people's environmental attitudes and behaviours with a focus on Catholic school staff in Ilocos Sur, Philippines. They discovered that these employees feel that nature only has significance when it helps humans' survival requirements, and that they are unsure whether humans have authority over nature. Moreover, they lack understanding of how to respect and use nature, as well as knowledge of environmental difficulties and the dangers they may face in the future, resulting in an undetermined degree of personal conservation intention and likelihood of their actions.

Through rigorous search in open access journals, it is noticeable that there are several studies conducted in the area of environmental conservation and sustainability, particularly on people's attitude and behaviour, however, though environmental attitude and behaviour of people have been broadly examined by a number of researchers, there is still scarcity of studies that has involved certain

groups; there is dearth of studies that have explored Filipino tourism management students' environmental attitude and behaviour. Moreover, the studies available that were conducted in the Philippines have only focused in one institution at a time, limiting the information it have provided, thus, creating the need to do a study on a larger scope. Hence, a research gap that this study have attempted to fill.

MATERIALS AND METHODS

Research Design

Guided by a descriptive correlational research design and incorporating quantitative research approach, the researchers were able to gather, analyse, and interpret data for this study. Through number scales, data were measured and interpreted, while a statistical formula was used to determine significant relationships.

Sample Population

The researchers have selected tourism management students of 4 colleges and universities in Region IV-A, Philippines, two of which are State Universities, while the other two are Private Colleges. These students have been chosen to be the subject of this study since Environmental Conservation and Ecotourism are courses included in the curriculum of the Bachelor of Science in Tourism Management Program, and the fact that most popular tourism attractions in the Philippines are nature-based. Out of the total population of 955 Students enrolled in the said program offered by the selected Higher Education Institutions, the sample size was computed with a 5% margin of error and a 99% confidence level, while the exact numbers of student-respondents needed from each educational institution were computed based on their percentage contribution to the total population aforementioned. Respondents were randomly selected through a fishbowl draw method.

Table 1. Breakdown of the total number of Bachelor of Science in Tourism Management Students enrolled in the selected Higher Education Institutions

Higher Education Institution (HEI)	**Total Number of Tourism Management Students**	**1st Year Students**	**2nd Year Students**	**3rd Year Students**	**4th Year Students**
HEI A	217	59	55	46	57
HEI B	259	74	80	33	72
HEI C	391	144	150	59	38
HEI D	88	37	26	8	17
Total Population	**955**	314	311	146	184

Table 2. Breakdown of the total number of respondents based on the computation of the sample size and percentage contribution of each Higher Education Institution

Higher Education Institution (HEI)	Sample Size per HEI	1st Year Respondents	2nd Year Respondents	3rd Year Respondents	4th Year Respondents
HEI A	90	25	22	20	23
HEI B	106	31	33	14	28
HEI C	161	60	61	24	16
HEI D	35	15	10	3	7
Total Sample Size	**392**	131	126	61	74

Research Instrument

The research instrument used was created based on the types of questions used by two studies; it was first inspired by the study instrument of Abun and Racoma (2017), where some questions were taken from, and adapted from the study of Heyl et al (2013), where the variables suggested to measure environmental attitude and behaviour were used. It is a survey composed of 38 questions, 2 of which are asked to determine the respondents' demographic profile, 18 are designed to learn about their level of environmental attitude, and the other 18 are for their environmental behaviour.

To measure the levels of environment attitude and behaviour, a four-point scale was used whereas; 1-Strongly Agree, 2-Agree, 3-Disagree, & 4-Strongly Disagree. It was made using Google Docs, distributed through direct messaging in a social media platform, and recorded a 100% response rate from all students that have been asked.

Table 3. Likert Scale Interpretations on respondents' environmental attitude and behaviour

Survey Responses	Environmental Attitude Interpretation	Environmental Behaviour Interpretation	Scale
Strongly Disagree	Very Positive	Very High Engagement	3.26-4.00
Disagree	Positive	High Engagement	2.51-3.25
Agree	Negative	Low Engagement	1.76-2.50
Strongly Agree	Very Negative	Very Low Engagement	1-1.75

STATISTICAL ANALYSIS

Frequency and percentage were computed to classify respondents in terms of their demographic profile, mean scores were computed to measure their environmental attitude and behaviour, while to understand the significant relationship between their environmental attitude and environmental behaviour, Spearman's Rho Correlation was executed.

RESULTS AND DISCUSSION

Students' Environmental Attitude in terms of each variable

The students strongly disagree that there is no need for each household to segregate their waste, with a mean score of 3.33, while they disagree that people do not need to reuse products such as plastic cups, plastic bottles, plastic bags, cans, and papers, and they just need to dispose it right after use, and people do not need to recycle things such as but not limited to shampoo sachets, papers, rubber, and cans, and they must dispose it right away, with mean scores of 3.01 and 2.87 respectively.

Table 4. Respondents' environmental attitude in terms of solid waste management

Statements	Mean	Descriptive Meaning
I believe that there is no need for each household to segregate their waste	3.33	Strongly Disagree
I think that people do not need to reuse products such as plastic cups, plastic bottles, plastic bags, cans, and papers, and they just need to dispose it right after use	3.01	Disagree
I believe that people do not need to recycle things such as but not limited to shampoo sachets, papers, rubber, and cans, and they must dispose it right away.	2.87	Disagree

The students strongly disagree that leaving appliances plugged in do not have any impact to the environment and that leaving a light on, and a cell phone charger plugged in if it's not being used is okay, with mean scores of 3.39 and 3.35 respectively, while they disagree that people may not save electricity as long as they could pay for it, with a mean of 3.25.

Table 5. Respondents' environmental attitude in terms of energy consumption

Statements	Mean	Descriptive Meaning
I think that leaving appliances plugged in do not have any impact to the environment	3.39	Strongly Disagree
I do not believe that people must save electricity as long as they could pay for it	3.25	Disagree
I believe that leaving a light on, and a cell phone charger plugged in if it's not being used is okay	3.35	Strongly Disagree

The students strongly disagree that it is fine to let the water running and wait for it to get warm before taking a bath and that people must not be obliged to save water as long as they could pay for it, with mean scores of 3.32 and 3.39 respectively, while they disagree that it is fine to open the faucet in max, while they are washing their hands to wash it thoroughly and to avoid leaving any soap on it, with a mean of 3.13.

Table 6. Respondents' environmental attitude in terms of water consumption

Statements	Mean	Descriptive Meaning
I believe that it is fine to let the water running and wait for it to get warm before taking a bath	3.32	Strongly Disagree
I think it is fine to open the faucet in max, while I am washing my hands to wash it thoroughly and to avoid leaving any soap on it	3.13	Disagree
I believe that people must not be obliged to save water as long as they could pay for it	3.39	Strongly Disagree

The students disagree that they prefer riding a motorcycle/tricycle when going to a nearby place than riding a bicycle or walking, and that that it is fine for car/ vehicle owners to leave their vehicles' engine running while it's parked, to maintain the coolness inside, especially if they are just waiting for someone, with mean scores of 2.75 and 3.14 respectively, while they agree that they prefer riding a personal vehicle (cars, motorcycle) than public transport when travelling, with a mean of 2.14.

Table 7. Respondents' environmental attitude in terms of transportation

Statements	Mean	Descriptive Meaning
I prefer riding a personal vehicle (cars, motorcycle) than public transport when travelling.	2.14	Agree
I prefer riding a motorcycle/tricycle when going to a nearby place than riding a bicycle or walking.	2.75	Disagree
I think that it is fine for car/ vehicle owners to leave their vehicles' engine running while it's parked, to maintain the coolness inside, especially if they are just waiting for someone.	3.14	Disagree

The students disagree that single-used materials like shampoo sachets, cotton buds plastic sticks, plastic and styro plates, balloons, and plastic straws are not major contributors to pollution (2.82), that buying and using aerosol sprays are okay to maintain a pleasant odor in my home/room (2.60), and that the functionality of a product based on the need of people is more important than its environmental consequences with a mean of 2.98.

Table 8. Respondents' environmental attitude in terms of purchase and use of products

Statements	Mean	Descriptive Meaning
I reject the idea that single-used materials like shampoo sachets, cotton buds plastic sticks, plastic and styro plates, balloons, and plastic straws are the major contributors to pollution	2.82	Disagree
I think that buying and using aerosol sprays are okay to maintain a pleasant odor in my home/room	2.60	Disagree
I think that the functionality of a product based on the need of people is more important than its environmental consequences	2.98	Disagree

The students strongly disagree that people's participation in environmental practices and programs is not needed, because it is the job of the government and other concerned private organizations, and that it is not necessary for them to discuss environmental conservation and sustainability with their friends, family, and community, because it is not their responsibility, with mean scores of 3.27 and 3.29 respectively, while they disagree that not all people must be a part of environmental organizations as it depends if their field of specialization is environmental management with a mean of 3.07.

Table 9. Respondents' environmental attitude in terms of actual participation

Statements	Mean	Descriptive Meaning
I believe that people's participation in environmental practices and programs is not needed, because it is the job of the government and other concerned private organizations.	3.27	Strongly Disagree
I think that it is not necessary for me to discuss environmental conservation and sustainability with my friends, family, and community, because it is not my responsibility.	3.29	Strongly Disagree

I believe that not all people must be a part of environmental organizations; it depends if their field of specialization is environmental management	3.07	Disagree

Students' Environmental Behaviour in terms of each variable
The students disagree that they only use some non-biodegradable materials once, even they know that they could use it again, such as plastic bottles, plastic bags, cans, and plastic containers, etc, with a mean score of 2.54, however, they agree they often forget to separate non-biodegradable and biodegradable wastes (2.43) and that they often do not recycle trash, such as shampoo sachets, papers, rubber, and cans (2.39).

Table 10. Respondents' environmental behaviour in terms of solid waste management

Statements	Mean	Descriptive Meaning
I often forget to separate non-biodegradable and biodegradable wastes	2.43	Agree
I only use some non-biodegradable materials once, even I know that I could use it again, such as plastic bottles, plastic bags, cans, and plastic containers, etc	2.54	Disagree
I often do not recycle trash, such as shampoo sachets, papers, rubber, and cans. I just dispose it right away after use	2.39	Agree

The students disagree that they always forget to unplug appliances and other things such as cellphone charger after use, with a mean of 3.00, they tend to leave electric fans, lights, and television on most of the time, and that often spend time alone separated from my family and use electricity, with mean scores of 3.18 and 2.64 respectively.

Table 11. Respondents' environmental behaviour in terms of energy consumption

Statements	Mean	Descriptive Meaning
I always forget to unplug appliances and other things such as cellphone charger after use	3.00	Disagree
I tend to leave electric fans, lights, and television on, most of the time	3.18	Disagree
I often spend time alone separated from my family and use electricity. Example: You are in your room most of the time using your own electric fan/aircon, and cellphone, while other members of the family are in the living room watching television or doing something else	2.64	Disagree

The students strongly disagree that they often forget to turn off the faucet after using it with a mean score of 3.34, while they disagree that they let the water running for a couple of minutes or until it gets warm before taking a bath, and that when they wash their hands, the dishes, or anything using a faucet, they often open it at maximum, with mean scores of 3.08 and 2.87 respectively.

Table 12. Respondents' environmental behaviour in terms of water consumption

Statements	Mean	Descriptive Meaning
Before I take a bath, I let the water running for a couple of minutes or until it gets warm.	3.08	Disagree
When I wash my hands, the dishes, or anything using a faucet, I often open it at maximum.	2.87	Disagree
I often forget to turn off the faucet after using it.	3.34	Strongly Agree

The students disagree that they use their personal or their family's vehicle (Car/Motorcycle) more often than going on public transportation when they travel (2.55), they ride a motorcycle or a tricycle, more often than walking or riding a bicycle (2.79), and they usually tolerate themselves and drivers of public utility vehicles leaving the engine running even it is parked (3.10).

Table 13. Respondents' environmental behaviour in terms of transportation

Statements	Mean	Descriptive Meaning
When I travel, I use my personal or my family's vehicle (Car/Motorcycle) more often than going on public transportation.	2.55	Disagree
When I go to a near place, I ride my motorcycle or a tricycle, more often than walking or riding a bicycle.	2.79	Disagree
When I travel using my motorcycle/car, I usually let the engine running even it is parked. / When I am commuting, it is fine for me if the driver keeps the vehicle's engine running while waiting for passengers in the terminal/parking area.	3.10	Disagree

The students disagree that they buy and use aerosol sprays with mean of 2.54, but they agree that they often buy and use products that utilize single-used plastics such as shampoo sachets, candies, junk foods, cotton buds with plastic sticks, disposable plates, and plastic bags (2.44), and they choose products based on needs, and they often do not check if it contains chemicals that are harmful to the environment (2.48).

Table 14. Respondents' environmental behaviour in terms of purchase and use of products

Statements	Mean	Descriptive Meaning
I often buy and use products that utilize single-used plastics such as shampoo sachets, candies, junk foods (chichirya), cotton buds with plastic sticks, disposable plates (styro & plastic), and plastic bags	2.44	Agree
I buy and use aerosol sprays (examples are Glade, Lysol, including deodorant sprays)	2.54	Disagree
When I buy products, I choose products based on needs, and I often do not check if it contains chemicals that are harmful to the environment	2.48	Agree

The students disagree that they rarely discuss about the environment with their friends, family, and community, and they often do not do environmental friendly practices like recycling, waste segregation, donating to environmental organizations, among other, because it is the government's responsibility, with mean scores of 2.52 and 3.00 respectively, but they agree that they are not a member of an environmental organization/group (2.32).

Table 15. Respondents' environmental behaviour in terms of actual participation

Statements	Mean	Descriptive Meaning
I am not a member of an environmental organization/group	2.32	Agree
I rarely discuss about the environment with my friends, family, and community	2.52	Disagree
I often do not do environmental friendly practices like recycling, waste segregation, donating to environmental organizations, etc, because it is the government's responsibility	3.00	Disagree

Students' Environmental Attitude and Behaviour based on demographic profile

In terms of solid waste management, students that are 19 years and below, 20-21, and 22-23 possess a positive attitude, and those who are 24-25 and 26 years old and above have a very positive attitude. Meanwhile, all age groups have a very positive attitude towards energy and water consumption, except those students that are 22-23 who only have a positive attitude. In terms of transportation, all groups have positive attitude, while only 19 and below, 20-21, 22-23, and 24-25 years old have positive attitude in the context of purchase and use of products, as those students that are 26 years old and above possess a negative attitude. Lastly, when it comes to the students' attitude on actual participation in environmental practices and programs, 20-21, 24-25, and 26 years old and above are very positive, while those 19 below and 22-23 years old only possess positive attitude. It is also clear that students that are 26 years old and above have the more positive attitude in terms of solid waste management, water consumption, transportation, and actual participation, while when it comes to energy consumption, those that are 24-25 and 26 years old above have the more positive attitude, and in terms of purchase and use of products, 24-25 years old students possess the more positive attitude.

Table 16. Respondents' environmental attitude based on their age

Age Group	Solid Waste Mgmt.	Energy Consumption	Water Consumption	Transportation	Purchase and use of products	Actual Participation
19 and below	3.01	3.33	3.28	2.66	2.72	3.16
20-21	3.16	3.37	3.32	2.70	2.88	3.28
22-23	2.90	3.16	3.14	2.61	2.76	3.10
24-25	3.50	4.00	3.67	2.83	2.83	3.33
26 and above	4.00	4.00	4.00	3.00	2.00	4.00

Students who are 24-25 and 26 years old and above possess a high level of engagement on solid waste management practices, while those 19 and below, 20-21, and 22-23 years old have low level of engagement. In terms of energy and water consumption practices, students that are 24-25 and 26 years old and above have a very high level of engagement, while the rest only possess a high level of engagement. Meanwhile, all groups recorded a high level of engagement in terms of transportation except those who are 24-25, which have very high level of engagement, while in regards to purchase and use of products, all groups have a high level of engagement, except for students that are 22-23 who possess a low level of engagement. Lastly, students in all age groups have high level of engagement in terms of their actual participation in environmental-friendly practices. It also noticeable that students that are 26 years and above have the highest level of engagement among all groups in terms of solid waste management, energy and water consumption, and actual participation, while those that are 24-25 years old have the highest level of engagement in terms of transportation, and both aforementioned groups in the context of purchase and use of products.

Table 17. Respondents' environmental behaviour based on their age

Age Group	Solid Waste Mgmt.	Energy Consumption	Water Consumption	Transportation	Purchase and use of products	Actual Participation
19 and below	2.44	2.92	3.04	2.76	2.36	2.89
20-21	2.49	2.96	3.17	2.87	2.59	2.99
22-23	2.38	2.89	2.96	2.73	2.44	2.83
24-25	2.83	3.33	3.67	3.33	3.00	2.83
26 and above	3.00	4.00	4.00	3.00	3.00	3.00

Students that are 26 and above possess the most positive environmental attitude and the highest level of engagement, though those that are 24-25 also have very positive attitude compared with other groups. Meanwhile, even though, they have positive environmental attitude and a high environmental practices engagement, students that are 22-23 years old have recorded the lowest mean scores in both categories. Additionally, it is also clear that the environmental behaviour of the students compared to their environmental attitude is lower, in fact, it is most noticeable among students that are 24-25 years old as despite having a very positive environmental attitude; they only have a high level of environmental-friendly practices engagement.

Table 18. Respondents' overall environmental attitude and behaviour when grouped in terms of age

Age Group	Overall Mean (Environmental Attitude)	Attitude Interpretation	Overall Mean (EnvironmentalBehaviour)	Behaviour Interpretation
19 and below	3.03	Positive	2.74	High Engagement
20-21	3.12	Positive	2.85	High Engagement
22-23	2.95	Positive	2.71	High Engagement
24-25	3.36	Very Positive	3.17	High Engagement
26 and above	3.50	Very Positive	3.33	Very High Engagement

Female students have a very positive attitude towards energy and water consumption, and actual participation, while only possess positive attitude in terms of solid waste management, transportation, and purchase and use of products. Meanwhile, male students have positive attitude in all areas, except in transportation, and purchase and use of products where they have a negative attitude. Moreover, it is also clear that female students have more positive attitude than males across all areas.

Table 19. Respondents' environmental attitude based on sex

Sex Group	Solid Waste Mgmt.	Energy Consumption	Water Consumption	Transportation	Purchase and use of products	Actual Participation
Female	3.14	3.43	3.36	2.74	2.90	3.31
Male	2.80	2.95	2.97	2.40	2.42	2.83

Female students have a high level of engagement in terms of energy and water consumption, transportation, purchase and use of products, and actual participation, however, have low engagement in terms of solid waste management practices. Meanwhile, male students high level of engagement in terms of energy and water consumption, transportation, and actual participation, while only have low level of engagement in terms of solid waste management, and purchase and use of products. It is also noticeable that female students have higher level of engagement than males across all areas.

Table 20. Respondents' environmental behaviour based on sex

Sex Group	Solid Waste Mgmt.	Energy Consumption	Water Consumption	Transportation	Purchase and use of products	Actual Participation
Female	2.48	2.98	3.13	2.87	2.52	3.00
Male	2.38	2.79	2.	2.62	2.37	2.65

Female and male students both have positive environmental attitude and high level of engagement in environmental-friendly practices, however, female students recorded higher mean scores in both categories, indicating that they have more positive environmental attitude and higher level of environmental behaviour. It also noticeable that the environmental behaviour of both groups compared to their environmental attitude is lower.

Table 21. Respondents' overall environmental attitude and behaviour when grouped in terms of sex

Age Group	Overall Mean (Environmental Attitude)	Attitude Interpretation	Overall Mean (EnvironmentalBehaviour)	Behaviour Interpretation
Female	3.15	Positive	2.83	High Engagement
Male	2.73	Positive	2.63	High Engagement

Students that are enrolled in public institutions possess a positive attitude in terms of all aspects, except in energy and water consumption where they have recorded a very positive attitude. Meanwhile, students that are studying in private institutions have a positive attitude in all aspects, except in energy consumption where they possess a very positive attitude. It also noticeable that students from public institutions have a more positive attitude than those from private institutions across all areas.

Table 22. Respondents' environmental attitude based on the type of institution they are enrolled at

Type of institution they are enrolled at	**Solid Waste Mgmt.**	**Energy Consumption**	**Water Consumption**	**Transportation**	**Purchase and use of products**	**Actual Participation**
Private	2.97	3.28	3.24	2.61	2.75	3.17
Public	3.16	3.38	3.32	2.74	2.85	3.24

Students that are enrolled in public institutions have a high level of engagement in terms of all aspects, except in solid waste management practices where they have low level of engagement. The same is the case for students studying in private institutions. It also noticeable that students from public institutions have higher level of engagement than those from private institutions across all areas.

Table 23. Respondents’ environmental behaviour based on the type of institution they are enrolled at

Type of institution they are enrolled at	Solid Waste Mgmt.	Energy Consumption	Water Consumption	Transportation	Purchase and use of products	Actual Participation
Private	2.41	2.91	3.06	2.73	2.42	2.92
Public	2.50	2.97	3.13	2.90	2.55	2.94

Students enrolled in public and private institutions both have positive environmental attitude and high level of engagement in environmental-friendly practices, however, female students recorded higher mean scores in both categories, indicating that they have more positive environmental attitude and higher level of environmental behaviour. It also noticeable that the environmental behaviour of both groups compared to their environmental attitude is lower.

Table 24. Respondents’ overall environmental attitude and behaviour when grouped base on the type of institution they are enrolled at

Type of institution they are enrolled at	Overall Mean (Environmental Attitude)	Attitude Interpretation	Overall Mean (EnvironmentalBehaviour)	Behaviour Interpretation
Private	3.00	Positive	2.74	High Engagement
Public	3.12	Positive	2.83	High Engagement

Overall environmental attitude and behaviour of tourism management students
Tourism management students have very positive attitude in terms of energy and water consumption, while they only possess a positive attitude in terms of solid waste management, transportation, purchase and use of products, and actual participation. In regards to their environmental behaviour, these students have high level of engagement in environmental-friendly practices in terms of energy and water consumption, transportation, and actual participation, however, have low level of engagement in purchase and use of products, and solid waste management practices. It is also noticeable that the students’ behaviour is lower compared to their attitude across all areas except in terms of transportation.

Table 25: Respondents’ environmental attitude and behaviour in all variables

Variables	Environmental Attitude	Attitude Interpretation	Environmental Behaviour	Behaviour Interpretation
Solid Waste Management	3.07	Positive	2.46	Low Engagement
Energy Consumption	3.33	Very Positive	2.94	High Engagement
Water Consumption	3.28	Very Positive	3.10	High Engagement
Transportation	2.67	Positive	2.81	High Engagement
Purchase and use of products	2.80	Positive	2.49	Low Engagement

Actual Participation	3.21	Positive	2.61	High Engagement

Tourism management students have a positive environmental attitude and high level of environmental behaviour that translates to high level of engagement in environmental-friendly practices. It is also clear that the level of environmental attitude the students have is higher than their environmental behaviour.

Table 26: Respondents' environmental attitude and behaviour

Statement	**Environmental Attitude**	**Attitude Interpretation**	**Environmental Behaviour**	**Behaviour Interpretation**
Environmental attitude and behaviour of Tourism Management students in selected HEIs in Region IV-A, Philippines	3.06	Positive	2.74	High Engagement

Using Spearman's Rho correlation, it was determined that there is no significant relationship between the students' environmental attitude and environmental behaviour.

Table 27: Relationship between the students' environmental attitude and environmental behaviour using Spearman's Rho correlation

Variables	***N***	***df***	***SD***	***R-score***	***P-value***	**Interpretation**
Environmental Attitude	392	0.05	1.87	0.54286	0.2657	Not Significant
Environmental Behavior						

CONCLUSIONS AND RECOMMENDATIONS

Based on the results presented, the researchers were able to determine that tourism management students in Region IV-A, Philippines have the most positive attitude and highest level of engagement in terms of energy and water consumption as they strongly believe that leaving appliances plugged has negative implications to the environment and that people must limit the use of electricity even they could afford it. They are also against the notion of leaving lights on, and cell phone chargers and cords plugged when not in use. Moreover, they strongly believe that it is never acceptable to let water running when not in use, as well as the notion of opening faucets in maximum when being used. Tourism Management students also think that people must limit use of water even they can afford it, and all of these translate into their practices. The students' environmental behaviour, particularly in terms of solid waste management, purchase and use of products, and actual practices, on the other hand recorded low scores. They often forget to segregate their solid wastes, and they do not recycle even those wrapped in single-used plastics. This is despite the fact that they often buy and use products that utilize single-used plastics such as shampoo sachets, candies, junk foods, cotton buds with plastic sticks, disposable plates, and plastic bags among others. Sadly, they are also not affiliated with any organization concerned with the environment, and they tend to purchase products based on their needs without checking whether such product contains chemicals that are harmful to the environment or do not.

When grouped according to their demographic profile, it was found out that students that are 26 years old and above, female, and studying in public institutions possess a more positive attitude and behaviour towards environmental practices in terms of solid waste management, energy and water consumption, and actual practices, while in terms of transportation and purchase and use of products, these groups of students only have the highest level of engagement. Meanwhile, those that are 24-25 years old, female, and enrolled in public institutions have the highest level of engagement on environmental practices in the area of transportation, and students that are 20-21 years old, female, and from public institutions possess the most positive environmental attitude in terms of purchase and use

of products. Overall, 26 years old and above, females, and students studying in public institutions have more positive environmental attitude and a higher level of engagement on environmental-friendly practices compared to their counterparts.

Tourism Management students in Region IV-A, Philippines possess a positive environmental attitude and a high level of engagement on environmental-friendly practices, however, their environmental behaviour in general is lower than their environmental attitude, in fact, based on the results of Spearman's Rho Correlation, there is no significant relationship between the students' environmental attitude and environmental behaviour, which indicates that their attitude towards the environment is different from their actual behaviour. The students could not translate what they have in mind into actual practice, hence, a problem that must be addressed.

From the conclusions, the following recommendations are made:

Environmental awareness with heavy emphasis on negative implications of human activities on global and smaller scales must be incorporated in all tourism major subjects that involve planning and development, and not just in environmental conservation in tourism and ecotourism, so students would realize the importance of not doing things that could harm nature and taking actions for the planet. Moreover, the students have great environmental attitude, however, it does not translate into practice in general, thus, topics and activities that focus on actual experience is a must such as but not limited to tree planting, proper waste segregation, recycling, and participation in programs organized by environmentally inclined organizations.

Single-used plastics are one of the major pollutants in the planet, so it is important that the students learn about this. The topics discussed involving environmental conservation and sustainability must give emphasis on the deeper consequences of the continuous production and disposal of single-used plastics, and not just on what is obvious. Discussions about this must be scientific, deep, and focused on long term effects, so it would be more effective in influencing students. This is critical because it is clear from the results that they do not recycle despite the frequent buying and using of products that utilize single-used plastics such as shampoo sachets, candies, junk foods, cotton buds with plastic sticks, disposable plates, and plastic bags, among others.

Male students must be exposed more to discussions about the environment since their environmental attitude and behaviour were consistently lower than of female's. Likewise, students studying in private institutions compared to those from public institutions. The management of private colleges and universities must include the environment and ecotourism in students' learning priority areas, while the management of public institutions are recommended to continue what they have been doing in the area of environmental conservation to maintain the positive attitude and high level of engagement possessed by their tourism management students.

Since the tourism management students are not affiliated to any environmentally inclined organization, the researchers hereby recommend the establishment of at least one student organization in each college and university in the Philippines that focuses on this area. This would help in spreading environmental awareness, and policy implementation, which could transform campuses into a more environmental-friendly place that could consequently motivate students to be more environmentally inclined.

Policies on environmental protection, preservation, and conservation must be reviewed aligned with the curricular program to ensure holistic and strong implementation as it may have effects to the attitude and behavior of students towards sustainable development.

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REVITALIZATION OF DEGRADED/CONTAMINATED SOIL AND METHODS OF DEVELOPING APPROPRIATE SOILBIOLOGICAL CHARACTERISTICS – A CASE STUDY

Borbála BIRÓ[1*], Zsolt KOTROCZÓ[1], Hosam E.A.F. BAYOUMI HAMUDA[2]

[1]Hungarian University of Agriculture and Life Sciences, Dept. of Agri-Environmental Studies, Budapest, Hungary, E-mail: biro.borbala@gmail.com; [2]Óbuda University, Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Budapest, Hungary, E-mail: hosameaf@gmail.com

***Abstract**:*
A pot experiment was set up to investigate the revitalization potential of selected treatments on a highly contaminated/degraded soil. In the experiment, 6 factors and 7 treatments were used, each in 4 replicates, using rape (Brassica napus) as test plant. During the time-period of the experiment continuous observations and measurements were conducted, plant and soil analyses – chemical and microbiological – were made to establish the main effects and results of the used treatments. Among them compost+soil-inoculum addition proved to be the best for the revitalization. This fact shows that the compost in a good quality, and the compost, enriched with microbes, or the inoculation with compost-extracted microbes can play the most important role in the revitalization of contaminated soils. Manure, and the manure+inoculums can also be used as a prominent treatment in the restoration of soils, to increase the organic matter content and the microbial activity in one-step. The single alga- and microbial inoculums treatment was not so successful, therefore, its use – without adding any parallel organic matter – cannot be fully recommended. The clay-additive on the other hand could increase persistency and activity of the applied microbes during the revitalization process. Application of organic additives supplemented with microbial inoculums is suggested as appropriate treatments of degraded/contaminated soils, of rather missing soil-biological activity.

***Keywords**: manure, compost, microbes, inoculation, revitalization, restoration,*

INTRODUCTION

The revitalization of soils that have become almost microbiologically „sterile" due to some heavy contamination is an important task for ecologists. This situation creates several technologies for soil remediation (HUTTMANOVÁ et al., 2015), such as thermal treatments, where after the extremely high temperature (about 200-500 °C), it is a requirement to make the soil susceptible again for plant cultivation and growth. For this reason, the most important requirement is the revitalization, the introduction of living organisms, of those almost „dead", non-living substrates. Without living organisms, we cannot consider those inorganic materials and decontaminated substrates to be a real and well-functioning soil (ATKINSON et al. 2010; PABAR et al., 2020). There are several known methods of revitalization such pre-treated substrates, where the contamination was eliminated, simultaneously with their soil-biological parameters (KOCSIS et al., 2018). Frequently inorganic fertilizers are given for improving plant growth and reestablishment. It can work for certain plant-growth, but in this case the substrate can only hold the plants, without self-feeding those soil-organisms (JUHOS et al., 2016). Due to the lack of organic materials, farmyard manure, composts or sewage sludge might be applied regularly (SCULLION, 1992; KARDOS et al., 2017). The combination of both methodologies was also reported, and an improvement of soil-fertility was found after an 8- and/or a 15-year-of-recultivation practice at open-coal-mine sites in Hungary (BIRÓ et al., 1993a).

Single inorganic fertilizer application alone could also enhance the development and functioning of the natural symbiosis in intensive agricultural systems (BIRÓ et al., 1993b, KÁTAI, 1999). There is still a great necessity to learn more about the interaction between soil-life, the various microbial populations and the different soil biotic and abiotic factors (KOTROCZÓ et al., 2017). Knowledge of the population levels of the microbiologically degraded soils is thus especially important when planning the reclamation and re-cultivation strategy during a site-rehabilitation. For studying the revitalization possibilities of such almost "sterile" soils, a pot experiment was designed with various treatments.
The aim of the experiment was to investigate the effects of: a) different organic and inorganic materials, b) microbial inoculum-preparations, and c) their combinations, in order to achieve faster and safer revitalization practice on the initially decontaminated, non-living substrates.

MATERIALS AND METHODS

Soil treatments and additives

A pot experiment, with 2 factors and 4 replicates, was carried out in greenhouse to study the effect of different additives on the contaminated soil. Revitalization success of the growth of the *Brassica napus* test plants were studied.
Preliminary thermal treatment of the highly contaminated soils was conducted in 2 kg containers for 4 hours at 350-, 250- and 170 °C (treatment C1, C2 and C3, respectively).
Growth of the test plant was investigated in C2 substrates with clay (A1) and perlite (A2) addition (2:1 = v:v).
The non-treated, absolute control soil was labelled as E1.
The main characteristics of the soils used in the experiment are shown in *Table 1*.

Table 1
Main characteristics of the soils used in the pot experiment and labelling of the various treatments

Soil characteristics	Heat-treatment of contaminated soil			Non-treated soil (A1)
	170 °C (C3)	250 °C (C2)	350 °C (C1)	
$pH_{(H2O)}$	9,32	7,95	7,82	8,10
Total salt %	0,08	0,15	0,19	0,12
SOM %	0,27	0,79	1,25	2,58
Plasticity K_A	40	30	37	37
NO_3-N mg/kg	5,07	2,13	8,64	3,32
P_2O_5 mg/kg	188	221	288	485
K_2O mg/kg	344	105	109	202
Ca %	2,60	0,50	1,10	0,89

The cultivation substrates, mentioned above were treated with different inorganic and organic additives, such as: fertilizer (II: 100–100 kg ha_{-1} N, P, K active ingredients) stabile manure (III) and compost (IV) (3:1 = v:v), alga (I) or full-strength microbial inoculums (V), and/or their mixtures (VI = II+V, VII = III+V, VIII = IV+V), using a non-treated control (E1).

Microbial inoculation

Different Cyanobacteria isolates were selected from a natural brown forest soil (by SZEGI, 1979). After their cultivation the antagonistic ability was tested *in vitro*. A mixture of the most antagonistic 4 strains (data not

shown) was used for the inoculation. After a one-week growth on light, 10 cm^3 inoculum was used in each pot of the algal treatment.

Full-spectrum microbial suspension was prepared from a ripened compost material by a dilution technique. 500 g compost was mixed with 1000 ml distilled water and shaken for 30 minutes. This suspension was used for upscaling the microbial inoculum in a sucrose enriched nutrient solution (by SZEGI, 1979) 24 hours growth at room temperature. After an approximately 10^8 CFU cm^3 propagule's-number, 10 cm^3 inoculum was applied to the treated pots after sowing.

Plant growth assessment

Ten seeds of *Brassica napus* were sown in 1 kg pots. Each treatment – with 4 replicates – was randomly arranged in the greenhouse. Seed germination was assessed after the emergence and plant height was measured in the pots 5 times during the vegetation period. Means of the data and significant differences were calculated for each treatment. Plant sampling was performed 5 times during the vegetation period (BUZÁS, 1988).

Green yields of shoot and root were measured and, after drying for the constant weight, the dry mass production was determined. Soil samples were taken from the treatments to determine the soil organic matter (SOM) and the nitrogen content at the end of the vegetation period.

STATISTICAL ANALYSIS

Results were analyzed and evaluated with the SPSS statistical program package, using single way analysis (ANOVA). The type of evaluation is statistical calculation, from single cases, to draw conclusions about the accuracy of the results.

RESULTS AND DISCUSSION

Green yield of the test-plants

Biomass production is one of the most important parameters of plant growth. The mean yields of the test plants were calculated for the treated pots and the results are given in *Table 2*. These data showed that the highest green yields were found on the substrate with the lowest heat treatment. A much lower efficiency was realized, therefore at the highest heat treatment.

The differences in green yield among the treatments were smaller than those of plant heights. In case of a further analysis of the different treatments, a more useful conclusion can be drawn. Using the earlier numerical values for the green yield data, the *compost+inoculums* treatment (VIII) was found to be the most effective. The result is in agreement with the plant height data.

The other valuable treatment is the single *compost* addition (treatment IV). The parallel addition of *clay and perlite mixture* was also effective in the 250 °C treated soil. It is also obvious from the results that the farmyard manure, and the *manure+inoculums* treatments can provide acceptable results on soil-revitalization. All other data, such as the microbiological survey further strengthen these results.

Microbial parameters of treated soils

The amended soils were assessed for microbial abundance, to show the relevance of used revitalization treatments. Results of microbiological investigations are summarized in *Table 3*. Clay treatments (A1) had an especially positive effect on studied microbial activities. The abundance of all microbial types could be increased with the addition of clay materials.

The number of *total countable microbes* was significantly enhanced by the microbial inoculation treatments in comparison to the addition of farmyard manure or compost.

Table 2

Mean data of the green yield of Brassica napus in the pot experiment

Organic/inorganic amendments	**A1 Clay**	**A2 Perlite**	**C1 350 °C**	**C2 270 °C**	**C3 170 °C**
III	7.99	11.88	8.77	**13.29**	**25.33**
IV	**19.27**	**17.72**	**18.59**	**17.16**	**30.28**
V	3.58	0.90	0.14	8.65	14.34
VI	11.01	7.99	11.17	**19.89**	15.27
VII	**24.86**	**18.78**	**24.26**	**18.65**	**30.34**
VIII	**24.35**	**11.34**	**21.69**	**28.75**	**40.85**

Treatments are shown in the text.

The number of filamentous fungi (micromycetes) was low in the farmyard manure and almost 100-times more (2-fold increase) in the composted material. In case of the liquid fermentation of the microbial inoculums, micromycetes were not able to produce a good growth. That is perhaps the reason for their failure and lesser activity.

The success of microbial inoculations was assessed in the soil substrates, after a 4-hour heat treatment at 350-, 250- and 170 °C. The main groups of culturable microbes, such as the total colony-forming units (CFU), micromycetes and *Actinomycetes* were counted on selective plates with differential media.

The less abundance (1- or 2-fold decrease) of culturable microbes was found when the soil was heat-treated at 350 °C. The detected results, however, differed as a function of the type of microbial group, investigated.

As it can be seen in *Table 3*, total microbes grown on the nutrient plates were greater in number at the lowest temperature treatment. Micromycetes, however better preferred the highest temperature pre-treatment of the soil substrates. Their abundance reached the maximum at 250 °C, except for the substrate with compost addition.

The third microbial group, the *Actinomycetes*, was not sensitive to the heat treatment of soil. In all substrates, either both with inorganic or organic additives their numbers were rather stabile (between 6.33 and 6.83), with no significant difference. Among the organic additives, compost proved to be more acceptable for promoting the success of revitalization.

In case of all microbial groups, the highest number was found generally in case of compost amendments. Somewhat similar results were published by INSAM & DOMSCH (1988). The countable number of micromycetes proved to be especially high in the composted material (2-fold increase, which means a 100-times higher amount).

Composting processes therefore can contribute to soil revitalization to a great extent.

The inoculum used also originated from the compost, except for the alga treatment. The mixture of blue- and green alga-strains was selected from the original, not-treated soil. Their effect, however, with the inoculation was not found to be significantly positive. Although the alternative application of alga treatments is currently being suggested as soil nutrient (P) indicators (ÖRDÖG & MÁTÉ, 2002), their abundance did not reflect soil quality in this study. For the revitalization purpose, therefore only a permanent algal treatment can make a positive contribution to soil revitalization and fertility on a long-term level.

Table 3.
Total number* of microbes, micromycetes and Actinomycetes in the treated soils of the pot experiment

Treat-ments	Microbes	Microbial abundance (log_{10}/g d.w.) in treatments					
		III	IV	V	VI	VII	VIII
A1	Total CFU	7.39	7.63	8.56	7.88	6.84	7.80
	Micromycetes	4.60	6.30	5.55	4.63	5.06	5.72
	Actinomycetes	6.76	8.08	n.d	6.86	6.23	6.02
A2	Total CFU	7.37	7.34	7.76	7.46	7.51	6.84
	Micromycetes	4.49	5.67	4.52	5.19	5.94	4.00
	Actinomycetes	6.40	6.25	6.64	6.77	6.54	6.47
C1	Total CFU	6.97	6.72	6.48	7.36	6.56	6.23
	Micromycetes	4.37	4.86	4.81	4.84	4.35	4.43
	Actinomycetes	6.59	5.74	n.d	6.33	6.72	n.d
C2	Total CFU	7.57	8.52	7.58	7.63	6.50	8.56
	Micromycetes	5.86	5.92	5.75	5.88	6.56	4.06
	Actinomycetes	6.42	n.d	6.61	6.83	n.d	6.46
C3	Total CFU	8.58	7.55	8.34	8.02	8.18	8.70
	Micromycetes	5.78	5.07	5.58	4.85	4.75	6.35
	Actinomycetes	6.56	6.60	6.46	6.68	6.66	6.65

CFU: colony forming units in 1 g dry soil; n-d: not determined; Treatments are in the text.

CONCLUSIONS AND RECOMMENDATIONS

Revitalization is very often needed in highly contaminated soils, or in those substrates where a preliminary decontamination process was applied. One of the most frequent methods is the heat-treatment, where the contaminants can be eliminated. The highest the used temperature, is the worst in case of maintaining original soil physical-chemical-biological characteristics. The revitalization proved to be potentially possible with the addition of organic materials, such as the compost and/or the farmyard manure. The combination of such materials with microbial inoculums can be also a suggested appropriate technique. In the revitalized substrate (soil) the growth of the test-plant was improved.

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PROTECT SOIL FOR SURVIVAL OF MANKIND

B.S. PANWAR[1], S.K. VARSHNEY[2], Hosam E.A.F. BAYOUMI HAMUDA[3], Borbála BIRÓ[4]

[1]*CCS Haryana Agricultural University, Hisar, India*
[2]*Ministry of Science and Technology, Government of India*
Department of Science and Technology
Technology Bhawan, New Mehrauli Road, New Delhi. India
[3]*Institute of Environmental Engineering & Natural Sciences Óbuda University. Budapest, Hungary*
[4]Hungarian University of Agriculture and Life Sciences, Budapest, Hungary
panwarbss@gmail.com

***Abstract**:*
If we are what we eat, we are only as healthy as the soil that produces our food. Healthy food smells good and so does healthy soil. You don't always need expensive lab tests to determine if the soil is healthy or not; instead, use your sniffing skills and you won't go wrong. Leaving soil without any green cover ends up killing its essential micronutrients and microfauna, in addition to disintegrating it to the point of no water retention capacity. Tillage creates and enhances many serious environmental impacts, such as increasing carbon emissions germination level plant grows in the moon soil. Lunar soil contains elements such as Fe and Mg. But it lacks most of the minerals found on Earth. it has a harder texture and contains a lot of small, sharp pieces. It contains fragments of microscopic glass left over from meteorite impacts. It's as if the world has come to an end to the land, Agricultural research in lunar conditions after Mars. Reducing cadmium (Cd) content in cereals and fodder crops is a public concern for food safety and security. Heavy metal toxicity and the danger of their bioaccumulation in the food chain represent one of the major environmental and health problems of our society. Primary sources of pollution is from the burning of fossil fuels, mining and smelting of metallic ferrous ores, municipal wastes, fertilizers, pesticides, and sewage sludge. The most common contaminants are Cadmium, Chromium, Copper, Mercury, Lead, Nickel and Zinc. Soil treatment using inorganic and organic amendments is considered as a cost-effective approach in immobilizing soil heavy metals and reducing metal uptake by crops. Contamination by heavy metals is a significant issue worldwide. In recent decades, soil heavy metals pollutants in Asia had adverse impacts on soil quality and threatened food security and human health. Anthropogenic inputs mainly generate heavy metal contamination in Asia. In this article, the approaches were used in these investigations, focusing on geochemical strategies and metal isotope methods, particularly useful for determining the pathway of mining and smelting derived pollution in the soil. Our findings indicate that heavy metal distribution substantially impacts topsoil around mining and smelting sites, which release massive amounts of heavy metals into the environment. Furthermore, heavy metal contamination and related hazards posed by Pb, Cd, As, and Hg are more severe to plants, soil organisms, and humans. It's worth observing that kids are particularly vulnerable to Pb toxicity. And this article also provides novel approaches to control and reduce the impacts of heavy metal pollution.

***Keyword**: Soil, natural body, heavy metals, pollution, Phytoremediation*

INTRODUCTION

Why soil is natural body?
let's stop "missing the forest for the trees "a teaspoon of our soil easily reveals: what we have been doing locally in our different farms and where we are headed nationally and how we would all end up globally."–

Francis bosah. The ongoing lack of access to inorganic fertilizers and galloping price inflation being experienced on other sister inputs the world over (literally) has succeeded in proving that: our soils are devoid

of biology (soil citizens), as we have been farming with only dirt and synthetic chemicals with the obituary announcement for the soil citizens by the chemicals, and have been on compromised diet since 1945.
Most of the world's farmers do not have contingency plans. it seems to be rather absurd because hunger does not go on strike nor wait until "the war" is over.
Putin (just one man, not to talk of when there may be combined forces denying the world of "essential resources") has put it to the entire world that we need to essentially deemphasize inputs and switch to a permanent regenerative farming culture like life-in-the-soil approach, permaculture, syntropic agroforestry, etc. in spite doubling mixing concentrations and heightening frequency of pesticide spraying, the chemical intensive agriculture can never lead us to the old growth forest successional stage experience under our current farming paradigm.
Use of chemicals can never lead to the restoration of degraded and disturbed natural areas and soils either, instead they will continue to aggravate the situation.
Indeed, "the wind has blown and the anus of the chicken has been exposed" - Nigerian proverb– and also, this situation reveals that we have come a long way the wrong way and need to work at turning the table around life-in-the-soil approach in tandem with the regenerative agriculture paradigm is the way to go. with this, we are going to stop "missing the forest for the trees".

Soils for healthy plants come from foundations, do you understand soil foundations?

That's what Earth love Global are specialists on is soil building strategies. So, learn from industry leaders and fast track your success in soil knowledge and understanding.

Building soil humus and fertility is far easier than you would expect and once you learn the best strategies you can grow in all locations throughout world no matter the type of soil or location. Even rainfall is not a problem anymore.

Laureate Rattan Lal was recently announced as one of the world's top plant and agronomy scientists.
Lal's research has examined and developed healthy soil systems for over 2 billion people worldwide. His work has significantly advanced the availability of nutritious food around the world.

We have soil and water but we are hungry?
I've heard these words many times before, and keep replying – maybe it's time for changes? If so, start with knowing the ground below your feet to use it, and not abuse it, as abused soil will not work for you Do your homework before acting and investing because you have only one chance to get it right or wrong, as the undo button doesn't work.
There are 78,000 kg of nitrogen above every hectare of soil, so why in the world are we applying synthetic fertilizers? Well, the answer is simple, we aren't capturing any of the atmospheric nitrogen.

We must ask ourselves why*?*
When you take a look at your soil and don't see any soil aggregates stuck to the roots, therein is part of the answer. Inside soil aggregates are free living nitrogen fixing bacteria. So even if you have legumes on your land, that does not mean that nitrogen is being fixed. But there is good news, because nitrogen fixing bacteria are the most common organism in healthy soil.

***"The poetry of the earth never ends.
Earth does not belong to us; we belong to it.
To hurt the Earth is to harm ourselves."***

Researchers tested for a better way to build bioretention cells, which help rain soak into the ground instead of carrying pollutants to waterways. One finding was that zeolite helped water soak in faster, and it retained more nitrogen than typical material

It is that 30 cm? It is the end of the root zone. The finer material will have to saturate before water releases into the gravel. The vegetation appears arid. Flood deposits generally fine upward. There may be an aeolian component at work on the surface. We are absolutely correct, mankind's interest in soil dynamics has been limited to what can be built above it or exploiting what is below it and pretty much nothing else in between. A sad reality.

A soil morphology is a base for soil literacy and the foundation of soil science, which holds the key answers to soil genesis, behaviour, management and use. It has the same meaning to soil Science as anatomy to medicine - we should use it wisely

Sustainably managing the forests, we have, and restoring the health of forests that are degraded, is critical to closing the emissions gap and regaining balance within our natural ecosystems.
The belowground root-soil-microbe interactions are complex and involve a range of physical, chemical, and biological processes that influence nutrient-use efficiency, plant growth and soil health.

During the formation of *rhizosheath*, root hairs play an important role in increasing soil adhesion to roots. Plants release about 10–40% of their total photosynthetically fixed carbon into the rhizosphere, where various forms of organic compounds have significant effects on the chemical, physical and biological processes of soil.

Root-induced chemical processes involve:
- Release of protons (acidifying the rhizosphere soil),
- Secretion of organic acid (OA) anions (carboxylates) solubilizing sparingly soluble nutrient complexes and improving nutrient availability,
- Release of enzymes to hydrolyze organic compounds.

Symbiotic root-microbe processes include
- Arbuscular mycorrhiza (AMF) formation,
- Symbiotic relationship with N2-fixing bacteria,
- Plant Growth-Promoting Rhizobacteria (PGPR) interactions,
- Effects on structure and activity of the core soil microbiome.

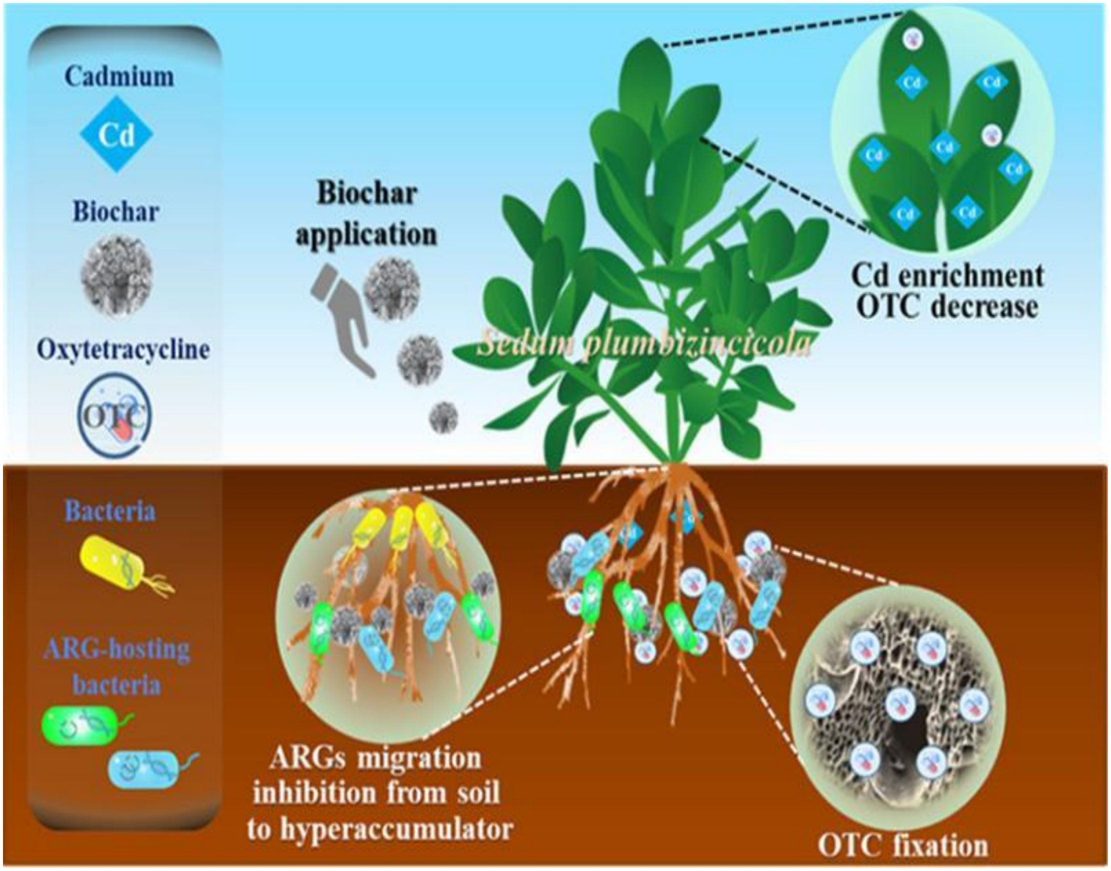
Researchers highlight how root-soil-microbe interactions could be manipulated to ensure food security and resource sustainability in a changing global climate.
Both natural and technological strategies exist to remove carbon dioxide from the atmosphere and store it through various means, such as in trees and plants, soils, underground reservoirs, rocks, the ocean and even through products.

Biochar - a climate-smart solution

A growing body of evidence proves the benefits of converting crop residues into a carbon-stable compound - biochar.

Biochar could play a key role in implementing the climate-smart agricultural practices, possessing a great potential of strengthening the resilience of small holder farmers' agricultural systems.

Biochar can have variable agronomic and soil effects that vary depending on farmland management practices, soil types, and crop species.



Key benefits of biochar application in agriculture include

- Improvement of soil fertility and reduced need for agricultural inputs (e.g. chemical fertilizers),
- Positive effect on soil microbial species richness and diversity,
- Improvement of soil carbon storage potential,
- Improvement of soil structure and physical stabilization of soil aggregates,
- Reduction of nitrous oxide (N_2O) and methane (CH_4) emissions from cultivated soils,
- Use of heat energy, bio-oils and synthesis gases generated during biochar production as alternative for fossil fuels

Soil fertility is the secret to yields in the field.
Worm farms are the solution and to feed them with cow or horse manure is a valuable soil amendment for commercial scale soils, Animal manure is a valuable soil amendment for farming and land holders. It is not only supplies primary nutrients (nitrogen, phosphorus and potassium) and micronutrients for plant growth, but also is a source of organic matter.
Respect as it was 70 years ago, meant the farms always had some green cover all year.
Soil doesn't eat itself but requires deep-rooted respect from us as a measure of the seriousness of our partnership with her and as an indicator of the extent to which we are willing to care deeply for her in return for optimal food and nutrition outputs.

Why the worsening run away soil degradation?

Systemic Disrespect/Disregard
The worsening run away soil degradation, we see around us today is a reward of the systemic disrespect/disregard we had for soil in our various past relationships with her at the intersection of agriculture, forestry and urbanization.

Consequences of our lack of special regard/respect and care for soil

The intersectional archeological information, revealed that history is fraught with the remains of civilizations that disrespected, disregarded, exploited, and degraded the soil to their own disadvantage.
Today, it's glaring enough that we are faced with same fate, as we now have one-third of the world’s soil already damaged by water (Flood in Pakistan 2022) and wind erosional forces, dumb deforestation, compaction, nutrient depletion, and pollution.
It's highly concerning that by our own actions and inactions, losing soil faster than nature can create it.

Alarmings
Information from The UN says that unless we protect the remaining soil and improve land use and conservation practices, the global amount of arable and productive land per person in 2050 will be only a quarter of what it was in 1960.

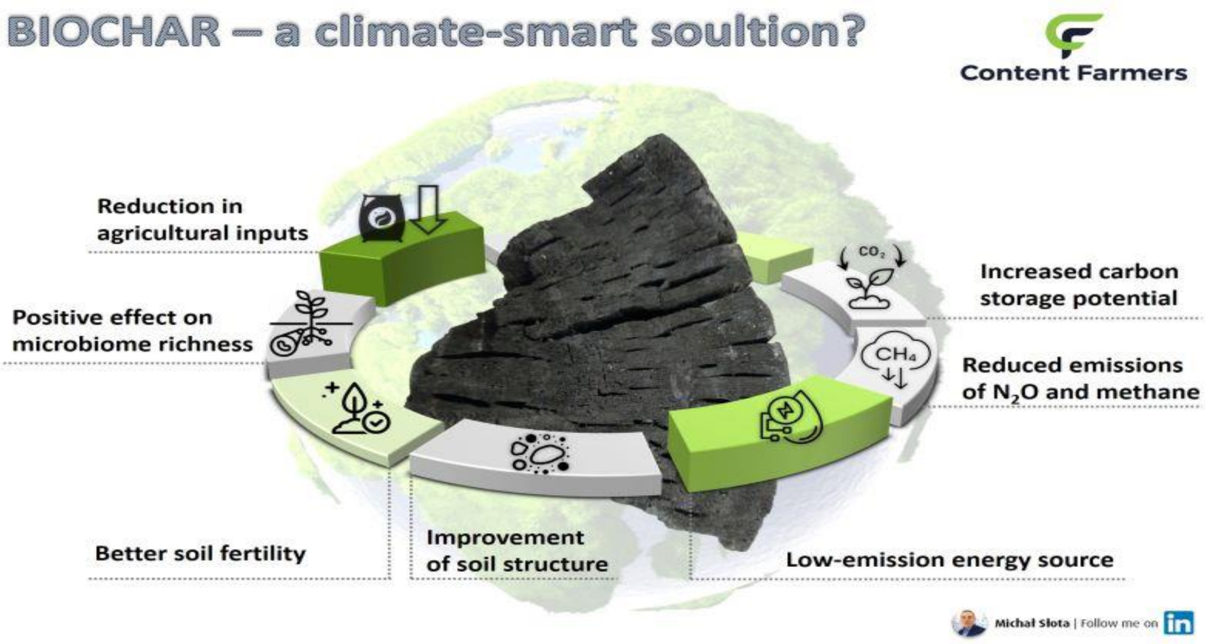
There's hope as we can sincerely build soil faster than nature does?
The recent growing interest and rise in research on soils and soil health as represented and exemplified by the modern break through understanding of the soil biology, the revolutionary concept of regenerative agriculture and ongoing immersive advocacy education and training that help to push the soil food approach and regenerative agriculture conversations are steps in the right direction, which are systemically improving our relational value of soil and re-building and preserving soil carbon, cutting erosions and improving soil nutrients.

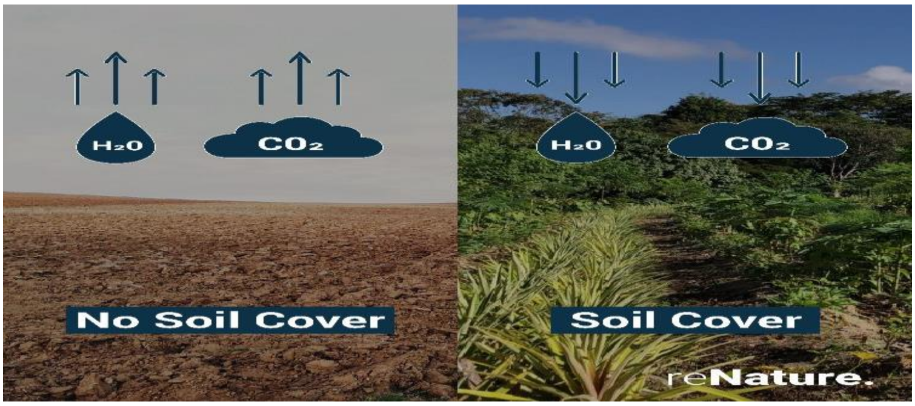
The place of deep-rooted respect and care for soil?
We are entering a decisive decade, and this is the time to do something impactful, to reach the much needed tipping point in our soil re-building and preservation efforts, we must make certain that communities, farmers and corporations are immersively educated to promote deep respect and responsibility for soil.

Conservation agriculture has three principles which includes; minimum tillage, crop rotation with mulching being the most important among the three. The three principles are more effective in increasing yield and soil conservation when applied combined than when applied individually.

Mulching is very important in conservation agriculture as it;

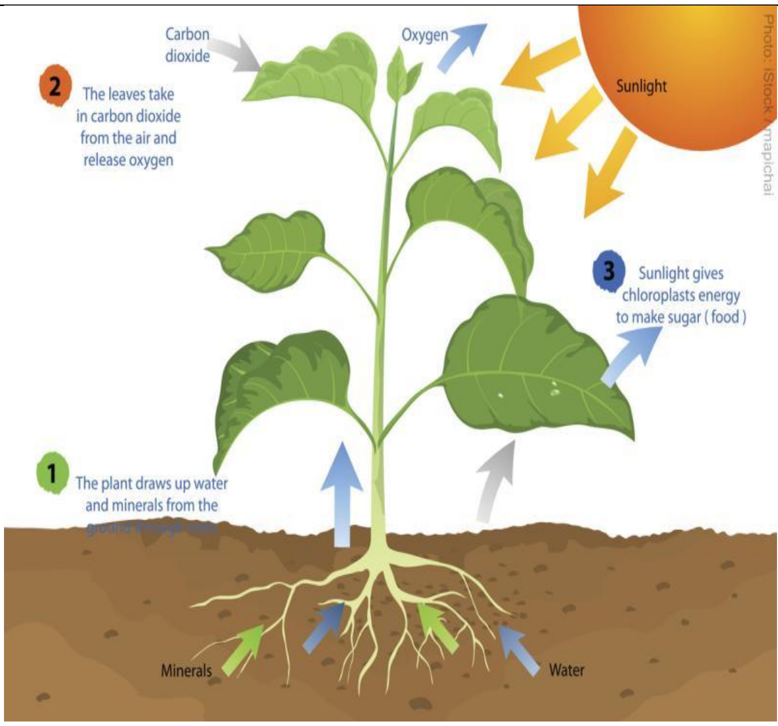
- Reduces soil deterioration by preventing runoff and soil loss.
- Minimizes weed infestation hence reducing labour cost.
- Conserves moisture in the soil by checking water evaporation.
- Helps to control temperature fluctuations in the soil.
- Organic mulch improves physical, chemical and biological properties of the soil as it adds nutrients in the soil when it decomposes.
- Boosts crop yield.
- Improves soil structure.

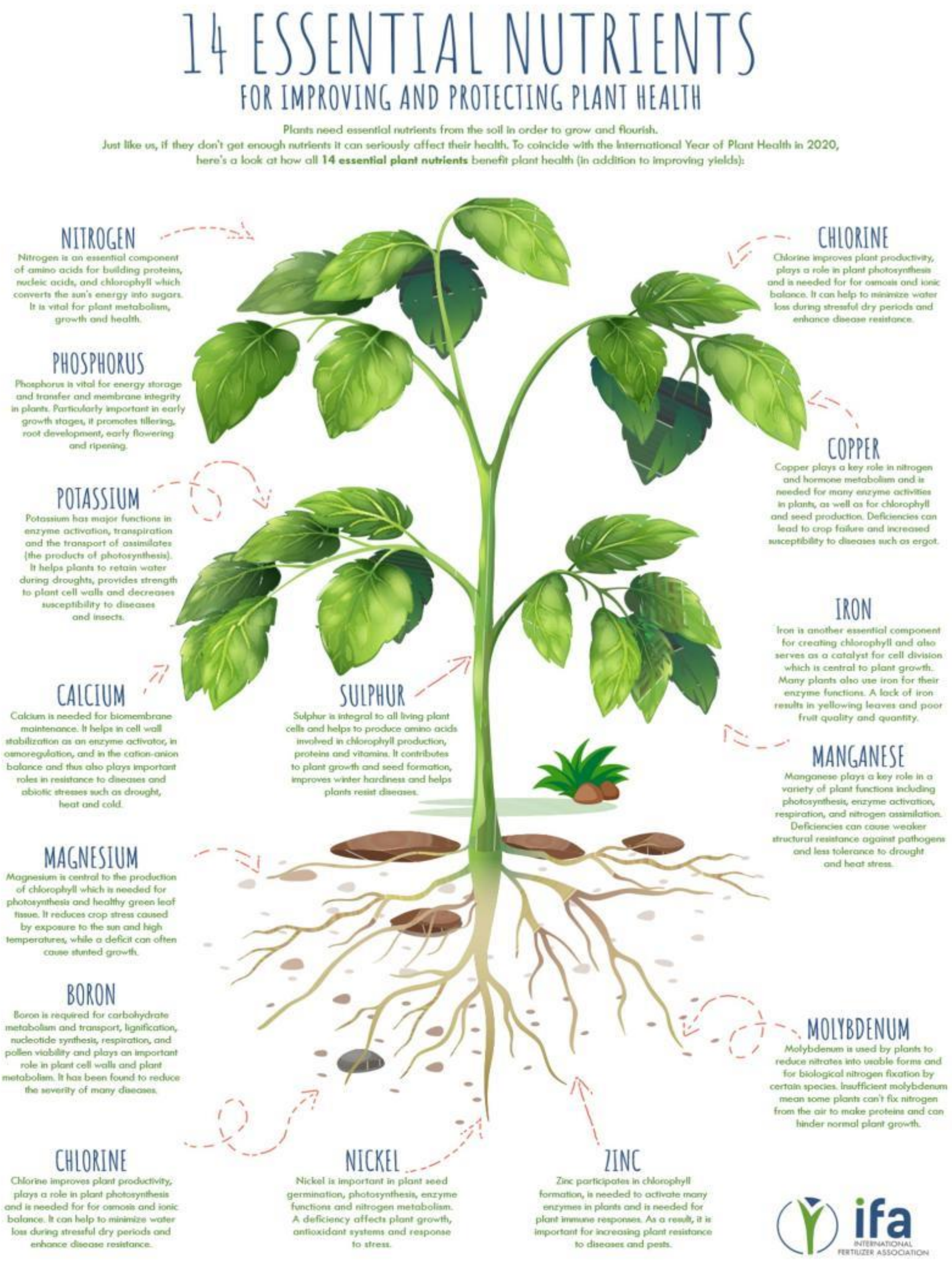




The concept of companion planting isn't just for the vegetable patch and very much exists between trees, influencing forest health and vitality. Trees thrive as part of a balanced community and prefer to grow in small clumps of the same species but intermixed with diversity of other local, indigenous species.
This allows numerous above and below ground subtle interactions that enable trees to collaborate and positively influence forest ecosystem biodiversity and balance.
The Celtic 'sacred trinity' of trees - oak, ash and hawthorn have always been found growing together and seem to boost each other's wellbeing. The growth pattern of these three species is a perfect balance - ash being more of a pioneer, quickly reaching for the skies, while the oak slowly fills out in the shade of the ash and eventually dominates. Meanwhile the Haw thorn busily shades the ground and creates a low-level canopy and home for biodiversity - particularly small birds and butterflies.

Along the Dalmatian coast there's a traditional association between olive trees, almond and cherry. The almond seemingly helps the olives yield more oil and the cherry helps with drought resistance.
This diversity and interaction formed over the eons, offers great resilience and adaptability partly through collaboration of species that's just not found in fragile managed mono planting. Finally, typical root system from a plant grown in mineral rich and biologically active soil. This plant is effectively resistant to insect and disease attack with no toxic sprays needed.


Carbon
dioxide
Oxygen
Sunlight
2
The leaves take
in carbon dioxide
from the air and
release oxygen
3
Sunlight gives
chloroplasts energy
to make sugar (food)
1
The plant draws up water
and minerals from the
Minerals
Water
Photo: iStock / mapichai



SOIL POLLUTION AND REMEDIATION

Cadmium

Low-cost lime-based waste materials have recently been used to immobilize metals in contaminated soils. A study was conducted to evaluate the effects of oyster shells and eggshells as lime-based waste materials on immobilization of cadmium (Cd) and lead (Pb) in contaminated soil, as well as their effects on metal

availability to maize plants (*Zea mays* L.). Oyster shells and eggshells were applied to soils at 1 and 5% w/w, after which they were subject to 420 days of incubation. The toxicity characteristic leaching procedure (TCLP) test was employed to determine the mobility of Cd and Pb in soils. The results showed that the addition of waste materials effectively reduced the metal mobility as indicated by the decrease in the concentration of TCLP-extractable Cd and Pb, and this was mainly due to significant increases in soil pH (from 6.74 in untreated soil to 7.85–8.13 in treated soil). Overall, these results indicate that oyster shells and eggshells can be used as low-cost lime-based amendments for immobilizing Cd and Pb in polluted soils (Jung Eun Lim, et al, 2013).
For characterization of the ability of crops to reflect changing soil properties after the addition of ameliorative materials into the soil both pot and rhizobox experiments were provided. In the pot experiment, the influence of the addition of lime and limestone into contaminated Cambisol containing 7.14 mg Cd/kg, 2174 mg Pb/kg, and 270 mg Zn/kg on element availability for spring wheat was tested. The ameliorative materials were added intothe pots containing 5 kg of soil in amount of 3 g CaO_3, and 5.36 g $CaCO_3$ per kg of the soil. The soil pH reached up to 7.3 in lime treatments compared to 5.7 in control soil. Mobile portion of soil elements (0.01 mol/l $CaCl_2$ extractable) dropped by 80% for Zn, 50% for Cd, and 20% for Pb, respectively. The content of elements in shoots and roots of wheat dropped mainly in the case of Cd and Pb. Soil mobile portion of all three tested elements introduced clear depletion curve in control treatment, both limed treatments showed high stability of element complexes almost not effected by wheat roots (P. Tlustoš et al, 2006).

In situ immobilization of contaminants by application of organic and inorganic amendments is one of the effective techniques to reduce availability of heavy metals to plants. A pot trial was carried out to evaluate the effects of inorganic (rock phosphate) and organic amendments (press mud compost) for Cd immobilization to improve maize growth and yield in Cd-spike soil. The results indicated that Cd contamination negatively affected and the effect was more pronounced under 30 mg Cd kg^{-1} compared to lower levels of Cd stress. But the immobilization of Cd due tothe combined application of rock phosphate and press mud compost improved the growth and yield of maize both in uncontaminated and Cd contaminated soil. In conclusion, Cd stress was highly detrimental to maize plants under higher level of contamination. Moreover, combined application of rock phosphate and press mud compost immobilized Cd and ultimately improved the growth and yield of maize in Cd contaminated soil (Akhtar, at al, 2019).

Long term use of sewage/waste waters containing even small quantity of Cd for irrigation onto agricultural lands has been reported to cause buildup of Cd around big cities. Among remediation options excavation of metal-polluted soils prohibitively expensive. one of major problems associated with Phytoremediation is low metal-removal rates. Hence, there has been anincreasing interest in the immobilization of heavy metals using range of inorganic and organic materials like lime, phosphate, organic manures. However, use of lime, phosphate and farm yardmanure-(FYM) is cost-effective option. lime offers a matrix for adsorption of metals and also facilitates pH-induced precipitation. The effectiveness of lime depends on soil type. metal, pH values of the limed soils and crop species. While lime has been evaluated for its effectiveness in reducing metal-toxicity, its usefulness on alkaline soil. The farm yard manure as metal- ameliorant has also been studied. The decrease in the availability of cadmium was obtained uponaddition of organic manures by several crops (Datta, *et al*, 2007).

The behaviour of Cadmium in plants and soils so as to find ways to minimize health hazards. which would help improve grain safety and safe guard human health from Cd contamination. Therefore, the present study was conducted to observe the immobilization of cadmium by organic and inorganic amendments, impacts on yield of maize in Cd-spiked soil.

METHODOLOGY

The pot experiment was conducted at Department of Soil Science, CCS Haryana Agricultural University, Hisar, India. The bulk soil samples were air-dried, ground and passed through a 2 mm sieve. Soil was sandy clay loam, neutral in reaction with pH (soil: water:1:2) 7.5 and non- saline with electrical conductivity of 0.63 dS m^{-1}. The cation exchange capacity and organic C content of soil were 16.5 cmol (p^{+}) kg^{-1} and 6.9 g kg^{-1}, respectively. The Olsen- P was 25 mg kg^{-1}.

The amount of free $CaCO_3$ was 7 g kg^{-1}. The DTPA- extractable Cd was 0.08 mg kg^{-1}. Each earthen potwas filled with 20 kg of spiked 100 mg Cd kg^{-1}. The recommended doses of N and K for maize (*Zea mays, L. variety HHM-2)* were applied through urea and Murat of potash, respectively in solution form and thoroughly mixed with the soils. Following the incorporation of basal nutrientsin soils, Cadmium was applied at the rate of O and 100 mg kg^{-1} soil through Cadmium chloride ($CdCl_2$). Five levels of amendments, *viz.* control, farm yard manure- FYM (1%), Vermicompost -VC (1%), SSP (100 mg P kg^{-1}) and $CaCO_3$ (3%) were applied to soil of each pot and mixed thoroughly.

The soil in each pot was watered to field capacity with deionized water and incubated for a fortnight. Six to seven seeds of Maize were sown in each pot and thinned to four plants per pot after 12 days of sowing. The pots were replicated thrice in a completely randomized design (CRD). Pots were watered daily on a weight basis to maintain the field capacity. At blooming stage (45 days), the above ground parts of maize plant were harvested.
After, harvest the plant samples were washed successively with tap water, distilled water and dilute acid solution (0.01 N HCL) for removing the mechanically adhering impurities. These samples were first air- dried in the open sun and the oven- dried at 65 ^{o}C until the attainment of constant weight in a hot air oven. The oven dried plant samples were ground with the help of a stainless-steel grinder and digested in diacid mixture for further analysis of cadmium in plants.

RESULTS AND DISCUSSION

The visual symptoms and crop growth was observed till the harvest. The green color and good stand of maize plants in Cd-spiked soil without any amendment was giving good performance indicating hyper accumulating capability of maize crops towards cadmium toxicity (Plate 1). The FYM and VC has also been able to mitigated the toxic effect of cadmium in plants (Plate 2 and 3). The poor growth of maize plants was observed in $CaCO_3$ amended pots (Plate 4) in comparison to Phosphorus amended soils may be attributed the more release of Cd^{++} in soil.

i) Dry matter yield:
The dry matter yield of maize straw (mean of four plants) was increased with SSP, FYM and VC marginally over control in no cadmium treated soil. The maximum reduction in yield was observed in $CaCO_3$ treated plot. The magnitude of dry matter yield increase was observed in SSP, FYM and VC pots in Cd spiked soil 26.4, 31.99 and 39.83 % respectively.

The 17.99% increase was observed in $CaCO_3$ treated plot which indicates the deteriorated effect of carbonate along with cadmium. The mean value of Yield 42.68 g pot^{-1} was found in no Cd treated soil however, it was 37.80 g pot^{-1} in contaminated soil (Table. 1)

Table 1
Effect of amendments on dry matter yield of maize plants straw (g pot^{-1})

Amendment	Cd (0 mg kg^{-1})	Cd (100 mg kg^{-1})	Per cent increase
Control	40.50	30.68	-
SSP	43.80	38.78	26.40
$CaCO_3$	38.60	36.20	17.99
FYM	44.90	40.48	31.94
VC	45.60	42.90	39.83
Mean Cd	42.68	37.80	-

ii) Cadmium concentration in plants:
The cadmium concentration was in increasing trends in FYM and VC pots 9.70 to 13.03% and with SSP and $CaCO_3$ pots it was 1.21 and 19.70% reduction in concentration. The mean Cd concentration in Cd-untreated plot was 0.63 and in treated pot it was 33.12 mg kg^{-1} (Table 2). It indicates beneficial effect of organic amendments over inorganic amendments in cadmium spiked soil.

Table 2.
Effect of amendments on Cd concentration in maize plants straw (mg kg^{-1})

Amendment	Cd (0 mg kg-1)	Cd (100 mg kg-1)	Per cent - increase/reduction
Control	0.54	33.00	-
SSP	0.65	32.60	1.21 (r)
CaCO3	0.45	26.50	19.70 (r)
FYM	0.75	36.20	9.70 (i)
VC	0.78	37.30	13.03 (i)
Mean Cd	0.63	33.12	-

iii) Cadmium Up take in maize plants:
The maximum uptake of cadmium was observed in VC treated pots and lowest in control plot. The up take was increases in the trend VC, FYM, SSP as 58.05, 44.73, 24.87 % respectively, over control. The 5.25% reduction was found in Cd uptake in $CaCO_3$ pots. The mean uptake of Cd in no Cd pots 27.39 and in Cd treated pots 1260.30 g pot $^{-1}$ (Table 3).

Table 3
Effect of amendments on Cd uptake in maize plants straw (mg pot^{-1})

Amendment	Cd (0 mg kg^{-1})	Cd (100 mg kg^{-1})	Per cent - increase/reduction
Control	21.87	1012.44	-
SSP	28.47	1264.23	24.87
$CaCO_3$	17.37	959.30	5.25 (r)
FYM	33.68	1465.37	44.73
VC	35.56	1600.17	58.05
Mean Cd	27.39	1260.30	-

iv) Post-harvest Cadmium in Spiked soil:

The increase in post-harvest cadmium was observed in SSP (37.5%), FYM (25.63%) and VC (22.53%) amended pots, whereas in $CaCO_3$ pots it was 59.15% reduction in cadmium content in spiked soil. The mean value of cadmium in no cadmium soil is 0.12 and in 100 mg Cd kg^{-1} spiked soil was 35.38 mg Cd kg^{-1} soil.

Table 4

Effect of amendments on the DTPA-extractable Cd (mg kg^{-1}) in soil after the harvest of maize plants

Amendment	Cd (0 mg kg^{-1})	Cd (100 mg kg^{-1})	Per cent - increase/reduction
Control	0.08	35.50	
SSP	0.09	38.80	9.30 (i)
$CaCO_3$	0.08	14.50	59.15 (r)
FYM	0.19	44.60	25.63 (i)
VC	0.18	43.50	22.53 (i)
Mean Cd	0.12	35.38	-

The results revealed that the DTPA extractable Cd increased from 0.12 in control to 35.38 mg kg^{-1} with the application of 100 mg Cd kg^{-1} (Table 4). The application of $CaCO_3$ @ 3% significantly reduced the DTPA-extractable Cd in soils. The application of SSP, FYM and VC amendments enhanced the DTPA- extractable Cd in soil by 9.30, 25.63 and 22.53% respectively.The 59.15% reduction in post-harvest Cd in soil was observed in $CaCO_3$ treated pots. The Cd content in plants was raised from 0.63 (Control) to 33.12 mg kg^{-1} in the Cd- treated pots (Table 2). On an average, application of $CaCO_3$ reduced the Cd content in plant tissues by 19.70% .

On the contrary, Cadmium content in plants exhibited an increase 9.70 and 13.03% due to application of FYM and VC. This trend was corroborated with DTPA- Cd in soils under differentamendments. The effect of liming in decreasing Cd uptake has been attributed to both decrease in mobility of Cd in soils and competition between Ca^{2+} and Cd^{2+} on the root surface for absorption. Further, in the limed-soil, Cd^{2+} activity may be limited due to the precipitation of Cdas $CdCO_3$ depending on partial pressure of CO_2 (g) and ion activity product of the system. Increase in availability of Cd due to addition of VC and FYM may be ascribed to the formationof soluble organo-metallic complexes in soils.

The impact of SSP in reducing bioavailability of Cd is attributed to the fact that solubility of $Cd_3(PO_4)2$ in general, is too high to control the solution concentration of Cd and also levels of immobilization reported for Pb in several studies do not hold good for other metals. Nevertheless, application of P at extraordinarily high rate was reported to the effective in immobilizing Cd in a smelter-contaminated soils. this calls for evaluation of SSP as amendment at high rate for the Cadmium contaminated soil.

A decreasing mobility of elements such as cadmium, copper, zinc, nickel, and lead in limed soil and effective decrease of their element uptake by several crops was intensively investigated in both pot and field conditions (Hooda *et al*. 1997).

The combined application of rock phosphate and press mud compost improved growth of maize and reduced the bioavailableCd in the soil. So, maize along with combined application of rock phosphate and press mud compost can be successfully grown in Cd contaminated soil (Akhtar, *et al*, 2019). It is quite possible that stunted growth of Cd exposed plant can be due to deficiency of essential elements such as phosphorus, which has been observed to make insoluble complexes with Cd (Gonçalves et*al*., 2009). As organic matter in soil can decrease the Cd uptake by plant through the formation of organic complexes (Kim *et al*., 2015), therefore, press mud compost might have decreased theaccumulation of heavy metals to above ground parts or edible parts of plant by organic-metal complexes due to the increased organic matter in soil. According to Bolan *et al*. (2003) precipitation is the main mechanism for the immobilization of Cd as metal- phosphate by phosphate containing amendments. This mechanism supports the present study where single super phosphate was used as source of phosphate and to immobilize the cadmium in soil

Plate: 1. Maize plants growth in control (No Cadmium and amendment)

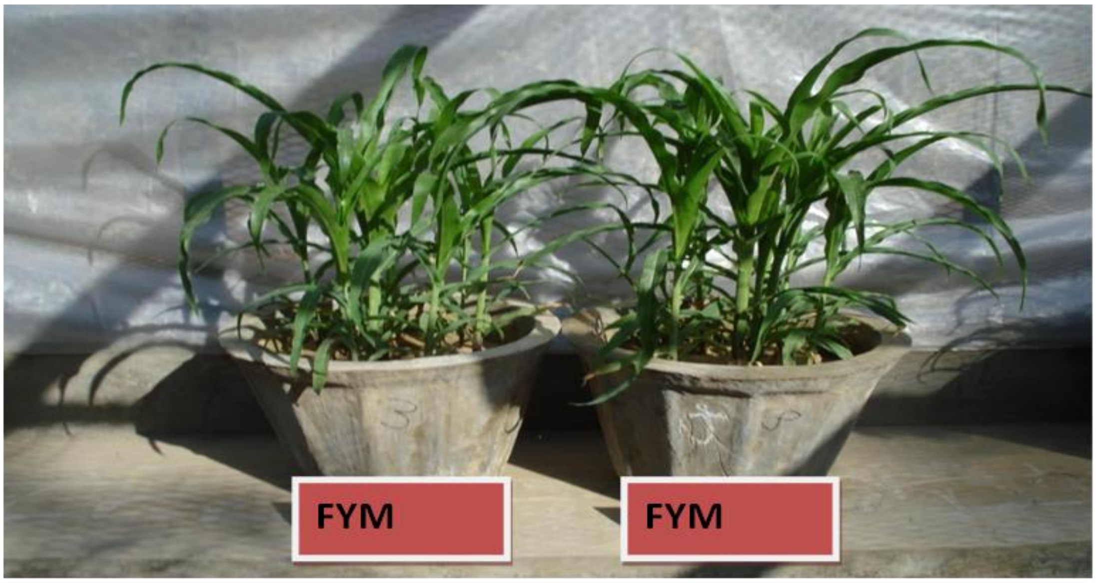


Plate: 2. Effect of FYM amendment on growth of maize plants

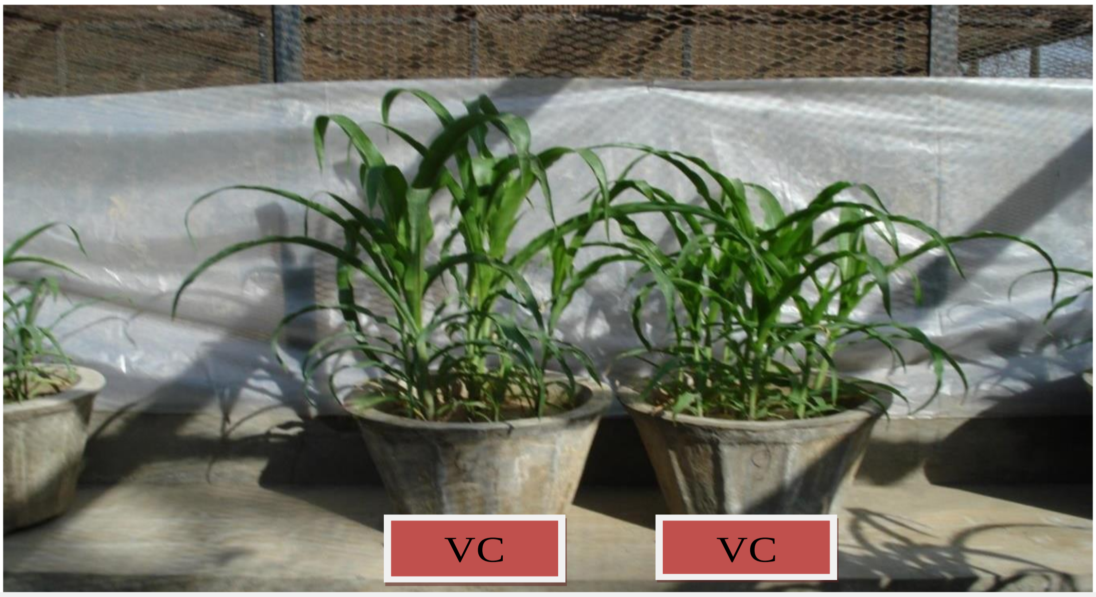


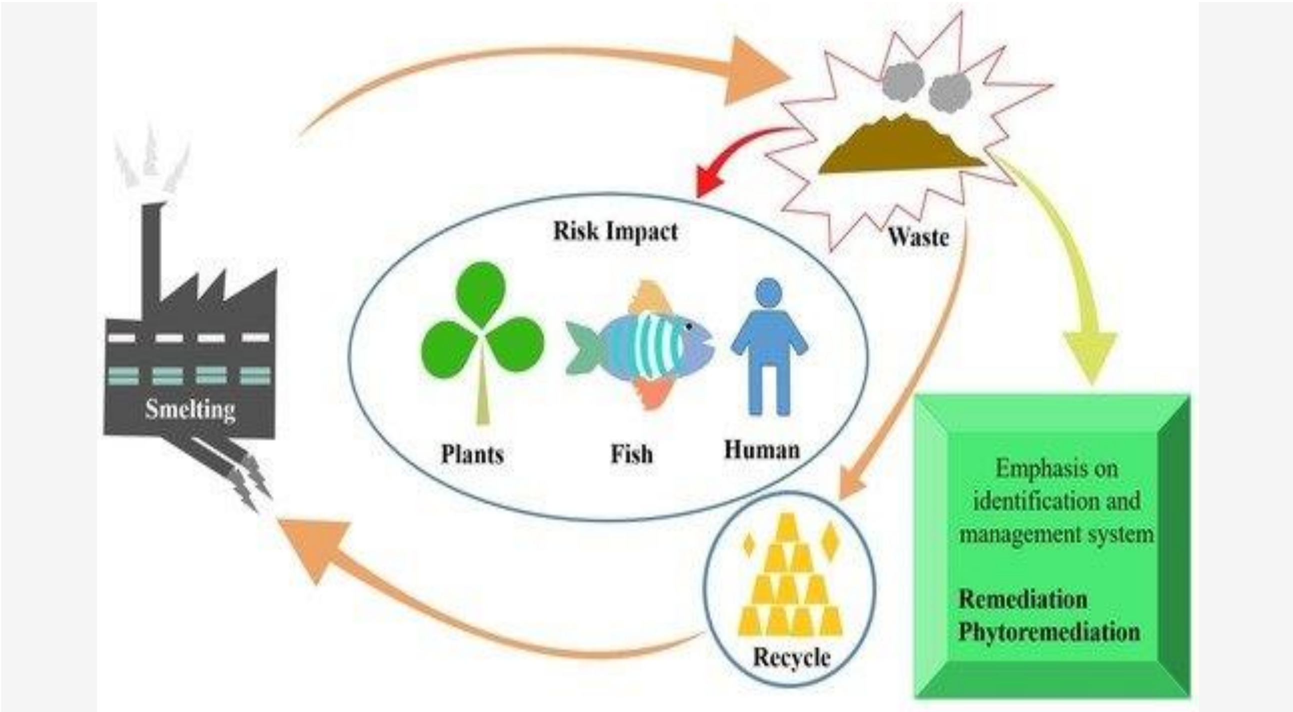
Plate: 3. Effect of VC amendment on growth of maize plants

Plate 4. Effect of CaCO3 and Phosphorus on growth of maize plants

PHYTOREMEDIATION:

Hydrometallurgy offers a potential method for extracting metals and removing potentially harmful heavy metals from waste to reduce pollution. However, environmentally friendly remediation of contaminated sites is a significant challenge. We also evaluate current technological advancements in the remediation of

polluted soil, such as stabilization/solidification, soil washing, and phytoremediation. The ability of biological approaches, especially phytoremediation, is cost-effective and favorable to the environment



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PROSPECTIVES, CHALLENGES AND CONDITION FOR THE USE OF FELDSPAR CONTENT IN IGNEOUS ROCKS AS SOURCE OF POTASSIUM (K) USING IN AGRICULTURAL

Hassni BELAIDI[1], Saida KITOUNI[2], Smaine CHELLAT[1]

[1*]*Geology and Environment Laboratory, University of Constantine 1, Road Ain El Bey Zouaghi Slimane Constantine 25 000, Algeria.* hassnibelaidi@gmail.com and smaine.chellat@gmail.com
[2*]*Department of Process Engineering, Faculty of Process Engineering. University Salah Boubnider Constantine 3, Algeria.* souad0714@gmail.com

Abstract:
Potassium (K) with nitrogen (N) and phosphorus (P) are the three major elements for better growth of plants. Potassium (K) has a well-established role in agriculture, as well as in maintaining human and animal health. Currently, 184.4 million tonnes of nitrogen, phosphorus, and potassium fertilizers are used worldwide, with 18% of those tonnes being potassium. Potassium sulfate (K2SO4) and muriate of potash are the two forms of K input in agriculture that are most frequently used. These naturally occurring potassium fertilizers, known as sylvite or complex K-Mg chlorides and sulfate, are extracted from sedimentary potash (K-salt) sources. During the last year, as the demand for potassium increases, the search for the feldspar has become in many sources, especially in igneous rock. The agricultural trials showed that, particularly in heavily worn acid soils, feldspar, mica, glauconite, nepheline, and schoenite are good suppliers of K for crops. However, some researchers claim that using feldspar or granite stones to crops has no positive effects on agronomy. Feldspar is widely distributed in the earth's crust, and could play a significant role in maintaining soil fertility for the poorest farmers.

Keywords*: Agriculture, Feldspar, fertility, igneous rock, Potassium.*

INTRODUCTION

Potassium (K) with nitrogen (N) and phosphorus (P) are the three major elements for better growth of plants. Potassium (K) has a well-established role in agriculture, as well as in maintaining human and animal health. Currently, 184.4 million tonnes of nitrogen (N), phosphorus (P), and potassium (K) fertilizers are used worldwide, with 18% of those tonnes being K [1]. This situation forced the farmers to increase the use of the potassium (K) in agriculture and had to look for new sources of it. Potassium sulfate (K2SO4) and muriate of potash are the two forms of K input in agriculture that are most frequently utilized. These fertilizers are naturally obtained from sylvite or complex K-Mg chlorides and Sulfates. During the last year, the prices of fertilizers have increase dramatically. Because the increasing of the prices of fertilizers and the great need of them a new approach used to reduce them costs by re-exploiting the fertilizers used. But even using this approach, potassium (K) remained the most vulnerable to deficit compared to N and P [2]. To cover this deficit, scientists and researchers had to look for new sources K to find, especially in igneous rocks. The potassium (K) can be found several minerals in the soils like K-feldspar ($KAlSi_3O_8$), leucite ($KAlSi_2O_6$), K-micas (biotite) ($K_2Fe_6Si_6Al_2O_{20}(OH)_4$), phlogopite ($K_2Mg_6Si_6Al_2O_{20}(OH)_4$), muscovite ($KAl_3Si_3O_{10}(OH)_2$) and glauconite (K, Na) (Fe^{3+}, Al, Mg)$_2$(Si,Al)$_4O_{10}(OH)_2$), and clays such as illite. In the naturel conditions, The K-bearing minerals leucite has relatively fast weathering characteristics; however, feldspar is highly resistant to weathering [3]. The biotite and the phlogopite are also less stable with

acid treatment and can give a large portion of K more than K-feldspar [4-5]. But what gives preference to feldspar at the expense of other minerals is that it is widely distributed in the earth's crust. Due to a high demand for potassium and intensive farming techniques, the traditional sources of potassium may become extinct in the future. Therefore, it is vital to investigate local sources of potassium nutrition for use in agriculture and food production. This work will review the outcome of fertilizer prices, the most important K source and challenges and techniques used to exploit feldspar as an alternative to potash k.

THE ROLE OF N, P AND K FERTILIZER IN AGRUCLTURE

The corps of plants need energy, water and minerals to grow. Plants get energy though CO_2 absorbed by leaves. The water and nutrients absorbed by roots from the soil. The N, P and K are the primary nutrients. The fertilizers provide plant nutrients for cops. Nitrogen (N) is essential for growth and development in plants. Supply of nitrogen determines a plant's growth, vigor, color and yield. Phosphorus (P) is vital for adequate root development and helps the plant resist drought. Phosphorus is also important for plant growth and development, such as the ripening of seed and fruit. Phosphorus (P) is vital for adequate root development and helps the plant resist drought. Phosphorus is also important for plant growth and development, such as the ripening of seed and fruit. The fertilizers are also necessary to replace the nutrients that have been removed from the field.

STATISTICAL ANALYSIS OF NPK

According to Food and Agriculture Organisation at the United Nation (FAO) data, the world production of N, P and K fertilizers has known a steady gradual increase in the last years and thanks to a recycling policy that has made it possible to increase production at a lower cost. Global production has seen an increases of about 318652 tons in 2022 which reached about 26000 tons compared to 2016 which was only 292423 tons. The share of N in this production was about 190397 tons, an increase of 5.84%, while P was 63702 tons with increases of 11.18% and P potash was 64553 tons and an increase of 18.14%. the nitrogen (N) is the is the most in production and the most in demand accounting for 59.7% of global production and 59.56% of demand.

Table 1. World capacity for producing ammonia, phosphoric acid and potash, 2016-2022 (thousand tonnes FAO, 2019 [6])

Years	2016	2017	2018	2019	2020	2021	2022
Nitrogen (N)	180 496	184 558	186 974	189 523	187 354	188 908	190 397
Phosphorus (P)	57 295	60 224	61 464	62 357	62 612	63 552	63 702
Potash, (K)	54 638	58 455	61 951	62 055	63 467	63 513	64 553
Total (N+P+K)	**292 429**	**303 237**	**310 389**	**313 935**	**313 433**	**315 973**	**318 652**

Theoretically, current production of fertilizers is more than enough to the current global demand but the world supply of this fertilizers is only 70% of total production, this is due the use of these materials in other fields. Although production still covers demand, it still remains unreasoning

especially with the increase of demand for agriculture or other uses and as well as the approximation of the amount of production and demand. The world's second challenge is that fertilizers are non-renewable. Despite the recycling policy has succeeded in increasing nitrogen (N) and phosphorus (P) but policy has not worked for potassium (P). According to the International Fertilizers Association (IFA), the global demand for K2O will rise globally by 2.3% year, with the biggest growth expected in Africa at 3.6% annually and the lowest in South Asia at 2.9% annually [7]. The increase of in potassic fertilizers requires to manage all available source of potassium.

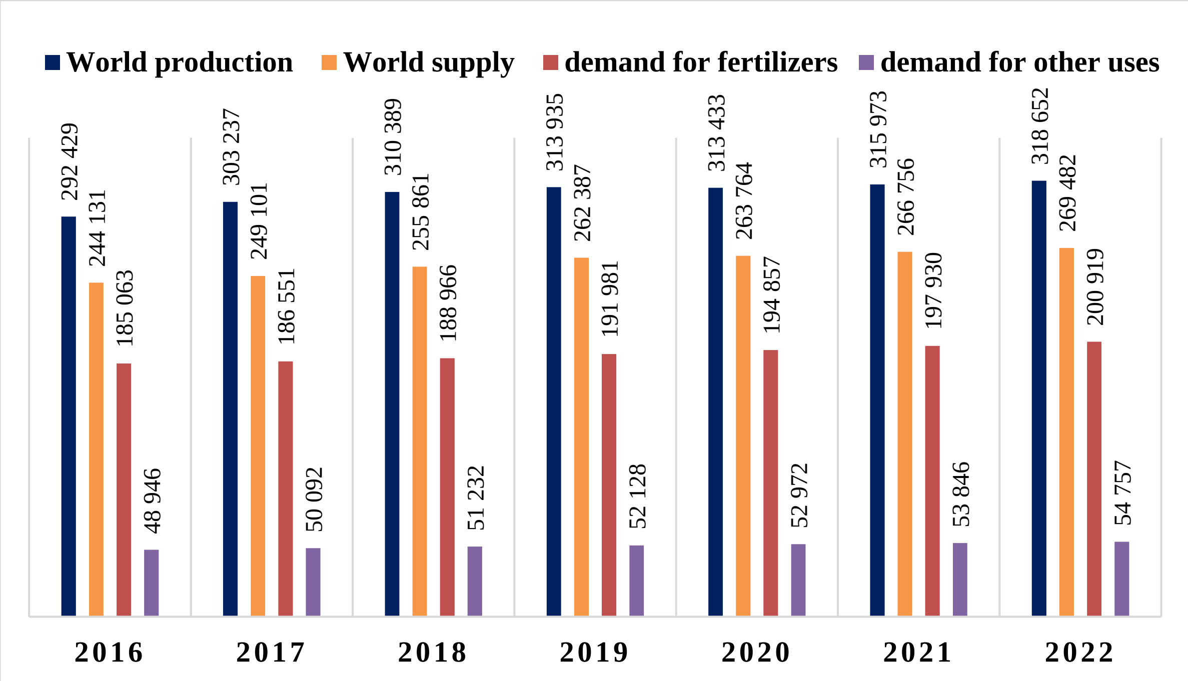

Figure1. Comparison between world production of NPK, world supply capacity and world demand for agriculture and other uses (based on **FAO, 2019** [6]).

Important source of Potassium (K)

The standard K fertilizers will continue to rule agriculture in the future due to their high solubility and simple accessibility to crop plants. Potassium sulfate (K2SO4) and muriate of potash are the two forms of K input in agriculture that are most frequently utilized. These naturally occurring K fertilizers are derived from complicated K-Mg chlorides and sulfates found in sylvite or sedimentary potash (K-salt) deposits. These traditional K fertilizers are preferred as fast-acting K fertilizers because they are water-soluble. The K can be found several minerals in the soils like K-feldspar (KAlSi3O8), leucite (KAlSi2O6), K-micas (biotite) (K2Fe6Si6Al2O20(OH)4), phlogopite (K2Mg6Si6Al2O20(OH)4), muscovite (KAl3Si3O10(OH)2) and glauconite (K,Na)(Fe3+, Al, Mg)2(Si,Al)4O10(OH)2), and clays such as illite. The feldspar represents the main source of Potassium, it represents the richest potassium mineral of all these minerals. The most prevalent rock-forming mineral in nature is feldspar, which accounts for over 60% of the earth's crust. Large presence makes all attention focus on it in order to exploit it as an alternative to potash potassium.

Table 2. Important sources of feldspar (Shirale et al, 2019[8])

Source of K	**Composition**	**Percent K_2O**
Silicate minerals		
Potassium feldspar	$KAlSi_3O_8$	16.91
Leucite	$KAlSi_2O_6$	21.56
Nepheline	$(Na, K)AlSiO_4$	15.67
Kalsilite	$KAlSiO_4$	29.75
Muscovite	$KAl_3Si_3O_{10}(OH)_2$	10.88
Biotite	K2Fe6Si6Al2O20(OH)4	9.18
Phlogopite	K2Mg6Si6Al2O20(OH)4	11.30
Salts of chlorides		
Sylvinite	KCl NaCl mixture	Approx. 28.0
Sylvite	KCl	63.1
Carnallite	$KCl\ MgCl_2\ 6H_2O$	17.0
Kainite	$4KCl\ 4MgSO_4\ 11H_2O$	18.9
Hanksite	$KCl\ 9Na_2SO_4\ 2Na_2CO_3$	3.0
Salts of sulfates		
Polyhalite	$K_2SO_4\ 2MgSO_4\ 2CaSO_4\ 2H_2O$	15.5
Langbeinite	$K_2SO_4\ 2MgSO_4$	22.6
Leonite	$K_2SO_4\ MgSO_4\ 4H_2O$	25.5
Schoenite	$K_2SO_4\ MgSO_4\ 4H_2O$	23.3
Krugite	$K_2SO_4\ MgSO_4\ 4CaSO_4\ 2H_2O$	10.7
Glaserite	$3K_2SO_4\ Na_2SO_4$	42.6
Syngenite	$K_2SO_4\ CaSO_4\ H_2O$	28.8
Kalinite	$K_2SO_4\ Al_2(SO_4)\ 24H_2O$	9.9
Alunite	K2 Al6(OH)12 (SO4)4	11.4

Important source of feldspar

Feldspars are an abundant mineral group and represent about 51% of the Earth's crust. They are present in many sedimentary deposits and are found in almost all igneous and metamorphic rocks. The crust-mantle interaction at the edge of the plate and inside the plate is the main source of these minerals. Feldspars can be extracted from several types of magmatic rocks such as pegmatites and aplites [9]; granitic rocks [10-11], acid effusive rocks and associated tuffs [12]. According to the latest global statistics released by [13] for 2021, the world's known and unknown feldspar resources are more than sufficient to meet global demand. The resources of feldspar are widely distributed in almost every country in the world, especially with the technics that made exploitation of feldspar possible from several types of rock. With such convenient data, the focus become entirely on discovering new in order to exploit it for use in agriculture.

TECHNICS AND CHALLENGES TO EXPLOIT FELDSPAR FOR AGRICULTURE

the use of feldspar in the agriculture sector has considerable support. Theoretically there are several

silicate minerals especially K-feldspar that enable this approach to succeed. At feldspars, potassium is found in particularly weather-resistant framework lattice sites [14]. Because the potassium ion is difficult to release, it is insufficient to fertilize crop plants. The report of [14] on metasomatized mudstone and feldspathic breccia proven that they have a 16% total K2O content. They concluded that recovering K from K-feldspars was not cost-effective though, as very little K is readily soluble in HCl. The experience of [15] has shown that feldspar crop revenues are lower than other fertilizers corp. Despite these results, this experience was a flam of hope, giving some positive results where [15] observed a significant improvement in yield of the crops. [16] showed that, as compared to potassium sulfate, feldspar provided the higher values for leaf mineral content, vegetative growth, yield, and fruit quality. However, it is frequently acknowledged that organisms and their metabolites can further mediate the weathering process. carbonic acid concentrations in the soils and groundwater elevated by plant roots and microbial degradation of organic. [17] proposed creating K-enriched compost using pulverized feldspar, silicate-dissolving bacteria, and crop residues. This compost has a higher K content than compost that has no K (via feldspar) added to it. They conducted an experiment with the creation of K-enriched compost, and the results showed that increasing the application of feldspar to organic materials significantly increased the content of total K in the final decomposed product, and that applying K-enriched compost significantly increased available K, uptake, recovery of K, and tomato yield. In the other experience, [18] showed that the use of feldspar mineral improved soil moisture and increased the availability of macronutrients in the experimental soil.

CONCLUSIONS AND RECOMMENDATIONS

The use of feldspar in agriculture was facing two obstacles, the obstacle of resource and the obstacle of the treatment technics. The obstacle of resources went with the technological development where feldspar can be extracted from several types of rocks especially igneous rocks. feldspars and its host rocks may be able to serve as an alternative if the price of traditional K sources limits their usage due to the necessity to preserve soil K stocks and to make up for excessive nutrient mining, especially in severely worn soils. For the technic obstacle, the experiences have varied about it so far. The existing literatures was inconsistent but the last experiences gave some good results need more research and development.

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IMPACT OF WILD BOAR (SUS SCROFA) ROOTING ON THE PHYSICO-CHEMICAL PROPERTIES OF SOIL IN THE EDOUGH FOREST (NORTHEAST, ALGERIA)

Kamelia Hesni BENOTMANE[1], Mehdi BOUKHEROUFA[2], Imene KAHLI[1], Rached HADIBY[3], Feriel SAKRAOUI[2]

[1]*Soil and Sustainable Development Laboratory, Department of Biology, Faculty of Science, Badji Mokhtar Annaba University, Annaba, Algeria, kameliabenotmane@gmail.com , 0662278216*
[2]*Eco biology Laboratory for Marine Environments and Coastal Areas, Faculty of Sciences, Badji Mokhtar Annaba University BP 12, 23 200, Annaba, Algeria, f.sakraoui@gmail.com ,0782302092*
[3]*Laboratory Ecobiology of Marine and Coastal Environments*

Abstract:
In Algeria, the wild boar sus scrofa is a very controversial species, which displays high densities leading to a necessary regulation of natural populations by hunting. However, this "ecosystem engineer" is a purely forest species that has an impact on soil aeration, through rooting. In this study, we were interested in the effect of the rooting of the species on the physico-chemical quality of soils in forest ecosystems. The resulting study was conducted at a locality in the Edough forest massif, through the analysis of some physico-chemical parameters on rooted soils and control soils. We chose 5 roots, which we geolocated, measured (depth, length and width) and on which we sampled from the soil in the internal part (IN),in the peripheral ring (RING) and a non-rooted control zone (OUT). The results obtained highlight a potential effect on thephysico-chemical properties of the soil in natural environments, which reinforces its role and its importance on an ecological scale.

Keywords: *Sus scrofa, rooting, soils – physico-chemical properties – Edough forest massif*

INTRODUCTION

Many terrestrial mammals influence natural ecosystems, playing a multitude of ecological roles such as pollination, insect pest control and soil bioturbation. Some of them are represented as ecosystem engineers who create, significantly modify or destroy habitat, while enhancing the heterogeneity of its biodiversity [1][2]. Among these mammals, the wild boar Sus scrofa is a purely forest species whose population has experienced a steady increase throughout its range in recent years [3][4][5][6][2]. This increase has visible consequences on different types of environments and habitats [7][4] which has directed the majority of work towards the characterization of the negative effects of this species on the environment.
Moreover, according to [8] [9] wild boar has negative impacts on wildlife; either directly through predation of vertebrates and invertebrates or indirectly through habitat modification and competition for food and flora through destruction of agricultural land and modification of the floristic procession. However, recent studies have shown positive effects of this species on forest soils, through a natural plowing effect [10][11][4][12].

These studies have therefore rehabilitated this species, which appears to be ecologically beneficial for the fauna and flora, and especially for the soils of the environments they colonize [13]. Our problematic aims to analyze the effects of wild boar on some properties of forest soils in the Mediterranean region. The resulting study was conducted at the Edough mountain range, through the physico-chemical characterization of rooted soils and control soils.

MATERIALS AND METHODS

Study area and sampling:

The study was carried out in the winter period 2022 (from the end of december until the end of february), on the northern slope of the Edough Massif,Northeastern Algeria, at 600 m of altitude (36°55'19.3"N 7°42'10.9"E). The climate of the region is typically warm Mediterranean, with an important rainfall difference between the mountains and the coast (1 200 and 700 mm respectively [14]. The sampling locality is a Cork Oak Forest (Quercus suberL) , with its associated rich floristic procession.

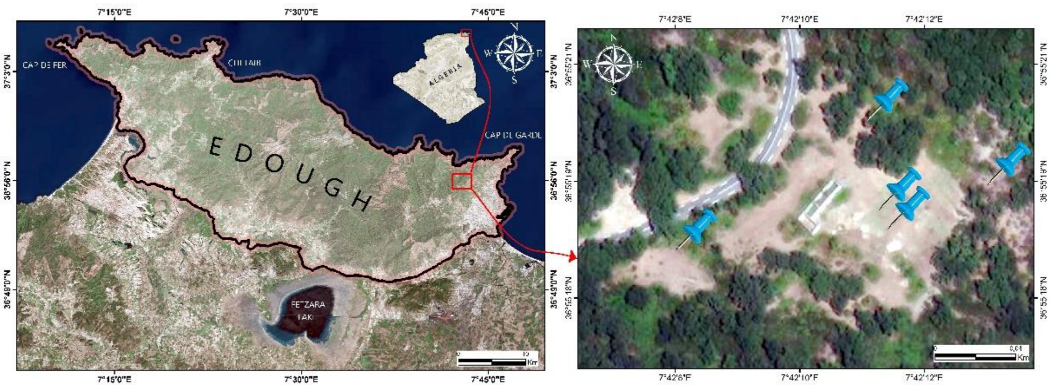

Figure 1
Map of study area and survey points

Sampling was carried out from December until the end of February, with two prospecting trips per month, to identify new roots. The selection and sampling protocol was carried out according to the method of Pitta-Osses et al, (2020). Rootings were geolocated by Map mobile application, and we mesured for each rooting the length, width and before the sample collection, to calculate the volume of soil excavated. Top 20 cm of soil were collected from inside (IN) and ring part of each rooting (RING) and the neighboring control area (OUT). 250 grams of soil was placed in clean sealed plastic bags for further measurements. In total, 15 samples were collected for analysis during the winter period.

Samples analysis:

Samples were analysed for their different chemical and physical properties: pH, texture (clay), organic atter, total calcium (Ca), total magnesium (Mg), total potassium (K), etc., using standard methods. The equivalent calcium carbonate was determined by the gasometrical method (Bernard's Calcimeter).

The pH was determined by using a pH meter (HANNA HI 8520) in aqueous extract after mixing soil with distilled water (1:2.5 w/v) [15]. Organic carbon was mesured by the Anne method. Soil texture was determined using a hydrometric method [16]. Samples were digested in a mixture (3:1) of HNO3 and HClO4, and the contents of Ca, Mg, and K were determined using an atomic absorptions pectrophotometer (AAS) (Model Analyst 700, Perkin Elmer) .

STATISTICAL ANALYSIS

Statistical analysis of the data was conducted using the software Past soft ware, version 4.03 (eds, 2015). The comparison of groups (IN, OUT and Ring) was carried out by the Krustal Wallis nonparametric test for median equality, to which we added the Mann-Withney-pairwise test to evaluate for comparison of organic matter.

RESULTS AND DISCUSSION

The statistical analysis of all the parameters and their comparison between the different batches (in, ring and out) indicate that there is no statistically significant difference, except for the organic matter which is the only parameter presenting a significant difference (P=0.0493*). (tab, 1).

Table 1
Comparison of different soil physicochemical parameters between different lots (IN/OUT/RING)

Parameters	**p**
K mg/l	0.2276
Na mg/l	0,5655
Mg mg/l	0,6126
Ca mg/l	0,4538
P *mol /l ISO 11263	0,3074
N % ISO 11264	0,2357
Ph* IS0 10390	0,3638
Argile	0,5712
MO	**0,0493***

Similar results were shown in the study of Alkhasova (2021) [2] and that of Michael J. Lacki (1983) [18] who explained this non-significant difference by the extremely high variation among all rooting classes which prevented the detection of differences that might have been present.

Table 2
Comparison of organic content between different lots (IN/OUT/RING)

	IN	OUT	RING
IN		**0,01219****	0,1437
OUT	**0,01219****		0,5309
RING	0,1437	0,5309	

The organic matter content is the only parameter that presents a significant difference among the rooting groups (P = 0.0493). (Tab, 2). This difference is highly significant between the soil inside the rooting and the control soil, i.e. outside the rooting (P=0.01219) using the Mann-Withney pairwise test. Similar results were reported by Wirthner et al (2012)[19] and Lacki and Lancia (1983)[18] who found higher OM concentrations in rooted plots compared to unrooted plots in Great Smoky Mountains National Park, USA. The authors explained their results by decomposition of organic matter stimulated on sites rooted by wild boar.

CONCLUSIONS AND RECOMMENDATIONS

The results obtained in this work corroborate all those achieved across the species' range, and highlight a potential effect on soil quality in natural environments, This leads to an improvement in the physico-chemical properties of the soil, which increases its aeration, an important microbial richness, the water retention necessary for a good hydration of the soil, the chemical stability and mineralization of the organic matter. All these modifications induced by the wild boar reinforce its role and its importance on the ecological scale.

ACKNOWLEDGMENTS

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APPLICATION OF LOW-COST SENSORS FOR INDOOR AIR QUALITY MONITORING IN BUDAPEST, HUNGARY

Bushra ATFEH, Róbert MÉSZÁROS

Eötvös Loránd University, Institute of Geography and Earth Sciences, Department of Meteorology, Pázmány Péter sétány 1/A, 1117 Budapest, Hungary;
bushra.at@hotmail.com, meszaros.robert@ttk.elte.hu

***Abstract**:*
In the last few years, indoor air quality monitoring by using low-cost sensors (LCSs) has gained popularity. This study presents indoor air quality measurements accomplished in one of the cosmetic salons in the center region of Budapest city. One AirVisual Pro air quality monitor was used during the period from the 12th to the 23rd of May 2022. This sensor is competent to capture the concentration of small aerosol particles (particle size smaller than 2,5 m - $PM_{2.5}$) and carbon-dioxide (CO_2) besides temperature and relative humidity. High $PM_{2.5}$ concentrations may be harmful to human health, while changes in CO_2 concentration may indicate human presence or ventilation. The aim of this study was to evaluate the indoor air quality at the salon by analysing the high temporal resolution time series of $PM_{2.5}$ and CO_2 concentrations. The hourly averages of $PM_{2.5}$ concentrations were also compared with the data measured at the outdoor air quality monitoring stations. The result of this study indicates the lack of sufficient ventilation inside the salon. The indoor $PM_{2.5}$ concentrations showed high variability and were generally higher than the outdoor $PM_{2.5}$ concentration during the opening hours. The exposure to such poor indoor air quality environment can have a long-term impact on the health of the salon staff and can cause serious health problems that could be reduced by proper ventilation.

***Keywords**: $PM_{2.5}$, CO_2, low-cost sensor, indoor air quality, beauty salon.*

INTRODUCTION

In the past few years, researchers increased the focus on indoor air quality and started the measurements of indoor environments by using what are called low-cost sensors (LCSs) [1,2]. Exposure to high levels of air pollutants in both the short and long term is the main responsible of most health issues worldwide. Such as cardiovascular, stroke, and chronic respiratory diseases and it may lead to lung cancer [3–6].
Particulate matter less than 2.5 microns ($PM_{2.5}$) is considered one of the common indoor air pollutants that can exist and cause serious human health problems [5]. Carbon dioxide (CO_2) plays an important role in evaluating the indoor environment as an indicator of ventilation effectiveness and human activities [7].
This case study is aimed to investigate the indoor air quality in one of the beauty salons in Budapest, Hungary. Beauty salons are known for poor indoor environments due to the use of cosmetics products and other emission sources [8]. In this study, we investigated how air quality varies in a salon, and compared the results of indoor measurements with data from the nearest air quality monitoring stations.

MATERIALS AND METHODS

The measurements of indoor small-size aerosol particles ($PM_{2.5}$) and carbon dioxide (CO_2) concentrations inside a beauty salon located in the center of Budapest city were carried out for the period from the 12th to the 23rd of May 2022. The measurements were done by using an AirVisual Pro monitor. The AirVisual Pro sensor was placed on a table at the reception desk at approximately 1 m high level. Concentration values were registered every 5 minutes, and hourly average values were calculated for the two-week period of May 2022. The indoor measurement results were compared with the outdoor data of the closest stations of the Hungarian Air Quality Network (HAQN) [9] (Kosztolányi square, Széna square, and Teleki square). Figure1. shows the measuring sites.

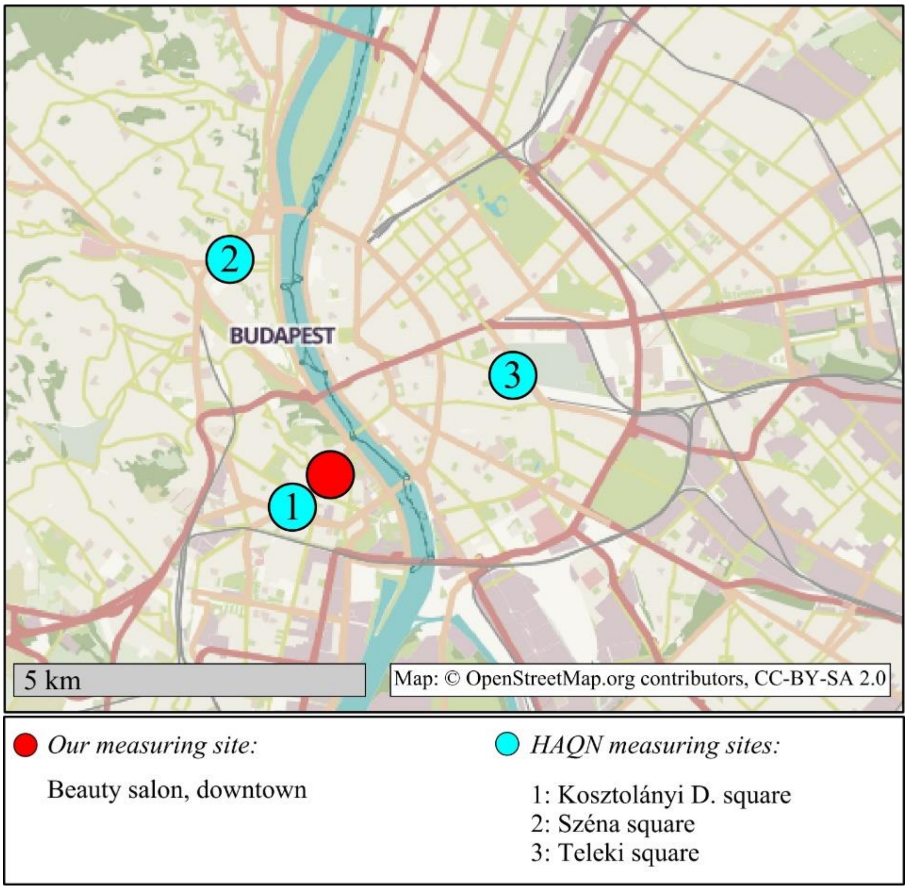

Figure 1. Location of the measuring sites in Budapest, Hungary. At the nearest station (1), Only PM_{10} was measured, so data from 2 other stations (2) and (3), where $PM_{2.5}$ was also measured, were also examined

RESULTS AND DISCUSSION

Hourly averages were calculated from the values measured every 5 minutes in the salon, and compared with the available hourly outdoor air quality data. Since the nearest monitoring station (No. 1. in Fig.1.)

to the salon does not measure $PM_{2.5}$ concentrations, data from another station in a similar environment (No. 2 in Fig 1.) to the salon were analysed (Figure 2.).

In addition, the PM_{10} data series for the nearest station (No. 3 in Fig 1.) is also shown in Figure 2. Despite the fact that the indoor and outdoor measurements were made with different types of instruments, and at a distance of a few km from each other, the differences in the dynamics of the concentration-time series are clearly visible.

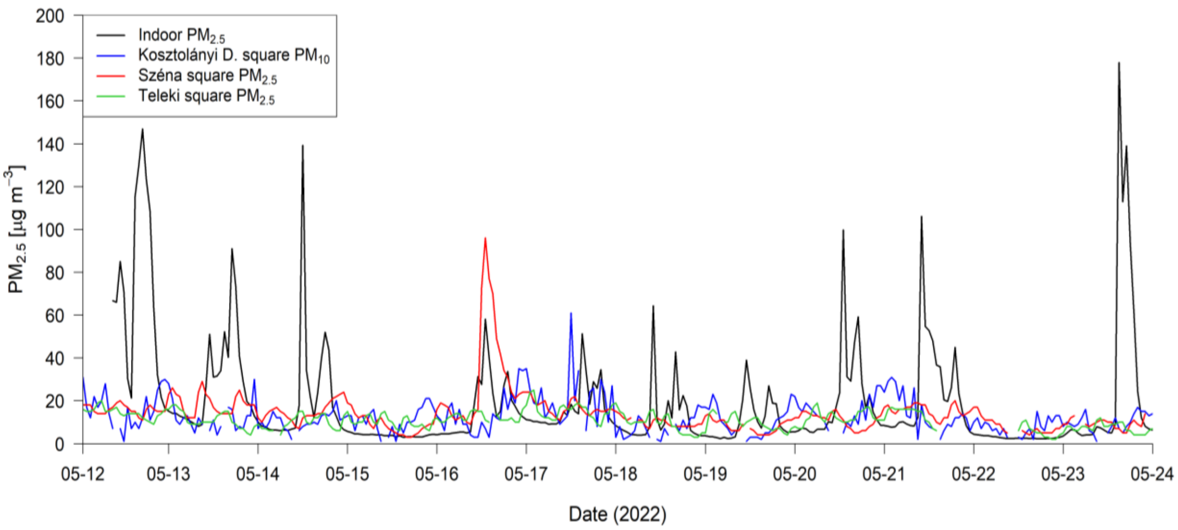

Figure 2. The hourly average of $PM_{2.5}$ indoor concentrations measured in the beauty salon (black line), compared with outdoor concentrations measured by air quality monitoring stations in Budapest.

The results show that indoor concentrations in the opening hours were generally higher than outdoor concentrations measured at HAQN station, except on 16 May, when the Széna square station data were higher, but this was probably due to some local effect (e.g. construction). The main reason for higher indoor PM2.5 concentrations is the various human activities inside the beauty salon, mainly the use of different cosmetic products. The effect of human activity is also shown by the fact that on Sundays (15 and 22 May), when the salon is closed, indoor concentrations were much lower.

In addition to the indoor $PM_{2.5}$ concentrations, Figure 3. also shows the course of the indoor CO_2 concentration. Human presence clearly results in higher CO_2 levels, which tend to decrease during ventilation when outdoor air quality is good (see e.g. on 19 May, when CO_2 drops from about 700 ppm to below 600 ppm during the day due to ventilation, outdoor aerosol concentrations are low and therefore $PM_{2.5}$ also decreases. After the ventilation, indoor $PM_{2.5}$ concentrations increased again. If ventilation occurs at a time when outdoor air quality is poorer, the decrease in $PM_{2.5}$ concentrations is less pronounced.

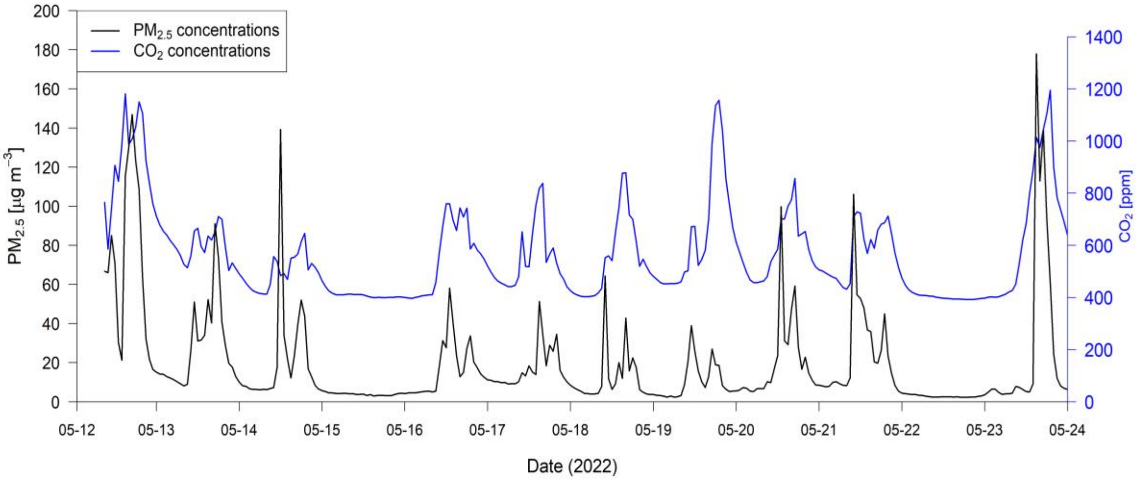

Figure 3. The hourly average of $PM_{2.5}$ indoor concentrations measured in the beauty salon (black line) compared with CO_2 indoor concentrations (blue line) measured by the AirVisual Pro monitor.

CONCLUSIONS AND RECOMMENDATIONS

The main aim of the study was to raise awareness of the need to assess, address and develop long-term solutions to indoor air quality problems. There is no doubt that improving indoor air quality improves workers' health and productivity. Our primary findings suggest that indoor air quality within beauty salons shows much greater variation and higher values than outdoor values. Indoor air quality can be improved by proper timing of ventilation, but this can only be effective if outdoor air quality is good. Extensive studies are needed in the future to improve air quality in beauty salons and other indoor spaces.

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HYDROGEOLOGICAL STUDY OF THE AQUIFER SYSTEM OF NORTHERN SAHARA (SASS): CASE OF THE REGION OF EL-OUED (SOUTH-EAST ALGERIA)

Boualem BOUSELSAL[1], Smaine CHELLAT[2]*

[1]*Laboratory of underground reservoirs oil and gas and aquifers. Department of Earth and Universe Sciences. University of Kasdi Merbah. Ghardaia Road, BP. 511, 30000 Ouargla. Algeria.*
bousboualem@gmail.com
[2]****Geology and Environment Laboratory, University of Constantine 1, Road Ain El Bey Zouaghi Slimane Constantine 25 000, Algeria.*** smaine.chellat@gmail.com

Abstract
The Northern Sahara Aquifer System (SASS) has a large water resource to meet the needs of the population. Which the city of El Oued is part of. A variety of vertical electrical soundings (S.E.V) and hydrogeological sections were made and interpreted, based on drilling logs, this data shows three aquifers; the shallow aquifer consisting essentially of sand and sandstone, it is limited at its base by a clay layer. Its average depth is of the order of 60 m. The unsaturated zone shows a significant soluble content of 16 % to 25%. This presents corrosion at the level of infrastructure anchored in a region threatened by the upwelling of the open water.
The aquifer of the terminal complex (CT) encompasses permeable soils; the first two are sandy-sandstone of Mio-Pliocene age CT_1 and CT_2, the last CT_3 is composed of limestone and dolomite of lower Senonian-Eocene age. At the end of the aquifer of continental intercalary (CI); encountered in boreholes at a depth of 1450 meters and a thickness that varies from 400 m to 460 m. it is represented by sandy-sandstone, sandy-clay and limestone deposits of Lower Cretaceous age..

Key words: *El Oued, SASS, Continental Intercalary, Terminal Complex, Drilling*

INTRODUCTION

The Northern Sahara Aquifer System (SASS) has been the subject of several hydrogeological studies in the north-east of the Sahara such as [1, 2, 3, 4, 5] works. In Algeria studies are limited on company reports of oil explorations and exploitations [6, 7], the application of geophysical methods and the analysis of hydraulic drilling logs fall within our working objective which is the determination of the lithology and geometry of aquifers of the El Oued region. It is located in the South-East of Algeria; it has an area of 500 Km^2 and inhabited by a population of about 250,000 inhabitants. The study area is limited between the geographical coordinates: 33°24' and 33°15' N, and 6°46' and 6°58'E (Fig. 1.).

The region of El Oued is part of the great eastern Erg [8], formed mainly by continental sand dunes, the slope is generally oriented South-North, with altitude values oscillating between 60 m and 120 m. Many depressions in the form of artificial funnels, characterizing the region used for the establishment of palm groves and vegetable fields, locally called "Ghout".

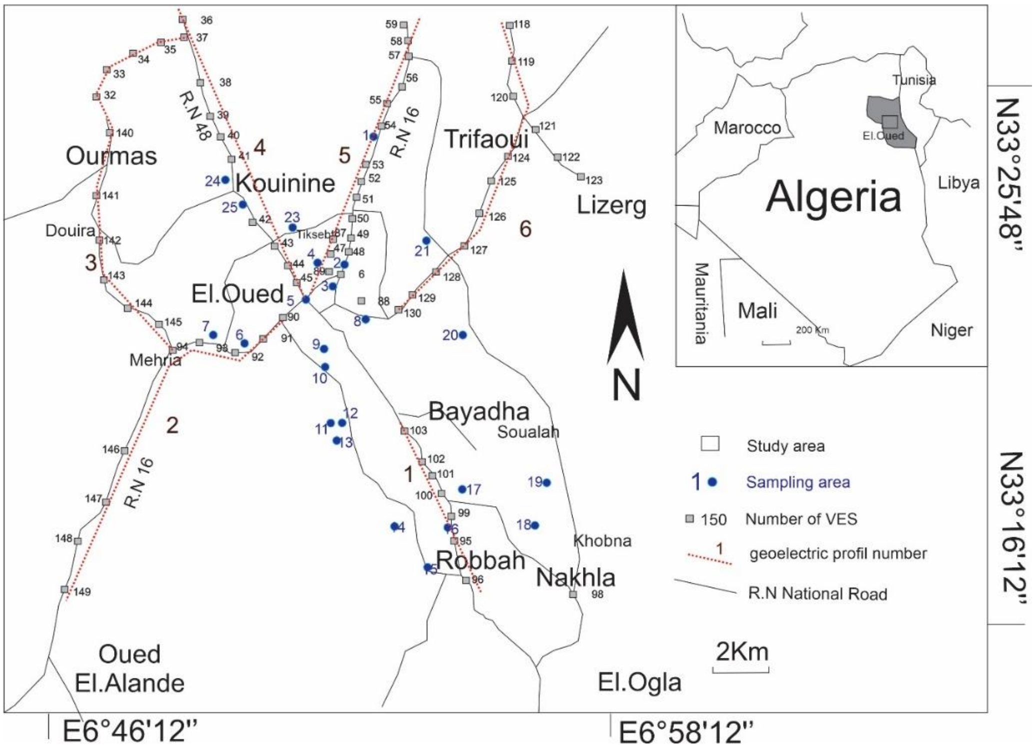

Figure 1: Geographical location of the study area and location of the sampling areas of the unsaturated zone and SEV electrical soundings according to ENAGEO [7].

The region of El Oued is part of the large sedimentary basin Oued M'Ya [8] whose extension covers an area of 780,000 km^2. The structure of this basin constitutes a significant topographic depression, in the form of an asymmetrical syncline. The sedimentary series is marked, in the center of the pit, by important subvertical tectonic accidents. The sedimentary basin of Oued M'Ya comprises, at its base, marine Paleozoic formations surmounted by secondary and Tertiary age formations with a thickness of several thousand meters. The Quaternary has a surface cover composed of silts and sands of dunes, whose thickness can reach one hundred meters. Only surface series are of hydrogeological interest [6].

MATERIALS AND METHODS

Geophysical exploration of the El Oued surface aquifer

A geophysical survey was conducted by ENAGEO [7] in the region of El-Oued, it used the vertical electrical sounding type Schlumberger AMNB based on the measurement of the resistivity of the rocks, the total number of vertical electrical boreholes exploited in the study area is 68 SEV, with an investigation depth AB = 500 m. (Fig.1)

Resistivity measurements are compared to the lithological descriptions of the nearest borehole, are chosen to calibrate the SEVs. A scale of resistivities was given (Tab.1), as a model for the interpretation of SEVs and the establishment of geoelectric profiles using ip2Win and Surfer 12 software. An isopach map of the clay substratum was drawn up at the end of the description of the cuts.

Table 1: Resistivities of geological formations in the El-Oued region.

Formation	Resistivity
Sands	> 100 Ω. m
Clay	< 10 Ω. m
Clay Sand	20 to 100 Ω. m
Sandy Clay	10 to 20 Ω. m

Collection and analysis of hydraulic drilling data.

A collection of hydraulic drilling data was carried out on the basis of the work of the ANRH (74 boreholes) and DHW of El-Oued (60 boreholes), to establish the lithological and hydrogeological sections.

The identification of aquifer layers is based on the hydrodynamic criteria of geological formations. There are three types of hydrogeological formations [7]; permeable, waterproof and semi-permeable. Data from the drilling logs made it possible to develop hydrogeological sections in the study area and to specify the lithology and type of the aquifer, using RokWorks 15 software.

Study of the nature of the unsaturated zone

Tests were carried out at the South Public Works Laboratory of Ouargla (LTPSO) in May 2012, on 25 samples taken from the unsaturated zone from different locations and at depths of 50 cm and 3 m by the manual auger (Fig.1), in order to determine the lithological nature of this zone.

RESULTS

Interpretation of Geoelectric profile.

The study area is explored by 68 vertical electrical boreholes (SEVs), grouped into six geoelectric sections that cover most of the surface of the study area, their positions are determined in Figure 1. (Fig.2a and b). These sections show the presence of three layers that rest on a substratum of identical characteristics, from top to bottom; A resistant layer that corresponds to dune sands up to 10 meters thick. The second less resistant layer (between 10 and 20 Ω. m), of constant thickness of about 15 m, this layer corresponds to a formation of clay sands. We notice the outcropping of this layer between SEV99 and SEV 103 following the disappearance of the dune sand. The third conductive layer consists of very thick sandy clays (about 35 m). At the base there is a clay substratum, it is very conductive and resistivity less than 10 Ω.m.

The lithostratigraphic correlations of hydraulic boreholes make it possible to establish several hydrogeological sections (Fig.2c). The geological formations aged Eocene at the base consisting of an intercalation of limestone and marl, followed by the Miocene-Pliocene, which rests in discordance on the Eocene carbonate, generally it is represented by intercalations of two sandy levels and a clay level, the thickness of each level is variable from one place to another. These formations are often mixed with gypsum, limestone, sandstone and marl pasts which makes it difficult to draw the boundaries between the clay level and the sandy level. The Quaternary consists of deposits of aeolian sands forming dunes, interspersed with lenses of clays, clay sands, sandy clays, sandstone and gypsum, at its base a layer of clays sometimes slightly sandy.

There are several tablecloths [9], from top to bottom:

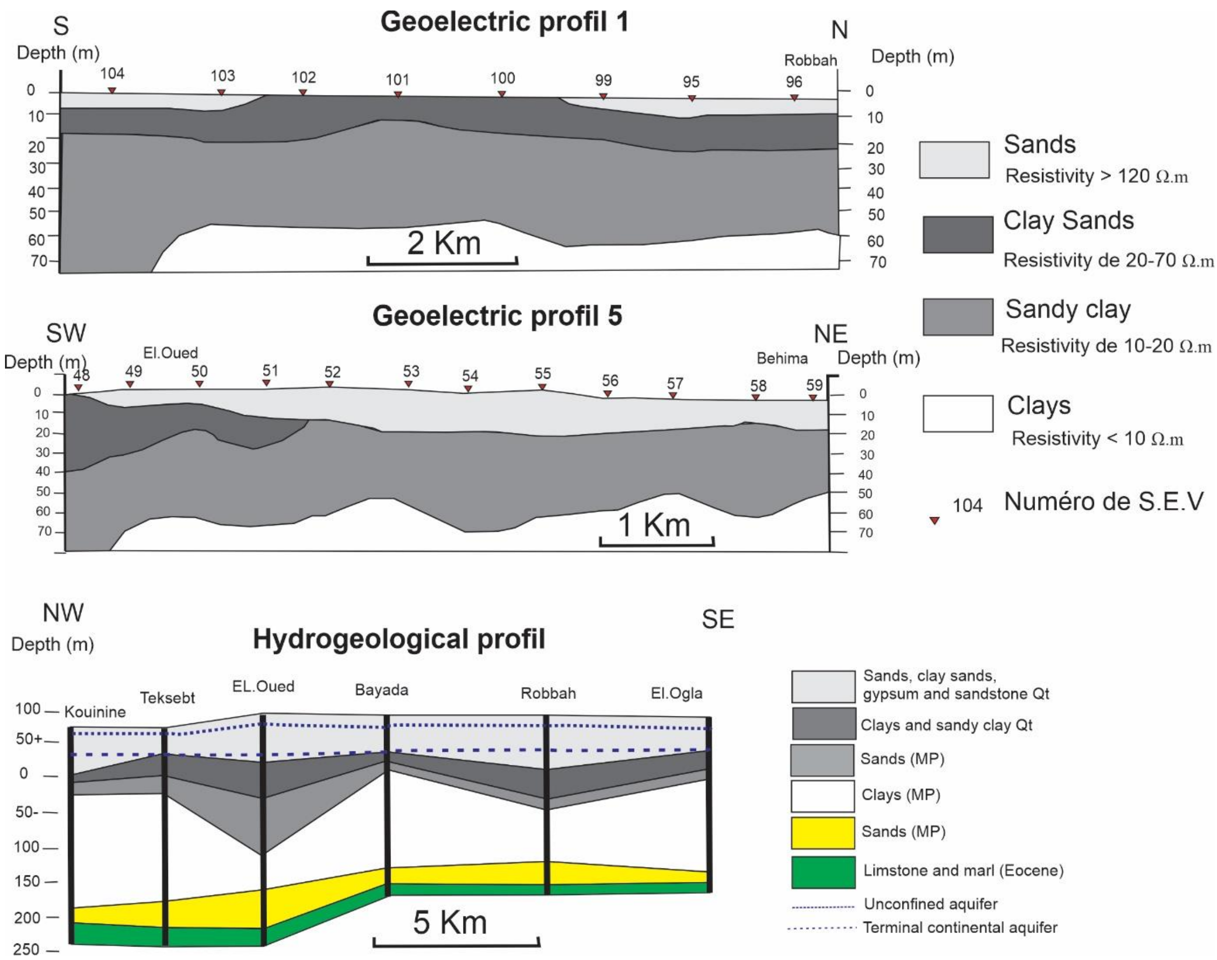

Figure 2: Example of established geoelectric and hydrogeological sections

The free aquifer consisting of sands and clay sands, the average thickness of the reservoir is 60m, the substratum is represented by slightly sandy clays.
Terminal complex aquifers represented by three aquifer layers; two layers of sands of Miocene age that rests on an aquifer layer of limestones of Senonian-Eocene age, they are separated by a thin layer of marl. This peculiarity characterizes the aquifers of the terminal complex of the study area of the other regions of the northern Sahara [10].

Nature of the unsaturated zone (particle size and geochemistry).

The results of the particle size tests carried out on the different samples show sand (coarse sand, medium sand and fine sand), their percentage varies between 75% and 92%. The fine fraction is generally less than 10% except for samples
25 samples distributed in the study area are analyzed, to determine the percentage of insoluble in the soil of the unsaturated zone. The results of geochemical analyses show soluble (sodium chlorides NaCl, carbonates, sulphates) varies between 16% and 25%.

DISCUSSION

According to the analysis of electric and core boreholes, three aquifers stand out; The free surface aquifer consists of detrital formations of Quaternary age represented by sands, sandstones, clay sands and sandy clays with a substratum consisting of clay. Its average depth is of the order of 60 m. The unsaturated zone consists of more than 80% sand and gravel, the fine fraction (silt and clay) represents a percentage of less than 20%; geochemical analysis of the unsaturated zone shows that the percentage of soluble elements varies between 16% and 25%. It also shows a significant soluble content of 16% to 25%. This jeopardizes the infrastructure anchored in a region known by the upwelling of free groundwater. This percentage is very important because it has serious consequences for the infrastructure, given that the region is threatened by the problem of upwelling of water from the free aquifer.
The Terminal Complex aquifer encompasses the permeable foundations of the Senonian-Eocene carbonated and Miocene Pliocene. It is possible to distinguish three tablecloths; the1st sand table CT1 represented by the sands of the Mio-Pliocene, the 2nd sand table CT2 it is formed of sands, sandstone and gravel of the Pontian and at the end the limestone table CT3 formed by limestones and dolomites of the Lower Senonian-Eocene. The depth of the Terminal Complex (CT) is between 100 and 600 meters, its average power is of the order of 300 m.
The Continental Intercalary (CI) aquifer is represented by sandy-sandstone, sandy-clay and Lower Cretaceous limestone continental deposits. Its depth reaches 1450 meters with a power that varies between 400 and 460 m.

CONCLUSION

The El Oued area is part of the Northern Sahara Aquifer System (SASS). Vertical electrical soundings and the interpretation of hydrogeological sections carried out on the basis of water drilling logs, show the presence of three aquifers, a free surface aquifer, followed by the captive terminal complex (T.C)) aquifer and the deepest inland (I.C.) aquifer.

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A MORE SUSTAINABLE TRANSPORT: REVIEW OF ELECTRIC CARS

Sara ALKHALDI*, Katalin A. FŐGLEIN, Krisztina DEMÉNY

*Obuda University, Budapest, Hungary,*sara.alkhaldi01@gmail.com, +36706577973*

***Abstract**:*
The idea of conserving the resources and Earth for future generations is becoming more popular. With climate change and increasing temperatures globally, the stability of life for future generations is affected. Thus, sustainability and sustainable development are hot topics nowadays. One of the basic principles of sustainable development is that, with a complex approach, it simultaneously considers the expectations of environmental issues, social needs, and economic development needs. Climate change has been accelerated in the past couple of years by anthropogenic factors. An example of these factors is the widespread transport that uses fuel, and emits greenhouse gases and air pollutants. However, we cannot simply stop using transport as it is important for social and economic development. One of the ways that have been suggested to reduce the emissions from transport is the use of different technologies of decreased or zero emission like hybrid and electric vehicles. This paper takes a deeper dive into the sustainable world of transport electrification and reviews the current literature of this growing industry.

***Keywords**: sustainable transport, electric cars*

INTRODUCTION

Transport has always been important around the world [1]. However, the transportation sector is one of the big contributors to global emissions. It accounts for a quarter of the greenhouse gas emissions in the EU [2]. Transport has a high reliance on fossil fuels. According to the International Energy Agency report, the yearly growth in transport emissions between the years 1990 and 2021 was 1.9% [3]. In 2021, cars and vans have accounted for 8% of the global contribution to emissions [4]. The use of more environmentally friendly vehicles can help to have sustainable transport. In this paper, electric cars are discussed. The history of the cars, types, main challenges, and improvements are tackled.

Main body

Definition of electric vehicles

An electric vehicle was defined by ISO 6469-3:2018 as "a vehicle with one or more electric drive(s) for vehicle propulsion" [5]

ISO, also, defined the different types of electric vehicles:

PHEV was defined as "HEV with a rechargeable energy storage system (RESS) that is intended to be charged from an external electric energy source". Also known as "externally chargeable HEV"

HEV was defined as a "vehicle with both a rechargeable energy storage system (RESS) and a fuelled power source for propulsion" [6]

BEV was defined as an “electric vehicle with only a traction battery as the power source for vehicle propulsion” [7]

History of electric cars

Cars first appeared more than a decade ago. Different types of cars which include electric, hybrid and fuel-powered cars were invented. The different types battled to become more popular. In this section, the emergence of the different vehicles is discussed.

In 1894 the electric car company Jeantaud manufactured the first electric car with batteries weighing 450kg. It was able to travel a distance of 21km/h. The golden age for electric cars started a couple of years later, in 1900. It lasted for 10 years. Electric cars represented 40% of cars in the United States at the time. However, when roads between towns were constructed to connect American cities, the limited range of electric cars was a negative factor to this type.

Electric cars in America were used by a newly established company that was named Electric Vehicle company. This was established as a taxi-service company. The “lead cab fever” reached some European countries like Belin and Paris. It was planning to expand to 12,000 cars. However, due to the failing performance of the cab and a financial scandal, the operating subsidiaries collapsed.

During that time electric cars had a lot of disadvantages. They were more expensive to manufacture and operate. There were very few charging facilities outside bigger cities and the batteries deteriorated quickly. Lastly, due to the use of batteries and limited range, the electric vehicle needed to be recharged. To solve this issue, car manufacturers were trying to extend the range of electric cars from limited to empty [8].

During the same time gasoline-powered and hybrid vehicles, were designed. An example is the first hybrid car, which was designed by Ferdinand Porsche, it was called the ‘Semper Vivus’. In this design, the car had a generator powered by a combustion engine. The generator would send an electric charge to the wheel hubs to drive them [9]. Several manufacturers followed and developed their own hybrid systems like Krieger.

As for gasoline vehicles, they were described in the American Monthly Review of Reviews as having a clumsy and complicated design. In addition. It was noisy, produced exhaust, and needed the effort to control. Thus, electric cars were preferred by female drivers compared to their counterparts, gasoline- and steam-powered cars [8]. However, vehicles with an internal combustion engine had characteristics that were unavailable in electric cars. It had a longer range, did not need a lot of maintenance, and could climb hilly areas.

When Henry Ford mass-produced Model T, the electric vehicles were killed. The Model T made gasoline-powered cars broadly accessible and reasonably priced when it was introduced in 1908. The gasoline car only cost $650 in 1912, whereas the price of an electric roadster was $1,750 (Energy, 2014). During the next decades, there were improvements in the more affordable technology of ICEs. However, there was an increase in the oil price in the 1960s and 1970s, which encouraged more research in hybrid and electric technologies. These still had drawbacks [10].

For the past years, the interest in lower- and zero-emission technologies is sparked due to a different reason. Today, the reduction in emissions of greenhouse gases is needed to reduce global warming. The Net Zero Scenario necessitates a 20% reduction in emissions from the transport sector to less than 6 Gt by 2030, even with predicted increases in transportation demand. One of the ways to make that possible is through the rapid electrification of road vehicles [3].

Challenges with electric cars

There are different challenges for hybrid and battery electric cars. Some are common between hybrid and battery electric vehicles while others are only for one of them. One of the factors impacting HEV and BEV is price [11][12]. Battery costs are expensive, which poses a challenge to the commercialization of electric vehicles. A sustainability assessment for electric vehicles was carried out. The result was that BEV is more expensive than ICEV. However, due to the inexpensive operational

costs of BEV and the battery price reduction in the future. The balance will tip towards BEV compared to ICEV [13].

Another challenge is recouping capital expenditures and R&D costs. It can take a couple of years. Each battery needs at least four to five years to be in production. For example, the introduction of the first generation of automotive lithium-ion batteries in 2011–2012, suggests that the second– and third–generation batteries could be commercialized in 2016–17 and early 2020, respectively. In addition, a factor that influences EVs is the charging or swapping of batteries. These two methods can have drawbacks. In the case of charging, not all car owners have charging facilities for their cars. This calls for many expensive public charging outlets. As for swap stations, they appear to have a very low income from an investment [14].

Batteries with lower ranges, also, need to be charged more frequently, which depends on the battery density of the car [15]. Furthermore, most of the energy mix is powered by fossil fuels [16]. The energy sources of charging can influence the degree of effectiveness of electric cars in comparison to ICE. In the case of electric cars that were powered solely by fossil fuels, the result showed that diesel-powered vehicles are more efficient than electric vehicles.

On the other hand, electric cars that are powered by renewable sources have a bigger efficiency [17]. Thus, the impacts of the effectiveness of EVs with regard to GHG emissions are tied to the energy mix [13].

The last challenge is to not have the so-called rebound effect. This effect would occur if electric cars had significantly lower carbon dioxide emissions than d and a reduction in fuel expenditure. People may decide to switch to electric cars because of this [18].

Improvements and innovations

In the past couple of years, there has been exponential growth in electric vehicles that featured improved range, model and performance. As an example, innovations in cell design and battery technology have helped to increase the range of electric vehicles. The range has doubled from 100-150 Wh/kg to 300 Wh/kg over the past 10 years.

In addition, the market share of lithium iron phosphate cathodes has increased. This can help reduce the batteries with critical metals like Cobalt and Nickel [15].

There are, also, innovations that are still being studied. For example, dynamic wireless power transmission allows cars to be charged while being driven or parked on roads, highways, or city crossings.

The user is liberated from range anxiety if their battery runs out of charge thanks to this method, which also gets rid of the nuisance of plugging in charger cords. Additionally, others claim that BEV technology is not appropriate for vehicles like huge trucks and buses that need lengthy cruising ranges because batteries are typically pricey and heavy [19].

CONCLUSIONS AND RECOMMENDATIONS

Both EV and electric cars have emerged in a similar tome period. However, ICEs had more popularity in the beginning. On the other hand, the spread of electric cars is much slower. Nowadays, light is shed on electric cars as we are trying to have a more sustainable future and reduce emissions. Electric cars have a lot of different challenges, from range, to cost and effect on the environment. However, the cars have also come along way and improved. For the recommendation, more research should be done on electric cars to understand the full lifecycle of electric cars and the methods to recycle it or dispose it.

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COMPARING SALINE AND QUICK CLAYS

Emőke IMRE[1,2], Diego MARCHETTI[3], Lachlan BATES[4] Miklós JUHÁSZ[5], Ágnes BÁLINT[6,2],

[1,2]Óbuda University, Bánki Donát Faculty, Budapest, Hungary, e-mail: imre.emoke@uni-obuda.hu, phone: +36202892656*
[2]Obuda University, EKIK Hydro-Bio-Mechanical Systems Research Center, Budapest, Hungary
[3]Studio Prof. Marchetti S. r. l A., Italy, e-mail: info@marchetti-dmt.it
[4]The School of Engineering, The University of Newcastle Callaghan, Newcastle, Australia, e-mail: lachlan.bates@newcastle.edu.au
[5]Debrecen University, Debrecen, e-mail: top@taupe.hu;
[6]Institute of Environmental Engineering and Natural Sciences, Óbuda University, Budapest, Hungary e-mail: balint.agnes@uni-obuda.hu

Abstract.
Various in situ and laboratory dissipation tests were made in two test sites (eg., Szeged, Hungary; Ballina, Australia) which are evaluated, and the results are compared with the evaluation results of some in situ and laboratory dissipation tests (oedometer creep test) in the same sites. The initial part of the cone resistance dissipation tests and the DMT total stress dissipation tests showed similar results concerning the degree of the post-depositional effect. However, the evaluation of the laboratory oedometer test entailed significantly different results as follows. Results of the saline soils showed that the ratio of the primary consolidation settlement to total settlement was below 20 % and the creep became dominant, the clay structure was degraded. In Ballina quick clay, the first evaluation results indicated that the ratio of the primary consolidation settlement to total settlement was above 60%. However, the Ballina soils became very compressible.

***Keywords**: pore water pressure and cone resistance dissipation tests, creep, consolidation, compression, saline, quick clay*

INTRODUCTION

In Hungary, between the Danube and Tisza rivers, there is a hilly area where groundwater moves downwards, while in the low areas along the two major rivers, groundwater moves upwards (Figures 1-4, [1 to 6]. A statistical study made by [5], based on soil physical parameters of 11000 laboratory tests determined from 2600 soil samples taken in the western side of Szeged (Figures 1 to 42) revealed that the layering is the same, however, the soil conditions are worse on part C in comparison with part A and B. In the first and second research projects, borings, laboratory, and CPT data were produced in the western side of Szeged down to 20 m depth, which was completed by chemical and dissipation tests. The result of the statistical analysis agreed the previous one. The soil tests showed salinity in area C. The third research project at the ELI site in area C was an investigation down to 70 m depth using conventional oedometric laboratory tests, CPTu u_2 dissipation tests, cone resistance dissipation tests and DMT total stress dissipation tests. Results revealed that saline-like soils can be found in any depth randomly.

Comparing saline and quick clays, three parameters were found useful to indicate fabric alteration. The total stress type cone resistance dissipation tests – being considerably simpler to obtain the dissipation curves than involving the measurement of pore water pressure – gave valuable information within a much

shorter time than the standard in situ pore water pressure or oedometer dissipation test. The larger total stress drops of cone resistance dissipation test in the first two minutes clearly indicated the fabric alteration (for saline and for quick clays).

The decrease in dissipation time in pore water dissipation tests may occur in saline clays and for quick clays. The void ratio increase is indicative for fabric alteration for both cases. However, the ratio of the creep/total settlement identified from laboratory compression test, may give significantly different results for saline and for quick clays.

MATERIALS AND METHODS

Analysis a saline spot down to 20 m in West part of Szeged

In the frame of the OTKA [6] research on in situ test modelling seven, approximately 15 to 20 m deep borings with undisturbed samples and CPT's with simple dissipation tests were made in areas A, B and C. All geotechnical data (classification tests, chemistry tests, continuous or dissipation type CPT) were separated into horizontal and vertical groups based on soil classification and area (i.e., area A, B and C). The data sets were statistically compared. Chemical tests were made on a few samples.

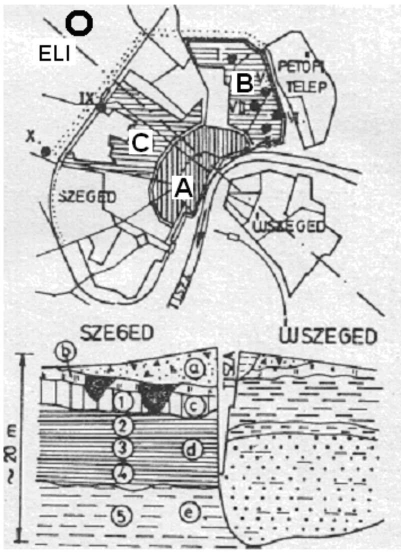

Figure 1 Site plan and section for Szeged.

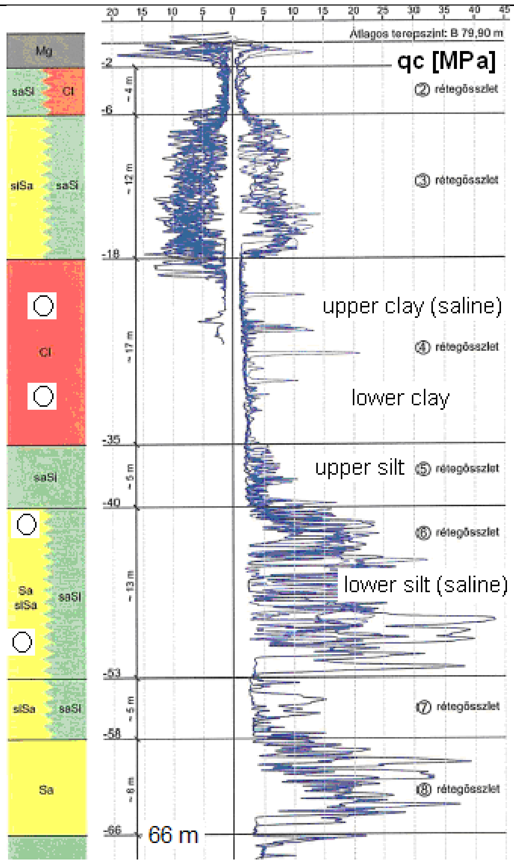

Figure 2 Szeged City, the exploration site ELI.

Notations: a. fill, b. humus soils, c. infusion loess, d. yellow lake clay, e. bluish-grey freshwater deposit (after Rétháti and Ungár, 1978 and Imre, 1995) see Table 1.

Evaluations

The CPT and DMT can be used in a logging and a rheological testing mode. In the ''simple rheological test" or dissipation test the time variation of the local side friction and the cone resistance or then total stress are measured for a few minutes. In the "simple rheological test" the time variation of the local side friction and the cone resistance are measured for a few minutes after the rod is clamped (Figures 5, 6). After an immediate stress drop, the cone resistance decreases, the shaft resistance or total stress decreases or increases in sand during the first minutes. The measured time variation (Δ, [6]) is controlled by the soil plasticity and soil salinity. The q_c-time relations or total stress – time showed larger measured time decrease (Δ) in saline soils, than non-saline soils (Figure 6).

The evaluation of the in-situ tests was made according to [8]. The DMT tests are described in [9]. The evaluation of the oedometric compression tests was made with a precise method based on the modified Terzaghi and Bjerrum [7] model, a parameter for the immediate compression was added. The immediate, consolidation and creep settlements were separated.

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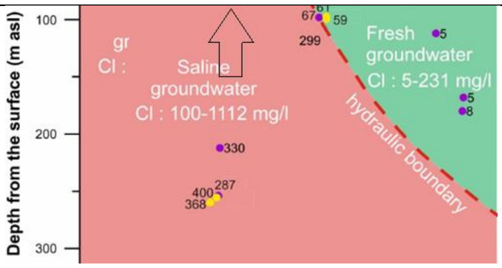

Figure 3. The upwards saline groundwater flow from lower marine clay [2]

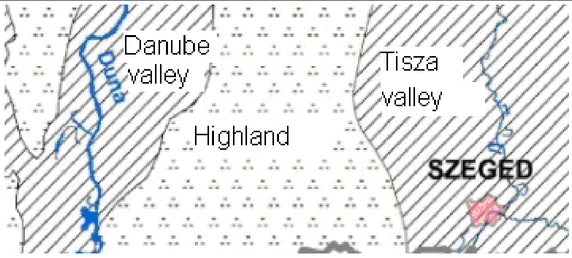

Figure 4. The section between Duna -Tisza Rivers. The Szeged environment is with upwards seepage, the highland with downwards seepage.

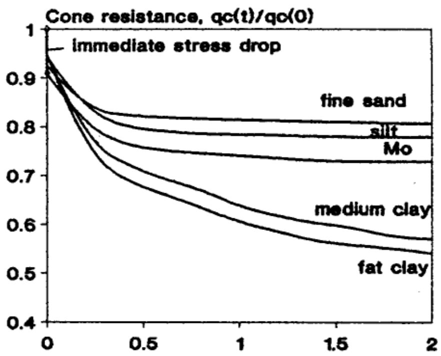

Figure 5. The S832 CPT mean dissipation tests in the function of time, cone resistance q_c-time relations

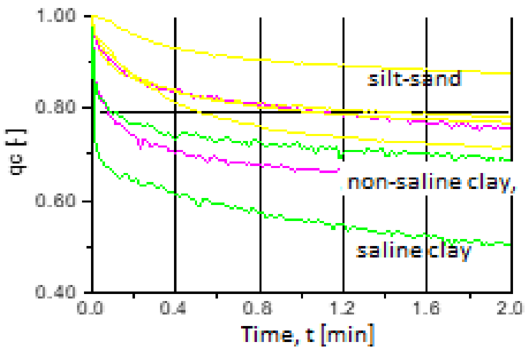

Figure 6. The Geomil CPT short dissipation tests data in the function of time, measured cone resistance q_c-time relations.

Table 1. Soils in Figure 1

Notation	Soil	Ip [%]	S_U [kPa]	k[m/s]	e[-]
1	Loess	7.4	86.2	$6.1.10^{-8}$	0.68
2	Upper yellow lacustrine clay	28.9	92.7	$3.9.10^{-8}$	0.76
3	Silty inclusion	19.	75.3	$3.8.10^{-8}$	0.76
4	Lower yellow lacustrine clay	36.3	95.0	$2.5.10^{-8}$	0.85
5	Blueish fresh-water deposit	30.01	60.0	$6.3.10^{-8}$	0.80

Table 2. Soils chemistry

Site, depth	ESP	Salt (%)	pH(H_2O)	Electric conductivity (mS/cm)
C: X-12.3m	8.02	0.66	3.94	0.15
AB: VI-12.5m	8.29	0.30	1.536	0.06
C: X-10.0m	7.96	0.86	5.142	0.17
AB: VI-5.0m	8.46	0.36	3.117	0.06
AB: VI-6.5m	8.53	0.34	1.93	0.05

GEOLOGY

Great Hungarian Plain is the largest Neogene Depression of the Carpathian Basin filled up with Quaternary deposits. It includes two hilly regions (Danube-Tisza Interfluve and the northeast part of the

Great Plain) and an almost perfect plain region (the Tisza-Körös Plain). The Transdanubian Tableland is composed of Late Tertiary deposits that have not undergone any marked subsidence. In area C some saline groundwater may move upwards from a very deep, old clay marine crystalline deposit, and, as a result, the soil may be altered in a different degree at various depths and locations.

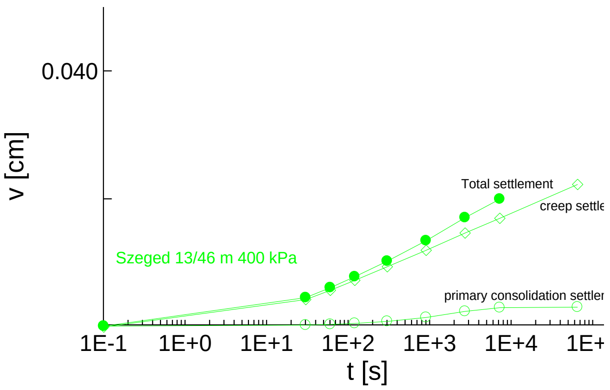

Figure 7: The upwards saline groundwater flow from lower marine clay [2]

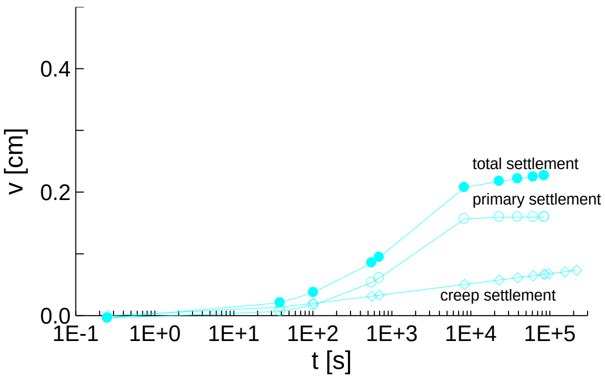

Figure 8: The quick clay in Ballina [10]

RESULTS AND DISCUSSION

Analyses in large area down to 20 m

135 simple rheological type CPT were made with the CPT Sz832 (with a shaft sensor of 350 cm^2) in Szeged. These were divided into 10 groups based on soil classification and site A, B and C. Tests made in the vicinity of layer boundaries were not included into these groups. Tests made in the aeolian sand layer 6 in Debrecen city were used as a reference with two groups based on the d<0.1 mm grain content. The mean simple CPT dissipation test records are shown in Figure 3.

The results generally showed an immediate stress drop (or discontinuity) at the stop of the steady penetration when the loading type changed from basically dynamic to quasi-static. After the stress drop, the rate of the cone resistance dissipation was larger in sand and is smaller in clay. The stress decrease after 2 minutes was larger in part C than in parts A or B possibly since the normalization unit was less B. In addition, a non-zero final tangent was observed in area C which may indicate an unstable fabric.

The result of the statistical analysis supported the result of the statistical study made by [5] showing worse soil condition in area C [6]. The yellow clay was separated into sub-layers 2 to 4.

The bluish-grey deposit had lower plasticity index IP at C than at A and B. The montmorillonite + illit content of the lower yellow clay layer was less on unit C than A and B. According to the results of the chemistry tests (see Table 3) saline soil with high salt content was found at various depths in part C. The lower yellow clay and the bluish-grey deposit had considerably less undrained shear strength cu, and ultimate cone resistance q_{cu}, on area C than on areas A, B.

Analysis a saline spot down to 66 m

The u_2 dissipation curves were non-monotonic in the NC clays (type III and IV) and were negative in the silty sand (type V). The over-consolidated shape in sand is caused by the basically drained penetration and the subsequent stress release in the vicinity of the shaft.

The c was larger in saline than in non-saline clays. The normalised stress drop Δ in cone resistance parameter dissipation was smaller in granular matter and larger in plastic soils. The stress drop Δ was larger in saline soils than in non-saline soil and the dissipation curves has a decreasing final tangent. Table 5 shows the in-situ coefficient of consolidation parameters. The c was larger in saline soils.

Comparing quick and saline soils

The coefficient of consolidation *c* identified from oedometer test data was larger for saline than non-saline clays, the *c* was larger for saline than non-saline clays. In applying the Bjerrum model, a constant term for the immediate compression was added [7] and the immediate, primary, and secondary consolidation settlements were separated. Results are shown in Figs. 7 and 8. The primary consolidation settlement was smaller, and the creep settlement was larger for the saline soils than for the non-saline. The immediate compression was zero for the sand-silt. The ratio of the primary consolidation settlement to total settlement was always less than 50% for each Szeged soil; for saline silt it was below 16%. In Ballina [10], the ratio of the primary consolidation was above 60%.

CONCLUSIONS AND RECOMMENDATIONS

(1) The effect of the upwards groundwater flow may cause spot-like salinity accumulation. / Freshwater may leach the marine clays. These saline and quick clays have an increase in the void ratio.
(2) The qc and DMT total stress dissipation tests in 2 minutes revealed a larger stress drop (smaller elastic soil response) in saline and quick clays.
(3) The ratio of the primary consolidation settlement to total settlement for saline clay and was below 20 %, for quick clay this ratio was larger than 60%. For quick clays the instability can primarily be caused by stress level while in saline clays the creep becomes a dominant feature.

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PREVENTIVE APPLICATION OF UNTREATED CITY SEWAGE/SEWER WATER FOR IRRIGATION IN CEREAL CROPS AVOIDING HEAVY METALS POLLUTION IN SOIL-PLANT ECOSYSTEM

B. S. PANWAR[1], Olha.A. KHLIESTOVA[2,3], Katarzyna EWA BUCZKOWSKA[2,4] Baturalp YALCINKAYA[2] Milan BOUSA[2]

[1]Department of Soil Sciences, CCS Haryana Agricultural University, Hisar
[2]Department of Material Science, Faculty of Mechanical Engineering, Technical University of Liberec, Liberec, Czech Republic.
[3]Department of Primary Science Institute of Modern Technologies, Pryazovskyi State Technical University, Dnipro, Ukraine.
[4]Department of Materials Technology and Production Systems, Faculty of Mechanical EngineeringLodz University of Technology, Poland.
[1]Corresponding author: panwarbss@gmail.com

***Abstract**:*
The sewage and non-sewage water quality were tested fit out for irrigation purposes. The pH, EC, calcium carbonate, CEC, exchangeable cations, micronutrients and available NPK were higher in the soils irrigated with sewage water than in soils irrigated with non-sewage water. The heavy metals (Cd, Ni and Pb) of sewage-irrigated soil were more than non-sewage irrigated soil during both years. Irrigation with wastewater increased Ni content in sewage-irrigated soil compared to non-sewage irrigated soil. Heavy metals, Cd, Ni, and Pb uptake in plant grain and straw were higher in the soils irrigated with sewage water than in non-sewage water irrigation. This might be due to the fact that the heavy metals present in the sewage water were in a higher amount which the plants extracted through the soil water continuum. Long-term application of sewage water on agricultural fields often increases the levels of macro-micronutrients and heavy metals in soils. There are various sources through which heavy metals get to the soil, including industrial, urban or agricultural wastes, sewage waste, industrial waste and gases emitted by vehicles and industries. The heavy metals (Cd, Ni and Pb) detected were found below the permissible limit in the rice-wheat and pearl millet-wheat cropping system. Therefore, it can be concluded that in the scarcity of irrigation water, sewage water can be used in the critical period of growth for the life-saving of the crops, and the savings in terms of micro-nutrient deficiency amelioration practices can be done without expending on expensive nutrient supplements in plants both in wheat and pearl millet-wheat cropping system. There was no excess heavy metal toxicity in the produces as well as in soils from sewer/sewage sources of irrigation water.

***Keywords**: Sewer water, heavy metals, wheat, pearl millets, cropping system*

INTRODUCTION

Healthy soil where we saw lots of pores, earthworms, earthworm casts, and roots - all the good stuff. The benefits of waste water use in irrigation are numerous but precautions should be taken to avoid soil pollution. It 'the need of time, to adopt recycle, reuse approaches to decrease the load of irrigation water on local sources.

It can prove beneficial in soil management as rich source of organic matter and act as an activator of soil microbial activity when used as soil amendment (Sharma and Dhaliwal, 2019).

Sewage water irrigation is also known to contribute the heavy metal content to soils (Mapanda *et al*., 2005). Several plant species have variable capacities to remove and accumulate heavy metals. There are certain species which may accumulate specific heavy metals, causing a serious risk to human health when plant-based foodstuffs are consumed (Fytianos *et al*., 2001). Vegetables, especially leafy vegetables grown in heavy metal-contaminated soils, accumulate higher amounts of metals than to those grown in uncontaminated soils because they absorb these metals through their leaves (Al Jassir *et al*., 2005). It is advisable to avoid such crops in polluted soils.

Most of the heavy metals are present in the upper layers of the soil applied with sewage water and most of the crop roots are present in this zone and there are chances of absorption of heavy metals by the plant roots posing threats to the standard and safety of food owing to the high levels of heavy metals in the agricultural soil (Khan *et al.*, 2018). In India, rice (*Oryza sativa* L.) - wheat (*Triticum aestivum* L.) is the dominant cropping system in Indo-Gangetic plains. Rice and wheat are the world's two most important cereal crops contributing 45% of the digestible energy and 30 per cent of total protein in the human diet.

Pearl millet-wheat cropping system is the most important and popular system under irrigated conditions in arid and semi-arid regions of India as well as in South-Western parts of Haryana where pearl millet is grown in *Kharif* and wheat in *Rabi* season.

Disposal of sewage water has become an unavoidable issue that can cause serious environmental problems. These substances being economical and easily available can be used in agriculture for soil fertility improvement and as amendment.

The sewage water is a major issue as the farmers apply the available sewage water just as supplementary and for free of cost irrigation without knowing the ill effects of the applied water. Though the nutrient supplying capacity is a major factor for sewage irrigation, maintaining adequate levels should also be a task of equal priority owing to the possible negative effects by overfeeding through inducement of succulence, lodging and the resultant loss of crop yields (Minhas *et al.*, 2015). The heavy metals content did not surpass toxicity levels in soil and plants. Hence, the incorporation of sewage water can save 25% mineral fertilizers and, also integrated application of sewage water with mineral fertilizers proved to be economically beneficial for crop production (Prakash *et al.*, 2021). There are many studied carried out on the effects of sewage water on soil condition as well as productivity of the grown crops particularly, wheat, rice and pearl millet with lacking heavy metals contents of soils.

The present study is carried out in two sites, where sewer water irrigation is in practice by farmers to evaluate, effect of long-term sewage /sewer water irrigation on heavy metals content in soil-plant ecosystem.

MATERIALS AND METHODS

The present study, involved a two-year field survey of Hisar in the *rabi* and *kharif* seasons during 2012-13 and 2013-14. Cropping history can be used to determine the exploratory field's production potential. The complexities of the field's cropping history before to survey's time are depicted in Table 1.

Table 1: Cropping history of the field

District	**Year**			
	2012-13		**2013-14**	
	Kharif	***Rabi***	***Kharif***	***Rabi***
Hisar	Pearl millet	Wheat	Pearl millet	Wheat

Collection and preparation of samples

Sewage water
Sewage water samples from Hisar districts of Haryana State were collected from sewage water discharge outlets. The sewage water sample was collected in duplicate *i.e.*, one already treated with a mixture of 1:1 HNO_3 and distilled water to avoid adsorption of heavy metals on the walls of the bottle and in another un-acidified bottle rinsed with only distilled water. Un-acidified sewage water samples were used for the determination of pH, electrical conductivity (EC), heavy metal ions were estimated in acidified samples as such after filtration.

Table 2: Sampling sites with coordinates

Location	Type	Site
Hisar	SW-1	Ludas
	SW-2	Dabra
	NSW-1	Ludas
	NSW-2	Dabra

SW-1: Sewage water sample-1;
SW-2: Sewage water sample -2;
NSW-1: non-sewage water- sample 1;
NSW-2: non-sewage water sample -2

Sewage water analysis
The following parameters were measured in the sewage waters using established procedures, as stated below:

pH: pH was determined by digital pH meter (Jackson, 1973).

Electrical conductivity: Electrical conductivity was estimated in the filtered sample with the help of Elico conductivity meter bridge (Jackson, 1973).

Heavy metal ions: Total, Cd, Pb and Ni were estimated in acidified digested samples using atomic absorption spectrophotometer (AAS).

Soil samples
Surface and sub-surface soil samples (0-15, m) were collected from rice-wheat and pearl-millet-wheat growing areas in the Haryana districts of Hisar for this study. Farmers irrigated fields with sewage water and ground-water from peri-urban areas for about fifteen years, and the fields were chosen at random. Standard procedures were used to collect soil samples from the research area. The soil samples were first air-dried ground with wooden pestle and mortar and passed through a 2 mm stainless steel sieve. After mixing thoroughly, the processed samples were stored in cloth bags and used for some chemical properties, micronutrients and heavy metal analysis, using standard methods.

ANALYSIS OF SOIL PARAMETERS:

Chemical properties
Soil pH
Soil pH was determined in a 1:2.5 soil water suspension by glass electrode pH meter (Piper, 1950).

Electrical conductivity

Electrical conductivity of supernatant liquid was determined by using conductivity meter (Piper, 1950).

Organic Carbon

Soil organic carbon content was determined by Walkley and Black (1934) method.

Calcium Carbonate

Soil calcium carbonate content was determined by Puri (1949).

DTPA extractable heavy metals: DTPA (Diethylene Triamine Penta Acetic acid 0.005 M) extractable (1:2 soil: DTPA) Cd, Ni and Pb were determined by using Lindsay and Norvell (1978) using atomic adsorption spectrophotometer.

Plant sampling

At threshing of crop, representative grain and straw samples from individual plots were collected, initially dried in air and finally in an oven at 60 ± 2^0C. The oven-dried samples were ground in mini-Willey mill with stainless steel blades and stored in polyethylene bags for the analysis of heavy metals.

Analysis of plant sample

The plant samples were collected at the harvest stage of crop. Samples were dried, grinded and digested. For digestion, 0.5 g plant material was weighed in a 50 ml conical flask. 10 ml of di-acid mixture of H_2SO_4 and $HClO_4$ in a ratio of 9:1 was added and kept overnight. Solution was kept on a hot plate and heated gently at first. Then heated more vigorously until a clear colourless solution was obtained. Heating was discontinued, when the volume was reduced to 3-4 ml. It was cooled and transferred to a 50 ml volumetric flask and volume was made up to mark by adding distilled water. The digested samples were filtered and stored in plastic bottles with proper labelling for further analysis. The standard procedure adopted for plant analysis was outlined by Jackson (1973) summarised below.

Determination of Heavy metals (Cd, Ni, Pb)

Half gram (0.5 g) plant material was weighed in a 50- or 100-ml conical flask. Add 10 ml of di-acid mixture of HNO_3 and $HClO_4$ in a ratio of 4:1. Keep it overnight. Keep on a hot plate and heat gently at first. Then heated more vigorously until a clear colourless solution results or until a white fume ceased to come out and was prevented to reach dryness.

Heating was discontinued, when the volume was reduced to 3-4 ml. Solution was cooled and transferred to 50 ml volumetric flask and volume was made up to mark by adding distilled water.
Solution was then filtered through Whatman No. 42 filter paper and used for further analysis and was determined by Atomic Absorption Spectrophotometer (Model: Varian AA240z).

Table 3: Critical limit of heavy metals in sewage water and irrigated soil

Heavy metals	Soil (mg kg^{-1})	Sewage water (mg L^{-1})
Zn	2.4	< 2.0
Pb	5.5	6.0
Cd	0.7	0.02

STATISTICAL ANALYSIS

Correlation between different soil and different water characteristics was calculated with OPSTAT software available at website of CCS HAU Hissar.

RESULTS AND DISCUSSION

Grain yield

The yield of rice, wheat and pearl millet was estimated under sewage and non-sewage water in Hisar district, as given in Table 4. The data clearly revealed that wheat and pearl millet yields were found higher under sewage water irrigation than in non-sewage water irrigation.

The pearl millet yield in Hisar under sewage water irrigation was 2722 kg ha^{-1} as compared to 2514 kg ha^{-1} under non-sewage water irrigation. The per cent increase in the pearl millet yield was 8.18 under sewage water over non-sewage water irrigation. Similarly, the per cent increase in the wheat yield under sewage water irrigation was 3.69 over the wheat yield under non-sewage water irrigation during 2019-20. Similar trend has been reported during 2020-21 in the yield of wheat and pearl millet.

Table 4: Grain yield (kg ha^{-1}) of different crops under sewage and non-sewage water in Haryana

Sites	Crops	Grain yield (kg ha^{-1})					
		2012-13			2013-14		
		Sewage water	Non-sewage water	% Increase in yield	Sewage water	Non-sewage water	Per cent increase in yield
Hisar	Pearl millet	2722	2514	8.18	2765	2534	9.07
	Wheat	3511	3386	3.69	3561	3411	4.47

Straw yield

The data pertaining to effect of sewage and non-sewage water irrigation on the straw yield of different crops are displayed in Table 5, from which it can be clearly inferenced that straw yield of all the crops in soils irrigated with sewage water were more compared to soils irrigated with non-sewage water at all the sampling sites during both the cropping years.

The straw yield of all the crops in 2nd year was slightly higher than the 1st year at all the sites under both sewage and soils irrigated with non-sewage waters., Pearl millet and wheat in Hisar was 5292.00 and 4809.00 kg ha^{-1}, respectively, under sewage water treatment and 4716.00 and 4267.00 kg ha^{-1}, respectively, under soils irrigated with non-sewage water. While in 2013-14, the straw yield of Pearl millet and wheat in Hisar was 5326.00 and 4839.00 kg ha^{-1}, respectively, under sewage water treatment and 4746.00 and 4295.00 kg ha^{-1}, respectively, under soils irrigated with non-sewage waters.

Table 5: Effect of sewage and non-sewage water on yield (kg ha^{-1}) of straw under rice-wheat and pearl millet-wheat cropping system in peri-urban areas of Haryana

Year	District	Crop	Straw yield (kg ha^{-1})	
			Sewage water	Non-sewage water
2012-13	Hisar	Pearl millet	5292	4716
		Wheat	4809	4267
		SD	**1230**	**1343**
2013-14	Hisar	Pearl millet	5326	4746
		Wheat	4839	4295
		SD	**1238**	**1342**

Heavy metals content in plant grain

Cd content

A perusal of data on Cd content (mg kg^{-1}) in grain presented in Table 6, revealed that the mean value of Cd content (mg kg^{-1}) in grain of crops (pearl millet and wheat) grown on soils irrigated with sewage water was more as compared to those grown on soils irrigated with non-sewage water during both the years. The Cd content in grain of both the crops at all the sampling sites was slightly higher in 2nd year compared to their corresponding values in 1st year under both sewage and soils irrigated with non-sewage water

Ni content

A perusal of data on Ni content (mg kg^{-1}) in grain presented in Table 6 revealed that the mean value of Ni content (mg kg^{-1}) in grain of crops pearl millet and wheat, grown on soils irrigated with sewage water was more as compared to those grown on soils irrigated with non-sewage water during both the years. The Ni content in grain of both the crops at all the sampling sites was slightly higher in 2nd year compared to their corresponding values in 1st year under both sewage and soils irrigated with non-sewage water except wheat in Hisar of sewage irrigated crop.

Pb content

A perusal of data on Pb content (mg kg^{-1}) in grain presented in Table 6 revealed that the mean value of Pb content (mg kg^{-1}) in grain of crops (pearl millet and wheat) grown on soils irrigated with sewage water was more as compared to those grown on soils irrigated with non-sewage water during both the years. The Pb content in grain of all the crops at all the sampling sites fluctuated in the 2nd year compared to their corresponding values in the 1st year under both sewage and non-sewage water.

Table 6: Effect of sewage and non-sewage water irrigation on heavy metal content (mg kg^{-1}) in grain under pearl millet-wheat cropping system

Year	District	Crop	Heavy metal content (mg kg^{-1}) in grain					
			Sewage water			Non-sewage water		
			Cd	Ni	Pb	Cd	Ni	Pb
2012-13	Hisar	Pearl millet	1.36	5.76	3.45	0.68	4.27	2.86
		Wheat	1.03	7.48	1.42	0.43	2.23	0.85
		SD	**0.26**	**1.54**	**0.97**	**0.15**	**0.94**	**0.90**
2013-14	Hisar	Pearl millet	1.41	5.84	3.46	0.72	4.39	2.80
		Wheat	1.11	7.44	1.46	0.45	2.26	0.85
		SD	**0.27**	**1.53**	**0.99**	**0.15**	**0.95**	**0.88**

Heavy metal (Cd, Ni, Pb) content in plant straw

Cd content

A perusal of data on Cd content (mg kg^{-1}) in straw presented in Table 7 revealed that the mean value of Cd content (mg kg^{-1}) in straw of crops (pearl millet and wheat) grown on soils irrigated with sewage water was more as compared to those grown on soils irrigated with non-sewage water during both the years. The Cd content in straw of all the crops at all the sampling sites was slightly higher in 2nd year compared to their corresponding values in 1st year under both sewage and soils irrigated with non-sewage water except wheat in Karnal of non-sewage irrigated crop.

Ni content

A perusal of data on Ni content (mg kg^{-1}) in straw presented in Table 7 revealed that the mean value of Ni content (mg kg^{-1}) in straw of crops (pearl millet and wheat) grown on soils irrigated with sewage water was

more as compared to those grown on soils irrigated with non-sewage water during both the years. The Ni content in straw of all the crops at all the sampling sites was slightly higher in 2nd year compared to their corresponding values in 1st year under both sewage and soils irrigated with non-sewage water except pearl millet in Hisar of sewage irrigated crop.

Pb content

A perusal of data on Pb content (mg kg^{-1}) in straw presented in Table 7 revealed that the mean value of Pb content (mg kg^{-1}) in straw of crops (pearl millet and wheat) grown on soils irrigated with sewage water was more as compared to those grown on soils irrigated with non-sewage water during both the years. The Pb content in straw of all the crops at all the sampling sites was slightly higher in 2nd year compared to their corresponding values in 1st year under both sewage and soils irrigated with non-sewage water except Pearl millet in Hisar of sewage irrigated crop.

Table 7: Effect of sewage and non-sewage water irrigation on heavy metal content (mg kg^{-1}) in straw under pearl millet-wheat cropping system

Year	District	Crop	Heavy metal content (mg kg^{-1}) in straw					
			Sewage water					
			Cd	Ni	Pb	Cd	Ni	Pb
2012-13	Hisar	Pearl millet	0.71	8.95	2.16	0.58	5.49	1.54
		Wheat	0.91	14.47	3.38	0.63	10.16	1.78
		SD	**0.33**	**2.94**	**0.89**	**0.13**	**2.77**	**0.45**
2013-14	Hisar	Pearl millet	0.77	8.69	2.12	0.67	5.64	1.63
		Wheat	0.99	14.75	3.43	0.69	10.17	1.84
		SD	**0.36**	**3.09**	**0.90**	**0.15**	**2.80**	**0.49**

Heavy metals (Pb, Cd, Ni) uptake in plant grain

Cd uptake

A perusal of data on Cd uptake (g kg^{-1}) in grain presented in Table 8 revealed that the mean value of Cd uptake (g kg^{-1}) in grain of crops (pearl millet and wheat) grown on soils irrigated with sewage water was more as compared to those grown on soils irrigated with non-sewage water during both the years.. The Cd uptake in grain of all the crops at all the sampling sites was slightly higher in 2nd year compared to their corresponding values in 1st year under both sewage and soils irrigated with non-sewage water except wheat in Karnal of non-sewage irrigated crop.

Ni uptake

A perusal of data on Ni uptake (g kg^{-1}) in grain presented in Table 8 revealed that the mean value of Ni uptake (g kg^{-1}) in grain of crops (pearl millet and wheat) grown on soils irrigated with sewage water was more as compared to those grown on soils irrigated with non-sewage water during both the years. The Ni uptake in grain of all the crops at all the sampling sites was slightly higher in 2nd year compared to their corresponding values in 1st year under both sewage and soils irrigated with non-sewage water.

Pb uptake

A perusal of data on Pb uptake (g kg^{-1}) in grain presented in Table 8 revealed that the mean value of Pb uptake (g kg^{-1}) in grain of crops (pearl millet and wheat) grown on soils irrigated with sewage water was more as compared to those grown on soils irrigated with non-sewage water during both the years. The Pb uptake in grain of all the crops at all the sampling sites fluctuated in the 2nd year compared to their corresponding values in the 1st year under both sewage and non-sewage water.

Table 8: Effect of sewage and non-sewage water irrigation on heavy metal uptake (g kg^{-1}) in grain under pearl millet-wheat cropping system

Year	District	Crop	Heavy metal content (g kg^{-1}) uptake in grain					
			Sewage water			Non-sewage water		
			Cd	Ni	Pb	Cd	Ni	Pb
2012-13	Hisar	Pearl millet	3.77	15.66	9.34	1.70	10.76	3.18
		Wheat	3.76	26.24	4.94	1.35	7.67	2.74
		SD	**0.71**	**10.47**	**1.92**	**0.55**	**6.09**	**1.62**
2013-14	Hisar	Pearl millet	3.97	16.10	9.65	1.84	10.96	3.12
		Wheat	3.93	26.35	5.08	1.45	7.79	2.84
		SD	**0.74**	**10.57**	**2.00**	**0.56**	**6.15**	**1.62**

Heavy metals (Cd, Ni, Pb) uptake in plant straw

Cd uptake

A perusal of data on Cd uptake (g kg^{-1}) in straw presented in Table 9 revealed that the mean value of Cd uptake (g kg^{-1}) in straw of crops (pearl millet and wheat) grown on soils irrigated with sewage water was more as compared to those grown on soils irrigated with non-sewage water during both the years. The Cd uptake in straw of all the crops at all the sampling sites was higher in 2nd year compared to their corresponding values in 1st year under both sewage and soils irrigated with non-sewage water except wheat in Karnal of non-sewage irrigated crop.

Ni uptake

A perusal of data on Ni uptake (g kg^{-1}) in straw presented in Table 9 revealed that the mean value of Ni uptake (g kg^{-1}) in straw of crops (pearl millet and wheat) grown on soils irrigated with sewage water was more as compared to those grown on soils irrigated with non-sewage water during both the years. The Ni uptake in straw of all the crops at all the sampling sites was slightly higher in 2nd year compared to their corresponding values in 1st year under both sewage and soils irrigated with non-sewage water except pearl millet in Hisar of sewage irrigated crop.

Pb uptake

A perusal of data on Pb uptake (g kg^{-1}) in straw presented in Table 9 revealed that the mean value of Pb uptake (g kg^{-1}) in straw of crops (pearl millet and wheat) grown on soils irrigated with sewage water was

more as compared to those grown on soils irrigated with non-sewage water during both the years. The Pb uptake in straw of all the crops at all the sampling sites was higher in 2nd year compared to their corresponding values in 1st year under both sewage and soils irrigated with non-sewage water except pearl millet in Hisar of sewage irrigated crop.

Table 9: Effect of sewage and non-sewage water irrigation on heavy metal uptake (mg kg^{-1}) in straw under pearl millet-wheat cropping system

Year	District	Crop	Heavy metal content (mg kg^{-1}) uptake in straw					
			Sewage water			Non-sewage water		
			Cd	Ni	Pb	Cd	Ni	Pb
2012-13	Hisar	Pearl millet	3.71	47.30	11.46	2.69	25.86	7.31
		Wheat	4.33	69.50	16.15	2.65	43.32	7.63
		SD	**1.56**	**10.78**	**6.10**	**0.60**	**10.26**	**4.20**
2013-14	Hisar	Pearl millet	4.06	46.24	11.29	3.05	26.75	7.63
		Wheat	4.77	71.45	16.55	2.92	43.73	7.96
		SD	**1.64**	**11.59**	**6.33**	**0.46**	**10.39**	**4.35**

POST-HARVEST HEAVY METALS IN SOILS

Cadmium (Cd)

A perusal of data on Cd presented in Table 10 showed the Cd of sewage and non-sewage water irrigated soils. The data clearly revealed that the mean value of Cd of soils irrigated with sewage water was more as compared to soils irrigated with non-sewage water during both the years.

Nickle (Ni)

A perusal of data on Ni presented in Table 10 that the mean value of Ni of sewage in irrigated soil was more as compared to soils irrigated with non-sewage water during both the years.

Lead (Pb)

A perusal of data on Pb presented in Table 10 revealed that the mean value of Pb of soils irrigated with sewage water was more as compared to soils irrigated with non-sewage water during both the years.

Table 10: Effect of sewage and non-sewage water irrigation on heavy metal of soils under pearl millet and wheat cropping system

Year	District	Crop	Heavy metal (mg kg^{-1})					
			Cd		Ni		Pb	
			Sewage water	Non-sewage water	Sewage water	Non-sewage water	Sewage water	Non-sewage water
			0-15 cm	0-15 cm	0-15 cm	0-15 cm	**0-15 cm**	**0-15 cm**
2012-13	Hisar	Pearl millet	0.05	0.02	0.49	0.12	1.34	0.98

		Wheat	0.07	0.02	0.50	0.18	1.58	1.12
		SD	**0.016**	**0.006**	**0.309**	**0.066**	**0.34**	**0.10**
2013-14	Hisar	Pearl millet	0.05	0.02	0.46	0.15	1.38	0.99
		Wheat	0.07	0.02	0.55	0.20	1.67	1.16
		SD	**0.014**	**0.006**	**0.313**	**0.065**	**0.34**	**0.11**

Table 11: Correlation between heavy metals in soils irrigated with sewage and non-sewage water

Particulars	**2012-13**			**2013-14**		
	Cd	**Ni**	**Pb**	**Cd**	**Ni**	**Pb**
Cd	1			1		
Pb	0.814**		1	0.873**		1
Ni	0.872**	1	0.913**	0.914**	1	0.923**

**significant at 0.01 level of alpha

CONCLUSION

The mean value of heavy metals *i.e.*, Cd, Pb, and Ni were found in permissible limit for irrigation purpose in sewage water. The concentration of heavy metals *viz.*, Cd and Ni and Pb were recorded higher in sewage water with respect to non-sewage water. Sewage water contains dissolved organic and inorganic substances. During anaerobic decomposition of organic and inorganic substances present in effluent resulted in release of different cations. The composition of the sewage water varies according to the nature of process for manufacturing and the raw material used. Narwal *et al*. (1992) found that effluents from cycle industry at Sonipat, Haryana, had high amounts of metals particularly nickel (30 mg L^{-1}). The wide variation in heavy metals content of sewage and industrial effluents of different districts are a reflection of variability of sources of heavy metals entering in the sewage system according to (Sidhu *et al*. (2010).

Irrigation with wastewater increased Ni content in sewage irrigated soil compared to non-sewage irrigated soil. This is in line with findings of Mapanda *et al*. (2005) and Jagtap *et al.* (2010). The major source of heavy metals in the sewage water is metal plating industries, combustion of fossil fuels and mining and electroplating. The direct discharge of the wastes from these industries into the sewage water resulted into increase in the heavy metal which upon irrigation increased the heavy metals in the agricultural land. Similar results were reported by Zan *et al.* (2013).

The Cd, Ni and Pb uptake in plant grain and straw were found higher in the soils irrigated with sewage water as compared to non-sewage water irrigation. This might be due to the fact that the heavy metals present in the sewage water were in higher amount which were extracted by the plants through soil water continuum. Similar finding was also reported by Ajmi *et al.* (2009).

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URBAN WOODY PLANT'S BENEFITS IN ATMOSPHERIC HEAVY METAL POLLUTION MONITORING AND REDUCTION

Haimei CHEN [1,2], Levente KARDOS[2], Magdolna Sütöriné DIÓSZEGI[1], Veronika SZABÓ[1]

[1*]*Hungarian University of Agriculture and Life Sciences, Institute of Landscapes Architecture, Urban Planning and Garden Art, Department of Floriculture and Dendrology, Villanyi ut, 29-43, 1118, Budapest, Hungary*
[2]*Hungarian University of Agriculture and Life Sciences, Institute of Environmental Science, Department of Agro-environment Studies, Villanyi ut, 29-43, 1118, Budapest, Hungary*
e-mail: ellenchm@yahoo.com, Telephone +36 303231996;

Abstract.
Urban green infrastructure planning plays an important role in aspects of pollution reduction, such as heavy metal trapping. However, the reduction effects are both influenced by the different pollution conditions in each city and the species-specific interactions of trees and pollution. Herein, we investigated three common urban woody plants (Acer platanoides L., Fraxinus excelsior L. Westhof's Glorie, and Tilia tomentosa Moench) in Budapest to compare their heavy metal trapping abilities from the airborne in leaf dust deposits and leaves. All samples were deconstructed by a wet digestion method, and heavy metal contents were determined by using an atomic absorption spectrometer (AAS). The investigated results indicate that woody plants are ideal candidates for heavy metal pollution monitoring, as Zn < Cu < Pb < Ni were found in all species, with the highest percentage of total metal concentration in the summer season as traffic emissions main sources of particulate matter. Among the species selected, the highest amount of dust was loaded in T. tomentosa during all sampling times, with a significant correlation between metal contents in the dust deposit and leaf found in T. tomentosa (0.926 at a p<0.01 level). Therefore, we suggest T. tomentosa, which has better atmospheric trace element capturing capacity than A. platanoides and F. excelsior and thus is a better option for pollution reduction in the urban area.

***Keywords**: Particulate matter, Heavy metals, Tilia tomentosa, Woody plant*

INTRODUCTION

Particulate matter (PM) is one of the major pollutions in the urban environment. Over 94% of the urban population in Europe was exposed to more $PM_{2.5}$ than what the WHO recommends, according to a research from the European Environment Agency (EEA, 2022). To date, besides industrial emissions and residential heating, road traffic is also considered an uncontrolled and significant source, accounting for 19% of total $PM_{2.5}$ in Hungary[1]. Fine particulates ($PM_{2.5}$) are suspended in the air and last longer than larger particulates (PM_{10})[2]. Because of its small particle size and large specific surface, $PM_{2.5}$ has a high adsorption capacity, which contributes to its complex composition and sources[3,4]. Heavy metals are typically found in lower concentrations of $PM_{2.5}$, but they endanger human health by causing problems with the pulmonary, cardiac, vascular, and neurological systems [5,6].
Urban woody plants are the most prominent elements of city decoration. Being directly exposed to air contaminants leaves passively collect dust on their surface and absorb gaseous and PM pollution[7].

Dust trapping ability is determined by species-specific leaf's morphological and anatomical parameters such as trichomes and epicuticular waxes, which distinguishes one species from another [2,8–10]. Planting woody plants in urban areas is a novel, efficient, eco-friendly, and low-cost technology for pollution reduction. However, both species and location of pollution sources are critical in determining effectiveness[11,12]. Thus, applying plants to the aspect of pollution reduction should be adapted to the local conditions.

As we are encountering extreme circumstances in urban areas with rising stress from anthropogenic activities and the local knowledge of interaction between woody plants and pollution in Hungary is scarce. This study was carried to assess the characteristics of PM pollution and the ability of woody plants to capture heavy metal in fine PM in Budapest, which will provide useful information for future environmental management and better urban planning.

MATERIALS AND METHODS

Sampling site

Budapest is the capital city of Hungary, located on both sides of the Danube River and with about 2 million inhabitants [13,14]. It has a temperate climate with impacts from the oceanic climate and the Mediterranean climate[14]. The annual mean temperature is 11.3 °C. The annual average of total sunshine is 2010 hours and annual rainfall is about 516 mm, which falls mainly from May to June and autumn, with large temporal variability in each year (mean of 30 years 1981-2010) (www.met.hu). The study area, Buda Arboretum (47°28' LN; 19° 2' LE, 120 m above sea level) is located on the south slope of Gellért-Hill, Budapest (Figure 1). It is a suburban park that has 7.5 ha of planting area with around 1900 woody plant species[15]. *Acer platanoides* L. (Norway maple), *Fraxinus excelsior* L. Westhof's Glorie (common ash), and *Tilia tomentosa* Moench (silver linden) are common deciduous urban trees in East-Central European cities and are among the most frequently planted species in Budapest[16]. They are different in leaf surface structure (Figure 2). The *A. platanoides* leaf is bright green, glabrous, and lustrous beneath, bearded in the axis of the veins. *F. excelsior* has glabrous compound leaves with villous along the midrib beneath. The *T. tomentosa* leaf, on the contrary, is slightly pubescent above and with white tomentose beneath[17].

Figure 1. Sampling site: location of Buda arboretum (Source: ArcGIS)

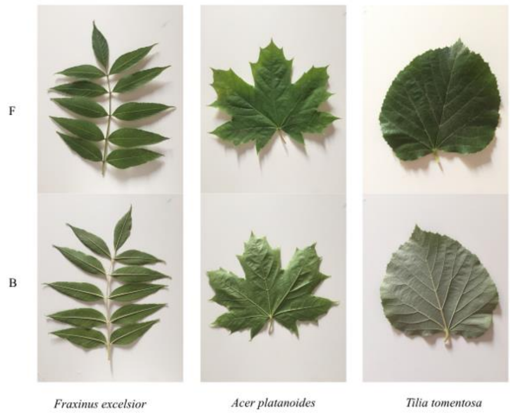

Figure 2. Leaf morphologies (F=Front side, B=Back side)

Sampling and sample analysis
The sampling times were May, July, and October 2019. Each sampling day was after a period of rainless days. To have a similar integration time of pollution, sampling trees are of similar age, height, and trunk diameter. We collected fully developed leaves with no spots or abnormal appearances. 45 leaves were sampled from 2-3 m height of the canopy, 2 trees from each species. All the samples were put carefully in paper bags and brought to the laboratory for further processing. Each sample, 25 leaves were measured by a leaf area meter AM350 (ADC BioScientific Ltd, UK). Real-time images and measured parameters were transferred to Excel files. Then we calculated the average leaf area of each species in square meters (m^2). Another 20 leaves were separated into two subsamples, soaked in 250 ml of distilled water for 20 hours and shaken in an ultrasonic cleaner (UC005AJ1 TESLA) for 10 minutes.

The solution is filtered by filter paper (pore size 2-4 μm). Then the fine particulate-containing suspension was evaporated to a constant weight. After washing off dust residues, leaves were naturally dried to a constant weight and grounded. All samples were chemically digested by using 4ml of 65% concentrated nitric acid for1hour at room temperature, then adding 2ml of 30% hydrogen peroxide and let stand still.

After deconstruction, the dust solution was diluted to 30ml and leaf solutions were diluted to 100ml. The Zn, Cu, Pb, and Ni contents of all samples were determined by an atomic absorption spectrometer (AURORA AI 1200-AURORA Instruments Ltd, Canada). The heavy metal content of the dust deposit was calculated at mg/m^2 of the leaf area and mg/kg of the leaf dry weight.

STATISTICAL ANALYSIS

We used the IBM SPSS 25 software package (SPSS Inc., Chicago, IL, USA) and Excel (Microsoft, Redmond, WA, USA) for statistical analysis. The dataset was firstly processed by the normality test. The normality of various was accepted as absolute values of Skewness and Kurtosis less than 2. The homogeneity of variances was tested by the Levene test. Based on data distribution, the dataset was standardized. Then the metal concentrations were compared by Multivariate ANOVA. If MANOVA was significant, we followed up Univariate-ANOVA with Bonferroni correction. Finally, Tukey's HSD post hoc tests were used if there was a significant difference. SPSS, ArcGIS 10.7 (ESRI, USA), and Origin (OriginLab Corporation, Massachusetts, USA) were used in creating figures.

RESULTS AND DISCUSSION

Physicochemical properties of the dust residue

Figure 3 shows a trend of Zn < Cu < Pb < Ni in the leaf $PM_{2.5}$ deposit in all species. Woody plant leaves are good indicators of heavy metal contents in $PM_{2.5}$ and are able to characterize the air quality in urban areas[18,19]. Aničić et al.,[18] Krutul et al.,[20] and Ţenche-Constantinescu et al.,[21] also stated that *A. platanoides, F. excelsior, and T.* tomentosa are suitable to use as bioindicators, but their capacities differ from one another. Zn was in the lowest concentration with an average of 2.20 mg/m^2 in all species. The content of Cu, an average of 4.84 mg/m^2, is also lower than Pb and Ni contents. This is because Zn and Cu have a similar source in the urban environment; they are ascribed to the metallic parts of cars, tire treads, tire dust, and engineer wear[9]. Furthermore, both of them are water-soluble elements and are easily washed off by rain[22]. In contrast, Ni and Pb were at a higher concentration and they also shown enriched in all three species (Figure 3). Since foliar dust is the most precise and direct indicator of the concentration of heavy metals in the atmospheric particulate matter and the quality of the air[23]. This can address the pressure from Pb and Ni in Budapest's air pollution. In line with the findings of Świetlik et al.,[24], we found that Ni and Pb emissions were very similar, with slightly less Pb than Ni. In the urban environment, Ni originates not only from fossil fuel combustion, stationary sources, the corrosion of cars, and motor vehicle parts but also from waste incineration[9]. Between 2010 and 2019, the total number of cars in Hungary increased dramatically, from 208,571 to 498,158 (www.oica.net). Ferenczi and Bozó[25], also stated that traffic emissions are one of the main factors determining the air quality of Budapest. There is no doubt that the mounting traffic nowadays in Budapest consequently raises the Pb and Ni content in the atmosphere.

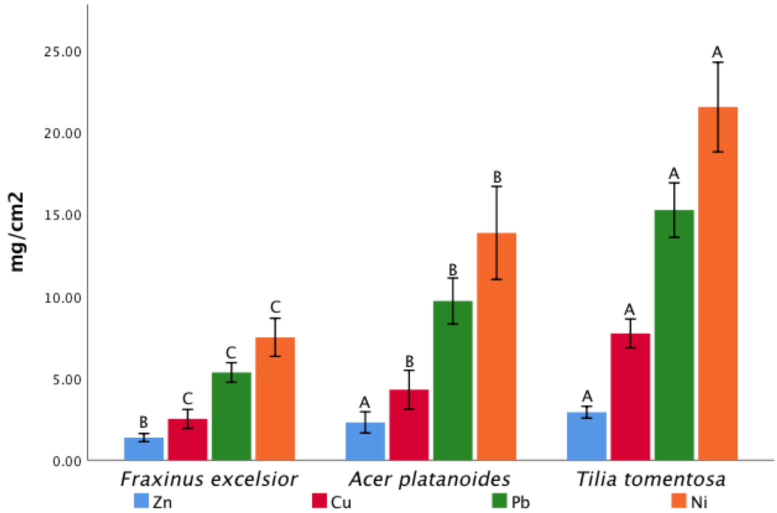

Figure 3. The mean content of heavy metals in leaf dust deposits

PM is mainly made of water-soluble ions, elemental carbon, organic carbon, and inorganic elements[26]. Wang et al.,[3] investigated 32 elements in $PM_{2.5}$ in Xiamen, China, and found the total elements were making up 1.37-16.15% of $PM_{2.5}$. In our study, the total percentage of four elements ranged between 0.28% and 2.37%. The average percentage of total heavy metal content of dust deposition is shown in Figure 4, where it is lower in autumn than in summer, despite the fact that total dust deposits were highest in the autumn season across all species (Figure 5). The element percentage shows a decreasing trend from spring towards autumn in *F. excelsior*, while *A. platanoides* and *T. tomentosa* show the highest percentage in the summer season. Wang (2020), also concluded the total metal element concentration in $PM_{2.5}$ was higher in the summer season than in the spring, autumn, and winter seasons. Because local resources, such as residential heating and traffic emissions, as well as meteorological conditions, influence PM2.5 concentrations in the air [25]. Therefore, the main determining factors in the autumn season are heating combined with unfavorable weather conditions.

Also, under humid and foggy weather conditions, water-soluble compounds comprise a higher percentage of the total PM[27]. In the summer season, traffic emissions are the key factor. Road traffic emissions, which can account for up to 66% of PM2.5, are one of the main sources of air pollution in urban areas[28,29]. Thus, woody plants are proper candidates to indicate PM pollution characteristics and the sources[26,30].

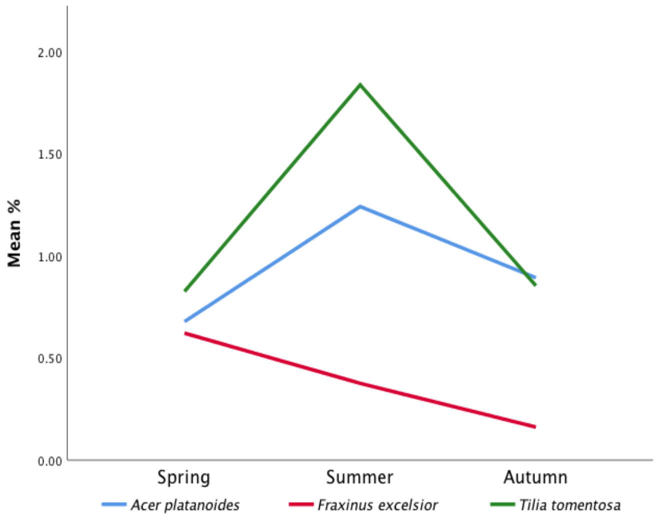

Figure 4. The mean percentage of heavy metals of dust deposit (%)

Dust trapping by different woody plants

Figure 5 lists comparisons in all sampling terms of the total element content in the dust deposits of different woody plants in Budapest. *T. tomentosa* contained the highest total heavy metal concentration in the dust deposit in each sampling term, significantly higher than the other species. Followed by *A. platanoides*, and the lowest is found in *F. excelsior*. In spring, *A. platanoides* showed no significant difference from *F. excelsior*. The biggest difference was in summer, when *T. tomentosa* captured 3.65 times more heavy metals in the leaf dust than *F. excelsior*. The statistical analysis revealed that the capture of atmospheric $PM_{2.5}$ by urban trees varied significantly by species and season[30]. The performance of total metal content in leaf dust deposits also confirms the data of Hrotkó et al.,[13] *T. tomentosa's* leaf surface has the highest ability to capture dust from the ambient, followed by *A. platanoides*, and then *F. excelsior*. Similarly, some studies have considered *T. tomentosa* as a future tree because of the great accumulative capacity of its leaves and the stronger tolerance to pollution marked it suitable as air pollution biomonitor and metal accumulation plant[21,31,32].

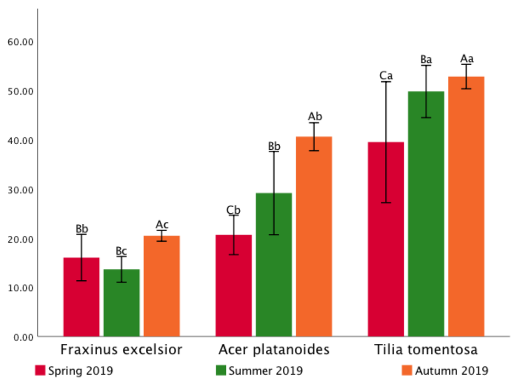

Figure 5. Total metal element contents of the leaf dust deposition (mg/m^2)

Note: Different letter represent significantly difference between groups (Tukey's HSD p<0.05). Lower cases are for comparison in species. Upper cases are for comparison in sampling time.

Moreover, meteorological changes also generate impacts on woody plants and $PM_{2.5}$ interactions in several ways. The weather in Budapest in autumn 2019 was calm and clear, anticyclonic, with wind speeds over 1 m/s at 1.5 m above ground, which is assumed to have a highly negative impact on the dust deposit on green vegetation[1,14,33]. However, Soudek et al.,[34] and Wang et al.[3] discovered a lower temperature day normal as well as higher PM in the air. It is because a cold period increased the intensity of communal heating and led to a larger emission of PM[13]. In our study, the autumn term may have been impacted by habitat heating.
We did not find a constant accumulation pattern by the factor of species, sampling time, and element (Figure 6). Even when exposed to similar sources and under similar environmental conditions, metal-accumulating plants are governed by individual species characteristics[35,36]. However, they accumulated higher amount in autumn season than in spring season. In the comparison of the relevant abundance of each element, *T. tomentosa* always has the highest concentration, followed with *A. platanoides*, and the lowest in the *F. excelsior*, but the differences ranged differently. The smallest difference was found in Zn among all the terms and species, in autumn season, 3.42 mg/m^2 in *A. platanoides* and 3.44 mg/m^2 in *T. tomentosa*. This can because of the emission sources and also plants are hard to trap Zn related particles. The biggest difference was found in the content of Ni in the summer season between *T. tomentosa* (23.57mg/m^2) and *F. excelsior* (6.55mg/m^2). Thus, based on the aforementioned results, we can conclude that *T. tomentosa* has a higher capacity in entrapping HM on the leaf surface than the other two species.

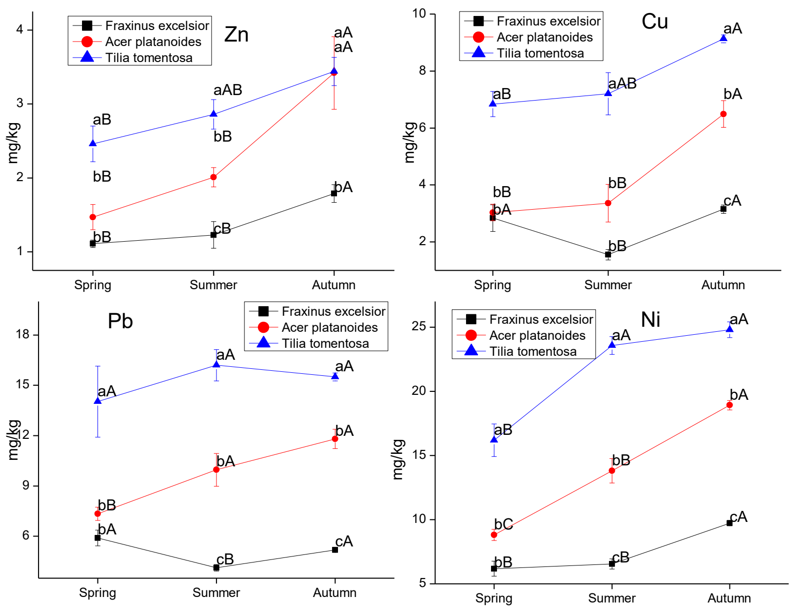

Figure 6. The course of HM content of the dust deposits from woody plant leaves surface
Note: Different letter shows significantly difference between groups (Tukey's HSD p<0.05). Lower cases are comparison in species. Upper cases are comparison in sampling time.

Corresponding to the PM accumulation species selection study, Sæbø et al.[37] also clustered *A. platanoides* in intermediate PM accumulation capacity group and *F. excelsior* in the lowest level. The leaves of woody plants in the urban area are highly exposed to atmospheric pollutions, their capacity in retaining dust also depends on several physiology factors. Trichomes on the leaf surface, size of stomata,

and stomatal density are the most influential factors in dust trapping [9]. As the surface of the leaves gets rougher, the elements' accumulation is increased due to their greater ability to trap particles.
Also, Emamverdian et al.,[38] demonstrated that trichomes functioned as metal storage. In the comparison of these three species, the leaf of *T. tomentosa*, with its branched hairy surface, big and stellar trichomes, retained the highest amount of dust on the surface[17,39]. And the larger size and high density of stomata *A. platanoides* contribute to its dust trapping capacity, while the smooth leaf surface and lower density of stomata on *F. excelsior* result in the lowest dust capture on the leaf surface[19].
Aničić et al.,[18] described that the amount of PM captured by deciduous woody plants was significantly increased during the vegetation period from spring (May) to autumn (September), which also corresponds to our study for *A. platanoides* and *T. tomentosa*. The total heavy metal content doubled in the deposited dust on the leaves of *A. platanoides.* The changes in *T. tomentosa* was not as huge as in *A. platanoides* but they increased from the spring to the autumn. As the leaf surface geometry is highly related to the PM interaction, the smooth leaf surface of *F. excelsior* may contribute to the decrease (16.03 -13.64 mg/m^2) in summer of element content by rain wash off or by wind blow.
In conclusion, different elements function differently for plant growth, and different physical characteristics as well as the air pollutant source are contributing to the accumulation of trace elements in the dust. Also, air pollutants, instead of remaining confined near the source of emission, spread over distances depending upon the topography and meteorological conditions, especially wind direction, wind speed, and vertical and horizontal thermal gradients[31]. Nevertheless, leaves with trichomes and rough or epicuticle wax on the surface have higher potentials for capturing dust[2,8].

The content of heavy metals in leaves

Statistics analysis results showed that there were no significant differences for each element between species (Table 1). Woody plants accumulate heavy metals in the leaf through leaf absorption and uptake from the soil as well[40,41]. The high concentrations of Pb and Ni are, to a large extent, the consequence of atmospheric deposition of particles and absorbed pollution[41]. In plants, the inorganic Pb is poorly absorbed while the organic compounds of Pb emitted from automobile exhaust are absorbed well and quickly, transported through the intercellular spaces of the leaves, and accumulated in the plant[40,41].

Also, Serbula et al.,[8] reported that branches and leaves of *Tilia spp.* were better biomonitors of airborne pollution with Pb than the other plant species. We also analyzed the correlation of the heavy metal content in the leaf and in the dust deposit, and results showed stronger correlations of each element and the total concentration in *T. tomentosa* (Table 2).

Although it is hard to determine their accumulating ability only by the concentration in the leaf because plant species, heavy metal concentrations in the environment, other environmental factors, and the plant physiological conditions could collectively influence the concentration of trace elements in plants. Nonetheless, based on the findings, we can conclude that the *T. tomentosa* leaf has a strong interaction with atmospheric $PM_{2.5}$ pollution.

Table 1. Heavy metal concentrations in leaves of woody plants (mg/kg)

Species	Zn	Cu	Pb	Ni	Total HM
Fraxinus excelsior	4.93±0.90	1.29±0.96	10.51±1.81	12.63±4.44	36.34±8.03
Acer platanoides	5.20±2.96	1.57±0.85	10.51±1.39	12.20±4.83	35.32±4.74
Tilia tomentosa	3.81±0.47	1.00±0.89	10.35±1.79	11.92±4.42	32.14±3.88

Table 2. Relationship of dust deposit-leaf heavy metals of woody plants

Leaf	Zn	Cu	Pb	Ni	Total HM
Fraxinus excelsior	0.837**	-0.687**	0.176	0.840**	0.523*
Acer platanoides	0.440	-0.688**	0.475	0.849**	0.711**
Tilia tomentosa	0.877**	-0.629**	0.548*	0.956**	0.926 **

*Note: Pearson correlation coefficient **. Correlation is significant at p<0.01 level (2-tailed). *. Correlation is significant at p<0.05 level (2-tailed).*

CONCLUSIONS AND RECOMMENDATIONS

Intensive anthropogenic activities are increasing air pollution in urban areas, which is threatening human health. Woody plants are not only important elements of urban environments but also contribute to human wellbeing in several ways. However, ideal urban trees have to meet more and more requirements, such as bearing shade, resisting drought, reducing air pollution, etc. We studied the interaction of urban woody plants' foliar and ambient heavy metal pollution through the investigation of heavy metal content in the leaf dust residue and in the leaves of three common woody plant species in Budapest. Results revealed that investigated woody plants are suitable for atmospheric heavy metal pollution monitoring and PM source analysis. Among the three examined woody plant species, *T. tomentosa* showed a higher capacity for accumulating all measured heavy metals on the leaf surface and stronger interaction with the leaf element content than *A. platanoides* and *F. excelsior*. Therefore, we suggested *T. tomentosa* as a better option for future urban landscape planting in Budapest. Nevertheless, since numerous factors can influence the interaction effects, further studies should be conducted to provide more accurate information and to discover the interaction mechanisms.

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USE OF ORGANIC POLLUTION INDICES IN THE EVALUATION OF THE PHYSICO-CHEMICAL QUALITY OF THE SURFACE WATERS OF WADI KEBIR-RHUMEL (NORTH-EAST ALGERIA)

Fouzia HIZIR[1], A. KRIKA[2], F. KESSASRA[1]

[1]Geological Engineering Laboratory (LGG), University of Mohamed Seddik Benyahia, Jijel, Algeria
[2]Laboratory of Biotechnology, Environment and Health, University of Mohamed Seddik Benyahia, Jijel, Algeria
Address: B.P.98 Ouled Aissa, 18000 Jijel, Algeria
e –mail:aminajijel18000@gmail.com
Phone: + 213 0790 18 14 56

Abstract:
Surface waters are subject to high anthropic pressure due to the development and expansion of agricultural activities as well as industrial and domestic activities. Pollution is a major environmental problem due to discharges into watercourses and the excessive use of agricultural fertilisers and discharges from urban and industrial sources. The objective of this study is to evaluate the quality and the state of organic pollution of the surface water of the wadi Kébir Rhumel which is considered as one of the most important wadis of the Algerian East and which is subjected to very strong demographic and industrial pressures, based on the organic pollution index (IPO) from the parameters determined during a sampling campaign carried out in July of the year 2020. Eight stations were studied along the wadi. The results obtained from this study indicate that the values of the organic pollution index show a high contamination at site (S8,S7and S6) and a very high contamination in the majority of the stations (S1, S2, S3, S4, S5). This anthropic degradation of the environment recorded much more in the four urban communes (El Milia, El Anser, Ain Smara and Constantine) would come from the use of nitrogen and phosphate agricultural fertilisers and especially from the discharge of untreated domestic and industrial wastewater from these communes.

Keywords*:* Oued Kébir Rhumel, Surface water, Algeria, Organic pollution index (IPO), Urban wastewater, Pollution.

INTRODUCTION

Rich in aquatic environments, Algeria is among the African countries most threatened by the scourge of water pollution **[1], [2], [3], [4]**. Water is a natural resource essential to life in any ecosystem**.** The knowledge of its quality gives a global view of the risks in order to ensure the protection of the resources and to determine the possible sources of water quality alteration **[5], [6].** Water sources can be mainly in the form of rivers, lakes, rainwater, groundwater, etc. In addition to drinking water supply needs, water resources play a vital role in various sectors of the Algerian economy such as agriculture, forestry, industrial activities, animal husbandry, hydropower generation, etc. The availability and quality of surface water has deteriorated due to some important factors such as population growth, pollution caused by industrialisation and urbanisation, etc. Water quality is an important criterion for meeting the demand and supply of water.

Ensuring a quality of freshwater that is adequate for human and ecological needs is therefore an important aspect of integrated environmental management and sustainable development. To give a clear picture of water quality, various water quality indices are used to assess the quality of surface waters. The organic pollution index IPO concedere as a very useful tool to make the right decision and to evaluate the degree of pollution and physico-chemical quality of these waters in time and space at the scale of the catchment area **[7], [8], [9].**

The present work is based on the use of organic pollution indices (IPO) according to the physico-chemical parameters of the surface waters of the wadi Kebir Rhumel which concedere as one of the most important wadi in the North-East of Algeria. The objective is to evaluate the quality and the state of organic pollution of the surface waters at the level of eight stations located upstream and downstream of the wadi during a campaign in the year 2020.

MAEERIALS AND METHODE

study area

The Kébir-Rhumel catchment area is one of the large hydrographic basins in Algeria, subdivided into 7 sub-basins with a surface area of 8815 km2 , with a maritime frontage of about 7 km, extending from the Seybouse catchment area in the east to the Setifian High Plateaux in the west (36° latitude North, 7° longitude East). The basin is limited:

- to the North by the two coastal basins of Constantine West and Centre.
- to the South, the Constantinois high plateaux basin.
- to the West, the Algerian-Hodna-Soummam basins and to the East the Seybouse basin **[10]**.

In this investigation, we are interested in the Kébir-Rhumel wadi, which is considered to be the most important watercourse in the Kébir-Rhumel watershed and in north-eastern Algeria (Fig. 01). 208 km long, it originates in the high plains of Setif (the region of Bellaa, wilaya of Setif). It occupies the upstream and downstream parts of the Kébir-Rhumelet catchment area and empties into the sea. Its waters are used for drinking water supply, industry and irrigation and it is characterised by distinct topographic, climatic, geological and hydrological contexts **[11].**

The study area has recently experienced a large population explosion accompanied by a difficult to control expansion of anarchic urban fabric, industrial and agricultural activities. The latter are the main sources of various liquid and solid discharges which are discharged directly into the wadi without any control and subsequently influence the water quality of the wadi as well as human health **[11].**

The present work is based on the use of organic pollution indices (IPO) according to the physico-chemical parameters of the surface waters of the wadi Kebir Rhumel (NO2, PO4, NH4 and BOD5). The objective is to evaluate the quality and the state of organic pollution of surface waters at eight stations located upstream and downstream of the wadi during the year 2020.

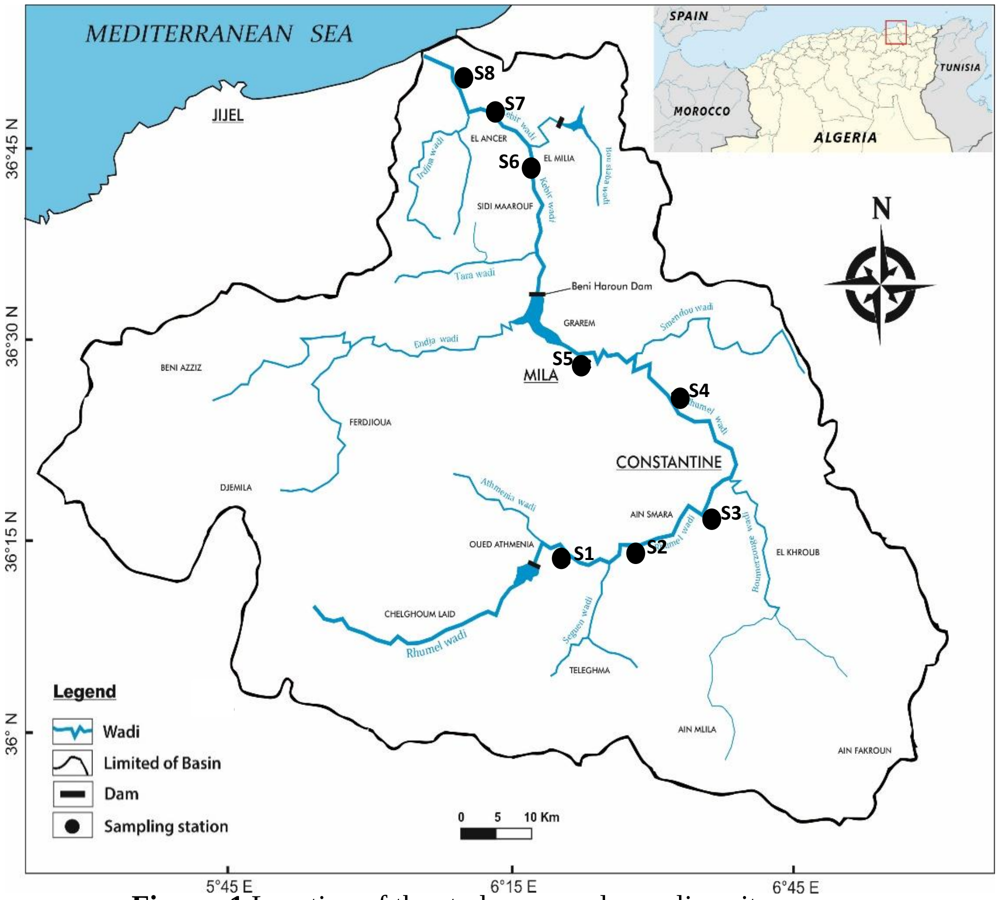


Figure. 1. Location of the study area and sampling sites

ANALYSIS METHODS

Water samples were taken monthly in July 2020 (Fig. 1) along the Kébir Rhumel wadi. At each of the eight stations, samples were taken at a depth of 15 cm and then packaged in polyethylene bottles. The bottles were cleaned beforehand and rinsed with water from the station before filling. These bottles containing raw river water were immediately preserved in ice cubes for transport and then placed in a refrigerator (4°C) for the analysis of physico-chemical parameters not measured in situ. Samples for physico-chemical analysis.
The estimation of pollution is evaluated by determining the biochemical oxygen content for 5 days (BOD5, BOD-meter), and the concentration of nutrients: Ammonia nitrogen, nitrite, and Orthophosphates by applying the molecular absorption spectrophotometry method of analysis **[12]**.

Calculation of the Organic Pollution Index (OPI)

By Leclercq (2001) **[13]** Organic Pollution Index (OPI) was also used to assess the organic load in the river. The OPI classifies the water quality into five (05) classes (Table 1). This index is obtained by means of the values of ammonium, BOD5, nitrite and phosphate. The principle of the calculation is to divide the values of the four pollutants into five classes and to determine, from the values obtained in the study, the corresponding class number for each parameter using the average data in Table 1.

The final index is the average of the pollution classes for all the parameters **[14].**

Table.**1**. Classes of organic pollution **[13], [14]**

Classes	**BOD5 (mg O2.L-1)**	**Ammonium (mg N.L-1)**	**Nitrites (µg N.L-1)**	**Phosphate (µg N.L-1)**	**0PI***	**Classes of organic pollution**
5	<2	<0,1	<5	<15	4,6-5,0	**Null organic pollution**
4	2,1-5	0,1-0,9	6-10	15-75	4,0-4,5	**Low organic pollution**
3	5,1-10	1-2,4	11-50	76-250	3,0-3,9	**Moderate organic pollution**
2	10,1-15	2,5-6	51-150	251-900	2,0-2,9	**High organic pollution**
1	>15	>6	>150	>900	1,0-1,9	**Very high organic pollution**

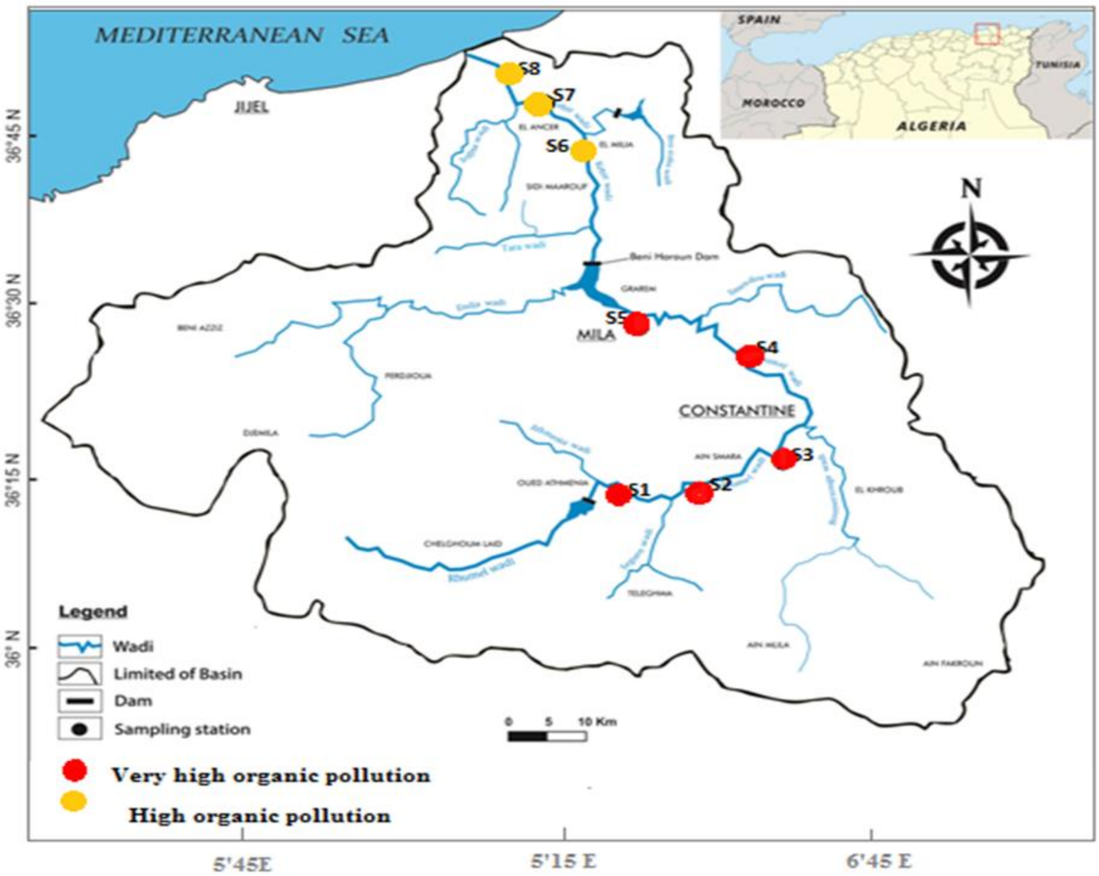
RESULTS AND DISCUSSION

Calculation of the IPO indices and assessment of water quality

After the calculation of the organic pollution index IPO using the results of the analyses of the pollution indicator parameters (NH_4, BOD_5, NO_2 and PO_4), the water quality class is determined for the thirty samples related to the eight sampling stations (Tab.2 and Fig.2). Thus, five organic pollution classes (no organic pollution, low, moderate, high and very high) were identified during the July 2020 campaign.
The analysis followed in the different stations was subject to a data processing by the establishment of a thematic map of organic pollution of the surface waters of Wadi Kebir Rhumel during the sampling campaign. It provides information on the spatial distribution of surface water quality through the organic pollution index IPO.
The interpretation of the organic pollution index map of natural waters (Figure 2) indicates the degree of alteration of the waters in the study area. It can be seen that the waters go from one quality to another (strong organic pollution to very strong organic pollution) and we notice the dominance of the strong pollution (Tab. 2).
Thus, all along the Kebir Rhumel wadi, a variation in the organic pollution index (IPO=1; 1.5 and 2.25) can be observed, due to the variation in the flow of wastewater from the different agglomerations into the receiving environment as well as agricultural runoff.
Upstream of the wadi (S1, S2, S3, S4 and S5) carry a high organic load, degrading its quality, which is explained by the high discharge rate, the runoff from agricultural land and also the low environmental oxygen contentaa. Stations S6, S7 and S8 have a relatively lower pollution balance compared to the previous stations. This is due to the release of water from the dam, which has allowed the dilution of the pollutants, and also to the low flow of the discharges.

Table.2. Calculation of the mean of OPI and the quality class of surface waters of Kebir wad.

Stations	IPO	Water quality
S1	1,5	**Very high organic pollution**
S2	1,5	**Very high organic pollution**
S3	1	**Very high organic pollution**
S4	1	**Very high organic pollution**
S5	1,5	**Very high organic pollution**
S6	2	**High organic pollution**
S7	2	**High organic pollution**
S8	2,25	**High organic pollution**



Figuer.2. The thematic map of the organic pollution index OPI of the surface waters of Kebir wadi east, within the comapins of July 2020.

DISCUSSION

The interpretation of the organic pollution index map of natural waters (Figure 2) indicates the degree of alteration of the waters in the study area. It can be seen that that the waters pass from one quality to another (strong organic pollution to very high organic pollution) **[15].**
The pollution status of the surface waters of Wadi Kebir East, calculated from the organic pollution index OPI, shows that 37% of the stations (03 stations) represent a high organic pollution (2<IPO<2.25). The exception is the 5 stations (S1, S2, S3, S4 and S5), representing 62% of the stations, which show a very high organic pollution ($1 \leq OPI \leq 1.5$) (Tab.2 and Fig.2).
This pollution is mainly related to the relatively high concentrations of BOD5, which exceed the WHO standards of potability (3 to 5 mgO2/l). This high BOD5 content is explained by low aeration, which is due to the consumption of dissolved oxygen by micro-organisms for the degradation of organic matter. he deterioration of water quality at all stations along the Wadi Kebir Rhumel is due to agricultural activities and wastewater discharges, agricultural activities and water waste without any prior treatment **[5], [16].**
The waters of the Oued Kébir Rhumel are very polluted at the level of the different stations, because of the very high concentrations of nitrates, ammonium and BOD5 which exceed the WHO norms of potability of 0,5 for Ammonium, 50mg/l for Nitrates, 0,1 mg/l for Nitrites and (3 - 5)mg/l for BOD5.
This deterioration is essentially anthropogenic and linked to agricultural activities, through runoff from fertiliser-laden land and urban wastewater **[17].** Similar research has shown that the increase in the degree of pollution in summer would be relative, without any doubt, to the decrease in the flow of the wadi, thus hoping that those of the full flow of domestic and industrial wastewater effluents coming from the different urban centres remain important.
These results are comparable to those obtained by Talhaoui et al **[7]** and El Hmaidi et al **[8]** at the Wadi Moulouya, in the north-east of Algeria. Wadi Moulouya, north-east Morocco **[16]** .

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, the excessive quantities of Ammonium and Nitrites, Phosphates, BOD5 in the waters of the El Kebir Rhumel wadis are the main cause of such pollution, the origin of which seems to be much more urban; wastewater in particular containing large quantities of nutritive substances such as organic matter favours, through its discharge, the rapid and continuous growth of algae and aquatic plants. and continuous growth of algae and aquatic plants.

Pollution is a serious problem for the environment due to discharges into the wadi and the excessive use of fertilisers in agriculture. The degree of pollution varies The degree of pollution varies from one area to another, with levels sometimes exceeding those recommended by recommended by the WHO. Water, with its high dissolving power, dissolves the substances released by human activity. human activity. The chemical pollutants are numerous and of diverse origins and the most harmful are nitrogen compounds such as nitrites, which cause serious serious disorders in young vertebrates through the degradation of haemoglobin and the production of toxic methaemoglobin (infant methaemoglobinaemia). They can cause hypertension and are precursors of carcinogenic nitrosamines **[18, [15].**

RECOMMENDATIONS

Inform and sensitise farmers on the use of fertilisers and pesticides along the wadi and particularly the upstream part (S1).
Avoid direct discharge of wastewater into the wadi without treatment and install treatment plants to control industrial and domestic discharges.

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ECOSYSTEMS AND LANDSCAPE FOR THE FUTURE GENERATIONS

Mythili MADHUSUDHAN

School of Architecture, Meenakshi College of Engineering, Chennai, Tamil Nadu – India

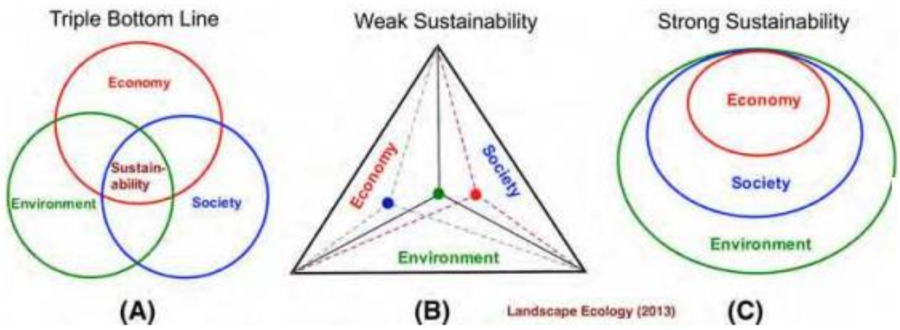
***Abstract**:*
In India, there are varying water scenarios. In fact, most resources that we depend upon are getting depleted at an alarming rate.
The global system is entering a new epoch—the Anthropocene—which is characterized by significant global environmental impacts mainly driven by human activities.
Since the advent of the industrial revolution approximately two centuries ago, the world population has increased exponentially, technological advances have mushroomed and the overall material well-being has improved substantially.
However, it is this spectacular success that has, perhaps unnecessarily, resulted in the many pressing environmental problems troubling the world today— biodiversity loss, ecosystem degradation, and climate change, to name a few.

Respected ladies and gentlemen and researchers and speakers: This is an immense opportunity for me to elaborate on current updates and future prospects for future generations on ecosystems and landscape, and I thank you all for the same. By profession, I am a teacher in the field of landscape and urban planning. My research has taken me further into the inter-disciplinary demands of the profession.

In India, where I come from, there are varying water scenarios. Some places have an abundance of water and some others have insufficient water. In both cases, urban and regional flooding is caused by precipitation. In fact, most resources that we depend upon are getting depleted at an alarming rate. The global system is entering a new epoch—the Anthropocene—which is characterized by significant global environmental impacts mainly driven by human activities. Since the advent of the industrial revolution approximately two centuries ago, the world population has increased exponentially, technological advances have mushroomed and the overall material well-being has improved substantially. Human ingenuity has proven exuberant, indeed. However, it is this spectacular success that has, perhaps unnecessarily, resulted in the many pressing environmental problems troubling the world today— biodiversity loss, ecosystem degradation, and climate change, to name a few.

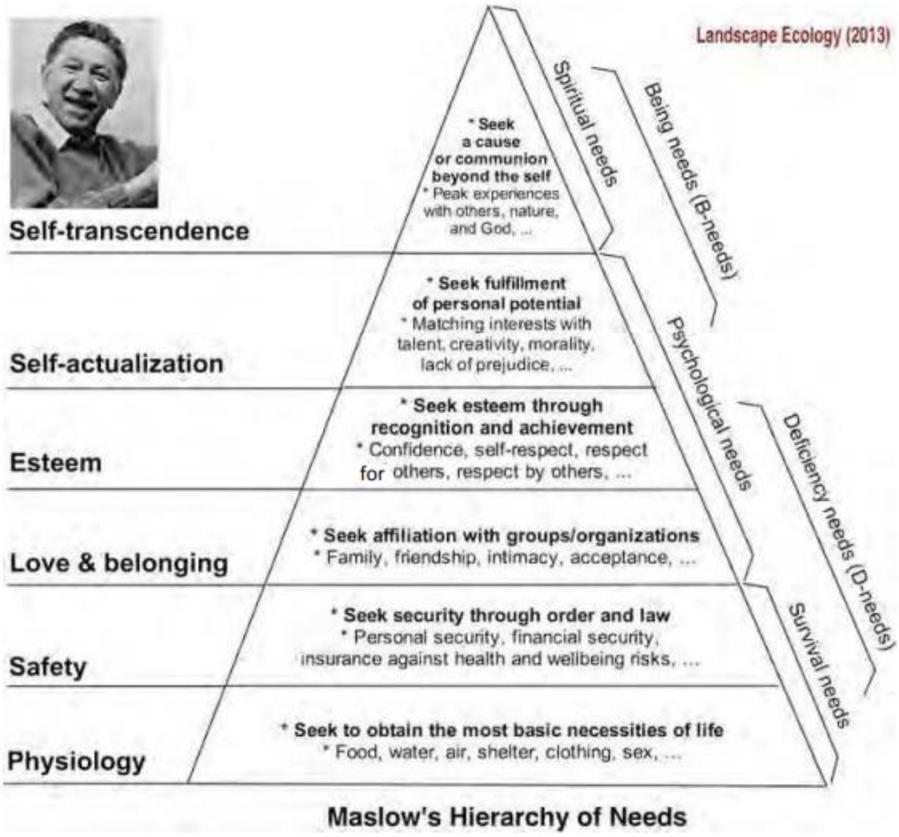
This brings to the forefront the popular buzzword of this era – "sustainability". According to Online Etymology Dictionary, the word ''sustainable'' first appeared in the 1610s, meaning ''bearable'' or ''defensible,'' and only acquired the connotation of ''capable of being continued at a certain level'' in 1965. The word ''sustainability'' emerged later in 1907, used in reference to a legal objection, and it did not acquire its contemporary meaning of the ability to sustain or to be sustained until 1972 - as a term that encompasses environmental, economic, and social dimensions.

The triple bottom line (also known as people, planet, and profit) was coined in 1994 by John Elkington, Co-founder and Chair of SustainAbility, a British business consultancy founded in 1987 (Elkington 2004). Inspired by the Brundtland Report, which was previously the universal authority on defining sustainability, TBL was proposed as a catchy term to emphasize that economic activities have important social and environmental consequences for which corporations must assume responsibility



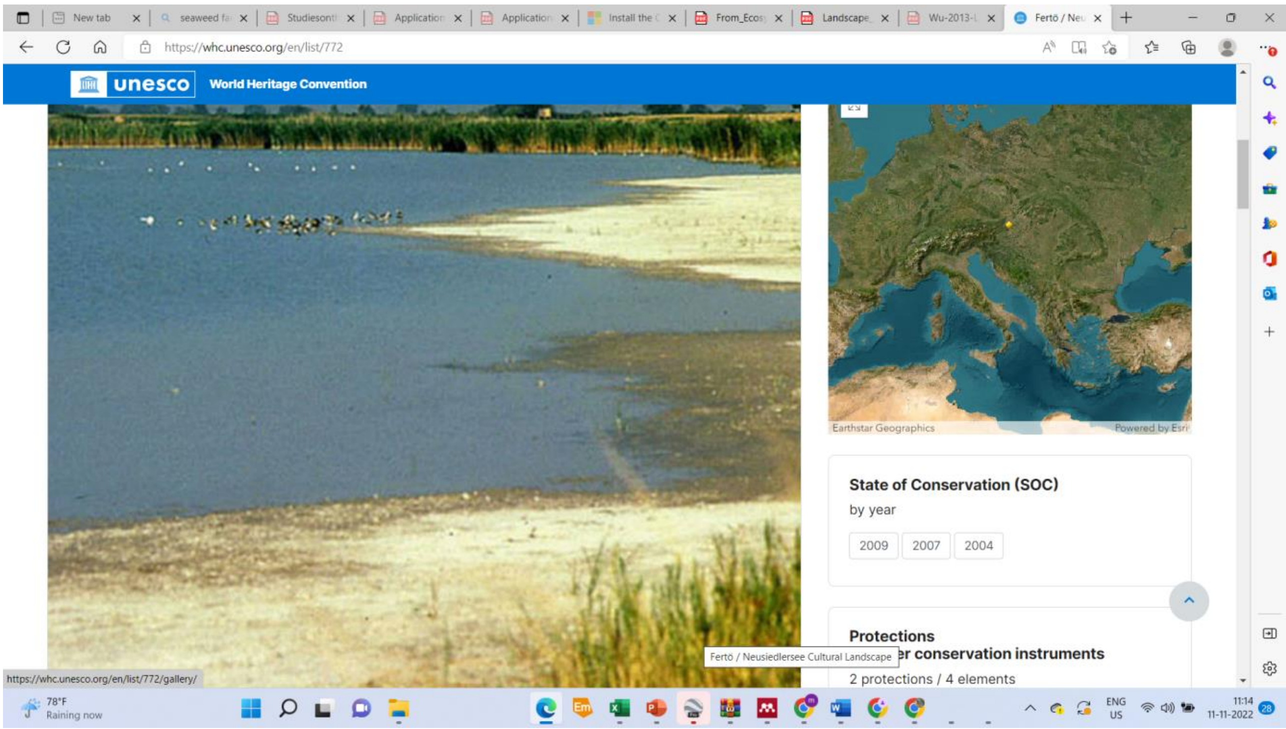
Sustainability is evidently an anthropocentric concept—focusing on meeting human needs of the current and future generations within the limits of the environment. But humans have many needs that vary with socioeconomic status, cultural traditions, and individual lifestyle and preferences

Maslow's hierarchy groups human needs into six levels in a descending order of prepotency: physiology, safety, love and belonging, esteem, selfactualization, and self-transcendence. High-level needs in Maslow's hierarchy are closely related to culture, values, and beliefs.



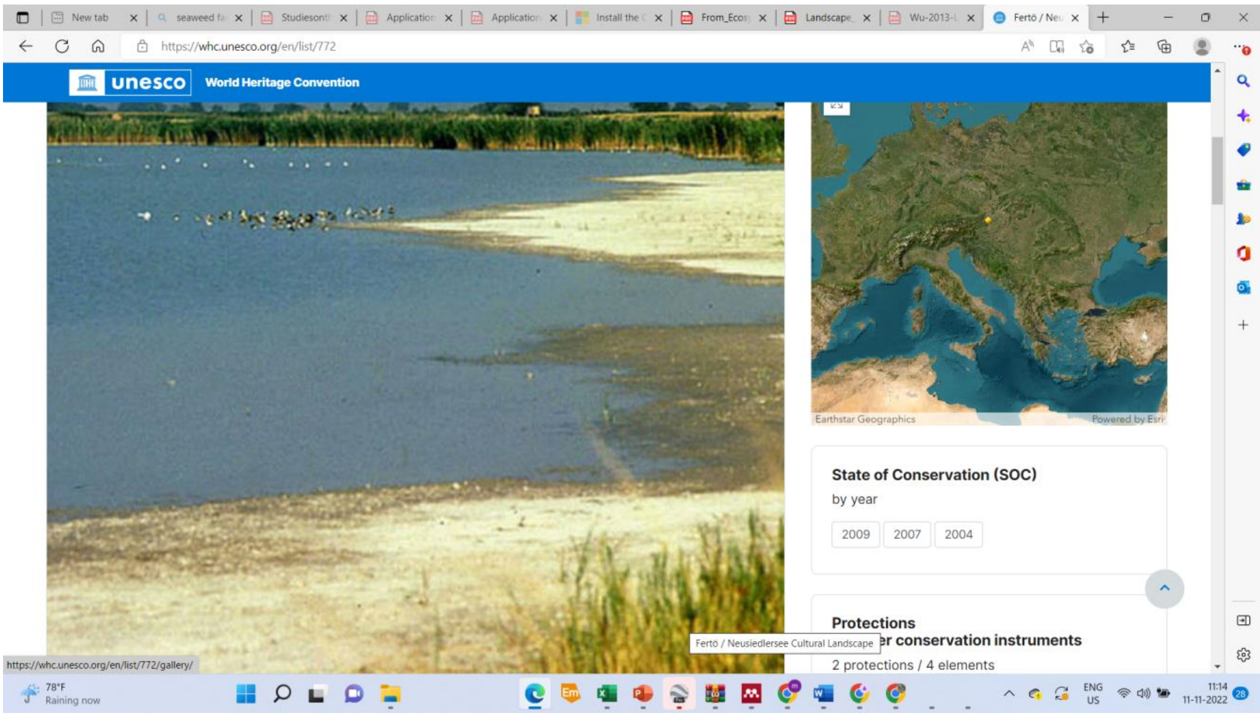
Even if we talk about physiological needs like food, water, air, shelter and the aspect of resources, man's intervention to satisfy his higher needs play a significant role in the activities which shape our daily lives. Do we need to conduct huge weddings to celebrate growth in the family, and let it be accompanied by a huge

wastage of resources? People, acquire property and build houses, unaware of whether they are on sensitive lands. Our research on certain wetlands in the city of Chennai, Tamil nadu, India, are focussed on a social-ecological approach. We have tried to explore the social angle by economic justification of restoration of the wetland, and the results of these studies go to show that we are very far from achieving our SDGs, both as a developing nation and as a community that lacks awareness.



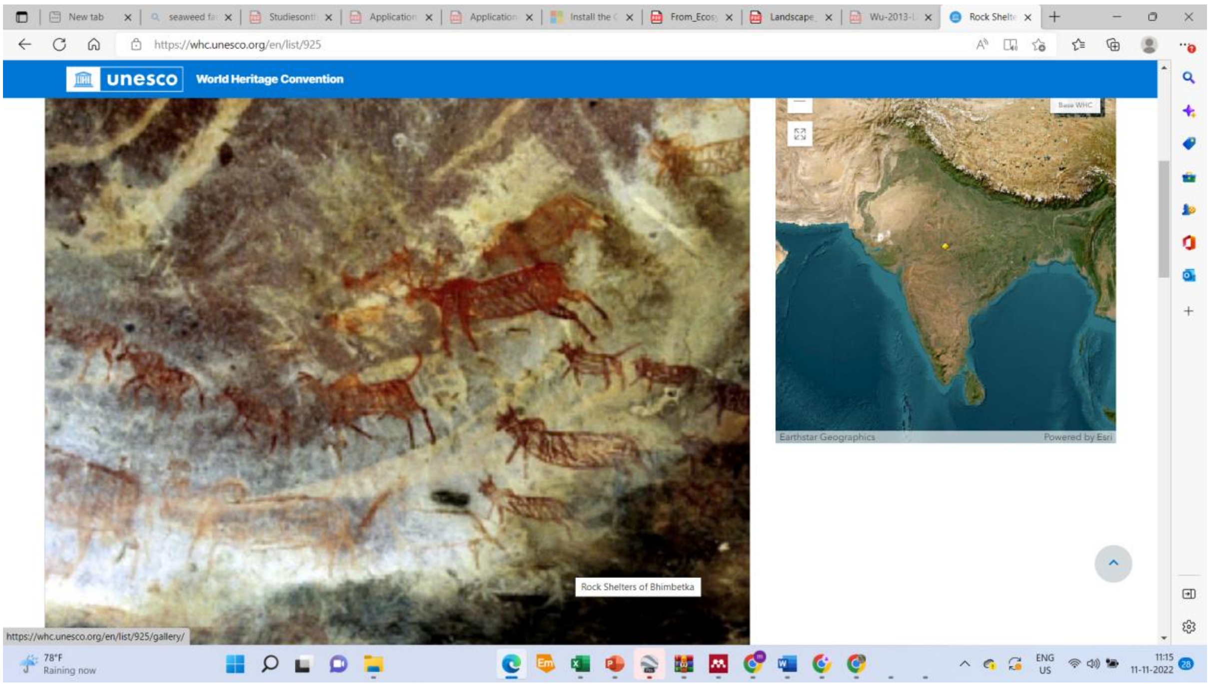
In the past decades, there have been agricultural disasters like salinity in Australia, the dust bowl in Canada and the US, biodiversity issues like elephant slaughter, deforestation, environmental threats to coastal reefs, bubonic plague, health effects arising from the September 11 attacks, industrial disasters like smog, land contamination, chemical spills, collapse of mines, dam breaches, landslides, oil spills, nuclear disasters like the Chernobyl disaster and the Soviet Submarine accident, disasters related to air like dust-storms, hazes, oil fires, burning of the Amazon forest, soil erosion, toxic waste dumps, polluted water, draining and development of marshes like the Everglades and loss of many wetlands. These are a direct effect of anthropogenic activities, impacts on natural, mineral resources and humankind and biodiversity are unmitigable and present a very depressing scenario.
On the other hand, there have also been positive growth evidences in landscape and ecosystem ecology. For instance, cultural landscapes, the world over, have been recognized and preserved for generations to come, like the following examples from Hungary and India.
To date, 121 properties with 6 transboundary properties (1 delisted property) on the World Heritage List have been included as cultural landscapes.
The Fertö/Neusiedler Lake area has been the meeting place of different cultures for eight millennia.

This is graphically demonstrated by its varied landscape, the result of an evolutionary symbiosis between human activity and the physical environment. The remarkable rural architecture of the villages surrounding the lake and several 18th- and 19th-century palaces add to the area's considerable cultural interest.
Much of the value of the area lies in its genuinely unchanging qualities of the way of life, the preservation of vernacular architecture and a landscape based upon a traditional and sustainable exploitation of a limited range of resources. Though tourism is both a change and a catalyst thereof, associated development and insertion of the intrusively modern construction will need to be controlled.
Maintaining these characteristics and the conditions of integrity will entail the development and enforcement of guidelines and zoning regulations to ensure that new development does not occur on open land and that it respects the form and scale of traditional buildings.



The Rock Shelters of Bhimbetka are in the foothills of the Vindhyan Mountains on the southern edge of the central Indian plateau.
Within massive sandstone outcrops, above comparatively dense forest, are five clusters of natural rock shelters, displaying paintings that appear to date from the Mesolithic Period right through to the historical period.
The cultural traditions of the inhabitants of the twenty-one villages adjacent to the site bear a strong resemblance to those represented in the rock paintings.

Bhimbetka reflects a long interaction between people and the landscape, as demonstrated in the quantity and quality of its rock art. Bhimbetka is closely associated with a hunting and gathering economy as demonstrated in the rock art and in the relicts of this tradition in the local tribal villages on the periphery of this site.
Technological advancements in landscape research uses data including satellite data to discern information on the geographical resources. Various remote sensing and GIS tools have been helping immensely in this front.
Landscape ecologists use remote sensing for three principal reasons: (1) to quantify landscape structure based on classified imagery; (2) to identify landscape change and its impact and make future predictions using statistical models; and (3) to quantify landscape function.



Landscape structure is the spatial arrangement of landscape elements, such as land cover types and forest patches. Landscape change refers to the changes in the landscape structure over time and space. Landscape function is the interactions between landscape structural elements, whether through ecological processes or energy flows, such as the interactions between animal migration routes and forest connectivity

For analyzing landscape function, advances will be made in landscape ecology by using new remote sensing data sources and analyses to quantify interactions between landscape structure and ecological processes (e.g., land cover type and population movement).

Calls have been made to shift habitat assessments from categorical indices (e.g., low, medium, and high) to continuous values (e.g., 0–100) to better evaluate impacts of landscape change on biodiversity and incorporate error quantification into landscape ecology models. Landscape ecology studies that incorporate remote sensing images can also incorporate data from non-remote sensing sources like crowdsourcing, participatory research, and other existing geospatial datasets. For example, landscape ecologists can incorporate geolocations of bird sightings collected by citizen scientists in eBird in combination with vertical vegetative structure data from lidar to improve models

analyzing species distribution or biodiversity. Additionally, the fusion of data and imagery from multiple sources can increase spatial, temporal, and spectral resolutions by updating the data cube with the finest resolution data available to better analyze landscape processes.

This promises a lot of positive activity in the fields of landscape and ecosystem ecology. The difference between the two is that landscape ecology is more spatial and ecosystem deals with interaction between various species. One is more horizontal and the other is vertical. Managers, policy planners and researchers can address the concerned issues with greater enthusiasm if the knowledge is made accessible to all and awareness is created. Problems of anthropogenic origin such as pollution, illegal occupation of land, water wars, accidental disasters can be thwarted if knowledge is disseminated and people act in a more responsible fashion. This is the route to self-actualization and self-transcendence as advocated by Maslow.

Wouldn't you want to preserve endangered species of butterflies and bees and bisons? Wouldn't you want to make available access to exotic landscapes for one and all? Wouldn't you want poverty to be eradicated by provision of clean water and hunger abatement by agricultural developments? Wouldn't you want every citizen to be aware of his surroundings, his potential for sustenance, his moral obligations to the environment and the ecosystem? Management and policy planning need to be directed to each of these sectors to the benefit of all humankind. This is the direction towards achieving SDGs and preserving resources for future generations. With this, I would like to thank you for this opportunity to share my thoughts on ecosystems and landscapes for the future generations.

WATER JET AND ITS ENVIRONMENTAL PROBLEMS

Lydia SOBOTOVA[1], Tibor DZURO[1], Miroslav BADIDA[1]

[1]Technical University of Košice, Faculty of Mechanical Engineering, Institute of Industrial Engineering, Management and Environmental Engineering, Department of Environmental Engineering, Košice, Slovakia,*
e-mail: lydia.sobotova@tuke.sk, tibor.dzuro@tuke.sk, miroslav.badida@tuke.sk
telephone: +421 55 602 2793, +421 55 602 2673, +421 55 602 2716

Abstract.
The presentation deals with water jet and abrasive water jet technologies. The maintenance and garnet and impurities removal after cutting operations are factors that also influence on environment. Common methods of garnet removal include expensive pump trucks, manual dig outs employing labour and shovels, mini-excavators, and back hoes. Alternatively, an investment in a garnet removal system can reduce many of the high costs associated with some of these cleaning methods and allows the waterjet operator to gain control over when and how frequently the garnet removal process will be performed. The environmental problems as noise, vibration, consumption of energy is known. The presentation gives us an overview of possibilities for removing waste from the production process. There are presented various methods for abrasive and water cleaning.

***Keywords**: water jet, abrasive, impurity removal, environment*

INTRODUCTION

The global environmental trends lead to utilizing of so called „clean technologies“ with minimum environmental impact. The analysis of the system of separating and recycling abrasive material from a fluid in abrasive water jet cutting process was the aim of the research. The research has been conducted with process condition, environmental approaches and high effectiveness of the technology. Technological process concerned with water jet cutting and the next waste elimination or waste treatment, in a view of high environmental demands, represents increasing demanding system for energy reducing, too. It is necessary to analyse environmental aspects of technological jetting process with abrasive material after cutting and the next recycling.

There is a close connection between using abrasive materials in Water technology and abrasive material recycling regarding to waste elimination. In the case Abrasive Water Jet, if the abrasive material is stored on scrap heap, the additional expenses are required. There is an environmentally harmful material mixed with mineral oil and with indefinable chemical composition. If it uses the recycling process in the actual application area, then there is no problem with the process security and the efficiency can be higher and the determination of optimal conditions reducing the manufacturing cost. The direct processing of production waste into re-usable material is a big advantage. [1]

ENVIRO

NMENTALISTIC REQUIREMENTS OF WJ AND AWJ TECHNOLOGIES

Based on the stated complex specification, a graphic complex model of hydro-erosion factors categories called as model KMKFJ 1 (Kmec´s model of hydroerosion factors categories – No. 1) shown in Figure 1. was created. [1]

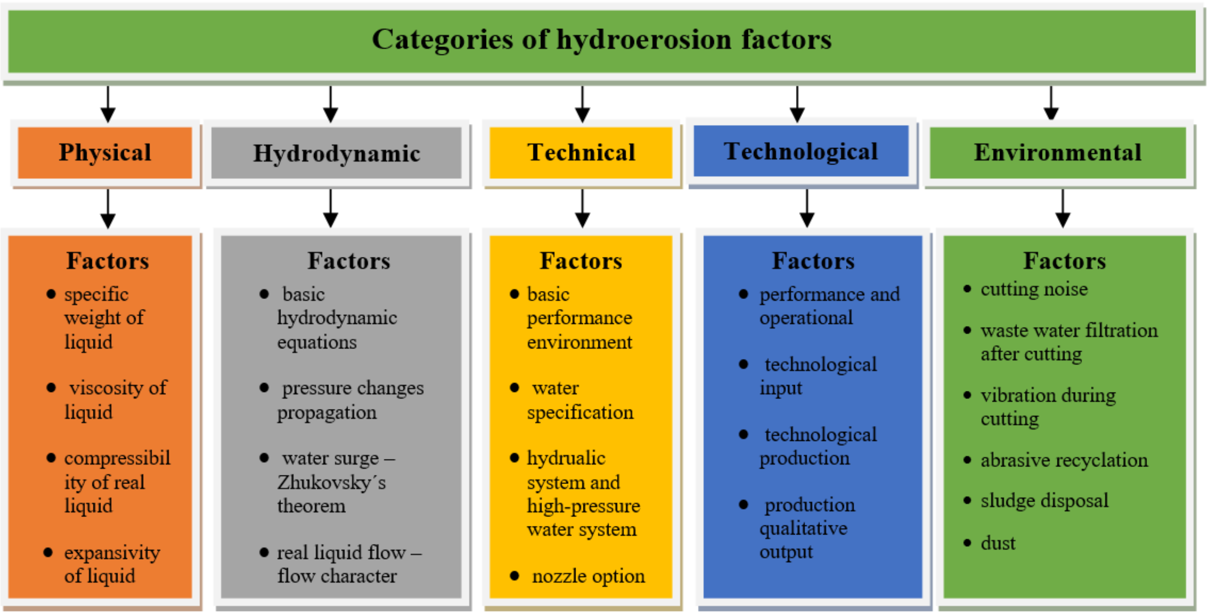


Figure 1. Graphic complex model of hydroerosion factors categories – model KMKFH 1 (Kmec´s model of hydroerosion factors categories – No. 1) [1]

From point of view of water jet technology, liquid (water), solid phase (abrasive) and suspension (a water jet with abrasive) are relevant for analysed purposes. After production, there is needed operations:

Waste water filtration after cutting,

Abrasive recyclation - After hydroabrasive cutting, abrasive used for cutting is caught in the desk cutting tank. Abrasive, most utilized one, called Garnet can be recycled very well and from 1 ton of abrasive 550 kg of recyclate can be obtained back. [1]

Dust, Aerosols - Dust during cutting is generated mainly at beginning of cutting, during cutting interruptions and consequent material perforations. Particles of cutting medium and abrasive are released into the surrounding.

Sludge disposal - Abrasive material being caught into the desk tank after cutting can be disposed as a construction waste because it basically contains fine abrasive dust mixed with abrasive sludge.

The stated environmental factors represent compact and in practice verified process of problem solving in relation to their impact to environment. Not all factors are discussed in general in every operational site because there is not a unified regulation and every operator using above stated technology deals with environmental problems individually.

Partial targets are:
to unload an exploitation of abrasive natural sources, water and energy,
to reduce an import of the abrasive into countries EC,
to improve quality of life and health by preserving the environment,
to create economic and ecological contributed device, able to compete overseas solution.

The use of mineral particles as abrasive material has negative environmental aspects that involve additional processes for manufacturers. Waste is produced both by the mixture of abrasive particles and water used for jet generation and the material spills mixed with particles produced during material cutting. Thus, managing the waste produced during the AWJ implies complicated additional processes. [2]
Abrasive particles are seldom re-used. Once there are used, there are smashed in very tiny particles, becoming less productive than the original abrasive particles. The recycling process consists on introducing the abrasive into an oven, to take the water away and get dry abrasive. As a result, end-users currently prefer buying new abrasive instead of recycling it.
The high amount of waste spills produced during the process means huge quantities of waste after all the year, which incurs besides in high economical costs. In an AWJ company with an average of 3 machines, approximately 24 Tn of abrasive are spent every 3 or 4 weeks. That is equivalent to a consumption of 360 t per year, with an economical cost of 95.400 €, Table 1. [3].

Table 1
Abrasive and Water consumption of 1 machine per year [3]

Abrasive and Water consumption of 1 machine per year				
Abrasive	g/min	kg/day	kg/month	t/year
	500	270	6480	75,6
Water	l/min	l/day	m^3/month	m^3/year
	3	1620	38,88	453,6

Due to the waste produced, water runs through an open circuit, which means no reusing of the water, Figure 2.

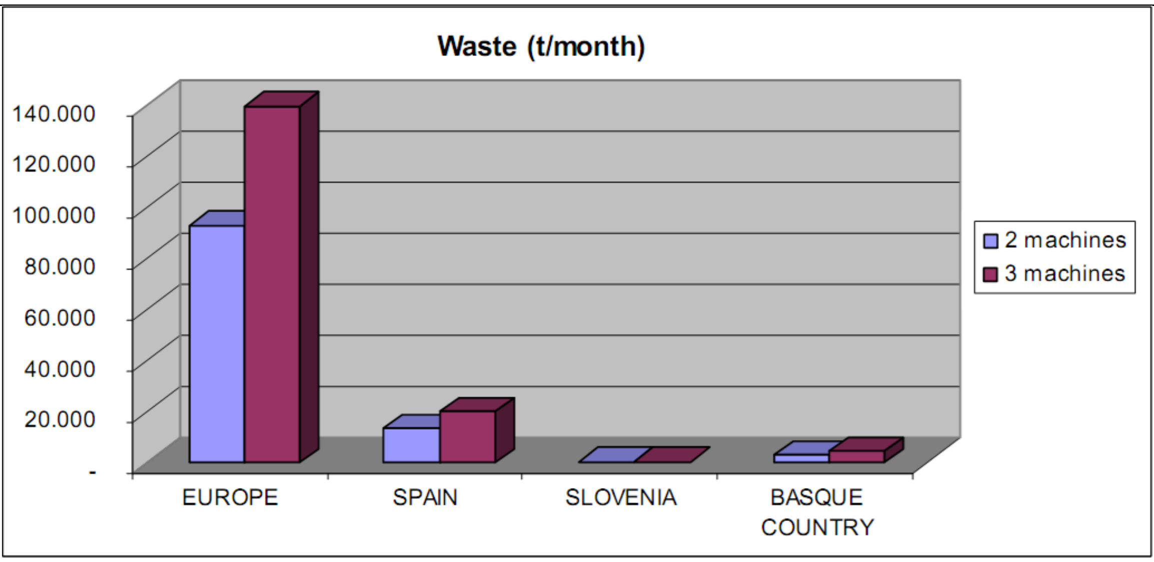


Figure 2. Yearly amounts of abrasive and water consumed by the AWJ machines in Europe [3]

WASTE WATER AND ABRASIVE TREATMENT

The environmental approach is a very important problem after water jet cutting connected with water and abrasive material. Environmental resources are limited, too. In the process two types of waste are produced:

- waste water,
- slime, sludge.

There is waste water, usually intend after drafting from working and for a further cleaning, technical modifying and using. The slim is the second important compound and consists of the abrasive grain particles and the microscopic machining particles. A Water Recycling System, or rather, a Closed Looped System for an abrasive waterjet cutting machine is a system that recycles the cutting water from the waterjet cutting process providing for zero discharge of wastewater. These systems are contained separately and can be installed/deinstalled from existing waterjet system very easily and at anytime. They consist of sediment catching weir tanks, filters, de-ionisation vessels, and organism killing devices that purify the water before returning it to the high pressure pump for reuse in the cutting process. These systems also include a 1 or more pumps to circulate the water and require a chiller to reduce the water temperature as the process of cutting creates an enormous amount of friction and thus, heat. However they do not remove abrasive settled into your machines catch tank they merely recycle the water. A separate abrasive removal method is required to keep your catch tank clean and/or prevent abrasive dig-outs. Common methods of garnet removal include expensive pump trucks, manual dig outs employing labour and shovels, mini-excavators, and back hoes. Alternatively, an investment in a garnet removal system can reduce many of the high costs associated with some of these cleaning methods and allows the waterjet operator to gain control over when and how frequently the garnet removal process will be performed. [5]

TYPES OF GARNET REMOVAL SYSTEMS FOR WATER JET MACHINES

There are several garnet removal systems in the marketplace today. Some will pump garnet slurry from your tank into a settling bin, where the relatively clean water is pulled off the top and returned to the tank after the heavier garnet sinks to the bottom. Periodically, when the bin is full, it is dumped and the "pump, wait to settle, and then return to tank," process is repeated. These systems have very slow removal rates, are prone to plugging, have high maintenance costs and return the fine particles back to your tank or, worse yet, down into your drain lines-which can cause expensive clogging. Other removal systems pump garnet slurry through a separator to achieve much faster garnet removal rates, but expose the operator to high maintenance costs as the sharp edges of the garnet eat up pump impellers and the slurry contaminates critical pump shaft bearings.
Removal system can be divided as:
permanent ones, which are designed together with WJ machine,
non-permanent ones, which can move from the place to place and used when is necessary.

The **parts of removal systems** are [1, 4, 5, 7]:
<u>Abrasive Removal System</u> - Continuously removes abrasive that collects inside the catch tank.
<u>Abrasive Bag Hopper</u> - Collects spent abrasive in a easy to service removable bag.
<u>In-Tank Sweeper Package</u> - Placed inside the catch tank to keep the abrasive from settling out and maintains optimum performance on the Abrasive Removal System.
<u>Settling Weir System</u> - Allow optimum Time to settle abrasive before entering Closed Loop Filter System.
<u>Closed Loop Filtration System</u> - Filters and Treats Table overflow water for reuse by the High-Pressure Pump
<u>Chillers</u> - Maintains a consistent temperature for cutting water and Closed Loop Filter System.
<u>RO Water Treatment System</u> - Recommended to treats Incoming water quality greater than 250 ppm

Also, it is important to note that these systems can be installed and de-installed very quickly and simply on any machine as they are stand-alone units only requiring a few hose connections, however once installed they must be turned on and operable in order to provide sufficient water flow to your waterjets pump.
The most famous examples of a water recycling system for an abrasive waterjet cutting machine are shown in the Figure 3., Figure 4., and Figure 5.

Figure 3. WARD water treatment apparatus [1]

Figure 4. The Closed Loop Filtration System Model Model #CLS-138 [5]

Figure 5. Mini hopper [1]

A Closed Loop/Water Recycling System for an Abrasive Waterjet Cutting System provides several benefits to the waterjet user including [5]:

Provides the best possible water to your high-pressure pump greatly increasing seal life to 1000 hours or more.
Reduces water consumption to near ZERO (Over-splash and evaporation are the only water losses).
Increases/Boosts incoming water pressure.
Eliminates the need to run/plumb water supplies and drains (however machine must be topped off daily to provide for water losses due to evaporation).

There exist lot of methods and systems of water and abrasive recycling. The most famous systems are:
System with suction with one permanent pipe in the middle of tank, Figure 6.,
System with suction using two permanent pipes, utilized for bigger constructions, Figure 7.,
System with peripheral suction of sludge and polluted water, Figure 8.

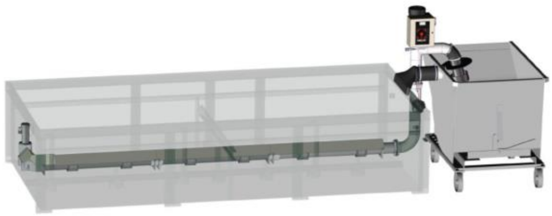


Figure 6. System with one pipe suction [7]

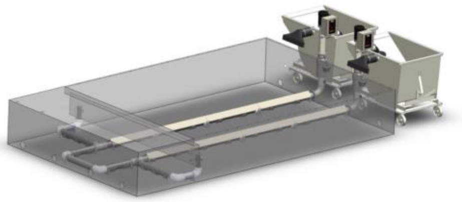


Figure 7. System with suction using two pipes [7]

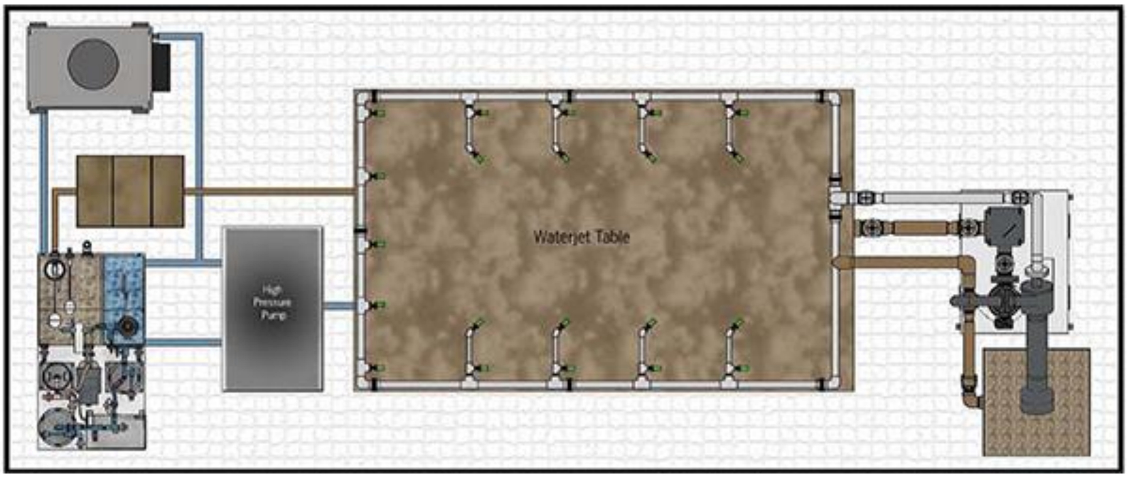


Figure 8. System with peripheral suction of sludge and polluted water [8]

A detail of the sludge after discharge and suction of polluted water is shown in Fig. 9 and detail of removal water system is in Fig. 10. The system with peripheral suction is in the Fig. 11.

Figure 9. Residual sludge

Figure 10. Peripheral suction [8]

Figure 11. Removal system [8]

Delong reject removal and recycles systems is shown in the Fig.12. In the Fig. 13 is shown the transport and detail of slim. [9]

Figure 12. Delong of waste water removal system [9]

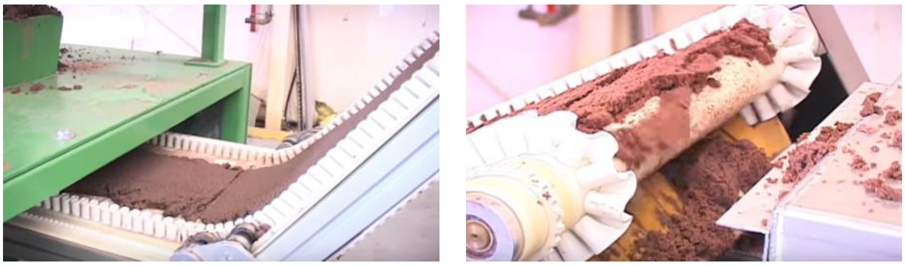


Figure 13. Detail of sludge from removal system [9]

The mobile removal system is shown in the Figure 14., where the removal aparatus is moved on the wheels to the WJ or AWJ machine. The detail of inside part is in the Figure 15. The waste water is removed by the water pressure and pulled the garnet slurry through the discharged hose, Figure 16. It allows you to work without interruption or loss of time. After filling with sludge and garnet, the bag is simply pulled out and replaced, Figure 17. The detail of removed sludge is in the Figure 18. [5, 11, 12]

Figure 14. Removal apparatus [5]

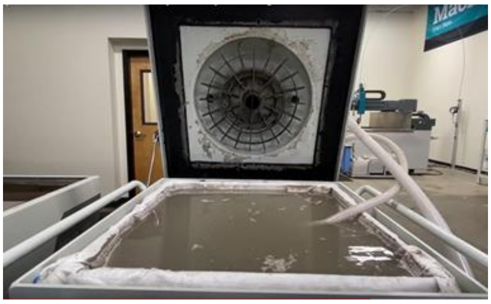


Figure 15. Detail of inside part with waste water [5]

Figure 16. Suction of waste water [5]

Figure 17. Sludge removal [5]   **Figure 18.** Detail of sludge

The abrasive particle shape is defined by granular rough, roundness and by the size which is tested by sieving. Abrasive particles disintegrate during the acceleration and focusing processes and also after cutting. During the cutting process, the breakdown of abrasive particles occurs in two stages [1]:
particle/particle, particle/water jet and particle/wall collisions in the mixing chamber/focusing tube assembly,
particle/particle and particle target collisions.

With proper cleaning and sorting, an important portion of sludge may be recycled and fed back to the cutting process. [1, 7, 9].
"Going green" often costs companies money, but not with the recycling systems of materials. The recycling systems have been engineered to assist manufacturers in cutting costs, but a nice side-effect is their help for the environment.
While the recycling systems do require fresh water for some of their functions, much of the water that is used is from their waterjet tanks and is returned to the tanks after use.
Reusing their abrasive also reduces the debris that gets sent to landfills or is disposed of in other methods.

CONCLUSIONS AND RECOMMENDATIONS

Reducing abrasive consumption decreases direct part cost. It also decreases the amount of work required to empty the abrasive out of the machine's tank and the cost of disposal. We can make some basic conclusion about consumption, recycling of abrasives [6, 9, 12]:
Abrasive Removal Systems. Abrasive removal systems can reduce part cost by eliminating the downtime that is required to remove abrasive from the machine's catcher tank; the abrasive is removed automatically throughout the cutting process. Anyone who has had to do the back-breaking work of shovelling out the sludge from a waterjet will appreciate an abrasive removal system.
Water Recycling Systems. Closed-loop water recycling systems can help save on water costs. Recycling systems separate abrasives from the water, leaving cleaner water for disposal and also improving the quality of the water going into the pump, which helps increase the life of the pump and cutting components.

Smaller Nozzles. Using a smaller water/abrasive nozzle combination can reduce abrasive consumption dramatically.

Utilization of more cutting heads. Most producers hesitate to change because a smaller water/abrasive nozzle combination results in fewer parts per hour. But not all parts are suitable for two-head cutting because of part size.

Pump Sizing. If you find that two-head cutting with a smaller nozzle combination is most cost-effective for your application, then you must determine the optimum pump size.

CNC Abrasive Metering. It takes less abrasive to make a quality cut than a production cut.. Because only the bottom surface of the waterjet stream does the work during the piercing

process with CNC abrasive metering, the amount of abrasive used during piercing can be reduced by 50 percent or more without increasing piercing time. Since it can take several seconds to pierce through thick material, reducing the amount of abrasive used during those seconds can save several pounds of abrasive per day.

ACKNOWLEDGMENTS

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NATURAL DISASTERS IMPACTS; RISK ASSESSMENT AND SUSTAINABILITY SOLUTION

Malak SHATNAWI[1*], Haya ALTALEB[2], Zoltán RAJNAI [3]

[1]*Doctoral School on Safety and Security Sciences, Óbuda University, Budapest, Hungry, Malak.shatnawi@uni-obuda.hu, +3625143327.*
[2]*Doctoral School on Safety and Security Sciences, Óbuda University, Budapest, Hungry, Haya.altaleb@uni-obuda.hu +36204107793.*
[3] *Doctoral School on Safety and Security Sciences, Óbuda University, Budapest, Hungry, Rajnai.zoltan@bgk.uni-obuda.hu + 3616665401.*

***Abstract**: In terms of disaster avoidance, mitigation, and recovery, disaster management, and crisis action planning play a vital role. According to the research, emergency response groups are crucial to the success of disaster management. Concerning the communication process, the growth of coordination, and the exercise of authority, there are issues with disaster risk management. This study will provide an overview and assessment of the risk management for different forms of natural catastrophes, which are categorized into five primary categories: geophysical, hydrological, climatological, meteorological, and biological. Biological disasters are of two origin types: calamities, which are caused by particular animals in crops, and pandemics, which are caused by the spread of infectious diseases to huge populations of humans. This form of crisis generates new hazards that must be detected. Implementing the risk assessment, the inquiry in this study will identify the risk concept associated with natural disasters and build the strategies, and set priorities to respond effectively where necessary. Despite the fact that all types of disasters share significant similarities in terms of their health, social, economic, and environmental impacts, the COVID-19 pandemic was the exact opposite from an environmental and social standpoint but had a significant impact on the death rate and urban health.*

***Keywords:** Disasters impacts, sustainability solutions, Crisis management, Pandemics, Risk management.*

Introduction

A hazard is a potential threat to people, property, livelihoods, or ecosystems as well as damage or destruction to facilities and environmental resources. It is described as "the risk of a natural or human-caused physical event resulting in death, injury, sickness, or other health consequences, as well as destruction and loss to property, infrastructure, and livelihoods" [1]. A hazard is a dangerous occurrence that leaves a huge number of people dead or severely damaged property in its wake. Depending on where and how people live, a natural disaster may or may not turn into a catastrophe. Dangerous events do not pose a threat or cause disasters in places devoid of human habitation [2]. Natural disasters have direct deep impacts on the affected regions that they utterly destroy and cause physical and psychological harm for individuals and communities, along with loss of human life and property, when natural disasters occur they disrupt the daily lives, and the socio-economic activities of a certain period of time [3]. This study intends to give planners a quick overview of disaster management and the damaging effects of hazard occurrences, as well as their implications for long-term sustainability. and also shows how scientists can contribute to rescue operations and preparedness by using lessons learned from previous disasters to aid in forecasting in order to prepare for, and enhance societal adaptability to, upcoming disasters' environmental and associated health impacts.

A disaster is a result of the combination of hazard, vulnerability, and insufficient measures that lead to eliminating the chances of rescue and affecting vulnerable populations and causes catastrophes and damages, Figure 1 below shows illustrate the relationship between hazard and vulnerability [4].
A natural hazard is an unforeseeable and/or uncontrollable natural phenomenon of extraordinary intensity that poses damage to life, properties, and the environment. A hazard is a possible source of danger or a circumstance that might result in loss. It's also known as a possible or current situation that might destroy lives or threaten property and the environment (Middelmann, 2007) also the hazard is an unexpected threat to humans and/or their property (Mayhew, 1997). These definitions show that hazards involve social, technological, and political dimensions in addition to environmental ones. Such hazards include; Geophysical, Hydrological, Climatological, Meteorological, and Biological disasters. The term vulnerability means being oversensitive to damage or injury, however, concerning natural disasters it is the situation and characteristics of a person or group that influence their capacity to resist and recover [5].

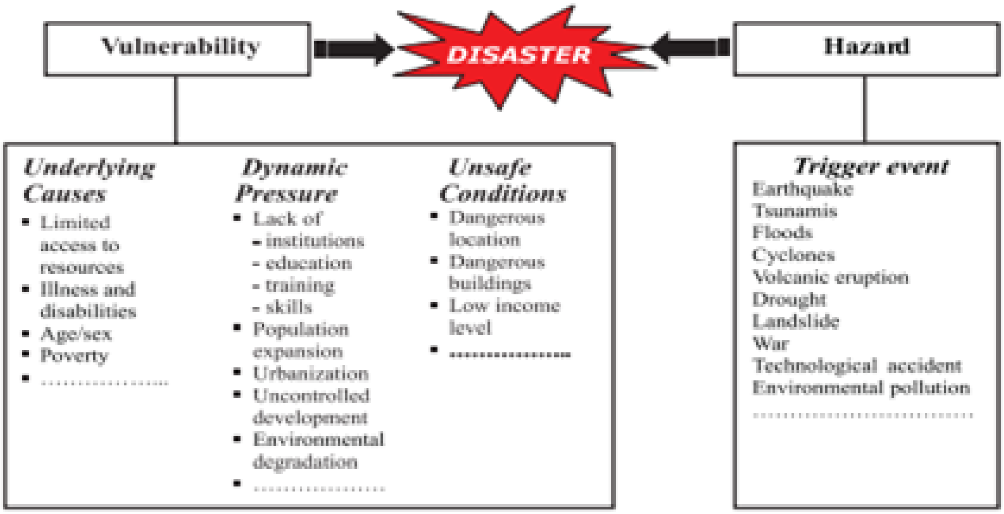

Figure 1; The relationship between hazards and vulnerability[4].

The United Nations Office for Disaster Risk Reduction DRR, specify natural disaster as "the disasters with either short period and affect relatively small areas like earthquakes or disasters that occur slowly and affect large areas like Droughts" [6]. According to the International Federation of Red Cross & Red Crescent IFRC, Societies "Natural disasters are phenomena that occur naturally triggered by quick or gradual start catastrophes that have direct repercussions on human health and subsequent impacts bringing more death and suffering,". [7]. As disasters become major threats to human life and the global economy, governments and international organizations must cooperate to enhance risk management globally and regionally, and raise awareness among people that disasters of all kinds, whether natural or human-made, must be dealt with professionally and consciously, and that the responsibility rests with individuals and institutions together in order to reduce disasters and improve the ability to mitigate them. the natural or human-caused disasters can be classified as follows [8]:

1. **Geological disasters**; Earthquakes, Volcano Activity, Landslides, Sinkholes, and Tsunami.
2. **Hydrological disasters**; Avalanche, Flood.
3. **Climatological;** Heatwaves and cold waves, Extreme Temperatures, Drought, Wildfires.
4. **Meteorological**; Cyclones, Storm Surge Waves.
5. **Biological disasters**; Plagues - Calamities produced in crops by certain animals, pandemics which are caused

by infectious diseases between many people such as; Coronavirus / COVID-19 [6].

Disaster Crises Management and Crisis Action Planning

The information systems framework for Disaster Management (DM) first main objective is to reduce disaster losses and conserve developmental gains by many methods; Policy and planning decisions for disaster preparedness and mitigation. preparing Hazard mapping and Vulnerability Assessment. Database of disaster history of pattern and trend analysis. Database of the disaster management plan, Awareness & training materials, Inventory of legal, techno legal, administrative, and institutional framework. the second main objective is a Quick emergency response and recovery by using the material and human response resources database. Besides, the Database of critical facilities, Infrastructure, and lifelines. As well as the database of trained human resources and finally with the Demographic information GIS-based information system [9].
In calamity counteraction, moderation, reaction, and recuperation, Information and Communication Technologies (ICTs) assume a critical base. Simultaneously, government organizations and other philanthropic entertainers partaking in dynamic and salvage tasks require a great deal of exact and opportune data. Four standards can be depicted in ICTs for Calamity The board: multi-risk, multi-staged, multi-innovation, and multi-partner [10]. Figure 2 below shows the main Phases of Disaster Management.

Figure 2: Phases of Disaster Management [11]

The communication process and information flow

The primary role of emergency organizations in disaster management is to carry out the activities of emergency responders. This includes the coordination of various agencies and the exercise of authority. Although disaster planning can help prevent disasters, it can also serve as a guide for handling the various aspects of crisis management. One of the most critical factors that can affect the success of disaster management is the communication process. There are various problems that prevent emergency organizations from effectively communicating with the public[12].
Organizational issues related to information flow can be seen in at least five main types of organizational behavior:

a. intra-organizational.
b. Inter-organizational.

c. From organizations to the public.
d. From the public to the organizations.
e. Inside structures of organizations.

The discussion which follows examines both the real information flow problem of the organizations in community disasters and mythological beliefs. It indicates how false assumptions about organizational behavior can undermine, and thus invalidate disaster preparedness planning and requires tactical management of specific difficulties [12]. Figure 3 explains the Risk management cycle.

Figure 3: Risk management cycle [13]

Information Flow Between Organizations

Under normal conditions, officials from various organizations will often chat informally, as they are accustomed to conversing with one another as friends and acquaintances. When tragedy occurs, however, official connections with previously unknown authorities within organizations with whom there were no prior ties are frequently required. It's not uncommon for organizations to make contact with groups that were beforehand unknown to them before the crisis. As a result, establishing and supporting a formal communication flow between officials who are unfamiliar with others in outside organizations may be difficult [14].

In the Intra organizational Information Flow, all organizations must communicate consistently and internally exchange data with their group members under ordinary conditions. The communication scheme is developed to process and exchange relatively predetermined types and quantities of information. Though, during a disaster, the team members who are using the communication system will often increase significantly [15]. This can be done in part by internal staffing changes undertaken by the organization to meet the demands of the crisis situation. E.g., double shifts may be used, or volunteers may be incorporated into the workforce. Frequently, the current communication system cannot accommodate the volume of data necessary for these additional system users. Normally, communications are routed through specific channels. The flow of information in non-crisis conditions follows the standard organizational line of command. As a result, system user information requirements, data exchange circumstances, and information and data flow from top to bottom (and vice versa) are all relatively well defined [15]. When the additional demands upon the internal communication system surpass its capability, this results in 'overload,' the net result of which causes either results in the loss of communication or system failure or delay of information to, from, and between staff members [16]. Nonetheless, conveying information throughout the organization becomes more difficult during a calamity.

It is not uncommon, for example, for numerous people to fill a job that was previously only held by one person; officials to take on non-routine duties, or officials to be reassigned to serve in temporary emergency positions within the organization. These and other circumstances might lead to situations where standard communication methods are insufficient to ensure that all important information reaches individuals who need to be informed about organizational actions.[17].

Information Flow From Administrations to the General Public

In disasters situation, organizations may have to pass on information to citizens in general, but this is often done rather poorly. Typically, these effects result from the organization's failure to recognize that knowledge that is crucial to organizational staff is not fundamentally valuable to threatened individuals. Officials might collect extensive information on a flood or a chemical threat, for example. The organization will next release an official statement of instruction to the general public based on this information, which will exclude the details of its conclusions and other pertinent information [18].

The Impact of Disasters

Earthquakes, volcanic eruptions, floods, and drought are examples of uncontrolled events that have an influence on the environment in which we live. Toxins are often produced from disasters in the ecosystem via loops that move between air, land, and water, eventually burying themselves in lakes or deep ocean deposits. Wildfires, floods, volcanic eruptions, tsunamis, and earthquakes, on the other hand, can release these elements in great quantities and quickly. Methyl mercury, a very poisonous type of mercury present in aquatic settings, can be emitted into the atmosphere as a result of geothermal activity. Mercury vapor affects the neurological, digestive, and immunological systems, as well as the lungs and kidneys, and maybe lethal if breathed. Because of the polluted toxic air, eight hundred persons die each hour, i.e. thirteen persons per minute. The Asia-Pacific area has a share of millions of these deaths. The UN Office for Disaster Risk Reduction's Global Assessment Report on Disaster Risk Reduction, 2019 revealed how hazards including air pollution, illnesses, droughts, and climate change connect and feed on each other, accelerating their negative health and environmental issues. Humans and assets are becoming vulnerable to a wide range of crises, in previously unknown locations and at unknown levels. Heatwaves combined with dry conditions can cause catastrophic wildfires that contribute significantly to air pollution which plays a role in the production of greenhouse gas (GHG) emissions, particulate matter, and other components, so, the heatwaves consider the most serious environmental hazard after global warming [19]. Negative impacts change the lives of individuals, families, communities, cities, and states, mostly can affect the economy of the entire country. The carrying capacity of the impact of the disaster has a great relationship with the level of preparedness, flexibility, and adaptation. However, recently it has been noticed that disasters are increasing in severity, especially human-made disasters, now the need to be prepared for a world full of unexpected shocks has become clearer than ever due to the acceleration that has been taken place in many countries all around the world, the industrial revolutions, technological, and biological activities, have given disasters new characteristics causing rapidly spread all over the world and increased the impact of disasters globally and in all levels [20].

a- Social (Individual And Community Impact)

One of the most serious issues that arise during and after tragic events is health problems, and in cases where mobility, transportation capabilities, and infrastructure are affected survivors of natural disasters may be cut off from rescue and urgent medical assistance. In addition, standing water, as in hurricanes and floods, can be a source of bacteria and microorganisms that can spread illness. Not to mention that survivors of any tragedy may suffer from mental health issues such as post-traumatic stress disorder [21].

Disasters can have immediate effects on human health, such as injuries, deaths, and disease outbreaks, as well as long-term effects such as noncommunicable illnesses, psychological morbidity, and impairments. Damage to health facilities and disruptions to health services typically impede the health sector's ability to respond to these consequences. The impact is often felt physically, and psychologically at the individual level. Natural disasters result in property damage, financial loss, death, illness, and deterioration of physical and mental health. In developing countries, the effects have a greater impact, sometimes leading not only to a shortage of resources, but also to the loss of security and safety, and massive human migrations. Because of the discharge of hazardous chemicals, flames, and explosions, a 'Natech' (natural-hazard-triggered technology) event can compound the impact of a natural catastrophe on the environment and human health. Risk managers have just recently begun to investigate the causes and effects of such catastrophes, while there may be preventative and preparedness measures as well as response and recovery strategies in place to address the risks posed by technology and natural disasters, these are seldom coordinated. Furthermore, there is a scarcity of risk analysis and planning methodologies and tools; as a result, it is critical to design strategies that include the potential of dealing with all of them at the same time [22].

b- Economic Impact

Infrastructure damage is the most urgent destructive problem of natural disasters, the damage of public and private infrastructure can cost a lot, and not all communities are prepared to support post-disaster recovery. Additionally, many landowners lack property insurance or the financial resources to rebuild, and certain natural catastrophes are not covered by insurance; this means that people may lose all of their fixed and unfixed assets with no recourse. Natural catastrophes can have long-term negative impacts in addition to the acute loss of life and infrastructure devastation. Usually, after crises, the incident will last for years throughout the areas and the surrounding. For example, due to one of the disasters that occurred in New Orleans, more than 200,000 houses have been demolished and more than 70% of citizens have been displaced. For that, a massive amount of aids should be allocated as a kind of help for the cities and surrounding areas to revive the economy and have a reasonable recovery to re-construct the infrastructure [22].

c- Environment Impact

Disasters strike has varying degrees all across the world, many disasters are known to be quick, whereas others, such as drought and climate change, are long-term, and can occur globally at varying frequencies and magnitudes. Various disasters have the potential to change the natural environment, for example, the cyclones that occurred in Myanmar in 2008, or the wildfires that spread in California through the years are examples of how areas of land can be dramatically damaged by the whole ecosystem just from a single disaster event. Estimates of sea-level rise due to melting glaciers is an important subject to debate regarding how to manage global climate change and its natural consequences since tidal waves threaten whole islands and several coastal settlements. Furthermore, the fast desalination of salty seas is a major concern, it has the potential to deprive the globe of edible fish and coral reefs.

Air pollution is one of the negative environmental factors that cannot be controlled, here are five ways in which disasters, natural or industrial, can either cause or exacerbate due to air damage:-

1- disasters in cities result in many technical problems, i.e, factories, and industries sites can be damaged, resulting in the discharge of toxic or harmful compounds, such as the 2011 nuclear accident at the Fukushima Nuclear Power Plant in Japan, when the tsunami cut the power that provide cooling to three reactors.
2- Natural disasters make it easier for dangerous materials to be released, i.e, when the stored gasoline inside large tanks is destroyed by fire or chemicals burn up, it affects a vast region and a lot of people.

3- Increased discharge of accumulated pollutants, such as when Mt Mayon in the Philippines exploded on January 13, 2018, spewing a 2500-meter-high cloud of grey vapor and ash.

4- The floodwaters for a long time will still be full of microorganisms and bacteria which can cause lung damage, asthma, allergies, and hypersensitivity pneumonitis becomes worse due to dust mites, pollutants, and germs left behind after a flood.

5- Droughts are more likely to cause sandstorms. A strong sandstorm blanketed Khartoum in March 2018, causing officials to postpone flights and close schools in the capital and surrounding communities.

Many nations rely on a variety of infrastructure facilities to reach sustainable development, such as highways, electric grids, ports, telecommunications networks, factories, and so on, in order to carry out socio-economic activities, any failure of these systems might result in severe impacts, and to avoid such losses, systems must be flexible and able to sustain and operate efficiently without large interruption, as well as recover swiftly with minimal cost [23].

d- The impact of human disasters as a compound of natural and man-made disasters: (The impact of the pandemic COVID 19)

A disaster of this kind causes severe destroy for livelihoods, economic catastrophe and can damage people's life for a long time. An epidemic is defined as "either an unexpected increase in the number of cases of a contagious diseases that already occurs in the region or country involved or the presence of an illness originally absent from a territory", according to the University of Louvain's Centre for Research on the Epidemiology of Disasters (CRED), the definition is used in public health to describe when a disease attacks a bigger number of individuals than predicted. [24].

COVID-19 is highly contagious and has been linked to a high incidence of deaths. Direct contact or close proximity to infected persons is the major and the mobility of people has rapidly increased the spread of the illnesses, pandemics have a direct and indirect influence on public health and people's livelihoods, and they can result in losses in manufacturing, jobs, trading, tourist, public and private transportation, education sectors, and many others. Additional expenditures must be incurred by the afflicted country to deal with the emergency, isolate, quarantine, and provide the right treatment for patients is an additional burden, especially in low-income countries. However, there are obvious impacts in the short and medium-term that will cause permanent damages, in the near term, more quarantine places are needed since the number of injured has much more exceeded the capacity of hospitals and health centers in some countries, as well as other side effects as a result of the increase in acute respiratory diseases and other diseases caused by the disaster, in the medium term, the living conditions become hard due to the pandemic and may extend for a while as a direct result of the increased vulnerability, health, and poor living conditions among individuals, and on societies as a result of the deterioration and disruption of the infrastructure and failure in basic services [25].Such disasters have health, social and economic consequences because they introduce new types of risks that have never been familiar before, It not only leads to deaths due to the rapid spread of the disease that has never been witnessed before but also negatively affects the safety and security of people, as well as reduce normal living standards due to many hidden costs or economic consequences. Part of this paper will identify the risk principle that will arise from pandemics, prepare plans, and set priorities to respond effectively where and when needed, by implementing risk assessment, threats, vulnerabilities, and impacts to reach the best scenario that will control the pandemic, and finally, the study in this research will address the question that everyone is concerned about: will conditions return to the way they were before the crisis. Although there are significant similarities in terms of the sustainability aspects of all types of disasters, the COVID-19 pandemic was somehow the opposite from an environmental and social point of view, i.e. the priority here has been changed. Psychological and social impacts are two further consequences on the population besides health. Where previously in disasters, social engagement was a necessary requirement to bring people together and assist family members, relatives, friends,

and workmates, but nowadays for their and your own safety and sake, it is better to be away and contact remotely as much as possible. Disasters affect the population both directly and indirectly.
It is useful to keep a separate record of people who lost their jobs as a result of the destruction of the company where they worked, as well as laborers who lose income, as this may provide an early significant warning and assess the direct and indirect effects on the population and for each sector. Private property damage is often classified and documented in the housing sector, whereas production damage and losses are included in evaluations of the impact on productive sectors. Although the loss of life is considered a permanent cost to society that cannot be replaced or recovered, the most well-known effect on catastrophe victims is an effect on their living levels. Disasters also posed a danger to people's security and confidence, as well as the loss of houses and belongings, lowering regular living standards, in addition to psychological suffering, and social changes, the depression of individuals who do not get enough support, indirect costs are among the unquantifiable effects on the population., such damages might have severe short- and long-term consequences. A recent Lancet Psychiatry paper (Xiang et al. 2020) recommends for early consideration to mental health in the face of the COVID19 pandemic, especially mental health evaluation, counseling, and treatments, based on previous pandemics experiences. Now the need for psychiatric treatments is increasing all over the world this is making scientists turn to digital psychiatry includes unique capabilities and resources, such as artificial intelligence, computer-assisted mental health services, and a variety of many other modern technologies, which can support internationally. For a more efficient and effective system and in order to reduce psychological stress, initiatives have been established for remote communication and harnessing modern technology and electronic transformation and linking the psychological treatment process with machine learning, including virtual reality, and AI, one of these initiatives is a Croatian initiative that supported by the European Union [26].

CONCLUSION

The paper reviews the main objectives and principles of the information systems framework for disaster management, as well as, the communication process and information flow; information flow between organizations, and information flow from administrations to the general public. Moreover, how the negative impacts can change the lives of in the cities. The carrying capacity of a disaster's impact has a strong link to sustainability, and it has recently been observed that disasters caused by industrial revolutions, technological advancements, and biological activities are becoming more severe, particularly those that are the result of human actions, behaviors, and decisions that become part of global environmental change processes. The negative consequences of such crises pose new social, economic, and environmental risks. The negative consequences of such crises pose new social, economic, and environmental risks, improving technology will improve risk management and reduce vulnerability. Healthy systems can aid post-disaster resilience, enhance health, and may also reduce the frequency and severity of risks, as well as the provision of preventive protection services.

Recommendations

Recommend researching and accumulating crisis management states from prior civilizations in all areas of life, including religious, political, international, and individual. An examination of what has been done in a crisis situation since then may find little has changed. We should also mention that crisis management has gotten more observable in recent years. Different approaches to world crisis management can be used, and we propose a historical, ethical, and sociological approach and framework that will include all perspectives of crisis management, including ethics, leadership, and communication. It is critically needed by the world.

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ENVIRONMENTAL EFFECTS OF THERMAL WATER IN THE REGION OF GUELMA, ALGERIA

Rima KIFOUCHE, F. BOUAICHA, O. BOUTERAA

Geology and Environment Laboratory, Constantine University 1, Route Ain El Bey Zouaghi Slimane Constantine 25 000.
**Corresponding author: kifouche.rima@gmail.com*
rima.kifouche@doc.umc.edu.dz

***Abstract**:*
A hydrochemical characterization of the waters of the Guelma region (North-East Algeria) was carried out following samples taken at 14 thermal springs and their effluents during the months of May 2022. The analysis of the waters allowed to establish the chemical facies and their classification according to the Stuyfzand's abacus and to deduce the aptitude of these waters for irrigation and the risks of salinity. Q-mode cluster analysis was applied to the thermal water quality data sets, and generated three (3) groups clusters. Group 1 dominated by sulfates and sodium. Group 2 represent a group of waters with low salinity dominated by Ca - HCO_3; Group 3 is dominated by sulfate, bicarbonate and magnesium. Stuyfzand's classification indicated that the waters are fresh with moderate alkalinity. Taking into account the classification of Richards, we were able to identify the presence of the C3S1 class for the majority of the stations. The C3S1 class designates waters that can be used without any particular control for the irrigation of crops that are moderately tolerant to salts, on well drained or well permeable soils. These waters have average EC values of 1437.57µS/cm allowing their use in a less restrictive way for irrigation, except for the region of Guerfa and downstream of Bouhamdane wadi where these sites present a C4S2 class which indicates that the water quality is poor. Potential environmental effluents from the thermal spas could pollute both irrigation and drinking water, which represents a danger to the health of the region's inhabitants.

***Keywords**: thermal water, hydrothermal effluents, chemical facies, Stuyfzand classification, salinity, Guelma.*

INTRODUCTION

The physico-chemical characterization is very important to study the suitability of thermal waters for consumption and irrigation. In the thermal spas, thousands of visitors bathe, some people, during the therapeutic period; drink without any pre-established restrictions. Regarding the potability and physico-chemical quality of water, the thermal waters of Guelma, according to WHO guidelines are not safe for consumption because the samples are hard, and the cations and anions exceed the WHO standards.

The wastewater diffused by the spas on the environment could pollute the surface and groundwater (e.g., pollution of the Zit Emba dam by the effluents of Hammam Ouled Ali 1, 2, and 3) [1]. In this case, it's possible to put local residents in danger.
This study aims to understand the hydrochemistry of thermal waters in particular the management of these water resources in a subhumid environment with semi-arid influences

MATERIALS AND METHODS

Study area

The study area is located in the North-East of Algeria, between latitudes 36°34'33''N to 35°53'08''N and on longitudes 5°44'41"E to 6°30'02"E. (Fig1). Covering an area of 3686.84km^2, Guelma is bounded by Jijel and skikda to the north, Sétif to the west, Batna and Oum El Bouaghi to the south and Constantine to the east. The region has a subhumid climate with a semi-arid influence to the South, with variable precipitation in time and space. The average annual precipitation is about 675mm/year. The annual temperature varies between 2.5°C (in January and February) and 34°C (in July and August). Hydrographically, the study area is characterized by a relatively dense hydrographic network composed essentially by Seybouse wadi and its main effluents Bouhamdane, Chenior Wadis and Hammame wadi.

Geological and hydrogeological settings

Guelma is part of the external zones within the Tellian zone [2] of the Maghrebides, a relatively complicated geology. The investigated area has various geological units and their age ranges from the Triassic to the Quaternary. The Guelma Basin is qualified as a lozenge basin created between two overlapping east-west dextral strike-slip faults. On the margins of this basin in pull apart, there is a series of N-S to NNW-SSE trending normal faults that intersect the subparallel shear faults [3] [4] [5]. The study area is a collapse zone filled with deposits from the Miocene (clays and gypsum marls) and the Quaternary (heterogeneous alluvium in the form of a terrace). These alluvial deposits, often very permeable and above all very thick, constitute an important source of water supplied by the infiltration of rainwater and by the lateral contributions of the Seybouse watershed. The infiltrations lead the surface waters to the deeper levels which form the base of the watershed of a very important thermal reservoir in the study area and the neighboring areas [6].

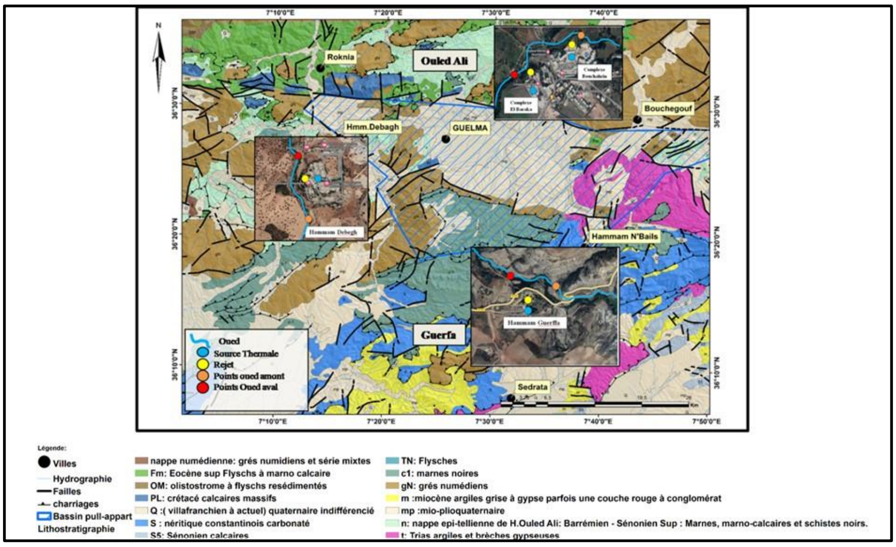


***Figure 2**: Geological and sampling map (Vila.J.M, 1980)*

Sampling and analysis

A sampling campaign was carried out at 14 stations during the month of May (Fig1) for the analysis of physical and chemical parameters. They were analyzed by different methods; pH, temperature (T) and conductivity (CE) were measured in situ, the major chemical elements (Ca^{+2}, Mg^{2+}, Cl^{-}, HCO_3^{-}) were determined by titration, SO_4^{2-} was determined by a spectrophotometric method and Na^+, K^+ were analyzed using a flame photometer.

Hydrochemical methods

The hydrochemical methods of characterization and classification of waters adopted in this study are based primarily on the Piper diagram [7] and the Stuyfzand classification [8]. The Piper diagram is used to represent the cationic, anionic and global facies. The Stuyfzand classification is used to determine the chemical characteristics namely the main type, type, subtype and class. The main type and type are determined on the basis of chloride content and alkalinity index. The subtype classification is determined from the dominant cations and anions. The class is determined from the sum of Na^+, K^+ and Mg^{2+} based on Stuyfzand's equation 1 which calculates the Base Exchange Index (BEI)

$$\mathbf{BEI = Na + K - 0.8768\ Cl} \qquad \mathbf{(1)}$$

Quantitative methods

The qualitative parameters used, in addition to electrical conductivity (EC), to assess groundwater quality for irrigation purposes are outlined in Table 1. These are Sodium percentage (Na %), Sodium Adsorption Rate (SAR), Magnesium Adsorption Rate (MAR), Permeability Index (PI), and Residual Sodium Carbonate (RSC).

Table 1: Evaluation equation of quantitative parameters

Parameter	Equations	
Na%	**Na% = Na + K / Na + K + Ca + Mg *100**	**(2)**
SAR	**SAR = Na / √ (Ca + Mg)/2)**	**(3)**
MAR	**MAR = Mg / Ca + Mg)**	**(4Ö**
IP	**IP = Na + √HCO_3 / Ca + Mg + Na *100**	**(5)**
RSC	**RSC = [(HCO_3 + CO_3) – (Ca + Mg)**	**(6)**

STATISTICAL ANALYSIS

Cluster analysis

A powerful approach for classifying data, hierarchical cluster analysis (HCA) makes use of differences between the items we want to group together. Scientists who study hydrogeochemistry frequently employ this unsupervised statistical method to categorize water samples based on how similar they are to one another [9-16].

By classifying water samples using Ward's technique (Ward, 1963) [17] and Euclidean distance as a measure of similarity, Q-mode HCA was utilized to distinguish hydrochemical groups. The HCA was performed using the normalized data set and all 11 hydrochemical parameters (pH, T°, EC,DHT, Ca, Mg, Na ,HCO_3, Cl, SO_4 and NO_2) that were measured.

RESULTS AND DISCUSSION

The summary of all physic-chemical analysis are shown in Table 2

Table 2: Statistical parameters values of the three principal water groups

		T°	pH	EC	DHT	HCO_3	Ca	Mg	Na	Cl	SO_4	NO_2
Group 1												
	Mean	46.95	7.24	1972.17	11.96	200.92	89.15	100.08	171.10	226.20	433.33	0.03
	Min	33.9	6.33	1700	7.2	144.7	49.09	48.09	86.85	151.05	80	0
	Max	61.1	7.9	2220	19	310.96	148.34	172.6	399	288.75	830	0.01
	SD	10.73	0.46	181.17	3.72	43.16	22.02	45.61	94.61	48.02	338.33	0.03
Group2												
	Mean	17.2	7.79	584	4.18	216.75	66.135	26.48	58.98	17.8	125	0.0085
	Min	16.6	7.78	568	2.36	203.3	44.09	12.87	17.66	15.3	100	0.006
	Max	17.8	7.8	600	6	230.2	88.18	40.09	100.3	20.3	150	0.011
	SD	0.6	0.01	16	1.82	13.45	22.045	13.61	41.32	41.32	25	0.0025
Group 3												
	Mean	40.75	7.33	1187.50	10.85	279.32	97.65	50.02	45.90	34.99	286.12	0.03
	Min	29.7	6.2	1065	6.6	188	72.14	36.53	4	16.85	120.7	0.051
	Max	55.5	7.79	1315	14.4	319.88	144	73.47	145.6	55.5	430	0.01
	SD	6.87	0.38	51.67	2.64	34.77	17.63	12.90	44.46	10.61	77.22	0.03

The analysis of the different physico-chemical parameters of thermal waters showed a relative heterogeneity. The temperature varies between 30-65°C which indicates that the waters are classified in two categories: mesothermal (30<T<50°) and hyperthermal (50<T<100°). For the pH the values vary between 6.2-7.9, which shows the neutral or slightly alkaline character. For the EC ranges between 568-2220µS/cm. For cations: Na concentrations vary from 4 to 399mg/l, Ca concentrations vary between 44-148.34mg/l, Mg ranges between 12.87-172.60mg/l. Cl, HCO_3, SO_4 anions concentrations fluctuate respectively between 15.30-288.75mg/l, from 144.7 to 319.88mg/l and from 80 to 830mg/l.

Hydrochemical classification

According to the chloride contents, the majority of the waters present a main **fresh type code F** (Table 2). Based on the average chemical elements, the subtypes are characterized by a dominance of Cl^-, Na^+, and SO_4^{2-}. The concentrations of HCO_3^- measured between 2-4 meq/l. Therefore, the alkalinity of the waters is of **moderate type**, it is generated by the dissolution of gypsum and/or limestone. For the class of waters, revealed a class in **surplus of code (+)**, these concentrations seem to be coming from the processes of dissolution of evaporites (triassic lands surrounding).

Table 3: Stuyfzand classification

	Classification level	Code
Principal type	**[Cl] (méq/I)**	
Oligohaline	<0.141	G
Oligohaline-fresh	0.141 - 0.846	g
Fresh water	***0.846 - 4,231***	***F***
Fresh water brackish	4.231 - 8.462	f
Brackish water	8.462 - 28.206	B
Brackish salt	28.206 - 282.064	b
Salt water	282.064 - 564.127	S
hyperhaline	>564.127	H
Type	**[HCO3] (méq/I)**	
Very low	<0,5	*
low	0,5-1	0
Modratly low	1-2	1
moderate	***2-4***	***2***
Moderatly high	4-8	3
High	8-16	4
Very high	16-32	5
Rather extreme	32-64	6
Extreme	>64	7
Classe	**BEI= Na + K - 0,8768 * Cl**	
Deficit of (Na + K + Mg)	< 0	-
Equilibre of (Na + K + Mg)	= 0	0
Surplus of (Na + K + Mg)	***> 0***	+

Cluster analysis

Group 1

The water type 1 (group 1) has an EC of 1972.17µS/cm and is dominated by sulfates and sodium but also contains a significant concentration of chloride. This group is characterized by the thermal spring of Guerfa and Debagh. Guerfa thermal spring comes out through cracks in limestone massifs owing to fault or fold-fault marked of presence of black marl and gray clays with occasionally reddish gypsium with conglomerates. During the last earthquake, the water gushed out with a red color (clay particles) for a few days, which indicates that the emergence is through an active zone on soft formations (gypsum to conglomerates). SO_4, Na and Cl are closely tied to the untreated effluents of hydrothermal complexes (Guerfa and Debagh) and also to the aquifers lithologic nature (Fig2, 3).

Group 2

Represents a group of waters with low salinity (medium EC=584µS/cm) and surrender orders (mg/l) HCO3>SO4>Cl and Ca>Na>Mg (Fig2, 3). The dominance of HCO_3 and Ca is closely tied to the aquifers lithologic nature.

The water type 3 Group 3

Is dominated by sulfate, bicarbonate and magnesium. This group has an electrical conductivity about 1187µS/cm, and can be observed in north of Guelma (Ouled Ali) (Fig2, 3). All the thermal sources come out along the lines of the fractures of the carbonate formations.

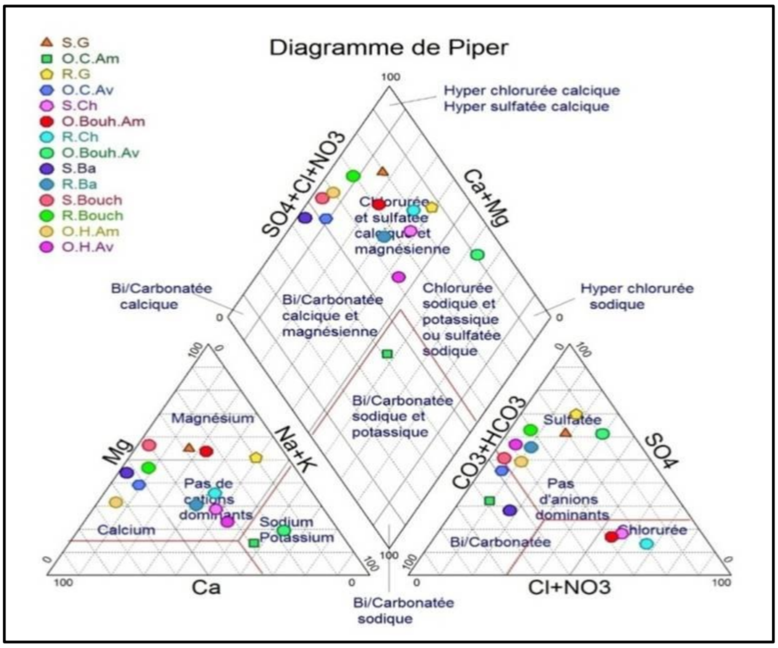
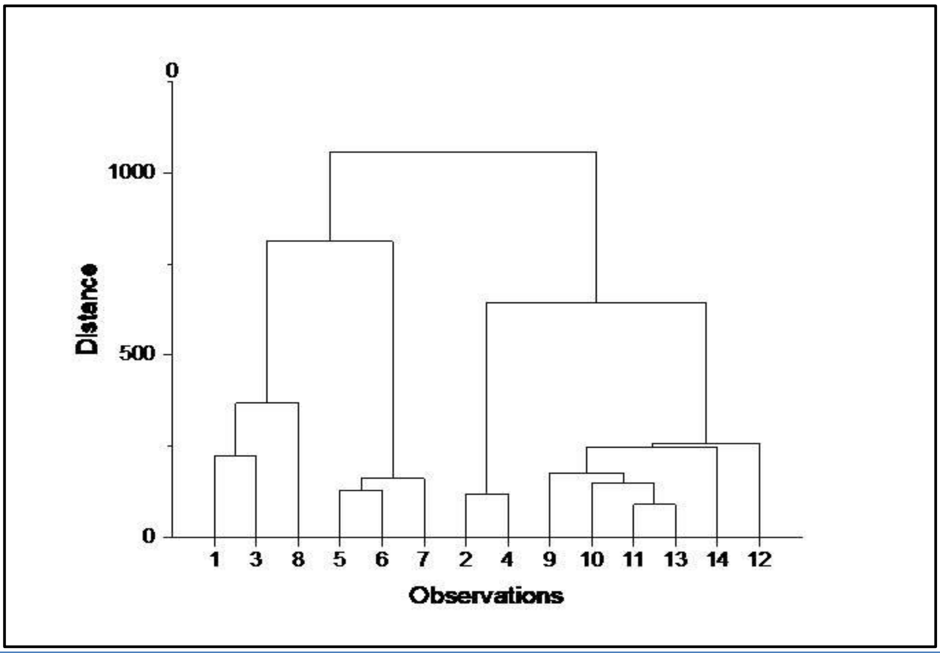


Figure 3: Piper diagram

Figure 4: *Dendrogram of cluster analysis*

Suitability of thermal waters for irrigation

The evaluation indices of the suitability of thermal waters of the Guelma region for irrigation are reported in Table 3. The results of Na% showed that 6 (42.85%) sampling points have an excellent quality of water,



5(35.71%) sampling points represent a Good quality, 2 (14.28%) points represent an acceptable quality and only one point reports a doubtful quality.
The calculation of the MAR showed that all the sampling points have concentrations lower than 50 of acceptable class, therefore usable for irrigation.

The PI values obtained highlighted 3 classes, of which the majority 12(85.71%) out of 14 water points have a good water quality.
For all the water samples analyzed, the CSR values are low, not exceeding 1.25 meq/l, which eliminates the harmful effects of carbonates and bicarbonates.
In terms of total mineralization, the EC reflect that the thermal waters of our study area, the majority has a good to acceptable class, except for the region of Guerfa and Bouhamdane wadi have a Doubtful quality.
According to the diagram (Fig4) (Richards, 1954) [18], based on the overall salinity and SAR, has allowed us to classify the thermal waters and their effluents in the study area as being of admissible quality C3S1, except for some water points in the region of Guerfa (group 1), Bouhamdane Wadi where these sites have a class C4S2 which means that the water quality is doubtful. So we can say that the waters are characterized by more or less low SAR, for this reason the sodium dangerous for irrigation, the water being suitable for the irrigation of salt tolerant crops, on well drained soils. However, the evolution of salinity must be controlled.

Table 1 : Suitability of thermal water for irrigation according to different indices of classification

Na % (méq/l)	Class	Numbre of samples	In %
<20	Excellent	6	42.85
20-40	Good	5	35.71
40-60	Acceptable	2	14.28
60-80	Doubtful	1	7.14
>80	Unacceptable	0	0
CE (Ds/m)	Excellent		
<0.25	Good	0	0
0.25-0.75	Acceptable	2	14.28
0.75-2	Doubtful	9	64.28
2-3.	Unacceptable	3	21.42
>3		0	0
SAR (méq/l)			
2-10.	Poor	14	100
10-26.	High	0	0
>26	Very High	0	0
MAR (méq/l)			
<50	Acceptable	14	100
>50	Unacceptable	0	0
IP (méq/l)			
>75	Very good	1	7.14
25/75	Good	12	85.71
<25	Unacceptable	1	7.14
RSC (méq/l)			
<1.25	Good	14	100
1.25-2.5	Doubtful	0	0
>1.5	Unacceptable	0	0

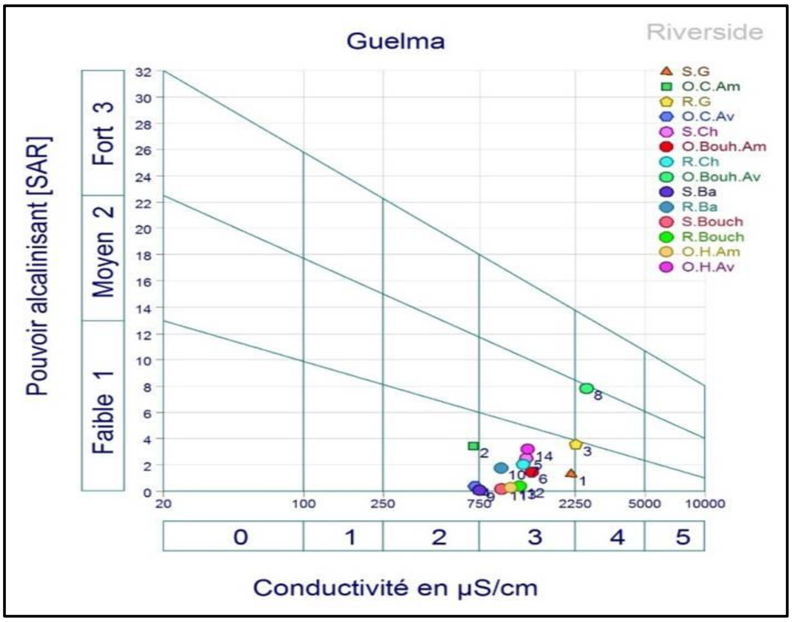


Figure 5: Classification of irrigation water using Richards SAR method

The Wilcox diagram 1955 [19] based on Na% and conductivity shows that most of the samples fall into the category of excellent and good water except for group 1(50%) where the water is doubtful quality for irrigation (Fig5).

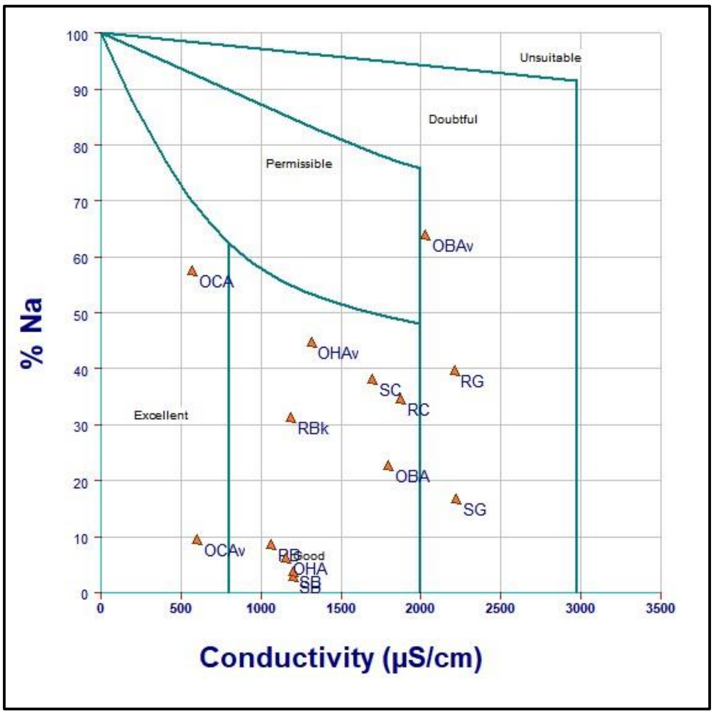


Figure 6: Wilcox Diagram for thermal water

CONCLUSION

Physico-chemical parameters and hydrochemical methods were used to characterize the quality of thermal waters of the Guelma region used in irrigation. The study was based on 14 water samples (springs, discharges and wadi). The results revealed physico-chemical characteristics, relatively, variable. Q-mode cluster analysis was applies to the thermal water quality data sets, and generated three groups cluster. Group1 represent a group of waters with dominated by sulfates and sodium; Group 2 represents a group of water with low salinity and surrender orders Ca-HCO3. Group 3 dominated by sulfate, bicarbonate and magnesium. The classification of Stuyfzand showed that the waters are fresh, of moderate alkalinity the presence of code (+). These classes reflect the basic exchanges between the waters and the clay minerals. The distribution of the chemical parameters revealed that the high concentrations of RS, Cl and Na are recorded near the triassic formations either near the discharges and downstream of the wadis. The analysis of the water quality indicators for irrigation use showed, globally, that the waters are usable without any particular control for the irrigation of crops moderately tolerant to salts, on well drained soils or soils with good permeability.

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FINANCIAL AND ECONOMIC POSITIONS OF PORTUGAL AT THE TURN OF 2020S

Csaba LENTNER[1], Sándor J. ZSARNÓCZAI[2,3]

[1]University of Public Service, Budapest, Faculty of Governmental and International Studies, Kálmán Széll Public Finance Pub, Ludovika tér 2., H-1083 Budapest, Hungary
e-mail: dr.lentnercsaba@mail.com, lentner.csaba@uni-nke.hu,
[2]University of Public Service, Budapest, Faculty of Governmental and International Studies, Kálmán Széll Public Finance Pub, Ludovika tér 2., H-1083 Budapest, Hungary
[3]Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering Institute of Environmental Engineering and Natural Sciences, Doberdó u. 6, H-1034 Budapest, Hungary, e-mail: zsarnoczai@yahoo.co.uk

Abstract
For Portugal, the stability of its financial and economic situation is important by increasing domestic investments and fixed capital investments and thus preserving jobs. Investments can further stimulate market conditions, financial stability, which must be associated with a reduction in the deficit of general government budget balance, government debt and the deficit of the balance of payments. The research period was between 2018 and 2022. In 2020, the pandemic caused a serious decline, resulting in 8.4% decline in real GDP. The gross domestic investment retained its 18.8% growth rate, which was unbroken after 2020. Through the statistical analysis method, the data of economic variables was processed. There is a need to increase the competitiveness of businesses in the domestic, EU and international markets, a positive balance of the country's foreign trade balance, which can increase the country's net international investment positions.

Keywords*: Fixed capital investments, government budget, government debt, competitiveness, statistics*

INTRODUCTION

Portugal's public finance and economic situation underwent a major change in the turn of the 2020s, which was primarily due to the increasingly unfolding coronation epidemic from the beginning of 2020. However, the worldwide epidemic at the same time as the pandemic relief at the beginning of 2022, the Russian - Ukrainian war was increasingly expanding to a global economic crisis due to the war and energy crisis in the wake [1]. The latter double crisis in Portugal also had a significant inflation effect, which has significantly burdened the government budget and in this context, worsened the balance of payment, which the deteriorating balance of the foreign trade balance was contributed to.
In Portugal, the central bank has made significant monetary efforts to help businesses, to protect jobs, to maintain employment at a possible level, avoiding possible unemployment increases. The Central Bank of Portugal could not influence the exchange rate of the euro, as the European Union's common currency can be influenced by the European Central Bank, but the Central Bank of Portugal can help protect jobs by possible domestic monetary assets and more favourable credit conditions for businesses and further investments to establish jobs.
In the generally deteriorating external, international and domestic economic situations, business investment opportunities have become unfavourable, partly due to the deterioration of credit conditions and partly from domestic narrowing market opportunities, which were contributed to the adverse of international market sales conditions. The database used during the research applies to period of 2018 and 2022, which is registered by

Central Bank of Portugal, the Portuguese Ministry of Finance, the National Bureau of Statistics, Eurostat and the IMF (International Monetary Fund) organizations and institutions. The data of 2022 can be evaluated as annual data, but some of this, primarily the performance of the second half of the year, is estimated.

In relatively wide international and domestic literature, studies and analysing materials have been published by authors indicating the serious difficulties of Portuguese financial and economic relations. The former IMF (2022) reported in Portugal that GDP had exceeded pre -epidemic level in the first quarter of 2022. The recovery was driven by a boom in strong internal demand and tourism from the second half of 2021, which was contributed to one of the highest vaccination rates in the world. Wide policy support has contributed to the maintenance of employment and income growth and to maintain financial stability [2]. Further authors recommend financial strategies adapted to specific economic conditions of each country [3]:

In the countries most affected by the war in Ukraine and sanctions against Russia, fiscal policy must respond to the humanitarian crisis and economic disorders. Given increasing inflation and interest rates, fiscal support must be directed to the most affected and priority areas.

In countries where growth is stronger and inflationary pressure remains high, fiscal policy must continue to support for economic recovery.

The MNB (Magyar Nemzeti Bank = National Bank of Hungary 2021) extended its capital requirement:

For the green bonds of companies, and in 2021, according to the MNB's earlier ideas, the EU-based taxonomy and related investments, including the energy efficiency of sustainable agriculture and non-residential properties. With this step, the MNB provides a wide range of investment support to domestic businesses to increase employment.

The MNB provides the central bank with a 0 percent interest rate, up to 25 years of refinancing loans, to the population for the purchase and construction of new residential properties for the population, and to buy new home buildings within the NHP ZOP (Growth Loan Program, Green Home Program). [4], [5], [15].

The MNB programs launched to promote economic growth help to achieve the goals of national economic convergence, balance and consolidation [14].

Csiszárik-Kocsir (2021) declared that since the mid-2010s, smartphones have become more popular, and the scope of online transactions has also expanded. The emergence of home-based finance has led to a reassessment of previous financial decisions, including the selection of bank service providers. Also, other authors focused on the customer preferences in bank selection and value-based analysis of the financial culture [6], [7]. Csiszárik-Kocsir (2022) focused on the importance of the digital space in the 21st century in order to create the perspective future banking system [8]. These technical banking improvements can help customers easier to obtain the banking services.

Furthermore, professional circles have pointed out that in 2020 the largest one-year debt growth since World War II, as global debt rose to $US 226 trillion, related to the global health crisis and deep recession [9], which is no exception from the financial crisis. Portugal, as a member of the eurozone, is also severely affected by the adjustment of the euro of other major foreign currencies of the European Union's common currency. However, the difficulties of the euro and the European Monetary Union in this crisis global economic and financial situations are even more affected by Portugal. Among other things, Halmai (2022) points to these difficulties when he analysed the unsustainable balance of the EMU (Economic and Monetary Union) and stated that despite the progress of recent years, the EMU 1.0 remains an unsustainable balance. Its main characteristics are the lack of the financial union (deficiencies in the Banking Union and the Association of Capital Markets) and the lack of central fiscal stabilization function. In this context, the system does not contain a satisfactory mechanism of movement either at the private or government level [10].

In such a financial situation, national development banks and government -owned financial institutions, which use public funds for economic development, should apply public finances in the appropriate form of implementation [16], [17], [18].

It should be proved that for Portugal, the economic performance of 2021 was in any case more favourable than in previous years, and in particular, a recovery against the severe low downturn during the 2020 pandemic period due to intensive growth of gross domestic investments.
It should be proved that the net international investment positions of the Portuguese population have also improved in Portugal through the growing capital power of the domestic population and businesses.
The study analyses the development of financial and economic situation related to the combined impact of the emerging global energy and food crisis in the case of Portugal, in connection with the financial situation, economic activities of enterprises, and the development of employment and retail consumption taking into account environmental ideas.

MATERIALS AND METHODS

In order to overview the general economic situation of Portugal, the use of broader economic characteristics or, in other words, economic variables, is required. Accordingly, these economic characteristics were involved in the analyses developed in the study. The economic characteristics used, which are contained in the Table 1 additional explanatory in the table. The first series of data is used to characterize economic growth: ReGDP1 Real GDP Growth, ToDoDe2 Total Domestic Demand, PrivCo3 Private Consumption and PubCo4 Public Consumption Development, GFixCapF5 Gross Fixed Capital Investment, Exports6 Exports and Imports7 Import. The savings investment balance is GDP % concerning the GDoInv8 gross domestic investment and HouseSaR9 the savings rate of households. Labour Management Characteristics Employ10 Employment and Unempl11 changes in unemployment. In terms of prices, the data refers to the ConPric12 evolution of consumer prices (harmonized index). Budget data belong to GeGoBal13 the budget balance and GeGoDebt14 changes in government debt. In addition, additional important features NIIP15 Net international investment position and CuAccBa16 the balance of the current accounting or pay balance is also a percentage of GDP (Table 1).
At the end of each quarter, the International Investment Position (IIP) shows that the value of the financial assets of the economy (Assets), which is non -resident, and the liabilities of the economy (Liabilities) are considered an extra gold reserve for non -residents. The difference between assets and liabilities is the net position of the NIIP and means net demand, claim, or net liability and belonging to the rest of the world. The value of the NIIP is due to other changes from transactions and residents and non -residents at the end of the period at the end of the previous period. Other changes in volume and revaluation (due to changes in exchange rates or prices). According to functional classification, cross -border financial transactions and positions are classified as direct investment, portfolio investment, financial derivative transactions (other than reserves) and employee stock options, other investments and reserve assets. Data is provided in the European Union in a quarterly million euros.
The most favourable processing method for processing the widespread data series is SPSS (Statistical Program for Social Science), which includes factor analysis and correlation matrix [11]. In the course of the analysis, the aim is to review the degree of correlation between each economic variable, which emphasizes the changes in the Portuguese economic characteristics. On this basis, the current economic state of the country and the resulting international economic strength and competitiveness can be measured. As Portugal, as a member of the European Union, is a part of the eurozone at the same time, the country also affects the economic situation of the eurozone.

STATISTICAL ANALYSIS

Table 1: Percentage of Portugal's major economic data in percent and million euro, between 2018-2022.

Title of economic variables	**2018**	**2019**	**2020**	**2021**	**2022**
Characteristics of economic growth					
ReGDP1	2.8	2.7	-8.4	4.9	5.8
ToDoDe2	3.2	3.1	-5.6	5.1	3.5
PrivCo3	2.6	3.3	-7.1	4.5	3.4
PubCo4	0.6	2.1	0.4	4.1	1.3
GFixCapF5	6.2	5.4	-2.7	6.5	5.9
Exports6	4.1	4.1	-18.6	13.1	7.2
Imports7	5.0	4.9	-12.1	13.1	1.7
Savings investment balance (in percent of GDP)					
GDoInv8	18.3	18.5	18.8	19.7	20.2
HouseSaR9	6.7	7.2	12.6	10.8	8.3
Labour Force					
Employ10	2.3	0.8	-1.8	1.9	1.2
UnEmpl11	7.2	6.7	7.1	6.6	6.5
Prices					
ConPric12	1.2	0.3	-0.1	0.9	6.1
Budget data (in percent of GDP)					
GeGoBal13	-0.3	0.1	-5.8	-2.8	-2.2
GeGoDebt14	121.5	116.6	135.2	127.4	115.8
NIIP15	-106.4	-100.0	-104.8	-95.9	-84.5
CuAccBa16	0.6	0.4	-1.1	-1.1	-1.3

Source: Bank of Portugal; Ministry of Finance, National Statistical Bureau; Eurostat; IMF. In million euro, in percent 2018-2022. (Bank of Portugal; Ministry of Finance; National Statistics Office (INE); Eurostat; and IMF staff projections. In percent, in million Euro)

The IMF (International Monetary Policy) and the Portuguese National Bureau of Statistics are estimated by July 1, 2022 for Portuguese data 2022. The study was submitted in September 2022.

Economic characteristics used in Table 1 for economic growth between 2018-2022

Titles of economic variables between 2018–2022	
ReGDP1	Real GDP
ToDoDe2	Total domestic demand
PrivCo3	Private consumption
PubCo4	Public consumption
GFixCapF5	Gross fixed capital formation
Exports6	Exports
Imports7	Imports
GDoInv8	Gross domestic investment
HouseSaR9	Household saving rate
Employ10	Employment

UnEmpl11	Unemployment rate (Percent, average)
ConPric12	Consumer prices (Harmonized index)
GeGoBal13	General government balance
GeGoDebt14	General government debt
NIIP15	Net International Investment Position
CuAccBa16	Current account balance (Percent of GDP)

Source: Bank of Portugal; Ministry of Finance; National Office of Statistics; Eurostat; IMF. Million euros, percent 2018-2022. Database and SPSS statistical calculations based on own calculations

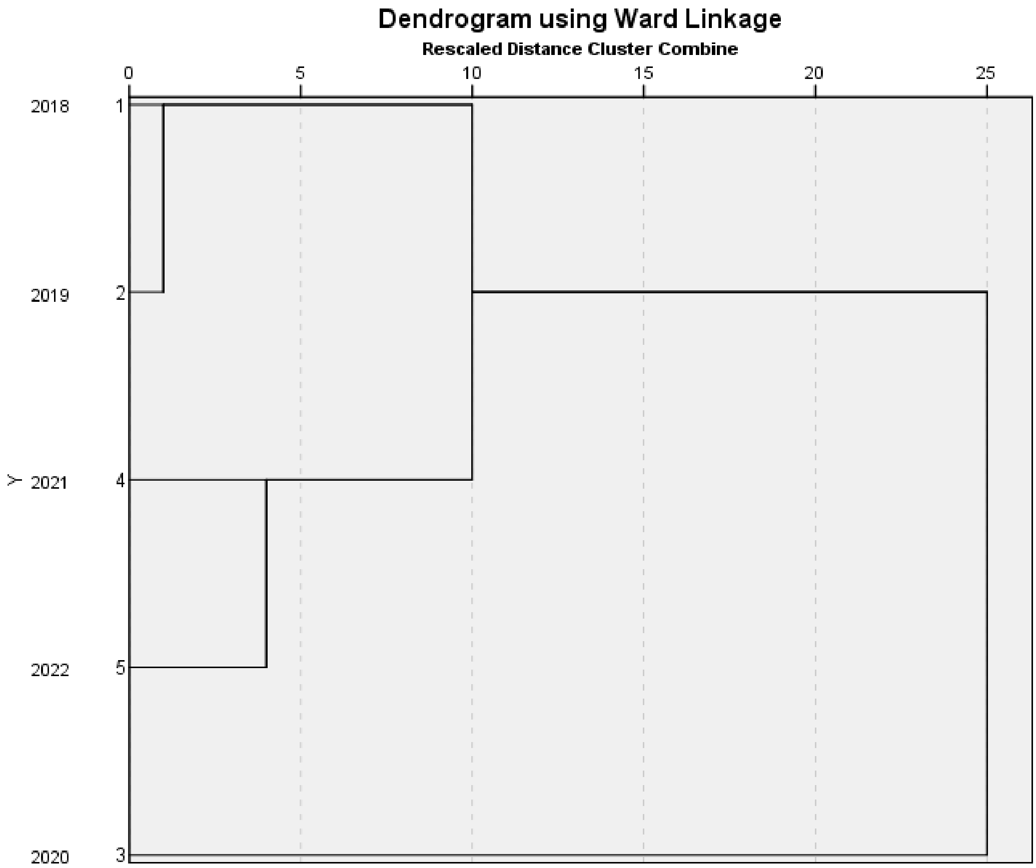

Figure 1: Clustering of each year based on their economic characteristics. Using the Ward connection method according to the dendrogram system.
Source: Bank of Portugal; Ministry of Finance; National Office of Statistics; Eurostat; IMF, Million euros, percent 2018-2022. Database and SPSS statistical calculations based on own calculations. Database and SPSS statistical calculations based on own calculations

Table 2: Correlation Matrix[a]

		ReGDP1	ToDoDe2	PrivCo3	PubCo4	GFixCapF5	Exports6	Import7	GDoInv8	HouseSaR9	Employ10	UnEmpl11	ConPric12	GeGoBal13	GeGoDebt14	NIIP15	CuAccBa16
Correlation	ReGDP1	1.000	.978	.981	.535	.976	.973	.870	.427	-.657	.899	-.637	.549	.719	-.789	.594	.141
	ToDoDe2		1.000	.996	.622	.991	.992	.949	.301	-.645	.938	-.560	.365	.757	-.715	.443	.244
	PrivCo3			1.000	.600	.990	.983	.929	.290	-.681	.917	-.585	.382	.787	-.766	.463	.266
	PubCo4				1.000	.516	.689	.779	.415	.115	.437	-.659	-.089	.147	-.069	.322	-.216
	GFixCapF5					1.000	.970	.915	.235	-.731	.959	-.485	.390	.814	-.765	.406	.325
	Exports6						1.000	.956	.397	-.548	.914	-.620	.386	.670	-.655	.500	.129
	Import7							1.000	.214	-.466	.897	-.480	.104	.651	-.486	.264	.235
	GDoInv8								1.000	.263	.130	-.787	.746	-.284	-.148	.912	-.827
	HouseSaR9									1.000	-.692	.057	-.289	-.954	.882	-.080	-.741
	Employ10										1.000	-.264	.297	.762	-.616	.229	.377
	UnEmpl11											1.000	-.559	-.146	.490	-.883	.463
	ConPric12												1.000	.117	-.580	.870	-.406
	GeGoBal13													1.000	-.839	.032	.771
	GeGoDebt14														1.000	-.511	-.390
	NIIP15															1.000	-.590
	CuAccBa16																1.000

a. This matrix is not positive definite

Source: Bank of Portugal; Ministry of Finance; National Office of Statistics; Eurostat; IMF. Million euros, percent 2018-2022. Database and SPSS statistical calculations based on own calculations

Table 3: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.582	59.888	59.888	9.582	59.888	59.888	6.157	38.481	38.481
2	4.029	25.182	85.070	4.029	25.182	85.070	5.058	31.615	70.096
3	1.854	11.589	96.658	1.854	11.589	96.658	4.250	26.562	96.658

Extraction Method: Principal Component Analysis
Source: Database and SPSS statistical calculations based on own calculations

RESULTS AND DISCUSSION

Some characters of changes in Portuguese economy

In both Hungarian and Portuguese conditions, the global energy and food crisis have resulted in serious challenges. In this extremely uncertain economic situation, it has become important to coordinate fiscal and monetary policy in order to support financial stability, purchasing power and support businesses, especially small and medium -sized enterprises. In order to ensure the national economy, short -term and medium -term objectives should be brought into line for long -term, and longer -term economic growth [9]. For this, it is also essential to provide energy supply in Hungary and to improve energy efficiency, to protect households, to strengthen economic growth, to improve budget and financial and, in particular, the monetary situation [12].
In Portugal, the budget deficit was significantly reduced by the end of 2021. Economic policy steps to reduce the effects of energy crisis from the beginning of 2022 are expected to strengthen further economic growth. In order to promote a continuous economic recovery in the future, it was necessary to restart budget consolidation from 2023, while expanding budget expenditures for the absolutely necessary public investments and the alleviation of high debt risks.
In this regard Heller (2005) pointed out that the government's borrowing from a banking system should be controlled by monetary political objectives, namely the aim of creating sufficient liquidity to support the real growth of the economy, which requires low inflation.
Continuous Portuguese economic policy efforts and definite implementation of EU -funded reform programs can provide a future opportunity for a more competitive and greener economy. Economic risks may require more fiscal support in the near future, which targets vulnerable households and the most affected but still viable businesses. In contrast, if the economy performs better than expected, there is a chance to save.
According to international opinion, despite the Portuguese banking system, it was able to provide a sufficiently stable financial system, there is a need for continuous monitoring of credit quality, including the risks of rising housing prices and tightening financial conditions. Efforts to further strengthen bank capital suffers are also essential. Structural reforms are key to further strengthening the growth potential of Portugal and accelerating income convergence processes for the rest of the euro area [2].
It is possible to agree with a number of international professional opinions [9] that monetary policy now places great emphasis on rising inflation and inflation expectations. While inflation and nominal GDP growth in some cases help to reduce debt rates in some cases, it cannot maintain a significantly decreasing rate of debt in the longer term. The central bank raises interest, which aims to prevent high inflation to increase borrowing costs. The aim of the central bank is to reduce government debt in the country, which will affect economic recovery and fiscal politics.

International experience shows that budget policy needs to be adjusted with rising interest rates. Fiscal aid will be less effective when interest rates rise - as less favourable credit conditions and higher spending or

lower taxes will have less stimulating effect on boosting and increasing employment, while increasing inflation. In such cases, debt is likely to increase. Financial and economic risks intensify if global interest rates rise faster than expected and economic growth may weaken. Significant tightening of financial conditions would increase pressure on the most indebted governments, households and companies. If the state and private sectors are forced to dismantle loans at the same time, growth prospects will deteriorate [9]. The correlation relationships between the 16 economic variables used in the analysis are inhabited by the data in the Table 2. The magnitude of the relationship between economic variables can be characterized by the fact that if these values are between 0.800 and 1,000, as between 80% and 100%, the correlation between economic variables is very strong. If these values are between 0.500 and 0.800, as between 50% and 100%, the correlations are strong. At 0.500, the correlation between economic variables is not important for statistical analysis. In many cases, the correlation value occurs with a negative sign, in which case the economic variable is inversely proportional to the other positive economic variables.
Of course, if the different economic variables have the same sign, for example only negative, then there is a straight proportionality between the variables, ie both two or more variables have a decreasing trend at the same time. If the correlation values of economic variables are only positive, there is a direct proportionality between them, then there is an increasing proportionality in this case.
In the case of data in the Table 2, the changes in real GDP (ReGDP1) are very strongly correlated with the total domestic demand ToDoDe2, private consumption PrivCo3, gross fixed capital investment GFixCapF5, Export Exports6, Import Imports7, and Employment Employ10 economic variables. It also shows that in Portugal the real GDP growth between 2018 and 2022 was significantly influenced by these economic factors and variables, because if domestic total demand, including private consumption, gross capital investments, imports and exports, as well as employment increases, then real GDP grows.
It can be seen from the Table 1 that in 2018-2019, real GDP growth was boosted by 2.8% and 2.7% of the aforementioned variables, primarily the growth of the gross capital investment by 6.2% in 2018 and 5.4% in 2019. Although a little increasing 0.8% of employment because of decreasing in investment felt in 2019, this did not seem to have an impact on real GDP growth. Gross investment growth in 2018 provided a 3.2% increase in total domestic demand and 2.6% of private consumption, while boosting exports slightly more than 4%, while imports kept imports at a higher growth rate of 4.9% and 5.0% at level. In 2019, employment levels barely increased, while unemployment still increased by 6.7%, although it fell by half percent compared to 7.2% last year. From this point of view, these two years were favourable for Portugal.
In 2020, the effect of the global coronavirus epidemic - pandemic - has already been felt with a drastic reduction in real GDP, which can be explained by a 2.7% decrease in gross capital investments. Decreasing investments and production activity significantly reduced total domestic demand by 5.6%, while private consumption decreased by 7.1%. Employment decreased 1.8% this year against the previous growth rate, while the increase in unemployment increased again to a growth rate of 7.0%. The decline in production based on a drastic decline in real GDP resulted in a severe 18.6% decline in export, while imports decreased to a very significant, albeit to a lesser extent than export, but still significantly reduced by 12.1% in a single year, which is foreign trade had a negative impact on balance.
In 2021 there was a seemingly transient recovery in Portugal, as gross fixed capital investment achieved a 6.5% growth rate, even a little more than in 2018. As a result, Real GDP increased by 4.9%, which was far better than the pre-pandemic level. All of this has drawn a 5.1% increase in total domestic demand, a 4.5% increase in private consumption, also in well above the pre-pandemic level. The increase of nearly 2% of the 2021 employment level and the lower level of unemployment below 7.0% could also contribute to the increase in domestic demand and internal consumption.

As internal demand and consumption increased, exports and imports increased significantly by 13.1%, nearly two and a half and three times over the pre-pandemic. It can be seen that in Portugal; the export-import rate has been sought to balance the growth rate to make the balance of the foreign trade balance in a positive direction. It is noticeable that real GDP growth, internal consumption and exports, along with employment, have been significantly dependent on gross fixed capital investments, which is the engine of economic development in Portugal. Between 2018 and 2022, its growth rate increased from 18.3% to 20.2%.

Changes in real GDP (ReGDP1) are in a strong straight correlation in the percentage of GDP with the evolution of the budget balance (GeGoBaL13). As the real GDP decreased to the impact of pandemic in 2020, in parallel,

the negative budget balance was share of GDP by nearly 6% compared to the balanced balance of previous years and the real GDP decreased by 8.4%. However, in 2021, with the reduction of the health crisis - the coronavirus epidemic - the deficit of the Portuguese budget balance decreased slightly less than half, which was still significantly below the more favourable situation before the pandemic.

The negatives of the Portuguese population and companies in their net international investment positions (NIIP15), its debts toward residents and businesses in other countries have been declining since 2018. In this decreasing negative balance, the effects of pandemic and the Russian-Ukrainian war are difficult to assess both food and energy crisis. This is noticeable between the two economic variables in the table for not their strongest correlation, as 0.594.

In addition, Portuguese real GDP change has a strong correlation with three other economic variables, government debt (GeGoDebt14), household savings (HouseSaR9) as a percentage of GDP and unemployment variables. The latter was already mentioned above, as the low GDP growth rate usually involved high unemployment. The Portuguese debt was 121.5% in 2018, which is very high on the financial requirements of the euro introduction, as it requires 60% of government debt as a percentage of GDP. However, this ratio is twice the required requirements. Although the proportion was slightly reduced in 2019, it had already dramatically rose to 135.2% in 2020 in the year of pandemic. It can be seen that, compared to the decreasing rate of real GDP, the savings of households have always achieved a higher increasing rate of growth, and the amount of government debt as a percentage of GDP, albeit to a decrease, but still very significant with real GDP growth.

In 2021, with the reduction of the crown virus epidemic, the 127.4% of Portuguese government debt in the percentage of GDP still did not decrease to 2018, indicating the significant deficit of the foreign trade balance in 2020, to which the budget deficit contributed and the fact that the budget deficit contributed in 2018-2019, the growth rate of imports exceeded the growth rate of exports. It was only in 2022 that the increase in exports increased by 7.2% compared to 1.7%of imports.

Household savings increased as a percentage of GDP, with only 6.7% in 2018, and in 2020 it was 12.6% at the time of pandemic, as this year the population customer mood decreased significantly. In 2021, household savings, although declined to the previous year, were still high at 10.8%. In 2022, the Russian-Ukrainian war and the global food and energy crisis following the result of the financial difficulties resulted in the savings of households decreased to 8.3% as a percentage of GDP. Of course, the 6.1%increase in consumer prices could contribute to this.

During the starting year of the Russian-Ukrainian war, in 2022, by real GDP excellent growth as 5.8%, and increasing exports and foreign trade active, and modest declining budget deficits in GDP by 2.2%; the government debt decreased to the level of 115.8 in the percentage of GDP %. This is still very high compared to the requirements of the introduction of the euro.

As a result of the post-crisis boom during the 2020 pandemic, gross domestic investment, which did not exceed 19% as a percentage of GDP, was already 19.7% in 2021, then in 2022 it has risen by 20.2% to the level of economic recovery. Real GDP growth reached the highest level with 5.8% in 2022, despite the fact that total domestic demand fell from 5.1% in 2021 to 3.5% in 2022, it was also higher than in the period starting in 2018. Private consumption gained a significant increase of 4.5% in 2021, much higher than the Year of Pandemic

(2020), which may have been influenced by an extremely high increase in gross domestic investments. Although this investment increase in 2022 increased by 20.2% despite the Russian-Ukrainian war, the 3.4% growth level exceeded 3.3% before pandemic, but below when it was 4.5% in 2021, but this was still significant. In 2020, public consumption increased by 0.4%, essentially stagnating, but it was more favourable than a decline in private consumption this year. The growth rate of 4.1% in 2021 in 2021 was close to the growth level of private consumption, but in 2022 its growth decreased significantly by 1.3%, which was slightly higher than one third of the growth level in private consumption. The economic consequences of the Ukrainian war, which continued to load the government budget, were obviously played a role in the significant restraint of public consumption. Accordingly, public expenditure had to be reduced to reduce the increase in budget deficits compared to 2020 and 2021.

In Portugal, gross fixed capital investments also declined significantly by 2.7% in 2020, but in 2021 6.5% were significantly in-house investments, ensuring the preservation of jobs, thus contributing to a significant increase in real GDP. The hoped economic recovery, gross fixed capital investments, gross domestic investments, significant export growth and low consumer prices, combined with hope for increased domestic demand, private consumption and public consumption on the producer and consumer side. However, the 2022 Ukrainian war resulted in a moderate economic downturn compared to the temporary economic boom in 2021. Although gross domestic investment in 2022, with a growth of 20.2%, which even slightly increased to 2021, gross stationary investment was 5.9% not much compared to the previous year, but in 2020 full domestic demand, private and public consumption have already fallen noticeably. In addition, in 2022, even exports lost its momentum compared to the previous year. In 2022, the 6.1% increase in consumer price increases also influenced the reduction of household savings as a percentage of GDP, which was only 8.3% in the previous year. In any case, the decrease in government debt as a percentage of GDP to 115.8% in 2022 and the reduction of the negative of the net international investment position balance to 84.5% to compare with 106.4% in 2018. It is clear from the data of the Table 2 that in Portugal, there is a significant impact on the development of total domestic demand (ToDoDe2) and there is a very strong correlation with economic variables namely, exports, imports, and employment. There is no doubt that private consumption, investment growth, export-imports and changes in employment have a serious impact on total domestic demand. As investment increased in 2018-2019 and 2021-2022, as a result, the level of employment could increase the level of private consumption and, in the end, total domestic demand. The increase in total domestic demand also attracted some importance of imported product market needs. The increase in exports also required importance of imports, and on the other hand, expanding export capacity in Portugal is an increasing product emission. Expanding export capacity investments encouraged the expansion of job creation, which increased the domestic demand side by increasing employment. Export products may not be consumed in Portugal, but domestic production will result in the expansion of jobs and employment and thus the domestic consumer market. While the expansion of imports is used to meet higher domestic-domestic market needs at the same time when there is an increase in domestic demand.

During the same period, the total domestic demand was in a strong correlation between the percentage of GDP and the inversely strong correlation relationship with the public debt with economic variables. In this case the negative of the budget balance increased as a percentage of GDP in 2018 and in the 2020-2022 period, which may have resulted in larger budget subsidies, both from an increase in business subsidies for businesses and the growth of domestic demand and also from an increase in social support that encourages domestic demand. In 2019, the minimum increase of 0.1% of the positive balance of the budget is irrelevant, as this meant stagnation. As economic variables, which significantly influenced economic development in 2020, showed a decline, which may have contributed to a reduction in government budget tax revenue, which resulted in a 5.8% deterioration in the government budget deficit. Total domestic demand could have been inversely strong correlations with government debt economic variable because the former modest rate of growth, except for

2020 results, was still a percentage of high government debt as a percentage of GDP. In this way, the two economic variables are inversely a strong correlation.
Furthermore, the Table 2 indicates a very strong correlation between the budget balance sheet with public debt and a very strong correlation with the balance of payments as a percentage of GDP. It should be noted that, contrary to the increase in the budget balance, the amount of government debt has decreased as a percentage of GDP. This is true even if we assume that from 2020 the deficit of the budget balance has increased decreased, while government debt clearly declined as a percentage of GDP. The other economic variables listed in the table, namely private consumption, gross fixed capital investment, exports, imports and gross domestic investment have already been analysed by other economic variables. At the same time, it was not proven that the gross domestic investment and the savings rate of households in the percentage of GDP would have had an impact with a decreasing increase in the balance of payments as a percentage of GDP. However, these economic variables can have an ad hoc effect on each other, with a significant correlation between them. It is also important to note that occasionally the computer statistical program is merely numerically interpreting the

correlation of each economic variable and not according to the actual economic and social processes. Therefore, it is important to note that, in the case of numerically correlation -related variables, it may be not actually economically related to correlations.
The Table 3 shows that the three components in the statistical analysis combine 96.6% (96.658) to explain the correctness of statistical analysis and thus draws real conclusions.
The Figure 1 in the classification of the research period, the economic performance of Portugal has achieved in each year in accordance with clusters' classification and the economic, financial and social relations of the country. Based on this, Portugal achieved similarly favourable economic growth in 2018 and 2019 thanks to recovering investments and related employment and increasing total domestic demand. In percentage of the GPD reduced low general government debt deficit was approximately close to the balanced rate of budget, at this level it was close to stagnation.
In contrast, the economic performance of 2020 deteriorated drastically during pandemic, which is why this year remains a separate cluster in the system. In the 2021 and 2022, Portugal achieved more favourable economic results in the 2018-2019 period, but at the same time it was able to achieve significantly higher performance at the bottom of the 2020 based on a statistical calculation program. Although the budget deficit as a percentage of GDP increased compared to 2018-2019, it was far more favourable to the 2020-year low.

CONCLUSION AND PROPOSALS

It was proven that Portugal's 2021 economic performance was certainly more favourable than in previous years, especially as a result of a severe, low downturn in the 2020 pandemic period. In the 2018-2022 period, the primary engine of economic recovery was an intense increase in continuous and unbroken gross domestic investments, which encompassed the country's whole economy, which was well illustrated by real GDP growth. In addition, investments were able to provide a favourable economic background to Portuguese entrepreneurs, which was noticeable in the growth of gross fixed capital investments. Employment expansion has increased residential purchasing power and also population savings.
These circumstances also had a beneficial effect on the country's internal economic stability, which are also noticeable in the post -crisis situation of the budget balance and public debt pandemic and in the modest deficit of the balance sheet balance.
It has been shown that the net international investment positions of the Portuguese population have also improved in Portugal, with the fact that its balance sheet is still negative, which indicates the growing capital power of the domestic population and businesses and the resulting greater entrepreneurial.

It is also important for Portugal to increase the competitiveness of businesses, both domestic and EU and international markets, which can increase the country's net international investment positions. It is also important to expand employment and to stabilize the positive balance of the country's foreign trade balance primarily by increasing the proportion of higher value-added products within exports.

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ASSESSMENT OF SOIL PROPERTIES UNDER DIFFERENT TILLAGE OPERATIONS

Malihe MASOUDI[1], Csaba CENTERI[1*], Viktória VONA[2], Márton VONA[2], Gergely JAKAB[3]

[1]Institute of Natural Resources Management, the Hungarian University of Agriculture and Life Sciences, Páter K. u. 1, 2100 Gödöllő, Hungary, e-mail: Masoudim65@gmail.com, Centeri.Csaba@szie.hu
[2]Csernozjom Ltd., 5065 Nagykörű, Arany János u. 10. Hungary, e-mail: vonaviki@gmail.com, vona.marton@gmail.com
[3]Geographical Institute, Research Centre for Astronomy and Earth Sciences, Budaörsi út 45. 1112 Budapest, Hungary, e-mail: jakab.gergely@csfk.org

Abstract
Different land-use management (e.g. agricultural, forest) influences soil properties and eventually soil quality. In this study, we tested a Near-Infrared Spectrometer to estimate soil properties in six different tillage systems (disking, shallow tine cultivation, no-till, deep tine cultivation, ploughing, loosening) and a natural land use management (natural tree line). A total of 48 soil samples were taken from 0 to 10 cm in a small region of Hungary's Józsefmajor. We estimated the pH, organic matter (OM) content, total N, total P, exchangeable K, clay content, and cation exchange capacity of the soil using a mobile agro scanner (CEC). The effects of various land-use management techniques on soil characteristics were measured using one-way analyses of variance (ANOVAs). Based on the results, there is a significant difference between a natural tree line and the six tillage operations for pH, OM, P, total N, and clay content, and the ratio of C/N. The measurement revealed that across all tillage systems, the tree line had the highest concentrations of OM, P, total N, and C/N. The pH and proportion of clay were the lowest. However, for these properties, we were unable to identify any differences in the various tillage techniques except for the quantity of clay (ploughing showed higher clay content than no-tillage, disking and shallow cultivation). Additionally, plowing and disking had a greater C/N ratio than no-tillage. For exchangeable K, a comparison is made between the tree line, loosening, deep and shallow cultivation, and plowing. This soil property also demonstrates differences in tillage practices, such as plowing and no-tillage loosening. For CEC, there were differences between ploughing and no-tillage, disking, also the tree line shows differences with ploughing and loosening. The tree line had the highest value of exchangeable K compared to other managements, but CEC had the highest value under ploughing. The study demonstrates land management can significantly affect soil properties and soil quality

Keywords*: soil properties, land use management, soil quality, spectroscopy*

INTRODUCTION

Soil physical and chemical properties, such as texture, acidity, and organic c, are important and effective on soil quality. They also are essential for different ecosystem service such as water retention and the preservation of carbon (C) and nutrient availability and plant growth, further affecting C and nutrient cycling as well as vegetation–climate feedback (Zhao et al, 2019).
Land use management is known as a very important factor that leads to a change in the chemical, physical and biological soil properties (Bizuhoraho et al. 2018).

Land-use and Agricultural management practice (tillage systems) can prompt immediate soil disturbance and ambient environmental changes that can fundamentally alter inputs and decomposition rates and eventually affects soil carbon content and other soil properties (Qin et al, 2016).
Standardized analytical techniques are used to measure soil properties, which are expensive, time-consuming, and require a professional operator. Therefore, alternative measurement techniques are necessary to replace laboratory reference methods in order to provide comprehensive knowledge about soils at a low cost, with acceptable reliability, and in a timely manner. (Mouazen et al, 2007). Near-infrared (NIR) spectroscopy is one of the valuable technologies that have a lot of potential in meeting these needs.
NIRS is a non-destructive analytical method for the characterization and quantification of chemical and physical properties of materials that are fast and easy to use. This method is commonly used as a quality control instrument in the agriculture and food industries (Williams and Norris, 1987).
The objective of this study is to use a Near-Infrared Spectrometer (Wavelength Range: 1300-2600nm MEMS (micro-electromechanical systems) technology) to estimate soil properties in six different tillage systems (disking, shallow tine cultivation, no-till, deep tine cultivation, ploughing, loosening) and a natural land use management (natural tree line).

MATERIALS AND METHODS

Location of the study

The study site includes cropland with 6 different tillage systems and a small natural and untouched tree line located at the Józsefmajor experimental and training Farm (JETF) of Szent István University (47° 41′ 30.6″ latitude N, - 19° 36′ 46.1″ longitude E; 110m above sea level).

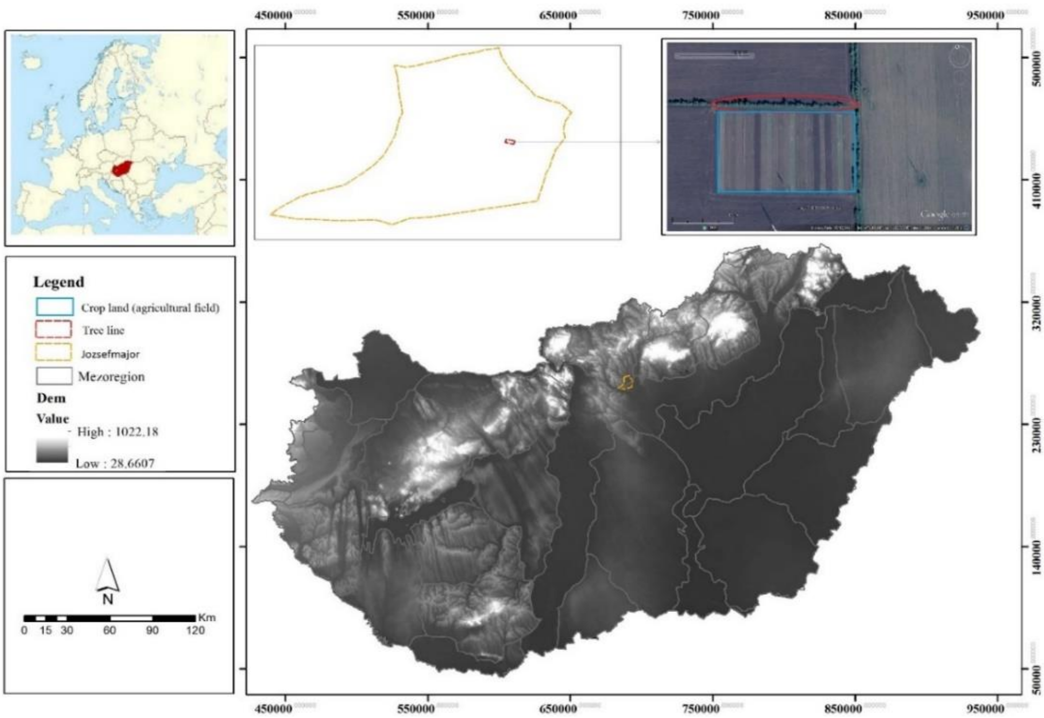

Fig 1. Location of study area in Hungary

Sampling and measurement

The sampling was performed in 48 plots, 12 plots in cropland, and 12 plots in the tree line. Soil samples are collected at a depth of 0-10 cm. For this purpose, 3-4 points were selected randomly at a different point of each plot and then were combined into a mixed sample so that finally 48 soil samples were available for the whole area, and the roots were picked out of the soil by hand.

We used Near-infrared spectrometry (Wavelength Range: 1300-2600 nm MEMS (micro- electromechanical systems) technology) to measure soil properties with an agro-care scanner device. Near-Infrared spectroscopy is a robust method that requires little soil preparation (e.g removing roots and stones) (Sharififar et al, 2019). After drying the soil in the air and grinding the large portion into small particles, parameters such as (OC (%), total N (g/kg), total P (g/kg), cation exchange capacity (CEC), exchangeable (mmol/kg), clay content (%), pH (KCl) were measured (figure 2). After that, distilled water was applied to the soil samples to determine the impact of water or moisture on measurement using this method (about 10% of the weight of each soil sample).

DATA ANALYSIS

ANOVA test was also applied to find the effect of different land management on different soil properties.

RESULTS AND DISCUSSION

Table 1 shows the result of the ANOVA test and observed difference between all land management based significant (difference determine based on p-value <0.05).

Table1- the result of the ANOVA test which shows a significant difference between different land management

Land use	OC	pH	Total P	Exchangeable K	C/N	Total N	CEC	Clay
Dc - D								
L - D								
Nt - D					*			
P - D							***	***
SC - D								
Tl - D	***	***	***			***		**
L - Dc								
Nt - Dc								
P - Dc								
SC - Dc								
Tl - Dc	***	***	***	*	*	***		***
Nt - L				*				
P - L								
SC - L								
Tl - L	***	***	***	***	***	***	*	***
P - Nt				*	*		**	***
SC - Nt								
Tl - Nt	***	***	***		***	***		**
SC - P								*
Tl- P	***	***	***	***		***	***	***
Tl - SC	***	***	***	*	***	***		***

According to the results, there is a significant difference between a natural tree line and the six tillage operations for pH, OM, P, total N, and clay content, and the ratio of C/N. As the measurement showed, the tree line had the highest OM, P, and total N content and ratio of C/N compared to all tillage systems. In contrast, the tree line had the lowest pH and clay percentage values. However, for these properties, we could not find any differences among the different tillage operations except for clay percentage (ploughing showed higher clay content than no-tillage, disking and shallow cultivation). In addition, the ratio of C/N was higher under ploughing and disking than no-tillage. The comparison shows differences between the tree line and ploughing, loosening, and deep and shallow cultivation for exchangeable K. This soil property also shows differences among tillage operations, including no-tillage loosening and ploughing. For CEC, there were differences between ploughing and no-tillage, disking and tree line show differences with ploughing and loosening. The tree line had the highest value of exchangeable K compared to other managements, but CEC had the highest value under ploughing. The study demonstrates land management can significantly affect soil properties and soil quality.

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7TH INTERNATIONAL CEEPUS WINTER SCHOOL DESIGN WEEK 2022

Virág NÉMETHY

Rejtő Sándor Faculty of Light Industry and Enviromental Engineering
Institute of Product Design
Phone: +36 20 314 7814, E-mail: nemethy.virag@uni-obuda.hu

Abstract:
In my article you can read a journal of the CEEPUS Winter School Design Week 2022, held between 16.10.2022 and 22.10.2022, which was organized by Prof. Jelka Geršak PhD, professor at the University of Maribor. Professors and students from seven different European countries attended the event, creating a very diverse atmosphere culturally. In addition to getting to know novelties and innovative technologies, we were able to gain significant professional experience because of the event, by getting to know different perspectives and design approaches.

Keywords: *Erasmus mobility, international relations*

INTRODUCTION

I was greatly honored to receive an invitation from the Director of the Institute to the 7th International CEEPUS Design Week, held from 16-22.10.2022 at the Faculty of Technology of the University of Maribor. Together with 3 students in the mobility program, we were excited about the novelties and challenges that awaited us as participants. The event attracted both lecturers and students from excellent universities in 7 European countries, and the diverse program series invited those interested with many interesting novelties.

PROGRAM DESCRIPTION

International CEEPUS Winter School Design Week has been a major international program series since 2012, the basic concept of the event came from Prof. Jelka Geršak PhD. The objective of Winter School Design Week is to explore the full spectrum of modern engineering design from the perspective of clothing and other textile forms and closely related areas such as art, color theory, smart materials, fashion theory, and photography. The insetting concept of the Winter School also aims to connect the fields of science and the arts with the creative work of students from different universities and the theoretical and practical method aspects of design that differ from country to country.

A key element is interoperability and openness between different disciplines, which allows for interaction between science, art and society, the environment necessary for the development and implementation of innovative ideas.

Transdisciplinary as a basic strategy drove the spirit of the workshops, which focused on sustainability and innovation design methods. Along these criteria, students and mentors implemented their projects in interdisciplinary designed creative workshops held in parallel time bands, which I will describe in detail below.

Figure 1: : Faculty of Technology of the University of Maribor

ZERO WASTE DESIGN INSPIRED BY CULTURAL HERITAGE

Professors Dr Katherine Townsend and Eloise Salter from the Faculty of Arts at Nottingham Trent University in England in collaboration with Professor Sonja Šterman of the University of Maribor Faculty of Technology held a workshop entitled Zero Waste design inspired by cultural heritage. The aim of the workshop was to design and implement an outfit based on pre-established criteria.

In addition to the use of waste-free tailoring processes, an important element of the project was the decorative pattern inspired by cultural heritage. In terms of the outcome of the projects, different interpretations of the cultural inspirations of students from different countries and the merging of innovative tailoring processes have led to unique results.

Figure 2:Students of Óbuda University (Luca Torma, Vajk Szebedy) at the workshop and the completed mock-up

SEMIOTICS OF FASHION – CONTEMPORARY SLOVENIAN FASHION PHOTOGRAPHY

Dr. Petra Krpan, professor at Zagreb University, held a modern media related workshop focusing on the relationship between fashion journalism and contemporary photography. At his lecture, we were able to participate in a photographic historical outlook and the study of contemporary art elements at the same time. The objective of his workshop was to create an editorial, the inspiration of which, although free, had to be connected to Maribor at some point. Inspired by street costumes, streetscapes, urban art, and landscape elements, his students created magazine editorials and newspaper article drafts. Each student approached the project from a completely different perspective, so the final results ranged from a very colorful scale.

CREATION OF A SKETCHBOOK FOR DENIM CAPSULE COLLECTION

The workshop held jointly by Dr. Edit Csanák DLA and Virág Némethy focused on the possibilities of using one of the most dominant clothing raw materials, the denim material. Breaking away from mainstream use, the participating students were able to learn new interpretations of the raw material. The aim of the workshop was to prepare the design documentation for a 6-piece capsule collection in the form of a unique skechbook. During the workshop, participants could follow the process from the very first phase of collection design, get to know the design criteria and objectives.

The students attending the workshop first set their goals during a brainstorming session, then sketched and planned. They created both on paper and in the available workshop for the technology, so they supplemented their designs with interesting textile manipulations.

Figure 3: Student work on the workshop (Adél Garics, ITF Grade 3)

DEVELOPMENT OF SMART CLOTHING TO IMPROVE SAFETY OF PEOPLE WITH DEMENTIA

Professor at the University of Maribor, Prof. Jelka Geršak PhD. and doctoral student Jan Slemenšek focused on an attempt to make life easier for people struggling with dementia, by setting up and modeling the concept of an intelligent garment. In addition to the design, the participants had the opportunity to get an insight into a complex technical background work during the design process of various circuits and support equipment. The end result is a jacket with programmable elements that have sensors to indicate when the wearers involved in an accident and to remind them of their programmed actions with the help of speakers.

SHAPE MODELING IN FASHION

The workshop, held by Professors Prof. Jolanta Talaikytė and Prof. A. Ščepanova of the Vilnius Academy of Art, focused on the study of structures that can be built around the body. The source of inspiration was the formal world of contemporary architecture; along which it was necessary to model the characteristic motifs of a given building in groups on the scale of a human body using metal parts. In addition to extravagant formal experimentation, students had the opportunity to study the parallels between architecture and tailoring.

"I want to travel"

Professor I, Andrea Pavetić and Koraljka Kovač Dugandžić, professors at the University of Zagreb, took the creative draining of confinement and the desire to travel as the basis for their workshop.

The purpose of the workshop was to design and construct a bag. In the spirit of handicrafts, the participating students were able to gain insight into the wide possibilities of decorating techniques, so the results became diverse and unique.

PHOTOGRAPHY

Dr. Pavel Trnka, professor at the University of Hradec Královégy in the Czech Republic, introduced his students to the world of media production. During his workshop, students could learn about the process of photo documentation and content production while making a joint short film. From lighting tricks to interviewing and content preparation, they collaborated interactively with the professor in each sub-process. The result was a great success among the participants of the Winter School, as every single person present became a part of their project directly and indirectly.

Figure 4: Professor of the Photography workshop (Dr. Pavel Trnka) and participants at work

The week was closed by a presentation, during which we could get to know the results of all the workshops and a joint exhibition. In conclusion, the event gave us all a lot and provided a huge experience. It was very interesting to experience the instructor side. This was the first mobility program I participated in, so this was the first time I could experience what it's like to work with students as a non-student. What I still feel like I've gotten a lot from my week in Maribor is being involved in building relationships. I felt in a special situation, as I am only a few years older than the students, so I could easily integrate into both sides at the same time.

Student feedback was very positive. They really felt it was useful to work hard all week, to learn about new perspectives, forms of education, technological developments. In addition, they have formed friendships across many countries, which strengthens their relationship capital and broadens their professional horizons.

Figure 5: Dr.Edit Csanák DLA and Némethy Virág

Abstract -
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November 17th – 18th, 2022
Óbuda University
Budapest – Hungary

The 13th ICEEE-2022 Online
International Annual Conference on
*"Global Environmental Development &
Sustainability: Research, Engineering &
Management"*

COMPOSITES MATERIALS, PROCESSES, PROPERTIES AND APPLICATIONS

Rudolf SZABÓ[1], Lóránt SZABÓ[2]

[1]Rejtő Sándor Foundation, Budapest, Hungary, ingtex@t-online.hu, +36309245612
[2]Institute of Environmental Protection Engineering and Natural Sciences, Budapest, Hungary, szabo.lorant@rkk.uni-obuda.hu,+36303865097

Abstract:
Composites have been found to be the most promising material available in this century. Presently, composites reinforced with fibers of synthetic or natural materials are gaining more importance as demands for lightweight materials with high strength for specific applications are growing in the market. Fiber-reinforced polymer composite offers not only high strength to weight ratio, but also reveals exceptional properties such as high durability; stiffness; damping property; flexural strength; and resistance to corrosion, wear, impact, and fire. Performance of composite materials predominantly depends on their constituent elements and manufacturing techniques, therefore, functional properties of various fibers available worldwide. Their classifications, and the manufacturing techniques used to fabricate the composite materials need to be studied in order to figure out the optimized characteristic of the material for the desired application.

Keywords: *fiber-reinforced polymer, specific properties, composites productions, applications*

INTRODUCTION

The push for fuel economy in the face of nowadays drastically increasing oil and gas prices, for example, has made lightweighting a priority in almost every mode of mechanical transportation, from bicycles to large commercial aircraft. Over time, materials are changed by humanity. Fig. 1 shows the relative importance of material development through the history.

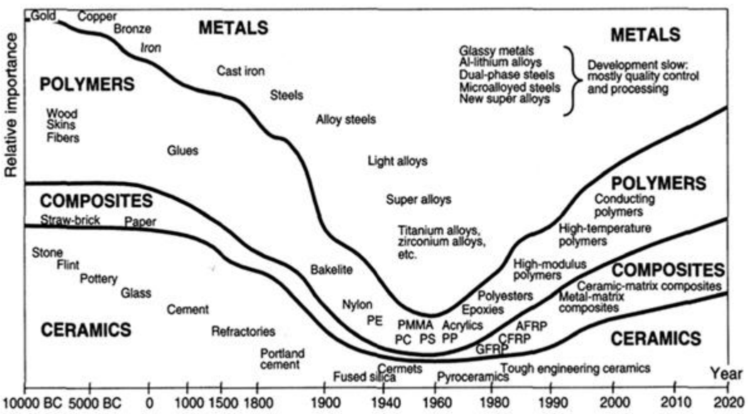


Figure 1. Material development through the history

Composites from materials with significantly different properties (fiber, matrix), particular production process are a new material with excellent properties (Fig. 2).

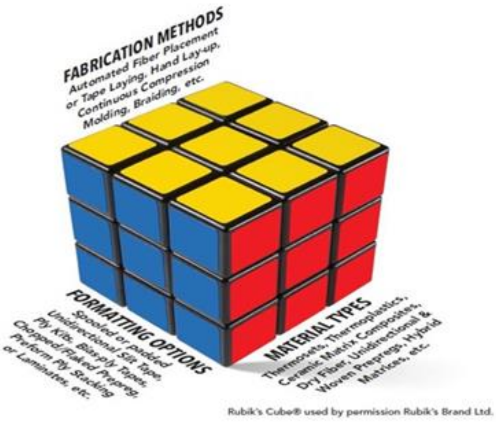
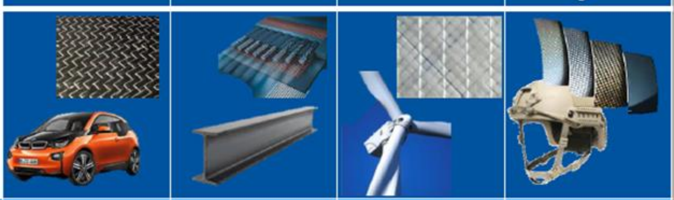


Figure 2. The complexity behind working with composites

REINFORCEMENT FIBERS

Compared to the block material, the fibrous form has many advantages in terms of mechanical and formability. Carbon fibers is a unique material (Fig. 3).



	Carbon	Steel	Glass	Polymer
Density	1.8 g/cm³	7.8 g/cm³	2.5 g/cm³	1.0 g/cm³
Tensile strength (Fiber)	7.1 GPa	4.0 GPa	4.0 GPa	3.20 GPa
Tensile strength (Bulk)	0.1 GPa	1.4 GPa	0.5 GPa	0.03 GPa

Figure 3. Comparison of physical properties of applied structural materials

Several high-performance fibers can be used to strengthen composites. Glass fibers are used in the largest amount in the reinforcement of composites, while carbon fiber has many excellent properties. Carbon fiber manufacturers produce carbon fiber bundles or "tows" consisting of thousands of continuous, untwisted and delicate filaments, much thinner than a human hair (d=7 μm). The filament count designated by a number followed by "K," meaning multiplication by 1,000. So, 12K tow indicates a bundle containing 12,000 continuous filaments. Typical aerospace composite applications use finer tow sizes ranging from 1K to 12K. Heavy-tow carbon fibers, with filament counts from 50K to 320K, are available at a lower cost than aerospace-grade fibers, because of precursor and processing differences. Carbon fiber demand, application and manufacturers are listed in Table 1.

Table 1. Carbon fiber supply and demand (2015-2015)

Carbon fiber demand (all tow sizes, all types)	
2015	65,000 MT
2020	120,000 MT
2025	170,000 MT
Market share, 2020	
Aerospace/defense	18%, 21,600 MT
Industrial	69%, 82,800 MT
Sports/leisure	13%, 15,600 MT

Carbon fiber suppliers, 2020 (nameplate)	
Toray	50,000 MT
Toho-Tenax	20,000 MT
Mitsubishi Rayon Carbon Fiber & Composites	15,000 MT
SGL Group	14,000 MT
Hexcel	13,000 MT
China	12,000 MT
Rest of World	5,000 MT

There is virtually no alternative to lightweight constructions: carbon fibres, the black wonder fibres that are superior to steel and aluminium in almost all respects when it comes to cutting weight. And, in terms of stability and lightness, carbon-reinforced plastic is simply unbeatable. Carbon fibers have higher strength and significantly higher stiffness than glass fibers, the specific gravity of laminates is slightly lower. Therefore, they are mainly used for rigid structures. For example, the wide-span wing of a fiberglass glider, or the blade stiffener of a wind turbine, bends to a greater extent and is heavier when compared to carbon fiber reinforced composites (CFRP). Fig. 4 shows mechanical properties of fibers.

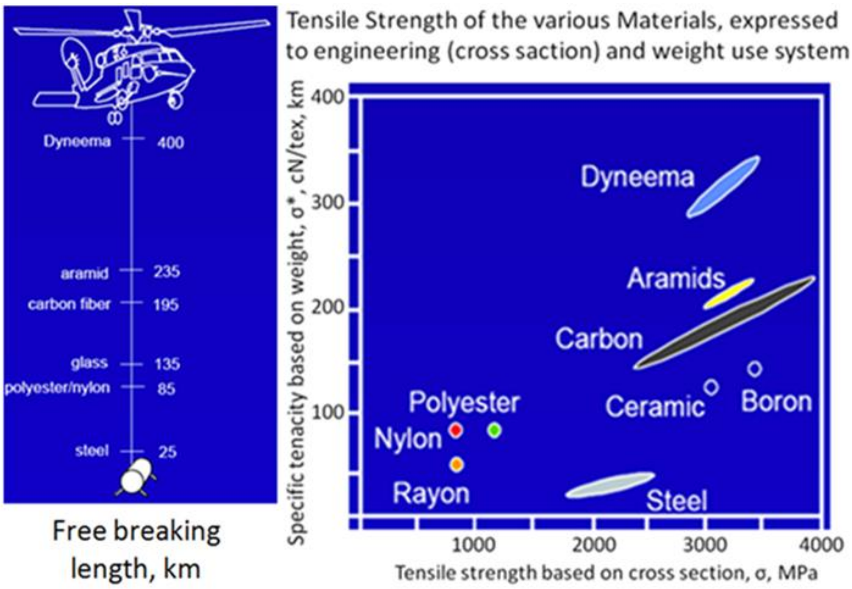


Figure 4. Mechanical properties of different fibers

The mechanical comparison of different structural materials can be expressed with specific characteristics, referring to the mass (weight) due to the significantly different densities (Table 2).

Table 2. Comparison of fiber properties of glass, aramid and carbon

Properties ↓ / Fiber materials →	Glass	Aramid	Carbon
Fiber isotropy	+	-	-
Tensile strength	+ -	+	+ +
Young's modulus	-	+ -	+
Impact	+ -	+ -	-
Humidity absorption	+	- -	+ +
Creep	+ -	+ +	+ +
Electrical conductivity	-	-	+ +
Chemical resistance	+ +	+ +	+ +
Temperature resistance	+	+ +	+ +
Matrix bonding/adhesion	+	-	+
Process ability	+ -	+ -	-
Aluminium	+	+	- -
Costs	+ +	-	- -

MATRICES

A wide range the matrices, so called bedding materials the shape of parts determining.
Fiber-reinforced composite matrices can be:
Polymer (FRP),
Elastomer (Tyre),
Concrete (building) amplifier structures,
Gain wood,
C and C composites,
C and Ceramics,
C and Metal, and
Bio-plastic.
Thermoset (TS) resin permanently cures into a cross-linked network when mixed with a catalyst, exposed to heat, or both. Fabricators can control the cure profile and viscosity through careful formulation of the catalyst package, which may include inhibitors, promoters and accelerators. For aerospace applications using CFRP, cure takes place in an airtight autoclave vessel, which applies heat and pressure to ensure good consolidation of the laminate to minimize any voids or air bubbles that can weaken the part. Alternative but less used curing technologies include electron beam, ultraviolet (UV) radiation, X-ray and microwave processes.
The thermoplastic (TP) resin is the other most commonly used matrix type, which is proving an increasingly popular option for composites manufacturers. Thermoplastic linear polymer chains are permanently cured into a crosslinked network when mixed with a catalyst, exposed to heat, or both formed and can be reformed into shaped solids by melting or softening and then cooling the material. Often sold in sheet or panel form, thermoplastics can be processed by in-situ consolidation techniques, such as simple press forming to make tough, near-net shape parts without the autoclave or vacuum-bag cure required by thermosets. TP reformability offers the potential to correct anomalies or repair in-service damage. Although there are many high-performance thermoplastic resin matrices available, such as polyetheretherketone (PEEK), which are finding their way into critical aircraft structures like

access doors and panels and wing leading edges. The newly application nanotechnologies that, when used as resin additives, can enhance the performance of resins in composites applications.

COMPOSITES MANUFACTURING PROCESS

The surface of the fiber is treated with a material (sizing) corresponding to the matrix to promote a better fiber/matrix connection. The mechanical properties of composite materials are derived primarily from the fiber reinforcement. Commercial composites for large markets, such as automotive components, boats, consumer goods and corrosion-resistant industrial parts, often are made from noncontinuous, random glass fibers or continuous but nonoriented fiber forms. Fig. 5 shows the characteristics features of **f**iber **r**einforced **p**lastics (FRP).

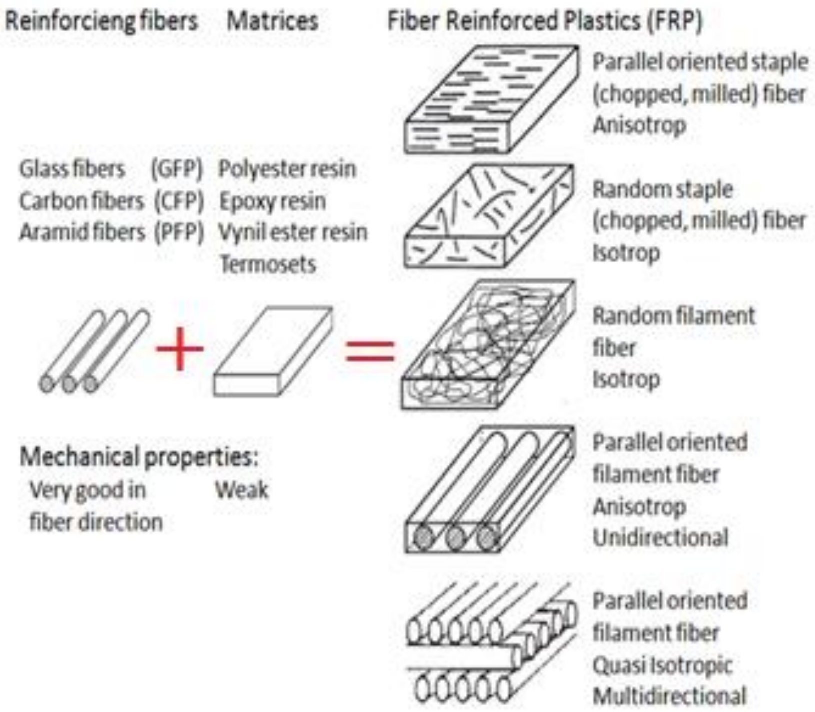


Figure 5. Characteristics features of fiber reinforced plastics (FRP)

The high-performance filament fibers in the composites are oriented according to the loads (unidirectional (UD), multidirectional (MD)). Curing usually occurs under elevated temperature and/or pressure conditions in an oven and/or vacuum bag or in an autoclave. Several processes have been developed for the production of composites (Fig. 6).

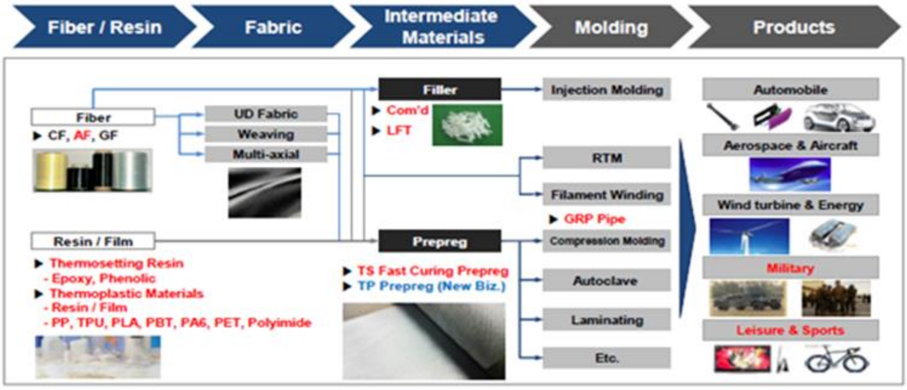


Figure 6. Scheme of composite manufacturing technologies

Composite materials are fabricated with a number of different techniques, among which every technique is applicable for certain material. Effectiveness of manufacturing technique is dependent on the combination of type and volume of matrix or fiber material used, as each material possesses different physical properties, such as melting point, stiffness, tensile strength, etc. (Fig. 7). Therefore, manufacturing techniques are defined as per the choice of material.
When making structures with high bending stiffness, a light core material sandwiched between the composite planes is placed.

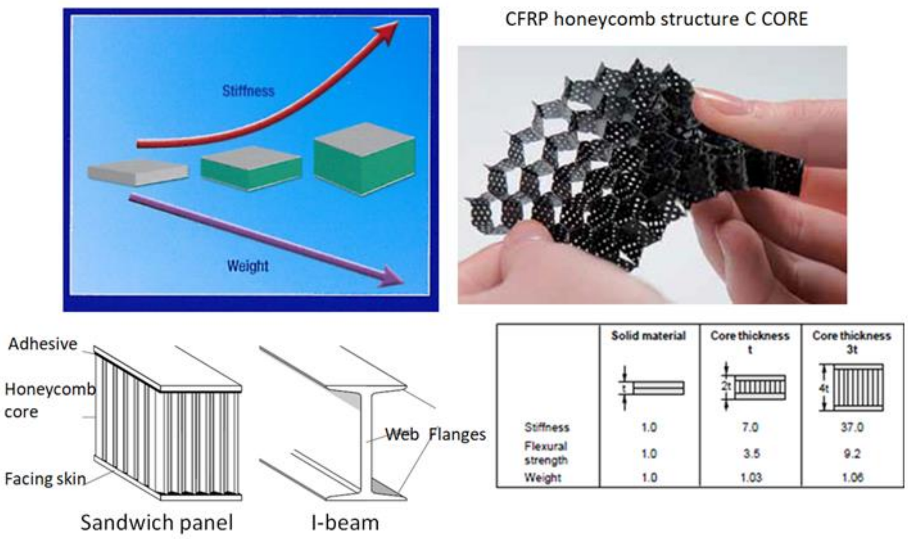


Figure 7. Benefits of honeycomb sandwich constructions

COMPOSITES PROPERTIES

Most composites are made up of two materials - the matrix (or binder) surrounds a cluster of fibers or fragments of a stronger material (reinforcement). A common example of this structure is fiberglass, which was developed in the 1940's to be the first modern composite and is still in widespread use. In fiberglass, fine fibers of glass, which are woven into a cloth of sorts, act as the reinforcement in a plastic or resin matrix.

Composites differ from traditional materials in that composite parts comprise two distinctly different components — fibers and a matrix material (most often, a polymer resin) — that, when combined, remain discrete but function interactively to make a new material, the properties of which cannot be predicted by simply summing the properties of its components. In fact, one of the major advantages of the fiber/resin combination is its complementary nature. Thin glass fibers, for example, exhibit relatively high tensile strength, but are susceptible to damage. By contrast, most polymer resins are weak in tensile strength but are extremely tough and malleable. When combined, however, the fiber and resin each counteract the other's weakness, producing a material far more useful than either of its individual components (Fig. 8).

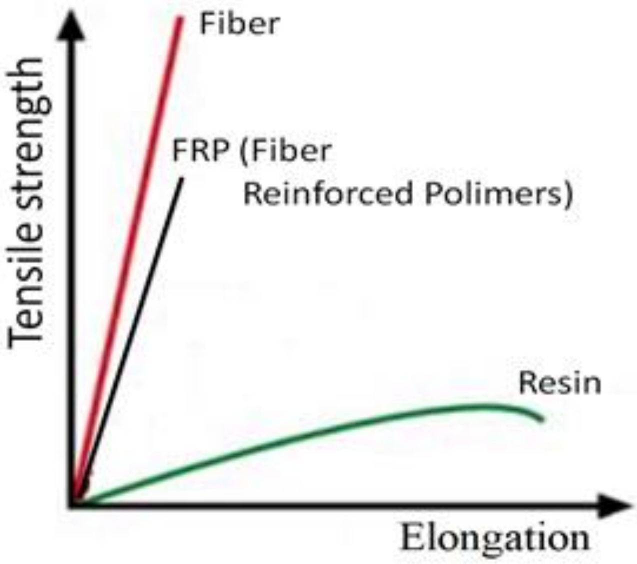


Figure 8. Force elongation diagram of fiber, matrix and composite

These materials do not blend or dissolve together but remain distinct within the final composite structure. Composite materials can be made to be stronger, lighter or more durable than traditional materials due to properties they gain from combining their different components.
High-performance composites derive their structural properties from continuous, oriented, high-strength fiber reinforcement — most commonly carbon, aramid or glass — in a matrix that promotes processability and enhances mechanical properties, such as stiffness and chemical resistance.
Composites have proven resistance to temperature extremes, corrosion and wear, especially in industrial settings, where these properties do much to reduce product lifecycle costs. These characteristics have propelled composites into wide use. High strength and low weight remain the winning combination that propels composite materials into new arenas (Fig. 9).

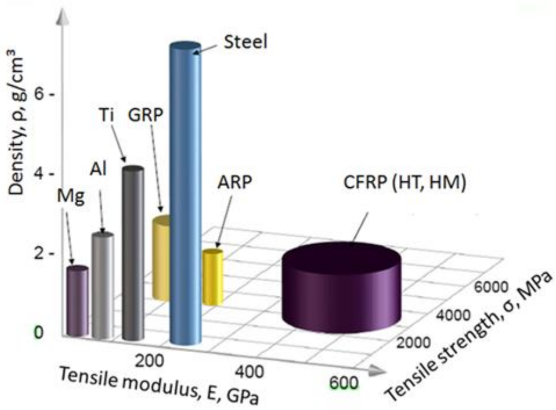


Figure 9. Mechanical properties of important structural materials

Composite materials offer good vibrational damping and low coefficient of thermal expansion (CTE), characteristics that can be engineered for specialized applications. Composites are resistant to fatigue and provide design/fabrication flexibility that can significantly decrease the number of parts needed for specific applications — which translates into a finished product that requires less raw material, fewer joints and fasteners and shorter assembly time.

APPLICATIONS

Advanced composites, initially developed for the military aerospace market, offer performance superior to that of conventional structural metals and now find applications in communication satellites, aircraft, sporting goods, transportation, heavy industry and in the energy sector in oil and gas exploration and wind turbine construction.
With the decrease in the price of carbon fiber and the development of composite technologies, the field of application is widening, and the quantity is growing rapidly (Fig. 10).

Figure 10. Carbon fiber history

Fiber orientation can be controlled, a factor that can improve performance in any application.

In composite golf club shafts, for example, boron and carbon fibers oriented at different angles within the composite shaft enable it to take best advantage of their strength and stiffness properties and withstand torque loads and multiple flexural, compressive and tensile forces.
The important large-volume use of the composite is aerospace, transportation, energy (wind blade), chemistry industry, high performance machine parts, sportswear, etc. (Fig. 11).

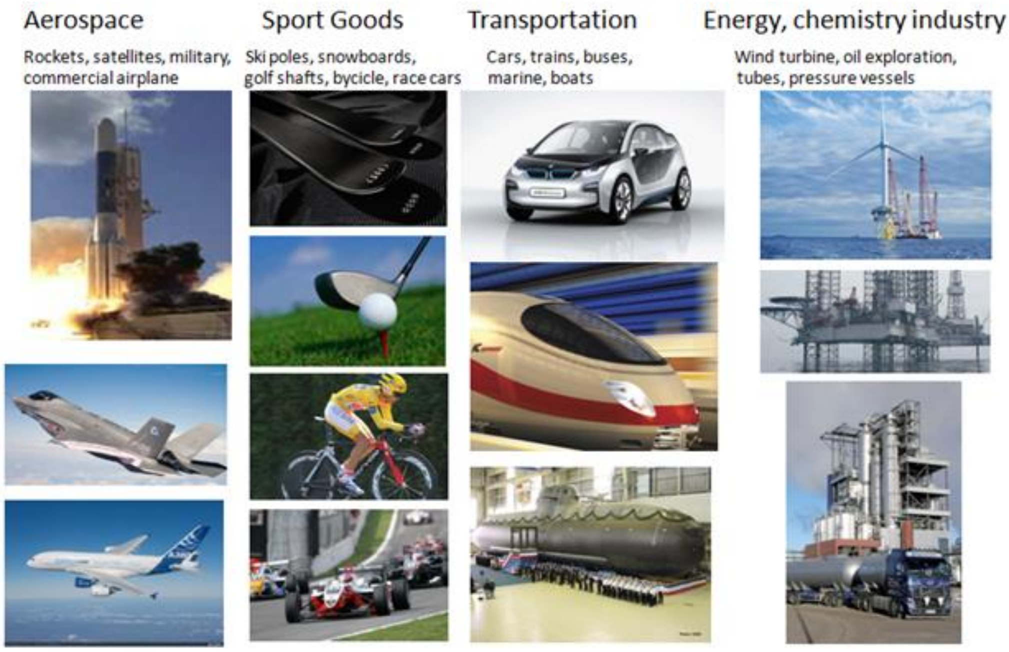


Figure 11. Example of FRP applications

They are trying to introduce hydrogen technology to store and use energy. In order to reduce the weight of high-pressure (p = 700 bar) tanks, he predicts a high demand for carbon fiber in the near future.

CONCLUSIONS AND RECOMMENDATIONS

Fibre-reinforced plastic materials or composites are recognised as possessing superior specific properties when compared to conventional engineering materials. However, the widespread use of these materials is still limited, with engineering designers choosing to stick with what they know best. Composite technology requires new knowledge and a new approach from technical specialists. Over the past decade the global economy and energy concerns have remade the markets for advanced composite materials, services, and technologies. Despite challenges, the global demand for carbon fiber is expected to nearly double of the next five years. Lightweight composite materials offer potential benefits for energy efficiency and renewable energy.

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THE CORPORATE ASPECTS OF CLIMATE CHANGE ACTION WANG XUECHU

Xuechu WANG

Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary, E-mail: victorwxch@gmail.com

Abstract:
The population has increased dramatically, forests have been deforested, many cities and factories have been expanded, and grasslands have become decertified. The current climate warming trend is fast. Will bring severe consequences to the global environment. Faced with the severe effects of global warming, how should companies deal with global warming? Does the Company have sufficient awareness of climate change? This article takes the environmental management system as the theoretical basis. Use the investigation experiment in a group of Chinese companies and the comparative investigation of several oil companies for analysis. It is concluded that the Company's activities affect climate change, and climate change brings challenges, opportunities, and risks to the Company.

INTRODUCTION

Human activities will have an impact on climate change. These effects are to change the composition and water vapor content of the atmosphere while releasing heat to the atmosphere and changing the physical and biological properties of the underlying surface. The latest report of the United Nations Intergovernmental Panel on Climate Change (IPCC) has determined the danger of rapid climate change. IPCC is an outstanding international organization composed of 195 world-leading climate scientists. It has been studying climate change in depth since 1988 and has published a series of continuous peer review reports. Its latest comprehensive information was released at the end of 2018 and removed within two years, confirming that the process of global warming is much faster than suggested by previous models. (Gerald H,2004)
The report further pointed out that record-breaking numbers of storms, floods, droughts, forests, fires, and sea ice melting have been set in the past ten years. Especially in the Arctic and Antarctica, where the melting of glaciers and ice can have a catastrophic impact on sea-level rise. Importantly, the report also tightened the ideal goal of reaching 2 degrees Celsius (or shift) at the historic Paris summit in 2015, rather than 1.5 seconds higher than the pre-industrial level. It warned that, based on the current emission trajectory, the budget for global warming and the absolute concentration of greenhouse gases in the atmosphere required to keep warming at or below that level may disappear within 11 years. (IPCC 2008) A recent report by the World Meteorological Organization (WMO) highlighted the impact of climate change on humans. In 2018 alone, about 6,200 people were directly affected by climate change, including the forced migration of 2 million "climate disasters." In addition, the trend in recent years is particularly worrying; after two consecutive years of decline, global CO_2 emissions increased in 2017 and 2018. In 2018, emissions increased by 1.77%, 70% higher than the average increase in the past ten years. (World Meteorological Organization 2009)

BACKGROUND INTRODUCTION

Climate change is the human development issue we face. All development is related to the expansion of human potential and the expansion of freedom. Because of this, development has cultivated human abilities

to make choices and live the lives they cherish. Climate change will damage human freedom and limit people's choices. (United Nations, 2007)
For example, we will see what kind of significant reversal in human development will begin. Millions of the world's poorest people must comply with the impact of climate change at all levels. The media worldwide have not paid full attention to these effects and have not shown them as events that foreshadow disasters. In the financial market, these events have not attracted attention when calculating the world's GDP today. Frequent droughts, more violent storms, floods, and environmental pressure will restrict the poor from improving their lives and their children's lives. (Chris，2006)
Climate change will quietly undermine the efforts of the international community to eradicate poverty. The Millennium Development Goals set a new ambitious goal for 2015. (United Nations 2015) Climate change will prevent people from changing this situation. Although many achievements have been made, many countries have yet to act. Three years ago, political leaders from worldwide gathered to formulate goals for accelerating humanity's sustainable development. (2017 Sustainable Development Goals Report) In the future, climate change will stagnate the achievements of generations of people in reducing extreme poverty and health, nutrition, education, and other fields, and it will also cause regression.
The proportion of commercial activities in climate change cannot be ignored; in the future, all mankind will face the danger of global warming. The rapid accumulation of greenhouse gases in the earth's atmosphere will fundamentally change the climate predictions of future generations. We are slowly moving towards this "critical point." Unpredictable events caused by climate change may trigger ecological disasters. An example is the accelerated decomposition of huge ice sheets (Intergovernmental Panel on Climate Change, 2007). These disasters will change the way of life of humanity and damage the vitality of the national economy. In recent years, we have seen the impact of climate change on us. If we do nothing, this situation will continue for our children and grandchildren.

CLIMATE CHANGE

Climate change includes all the variations in the climate that last longer than individual weather events. In contrast, the term climate change only refers to those variations that persist for a longer period, typically decades or more. Since the Industrial Revolution, the climate has increasingly been affected by human activities causing global warming and climate change. （America's Climate Choices 2014）
The climate system receives nearly all its energy from the sun. The climate system also radiates energy to outer space. The balance of incoming and outgoing energy, and the passage of the energy through the climate system, determine Earth's energy budget. Earth's energy budget is positive when the incoming energy is greater than the outgoing energy, and the climate system is warming. If more energy goes out, the energy budget is negative, and the earth experiences cooling. (Rohli & Vega 2018)
The energy moving through Earth's climate system finds expression in weather, varying on geographic scales and time. Long-term averages and variability of temperature in a region constitute the region's climate. Such changes can result from "internal variability" when natural processes inherent to the various parts of the climate system alter energy distribution. （IPCC AR5 WG1 Glossary 2013）

Examples include variability in ocean basins such as the Pacific decadal oscillation and Atlantic multidecadal oscillation. Climate variability can also result from external forcing when events outside of the climate system's components produce changes within the system. Examples include changes in solar output and volcanism. Climate change has consequences for sea-level changes, plant life, and mass extinctions; it also affects human societies. (The United Nations Framework Convention on Climate Change 1994)

HUMAN ACTIVITIES IMPACT IN CLIMATE

Global CO_2 emissions increased in 2017 and 2018. In 2018, emissions increased by 1.77%, which is 70% higher than the average increase in the past ten years. (2018 "Global Energy and Carbon Dioxide Status Report") Human activities affect climate change by changing the number of greenhouse gases in the atmosphere, a suspension of fine solid particles or liquid droplets in air, or another gas (aerosol) and clouds. (IPCC AR4 SYR Appendix Glossary. 2008)The largest production source is the burning of fossil fuels, releasing carbon dioxide gas into the atmosphere. The way greenhouse gases and aerosols affect climate change the amount of incident solar radiation and the number of electromagnetic waves (infrared radiation) between microwaves and visible light. They are all part of the Earth's energy balance. Changing the atmosphere's content or characteristics and particles in the atmosphere can lead to warming or cooling the climate system. Since the beginning of the industrial age (Approximately 1750), human activities have continued to warm the climate. Recent years, the impact of humans on climate exceeds the impact of changes in natural processes such as solar activity and volcanic eruptions. (ESRL Web Team 2008)

Many factors indicate that human activities are the main reason for the increase in greenhouse gas concentrations (Stott, P. Attribution 2015). For example, the ratio of carbon isotopes in atmospheric carbon dioxide and the change trend of atmospheric carbon dioxide distribution are consistent with human emissions. There is also other evidence that human activities also contribute to the increase of other greenhouse gases. (Christidis, 2015)

Human activities have led to four main gases: CO_2, CH_4, N_2O, and halocarbons (a group of gases containing fluorine, chlorine, and bromine). These gases accumulate in the atmosphere, causing their concentration to increase over time. In the age of industrialization, all these gases have a significant increase in the atmosphere. All these increases are attributed to human activities.

Human transportation, building heating and cooling, and fossil fuels in cement and other products are the long-term result of the increase in CO_2. The process of destroying forests increases the amount of CO_2 emitted and reduces the amount of CO_2 absorbed by plants. CO_2 is also released through some natural processes, such as plant decay. (IPCC 2007)

The growth of CH_4 is caused by human activities related to agriculture, natural gas transmission and distribution, and landfill. Natural processes also release CH_4, such as those occurring in wetlands. (IPCC 2007)

N_2O is also emitted by human activities, such as using fertilizers and burning fossil fuels. Natural processes in the soil and ocean also release N_2O. (IPCC 2007)

The increase in halocarbon gas concentration is mainly the result of human activities. Natural processes are also a small source of emissions. The main halocarbon gases include chlorofluorocarbons (such as CFC-11 and CFC-12), widely used as refrigerants and other industrial processes before they were found to destroy stratospheric ozone after entering the atmosphere. Due to the implementation of international rules to protect the ozone layer, the concentration of chlorofluorocarbon gases is declining. (IPCC 2007)

Ozone is a greenhouse gas, which is continuously produced and destroyed by chemical reactions in the atmosphere. Human activities increase the ozone content in the troposphere because carbon monoxide, hydrocarbons, and nitrous oxide emitted from activities undergo chemical reactions to produce ozone. As mentioned above, the halocarbons released by human activities destroy the ozone in the stratosphere, creating an ozone hole over Antarctica. (US EPA 2013)

Water vapor is the highest and most important greenhouse gas in the atmosphere.

However, the direct impact of human activities on the water vapor content in the atmosphere is very small. However, by changing the climate, humans can directly impact the water vapor content. For example, the higher the atmospheric temperature, the more water vapor it can hold. The CH4 emitted by human activities also affects the water vapor content because methane produces a small amount of water vapor after being destroyed by chemical processes in the stratosphere. (Lloyd, Robin 2011)

Aerosols are small particles in the atmosphere, with various sizes, concentrations, and chemical compositions. Some aerosols are emitted directly into the atmosphere, and some are formed through the reaction of other compounds emitted. Aerosols include naturally occurring compounds and compounds produced by human activities. The burning of fossil fuels and biomass adds sulfur compounds, organic compounds, and black carbon (soot). Human activities such as open-pit mining and industrial processes increase the dust in the atmosphere. Natural aerosols include mineral dust released on the surface, sea salt aerosols, biological emissions from land and oceans, and sulfate and dust aerosols produced by volcanic eruptions. (Friedlander 2000)

THE CONSEQUENCES OF CLIMATE CHANGE

Vegetation
As the climate changes, the types, distribution, and coverage of vegetation will also change. This influence affects the rate of many natural cycles. For example, the rate of decomposition of plant litter is reduced. The gradual warming of an area will lead to earlier flowering and fruit setting times, thereby changing the life cycle of independent organisms. On the contrary, cold causes the plant's biological cycle to lag.
In some cases, climate change may increase vegetation pressure, rapid plant loss and desertification. An example of this occurred in the Carboniferous Rainforest Collapse (CRC) extinction event 300 million years ago. At this time, the vast rainforest covered the equatorial regions of Europe and the United States. Climate change has destroyed these tropical rain forests, causing habitats to suddenly split into isolated "islands" and leading to the extinction of many animal and plant species.

Wild animals
One of the most important ways for animals to cope with climate change is to migrate to warm or cold regions. Over a longer period, evolution has made ecosystems, including animals, better adapted to the new climate. When organisms are overstretched and unable to adapt, rapid or extensive climate change can lead to mass extinction.

Human civilizations
The collapse of past civilizations (such as the Maya) may be related to the cycle of precipitation, especially drought. In this example, it is also associated with the warm pools in the Western Hemisphere. About 70,000 years ago, the eruption of the Toba super volcano created a freezing period during the ice age, leading to possible genetic bottlenecks in the human population. (John 2008)

Glaciers and ice caps
Glaciers are one of the most sensitive indicators of climate change. Their size is determined by the mass balance between snow cover and snowmelt. As the temperature rises, the glacier will retreat unless the snowfall number increases to compensate for the additional melting. Glaciers grow and shrink due to natural changes and external forces. Changes in temperature, precipitation, and hydrology can strongly determine the evolution of glaciers in a particular season. (Climate change and the environment 2019)
Since the middle to late Pliocene (about three million years ago), the most important climate process is the cycle between glaciers and glaciers. The current interglacial period (Holocene) has lasted about 11,700 years. Affected by orbital changes, the rise and fall of continental ice sheets and major sea-level changes will help create the climate. However, other changes, including the Heinrich event, the Dansgaard-Ersge event, and the younger tree frog event, all illustrate how glacier changes may affect the climate without orbital forcing. (Climate change and the environment 2019)

Sea level change
During the last glacier peak about 25,000 years ago, the sea level was about 130 m lower than today. Rapid changes in sea level characterize the subsequent deglaciation. In the early Pliocene, global temperatures were 1–2˚C higher than current temperatures, but sea levels were 15–25 meters higher than today.

Sea ice
Sea ice plays an essential role in the Earth's climate because it affects the total amount of sunlight reflected from the Earth. Many years ago, almost all oceans on the earth were covered by sea ice. But under the influence of climate change, the ocean ice will gradually disappear. When there is a large amount of sea ice globally, especially in the tropics and subtropics, the climate is more sensitive to forcing due to the vital feedback of ice-albedo.

BUSINESS AND CLIMATE CHANGE

Climate change has an increasingly important role in business competition. Greenhouse gas emissions will be increasingly subject to scrutiny, regulation, and pricing. Although individual managers may have direct and significant differences of opinion on the impact of climate change, companies need to take immediate action. (Jonathan Woetzel 2020)
Companies that insist on treating climate change only as a corporate social responsibility rather than a business issue will bear the greatest consequences. Of course, stakeholders' expectations and social responsibility standards will affect the Company's climate policy. But now, the impact of climate on company operations is so obvious that it is certain that this problem is best solved with the tools of strategists rather than philanthropists. Companies tackling climate change are under increasing scrutiny in 2015.
Some companies are hindering the development of climate action. The European Chemical Industry Council, the American Chamber of Commerce, Australian Business Indicators, and the comprehensive Federation of Japanese Economic Organizations encompass almost all major Japanese companies. ImpactMap stated that these groups "strongly oppose most climate legislation." (National Climate Assessment 2017)
In 2011, the head of the UN climate department, Christiana Figueres, solved this problem and attracted resource companies' attention with economic and political strength. These companies are urging the government to maintain the current alternative to fossil fuels.
Over the past few years, scrutiny of companies' influence and their trading groups has grown steadily. The Federation of Concerned Scientists has compiled a report (National Climate Assessment 2017) that assesses whether well-known American companies have accepted climate change science and studied how they lobby for climate policy.

CARBON EMISSIONS OF COMPANY

In 2018, global greenhouse gas emissions originated from changes in land use and agriculture. Most of the rest comes from energy consumption and emissions in industrial processes. (World Resources Institute, 2018)
Data from the think tank World Resources Institute shows how these emissions are distributed. Buildings (17% of the total) and road transportation (12%) are the biggest contributors. Other modes of transportation are also important, with sea and air transportation accounting for 2%. In the industry, steel (8%), chemical and petrochemical (6%) and cement (3%) constitute a large piece. On a national scale, China is the largest pollution source, and it emits about a quarter of the world's pollutants. The United States ranks second with 12%. The

EU and India each produce about 7%. In summary, the 20 most polluting countries/regions globally account for approximately 80% of global emissions. (World Resources Institute, 2018)

Traditionally, large-scale greenhouse gas emissions data have been collected at the national level, but this report focuses on fossil fuel producers. It is compiled based on a publicly available database of emissions data. It is intended as the first in a series of publications, focusing on the role companies and their investors can play in combating climate change. Since 1988 (the year the Intergovernmental Panel on Climate Change was established), more than half of global industrial emissions can be traced back to only 25 companies and state-owned entities.

The report stated that the historical emissions associated with these fossil fuel producers are large enough to make a significant contribution to climate change. (World Resources Institute, 2018)
Exxon Mobil, Shell, BP, and Chevron are investor-owned companies with the largest emissions since 1988. If fossil fuels continue to be mined at the same rate as 1988 to 2017 in the next 28 years, the average temperature will rise by four °C by the end of this century. That could have catastrophic consequences, including the extinction of large numbers of species and the risk of global food shortages. Although companies can play a huge role in promoting climate change, the short-term profitability of companies is still an obstacle to reducing emissions.

Corporate Standard:
The "Greenhouse Gas Protocol Corporate Accounting and Reporting Standard" provides requirements and guidelines for companies and other organizations that prepare greenhouse gas emission inventories. Its design considers the following goals:

- ★ Using standardized methods and principles helps companies prepare a true and fair greenhouse gas inventory representing their emissions.
- ★ Simplify and reduce the cost of preparing greenhouse gas inventories.
- ★ Provide companies with information that can be used to develop effective strategies to manage and reduce greenhouse gas emissions.
- ★ Increase the consistency and transparency of greenhouse gas accounting and reporting between companies and greenhouse gas plans.
- ★ This module is based on more than 350 leading experts from companies, NGOs, governments, and accounting associations. It has already conducted drive tests in more than 30 companies in 9 countries/regions.

The standard is mainly prepared from the perspective of companies that develop greenhouse gas inventories. However, it also applies to other types of organizations whose operations generate greenhouse gas emissions, such as non-governmental organizations, government agencies, and universities. The "Greenhouse Gas Project Accounting Protocol" provides requirements and guidance for this. Policymakers and architects of greenhouse gas programs can also use relevant parts of this standard as the basis for their accounting and reporting requirements.

The GHG Protocol Corporate Standard has been designed to be program or policy neutral. However, it is compatible with most existing GHG programs and their accounting and reporting requirements. It is important to distinguish between the GHG Protocol Corporate Standard from other GHG programs. This standard focuses only on the accounting and reporting of emissions but does not require emissions information to be reported to WRI or WBCSD. In addition, while this standard is designed to develop a verifiable inventory, it does not provide a benchmark for how the verification process should be conducted. (Corporate Standard 2020)

COMPANIES RELY ON CLIMATE CHALLENGE

Sustainable development

Focusing on climate change is not just about reducing carbon emissions. Whether the Company's management has a reliable strategy for managing climate change risks and opportunities is also the key. Large companies should also consider the impact of company activities on climate change.

The actions of Tetra Pak's large packaging solutions company are a good example. It instead uses the energy generated by burning waste wood to produce sustainable virgin fiber packaging. We have seen more and more companies provide innovative solutions for the growing and environmentally conscious market. (Tetra Pak 2020)

In another example, a water and waste management company took active measures to improve the cleanliness of emissions from its industrial projects. The Company also owns the biodiversity of the wetlands surrounding its facilities, turning the surrounding area into a wildlife park popular with birdwatchers.

Traditional energy to new energy

For example, Ørsted Energy has converted almost entirely from coal-derived from oil, natural gas and thermal energy to become one of the country's leading offshore wind farm operators.

Today, the Company focuses almost entirely on renewable energy. It finds and develops suitable sites, manages and maintains facilities, and sells energy to the grid. We believe that companies are increasingly turning to renewable energy on a large scale, and investors seem to have realized the industry's huge potential.

Addressing climate change is a long-term effort.

One of the main challenges we face is determining which companies truly believe in creating meaningful change through their products and operations. As people pay more and more attention to the Company's environmental qualifications, some companies may exaggerate their commitment to sustainability. For us, it is vital to understand whether sustainability exists in the Company.

SOLUTION

The impact of climate change cannot be ignored. To solve this problem, reducing carbon emissions alone is not enough. Governments, asset owners, technicians and managers should play a more significant role in addressing climate change challenges.

GOVERNMENT POLICY FOCUS ON

According to the requirements of the Intergovernmental Panel on Climate Change (IPCC), to keep the global warming range below two °C, the emissions of carbon dioxide (CO2) and other greenhouse gases (GHGs) must be halved by 2050 (compared to the 1990 Year's level ratio). It is expected that emissions will need to be reduced by 80% to 95% by 2050. Advanced alternatives with large emissions (such as China, India, and Brazil) will limit their emissions. (IPCC 2020)

The "Kyoto Protocol" of the "United Nations Framework Convention on Climate Change" reached an agreement in 1997, which is a step towards achieving a global scale. It sets binding emission targets for alternatives that have ratified the convention (such as EU alternatives) and limits the increase in emissions caused by other countries' first commitments from 2008 to 2012. Before 2004, the 15 EU alternatives (EU-15) jointly adopted the "burden-sharing agreement" within the EU, allowing certain EU

budgets to increase emissions, while others must reduce emissions. Most of the highest goals for joining the EU after May 1, 2004 are -6 to -8% in the base year (Mainly 1990).

The United States, which accounts for a large proportion of total global greenhouse gas emissions, has not yet ratified the protocol. According to the protocol, China and several other countries with large greenhouse gas emissions have no binding emission targets. It is expected that governments will achieve their goals, mainly through domestic policies and measures. They can accomplish some of their desired goals by investing in scaled projects (clean development mechanism (CDM)) or planned (joint implementation (JI)). The clean development mechanism also aims to support sustainable development, for example, by funding renewable energy projects.

The Cancun Agreement, adopted at the United Nations Climate Conference in Mexico (December 2010), includes a comprehensive financial, technical, and capacitybuilding support plan to help mitigate climate change and adopt a low-emission economy agreement. It will raise 100 billion U.S. dollars in climate funding for cuts before 2020 and establish a Green Climate Fund through which most of the budget will be provided.

The "Durban Platform for Enhanced Action" adopted at the United Nations General Assembly in South Africa (December 2011) agreed on a roadmap for developing a new legal framework by 2015, which applies to all United Nations climate convention proposals. It also foresees the second commitment period of the "Kyoto Protocol" starting in 2013. An agreement was also reached on the design and governance arrangements for the new Green Climate Fund. (IPCC, 2020)

BUSINESS SOLUTIONS

Climate change is a complex systemic issue, which means that it is not easy for companies to solve this problem in their strategy.

Unpredictable extreme weather may lead to shutdowns of production facilities, logistics chaos, and reduced agricultural output. In severe cases, it may even lead to social instability and immigration. Technological innovation, regulatory changes, and consumer and investor behavior changes may be more difficult to predict. (Jean Palutikof,1983)

One of the main ways to deal with climate change is to set science-based carbon reduction targets globally. That requires companies to make a comprehensive commitment following the necessary emission reduction trajectory and control global temperature rise within two °C in the Paris Agreement. In some cases, companies have made further commitments to achieve a higher goal of keeping the temperature rise within 1.5°C.

About 500 companies have currently participated in the Scientific Carbon Reduction Initiative (SBTi) jointly launched by the World Resources Institute, the United Nations Global Compact Project, the Worldwide Fund for Nature and the Carbon Information Disclosure Project. (CIOB 2050)

Climate change is one of the biggest crises facing humankind but coping with the climate crisis also brings huge economic opportunities. The impact of climate change on business and society is visible. Suppose it cannot be dealt with effectively. In that case, climate change will cause huge damage to infrastructure, disrupt supply chains and distribution networks, threaten energy supply, affect global food, and water resources' safety, and bring more uncertainties to the market. Lead to an increase in business operating costs. If we cannot effectively intervene in the climate change crisis, we will not achieve fair, just, and high-quality, sustainable growth. To reduce risks, companies need to find new business models. The sooner a company finds such a business model, the less disruptive the impact of climate change on the Company will be, and the lower the cost of corporate transformation will be.

Nestlé is committed to reducing greenhouse gas emissions related to food and beverage production and distribution by improving energy efficiency, using cleaner energy sources, and investing in renewable resources. For example, in Europe, we have transformed long-distance road transportation into rail

transportation or short-distance sea transportation. In Mexico, we choose to use wind power to provide energy for factories. In some factories in France, we install wood-fueled boilers. Nestlé has installed a solid-liquid fuel mixed boiler at the Dongguan coffee factory in China, burning coffee grounds to produce steam. By doing so, we have greatly reduced solid waste, recycled the heat contained in coffee grounds, reduced fuel consumption, and saved 1,400 tons of heavy oil every year. That also reduces the sulfur dioxide and carbon dioxide emitted from fossil fuels, which are the main causes of acid rain and the greenhouse effect. (Nestlé, 2013)
The low-carbon revolution has brought huge opportunities for enterprises, society, and the overall economy. If there are good policy incentives, this will be a great opportunity for companies to develop new products and services, increase employment, and reduce energy consumption to improve competitiveness through a new round of low-carbon technological innovation. The global promotion and use of clean energy will also have many positive effects on public health, energy security, and global poverty reduction. Many companies have taken strides to join this global initiative. They have joined the global climate solution by setting ambitious emission reduction targets, disclosing carbon emissions, and expanding low-carbon investment. However, to accelerate the low-carbon actions of enterprises, greater government support and measures are particularly necessary. Only through effective policy signals and tools can companies expand their investments in clean energy, energy conservation, and natural resources protection and enhance their own and communities' ability to adapt to the climate. Through cooperation, companies and governments can effectively deal with the risks brought by climate change and create a better, safer, and healthy world.

TECHNOLOGICAL SOLUTIONS

The importance of technology in negotiating the future climate pattern is increasing day by day. For example, in Bali Action Plan agreed on in Bali in December 2007, two of the five core elements focused on strengthening technology development and transfer and providing sufficient financial support to help technology development and transfer. At the COP held in Poznan in December 2008, the Poznan Technology Transfer Strategic Project was launched.
It is a key measure to expand the scale of investment in technology transfer and help developing countries express their demands for environmentally beneficial technologies. The Conference of the Parties (COP) meeting held in Copenhagen in December 2009 finally recommended that "...the technology transfer process should be accelerated to support adaptation and mitigation actions. The entire process should be country-driven, and the specific design should be determined by the country's particular conditions and priority areas.
In addition to helping countries carry out technology needs assessments and find priority technology combinations in mitigation and adaptation, the new version of the manual also provides developing countries with low-emission and low-vulnerability strategies (such as identifying appropriate domestic abatement actions (NAMAs)). For example, this handbook discusses how a country can accelerate the development and transfer of priority technologies and how this information can be useful in formulating strategies. This handbook summarizes the latest results of strategies developed by countries during and after the COP meeting.
For example, the European Union proposed a new concept, suggesting that developing countries can prepare low-carbon development plans as appropriate domestic emission reduction actions. South Korea suggested that "developed country Parties should provide developing country Parties with suggestions on low-carbon development paths, and at the same time, they should also provide appropriate policy tools and necessary

support for developing countries to achieve greenhouse gas emission reduction and economic development at the same time.". (United Nations 2017)

NEW TECHNOLOGIES APPLY TO COMBAT CLIMATE CHANGE

Promote the use of artificial intelligence and other cutting-edge technologies to accelerate climate and circular economy actions: advanced solutions use data to discover patterns and analyze energy and material consumption. As a result, industries and companies can optimize energy and operational efficiency, thereby significantly improving environmental sustainability in supply chain management. Big data and predictive analysis provide stakeholders with important information about their surroundings' socio-economic and spatial dynamics. This allows the assessment of climate weaknesses to be incorporated into spatial planning and urban design, thereby maximizing the potential of cities to reduce emissions. Real-time information also enhances the ability of climate monitoring and risk location in agriculture to improve climate resilience. In addition, cutting-edge technologies play an important role in improving the life cycle assessment of ICT products and transforming ideas into executable plans to provide information for companies to implement relevant ecodesign guidelines in their products. (ICT 2020)

Establish a comprehensive framework to ensure active technological disruption: Establish a comprehensive framework to define the goals and boundaries of frontier technologies and make disruptive innovations and the common goals and visions of the international community, especially the Sustainable Development Goals, the Paris Agreement on Climate Change the Agreement is consistent with the New Urban

Agenda. It will provide industries and businesses, and governments with a basic understanding of the decarbonized society, thereby improving accountability and transparency while ensuring that the application of cutting-edge technologies is sustainable, inclusive, and ethical technologies are effective. The well-being can benefit all relevant stakeholders. In this process, the existing architecture in different contexts should be evaluated. The cultural structure and rules essential to the use of technology should be recognized, and the principle of no harm should have adhered to. Where possible, a widely participatory and democratic process should be adopted in the development, testing, and use of this cutting-edge technology. (ITU 2020)

Encourage multi-stakeholder partnerships and international cooperation to promote sustainable and inclusive growth: there is a need to strengthen collaboration between industries, companies, governments, academia, NGOs and international organizations, and other stakeholders to raise and share knowledge, resources, and expertise on the latest innovations. Technologies and forums that support youth participation, women, and marginalized communities in decision-making should also be promoted. An international platform that gathers the views and expertise of all relevant stakeholders is an important channel to promote best practices and strengthen multi-stakeholder partnerships and cooperation. They allow the contribution of marginalized groups to sustainable development to be reflected at the international level, thereby encouraging equitable development for all.

Implement international standards, uniformly deploy next-generation information and communication technology infrastructure and assess the environmental impact of cutting-edge technologies: International standards, such as ITU Recommendations and other international frameworks and guidelines, such as the ten principles of the United Nations Global Compact, are all Contains important guidelines and tools to support governments to implement and coordinate the deployment of cutting-edge technologies at all levels. They also assist industries and companies in determining the environmental requirements of ICT infrastructure and assessing these technologies' environmental impact. International standards are the key to promoting and sharing best practices in applying cutting-edge technologies. (ITU 2020)

Raise awareness of the role of cutting-edge technologies in tackling climate change and realizing a circular economy: industries, businesses, and public sectors should be aware of the potential of advanced technologies in reducing carbon emissions, improving climate resilience, and reducing waste generation. Once they have reduced the benefits of their social, economic, and environmental impacts, as well as the benefits of cutting-edge technologies to achieve climate change adaptation, they may be likely to accept digital conversion. Therefore, more publicity activities must be organized at the national and international levels.

Reducing the negative impact of ICT-related e-waste to promote climate change and the transition to a circular economy: The environmental effects of e-waste related to cutting-edge technologies must be assessed and properly dealt with inclusively and efficiently. Encouraging best practices and ecological design principles and using advanced technologies can help reduce tons of greenhouse gas emissions each year while improving public health, working conditions, and the environment. (ICT 2020)
Guide cutting-edge technologies to adopt scientific methods to reduce social greenhouse gas emissions and promote a circular economy: industries and enterprises should use their power to reduce their own and social emissions and support the circular economy. That requires coherent policies to prevent pollution while promoting inclusive and environmentally friendly business models and solutions. Frontier technologies should be used to enhance learning at all levels and promote successful policies.

MANAGEMENT SOLUTIONS
CARBON ACCOUNTING

Whether you are solving deforestation or energy consumption issues in your supply chain, greenhouse gas emissions can have a significant environmental impact on your Company. Companies can play an important role in reducing emissions to meet the scientific community's carbon budget. But how much emissions should any company reduce?
Carbon accounting is how organizations quantify greenhouse gas emissions to understand their climate impact and set targets to limit their emissions. In some organizations, this is also called a carbon or greenhouse gas inventory.

Scope 1, 2, and 3 emissions
A company will measure and set emission reduction targets within the framework of three " Scope " (SIENENS 2020)

Scope 1
Emissions from the Company's direct activities, such as the fuel combustion of facilities and vehicles owned or controlled by the Company.

Scope 2
Emissions from purchased electricity consumed by your Company, such as electricity purchase, steam, heating, and cooling.

Scope 3
Emissions from all other indirect sources in the Company's supply chain include original purchases, distribution and transportation, employee commuting, use of sold products, and disposal.

Scope 1 and 2
Companies that are just starting carbon accounting may set targets for Scope 1 and 2 first. Within these Scopes, emissions closer to the Company are easier to measure and influence. Establish and achieve goals to reduce

Scope 1 and Scope 2 emissions-by investing in more efficient lighting and HVAC systems; using new software and AI to improve the efficiency of buildings and operations; to name a few examples, improve fleet logistics and introduce more Environmentally friendly vehicles may also bring tangible business benefits. That is a more convincing business case for companies that need proof of concept before determining their complete supply chain emission targets.

Maximum impact: Scope 3
Scope 3 emissions are often much higher than company Scope 1 and 2 emissions, accounting for 70% of companies' total emissions in most industries. To set meaningful emission reduction targets, companies must also consider Scope 3 emissions. Scope 3 emissions are usually the most difficult to be affected because companies have limited control over activities that occur upstream and downstream of their operations.

Companies rising to the challenge.
Many leading companies have already taken on the challenge of setting scope three targets. Walmart's Project Gigaton, an initiative to reduce the Company's full supply chain GHG emissions by 1 billion tons by 2030, necessitates engagement with the Company's suppliers — of which CPG giants like PepsiCo, Mars, and Unilever have already signed on. Smithfield has committed to reducing overall emissions in its United States supply chain by 25 percent by 2025. As part of its journey to be carbon neutral by 2050, Danone has set a goal to reduce its scope 1, 2, and 3 emission intensity by 50 percent by 2030.

CIRCULAR ECONOMY

A circular economy (also known as "circular economy") is an economic system designed to eliminate waste and continue to use resources. The recycling system uses reuse, sharing, repair, refurbishment, remanufacturing, and recycling to create a closedloop system, minimize resources, and generate waste, pollution, and carbon emissions. The circular economy aims to make products, equipment, and infrastructure longer, thereby increasing the productivity of these resources. Waste and energy should be inputs to other processes: as a component of recycled resource in another industrial process or as a renewable resource in nature (such as compost). This regenerative approach contrasts with the traditional linear economy, which has a "take, make, dispose of" model of production."(Wiki Circular economy)
The circular economy suggests that we start to do things differently. The organization believes that if we improve resource efficiency and develop more circular business models, we can reduce greenhouse gas emissions. For example, we can start by adopting principles such as reuse, remanufacturing, or recycling. The author believes that the world's supply chain should be redesigned to "return to the wells, fields, mines, and quarries where our resources originated, thereby reducing our consumption of raw materials." Due to reduced greenhouse gas emissions, the economy will become more efficient. However, the report stated that governments have not yet realized the potential of a circular economy to combat climate change. The report pointed out that most governments' strategies to keep the earth's average temperature below 1.5ºC are mainly focused on preventing deforestation and developing more renewable energy sources. Therefore, in a sense, this report calls on the government to abandon the linear approach of adopting, manufacturing, using and wasting, and providing opportunities for the circular economy's principles.
What exactly are these principles of circular economy to protect the environment? Optimizing the service life of a building, designing it for multiple uses, and reusing building materials are just a few examples that can be used for all types of products. Improving the recycling system is another example. It can be done as soon as the products are built they can be produced using "modular design" to be easily remanufactured. Finally, reducing material consumption and using low-carbon, biodegradable alternatives (such as bamboo toothbrushes instead of plastic toothbrushes) are good examples. (AndréGonçalves 2019)

Of course, as consumers, we can ask private and public companies to make the changes we want to see. However, changes due to popular demand require many people with the same beliefs to demand relatively specific modifications to a recognized problem. This question is very broad because it covers how society integrates into its business activities. As a result, if politics changes the game rules, it is more likely to change. Therefore, the circular economy has made some government recommendations that mainly focus on taxation power and spending plans. The first recommendation is to end economic incentives that encourage excessive use of natural resources (such as fossil fuels or palm oil). The second is to reduce labor taxes to promote recycling. The third is to increase emissions taxes and over-exploit resources. (AndréGonçalves 2019)

INNOVATIVE BUSINESS MODELS

Climate services are a form of sustainable innovation, "with environmental, social and economic factors considered in the process of their development and use" (Larson, 2007). Business models are critical to the success of climate services (Long et al., 2017).
Sustainable innovation can be technological, organizational, and social innovation (Boons and Lüdeke-Freund, 2013). The business model shapes internal administrative processes and supports the effectiveness of link providers and users. In addition, they also help to maximize collective utility through technological transformation, thereby achieving social maximization. Analysis of the existing literature shows that business models act as signals and intermediaries in a given market, often making income models lagging and positively impacting society (Boons and Lüdeke-Freund, 2013; Doganova and Eyquem-Renault, 2009 year).
Climate services are a special type of knowledge-intensive business services (KIBS), non-financial, knowledge-intensive services characterized by high human capital density (Brenner et al., 2017; Koschatzky et al., 2001). They are intangible and difficult to standardize (Miles, 1995). The gradual shift from an industrial economy to a service-based economy (three-in-one) is beneficial to the knowledge industry, and climate services are part of this shift (Baró, 2008). KIBS produces new products and services and supports innovative joint production (Amara et al., 2008). They have three common characteristics:

- ★ Knowledge is the input and output of knowledge-intensive services. Knowledge includes the entire "professional knowledge base" (Starbucks, 1992), including judgments and choices tailored to local conditions. That is why KIBS standardization is difficult.
- ★ Service is the product of close and multiple interactions between provider and customer, which is self-evident to the co-creation process (Xu et al., 2016). The final service is tailored to the specific knowledge needs of the customer (Koschatzky Et al., 2001).
- ★ The systematic understanding of innovation includes product/service development, marketing strategy, and innovative work practices (Flikkema et al., 2007)
- ★ Climate services include these functions and incorporate them into business models (Larosa and Perrels, 2017). However, the literature reveals three main obstacles:
- ★ The common development of climate services must be fostered, and the added value of services must be explored from the beginning (Vaughan et al., 2016; Service and Commission, 2014).
- ★ Business models are often ineffective and unable to adapt to profit-oriented and private sector culture (Brasseur and Gallardo, 2016)
- ★ To equally understand the meaning of providing timely and accurate climate information to society, the benefits and asymmetry of each group must be addressed (Vaughan and Dessai, 2014)

Until now, mitigation measures have found a relatively successful window of opportunity (Brasseur and Gallardo, 2016), and adaptation to the market is also promising in the early stages of development. Various participants and organizations provide climate services to a wide range of economic and policy sectors (Medri et al., 2012). The adoption of climate services is not only driven by knowledge products themselves. It is also important to clearly define the value proposition (the advantage the user gains). Finally, service providers can be both providers and users of climate services, making the identification of stakeholders difficult (Cortekar, 2017).

THE MOST IMPORTANT CORPORATE IMPACTS ON CLIMATE CHANGE

From effectiveness to strategy.
There is no one-size-fits-all way to deal with climate change. Each Company's approach will depend on its specific business and should be consistent with its overall strategy. This approach must include measures to reduce climate-related costs and risks in its value chain for every Company. Business leaders need to start treating carbon emissions at high prices because they have or will become a reality. Companies need to assess and reduce their vulnerability to climate-related environmental and economic shocks. Considering operational efficiency, every Company must correctly master this basic knowledge.
If a company has more employees than its transportation department needs, its operations are inefficient; its managers waste resources and drag down performance. Similarly, a company that generates excessive emissions in its shipping business is also ineffective in its operations. It wastes resources and generates unnecessary costs that inevitably increase. Implementing best practices in managing climate-related costs is the minimum required to remain competitive. (Achim Steiner, 2015)
In addition to understanding the costs of its emissions, each Company also needs to assess its vulnerability to climate-related impacts, such as regional changes in energy and water supplies, the reliability of infrastructure and supply chains, and the prevalence of infectious diseases. The Company's leaders should systematically assess these risks and then decide which bets to reduce by redesigning operations, transfer to other risks through insurance or hedging contracts, and which risks bearing.
For some companies, the approach to climate change can go beyond operational efficiency and become strategic. In the process of tackling climate change, some companies will find opportunities to adjust their industrial structure by creating products that can take advantage of climate-induced demand (such as hybrid vehicles) to solve the climate problem more effectively, thereby increasing or expanding competition.

THE PRESSURE OF CLIMATE CHANGE ON THE COMPANY

To better understand how companies view climate change, the latest version of the European CFO (Chief Financial Officer) investigation asked nearly 1,200 European finance executives to what extent they feel the pressure of the Company to act and what they are doing. (Financial Times,2019) The investigation shows that most companies are feeling pressure from various stakeholders. Customers and customers are most often considered the source of great pressure, but employees, regulators, civil society, and investors follow closely. (Figure 1)

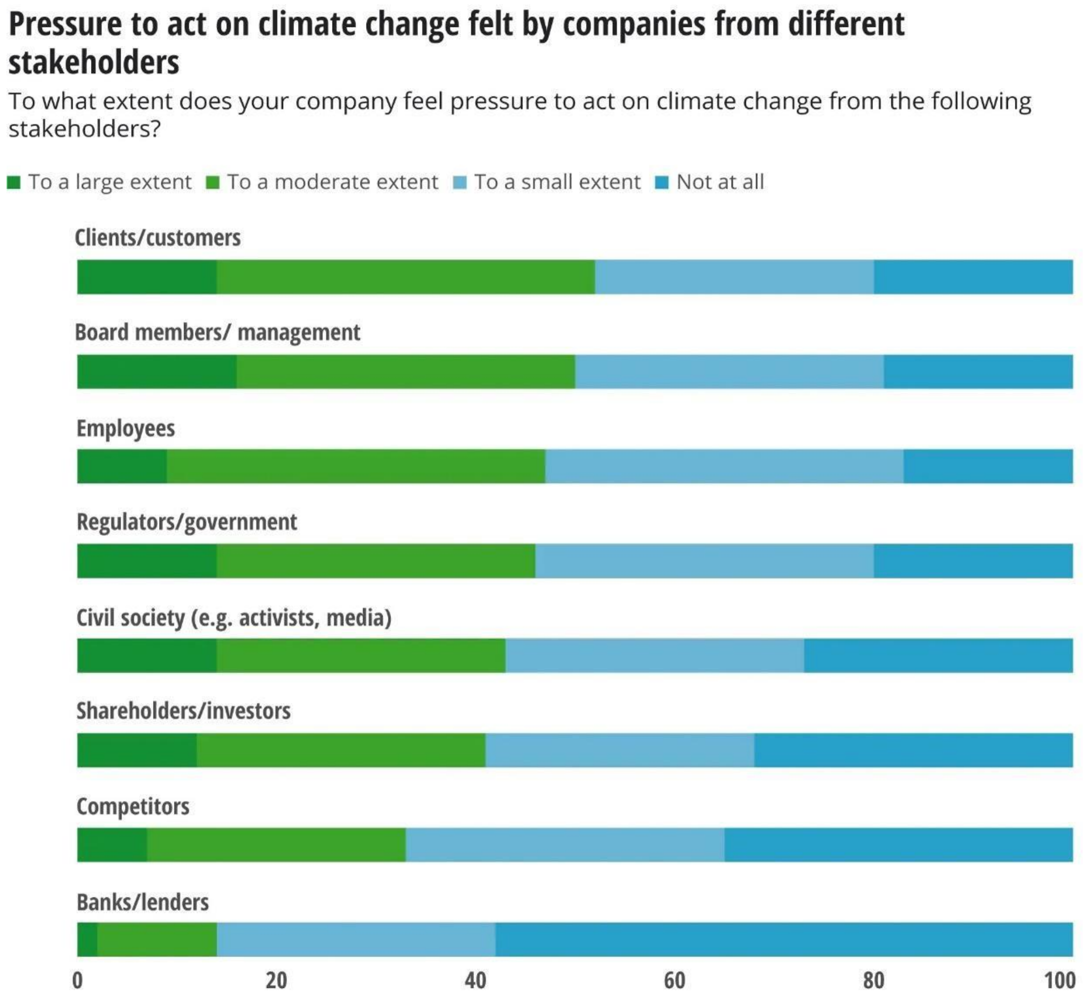

Figure 1. The pressure of climate change on the Company

The degree to which companies feel external pressure varies greatly.

Approximately 30% of people do not feel the tremendous pressure from anyone, and 19% of the force comes from only one or two stakeholders-usually from regulatory agencies and civil society. Larger companies (defined as companies with annual revenues of 1 billion euros or more) are more likely to be pressured from multiple sources. Almost two-thirds (61%) of CFOs said they feel they come from three or more countries, The pressure to act. More stakeholders, nearly 70% of customers feel pressured. In contrast, regulators are the main source of stress for small companies (annual revenues do not exceed 100 million euros).

In the travel, automotive, consumer products, and energy and public utilities sectors, the proportion of executives reporting pressure to take action is the highest for each stakeholder group. Yes, the difference between these departments lies in the degree of influence of each stakeholder. For example, in the tourism, consumer goods, and automotive industries, the pressure from customers is even stronger. The pressure comes more from investors and regulators (Figure 2).

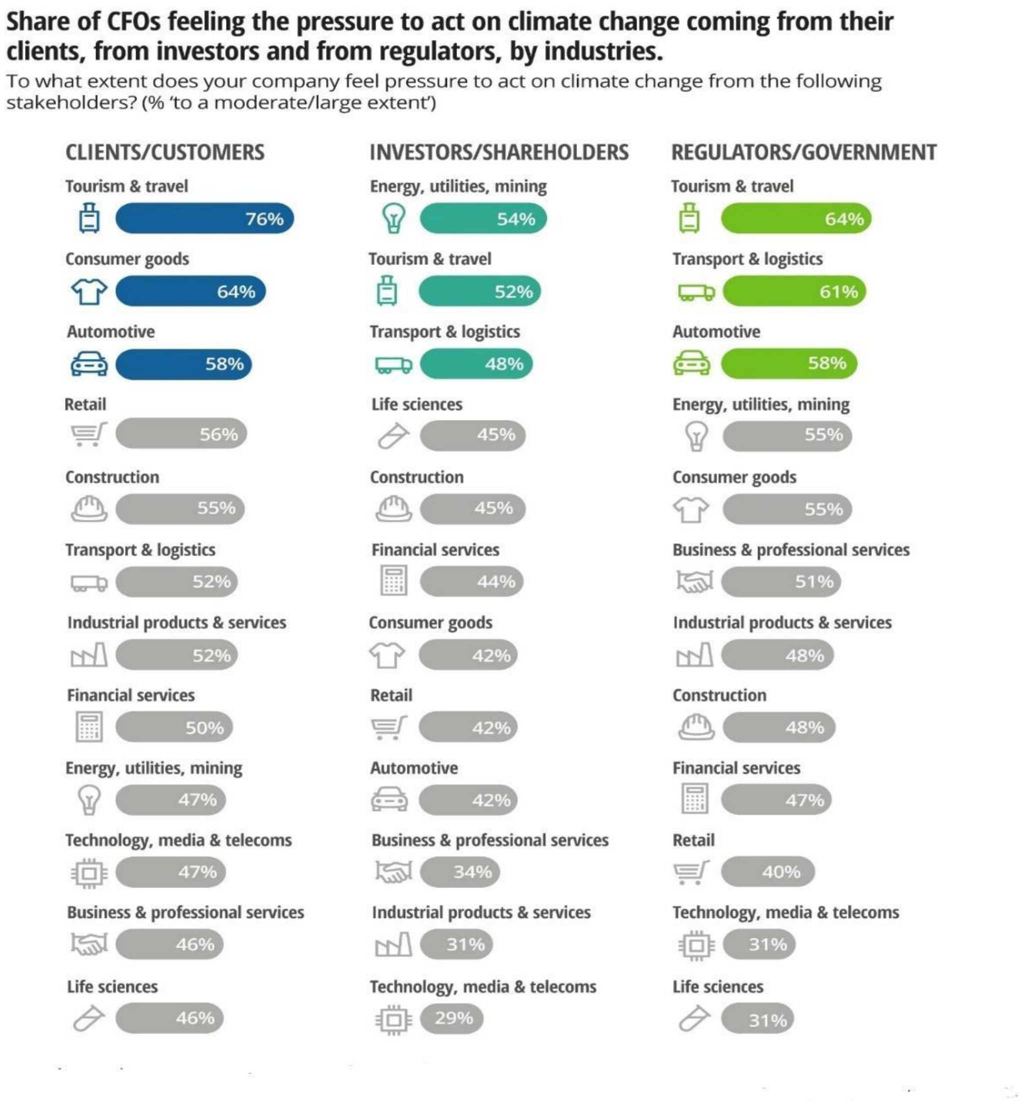

Figure 2， Pressure comes more from investors and regulators

On the other hand, as far as climate change is concerned, the technology, media, and telecommunications (TMT) industries currently seem to be developing rapidly. TMT executives are not under special pressure from any specific stakeholder (their employees) to take action, partly because the industry's emissions are relatively low. However, TMT has more room to do more to help combat climate change. A joint study by the Global Initiative for Sustainable Development (GeSi) and Deloitte (Deloitte) shows that the digital capabilities of information and communication technology (ICT) can help provide solutions to various sustainable development challenges, especially climate diversity. For example, digital technology can help decouple economic growth from resource consumption, increase transparency and accountability of environmental impacts, and help analyze and predict the development of climate change. (Alice Jacqueline.2019)
Comprehensive analysis of the Company's situation

To understand the internal to external impact, managers need to study the Company's value chain. Any value chain activity (inbound logistics, operations, outbound logistics, marketing, sales, after-sales service) may generate emissions. The simple ratio of profit to total emissions in the value chain is a good measure of

potential climate impact. If the new regulations set the price per ton of emissions at $10, will this greatly weaken profits or even swallow them all? With the impact of carbon costs on profits, "carbon exposure" rises. Like other risks, carbon exposure brings both opportunities and challenges. For example, a forestry company may find that removing carbon dioxide from the air by planting trees is just as profitable as cutting trees to produce paper or plywood.

The emission impacts of activities in the value chain can be direct or indirect. Activities can generate emissions under the Company's direct control, or the Company can induce them in suppliers, channels, and customers. Companies need to understand the emissions that lead to their business partners and their emissions: both types are important targets for reducing emissions.

Analysis from the inside out shows that high carbon exposure does not mean that climate is of strategic significance to companies. Once the manager understands the Company's overall carbon emissions and the impact of specific activities in the value chain, they can formulate an action plan to address these issues. Emissions-intensive activities have little value and can be eliminated or outsourced to more efficient companies. If a company can reduce its risk exposure to competitors by improving performance, then those assets that are critical to value may become strategic.

Analysis from the inside out helps clarify the logic behind Wal-Mart's response to climate change. Wal-Mart's activities are logistics and transportation intensive, and the Company is actively seeking to reduce the resulting emissions. At first glance, this approach seems entirely feasible: the Company is reducing energy use to mitigate the potentially harmful effects of emissions on the cost of its value chain. However, suppose Wal-Mart can use its scale, scope, ability to invest heavily in technology, and reconfiguration its value chain to reduce emissions, making it difficult for smaller competitors to replicate. In that case, Wal-Mart's emission reduction plan will be of strategic significance. Wal-Mart seems to be making a strategic bet to reduce its carbon emissions more than its competitors and keep it low.

Combined with the inside-out analysis, the inside-out appearance can reveal a series of new opportunities and threats. Climate change will affect the business environment of companies in two broad ways: through changes in temperature and weather patterns and through regulations that increase emissions costs. Both will affect the availability of business inputs; the scale, growth, and nature of demand; access to related and supporting industries; and industry competition rules and incentives. Business leaders should assess how climate change affects all parts of the competitive environment.

For example, although property insurance companies may have very low carbon emissions, for companies that insure or reinsure coastal real estate threatened by rising sea levels, carbon exposure may be high. Similarly, most of the carbon emissions associated with oil do not come from oil companies but their customers. Emission restrictions will limit the demand for these companies' products. Or consider having a multifaceted internal-outside influence on food companies like Nestlé. Climate change will change the relative productivity of the regions where companies buy agricultural products, thereby affecting input costs. At the same time, regulatory measures against climate change will increase the energy cost of ice cream in retail stores to keep cold, which will affect demand. And many more.

If a company can manage it so that its competitors cannot easily match, it can strategically address the "outside-in" impact. Nestlé avoids upstream vertical integration and instead outsources its raw material production. That makes its supply chain more flexible and can provide valuable strategic advantages if productivity changes across regions and Nestlé's competitors find themselves bound by a more rigid supply structure. Similarly, drought-resistant crop strains and vaccines, and treatments for insect-borne diseases will become increasingly valuable (if their innovators can protect their intellectual property).

As globalization and the information technology revolution have been doing for the past few decades, significant new forces regularly reshape the business world. The complexity and potential impact of climate change may contend with them. Although many companies may still view global warming as a corporate social responsibility issue, corporate leaders need to respond with a firm attitude like any other strategic threat or opportunity. (Yin Cao,2019)

The relationship between climate change and corporate strategy

Social responsibility

The number of climate litigation in different jurisdictions has steadily increased over the past decade. At the beginning of 2017, more than 1,200 laws and policies related to climate change in 164 countries. In 1997, the number was only 60. In the United States, there are about 20 new lawsuits involving climate change and its effects each year. In 2002, there were only two such lawsuits. Outside the United States, there have been 64 climate lawsuits in the past 15 years, of which 21 have been initiated since 2015. (Climate Litigation against Companies,2019) From these climate lawsuits against companies, we can see that society's expectations for companies to assume public responsibilities are increasing, and companies need to take more social responsibilities. When dealing with global environmental, social, and governance issues, the methods adopted by multinational companies will affect their reputation and their competitive position.

According to a worldwide investigation, the top executives of companies generally believe that for companies to succeed in the future, people's increasing attention to the environment has become the most important trend affecting the public's expectations of companies. Climate change is the most critical environmental, social, and governance issue. The investigation results also show that employees and customers are the stakeholder groups that significantly impact corporate management and social expectations. The corporate's social responsibility awareness is related to the Company's attractiveness to customers and the company's talents. (Eric Lindberg,2017) In the market, consumers will punish companies that fail to fulfill their public responsibilities and reduce their market share. Companies that are irresponsible to society may also make it difficult for companies to attract and retain talent.

Climate change leads to the emergence of new economic models

As mentioned before, the content of related carbon emissions. In the face of climate change, investors are convinced that the control of carbon emissions is inevitable. Insurance companies are worried that the climate will deteriorate, carbon emission regulations will bring changes to costs, and various new standards have emerged. Large financial institutions, such as California public servants pension funds, New York State, and New York City pension funds, have urged investors to report their "carbon footprint" and asked them to explain the risks caused by regulations such as emission limits. (Noelle Eckley Selin, 2020) People worry about whether reducing emissions will create or destroy shareholder value. Most corporate executives consider countermeasures against climate change from a risk perspective, and timely response also creates opportunities for companies. That is the transition to a low-carbon economy due to climate change.

Environmental changes may fundamentally change the pattern of the industry, which will lead to the birth of new products or new market strategies. Concern for environmental protection has made supervision more stringent. Companies' improper handling of environmental protection issues will have negative short-term financial impacts and long-term reputational impacts. The transition to a low-carbon economy has begun, and companies must be prepared, whether in the energy, transportation, and heavy industries at the core of a carbon-emission-intensive economy or companies in other industries. Ideally, global greenhouse gas emissions should be reduced by 90% from the current level by 2050 to control global warming below 2 degrees Celsius.

Based on this calculation, global carbon productivity must reach an annual average of 5% to 7%. (Andrea Thompson, 2014) The growth rate, economic growth mode must be fundamentally transformed. To help companies profit from the transformation, they must reposition the Company and adjust its corporate strategy.

Climate change induces strategic adjustments of companies.
In the face of changes brought about by climate change, economic analysis and planning techniques are used to assess the strategic impact of change trends. Combine all kinds of information, evaluate possible risks, and check the entire value chain. The value chain includes raw material procurement, product production, and sales methods. It is envisaged that possible future conditions include the reactions of competitors, changes in consumption patterns, and the possibility of legal proceedings and supervision while taking strategic actions based on the analysis conclusions. To correctly respond to the opportunities brought about by environmental changes, we can adopt a large number of small-scale investments and multi-plan portfolio strategies. GE's "Ecomagination" program strengthens the Company's commitment to pollutionfree products and reducing pollutant emissions. That is a relatively low-cost, low-risk method for predicting future products and services based on changing trends.

THE IMPACT OF CLIMATE CHANGE ON CORPORATES：CLIMATE CHANGE CONSCIOUSNESS

Environmental awareness is a philosophical concept. It is the level of people's awareness and degree of understanding of the environment and environmental protection. It is also the consciousness of people's practice of adjusting their economic activities and social behaviors to protect the environment and coordinating the relationship between man and the environment and between man and nature. In other words, environmental awareness includes two meanings. One is people's understanding of the environment: ecological values, including psychology, feelings, perception, thinking, and emotion; the other is people's awareness of environmental protection. (Baidu,) I believe climate change awareness is a part of ecological awareness produced by people's understanding of climate change and responses to climate change. The awareness of climate change has two meanings: 1. The degree of awareness of climate change. 2. The degree of awareness of climate change.
Chinese companies started late in their understanding of climate change and the low-carbon economy. Most companies have not considered low-carbon development from a strategic perspective, nor have they studied the importance of addressing climate change from a global perspective. I think the climate change awareness of business managers mainly refers to the climate change awareness of business managers as the main body of corporate decision-making and corporate behavior, which is not equivalent to the climate change awareness of the public. Due to the impact of companies in responding to climate change, the understanding of climate change among corporate managers is very important in responding to climate change.

INVESTIGATING AWARENESS OF CLIMATE CHANGE IN BUSINESSES

China is in the middle and late stages of industrialization, facing the challenges and opportunities of economic structural transformation. On the road of building an ecological civilization, energy-saving and emission reduction, and developing a green and low-carbon economy, enterprises are the most important and most direct implementation of relevant national policies. And performer. Therefore, corporate managers' awareness of climate change will directly affect whether my country's peak carbon dioxide emissions target around 2030 can be achieved. Consequently, it is of very important theoretical and practical significance to investigate the climate change awareness of Chinese enterprises, find out the existing problems, difficulties and obstacles, and put forward relevant suggestions and measures. This is a investigation experiment conducted by the Climate Change Research Progress Group. The investigation selected the most microscopic and most direct actors in the economy and society-enterprises and their managers and conducted more than 800 questionnaire investigations covering key economic development regions in China.

Among Chinese companies, the disclosure of climate change information is still in the early stages. The Carbon Disclosure Project issued invitations to the 100 largest companies in China by market capitalization in 2008. In 2013, of the 100 Chinese companies that received the invitation, 32 responded to the questionnaire through the online questionnaire system. In 2014, the response to the CDP questionnaire was further improved, reaching 45 Homes. In later years, the number of Chinese companies that responded to CDP questionnaires declined. In 2017, 25 companies completed CDP disclosures. At the same time, some social organizations rank the carbon emission intensity of Chinese companies to attract attention from the corporate level. The 2013 Worldwide Fund for Nature (WWF) Carbon Emission Reduction Pioneer Project and
Hurun Report jointly released the "2013 Carbon Intensity Ranking Report of non-fossil Energy Companies in China". The ranking shows that Lenovo Group, Industrial and Commercial Bank of China, and Weichai Power Co., Ltd. has the lowest carbon emission intensity among the companies that have disclosed data in their industry (Enterprise climate change awareness investigation experiment 2018)
Based on the 2011 study (Enterprise climate change awareness investigation experiment11), the research team, combined with the current practical needs of Chinese companies, conducted an in-depth study of corporate managers' awareness of climate change and the status quo and influencing factors of corporate response to climate change and strived to conduct theoretical research and research on corporate responses to climate change. Explore and try in practical work.

RESULTS OF THE INVESTIGATION

The influence of gender: Gender is not related to the level of awareness, indicating
that business managers of different genders have no significant differences in climate change awareness, and gender is not an influencing factor of climate change awareness.
Influence of age: Age is related to awareness, indicating that young business managers are more aware of climate change than older business managers.
According to the experiment, it is concluded that climate change is a new cognitive concept for the predecessor of developing countries.
Influence of education level: First of all, managers of enterprises who cognize in climate change are not related to education level. This result illustrates the lack of systematic cultivation of climate change awareness in education for a long time. The distinguished students of climate change have not been significantly improved due to increasing education.
Influence of industry type: The climate change awareness of the primary and secondary industries managers is better than that of the tertiary sector. Due to the government's emphasis on energy conservation, emission reduction and consumption reduction, the secondary industry is the government's focus in reducing consumption. At the same time, since only 2% of the respondents from the primary industry accounted for, the sample size was too small to be representative.
The impact of business type: The level of climate change awareness of state-owned enterprise managers is higher than that of private enterprises. The operational purpose of state-owned enterprises is to make profits and shoulder more social responsibilities. From another perspective, state-owned enterprises receive more government support. Their operating pressure is less, and the living environment of private enterprises is more complicated. That leaves private companies with no more energy to think about climate change issues.
Influence of work department: The level of climate change awareness of corporate managers is related to their work department. The technical department has a strong climate change awareness, followed by the personnel department, and the rest of the departments are relatively poor.
Expected impact: When corporate managers recognize new opportunities for companies in the context of climate change, companies will take more active measures to deal with climate change. Therefore, it helps business managers recognize new business opportunities and new opportunities in the context of tackling

climate change. Enabling business managers to face the current situation more optimistically will help increase companies' enthusiasm to take various measures to deal with climate change.
Influence of ownership of independent intellectual property rights: The amount of ownership of independent intellectual property rights reflects the technological level of an enterprise. To a certain extent, it reflects the core competitiveness of the enterprise. Companies with more independent intellectual property rights and stronger core competitiveness have taken more measures to deal with climate change and are more motivated.
The influence of the proportion of scientific research fund profit: The ratio of scientific research fund profit is an important indicator to measure enterprise science and technology investment. The corporate response to climate change is not related to the proportion of earnings from scientific research funds. Still, it is related to the amount of corporate independent intellectual property rights. This result reflects the current low level of investment in scientific research at the enterprise level in China. The acquisition of intellectual property rights is more dependent on the purchase of patent rights of others. As Chinese companies continue to attach importance to independent research and development, the intensity of future scientific research investment must be an important factor in the company's measures to address climate change.

REPORT CONCLUSION

The investigation data shows that the managers of secondary industry enterprises have a high degree of awareness. That is mainly because the country has adopted a series of measures to eliminate outdated production capacity, shutting down and transferring. All enterprises, especially those in the secondary industry, are mandatory.
Under pressure from various aspects such as laws and regulations, they have changed their development model and actively responded to climate change, seeking new business opportunities and new profit growth points.
The corporate managers of state-owned enterprises have a high level of cognition and awareness. State-owned enterprises are the main implementers of the national energy-saving and emission-reduction strategy. The leading role of state-owned enterprises in energy-saving and emission-reduction work has promoted their managers' awareness of climate change. State-owned enterprises have a greater sense of responsibility than other enterprises. Accordingly, the managers of state-owned enterprises also have a higher level of awareness and awareness.
The corporate managers of large enterprises have a high level of cognition, behavior and awareness. In China, most large enterprises are both secondary industries and state-owned enterprises. Therefore, the analysis of industry type and enterprise type is also applicable to enterprise scale. Large state-owned enterprises are at the forefront of energy conservation, emission reduction and climate change, and their managers naturally have a high awareness of climate change.
The influence of the work sector.: Enterprise managers in the technical department have a high level of cognition and awareness. Responding to climate change requires advanced technology as a guarantee. As managers in the technical department of an enterprise, they are enthusiastic about the dynamics of technological development and could first contact new technologies and new processes for climate change. They have a higher level of awareness than other departments. And the level of consciousness survey shows that the board of directors and the board of supervisors have the lowest level of understanding. The reason is that the board of directors and board of supervisors participating in the investigation are mainly from private companies and small and medium-sized enterprises. At the same time, the bad scoring rate of the director's awareness index is higher than that of the cognitive index. Although these managers have a reduced understanding of climate, they are still responding to climate change in practice. That is the result of government policy and supervision.

Based on the above data and analysis, the company's strategic decisions and employees have undergone tremendous changes due to climate change. I think this is the most important impact of climate change on the company.

COMPANIES ADAPT TO CLIMATE CHANGE

With the development of modern science and technology and the improvement of productivity, human beings have an increasingly greater impact on the natural ecological environment than the earth's ecological environment system. In particular, the use of large-scale fossil fuels has led to a continuous increase in atmospheric CO2 concentration. Although some scholars questioned the phenomenon of global warming caused by the greenhouse effect, most people still completely ignore the continuous increase in the concentration of greenhouse gases in the atmosphere, which will bring catastrophic losses to all mankind. Humanity must take measures to reduce the CO2 concentration in the atmosphere before confirming this relationship. CO2 is different from the local pollution characteristics of conventional air pollutants such as SO2, N, and soot as one of the atmospheric components. The change of its concentration has a potential impact on the global energy balance and climate ecosystem. It also has global "ecological" characteristics of "pollutants." Controlling CO2 requires the joint efforts of all humanity, just like the control of soil desertification, the ecological impact of water conservancy projects, and species extinction. Therefore, tackling climate change has become a common challenge facing the world.

THE NECESSITY OF SINOPEC TO COPE WITH CLIMATE CHANGE

Responding to climate change is an important manifestation of my country's global governance strength. The international community currently agrees that addressing climate change is a common challenge facing the world. For a long time, governments of various countries have been arguing about their responsibilities and obligations to reduce greenhouse gas emissions. Moreover, climate negotiations have become the most complex and highest-level negotiations. As the country with the largest carbon emissions, China has suffered significant pressure during the climate negotiations and has been pushed to the forefront of the global game. China's climate policy has also changed from being blamed for passive emission reduction to taking the initiative to reduce emissions. As a major responsible country, China has also undertaken obligations commensurate with its capabilities. At the Paris Climate Conference in November 2015, China proposed to peak carbon dioxide emissions around 2030 and strive to achieve them as soon as possible. In 2030, carbon dioxide emissions per unit of GDP will be reduced by 60% to 65% compared with 2005. Setting a specific time limit for peak carbon emissions and a roadmap for absolute emission reductions means that China will become a political promoter of global climate change and a major advocate of climate governance.
As a company that recognizes the importance of climate change, Sinopec has been actively proposing and implementing a "green and low-carbon" development strategy for a long time. At the same time, Sinopec considered the strategic development path under the conditions of rising global temperature. Comply with corporate environmental standards and make every effort to promote energy conservation in the production process. Reduce emissions, increase the use of clean and low-carbon fuels, and actively develop low-carbon energy supplies such as geothermal, shale gas, biomass, and hydrogen energy. Climate change is an important part of the company's "green and low-carbon" strategy. The fields related to corporate greenhouse gas emissions and emission reduction are also internal requirements for companies to achieve "sustainable development" goals.

The "Emission Standards for Air Pollutants from Land-based Petroleum and Natural Gas Extraction Industries" is China's emission standards (GB 39728-2020), jointly issued by the Ministry of Ecology and Environment and the State Administration of Market Supervision and Administration.
This standard is the industry's first national air pollutant emission standard, and it is also China's first national pollutant emission standard for coordinated control of greenhouse gas emissions. According to the law, the standard has a mandatory enforcement effect and will be implemented from January 1, 2021.
Due to the scattered facilities, remote location, difficult governance, and obvious characteristics of the oil and gas extraction industry, the relevant provisions of the current national "Comprehensive Emission Standard of Air Pollutants" and "Unorganized Emission Control Standard of Volatile Organic Compounds" do not apply to this industry. To meet the requirements of precise and scientific pollution control by the law., people urgently need to formulate emission control standards applicable to the industry based on the characteristics of the industry and the technical and economic conditions for pollution prevention and control.
By the deployment of the group company, the Institute of Safety and Environmental Protection led the organization. It established a standard preparation team in conjunction with Southwest Oil and Gas Field Company, China University of Petroleum (East China), and the Chinese Academy of Environmental Sciences. After 5 years of development of standards and two extensive solicitations of opinions from the whole society, and it was finally reviewed and approved by the executive meeting of the Ministry of Ecology and Environment, the special meeting of ministers, and the executive meeting.
This standard specifies the control of volatile organic compounds (VOC) and sulfur dioxide emissions from natural gas purification plants of industrial enterprises in onshore oil and gas exploitation, sulfur dioxide emissions, methane emissions, and coordinated control greenhouses, and monitoring and supervision requirements.
The implementation bodies of this standard include PetroChina, Sinopec, CNOOC (land-shore terminal of offshore oil and gas field), and Yanchang Petroleum. Its implementation is to implement the Environmental Protection Law and the Air
Pollution Prevention and Control Law for onshore oil and gas mining industrial enterprises, improve the quality of the ecological environment, prevent environmental pollution, and promote the technological progress and green, low-carbon, and highquality development of the onshore oil and gas mining industry. This will play a role in helping China meet its greenhouse gas reduction targets. (Emission Standard of Air Pollutants for Onshore Oil and Gas Extraction Industry 2021)

SINOPEC GREENHOUSE GAS EMISSIONS AND CHARACTERISTICS

Climate change affects the market's attitude towards financing the oil and gas industry. Potential investors and stakeholders are increasingly concerned about the significant financial risks that climate change brings to them. The World Bank announced that it would no longer provide loans for oil and gas exploration and extraction projects after 2019. In September 2014, the Rockefeller Brothers Foundation announced that it would divest its fossil fuel assets. In 2019, EU finance ministers joined forces with the European Investment Bank and other global financial institutions to stop financing oil, gas, and coal projects. (Souhu 2020)
Sinopec is a Chinese oil and gas company headquartered in Beijing. It is listed in Hong Kong and traded in Shanghai and New York.
Sinopec's parent company, Sinopec Group, is the world's largest refining, natural gas and petrochemical group, headquartered in Chaoyang District, Beijing. Sinopec's business includes oil and gas exploration, refining and marketing; production and sales of petrochemicals, chemical fibers, fertilizers and other chemical products; storage and pipeline transportation of crude oil and natural gas; crude oil, natural gas, refined oil, petrochemical products and other chemicals Import and export, import and export agency business. It also

produces ethanol and several biofuels from waste vegetable oils, such as biodiesel and green jet fuel. (Wiki Sinopec)

The international accounting standards and methods for greenhouse gas emissions mainly include two levels. The first category is ethical standards, including related standards issued by the World Resources Institute (WRI), International Organization for Standardization (ISO), World Business Council for Sustainable Development

(WBCSD), British Standards Institution (BSI) and other institutions. "Series of Greenhouse Gas Verification Standards (IS014064), "Greenhouse Gas Accounting System Enterprise Accounting and Reporting Standards" (GHGProtocol), PAS2050 "Products and Services Life Cycle Greenhouse Gas Emission Assessment Standards" provide these companies with moral standards and treatment methods. For example, determine the scope of business, the base year, determine the emission source, determine the facility's ownership, and avoid double counting between the industry chains. The other is methodological standards, including the greenhouse gas calculation methods issued by the United Nations Intergovernmental Panel on Climate Change (IPCC), the American Petroleum Institute (API), and other organizations; China's "Petrochemical Production Enterprise CO2 Emission Calculation Method" (SH/

T5000-20H) standards, "Greenhouse Gas Emission Accounting and Reporting Requirements" (GB/T32 Qiaoji 0-20 Qiao), etc. Most of these standards are aimed at the greenhouse gas emission process of enterprises and organizations, and specify the greenhouse gas emission process, fuel emission factors, and process emission calculation methods.

Oil companies are under pressure from the government, investors and the public. International oil companies have formulated action plans to address climate change and established increasingly low-carbon investment portfolios, making the low-carbon business one of their corporate development strategies. The thesis analyzes the strategies and actions of Sinopec, Exxon Mobil, BP, Total, and Chevron Corporation to address climate change. Focus on analyzing their activities and practices in four aspects: corporate governance, strategy and risk, investment and effort, and public policy. Provide reference and reference for oil and gas companies that have not yet embarked on low-carbon transformation.

ACCOUNTING STANDARDS AND EMISSIONS

Their production processes mainly determine the greenhouse gas emissions of Chinese Sinopec. According to the company's emission sources' status and control, the emission sources can be divided into direct and indirect emissions. Natural emission sources mainly include fuel combustion emissions, process production process emissions, and fugitive emissions. Combustion emissions are primarily carbon dioxide emissions from the combustion of boilers, heating furnaces and torches: process emissions include carbon dioxide emissions from the production process of catalytic cracking, hydrogen production, ammonia, ethylene glycol and other devices. Indirect emission sources mainly refer to purchased energy (steam, electricity). Table 1 lists the greenhouse gas emissions and operating data of major domestic and foreign Sinopec in 2017.

Table 1 Comparison of greenhouse gas emissions and operating data of international Sinopec companies in 2017

Company	Emission of GHG (Ten thousand tons)	Oil and gas production (million barrels)	Crude oil processing capacity (million tons)
Sinopec	16266	448.79	238.5
Exxon Mobil	12200	1418.7	214.55
BP	5050	1312.2	85.1
Total	5400	936.6	101.05
Chevron Corporation	6600	995.72	83.05

CHARACTERISTIC

The greenhouse gas emissions of Sinopec companies have their characteristics. 1）Large emissions Compared with international petroleum and petrochemical companies, the CO_2 emissions and intensity of Sinopec companies have been overcome. For example, the carbon intensity of ExxonMobil upstream production is 0.246tCO_2/t oil and gas equivalent, and the carbon intensity of refinery production is 0.186tCO_2/t crude oil processing volume. The carbon intensity produced by the chemical business is 0.533tCO_2/t product. The carbon intensity of Sinopec's upstream production is 0.496tCO_2/t of oil and gas equivalent, and the carbon intensity of refining production is 0.288tCO_2/t of crude oil processing volume. The CO_2 emission intensity is related to the energy efficiency of the production process and the self-owned power plants of Chinese refining and chemical enterprises. There is a binding relationship with coal as fuel.

2）Some CO_2 emission sources have higher emission concentrations.

Certain processes in the oil and petrochemical production process have higher CO_2 emission concentrations (Maryam Takht Ravanchi 2014). For example, in the coal-tohydrogen process, ethylene glycol production, internal nitrile production, methanol production, etc. High-concentration CO_2 emissions as a resource with potentially recoverable value are a source of pollution emissions and a waste of resources. The resource nature of this emission source is reflected in the chemical production process, which consumes a lot of energy to purify CO_2. For example, the cooling energy consumption of the low-temperature methanol washing process, the air separation energy consumption of the coal chemical process, etc. The energy consumption of the solvent regeneration of the carbon absorption tower in the coal gasification process and the ethylene glycol process. Therefore, high-concentration CO_2 emissions are pollutant emissions and energy waste in the CO_2 concentration process.

3) Diversified CO_2 separation and purification technologies

The petroleum and petrochemical production process include many processes for separating CO2, and the separation methods are different for different process devices. The general hydrogen production process uses PSA technology to separate hydrogen and desorbed gas. The ethylene glycol production process uses the potassium carbonate solution absorption and desorption process to split CO2 and process gas. The methanol production process uses low-temperature methanol washing technology to separate shift gas, and the flue of coal-fired uses Carbon Capture and Storage technology to split CO2. There are certain differences in the cost of various separation processes. Still, the determination of the separation process is often based on the separation task and the components of the separated feed gas.

4) There are high-value greenhouse gas emissions
There are methane emissions in oilfield-associated gas, oil testing, crude oil gathering and transportation. Strengthening methane recovery can not only reduce greenhouse gas emissions but also generate greater economic value. Petroleum energy companies should strengthen the daily inspection and management of pipeline storage and transportation facilities, optimize pipeline operations, arrange operation time, and reduce methane emissions during construction. Oil and natural gas should be recycled in natural gas, casing gas, and oil and natural gas during natural gas production and gas testing.
5) There is high GWP greenhouse gas emissions
The greenhouse effect of the six greenhouse gases announced by the IPCC is quite different. GWP usually characterizes them. For example, N_20 has a GWP of 298. Sinopec's production process has high GWP greenhouse gas emissions, such as caprolactam, nitric acid, and adipic acid.

ANALYSING STRATEGY OF SINOPEC TO COPE WITH CLIMATE CHANGE

As the lifeblood of the national economy, the petroleum and petrochemical industries should make historic contributions to satisfying the country's main strategic needs and improving people's lives.In the future, China will speed up the construction of a modern economic system. The petroleum and petrochemical industry should shoulder corresponding responsibilities in implementing the country's global ecosystem governance (Deloitte 2013) and formulate a climate change strategy for petroleum and petrochemical enterprises. The content should be grasped from three levels.
Through carbon inventory, carbon standards, carbon footprint (Noelle Eckley Selin 2020), carbon label research and standardization, we can find out the CO2 emissions of each sector, device, product, link and process, and actively participate in the carbon information disclosure project (CDP), Carry out carbon emission calculations under the forward-looking concept, identify CO2 emission reduction and recycle opportunities, lay a foundation for tapping their emission reduction potential and discover emission reduction costs, and participate in the formulation of petrochemical products carbon emission limit standards. Since the establishment of the national pilot carbon market in 2013, some petroleum and petrochemical companies have carried out system-wide carbon inventory work. While strengthening their green and low-carbon awareness, they have obtained basic information on corporate greenhouse gas emissions. The standard of this method is earlier than the "Guidelines for Accounting Methods and Reporting of Greenhouse Gases for Sinopec Production Enterprises" issued by the National Development and Reform Commission. Therefore, the greenhouse gas accounting methods and emissions are slightly different between the two. The company's carbon inventory is only quantified for the boundaries of the company's legal person and greenhouse gases. The entire life cycle of the product is rarely assessed for its carbon footprint. Strengthen the company's green and low-carbon awareness through basic-level work and form an ideological consensus and cognitive motivation to actively meet and respond to the low-carbon development trend. By participating in national carbon market construction and carbon trading, developing CCER and CDM projects, strengthening corporate carbon asset funds and green climate financial management, we will win the initiative for petroleum and petrochemical companies in future carbon market transactions development of petrochemical industries with sufficient carbon allowances. Lay the foundation.
The carbon market mechanism is an important tool to use economic means to achieve carbon emission reduction targets. It has become a policy choice for most countries to achieve emission reduction targets. Establishing a carbon market trading mechanism can encourage companies to discover their emission reductions by giving value to emission rights. Costs, and formulate corresponding emission reduction strategies by comparing their emission reduction costs with carbon prices and provide benefits for companies with lower emission reduction costs to undertake more emission reductions. This will help reduce the emission

reduction costs of the whole society, but low-carbon industries have become a new engine for driving economic growth to improve guarantees.

In 2013, China established seven pilot carbon markets. In the future, a unified national carbon trading market will be established. Sinopec should actively participate in the formulation of quota allocation methods for refining and chemical products on the national carbon market to promote the structural adjustment of the petroleum and petrochemical industry in the carbon market. At the same time, improve quality and efficiency and play a corresponding role in healthy development. Quotas do not restrict the strategic development and commercial operation of petroleum and petrochemical companies, and the carbon economic value is maximized through carbon asset management. In the end, carbon asset management can serve the realization of the company's development strategy and development goals.

Reduce energy consumption and CO2 emissions during production and operation by improving energy efficiency, improving energy conversion system configuration, and increasing the use of low-carbon energy; actively carrying out CO2 capture, storage, and oil displacement projects, and oilfield methane gas recovery and recycle technology; Taking advantage of some of the industry characteristics of high CO2 emission concentration, research and development of CO2 preparation of high value-added chemicals technology, CO2 chemical recycle process low hydrogen consumption technology, and strive to take the lead in realizing CO2 resource recycle in central enterprises, and occupy CO2 recycle through technology research and development And the commanding heights of low-carbon economic growth, create new advantages in low-carbon development, and transform the end-of-CO2 research and development into its own development competitiveness, such as the development of low-CO2 emission coal chemical technology.

THE IMPORTANCE OF CARBON CYCLE

Most CO2 substantial emission reduction and resource recycling projects cannot form commercial competitiveness based on the current technological level. Compared with private and foreign-funded enterprises, petroleum and petrochemical enterprises are the lifeblood of national security and the national economy. The country's primary industries and key areas should actively assume the country's ecological governance responsibilities, develop and reserve related technologies in advance in the regions that meet the country's primary strategic needs and improve the economic competitiveness of CO2 resource recycle through technological innovation.

Sinopec companies have two advantages in the recycling of CO2. First, it has technical advantages in the production of chemical products. International chemical companies occupy the front end of the industry chain by operating gas products. For example, Linde and Air Liquide are the world's top gas management technology companies. There are also many domestic companies operating liquid and gas CO2 businesses. Sinopec companies have high concentrations in the production process. CO2 emissions, as a chemical product manufacturer. With the relevant resources and technical advantages for CO2 sales and production of various chemicals, the enterprise's value chain should be actively expanded through the extension of the industrial chain.

Second, high-concentration CO2 emissions can reduce the cost of resource recycling. The CO2 capture technology of flue gas is relatively mature, and there is a large amount of high-concentration CO2 emissions in the production process of petroleum and petrochemical enterprises. On this basis, CO2 resource recycle can reduce the raw material cost of CO2 production of chemicals.

The carbon market mechanism is an important tool to use economic means to achieve carbon emission reduction targets. It has become a policy choice for most countries to achieve emission reduction targets. Establishing a carbon market trading mechanism can encourage companies to discover their emission reductions by giving value to emission rights. Costs, and formulate corresponding emission reduction strategies by comparing their emission reduction costs with carbon prices and provide benefits for companies

with lower emission reduction costs to undertake more emission reductions. This will help reduce the emission reduction costs of the whole society, but low-carbon industries have become a new engine for driving economic growth to improve guarantees.
Sinopec uses CO2 as an alternative raw material to produce high value-added chemicals. Not only must the value of the target product (such as the market price of methanol, ethylene glycol, ethylene carbonate, etc.) be considered, but more importantly, the cost of raw materials to produce the target product must be evaluated—the proportion of production costs. If the price of existing raw materials is high, then CO2 as an alternative raw material has the possibility of economic promotion. At the same time, the problem of net emission reduction in the whole life cycle should be considered; the key restriction bottleneck of CO2 resource recycle is cheap Energy source or cheap hydrogen preparation technology; combined with wind power and solar power generation in Northwest China, which are difficult to absorb online, use wind power or photovoltaics to produce hydrogen through electrolysis, and use chemical coal CO2 to prepare chemical products.

SUMMARY

At the last climate change agenda meeting-the 2009 Copenhagen Climate Summit (COP15), companies' hijacking efforts to reduce greenhouse gas emissions became a major concern. The meeting was generally regarded as a failure, with some accusing fossil fuels of obstructing lobbying companies and high-tech industries.
Due to the direct impact of climate change on business operations and supply chains and the demands of more and more stakeholders for action, business risks will increase. Take strong and destructive intervention measures, which incur huge costs to the company.
Companies can actively respond to the risks and pressures of climate change in a variety of ways.
Companies should actively monitor the development of legislation and regulations to avoid being bothered by policy changes or unexpected rules. Some effects are strongly and suddenly promoted by the public, such as the anti-plastic movement. In contrast, others, such as automobile emission standards and regulations, have become the prey of conflicting expectations and may catch the entire industry by surprise.
Companies should prepare for all stakeholders (investors, customers, employees, and communities) to face greater pressure on climate issues. Is it possible for investors to request exit from certain sectors, such as fossil fuels? Can employees initiate a strike on climate change countermeasures? Will customers boycott unsustainable products? Or will litigation be filed for lack of action to mitigate or adapt to climate change?
Risk quantification and program planning are positive steps. Companies should critically analyze their climate change risks, from actual risk exposures to policy changes to the challenges of transitioning to financial impact. Today, the increase in data and computing power means that potential sources of disruption to operations, markets, customers, and investments can be modeled and better integrated into overall risk management and business plans. More rigorous analysis can also help companies identify risk indicators to monitor and meet the possible expansion of institutional investors, lenders, and legislators' climate risk disclosure requirements.
Take the oil company as an example. At present, the oil and gas production lines in the petroleum and petrochemical industry are extensive, mainly involving pollution sources and ecologically sensitive areas; refining and chemical plants are flammable and explosive and are close to rivers, lakes, and seas and residential areas. This characteristic of high environmental risks determines the arduousness, complexity, and long-term nature of environmental protection work in petroleum companies. At present, many units in oil companies are only satisfied with the post-event treatment of accidents and the end treatment of parasites, and there is an idea of focusing on treatment rather than prevention. The existing basic environmental protection indicators of oil companies in China and other countries are in proportion to current laws and regulations and social development requirements. The operation and environmental management foundation of conventional oil companies is still relatively weak. The current environmental problems caused by the petrochemical industry

are becoming increasingly prominent, which will arouse great attention and attention from the national government, people and public opinion; future environmental legislation and environmental-related environmental standards will be more stringent. International trade barriers are more rigid, and environmental liability insurance requirements are more stringent. Under this new indicator, how to deal with the coordinated development of environmental protection and production and operation and improve the overall competitiveness is one of the core issues facing the development strategy of oil companies in developing countries.

In my opinion, addressing climate change is an important manifestation of my country's global governance strength. Sinopec companies should actively implement a green and low-carbon strategy. Consider the strategic development path under the condition that the global temperature rise does not exceed 2°C. Sinopec has many greenhouse gas emissions, high CO2 emissions from some processes, diversified CO2 separation and purification technologies, and high-value and high GWP greenhouse gas emissions. Sinopec's strategy for addressing climate change should actively respond to and respond to low-carbon development trends: At the level of commercial operations, Sinopec's strategic development and commercial operations will not be restricted due to quotas; emission reduction levels should be to support the achievement of peak carbon emissions in 2030. The national goal of a global average temperature rises of not more than 2°C has made a significant contribution. Due to the high CO2 emissions in the production process, petroleum and petrochemical companies, as chemical producers, have the relevant capital and technical advantages to carry out CO2 sales and production of various chemicals and actively expand the corporate value by extending the industrial chain.

Summarize the practical experience of the international oil companies in addressing climate change and put forward the following suggestions to other oil companies that have not yet made strategic plans and actions to address climate change.

1. Corporate governance.

Incorporate climate change-related issues into the company's board of directors for supervision and strengthen the frequency of maintenance of climate change-related risks and opportunities. Clearly define the climate change management department, clarify the boundaries of responsibilities, set up a cross-departmental carbon leadership group, and ensure that all functional departments and business departments are coordinated. Set up low-carbon incentive mechanisms in the form of cash and non-cash, link high-level compensation with low-carbon strategic goals, and fully mobilize the enthusiasm of management and employees. Do a good job in the public disclosure of carbon information and promote the communication and understanding of stakeholders.

2. Low-carbon strategy and risk management.

Integrate climate change strategy into the company's overall. At the same time, it analyzes and predicts various climate issues that may arise in the future, sets emission reduction targets and internal carbon pricing suitable for its characteristics and considers the multi-faceted impact of carbon. Implement climate change risk management, identify more types of risks, and reduce risks.

3. Low-carbon investment and action.

proportion of low-carbon investment. Enterprises should adopt various forms such as direct investment, mergers and acquisitions, venture capital and R&D investment. At the same time implement a broader low-carbon investment portfolio, including improving energy efficiency, control methods, reducing flares, increasing natural gas production, renewable energy development, carbon capture, recycling and storage technology achievements, the implementation of carbon trading, and forestry carbon Foreign exchange investment. In terms of public policy participation. Actively communicate with government policymakers of various countries, take the lead in organizing or participating in industry associations around the world, and join in and lead the formulation of related industry plans, industry policies, and standards

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WATER IN FUTURES MARKET: SMART CAPITALISM OR TOXIC DISDAIN FOR HUMAN RIGHTS?

Kshitij NAIKADE[1]; Sujata ARYA[2]

[1]DAAD Scholar, Berlin School of Economics and Law, Berlin, Germany, Assistant Professor, Symbiosis Law School, Pune, India, kshitij.naikade@symlaw.ac.in, +91-9619292797
[2]Symbiosis Law School, Pune, India, sujataarya@symlaw.ac.in, +91-9011018412

Abstract
The 21st century has seen over 2/3rd of the globe suffer from severe water scarcity for at least one month in a year. As per the IPCC (Intercontinental Panel on Climate Change) report in 2022, it is going to get worse from here on and by 2040, we might see massive forced migration, continental conflict and even wars over control over water resources. However, ironically, capitalists have sought an opportunity in this crisis and have converted this scarce resource into a lucrative commodity. By launching "water trading" or "water futures" on the stock exchange, water has become a contested product which puts the life of citizens (since water is essential for life) in the hands of market manipulators, investors and stock market financial institutions. The trend, which was restricted to the developed countries has reached the developing and underdeveloped countries as well, with India, one of the most water-stressed countries in the world has launched public consultation to bring water in the commodities market. This paper will critically analyze the existing water futures and compare the successful and unsuccessful implementation of stock market trading of water on fixed variables and parameters. The authors will analyze whether leaving a basic life source like water in the hands of speculative market forces has helped in the sustainable distribution and conservation of water resources. The paper aims to analyse the rationality and feasibility of trading water in the context of sustainability of the ecosystem. Access to safe drinking water is a non-negotiable right according to the United Nations. Has this right been safeguarded by the markets?
The paper will like to conclude by giving recommendations and cautionary warnings to the developing countries like India who aspire to let go of the value of water as a public good in combating climate change adaptation mechanisms.

Keywords: *Sustainable development, scarcity, futures contract, water trading, climate change*

INTRODUCTION

Global Water Crisis in a Nutshell

Earth, the Blue Planet, has 326 million trillion gallons of water, however, due to 99 percent of it being in salty oceans or trapped in ice at the poles, the entire reliance of water for consumption is on this remaining 1%.[3] Most of this water is underground and logistically and financially difficult to harness. Hence, water as a life

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[1] DAAD Scholar, Assistant Professor, Symbiosis Law School, Symbiosis International University, Pune, India, kshitij.naikade@symlaw.ac.in, +91-9619292797
[2] Assistant Professor, Symbiosis Law School, Symbiosis International University, Pune, India. sujataarya@symlaw.ac.in
[3] *Earth's Freshwater | National Geographic Society*. (n.d.). Retrieved November 7, 2022, from https://education.nationalgeographic.org/resource/earths-fresh-water/.

source and the quest for potable drinking water has been the foundation of human evolution over the centuries. Civilizations have been established and flourished with the access and evolution of harnessing

water for personal and occupational consumption. The ones that could not, withered away in the oblivion of history. Most civilizations came up near a river or other easily accessible sources of surface water. Thus 90% of the population on this planet lives within a 10 km radius of a water source.[4] Over the centuries, man has used his superior position in the food chain to methodically harness this water from its sources to the taps of every household and pipes of every industry and occupation

However, with the exponentially rising population and depleting water table, various countries in the world started to feel the pinch of water scarcity by the 20th century. The 21st century is facing a major water crisis unlike any in our history and it threatens to destabilize this much valued global stability.

Cape Town in South Africa came very close to becoming the first city in the world to "run out of water". The ominous Day Zero was necessitated by the indiscreet use of water and the subsequent droughts. Not just Cape Town, major capital and industrial cities in the world like Melbourne, São Paulo, Jakarta, London, Beijing, Istanbul, Bangalore and Barcelona are some of the few cities which will face their own Day Zero in the decades to come, unless they radically change their water use.[5]

CRITICAL ANALYSIS

Threat of Climate Change

In this century, the per capita water consumption has increased sevenfold. Couple that with the fact that the rains and snow, which are the biggest sources of refilling these water systems have become erratic and unpredictable. The temperatures across the globe are increasing due to man-made reasons. Thus, Climate Change is making rains and other natural water phenomena erratic. Majority periods are currently facing long dry periods. [6]

Capitalization of Water

Just like every inflection point in History, man has decided to convert this calamity into an opportunity. Labeled as "Liquid Gold"[7] by many, water today has emerged as the most valuable commodity in the world. A commodity without whose consumption, every living being on this planet will wither away and die in a

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[4] Agardy, Tundi and Jacqueline Alder (Coordinating Lead Authors), 2005, "Coastal Systems," chapter 19 in Rashin Hassan, Robert Scholes, and Neville Ash, eds, Ecosystems and Human Well-Being: Current State and Trends, Volume 1, Washington, DC: Island Press. Agenda 21. http://www.un.org/esa/sustdev/agenda21.htm.

[5] Edmond. (2019, August 23). *Cape Town almost ran out of water. Here's how it averted the crisis*. World Economic Forum. Retrieved November 1, 2022, from https://www.weforum.org/agenda/2019/08/cape-town-was-90-days-away-from-running-out-of-water-heres-how-it-averted-the-crisis/.

[6] *Drought and Climate Change - Center for Climate and Energy Solutions*. (2022, November 1). Center for Climate and Energy Solutions. Retrieved November 2, 2022, from https://www.c2es.org/content/drought-and-climate-change/.

[7] Borzykowski, B. (2015, September 17). *Is this the real liquid gold?* Is This the Real Liquid Gold? - BBC Worklife. Retrieved October 31, 2022, from https://www.bbc.com/worklife/article/20150916-is-this-the-real-liquid-gold.

matter of few days. This life sustaining commodity is at the center of an intense moral ethical debate about its lucrative viability. A similar debate emerged recently during the covid 19 pandemic over the supply and distribution of live saving drugs in the face of a fatal virus. However, in this case, it is about a naturally occurring live sustaining phenomenon which needs to be consumed every day, irrespective of your country,

sex, religion, race or even financial capability. Water as a Human Right is the foundation of this big ethical debate.[8]

In July 2010, the United Nations pledged through a General Assembly resolution that access to clean drinking water is an integral Human Right. It urges member states to actively invest resources in providing water stability and create capacity to help countries who may not be in a position to provide this clean safe drinking water to all its citizens. Hence, this paper argues that by encouraging Water on the Futures market, the States are going against this commitment given for realizing human rights. Moving on, the UN Human Rights Council further reiterated that this Right to clean drinking water as a human right is an integral part of International Law and it is legally binding on all its member states.[9] Hence, the introduction of water on the futures market takes us away from releasing this crucial goal.

What is a futures market?

Water is the new Oil or Petroleum, remarked a Goldman Sachs report. The price of water has gone up exponentially around the world, even in first world countries. California, the place where this idea of trading water as a futures product emerged, saw the price of water triple over the years. The recent wildfires and droughts have accelerated this scarcity of water. Hence, the CME group(Chicago Mercantile Exchange), a private entity, decided to monetize this precarious situation, a typical neo liberal capitalist tendency. Futures market, simply put, is an auction market. You buy and sell today for a delivery in the future. The price is set today and the commodity is delivered tomorrow or at a later date. The idea is for an individual to bet on how well a product will be sold at a future date but set a price for it today. This kind of trading is usually reserved for high value products like oil and gold. That is why it is called Futures Trading. The company, CME, announced contracts for spotwater in California. This market in California alone is worth 1.1 billion dollars and counting. This eventually results in the price of water fluctuating regularly, just like oil and gold. [10]
The Chicago Mercantile Exchange[11] launched the world's first water futures market which allowed investors to bet on the prices of water. This model was replicated at several places around the globe to mixed results.

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[8] United Nations General Assembly, *Resolution A/RES/64/292*, July 2012, from https://www.un.org/waterforlifedecade/human_right_to_water.shtml.

[9] UN Committee on Economic, Social and Cultural Rights, General Comment No. 15, *The right to water*, November 2002, from http://www.unhchr.ch/tbs/doc.nsf/0/a5458d1d1bbd713fc1256cc400389e94/$FILE/G0340229.pdf.

[10] *Nasdaq Veles California Water Index Overview - CME Group*. (2022, October 17). Nasdaq Veles California Water Index Overview - CME Group. Retrieved October 25, 2022, from https://www.cmegroup.com/markets/equities/nasdaq/nasdaq-veles-california-water-index.html.

[11] DiFelice. (2022, July 25). *Futures Trading: Another Threat To Our Right To Water*. Food & Water Watch. Retrieved October 28, 2022, from https://www.foodandwaterwatch.org/2022/07/25/futures-trading-another-threat-to-our-right-to-water/.

Countries like India too through the NITI Aayog have launched attempts at futures commodification.[12] It is a part of the larger attempt at privatization and commodification from the state government.
CME fixes the price of water on a pre-decided index. Investors bet on this index by entering into a contract. The buyer and the seller of this futures contract will bet on the fluctuation of the price at a certain predetermined date in the future. The sellers of this contract will hope that the prices go down as they stand

to earn profits from the margin while the buyer of this futures contract will hope for the price to go up so that the inflated market sentiment can be used for more profits. [13]
However, before we begin further, it is important to acknowledge the importance of the United Nations 1992 conference on Water and the Environment held in Dublin. It got overshadowed by the more hyped Rio Summit held the same year. However, the Dublin conference was the first time where water was discussed as a commodity having an economic value. Thus, when the supporters of economic globalization were optimistic, this change in language over the commercialization of water came as a crucial step. At the same time, the general agreement of trade and tariff was more than keen to include water in all its trade parameters, including ice and snow as tradable goods.[14] It was preceded by the famous declaration by the British Prime Minister, Margaret Thatcher to privatize the water industry in 1989. Taking cue from such global precedents, the World Bank too started putting Water Privatization as an important prerequisite for global funding and aid. This was quickly internalized by several countries in the global south and hence, this insistence to treat water as a tradable good and not as a human right originates from such global events.[15]

Merits of the Futures Contract
This pegging of water as a futures commodity will remove uncertainty around water prices. People can plan well in advance with respect to their water use. Farmers, authorities can plan for the judicious use of water well in advance. South Africa has already banned free flowing tap water in some of its prominent cities.[16] Instead, they offer water rations or water credit to citizens who have to go and refill their water just like foodgrains. This puts an accountability on the end user. Governments can make budgetary provisions according to the prices. Today most parts of the world use water as if they will be having enough of it forever. Most places where water intensive industries and agriculture is operational, pay a fraction of what they should be ideally paying. In most third world countries, water and its pricing are a politically sensitive issue, ensuring it is kept abnormally low, against economic rationality.[17]

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[12] Nilanjan Ghosh (2022, October 11). *How liquid can water be? Possibilities with water derivatives trading in India*. Retrieve October 25, 2022, from https://www.orfonline.org/research/how-liquid-can-water-be/.

[13] *Hedging with Water Futures - CME Group*. (2021, May 26). Hedging With Water Futures - CME Group. Retrieved October 27, 2022, from https://www.cmegroup.com/content/cmegroup/en/education/articles-and-reports/hedging-with-water-futures.html.

[14] Organization for Economic Cooperation and Development. (2015). *Water And Cities: Ensuring Sustainable Futures: OECD Studies On Water*. Organization For Economic Co-Operation & Development.

[15] United Nations Environment Programme, & World Meteorological Organization (1992). *International Conference on Water and the Environment: Development Issues for the 2lst century*. https://wedocs.unep.org/20.500.11822/30961.

[16] Gersony, L. (2022, June 20). *HotSpots H2O: "Day Zero" Looms for South African Province*. Circle of Blue. Retrieved November 4, 2022, from https://www.circleofblue.org/2022/world/hotspots-h2o-day-zero-looms-for-south-african-province/.

[17] Lyons, K. (2022). *Buying for the Future: Contract Management and the Environmental Challeng*. Pluto Press.

The benefit of putting a price (admittedly higher) on water will ensure discreet use of this precious commodity. Most places in India and China grow water guzzling lucrative cash crops in some of their most dry regions.[18] Soft Drink beverage companies mushroom around the world promising employment, but sucking thousands of liters of water to produce a liter of the soft drink. Because the amount paid for water is so meager, they are in a position to sell their products for cheap. As per a study, it takes 1650 liters of water to make a meat burger, a popular American snack. The reason why it costs hardly 1 dollar is because the entire supply chain which produces the ingredients necessary for the burger do not pay an adequate amount

for the water consumption required for the production. A price tag on water through the commodities market may sound like an exploitative idea, but it has the potential to discipline industries into judicious utilization. Sending out a 'Price Signal' through the future market is just putting forth to all the citizens the true worth of this precious liquid. Governments will change their policies to ensure that crop cultivation is not encouraged for crops which are not suitable for dry arid regions.[19]

Negative light around the Futures Contract

Water is a basic human need and cannot be put in the hands of financial institutes. Gold and Oil are not necessary for day-to-day survival. But price fluctuation of water can be fatal for survival. It is like gambling or betting on the lives of people. People will stand to gain more money if there is more scarcity. Hence, profits will be earned at the cost of people's lives. Is this ethical? or even viable in a democratic polity based on socialistic human rights parameters.

2 Billion people around the globe are plagued with water scarcity problems.[20] The NITI Aayog in India (National Institute for Transforming India) is toying with the idea of introducing it. So, the idea which started in a first world country is slowly catching up with third world countries as well. It will be just a matter of time before water as a tradable commodity becomes a viable idea for money minting opportunists. That is a dangerous precedent, especially when multiple countries have announced water to be a basic necessity protected by constitutional parameters. If 2/3rd of the world is expected to face water shortage by 2025[21] and the next world war is predicted to be fought over control over water resources, then jumping on the bandwagon of water trading is not a good idea. Households, business, farmers etc. all will suffer massively due to such adventurism and it will be fatal for civilizational survival.

The CME has recently also announced the financialization of water futures without public hearings. This is one step above gambling on water prices and gives opportunities to gamble on droughts and a planet which is running out of water.

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[18] Zhuo, L., Mekonnen, M.M. and Hoekstra, A.Y. (2016) Water footprint and virtual water trade of China: Past and future, Value of Water Research Report Series No. 69, UNESCO-IHE, Delft, the Netherlands.

[19] Doshi, V. (2017, March 1). *Indian traders boycott Coca-Cola for "straining water resources."* The Guardian. Retrieved October 28, 2022, from http://www.theguardian.com/world/2017/mar/01/indian-traders-boycott-coca-cola-for-straining-water-resources.

[20] *Water scarcity*. (n.d.). Water Scarcity | UNICEF. Retrieved November 7, 2022, from https://www.unicef.org/wash/water-scarcity,

[21] *Secretary-General Warns Two Thirds of Global Population Could Face Water-Stressed Conditions within Next Decade, in Message for International Forests Day | UN Press*. (2016, March 18). Secretary-General Warns Two Thirds of Global Population Could Face Water-Stressed Conditions Within Next Decade, in Message for International Forests Day | UN Press. Retrieved November 3, 2022, from https://press.un.org/en/2016/sgsm17610.doc.htm#:~:text=By%202025%2C%20nearly%201.8%20billion,central%20to%20addressing%20climate%20change.

A very direct report from Citibank expects and predicts a massive expansion of investment in the water sector in the next 15 years. Not just futures, but investment in storage, shipping and transportation will ensure that the water pipelines will far exceed that of oil and natural gas. Once water on the future market goes global, capitalism will ensure a globally integrated market for fresh water. The rise of bitcoin will further supplement this exchange.[22] There will be legitimately traded types and grades of fresh drinking water, just like we have different types of crude oil and gas. Water will become an asset class and will eventually, as we move towards a water scarce world, will emerge as a single most important tradable commodity, overtaking oil. This will leave the lowest denominator of the society extremely vulnerable and will lead to direct human conflicts for ownership and control over water.[23]

It contradicts the above-mentioned commitments which the UN and its member states had bindingly taken to provide water a human right. The idea of Water on the Future market promotes this toxic tendency of financialization. This promotes rampant speculation and frenzy. This can be understandable on the conventional stock market where other listed companies rely on 'market sentiment' as a legitimate reason for the bull and bear run. However, the same can be disastrous when it comes to making futures contracts for water. Furthermore, the financial viability of the futures markets is inherently based on 'scarcity'. If water as a commodity is abundantly available for everyone, it will not generate adequate enthusiasm from the private capitalists to invest and grow. Thus, this negative attitude towards looking at such a basic need of mankind is bound to bring doom.

The most important criticism of the entire future market commodification of water is that it alienates the indigenous communities from crucial decision making over resources which are their primary source of livelihood.

Financial entities are always looking for a new asset to manage and make profits. That's how water is for these entities, plain and simple. The initial attempt to do so in California under Water Rights was a contract between Nasdaq Exchange, New York based on a water price index created by the valley's Ltd. in London.[24] This index was used to determine the cash price of water in the subsequent trading. The CME used this price index and made it into the underlying contract for futures trading. That way they standardize water in an acre of water mass for a certain specified time period. For commercial users of this water, if they anticipate scarcity later, they will buy it in advance at a relatively cheaper price and then in peak demand season sell it to farmers and other allied agriculturalists. This will impact the entire food chain and will lead to skyrocketing prices of the basic goods. Currently, the input costs associated with water for all agricultural produce is subsidized and hence stabilized.[25] Hence, water rarely becomes the reason for price volatility. In case of water futures, this will offset commercials of water to put the price of water on the end user, the customer.

Historically, the global financing agencies like IMF (International Monetary Fund) and World Bank have, under structural adjustment, used public money to fund private finance. However historically, these adjustment plans which have involved privatizing water and generating competing interest points have led to tensions amongst local communities. Hence, it is important to determine whether we are looking at water as a

[22] Kleinman, G. (2022). *Trading Commodities and Financial Futures: A Step by Step Guide to Mastering the Markets, 3rd Edition* (3rd ed.). Ft Pr.

[23] Reinhard. (2022, March 22). *Water scarcity: One of the greatest challenges of our time*. Water Scarcity: One of the Greatest Challenges of Our Time. Retrieved October 22, 2022, from https://www.privatebank.citibank.com/insights/water-scarcity-impacts-investing.

[24] *Valley National Bank Rings the Nasdaq Stock Market Closing Bell*. (2022, September 15). Valley National Bank Rings the Nasdaq Stock Market Closing Bell | Nasdaq. Retrieved November 7, 2022, from https://www.nasdaq.com/videos/valley-national-bank-rings-the-nasdaq-stock-market-closing-bell.

[25] Bolin, B., Collins, T., Darby, K., 2008. Fate of the verde: Water, environmental conflict, and the politics of scale in Arizona's central highlands. Geoforum 39(3): 1494-1511.

commodity which can be profited from or is it a common which should equitably benefit all flora and fauna for the growth of the ecosystem. We need stricter global legislation to protect water as a human right. [26]
The problem with trading water as futures is that unlike the conventional stock market, where market volatility or demand will lead to an inflated amount for a stock of a company or a corporation which then translates into more funds for the company, which then translates into more profits for shareholders who would have bought the shares at a cheaper price, here the finite amount of water has to be commercially used for broad use throughout the industry. Thus, the farmers or anyone from the agrarian economy, who will participate in this market with the hope of securing a price for water for the future, can be in for a rude shock

with the extremely high-water prices due to severe market manipulation. Thus, if the same water is not pledged through contracts, there is a possibility of it being priced considerably lower and equitably available for everyone. For third world countries like India, such adventurism, amidst droughts and unequal water table availability, can lead to mass protests, hunger, migration and deepening of poverty.[27]
Futures markets for other products are well known for intense price fluctuation and market manipulation. However, since the commodities being traded there are not live saving, the impact is felt only on the investors. Here, with huge amount of money being gambled, the stakes are always high and hence, the prices on the indices will artificially always be kept high. This intense speculation will lead to the actual holder of physical water from hoarding on the precious liquid, thus denying legitimate access to millions to a basic human right. This will further lead to unregulated cartelization which will make it complicated for governments to regain control, even if they intend to do so.
Rise of the Capitalist – Third world countries like India are facing existing concerns of small land holding and excessive fragmentation of land. This leads to increased input costs for conducting agriculture on smaller pieces of land. Economies of scale prevents larger output. This has led to agriculture not being an affordable career option for several rural households. In such an instance, if the prices of water, pledged through futures markets keep fluctuating, it will hit the agricultural sector massively. The inflated prices of water will make agriculture an unaffordable profession. People with small land holdings will sell off their land and move to the cities for better livelihood, thus increasing internal push migration accelerating the urban rural divide and putting pressure on already stressed urban governance. It is important to note that when they will sell this land, the most obvious choice of buyers will be the big agro-conglomerates or business houses. These agro-businesses with multimillion dollar turnover, will benefit from this farmland consolidation ensuring more profits. Thus, to prevent capitalism from monetizing water for profiteering, it is important to keep it away from the futures market. [28]

Civil Society

However, the march towards making water a commodity has been opposed at several junctures around the globe by an alert civil society. The outcomes of such sustained campaigns have given rise to implementable solutions. There are over 300 municipal corporations across the global north who initially were inclined towards privatization and jumping on to the futures bandwagon, but have realized the pitfalls and have moved

[26] Collins, T.W., Bolin, B., 2007. Characterizing vulnerability to water scarcity: The case of a groundwater dependent, rapidly urbanizing region. Environmental Hazards 7(4): 399-418.
[27] *Climate Change Indicators: Drought | US EPA*. (2016, June 27). United States Environmental Protection Agency, Climate Change Indicators: Drought. Retrieved October 31, 2022, from https://www.epa.gov/climate-indicators/climate-change-indicators-drought.
[28] 2 Mont. L. Rev. 91 (1941) Corporations: Validity of a Contract to Issue Stock for Future Services.

back to public government management and regulation of water services.[29] There are efforts to delink water from the land and sell it separately, just on the lines of bottled water and not bid on the prices under futures. In Australia, where water futures were launched amidst much fanfare, the farmers were initially incentivized to save water and sell the conserved water through futures.[30] This was launched with the hope that this could incentivize the farmer into judiciously utilizing water. However, this did not work out, the multinational agribusiness corporates came in, international investors got involved and the prices of water skyrocketed thus making it unaffordable for the very people for whom this was launched.[31]

RECOMMENDATIONS AND CONCLUSION

- **Water Security**

State establishments across the world should make providing water to every citizen their primary responsibility. By encouraging ideas like water futures, one runs the risk of converting a primary life sustaining element like water into an elite commodity which is ripe to be exploited for private profits. Water security is the primary right of every individual on this planet. The same has been reiterated through multiple resolutions of the United Nations.[32] It is high time adventurism like water futures are nipped in the bud and the governments focus on equitable and judicious distribution of water.[33]

- **Water Regulatory Authority**

With the rising water crisis around the globe due to climate change, it's imperative that a dedicated WRA is established to monitor the water use. The scientific extraction of groundwater in the coming decades is going to be crucial for life sustenance. Ideas like Water Futures need to be studied carefully by a WRA. The positives of launching water as a commodity should be analyzed carefully and ways should be found to incorporate them into policymaking without falling for short term greed as it has the potential to snowball into a long-term catastrophe.

- **Relationship with Water**

  It is important to understand that water is not just a mere life sustaining thirst-quenching liquid. In most third world countries, water has a politically, socially and ideologically sensitive connotation to it.[34] Several indigenous groups consider water and its various sources extremely sacred and hold it as a deity. In India, most rivers and water sources are commemorated with a religious shrine. New Zealand recently passed a legislation which accorded Rivers the status of a living object. Hence, commercially exploiting rivers for profit under the guise of price stability is an artificial way of altering these sentimental associations with water. The state and various local authorities need to ensure the water commons are kept public. Water futures need to first prove its viability in a tested case study for it to be considered adaptable for most countries in the world.

- **Water availability index (wai)**

Every country needs to create a public index about the availability of freshwater. This sensitization should be coupled with strict regulatory decisions for judicious utilization and consumption. The WAI can be used to

[29] 14 Global Governance 503 (2008) Global Trade and Water: Lessons from China and the WTO.
[30] Cooper, G. (n.d.). *Water Funds 2013* (1st ed.). Environmental Finance Publications.
[31] 5 Buff. Envtl. L. J. 179 (1997-98) Can Trade Promote an Ecologically Secure World--The Global Economy from an Ecological Footprint Perspective.
[32] 29 Int'l L. 615 (1995) Why Does Not the Rising Water Lift the Boat - Internationalization of the Stock Markets and the Securities Regulatory Regime in China.
[33] 32 Envtl. L. Rep. News & Analysis 10167 (2002) Fresh Water - Toward a Sustainable Future.
[34] Esty, D. C., & Winston, A. (2009). *Green to Gold: How Smart Companies Use Environmental Strategy to Innovate, Create Value, and Build Competitive Advantage* (Revised&Updated). Wiley.

create the indices for water futures, if needed. This will be a more transparent and people centric approach to trade water on the futures market[35]

However, if the government wants to invest in the idea of a water future, it should do so to ensure efficient scientific distribution of water across the spectrum. A detailed commercial industry requirement analysis needs to be done before pegging water as a commodity. This decision can also encourage investment opportunities in improving water management infrastructure in water scarce regions.

FOCUS ON FARMER

The farmer, who is the most crucial cog in this wheel should be taken into confidence by the market forces. The water industry is huge and includes bottled water and other ancillary subsidiaries.[36] The water futures should include the farmer as a primary stakeholder just like how the cooperative sector has done successfully with the sugar and jute cooperatives in South Asia. The futures market should expose the farmer to global opportunities to scale up operations and make the most of the global market indices. This will make the farmer an equal shareholder in this growth trajectory along with the investors.

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[3] Edmond. (2019, August 23). *Cape Town almost ran out of water. Here's how it averted the crisis*. World Economic Forum. Retrieved November 1, 2022, from https://www.weforum.org/agenda/2019/08/cape-town-was-90-days-away-from-running-out-of-water-heres-how-it-averted-the-crisis/.

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[5] Borzykowski, B. (2015, September 17). *Is this the real liquid gold?* Is This the Real Liquid Gold? - BBC Worklife. Retrieved October 31, 2022, from https://www.bbc.com/worklife/article/20150916-is-this-the-real-liquid-gold.

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[7] UN Committee on Economic, Social and Cultural Rights, General Comment No. 15, *The right to water*, November 2002, from http://www.unhchr.ch/tbs/doc.nsf/0/a5458d1d1bbd713fc1256cc400389e94/$FILE/G0340229.pdf.

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RECYCLING OF ORGANIC WASTE : AN OVERVIEW OF PÁLINKA DISTILLERY MASH COMPOSTING

LARA RÚBIA BORGES SILVA [1] – LEVENTE KARDOS

Hungarian University of Agriculture and Life Sciences, Budapest, Hungary
[1] borgesrubialara@gmail.com, +36706164888

Abstract
Organic waste generation has been extending to an alarming level in most areas of the world, and its sustainable management is required. In Hungary, the amount of organic waste is increasing significantly, especially in Pálinka manufacturing - a Hungarian hard liquor - producing a great quantity of mash residue, mostly grape pomace spent wash, a non-hazardous food waste that is a suspension left over by the distillation of fermented spirits. Around two hundred thousand tons of fruit waste are generated annually, and its full recycling and legal disposal are unprecedented in Hungarian distilling plants, threatening the environment if disposed of incorrectly. In this paper, we focused on reviewing the Pálinka mash composting, where the biggest challenge for its treatment is its initial pH, around 4, which can be successfully neutralized with mineral additives. The applied additives were chosen by their beneficial physical, chemical, and biological qualities. Accordingly, andesite and alginite were employed in the experimental composting. The results of our observation have confirmed that the mineral additives can establish valuable compost or fertilizer, favourably altering the dynamics of the decomposition and synthesis reactions. As an experiment on mash composting technology, we also tested the mature mash compost in culture vessel experiments for heavy metal adsorption capacity of the ma tube mash compost using lettuce (Lactuca sativa) and tomato (Solanum Lycopersicum) as test plants. The plants were irrigated with lead (Pb), and iron (Fe) contaminated water, and then it was determined the metals accumulation capacity of the plants and growing media with an Atomic Absorption Spectrometer (AAS). The study could compare the rate of heavy metal accumulation by different plant parts and ratios of Pálinka mash compost in the growing media.

Keywords*: organic waste, Pálinka mash residue, composting, heavy metal accumulation*

INTRODUCTION

The necessity of sustainable waste management is rising, especially facing the increase in organic waste generation worldwide, stimulating new approaches for feasible management method options like waste recycling for sources of nutrients and organic matter. Waste management is a huge environmental, social and economic issue nowadays because of the scarcity of practical approaches for its recycling and disposal [1]. Sustainable management of organic waste is required to prevent scarcity of natural resources, reduce danger to human well-being, and maintain an overall environmental and ecosystem balance [2].
Over the years, some solutions for resource recovery of organic wastes have been created, such as (1) recovery of the organics and nutrients by using directly in the soil or by composting, (2) energy generation potential by modification of the organics, or (3) production of new products by alteration of the organics such as recycling paper into new paper products. In this paper, composting was the chosen method for organic waste management because this procedure has been proven a great organic additive

by providing humus and nutrients to poor soils, notably increasing crop yields and minimizing irrigation demands [3].

One example of organic waste promoting challenges in management is the *grape pomace spent wash* or *mash*. According to BURG [1], there are 8 million tons of grape pomace accessible annually in Europe, which is still increasing. Grape pomace consists basically of the skin, pulp, and seeds of the grape and from the waste management point of view, it is classified as biotic waste generated in the Food-Drink-Milk sector [1, 4].

In Hungary, the amount of organic waste is increasing significantly, especially in Pálinka manufacturing which produces a great quantity of *mash residue*. Pálinka is a traditional Hungarian fruit distillate made exclusively from fermented fruit mash, and its distillation process generates a significant amount of waste. BARABAS and SZIGETI [8] stated that nowadays, approximately 150.000 to 200.000 tons of fruit waste is produced annually in Hungary. The management of this type of waste produced during the Pálinka distillation process is a significant environmental issue.

Pálinka beverage is a Hungarian specialty, and its production is limited to Hungary and some areas of Austria [5]. Its production is increasing significantly due to the permissive legislation of home distilling being a matter of serious concern as home distillation waste handling is uncontrolled and produces four or five times more waste than the industry [6].

During Pálinka distillation, merely 10% of the initial mash and raw materials may become the end product, so the residues generated by this process represent a considerable volume of the input [7]. In the case of using grapes for Pálinka production, it generates a distilled by-product named *marc, mash,* or *grape pomace spent wash* where this fruit waste represents around 85% of the input material [8]. The spent wash can represent a huge environmental risk because, at present, the complete recycling of wastes and their legal disposal requires significant expenditure from Hungarian distilling plants. On the other hand, *spent wash* (residue of brandy distillation) contains many nutrients that can be useful for future applications in agriculture as compost and/or fertilizer.

Due to the exponentially growing production of organic waste nowadays, the development of sustainable agriculture by mobilizing the recycling of this kind of material as a source of organic matter and nutrients is a great management strategy option [9]. Nowadays, the disposal or utilization of the generated waste is a key issue of Hungarian Pálinka distillation, and some practices should be improved to solve these issues, such as its utilization for soil strengthening, composting, and disposal at wastewater treatment plants, biogas production, and foraging [8].

The *grape pomace spent wash* (residue of grape pomace distillation) can represent a huge environmental risk because, at present, according to HARCSA [7], the complete recycling of this waste and its legal disposal is unprecedented in Hungarian distilling plants, threatening the environment if disposed of incorrectly.

Alternatively, *grape pomace*, like most organic waste materials, can be beneficial in agriculture if applied as compost or crop fertilizer due to its high concentration of macro-and micro-nutrients, as it releases these nutrients gradually in the soil [10]. Moreover, *like other composted materials, grape pomace* promotes the filtration of environmental pollutants and stimulates plants to improve their drought tolerance [11]. It also has a positive effect on the soil structure, and due to this improvement, the oxygen distribution is more favorable in the soil [12].

According to ELEONORA [13], the *grape pomace* is a product for which the industry and scientists have tried to find an effective recycling and disposal method, and its disposal is getting hard as the production of its derivate grows.

The study of BURG [1] described the main restrictions of a direct application of fresh *grape pomace* in the soil, which consists of a long decomposition period for this material due to its adverse carbon and nitrogen ratio (between 40 - 45:1) and a meager improvement of soil conditions. These impediments can be suppressed by combining nitrogen and phosphatic fertilizers with *grape pomace*. Moreover, the

direct incorporation of *grape pomace* into agricultural land can lead to severe problems since degradation products can inhibit root growth [14].
Some features of *grape pomace* constitution can promote obstacles in the composition process, such as a relatively high proportion of dry seeds which contain fiber, fat, acid, and oils, restricting microbial activity, and prolonging the decomposition time [15].
Another challenge about *grape pomace* is its low pH (3.7- 4.5), requiring adjustment before its application to the soil or composting to activate the microorganisms and ensure microbiological conversion. Then, to respond to its acidity, *grape pomace* can be mixed with some amendments for a better composting process, in this study, two minerals were chosen: *pyroxene-andesite* and *alginite*. These minerals were chosen due to their further properties to amend the compost's chemical, physical and biological characteristics, affecting mainly the number of nutrients like phosphorus and potassium. The mineral *alginite* is a starting agent for the improvement of soil and composting; it promotes the maturation of compost, deodorizes, and improves the water-binding ability of matured compost. This mineral was mined at Pula (Hungary), and its origin is from the biomass of fossil algae over several million years in volcanic craters. According to SZABO [16], the organic material content of this mineral is around 5-50%. Moreover, *pyroxene-andesite* is a volcanic rock that contains some minerals such as phosphorus and potassium, which can increase the amount of these nutrients in the compost. It was mined in Bercel (Hungary) and is a byproduct of the milling of the main mineral product used in road building. According to DALMORA [17], this silicate rock-derived powder can be used to replace high soluble fertilizers because of its mineral's good dissolution rates, which can be applied in place of carbonate-based liming.
Over the years, some solutions for resource recovery of organic wastes have been created, such as composting. This method was chosen for organic waste management because this procedure has been proven as a great organic additive by providing humus and nutrients to poor soils, notably increasing crop yields, and minimizing irrigation demands [3,12].
Composting is a relatively simple and cost-effective method of organic waste treatment, and it is based on mainly aerobic microbial decomposition of the organic compounds. The input material for composting is required to have a high moisture content and a good carbon-to-nitrogen (C: N) ratio to generate optimal compost. A good carbon-to-nitrogen ratio is important because it adds nutrients for the microbes to survive and to continue degradation (12, 18). Compost is the main product generated by composting and it can be characterized by being an organic soil conditioner that has been stabilized to a humus-like product, a material free of human and plant pathogens, and that is beneficial to plant growth (3, 15). In addition, composting promotes various benefits besides the use of compost as a soil amendment. It also provides an increase in the disposal site's lifespan and minimizes leachate quantity and quality in a landfill and the generated gases. The production of compost follows three steps, as cited by DIAZ [15], "(1) an initial, rapid stage of decomposition: (2) a stage of stabilization, and (3) an incomplete process of humification." Moreover, composting needs an optimal temperature, humidity, aeration, and pH to successfully produce high-quality compost. Some soil properties are enhanced by the application of composts, such as water content and water retention, aggregation, soil aeration, soil permeability, water infiltration, cation exchange capacity, pH buffering, resilience, or carbon sequestration; it also decreases surface crusting.
As already mentioned, composting is a practical solution for the waste management issue, especially for organic wastes, due to the biological stabilization of this material [19]. In Hungary, the compost derived from Pálinka distillery mash is a product rich in minerals; if stabilized by composting, it can be used in crop cultivation. The generation of compost and high-quality organic fertilizers would improve the soil characteristics to meet the high demand for agriculture in the country. The production of compost is not only a matter of waste management but also sustainable soil management in Hungary [20]. During the composting process, complex organic compounds such as carbohydrates and proteins and inorganic

compounds are gradually decomposed, and some of the substances are oxidized to carbon dioxide and water. The main objective of composting is to generate a biologically stable material that will not rapidly decompose or promote undesirable rotting processes. Therefore, composting does not aim for the complete decomposition of input components but has a purpose of a steady matter [21].
Grape pomace composting represents an effective practice for its management and as a non-waste technology, composting is a recommended method according to the most recent waste management principles applied in the European Union [1]. Then, composting is one viable procedure for effective utilization of *grape pomace* as a waste product promoting a material suitable for soil application by aerobic biodegradation and reducing the concentration of unstable compounds [13]. Unfortunately, the application of *grape pomace* compost has some limiting factors for its usage as fertilizer, such as problems related to heavy metals accumulation in the soil after a long time, causing issues in agriculture (10, 22).
Hence, the composting of grape pomace distillery waste into compost is a potential way of sustainably disposing of waste while generating a useful product.

MATERIALS AND METHODS

The experiment began in July 2019 with the analysis of the chemical and microbial parameters such as pH, Organic Matter, Moisture Ratio, Nitrogen forms, Potassium, and Phosphorus. The most important biological tests are the microscopic and dehydrogenase enzyme activity investigations. Each one of the treatments had a duplicate, and the analysis of the parameters happened once per month for seven months. Then, each month were analyzed parameters of 8 samples (4 treatments + 4 duplicates), 56 samples in total.
The Pálinka distillery mash used for the composting experiments was provided by Pálinka Nemzeti Tanács (Pálinka National Council) located in Budapest (Hungary), and the pilot scale composting systems using this distillation residue were located at a private estate in Nógrád County. As already mentioned, one of the main issues regarding the usage of spent wash for composting is its low pH, and two additives were chosen to be mixed with Pálinka distillation residue: *pyroxene-andesite* and *alginite*.
The pilot scale composting system used for the experiments consisted of static piles **(Figure 1.)** with four different technological designs, administering additives to improve the initial adverse pH and significant water content of the mash slurry. These were: mash slurry + 3% andesite, mash slurry + 3% andesite + 3% alginite, mash slurry + 3% alginite, and mash with no additive (control).

Figure 1. Pilot Scale Composting Systems with thermometers (static piles)
(Source: The authors)

After the composting process, the mash compost was pre-treated and used in two experimental works to analyze its influence on heavy metal accumulation in the growing media and in different plant parts. In the first experimental work [23], the mash compost derived from the four types of technological composts cited above was placed in culture vessel experiments using lettuce as a test plant for lead accumulation capacity. From the mature composts, two mixtures were created: a 50-50% mixture with black peat and a 75% compost - 25% black peat mixture. The lettuce test plant was seeded in triplicates in each mixture; it was chosen as a test plant due to its rapid growth and good accumulative capacity [24]. After reaching the required phenological phase (1 month), the plants were irrigated with a lead solution using different lead concentrations, considering the 6/2009. Government Decree on the "B" pollution limit for lead. Lead concentrations were as follows: 480 mg/dm3 (below limit value), 600 mg/dm3 (limit value), and 900 mg/dm3 (above limit value). Commercially available vegetable growing media was used as a control, and control samples were irrigated with tap water throughout the experiment.

In the second experimental work [25], it was also used the mash compost in culture vessel experiments, but now the tomato plant was used as a test plant for iron accumulation capacity. Different from the first experimental work, in this study, there were three technological designs: 100% mash compost, 75% mash compost, 25% brown forest soil, 50% mash compost, and 50% brown forest soil. The goal of these studies was to demonstrate how Pálinka mash compost affects metal accumulation in the growing media and in the plants. For iron accumulation analysis, we cultivated tomato plants (*Solanum Lycopersicum)* in a growing media composed of mature mash compost in three different ratios with soil (100%, 75%, and 50% compost), as mentioned above. The test plants were irrigated twice a week for two weeks with iron-contaminated water (500 mg/kg). Moreover, the tomato test plant was seeded in triplicates for each of the three mixtures of compost soil. Before the tomato plant cultivation and compost addition to the soil, the iron concentrations of the compost and the soil were measured, 190,65 mg/kg and 165,98 mg/kg, respectively.
After the elimination of the series of experiments, the growing media, as well as the roots and above-ground plant parts of the tomato plants, were processed separately. The samples were air-dried, ground, and then examined for iron concentration which was determined by Atomic Absorption Spectrophotometry (Aurora AI1200 AAS instrument).

RESULTS AND DISCUSSION

Physical, chemical, and biological parameters measurements

The pH results show that its values increased over the months, especially in the *grape pomace spent wash and alginite mixture* **(Figure 2.)**. We can also notice that the pH was already high (alkaline) at the beginning of the experiment. This, and the fact that the compost had a relatively low initial temperature (somewhat above 40 °C), show that the decomposing process had started earlier, and the provided source material had not been freshly distilled. The mineral *alginite* also has a protracting alkalizing effect that can be observed in the chart below.

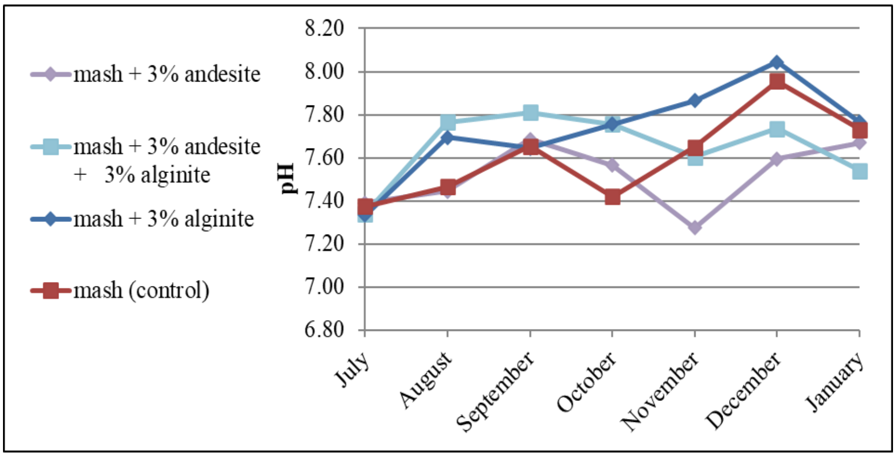

Figure 2. pH measurement of the composts

The phosphorus content increased over the months in all mixtures, especially in the *grape pomace Pálinka spent wash and andesite mixture* **(Figure 3.)**. According to PORDER and RAMACHANDRAN [26], the minerals of *andesite* are rich in phosphorus, having in its composition around 1000 ppm of the mineral, which is released due to thriving microbial activity explaining the high content of phosphorus in the mixture *grape pomace Pálinka spent wash and andesite*. Besides microorganisms, the available phosphorus content also depends on pH; consequently, this parameter crucial for plant life is also important to investigate.

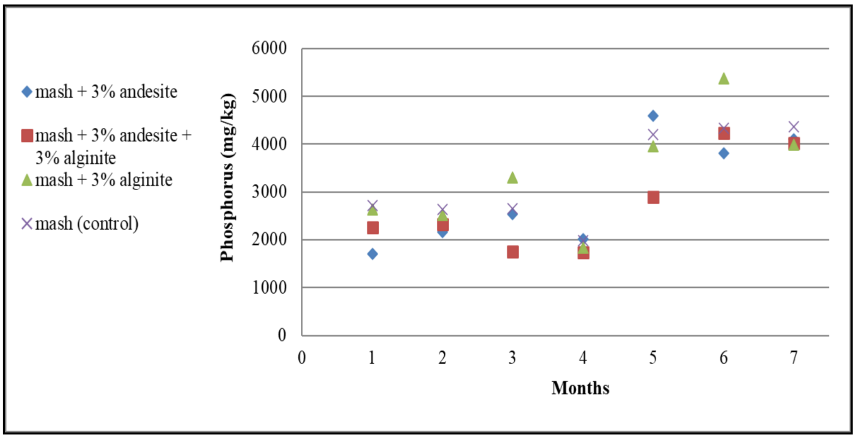

Figure 3. Phosphorus (P_2O_5) measurement of the composts

The diversity of microorganisms can be highly affected by pH because most organisms require neutral pH values to have optimum growth, and microbes can also alter the pH around them. To verify the microbial diversity, we can compare the pH and phosphorus figures for each compost treatment over the months **(Figure 4.)**. Analyzing the data, we can state that the November samples containing *andesite* exhibit a significant drop in pH and a rise in phosphorus. The probable reason for the phosphorus rise can be due to the presence of this element in the crystals of the minerals of *andesite*, and the drop of pH values in November samples could have promoted the release of phosphorus from this month. For this study, we tested total P_2O_5 content, and *andesite* seems to have the least phosphorus supply, which is still a very good reserve compared to the soil's estimated average parameter between 0,02 - 0,2%.

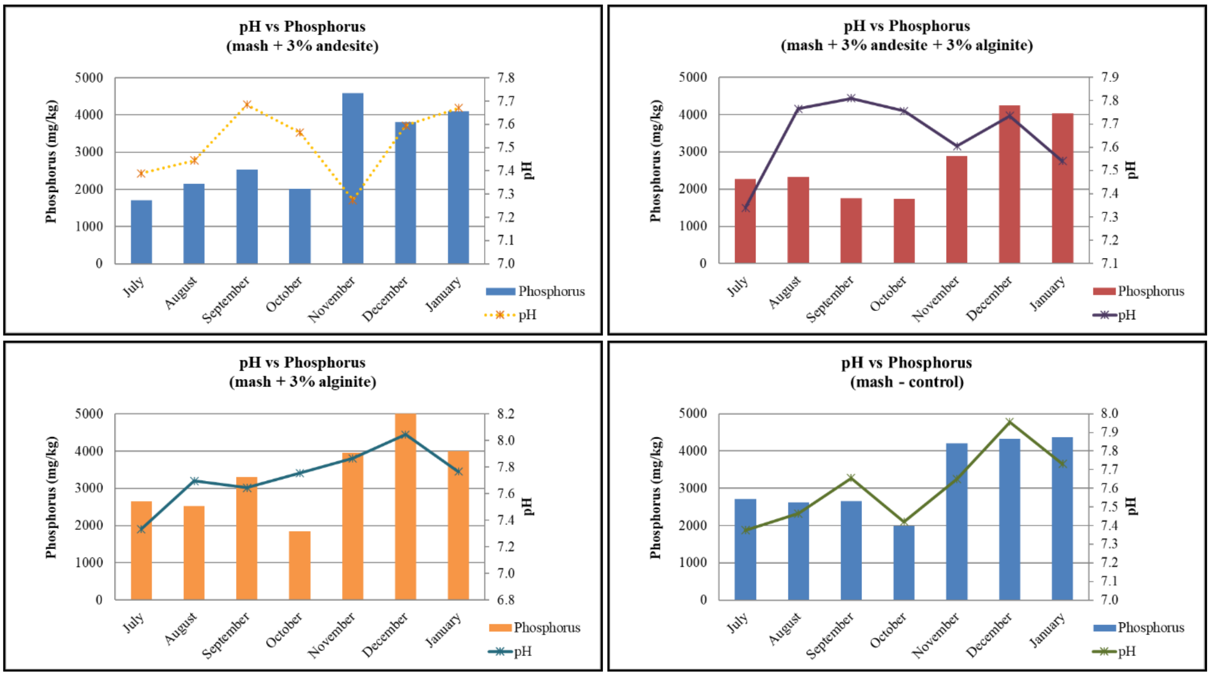

Figure 4. Correlation between pH and Phosphorus (P_2O_5) content in the compost samples

Potassium (K) is the third most important nutrient besides nitrogen and phosphorus; it is used in soils as inorganic fertilizer. The potassium quantity had a huge increase in the four compost treatments after October **(Figure 5.)**.

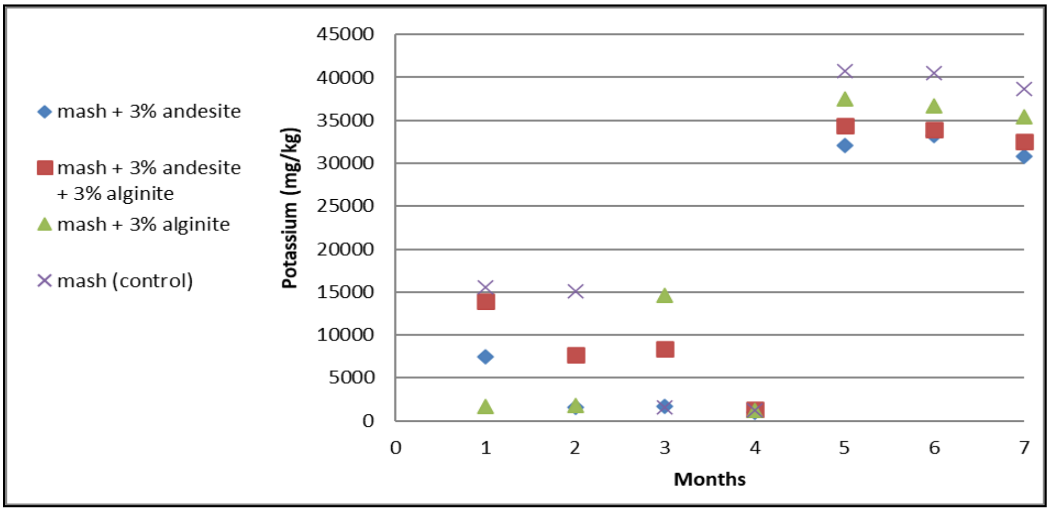

Figure 5. Potassium (K_2O) measurement of the composts

This increase in potassium after October correlates with the drop of pH in the mixtures with *andesite*. For the *control* and *alginite* treatments, the potassium levels increase with the pH rise **(Figure 6.)**.

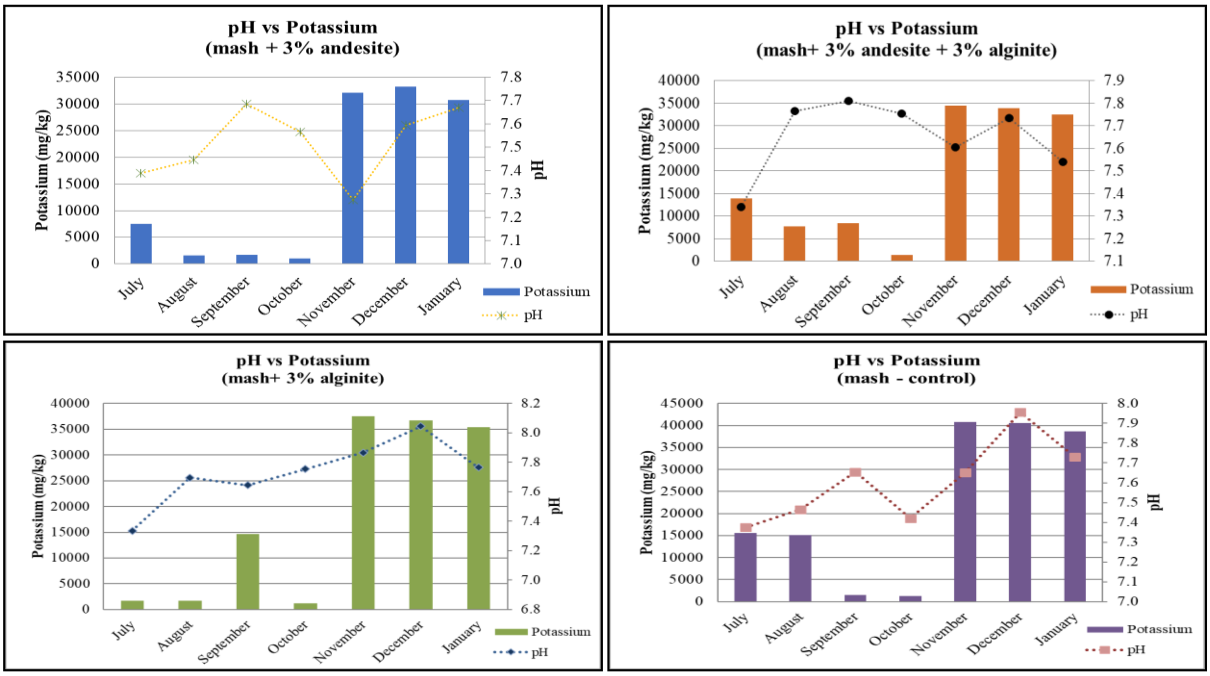

Figure 6. Correlation between pH and Potassium (K_2O) content of the composts

The ammonium content increased in all the mixtures through the months **(Figure 7.)**. This increase can be explained by the ammonification of the organic matter by decomposers increasing the NH_4 ions in the compost. This amount of ammonium produced over the months reflects the capacity of the compost for nitrogen mineralization.

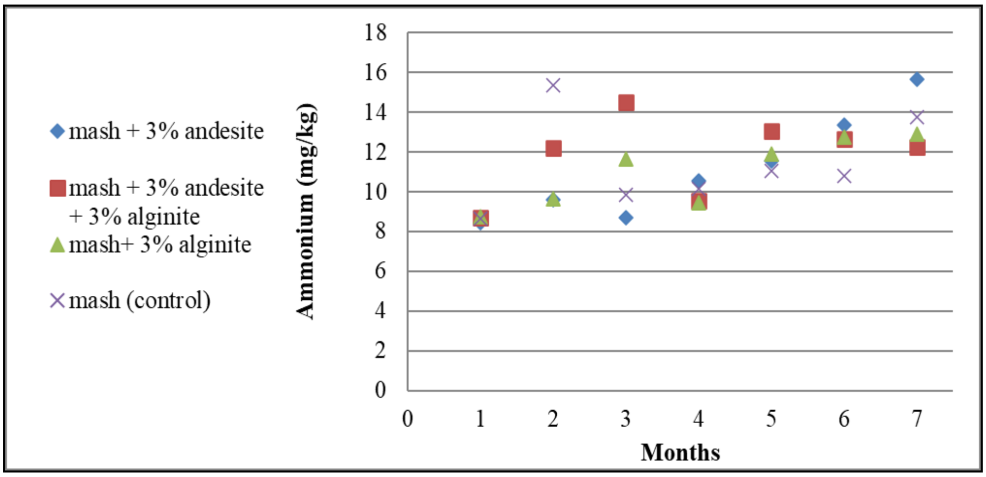

Figure 7. Ammonium measurement of the composts

The nitrate content increased in all mixtures over the months **(Figure 8.)**. The *grape pomace Pálinka spent wash* sample, and the *spent wash and andesite mixture* showed the highest values of nitrate. The nitrate must have increased because, after some time, more oxygen became available, and nitrification occurs (aerobic process), usually following ammonification.

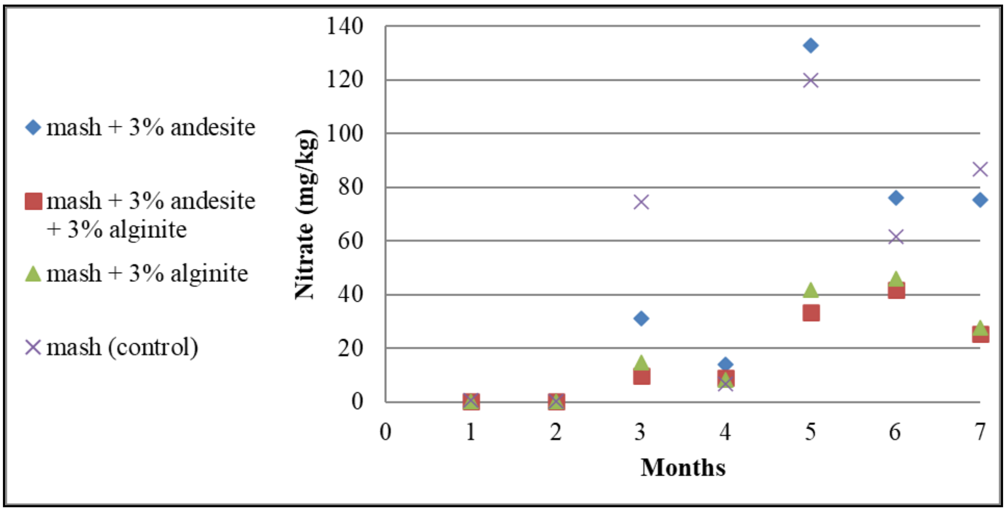

Figure 8. Nitrate measurement of the composts

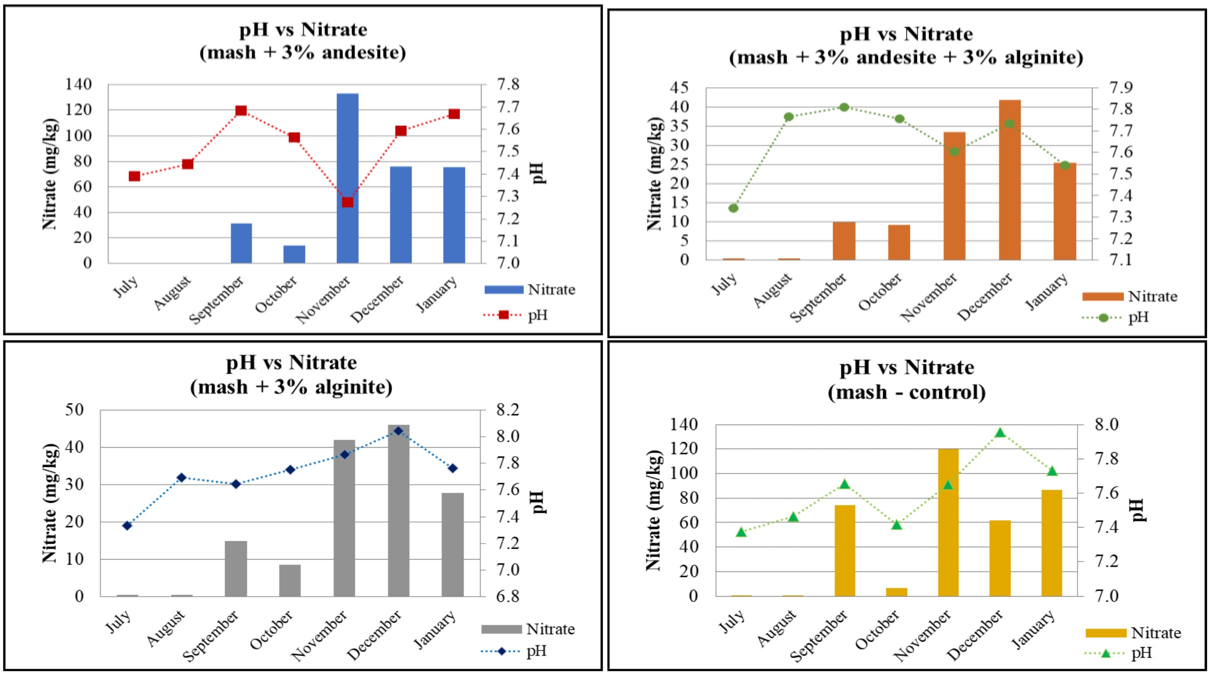

Figure 9. Correlation between pH and Nitrate content of the composts

Nitrogen forms are highly transformable; consequently, they change permanently, and the results are only approximate. In November, just like the levels of phosphorus and potassium, nitrification increased following the peak of ammonification. They respectively confirm a correlation between them along with pH **(Figure 9.)**.

Analyzing the macronutrients - nitrogen forms, phosphorus, potassium – measurements, we verify that in October, the level of these parameters decreased. The levels of NPK show a sharp increase in November, unveiling largely similar dynamics as they are accelerating after this period.

Loss on Ignition (LOI) test is recognized in inorganic analytical chemistry, particularly in the analysis of minerals and carbonate content in sediments, and it was used to estimate organic carbon content in the compost. This test allows volatile substances to escape at high temperatures, and the percentage of Loss on Ignition shows the organic matter content in the sample; the higher the loss on ignition appears, the higher the organic matter quantity present in the sample.

The values of LOI did not change much during the months, but we can notice that the largest amount is present in the *control* sample and did not change much in the samples containing the minerals of *alginite* and *andesite* **(Figure 10.)**. However, the *mixture of spent wash and alginite* showed a significant increase over the months (19%). It can be due to the properties of *alginite*; it has organic carbon and inorganic carbon in its composition that contribute to the compost. On the other hand, the minerals of *andesite* have very little organic and inorganic carbon in their composition. It can be noticed, analyzing the LOI results, that there is a pattern of the organic carbon results showing similar dynamics in the samples of the mixed composts: decreasing organic carbon content and reaching the level of that of the *control* later. The decomposing provokes carbon dioxide emission, and then it can be fixed from the environment in the synthesis.

Andesite establishes lower organic carbon content that increases after the first adaptation period. The reason may be that the *andesite* is capable of propelling microbial life that takes up CO_2. The course of the carbon cycle is quite balanced in the case of the *alginite mixture* and the *control*. We can conclude from the data so far that the carbon fixing potential of the *andesite* mixture is favourable as the original organic carbon content rises only here, having an increase of around 19% after the system is stabilized. The LOI results for October are inconsistent with the rest of the data; it must be a mistake in measurement.

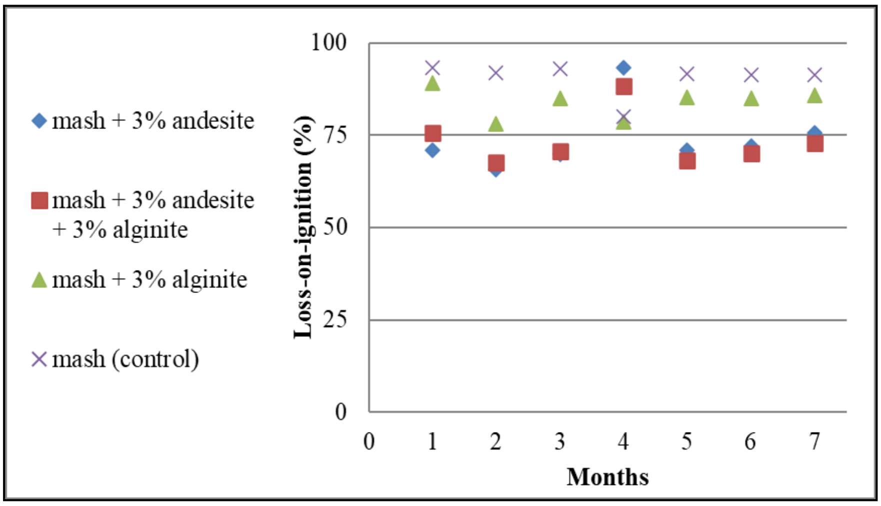

Figure 10. Loss on Ignition measurement of the composts

The moisture ratio decreased over the months for all the samples, especially in the *spent wash and andesite* mixture **(Figure 11.)**. Composting proceeds best at a moisture content of 40-60% by weight. At lower moisture levels, microbial activity is limited. At higher levels, the process is likely to become anaerobic and foul-smelling. At its present state, the compost presents good moisture levels; however, we must be concerned that the moisture data is showing a tendency to drop, which can cause very dry compost, limiting microbial activity. In the case of a pilot-scale experiment, taking samples from the composts adds up to such a level of volume loss that the system can become less stable and exposed to drying. Moisture is a very critical aspect of composting [27].

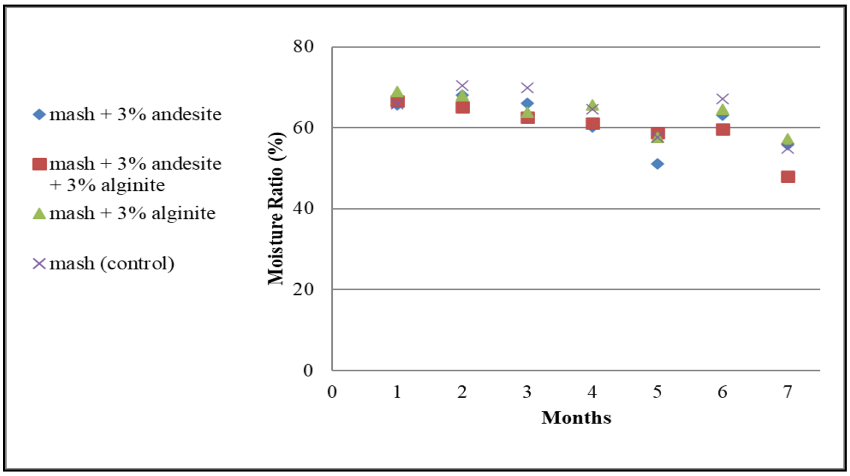

Figure 11. Moisture ratio measurement of the composts

For the microbial activity analysis, we measured the dehydrogenase activity (DHA) in the composts **(Figure 12.)**. A large amount of information about the biological characteristics of the soil is given by the determination of DHA. One characteristic of DHA, according to WOLINSKA and STEPNIEWSKA [28], is that it strongly increases under anaerobic conditions. The highest microbial activity was present in the *mixture of spent wash and alginite*; the added mineral having organic compounds seems capable of boosting the composting. On the other hand, *andesite* shows intensive microbial life at the beginning, then drops with time, which may indicate the settling of the transformation processes. The spent wash, *alginite, and andesite mixture* had results similar to the figures of the *control*. For this experiment, we chose a rich material that is proven by the *control* data showing intensive microbial activity characterizing valuable compost.

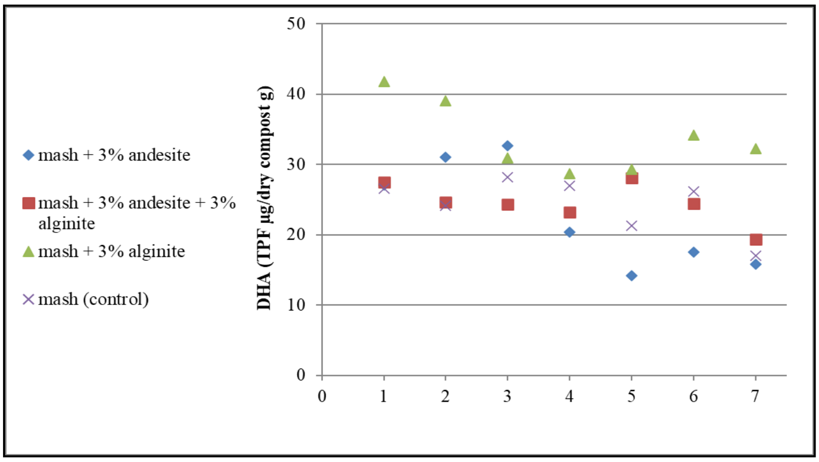

Figure 12. Dehydrogenase Activity (DHA) measurement of the composts

Heavy metal adsorption capacity – lead and iron

Based on the experimental work using (*Lactuca sativa*) as a test plant for lead accumulation capacity, it can be concluded that mash composts had a positive effect on plant development compared to control samples. The chemical studies showed increased potassium concentration in the mixtures containing

75% compost. As the lead content increased, the potassium content concentration decreased, but it was always higher in the mixtures containing 75% compost than in the mixtures containing 50% compost.

Table 1. Change of chemical parameters. The sample number indicates the additive: .1 – andesite, .2 andesite & alginite, .3 – alginite, .4 – no additive.
The values show the effect of increasing lead concentration on macronutrients and organic matter.

ample nr.	Mixture ratio	Lead contamination	Lead (mg/kg)	Phosphorus (mg/kg)	Nitrate (mg/kg)	Potassium (mg/kg)	Organic matter (%)
1.1	**50% compost. 50% peat**	**above limit value**	295.82	54.71	1.10	688.00	62.56
1.2			298.35	69.05	1.00	988.20	57.28
1.3			300.02	71.27	1.40	879.20	67.12
1.4			318.66	68.53	1.00	952.60	68.83
2.1	**75% compost. 25% peat**		349.67	70.10	1.00	1107.80	n.d.
2.2			277.28	78.96	1.30	1531.80	61.94
2.3			410.28	76.35	1.00	1655.60	71.36
2.4			326.11	75.44	1.40	1759.80	64.44
3.1	**50% compost. 50% peat**	**limit value**	323.28	66.31	0.70	837.80	63.55
3.2			270.42	73.36	0.70	993.40	59.02
3.3			332.94	72.83	0.70	908.60	68.48
3.4			340.21	67.10	1.00	1066.00	72.20
4.1	**75% compost. 25% peat**		325.55	69.70	0.90	1314.00	57.90
4.2			347.76	77.14	1.40	1734.60	60.01
4.3			323.12	75.83	1.00	1545.00	70.89
4.4			354.44	73.62	1.40	2684.80	78.35
5.1	**50% compost. 50% peat**	**below limit value**	318.41	59.27	1.10	996.00	66.19
5.2			275.94	68.27	1.00	1209.00	60.07
5.3			339.88	69.70	0.80	1090.00	69.22
5.4			348.16	65.27	1.50	1438.00	70.38
6.1	**75% compost. 25% peat**		321.49	65.92	1.20	1468.00	58.42
6.2			301.38	76.88	1.40	1746.80	60.79
6.3			332.53	75.31	0.60	2330.00	68.98
6.4			300.05	74.40	1.80	3146.40	74.63
7	**control**	**no contamination**	167.66	50.01	1.30	876.40	68.36
7			135.15	56.14	1.80	842.80	79.80
7			141.58	65.79	1.10	632.80	84.74

Lead binding was significantly affected by compost content. In the case of mixtures with 75%, compost content and higher lead binding were observed at the limit value and above the limit value. Alginite addition increased lead binding. The chemical results of our experiments are shown in **Table 1**.

An increase in lead concentration (similar to potassium ion) reduced the concentration of available nitrate ions in the compost. The lettuce could not assimilate the phosphorus due to the increase in lead concentration, so the phosphorus content of the compost also increased.

Based on the experimental work using *Solanum lycopersicum* as a test plant for iron accumulation capacity which concentrations are shown in **Table 2**.

Table 2. Effect of mash compost on iron concentration in growing media (GM), roots (R) and above-ground parts (P) of tomato plants (*Solanum lycopersicum*) cultivated in different compost-soil ratios. Avg. and SD indicate average and standard deviation

Iron concentration (mg/kg)			
Samples	**Ratio of mash compost and soil**		
	100% compost + 0% soil	**75% compost + 25% soil**	**50% compost + 50% soil**
GM1	356.15	341.28	250.58
GM2	379.56	335.89	262.81
GM3	390.36	339.21	259.78
Avg. GM	**375.36**	**338.79**	**257.72**
SD. GM	**17.49**	**2.72**	**6.37**
R1	290.25	335.26	412.58
R2	325.26	338.9	425.74
R3	330.14	350.6	418.93
Avg. R	**315.22**	**341.59**	**419.08**
SD. R	**21.76**	**8.02**	**6.58**
P1	220.36	255.96	279.24
P2	234.29	247.69	285.69
P3	225.28	251.36	297.93
Avg. P	**226.64**	**251.67**	**287.62**
SD. P	**7.06**	**4.14**	**9.49**

For a better iron concentration evaluation, a graph was compiled using the results from Table 2. comparing the ratio of compost-soil present in the tomato plants growing media and the average values of iron concentration for the growing media, roots, and above-ground plant parts (**Figure 13.**).

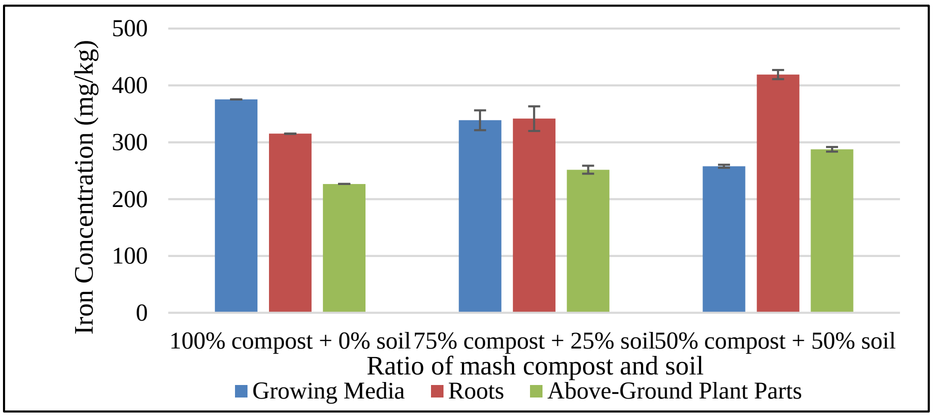

Figure 13. Average iron concentration values of growing media, roots and above-ground parts of *Solanum Lycopersicum* cultivated in three different compost-soil ratios.

Based on the results shown above, we can assert that the concentration of Fe was bigger in the media with a higher percentage of mash compost presence. Then, the compost was able to enhance the iron accumulation capacity in the growing media. This statement can be confirmed by analyzing the decrease in iron concentration as the percentage of compost also decreases. On the other hand, the accumulation of Fe in the roots increases when the percentage of compost decreases because the compost could adsorb Fe, increasing its concentration in the growing media but also decreasing the flow of Fe to the roots and to upper plant parts. Therefore, the above-ground plant parts of the tomato plants accumulate a smaller amount of Fe.

CONCLUSIONS AND RECOMMENDATIONS

The present overview of Pálinka mash composting demonstrates that the compost made from this organic waste has great potential to become high-quality organic compost. Moreover, alginite and andesite promoted a good contribution to composting, especially in the improvement of nutrient concentration, moisture ratio, and pH. Then, it was possible to verify the qualifying effects of andesite and alginite on the dynamics and quality of composting grape pomace Pálinka spent wash. These effects can be expressed in a significant increase in macronutrient content in the composts, mainly in phosphorus and potassium. The minerals of andesite clearly improve the distillery spent wash in terms of nitrification and ammonification processes.

The organic matter values also increased in the compost using andesite as an additive; however, the moisture ratio and dehydrogenase activity values decreased more than in the other treatments. It shows clear signs of a complete compost. For alginite, the level of the parameters like pH, potassium, and phosphorus increases over time more than in the other treatments, with special attention to the potassium content that increases significantly. Thus, the agents of andesite and alginite have their own particularities regarding the dynamics in the compost, and both present good contributions to the composting. Moreover, the grape pomace Pálinka spent wash proves to be a rich material showing intensive microbial activity characterizing valuable composts.

Regarding the heavy metal accumulation by growing media and the test plant parts for lead and iron, it could be noticed the increase in lead concentration was affected by the availability of macronutrients. The samples with a higher compost ratio had higher lead concentrations; the humus materials adsorbed the lead, so their application had a positive effect on the physiology of the plants. The investigation of heavy metals in lettuce is still in progress, and the translocation factor can be calculated after all the results are known.

For iron accumulation, the samples with a higher compost ratio had a higher iron concentration in the growing media, which can be explained by the presence of humus materials in the compost that adsorbed the iron, so their application has a positive effect on the physiology of the plants. Hence, it was demonstrated that Pálinka mash compost directly affects and substantially affects how iron is accumulated in the growing media when mixed with compost and also in the tomato plant parts.

Therefore, the studies examined by this review paper about Pálinka mash residue and its composting conclude that grape pomace spent wash must be considered a great source of nutrients and organic matter for composting, providing a favorable environment for microorganisms and, furthermore for plants. Additionally, the waste concern related to Pálinka production can be tackled, promoting an environmental and sustainable solution.

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AIR QUALITY AND DISTRIBUTION OF LICHENS AS BIOMONITORS IN SOME SERBIAN AND HUNGARIAN TERRITORIES

Doris STOJILKOVIC, Hosam E.A.F. BAYOUMI HAMUDA

Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest – Hungary
e-mail: bayoumi.hosam@uni-obuda.hu

***Abstract**:*
The objective of this diploma work was to indicate the importance of epiphytic symbiotic relationship between the unicellular green algae or cyanobacteria and filamentous fungal species belonging to Ascomycota or Basidiomycota in term of lichens as a biological indicator of the quality of air. Recently and now a day, the degrees of quality, healthy and clean air are still belonging to the global environmental crisis because of the activities of human, traffic motions as well as manufacturing activities which increase the air pollution. The investigations and analysis of air content become obligate to establish the degree of air pollution and search for reducing the sources of this pollution. Quality of the atmosphere is one of the targets related to human health especially with the respiratory system. Biological monitoring is an analysis require to detect and investigating the variations of the bio-organizational system and distribution of the communities of biotas under the impacts of air pollution. It was found that not all epiphytic lichen species are uniformly indicating various levels of atmospheric contamination. The evaluation of lichen biological diversity was focused on the calculating process of lichen abundance indices. The main aim of this study work using lichens as a biological indicators of the quality of air also, this study was carried out from different regions in Serbia and Hungary too. It was demonstrated the similarity between the quality of air, and distributions of lichens as a biological indicator for the atmospheric quality, in some locations of Serbia and Hungary such as in the cities of Sremska Mitrovica, Fruska Gora mountine, Palic Lake Silver Lake, and as in various regions in Budapest. The biological analysis of the samples from studied areas shows the presence of various lichen types, which indicates that these areas containing huge numbers of lichens. The highly distribution of lichens in relation to air quality index of Zrenjanin city as an example of the Serbian locations, and Budapest as Hungarian are depended on the chemical pollutants, climate changes. Also, this research indicates the distribution of the lichens in the examined areas. The lichens growth demonstrates that the air in this area is clean or with very low pollution degree: Sremska Mitrovica city, Fruska Gora mountine, Palic Lake and Silver Lake is quite good. But, in Budapest, the growth and appearance of lichens is varied, depending of the investigated region. Finally, this study pointed out that the occurrence of epiphytic lichens plays an important role in monitoring the atmospheric pollution in those areas. The most dominant lichen types were Rhizocarpon geographicum, Lecanora muralis, Lecanora muralis, Rhizocarpon geographicum, Xanthoria parietina and Xanthoria Candelaria, Physcia adscendens, Flavoparmelia caperata, Physcia caesia, and Phaeophyscia orbicularis.

***Keywords**:* air quality, distribution of lichens, biomonitors, Serbian and Hungarian territories

INTRODUCTION

Recently, the quality of air is one of the most global environmental crisis because of manufacturing activities and traffic notions. Atmospheric investigation has become useful to control air quality and reduce the sources of pollution [1]; [2]. The determination of conventional measurement techniques for continuing to advance the quality of air. A biological monitoring using biotas offers an interesting harmonizing tool to indicate the influences of pollution of air. It is necessary to live with clean air, regarding to the human and environmental health, and high qualified life. Low air quality is a reason of many human diseases, e.g., respiratory diseases, cancer can be developed, strokes, heart diseases, and many chronic diseases. Constant breathing low air quality, develop what is called the long-term damage to people's nerves in brain, etc. Air pollution is now days considered as the biggest environmental risk to the health [3]. It well known that the air contamination is highly has harmful impacts of on human health [4]. Accordingly, the available information about the possible problems that can be caused negative impacts on the environmental health and human too, that is why it is important to known the types and the concentrations of air pollutants [5]. The principle to improve the quality of the air is the monitoring the air contents and their concentrations with recordings continually using the physical, chemical or biological methods [6]. Globally, the quality of the atmosphere is going from bad to worse day after day. Pollution of air can be detected biological through the detection and registration of epiphytic lichens at various locations with or without high human activities e.g., industrial activities which increase the rate of pollution. Recently, this sort of detections were used in Serbia since the last decade of 20th century [1], [7], [8]. The epiphytic complex organisms called lichens are represent a symbiotic relationship between autotrophic single cells of green algae (phycobiont) or cyanobacteria (cyanobiont) generally named as photobiont and a member of filamentous fungi related to Ascomycetes or belonging to Basidiomycetes or Zygomycetes which named as mycobiont [9]. Worldwide, it was found that seven million people were died because of air pollution. So, pollution of the air is considered as the biggest and most important risk factor for environmental and human health. In EC, 400,000 people suffer a premature death. [10] Pollutants that have high risk affecting the environmental and human health are for example: nitrogen and sulphur dioxides (NO_2 and SO_2, respectively), ozone and particulate matter (PM). It was mentioned that $PM_{2.5}$ is the most risk factor induce non-infectious diseases in respiratory and vascular systems with a continuous exposure to such air pollutants.

Nitrogen oxide (NO_2) is forming from the ground level emissions, from the burning fossil fuels (used in transportation vehicles), power plants, industrial areas and facilities. Natural source of nitrogen oxide is in volcanoes, oceans and lightning striker, but unfortunately there is approximately 24 million tons of the NO_2 is added to the atmosphere by different human activities, and in that way and amount it is polluting the air, and making it harmful for the environment.

Sulphur dioxide (SO_2) is a gas, without colour, which can be in a liquid state as well, can be produced by burning fossil fuels (such as coal and oils), and by melting the mineral ores which are containing sulphur. (Such as aluminium, copper, zinc, iron). It can be produced of coal, fuel oils, and gasoline, also in the volcanic eruptions, by oxidation of natural sulphur gasses. Sulphur dioxide can be also human made.

Ozone forms with reaction of the nitrogen oxides and volatile organic compounds, on the sunlight and wit hot temperatures. Like sulphur dioxide, and nitrogen dioxide, it also comes from the emission of gasses from transportation vehicles, power and chemical plants, industrial facilities, refineries.

Particulate matter (PM) is forms from the solid particles and liquid droplets in the air, in fact and type of burning or dust generating activity can be source of the particulate matter. PM_{10} include the particles with the diameter smaller than 10 µm, and $PM_{2.5}$ include those particles with diameter smaller than 2.5 µm. The toxicity of airborne particles is mainly due to particles with a diameter of less than 10 µm, but the particles with the diameter smaller than 2.5 µm are more dangerous for the health, because of its size.

Lead (Pb) is heavy metal (relatively soft and chemically resistant) which can be found naturally (example: in the earth's crust), but it can be manufactured as well (transportation motor vehicles, industrial source). Currently, as an air pollutant, it is present in a small particle.

On the other hand, besides the previously mentioned outdoor pollutants, there are the indoor pollutants, that are present in our everyday life. Some of the most common indoor pollutants are for example the tobacco smoke, fumes from paints, formaldehyde, as well as the animal's hair, molds, and different bacteria, that people unfortunately are facing every day of their life.

Following the monitoring investigation of quality of air, results indicated that Serbia is belonging to the countries which are considered the most polluted counties and it has a position 33rd as mentioned in the list of polluted counties worldwide (Based on IQAir's "2021 World Air Quality Report",).
The high air pollution in Serbia is due to the sources of energy sector e.g., burning coal and wood. The sources of emissions of pollutants are e.g., from traffic transportation, industrial activities, landfills and agriculture as well as the petrochemical complex around the cities of Pančevo and Novi Sad. Some Serbian cities showed high levels of air pollution e.g., Belgrade (Figure 1), Novi Sad and Niš, due to urban air pollution. The degree of air pollution in Serbia is varied because of the activities and also the population (Urbanization).
The most polluted city in Serbia is Lazarevac, Central Serbia, and the cleanest is Bor, Central Serbia. [11]

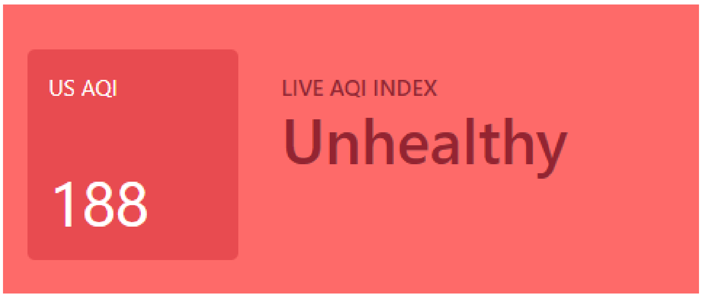


Figure 1: Air quality index in Belgrade, Serbia (October 2022)

On the other hand, Hungary is on a slightly better position in the ranking list of most polluted countries of the world, and it takes 65th place, with the particular matter ($PM_{2.5}$) reading of 14.57μg/m³. Based on these monitoring, it is concluded that the Hungarian cities do not contain any catastrophic levels of pollution, but still for European nations, the pollution is still higher than it should be. Main reasons for the pollution in Hungary, are as mostly everywhere, the emissions of gases caused by traffic, and transportation vehicles, then the so called "chimney smoke" pollution, and the big amounts of coal, coming from the industrial facilities and areas. Currently the cleanest city in Hungary is Balassagyarmat, Nograd, and the most populated is Szeged (Figure 2), located in Southern Great Plain. [58]

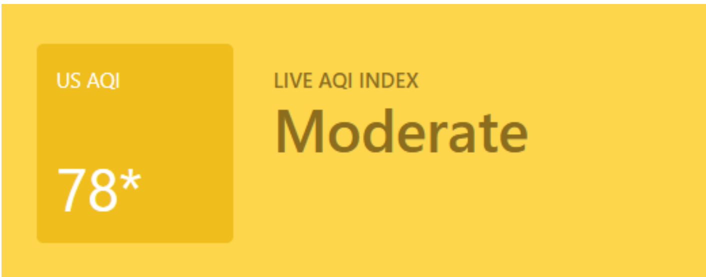


Figure 2: Air quality index in Szeged, Hungary (October 2022)

From the figures shown above, we can see that there is a really big difference in the Air Quality index in the most polluted cities of these two countries. In Serbian most polluted city, the AQI shows that the air is unhealthy, while in Hungarian it is still moderate.

The objectives
In this work, the goal is to show air quality in two different countries, Serbia and Hungary, comparison of their data, and use of the lichens as a bioindicators of the quality of air. Biological monitoring is focused on the presence and examining the variations that occur on different levels of the biological organization for biotas under the influence of air pollutants. It was shown that not all lichens are equally indicating different concentrations of pollution of the air.

This diploma research clarifies that how lichens are used as a biological indicators of the quality of air conducted from various Serbian and Hungarian locations. It would be shown, the different types of the lichens, places where they can be found, and the most dominant lichen taxa, with the samples. The aim is to show the importance of the air pollution, for everyone, the ways that it is monitored, as well as, its quality in these countries, based on its lichen population presence.

AIR QUALITY INDEX (AQI

Air quality index is used for showing the pollution of the air to the public, at the curtain point of time. The information is obtained from average readings, and are including all of the factors that can have influence on the air quality. It is used by the government agencies, to inform the public. It is used to show how polluted or clean air is, and what impact it can possibly have on the everyday life. As the air quality index is higher, the air pollution is greater as well, and it raises bigger concerns.
The information of daily report of index of quality of the air (Table 1) in certain location is important to classify the air as clear or polluted and meanwhile to know the factor(s) that affect the health. [12]

Table 1. Air Quality Index information

Air Quality Index (Aqi) Values	Levels Of Health Concern	Colours
AQI RANGE:	Air Quality Conditions	Symbolized By Colour:
0-50	Good	Green
51-100	Moderate	Yellow
101-150	Unhealthy For Sensitive Groups	Orange
151-200	Unhealthy	Red
201-300	Very Unhealthy	Purple
301-500	Hazardous	Maroon

If the value of the air quality index is up to 50, it represents the good air quality, and low potential for developing the health issues. Values that are below 100, are acceptable, or satisfactory, but still need to be constantly monitored. In case of the values of AQI that are over 100, are considered as an unhealthy, especially for people who belong to the sensitive groups. Hazardous conditions are at the places belonging to the maroon colour, which represents the air quality index with values that are from 301 to 500.
Globally, air quality data for over 4000 cities, as reported by IQAir's "2021 World Air Quality Report", Serbia has occupied the position of the 33rd of the most polluted countries worldwide, and 118 ranked countries regarding to $PM_{2.5}$ pollutions, and Hungary is on 65th. [11] The annual average $PM_{2.5}$ levels in Serbia measured due to population, showed as 23.3 μg/m^3, which occupy a twofold exceedance of the World Health Organization (WHO) international guideline limit for $PM_{2.5}$ as 10 μg/m^3. [13]
Figure (3) shows the air quality index in one of Serbian city named Zrenjanin during the Summer (August 2021), while Figure (4) illustrates the air quality index September 2021. [14]

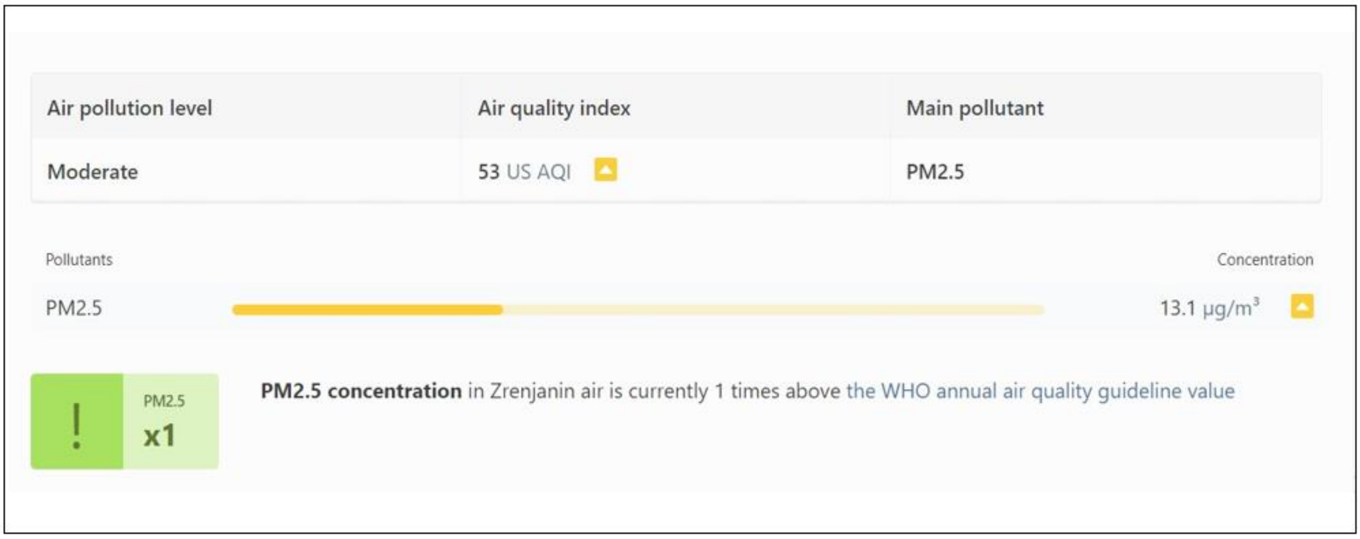


Figure 3. Air quality index in Zrenjanin during August 2021 [14]

Figure 4: Air quality index in Zrenjanin during September 2021 [14]

Table 2. Air quality index due to for Ozone and Particle Pollution [17]

Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
Green	Good	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Red	Unhealthy	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	Health alert: The risk of health effects is increased for everyone.
Maroon	Hazardous	301 and higher	Health warning of emergency conditions: everyone is more likely to be affected.

Continuous exposure to fine particles ($PM_{2.5}$) is able to increase the health disease by travelling deeply into the respiratory system, reaching the lungs and also, causes a lot of diseases such as short-term health effects such as eye, nose, throat and lung irritation, coughing, sneezing, runny nose and shortness of breath. Also, affect lung function and worsen medical conditions such as asthma and heart disease. Some studies mentioned that the increases in daily $PM_{2.5}$ exposures increased the risk of respiratory and cardiovascular diseases in hospital admissions, emergency department visits and deaths. Also, it suggest that long term exposure to fine $PM_{2.5}$ may associate with increase the rates of chronic bronchitis, reduce lung function and increase mortality from lung cancer and heart diseases. Patients with breathing and heart problems, children and the elderly may susceptible to $PM_{2.5}$ as in Zrenjanin (Figure 5).

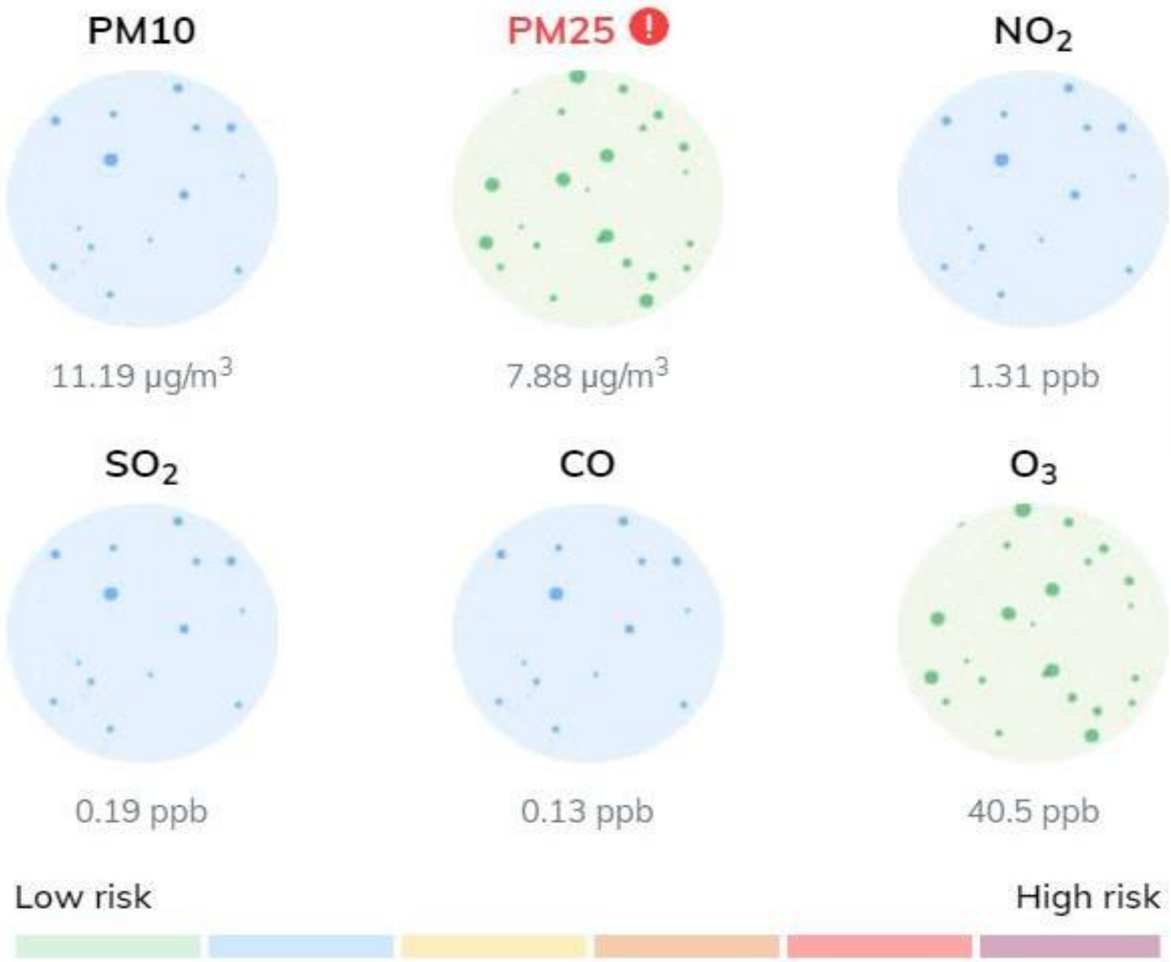


Figure 5. Concentrations of pollutants in Zrenjanin

AIR POLLUTANTS IN ZRENJANIN

Zrenjanin is a city in Central Banat region, in the Vojvodina province. Population in this city in urban areas is 76511 inhabitants, while the administrative of city has 123362 inhabitants, and it is the biggest city in this Serbian region.

Atmospheric Pollutants:
It was found that the most important pollutants are listed below [17]: **Ozone (O_3):** O_3 has a highest oxidant power and has an important industrial and consumer applications due to its oxidation. It has negative effects on animals and plants.

Particulate matters (PM):
PM_{10}: Inhalable particles, with diameters that are generally 10 micrometre and smaller. These particles have varies sizes and shapes and made up of 100s of varies chemical formulae.

PM_{25}: Inhalable fractions with 2.5 micrometre in diameter. Their emissions come from a source, e.g., construction sites, unpaved roads, fields, smokestacks or fires.
Carbon monoxide (CO): CO is a colourless, odourless gas and dangerous when inhaled in large amounts. Main sources of CO are the traffic motion by cars, etc. or machinery that burn fossil fuels.
Sulphur dioxide (SO_2): The largest source of SO_2 in the atmosphere is the burning of fossil fuels by power plants and other industrial tools.
Nitrogen dioxide (NO_2): It reach air from the burning of fuel as well as traffic motions with cars and others. [17]

ZRENJANIN AND CLIMATOLOGICAL CHANGES

Serbia's climate is continental in the north part of the country, with cold winters warm, humid summers and a lot rainfall patterns, and Mediterranean in south part, with hot summers, that are dry, and rainier autumns and winters with a lot of snowfall. Air pollution can affect the climate and result in the climate changes. In Zrenjanin, the concentrations of pollutants are due to various air contents as well as human activities and the mixed influence of microclimate, substrate and geo-physical features, also, the distribution of "green" areas such as gardens.
Figure (6) demonstrates the months with the largest rainfall in May, June, July with 209 millimetre precipitation. Most rainfall occurs in June with an average 83 millimetre. The yearly amount of precipitation in Zrenjanin is 619 mm. In Zrenjanin, the mean yearly temperature is 16□C. July is the hottest month of the year is, with a mean temperature 28□C. January is considered as the coldest month, with mean temperature 2□C. The various between the hottest month July and the coldest month January is 26□C. The various between the highest rainfall (June) and the lowest rainfall (February) is 48 millimetre. The lowest temperature recorded (monthly mean) was -10□C in February 1956 in Zrenjanin. The highest temperature was recorded (monthly average) as 26□C in August 1992 in Zrenjanin. The year 2017 was the hottest in Zrenjanin, mean temperature was 14□C. 1956 was the coldest year (Figure 5), with average temperature 10□C. [18]

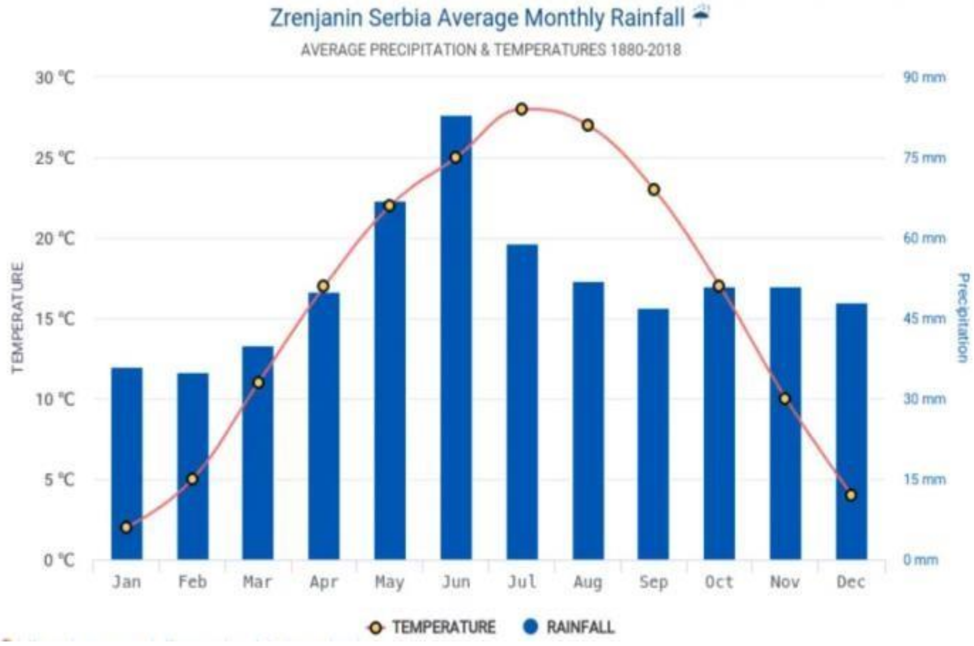


Figure 6. Monthly averages climate data (Temperature and rainfall) in Zrenjanin [18]

In general, Zrenjanin has warm summers, dry and cold winters, and during the year is usually partly cloudy. Over the year, the temperature was variants from 2°C to 28°C, and it rarely goes under -10°C and above 33°C [5].

Figure 7. Mean temperature in Zrenjanin over the years

Figures (8) and (9) show the various climatic factors such as temperature, relative humidity and wind and the $PM_{2.5}$ and PM_{10} at different times, August and September, respectively.

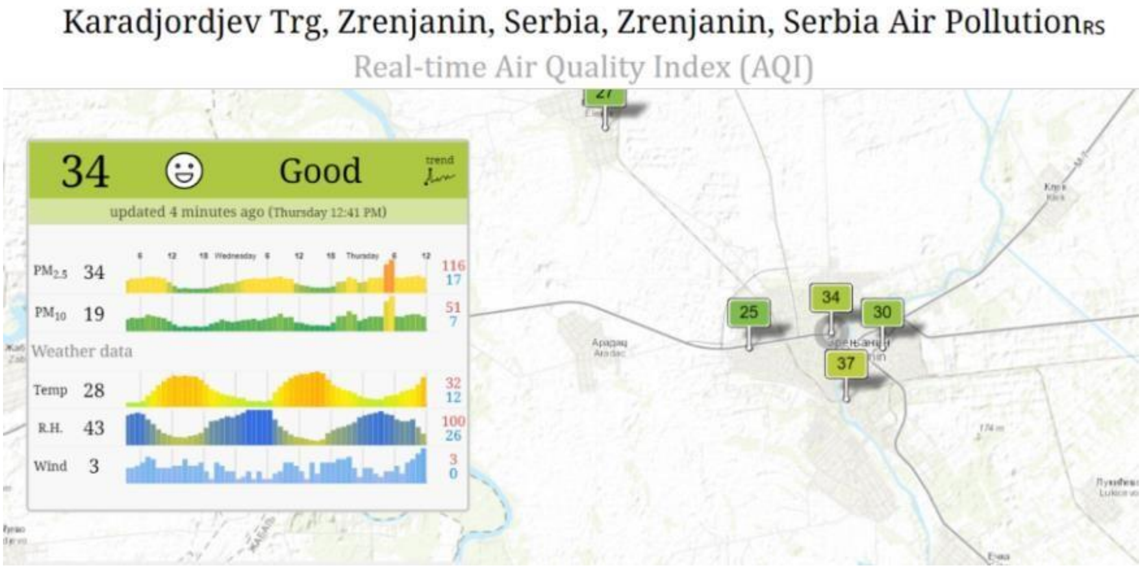


Figure 8: Data of summer time (August) in Zrenjanin

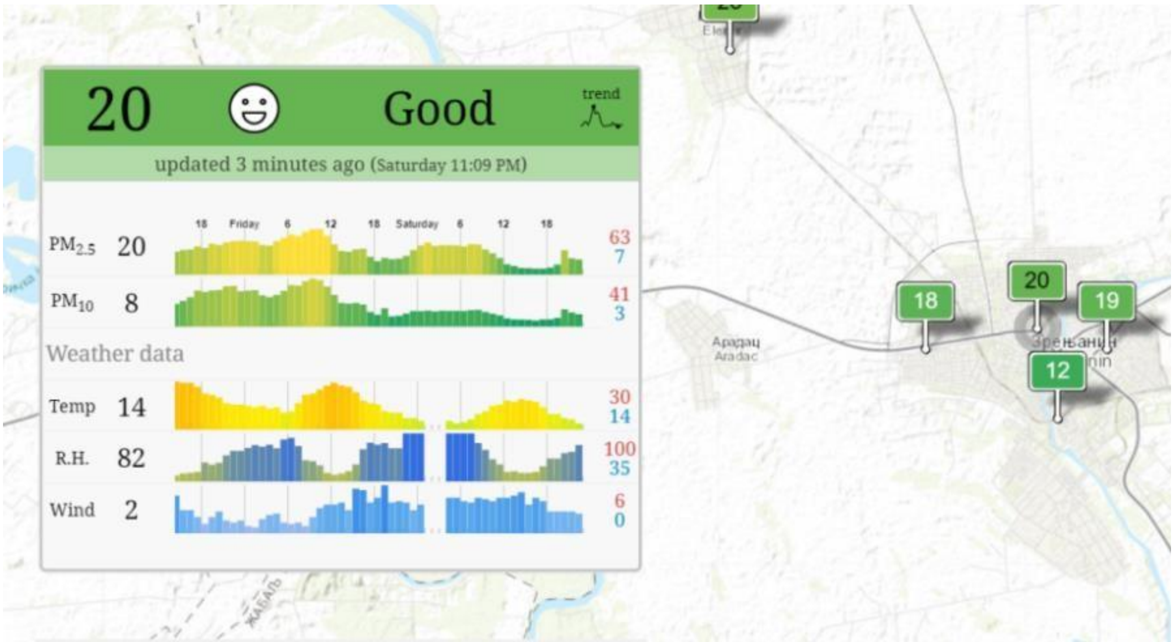


Figure 9: Information about September time in Zrenjanin [19]

DATA ABOUT ZRENJANIN AIR QUALITY OBTAINED FROM THE INTERNSHIP

The research was preformed and done in the Serbian Technical faculty "Mihajlo Pupin" in Zrenjanin, supervised by the Professor Doctor Bogdana Vujic, head of the department of Environmental Engineering. The Air quality index in this city variates from 40 the highest to 20 the lowest, depending on the streets where it was measured. The differences of the number of AQI are based on the street's locations, and its distances from the sources of pollution. In the Figure (10) bellow the measured values are during the summer time, but unfortunately during winter situation is much worse, and the air is more polluted.

Figure 10: Air Quality Index in streets of Zrenjanin

The pollutants that are present in this city are sulphur dioxide and soot (black carbon) that create winter smog, and the concentrations of these two pollutants are highest precisely during the peak of the heating season in January and February. The mean annual value of sulphur dioxide is approximately 61,01 micrograms per m3. Because of that, there are six automatic measuring devices for measuring air quality. At the present time the biggest chemical pollutant of the air in Zrenjanin iz O_3. Besides these previously mentioned pollutants, there can be also found the PM_{10}, PM_{25}, NO_2, and CO.
The Figure (11) represents the Automatic Station 2ZRS – Zrenjanin, which is intended for constant measuring and monitoring of the pollution level in the residential and business zone, mainly coming from the traffic (emission of gasses), but it does not exclude other pollution sources. The parameters that are uses are the direction and speed of the wind, temperature and relative air humidity, atmospheric pressure. Indicators of pollution are: benzene, toluene, ethylbenzene and xylenes (BTEX), nitrogen oxides ($NO/NO_2/NOx$), sulphur dioxide (H_2S/SO_2), suspended particles (PM_{10}), TM/M (As, Cd, Pb, Ni), and BaP. PM_{10} is used for determination of the 24-hour mass concentration of suspended particles of the PM_{10} fractions by reference gravimetric method. TM/M is used for determination of the content of suspended particles of the PM_{10} fraction in 24-hour samples (TM- heavy metals: cadmium (Cd), lead (Pb), nickel (Ni)); M-metalloids (As -arsenic), and BaP for determination of the content of suspended particles of the PM_{10} fraction in 24-hour samples (BaP -benzo(a)pyrene).

Figure 11: Automatic Station 2ZRS-Zrenjanin

Air pollution can affect the climate and result in the climate changes. The different air pollution levels in Zrenjanin are a logical consequence of air pollution and the mixed influence of microclimate, substrate and geo-physical features, as well as the distribution of "green" areas and objects. Polluted and bad quality air can have a huge impact on the climate and climate changes. The reason for that is that greenhouse gases and air pollutants are usually emitted together, and a big number of those pollutants can directly or indirectly affect the climate of the area. As we know, one of the biggest air pollutants, and something that mainly affects the climate changes are the greenhouse gases and effects. Greenhouse gas that is most common is the carbon dioxide, and in general it is mainly coming from the human activities. When we talk about fossil fuels, which are as well one of the most known and common material causing environmental problems, as in case of Zrenjanin, there is a lot of black carbon (soot). Black carbon has a warming impact on climate that is approximately 1000 higher than CO_2.

CLIMATE CHANGE IN BUDAPEST (IN LIMITED TIME)

Figure (12), shows that the months with the largest precipitation are May, Jun, July and August. Most precipitation occurred in Jun, with an average precipitation of approximately 67mm. The annual amount of the precipitation in Budapest is on average 563 mm of rainfall per year, or 46.9mm, averagely per month.

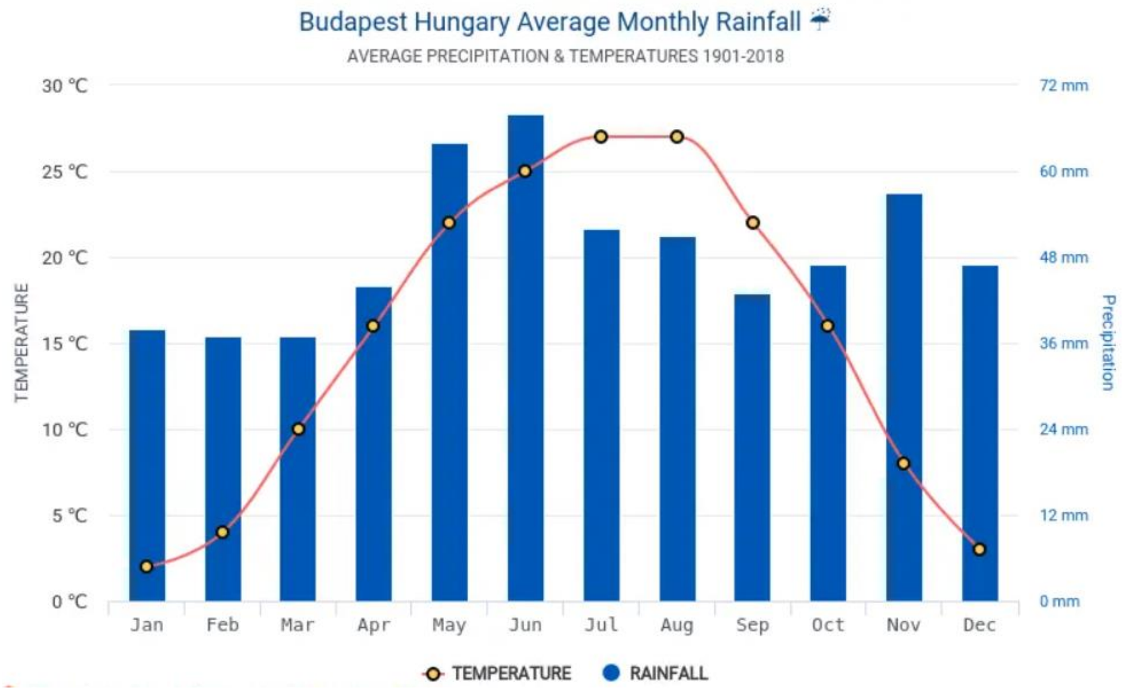


Figure 12: Climograph of monthly averages climate data
Temperature and precipitation in Budapest, basic climate set in period between 1901-2018 for Budapest [58]

There is approximately 90 days during the year that have more than 0.1mm of precipitation. The annual average temperature in Budapest is around 15□C. The coldest month of the year in Budapest is January, with an average temperature of 2□C, while the warmest is July, and the temperature during that month is on average around 27□C. The difference between the warmest (July) and the coldest (January) month in Budapest is 24□C. The month with the highest precipitation is Jun, approximately 67mm, and with lowest are February and March, approximately 37mm. Difference between the highest (Jun) and lowest (February, March) precipitation is 30mm. [59]

Table 3: Temperature during the day and night time in Budapest, during the year

	January	February	March	April	May	June	July	August	September	October	November	December
Day	2°C	4°C	10°C	16°C	22°C	25°C	27°C	27°C	22°C	16°C	8°C	3°C
Night	-2°C	-1°C	2°C	7°C	11°C	14°C	16°C	16°C	12°C	7°C	3°C	0°C

The temperature in Budapest usually variates from -2□C to 27□C. In this city, the temperature rarely goes below -11□C and above 32□C. The highest temperature ever recorded in Budapest is 40.7□C, and it was on July 20th, 2007. The lowest recorded temperature was -22□C, on January 8th, 1987. Warm season in Budapest lasts for approximately 3.6 months, from second part of May, until the first half of September. During that period, average temperature during the day is around 22□C. Cold season of this city lasts for 3.5 months, from second part of November, until the beginning of the March, and average day temperature in that period is around 7□C.

In general, summers in Budapest are quite warm, with usually low humidity levels, and the winters are cold, dry and as some people say really grey. [60].

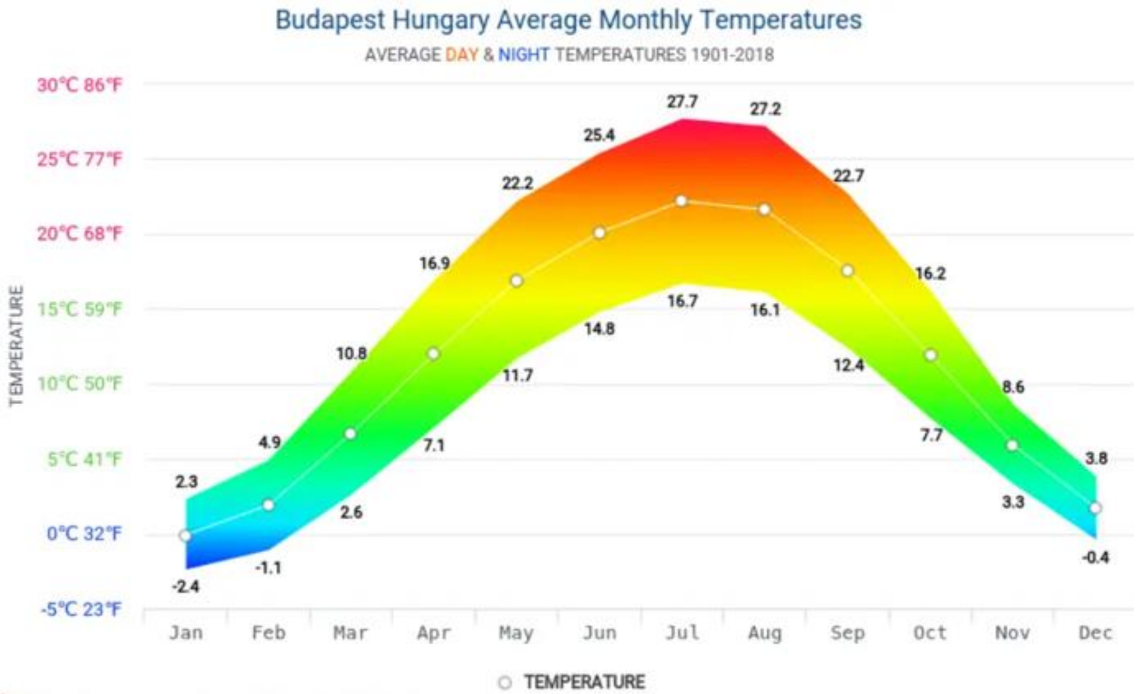


Figure 13: Average monthly temperature in Budapest, over the years in period between 1901-2018

Figures (14) and (15) give the various climatic factors such as temperature, humidity, PM_{10}, and the concentrations of O_3, NO_2, SO_2, CO, wind, and pressure, and air quality index in two different locations in Budapest, Széna tér, and Teleki tér, in October 2022.

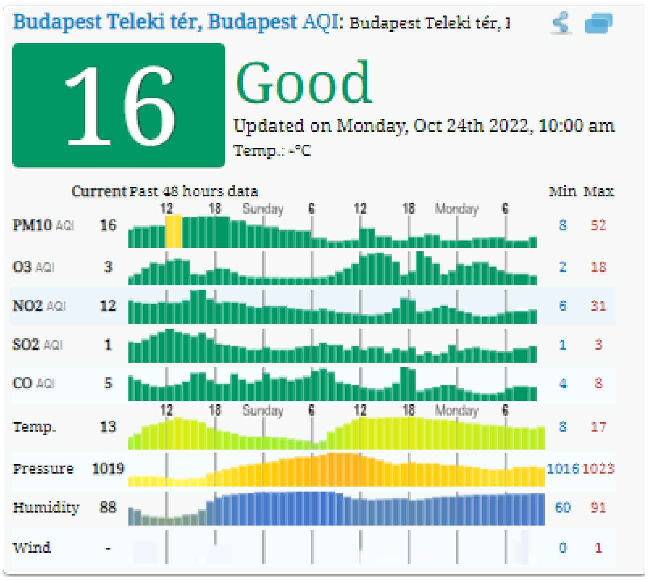


Figure 14: Data in Budapest, in Autumn time (October)

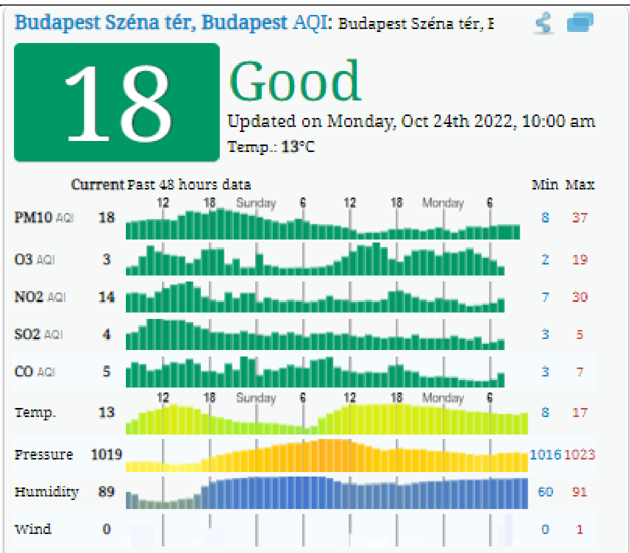


Figure 15: Data in Budapest in Autumn time (October)

LICHENS AS AIR POLLUTION BIOMONITORS IN SERBIA AND HUNGARY

Biological monitoring is based on the detection and monitoring of changes that occur on different levels of the biological organization for biotas under the effects of pollutants [20]. The epiphytic lichens are characterized by the slow growing organisms, which usually can be found on the solid surface, life for example crusts, rocks, walls, and trees, made of symbiosis of alga, fungus or cyanobacteria. The fungus provides the moist, refuge for algae or cyanobacteria, while they provide the nutrients and food for the fungus. Lichens are able to grow only on the places with good air conditions, and because of that, they are considered to be the indicators of the air quality. The epiphytic lichens are considered as bioindicator organisms that have significant use in the bio detection of air quality. Recently, studies have shown that some lichens species are sensitive to air pollutants in the atmosphere while others not. The reason for its sensitivity is because they receive the necessary nutrients from the atmosphere, and that makes them really relevant and important organisms [21], [22]. Epiphytic lichens are considered as "permanent control systems" for detecting air pollution [23]. Epiphytic lichens are very sensitive to environmental changes because of their physiological properties [24]. Also, they are the most used species in bioindication to detect and monitor air quality. The sensitivity of lichens is related to their biological properties e.g., the lack of cuticle and stomata [1], [25]; [26]; [27]; [28].
Bioindication techniques have been established based on the composition of the lichenic flora [29], mainly the Shannon diversity index (H') [30], the lichen diversity value index (LDV) [31] and the atmospheric purity index (IAP) [32]. These indices are used to estimate air pollution levels that affect lichen diversity [25]; [28], [33]; [34], so that some environmental sources of pollution can be identified [3]; [35]. Loppi & Corsini [25] found that the growth of lichen can be influenced by various gaseous air pollutants like high SO_2 level, C compounds in smoke, fluorides, car fumes (CO, NOx, Pb containing compounds, hydrocarbons) and dust, photochemical smog (ozone, peroxyacetyl nitrate, NOx, etc.), heavy metals (e.g., iron (Fe), lead (Pb), zinc (Zn), and copper (Cu)), radioactive isotopes of metals (e.g., radionuclides), agrochemicals (like pesticides and fertilizers).

Generally, the most reasons for categorization of lichens as vulnerable organisms are disappearance and contamination of their environments primarily due to human activities, e.g., pollution of the atmosphere, industrialization, agriculture, unfavourable biology practices and phylogeny alterations of huge habitat areas. All of those crises have led to the degradation of lichen habitats. In Serbia there are around 586 species of epiphytic lichens. [10]

Biological monitoring is depending on the detection and monitoring of changes that occur on various concentrations of the biological organization for biotas under the effects of pollutants [20]. Lichens are named as bioindicator organisms that have significant use in the bioindication of the quality of the air. [21], [22].

Lichen flora in Vojvodina, including bank region of the River Tamiš and the Danube-Tisza-Danube flow hydrosystem has been explored randomly [38], [39], [40], and more systematically within the study of former Yugoslavia lichen flora [41], [42], [43].

Lichens are used as an environmental biological indicator (bioindicator) for the pollution worldwide. In case that air is polluted with e.g., SO_2, there won't be any presents of lichen, only the green algae can be found. Because of lichens are sensitivity to SO_2 and they can be considered, and used as a bioindicators of air quality and air pollution indicator. On the other hand, in case that air is clean, and air quality is good, lichens become abundant, which means that in absence of pollution, lichens are presence. [44] Molecular Approaches: PCR genotyping and DNA Barcoding [45]Many studies on air quality are depend on testing of lichens, in which a large number of papers have described the air quality level in urban areas [46], [47], [48], [49], [50], [51], [52]. Degtjarenko et al. [53] mentioned that lichen growth form, reproductive strategy, and tolerance to substrate pH could serve as potential tools for indicating the effects of dust pollution. Szwed et al. [54] showed a high level of lichen sensitivity to air quality changes created by anthropogenic impact. In different studies of biomonitoring of air quality, the degree of urbanization and traffic density are the basic causes of pollution in urban areas [55], [56]. Lichenological study in Serbia is still developing. Basically, basic work must be comprehended in order to meet the nation's needs and also to strive towards the biotechnology industry.

MATERIAL AND METHODS

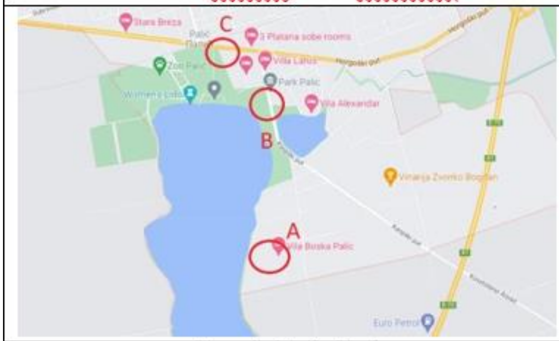
Collecting samples in Serbia

Four sites are selected to study their characterization by the presence of lichens. The lichen samples were collected from various climatic and topological conditions sites:

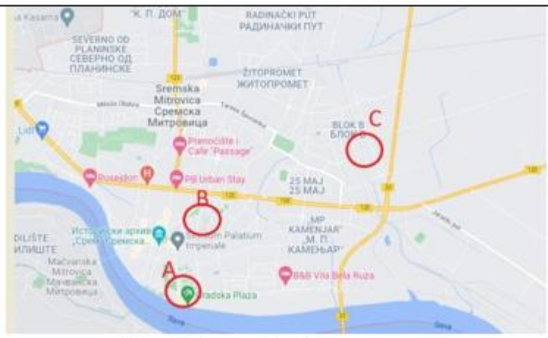
Site A: Fruska Gora mountain, Site B: Silver Lake, Site C: Palic Lake, D: Sremska Mitrovica city (Figure 16).

Site A: Fruska Gora mountine

Site B: Silver Lake



Site C: Palic Lake



Site D: Sremska Mitrovica city

Figure 16: The collection sites of lichen samples. Collection sites are presented by red circle

Collections of Lichen samples in Sremska Mitrovica city, Fruska Gora Mountain, Palic Lake and Silver Lake were collected from various trunks of different trees at different locations. The investigated sites are located in the urban part of Sremska Mitrovica, starting from the centre of town and close to Sava River (Figure 16).

Air Quality Index of the investigated sites in Serbia.

Figure 17: Air Quality Index in Sremska Mitrovica

Figure 18: Air Quality Index in Fruska Gora mountain

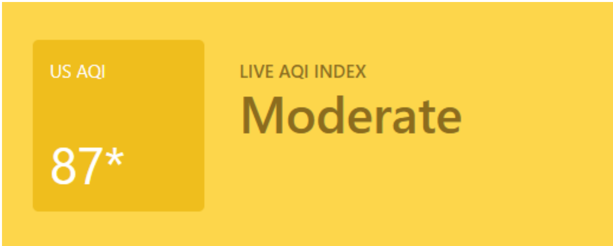


Figure 19: Air Quality Index in Palic Lake

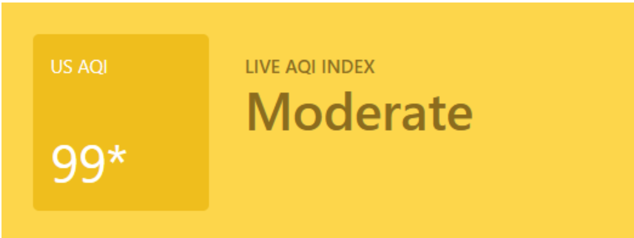


Figure 20: Air Quality Index in Silver Lake

Sites of collecting samples in Hungary

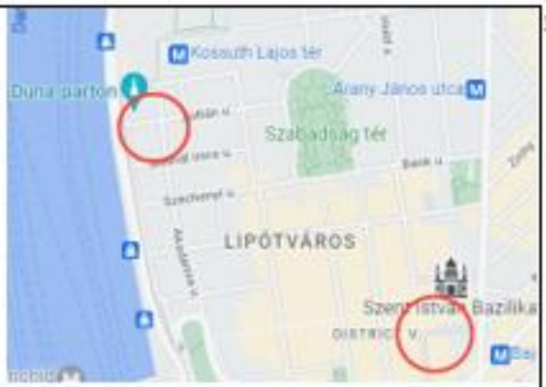
	
Site-A: Budapest, 3rd district	*Site-B: Budapest, 5th district*
	
Site-C: Budapest, 7th district	

Figure 21: The sites of lichen samples collection presented by red circle

Air Quality Index of the investigated sites in Hungary (Budapest).

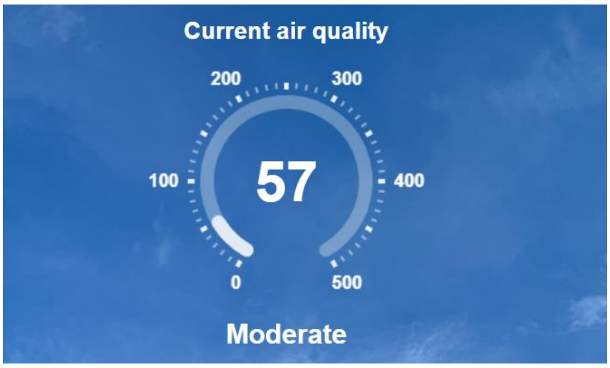


Figure 22: Air quality index in Budapest, 3rd district

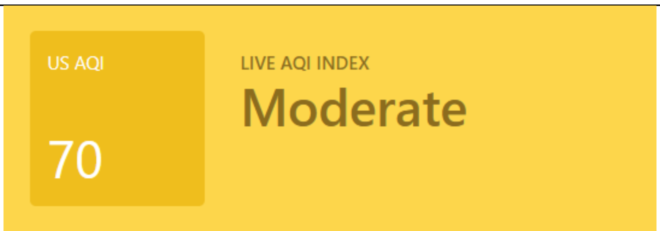


Figure 24: Air quality index in Budapest, 5th district

Figure 23: Air quality index in Budapest, 7th district

RESULTS AND DISCUSSION

At four investigated sites in Serbia, different epiphytic lichens from various genera were collected. The most frequent, dominant and common taxa in these four collection sites were *Rhizocarpon geographicum*, *Lecanora muralis*, *Lecanora muralis*, *Rhizocarpon geographicum*, *Xanthoria parietina* and *Xanthoria candelaria*.

The abundant of lichens demonstrates that the air quality of the study sites (Sremska Mitrovica city, Fruska Gora mountain, Palic Lake and Silver Lake) is quite good. Also, it was concluded that the presence of epiphytic lichens plays an important role in determining the various degree in air quality. The following Figures (from 9 to 13) demonstrate some preventative and common samples of collected lichens in the detected sites.

Figure 24: Samples of lichens collected from Fruska Gora mountain

Figure 25: Lichens in Sremska Mitrovica city

Figure 26: Lichens near Sava River in Sremska Mitrovica

Figure 27: Lichens found close to Palic Lake

Figure 28: Lichens found close to Silver Lake

The most dominant lichen species that are found and presented in the different areas of Serbia are *Rhizocarpon geographicum*, *Lecanora muralis*, *Xanthoria parietina* and *Xanthoria Candelaria*.
Rhizocarpon geographicum is a lichen species that mostly grows on the areas of mountains, with a low pollution level. This lichens always grow by the side of each other, so it creates the lichen map. This lichen species has the flat patch, and usually it is surrounded by the black line of fungal hyphae. [61] *Lecanora muralis* is a type of lichens which is mostly looking like wax, in a yellow-green colour. This lichen is in general growing in the shape of roses, beginning from the central part, and surrounded by the yellowish bodies similar to the shape of disk. It grows on the rocks, sometimes on different type of crust. [62] *Xanthoria Parietina* is one of the lichens species, with the wide distribution, and different commonly used names, like for example: common orange lichen, yellow scale, maritime sunburst lichen and shore lichen. *Xanthoria Parietina* mostly grows close to the coasts, on the rocks, on the walls, and on the crust as well. [63] *Xanthoria Candelaria* is a lichen type that can be found on the fences which are rich in nutrition, and on a different stones and walls. This lichen has yellowish-orange color. [64] In Serbia, there is currently found 586 species of lichens, on the territory of the whole country, accounted since the year 1859.

Figure 29: Lichens found in Budapest (3rd district)

Figure 30: Lichen samples found in Budapest (7th district)

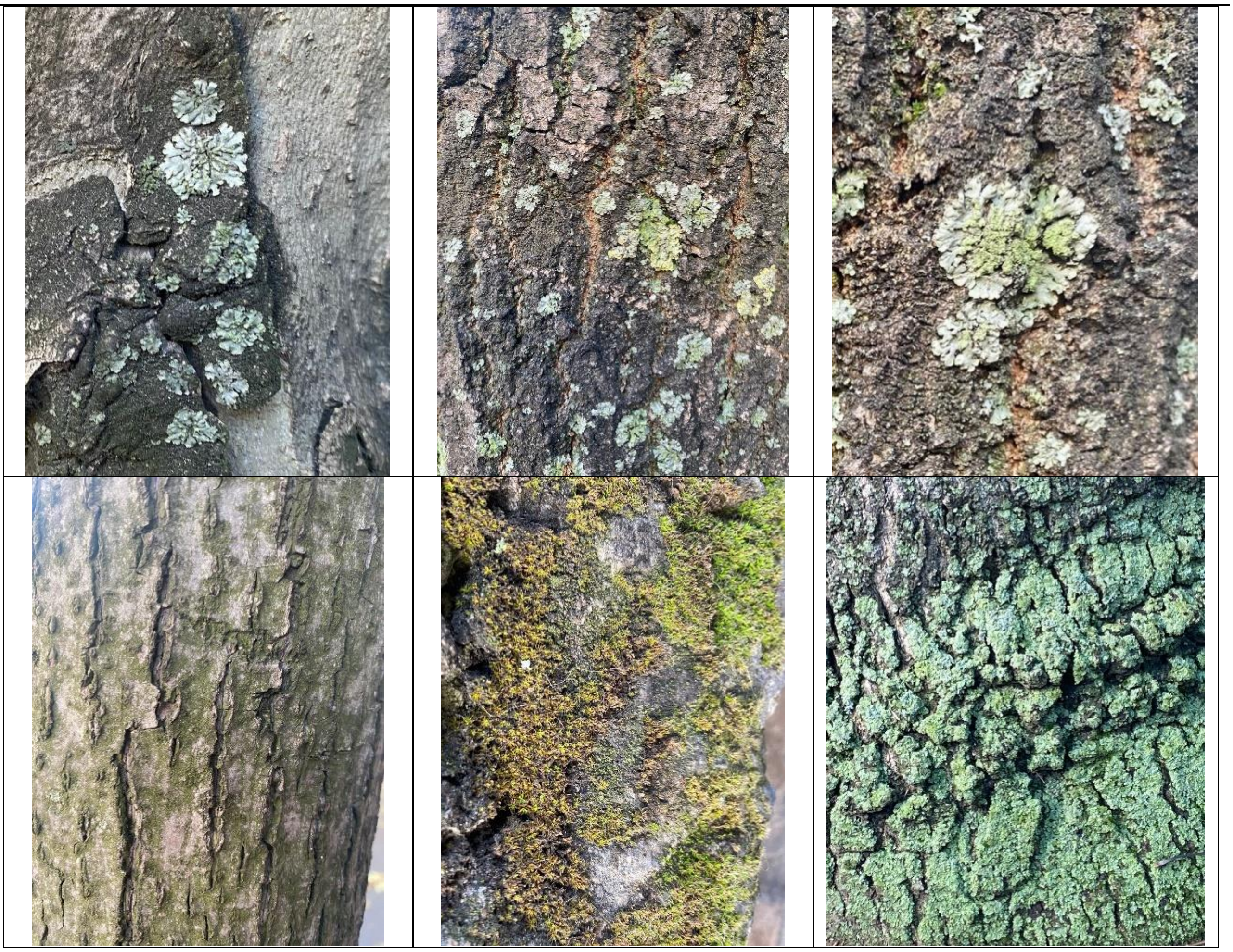


Figure 31: Lichen samples from Budapest (5th district)

In the three investigated sites in Budapest the lichens taxa are very various. The most dominant lichens taxa found are: *Physcia adscendens, Flavoparmelia caperata, Xanthoria parietina, Physcia caesia*, and *Phaeophyscia orbicularis*. Based on the researches, in Hungary there is currently present approximately 55000 lichens specimens. *Physcia adscendens* is type of the lichen that is composed of the tight and narrow branches, with inflated ends. It can be found on the different rooftops, and walls, usually grey. *Flavoparmelia caperata* is a lichen in mostly green colour. It grows on the tree trunks, and on the rocks. The size of this lichen is medium large. *Physcia caesia* is a grey lichen, it is growing on the different types of rocks and stones, and on the concrete. *Phaeophyscia orbicularis* is lichen whose colour can variate between grey, yellow and brown. It grows on the rocks, stones and tree trunks.

CONCLUSION

The lichens collections from areas in Serbia were sampled from urban settlement and with low and small industry and low traffic motions (Palic Lake, Silver Lake and Fruska Gora mountain), and Sremska Mitrovica, city in Vojvodina, on the left bank of Sava River, which is located near the industrial area. A biological indication and physical-chemical examinations of air pollution in Zrenjanin has not been completed yet. At various investigated areas a lot of lichen taxa were collected and their identifications were belonging to various genera. The most frequent lichen taxa are: *Rhizocarpon geographicum*, *Lecanora muralis*, *Lecanora muralis*, *Rhizocarpon geographicum*, *Xanthoria parietina* and *Xanthoria candelaria*. The presence of lichen indicates that the air quality in these sites (Sremska Mitrovica city, Fruska Gora mountain, Palic Lake and Silver Lake) is mostly good (based on the AQI, moderate), or slightly over the moderate range (AQI a little bit over 100, belonging to Unhealthy for sensitive groups). Finally, the appearance and the growth of epiphytic lichens demonstrate their benefit in determining and distinguish between the air pollution at the various locations of collections. Also, the need for further study on epiphytic lichens is suggested as a fundamental for their effective protection and conservation in relation with the climatic changes and air quality. Another part of the research was conducted in the different districts in Budapest (3rd, 5th, 7th), so the samples were collected in the urban are, with a lot of traffic, especially in the districts 5 and 7. The presence of the different lichen taxa shows that the air quality in these areas is good. Based on the air quality index, the air quality is moderate (in range between 51 and 100). The most present lichen types that were found in Budapest are *Physcia adscendens*, *Flavoparmelia caperata*, *Xanthoria parietina*, *Physcia caesia*, and *Phaeophyscia orbicularis*. Air pollution is one of the most important problems affecting environment and publics heath. It is a consequence of the now day’s industrialization, transportation, and as well the development of the urban areas. In today’s world the health risk caused by pollution, is raising every day, and affecting more and more people, especially those who belong to the vulnerable people, including children and elderly people, who already have compromised health or poor immunity. On the other hand, the poor quality of living conditions, like poor air quality, is affecting the whole environment, plants, animals, and vegetation, not just people. For these reasons, it is necessary to have constant monitoring, and checkups of the pollution levels. The levels of air pollution in different well developed European countries it is enormously decreasing over the past decades, but it is still high, and requires constant attention. Unfortunately, on the other hand in non-developed countries it is still a huge problem. After the research done for this paper, and gained knowledge during its preparation, it is concluded that, first of all, it is important to maintain the awareness of the importance of the clean air and healthy environment, and how important it is to raise that awareness among the people in our surrounding.

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SOIL MICROBIOMES AND PROTECTION OF SOIL QUALITY

Hosam E.A.F. BAYOUMI HAMUDA[1], Lyudmyla SYMOCHKO[2,3]

[1]*Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, H-1034 Doberdó út 6 Budapest – Hungary*
Phone: +36303900813 E-mail: bayoumi.hosam@uni-obuda.hu
[2]*Coimbra University, Coimbra-Portugal,* [3]*Uzhhorod National University, Uzhhorod – Ukraine*

***Abstract**:*
Increasing the global human population needs more food and the world population will rise to about 9.5 billion by 2050. Implementing safe and environmental friendly technology would be viable solution for achieving sustainable restoration of degraded soils. Worldwide, phytopathogenic fungi constitute a big problem because they affect a large number of crop species of economic importance causing multiple damages and diseases in agroecosystems. The objective of the present research work is to illustrate the comparison between the rates of antagonistic activities of various soil microbimes potential (isolated from wastewater sludge amended soil) to antagonise some phytopathogenic fungi under various environmental factors such as NaCl, $CdCl_2$, $ZnCl_2$, pH 8.3 and 35°C incubation temperature. All antagonists assigned to show different patterns of antagonistic activity against different phytopathogens like Alternaria sp., Fusarium oxysporum, F. solani, Pythium sp., Rhizoctonia solani and Sclerotinia sp. Application of Pseudomonas, Burkholderia cepacia, Enterobacter sp. and Bacillus cells showed a significant reduction in the growth of phytopathogens in vitro experiments. However, P. fluorescens strongly inhibited the growth of phytopathogens more than the action of other antagonists due to production rates of allelochemicals that include metabolites, siderophores, antibiotics, volatile metabolites, cyanide and hydrolytic enzymes. This study will help to optimize the application strategies of P. fluorescens, Burkholderia cepacia and B. subtilis as biocontrolling agents or their metabolites as biopesticides. Therefore, disease is not a property of the host, but a product of the interrelationship of host and pathogen under or synergistic interaction with indigenous microbiotas or their inoculation with organic fertilizers. Finally, biocontrolling is an alternative, environmentally friendly and relatively cost-effective to conventional biological soil amendemental technique.

***Keywords**: Biocontrol agent, PGPR, Phytopathogens, Environmental factors, Hydrolytic enzymes*

INTRODUCTION

Soil microbiotas respond sensitively to land management practices and climate changes. These soil microbiomes are well correlated with beneficial soil and agroecosystem functions including water storage, decomposition and nutrient recycling, detoxification of toxicants, and suppression of noxious and pathogenic organisms. Soil health is the capacity of soil to function as a vital living system, within agroecosystem and land-use boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and promote plant and animal health.
Increasing the global human population needs more food and the world population will rise to about 9.5 billion by 2050. Implementing safe and environmental friendly technology would be viable solution for achieving sustainable restoration of degraded soils. Worldwide, phytopathogenic fungi constitute a big problem because they affect a large number of crop species of economic importance causing multiple damages and diseases in agroecosystems.

The living soil ecosystem is instrumental to key life support functions that safeguard life on Earth. The soil microbiome has a main role as a driver of these life support functions. Current global developments, like anthropogenic threats to soil via intensive agriculture and climate change, pose a burden on soil functioning. Therefore, it is important to dispose of robust indicators that report on the nature of deleterious changes and thus soil quality. There has been a long debate on the best selection of bioindicators that report on soil quality. Such indicators should ideally describe organisms with key functions in the agroecosystem, or with key regulatory/connecting roles (so-called keystone species). However, in the light of the huge functional redundancy in most soil microbiomes, finding specific keystone markers is not a trivial task.

Microbiomes in the rhizosphere form complex communities, which are strongly driven by influences from the plant root. In particular, those members of the soil microbiomes that play major roles in the promotion of the growth and health of plants are important, as they may need stimuli in their microhabitat to exert their function. Some examples are plant-beneficial microbiomes, like the symbiotic nitrogen (N_2)-fixing rhizobia or the plant-associative N-fixers such as azospirilli and paenibacilli, the phosphate-solubilizing micoorganisms, and the pathogen-suppressing organisms such as diverse pseudomonads and bacilli (Berendsen et al. 2012). In addition, microbiomes that incite systemic induced resistance in plants, and arbuscular mycorrhizal (AM) and ectomycorrhizal (EM) fungi that form beneficial symbioses with host plants are important. Particular key genes of such microorganisms may be taken to serve as indicators for the conduciveness of soil for production of high-quality plants. In contrast, markers for plant pathogens like *Fusarium* will enable an assessment of the adverse effects plants may sense in their quest to develop in a given soil.

Examples of microbial characters potentially yielding gene proxies as markers - that assist plants in (1) warding off pathogens and (2) promoting plant growth, are the production of anti-pathogen compounds, as well as of plant growth hormones such as indole acetic acid (IAA) (Berendsen et al. 2012). Moreover, plant physiology is strongly influenced. Also, microbiomes characters that assist the plant in nutrient mobilization e.g., by N_2-fixation or phosphorus solubilization are important (Pii et al. 2015).

However, researchers still have a poor understanding of the dynamics of, and interactions in, rhizosphere microbiomes. Given the fact that conditions in the rhizosphere are very dynamic (e.g., as a result of the day/ night cycles of photosynthesis and assimilation, and the dynamic growth of roots), plant-associated microbial communities are considered to be highly variable in time and space. This implies that different types of microorganisms and functions are important at different time points during plant development. Hence, particular functions that are in high demand at certain points in time may be almost irrelevant at other time points. This facet of the rhizosphere microbiomes is often overlooked, yet it needs to be taken into consideration to come to a balanced view of rhizosphere community function. Clearly, plant species type can affect the activity, abundance and composition of the local microbial communities through rhizodepositions. The huge microbial diversity of the bulk soil may be more important as the resource library for the rhizosphere, and hence the effect of plant roots is often temporary.

The current rapid development of molecular (DNA-based) methods that facilitate deciphering microbiomes with respect to key functions will enable the development of improved criteria by which molecular information can be tuned to yield molecular markers of soil life support functions.

Plant diseases cause economic losses by reducing crop production, lowering the quality of the production and contaminating plant crops with chemical toxicants. The endless variety and complexity of the many diseases of plants caused by fungi have led to develop of large new fungicides; unfortunately, several phytopathogens have developed resistance to certain fungicides for e.g., resistant to benomyl. Disease is a dynamic interaction between a pathogen, a host and the environment, which causes physiological and morphological abnormal changes in the host. a specific environment. Success rate of microbial inoculation under field conditions depends on their antagonistic Therefore, disease is not a property of the host, but a product of the interrelationship of host and pathogen under or synergistic interaction with indigenous microbiotas or their inoculation with organic fertilizers (Rashid. et al., 2016).

Nowadays, allelopathicals are being explored and research is ongoing in the field of crop production for integrated disease management. Allelochemistry is the science of the production and release of toxic chemicals produced by one species that affect a receiving sensitive species, has been the subject of diverse groups of scientific community. Allelopathy defined as chemically elicited interactions between plants or pathogens is mediated by secondary metabolites type of compounds (Seigler, 1996). Allelopathy involves the synthesis of bioactive compounds known as “allelochemicals” which play a vital role as natural pesticides and can resolve problems like pest biotypes, health defects, soil and environment pollution resulting in climate change caused by the indiscriminate use of synthetic agrochemicals (Farooq et al., 2011). The allelopathic effect is highly dependent on environmental conditions such as water, nutrition, bacterial density, soil structure, and texture (Barazani and Friedman, 2001).

Biocontrol is regarded as a desirable technique for controlling phytopathogens, due to its minimal environmental impact and preventing the development of resistance in vectors. Biocontrol has been defined a number of times. A recent definition by Eilenberg et al. (Eilenberg et al., 2001) is the use of living organisms to suppress the population density or impact of a specific pest organism, making it less abundant or less damaging than it would otherwise be.

Biocontrol can be divided into four complementary strategies: 1. classical, 2. inoculation, 3. inundation and 4. conservation. Rhizobacteria as a group of what is called rhizomicrobiomes are the most widely studied as plant growth-promoting bacteria, associated with plant rhizosphere and are present in all agroecosystems.

Antagonistic rhizobacteria are considered as biological control (biocontrol) agents because of the rapid growth, easy handling, and aggressive colonization of the rhizosphere. The use of plant growth promoting rhizobacteria (PGPR) as biocontrol agents of soil borne phytopathogens is an alternative or complementary strategy to physical and chemical disease management have been investigated for over a century. PGPR (Figure 1) support plant growth by improving growth restricting conditions via production of antibiotics; depletion of iron from the rhizosphere; production of fungal cell wall lysing enzymes β-(1,3)-glucanase and chitinase; synthesis of antifungal metabolites such as cyanide; competition for infection sites on roots; induction of systemic resistance (Saraf. et al., 2014)

Given their often large and complex microbiomes, soils can be considered as hotspots for microbial biodiversity on Earth. Soil provides a large number of biological services that are essential for life on Earth, which are considered as life support functions. These life support functions include (Schloter et al., 2018):

- The provision of “fertile ground” as a basis for a sustainable bio-economy, including the growth of food, feed, fibers, and bioenergy crops;
- The maintenance of a natural unthreatened plant biodiversity at sites which are not used for agricultural production;
- The safeguarding of drinking water, by filtering and degrading pollutants in soil before they enter the groundwater body;
- The protection from erosion;
- The potential to act as a sink for atmospheric CO_2.

PGPR include Gram-positive bacterial taxa that include e.g., B. subtilis and Gram-negative bacteria like fluorescent and non-fluorescent pseudomonads as well as different members of the family Enterobacteriaceae e.g., *Enterobacter*.

In particular, strains of *Pseudomonas*, *Stenotrophomonas*, and *Bacillus* have been successfully used to control phytopathogens and increase plant growth (El-Sayed et al2014). The fungal antagonists *Pseudomonas stutzeri*,

B. subtilis, B. amyloliquifaciens, and *S. maltophilia* have been shown to be effective biocontrol agents in prior studies (Islam and Hossain, 2013; Erlacher et al., 2014; Islam et al., 2016). Different *Pseudomonas* species produce several metabolites with antimicrobial activity towards other bacteria and fungi. Indeed, the first clear-cut experimental demonstration that a bacteria-produced antibiotic could suppress plant disease in an agroecosystem was made by Thomashow & Weller (1988). Rhizobacteria that benefit for plants by stimulating growth and suppressing disease are referred to as PGPR.
The objectives of this study were to identify and characterize PGPR indigenous and to evaluate their ability to suppress the growth of some phytopathogenic fungi. The role of PGPR in adaptation of plants in extreme environments is not yet completely understood.

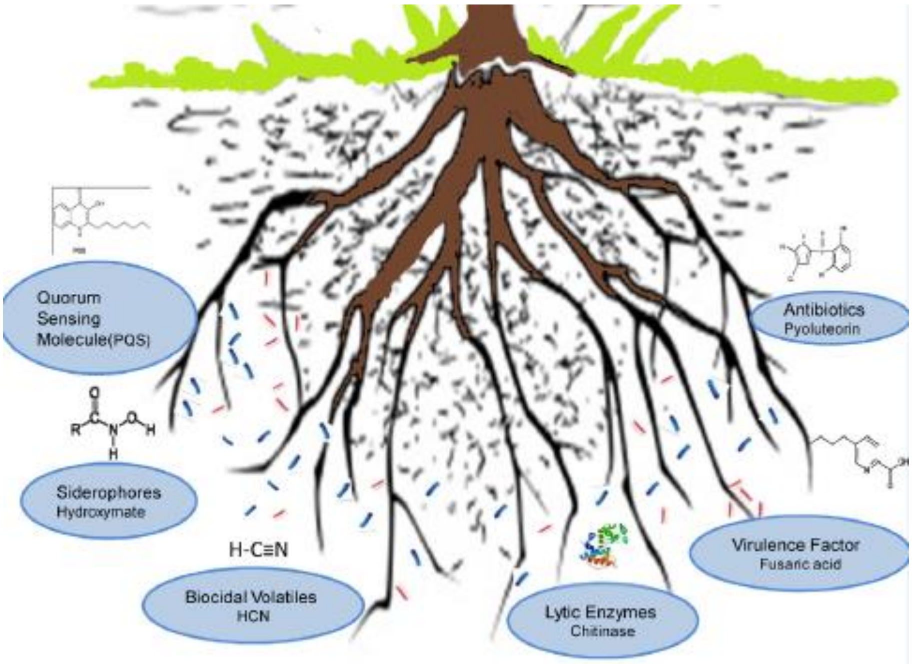

Figure 1: Basic mechanisms of allelochemicals from rhizobacteria (Source: Saraf et al., 2014).

For this reason, study native bacteria were isolated from rhizospheric soils treated with 30% sewage sludge and evaluation of their antagonistic potential against different phytopathogenic fungi under different environmental conditions such as temperature, pH, alkaline and heavy metal ions.

EXPERIMENTAL

The following rhizomicrobial strains used for measuring their potential antagonistic characterizations were isolated from sandy brown forest soil (Gödöllő) treated with 30% wastewater sludge (originated from Nyíregyháza) rhizospheres of two commercial cultivars of sunflower and maize in nursery conditions at similar age of five weeks old. The plants were grown in plastic pots containing 2 kg of non-sterile wastewater sludge amended soil for five weeks under greenhouse conditions to be consisted of a 16 h photoperiod day light at temperature 25±3°C. The plant cultures were watered as necessary to maintain the soil moisture at approximately 45%.
The selected potent bacterial antagonists were: *Pseudomonas fluorescens, P. aureofaciens, P. putida, P. aeruginosa, Stenotrophomonas maltophilia, Burkholderia cepacia, Enterobacter* sp., *Bacillus subtilis, B.*

cereus, B. mycoides and *Streptomyces* sp. The selected phytopathogenic fungi used were: *Alternaria* sp., *Fusarium solani, Fusarium oxysporum, Pythium* sp., *Rhizoctonia solani* and *Sclerotinia* sp.

Detection of hydrolytic enzyme produced by rhizobacteria

The selected colonies of antagonists were investigated in agar plate assay for chitinase and protease activity. The chitinase activity was assessed using a soil minimal medium containing (gl^{-1}): 0.8 K_2HPO_4, 0.2 KH_2PO_4, 0.5 $(NH_4)_2SO_4$, 0.2 $MgSO_4.7H_2O$, 2 Casamino acids, 15 purified agar agar and an equal volume of 1% (w-v)

of colloidal chitin suspension (Sigma), as well as containing (mgl^{-1}): 10 $CaCl_2.2H_2O$, 10 $FeCl_3.6H_2O$, 1 $ZnSO_4.7H_2O$, and distilled water. The protease activity was investigated on plates containing (gl^{-1}): 100 skim milk, 1.5 yeast extract, and 15 technical agar agar, and distilled water. Using the procedure described by Dunne et al. (1998), the isolates were spotted onto the agar surfaces. The plates were incubated for 1 or 3 and 2 or 5 days at 28°C. The assays were repeated three times. Both chitin- and skim milk- containing plates are opaque and enzyme activity was identified by the development of a clear zone around the colonies and spots.

***In Vitro* Screening for Antagonism**

To test antagonism of *Alternaria* sp., *F. oxysporum, F. solani, Pythium* sp., *Sclerotinia* sp. and *Rhizoctonia solani* by each strain of rhizobacteria *P. fluorescens, P. aureofaciens, P. putida, P. aeruginosa, Stenotrophomonas maltophilia, Burkholderia cepacia, Enterobacter* sp., *B. subtilis, B. cereus, B. mycoides* and *Streptomyces* sp., the phytopathogens and antagonistic bacteria were inoculated 3 cm a part on the same a garplate. Fungal growth on each plate was observed, and the zone of inhibition, if present, was determined as following:

$$\% \text{ Inhibition of mycelial growth} = [(X–Y)/X]\times 100 \qquad (1)$$

Where, X is mycelial growth of pathogen in absence of antagonists and Y is mycelial growth of pathogen in presence of antagonists.

***In vitro* antagonistic activity under various environmental conditions**

The investigation of the antagonistic impact was carried out by the same procedure mentioned above. Under the variations of the ecological factors, the 6 selected rhizobacterial strains were screened for their antagonistic activity towards *Alternaria* sp., *F. oxysporum, F. solani, Pythium* sp., *Sclerotinia* sp. and *Rhizoctonia solani* onto potato dextrose agar (PDA) medium. Zones of inhibition were recorded after 2 and 5 days of incubation at 35°C or with different concentrations of 25 mM of NaCl or under the stress of 25 µM of $CdCl_2$ and $ZnCl_2$ or under pH 8.3 values. Fungal growth on each plate was observed, and the zone of inhibition, if present, was determined as described above.

RESULTS

The antagonistic investigations showed that the inoculation of PGPR biocontrol agents significantly increased the plant growth in nursery conditions (data not show). Thus this study underlines the commercial potential of the selected PGPR biocontrol agents for sustainable plant cultivation.

Detection of hydrolytic enzyme produced by rhizobacteria

The investigation of the chitinase and protease activities of the selected antagonistic rhizobacteria is illustrated in Figure 2. It was found that *P. fluorescens* was the most enzyme producing strains, while the *Stenotrophomonas* was the lowest producer.

In Vitro Screening for Antagonism

The results of the antagonistic potential of the rhizobacterial strains are demonstrated in Figures 3-8. Figures 3, 4, 6, 7 and 8 show that the strains *P. fluorescens* had the highest inhibiting potent on the growth of *Rhizoctonia solani*, *Alternaria* sp., *F. oxysporum*, *F. solani*, and *Sclerotinia* sp., respectively. Also these figures demonstrate that the *Streptomyces* sp. had the lowest inhibitor and produce low antagonistic metabolites to reduce the growth of these phytopathogens. Figure 5. shows that *Enterobacter* sp. strain had the highest potent to reduce the growth of *Pythium* sp.

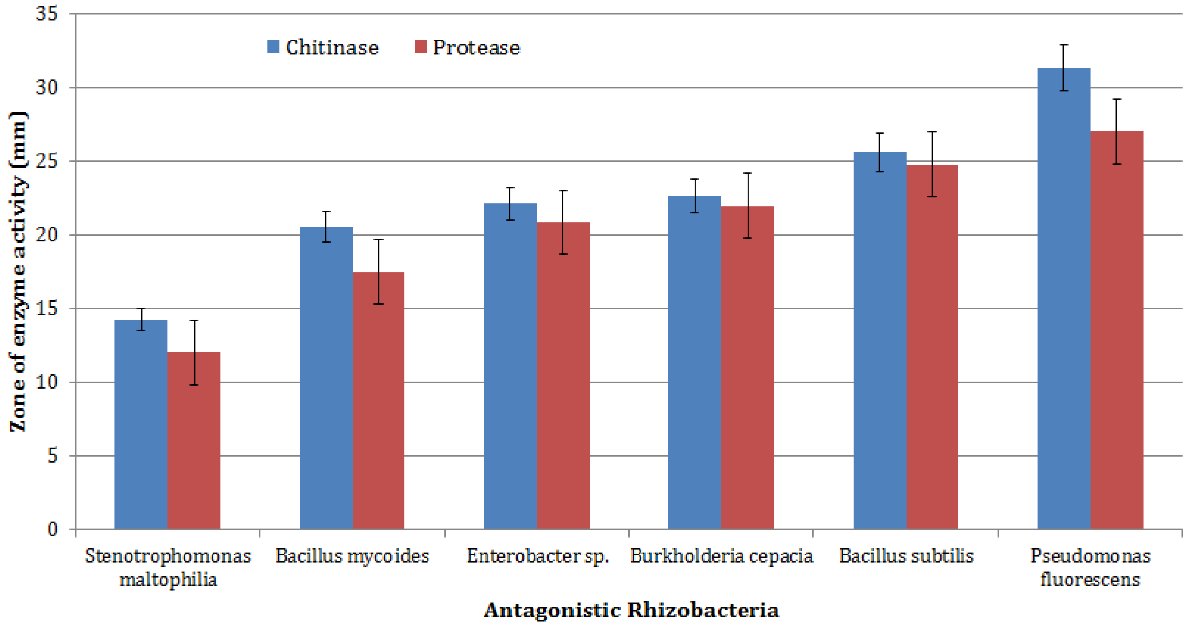

Figure 2: Enzymatic activities of antagonistic rhizobacterial

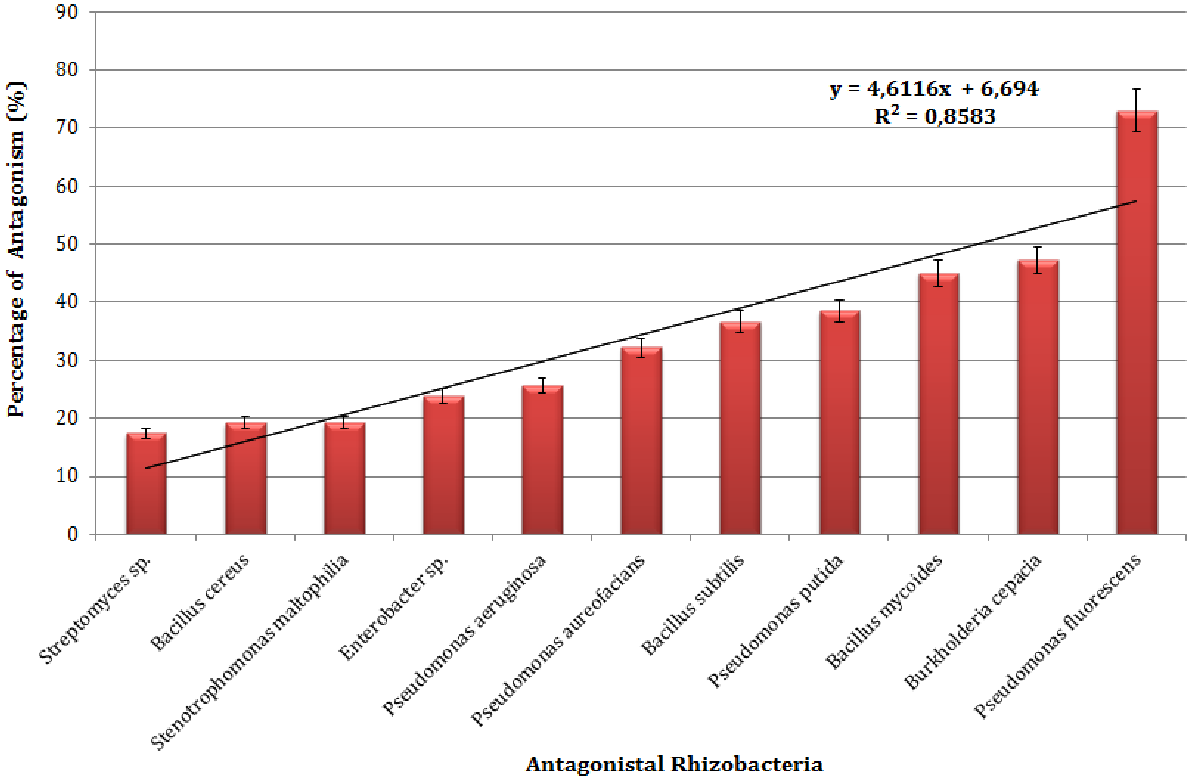

Figure 3: Effect of different antagonists on the growth of *Rhizoctonia* solani

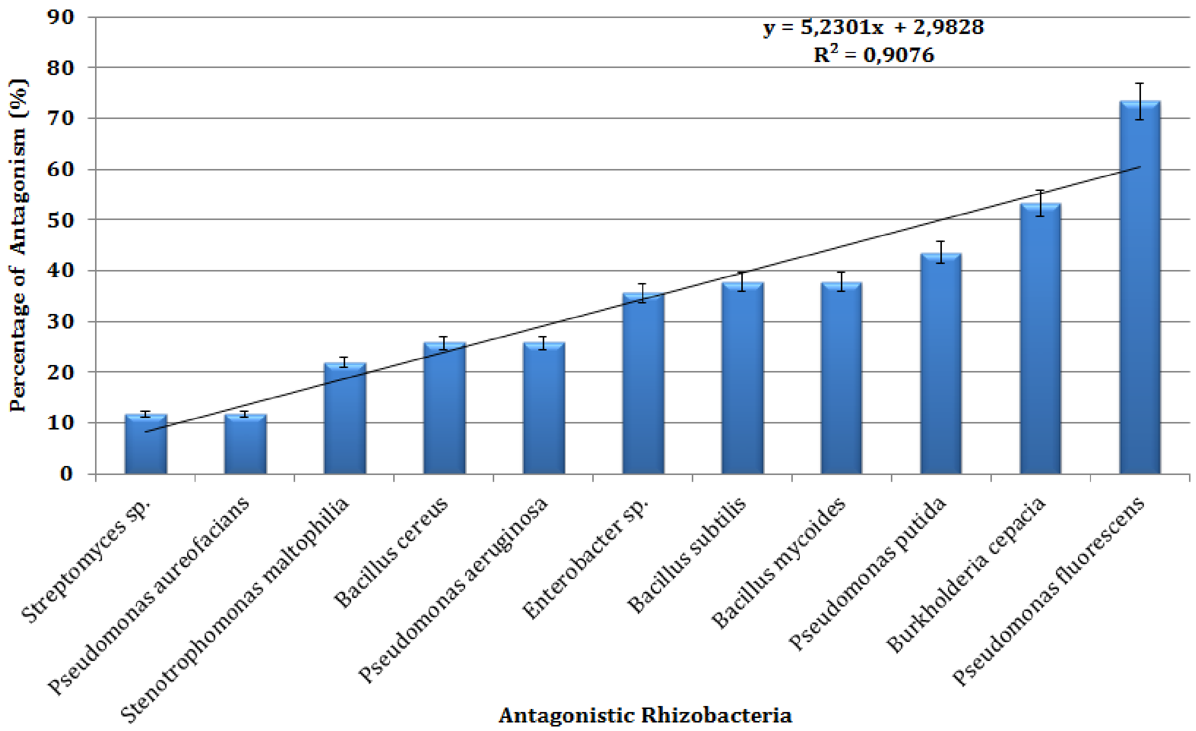

Figure 4: Effect of different antagonists on the growth of *Alternaria* sp.

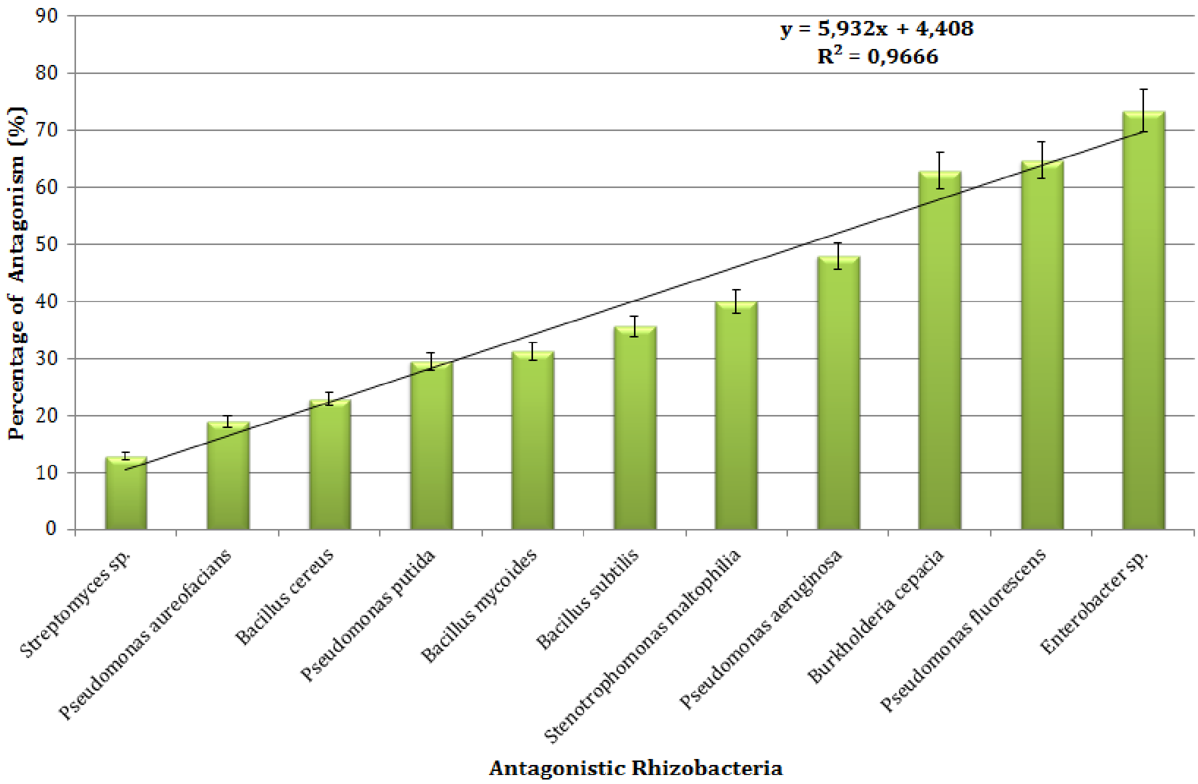

Figure 5: Effect of different antagonists on the growth of *Pythium* sp.

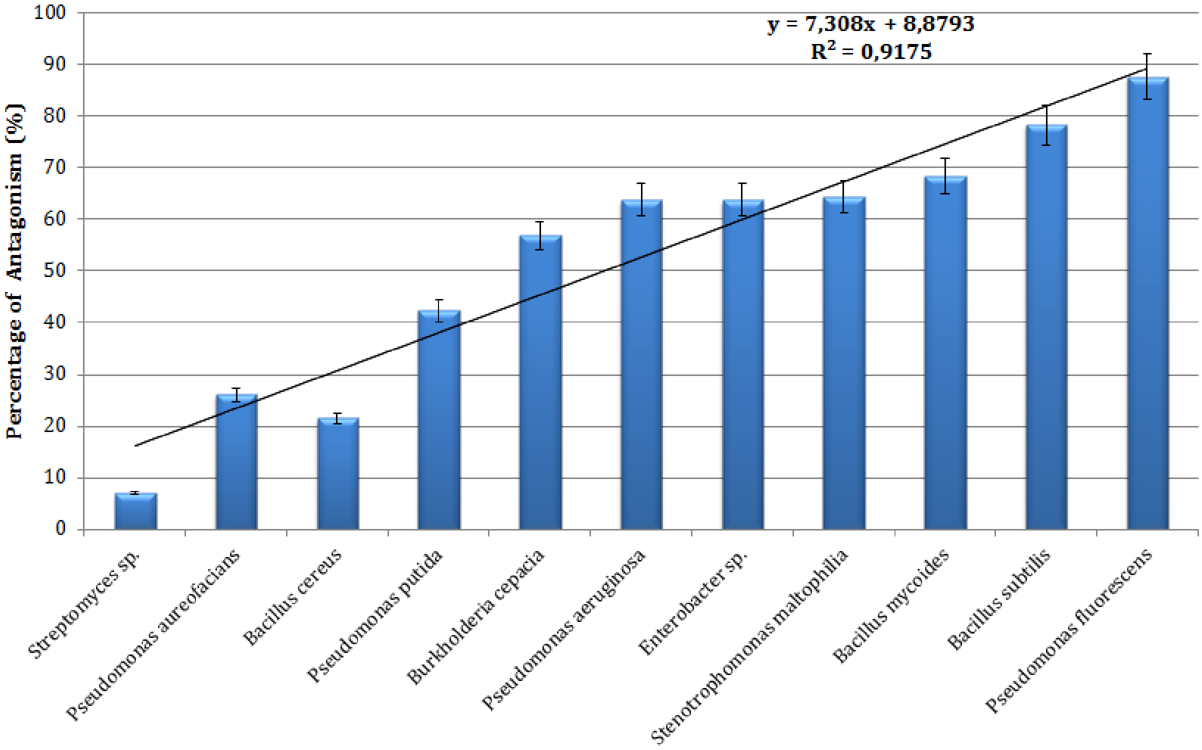

Figure 6: Effect of different antagonists on the growth of *Fusarium oxysporum*.

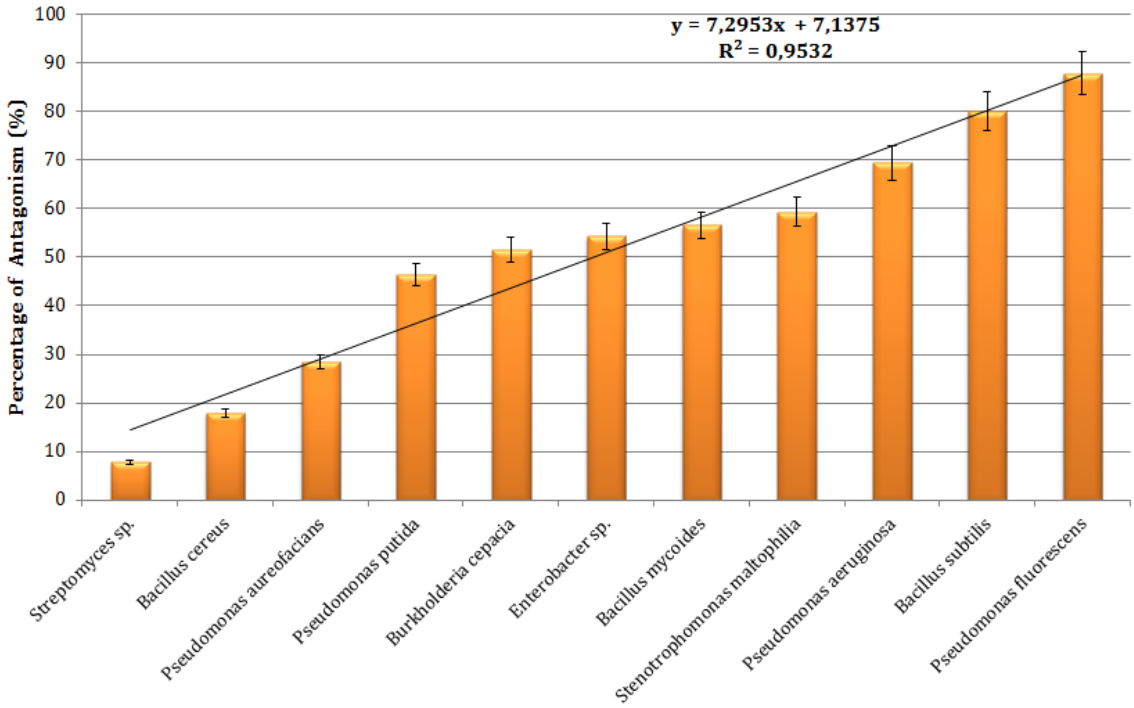

Figure 7: Effect of different antagonists on the growth of *Fusarium solani*.

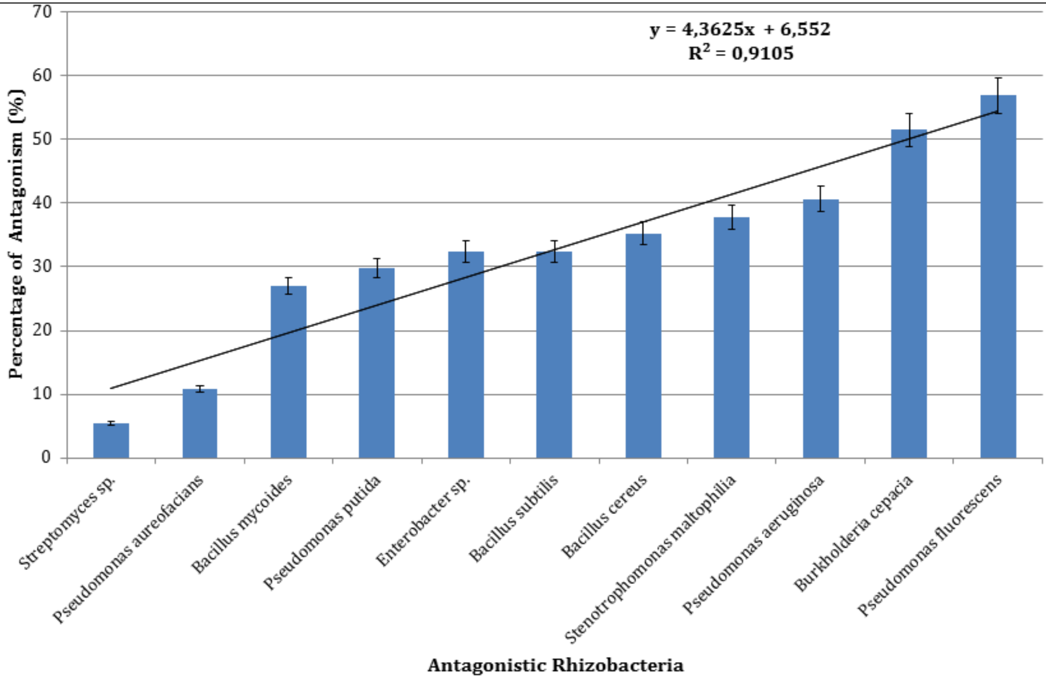

Figure 8: Effect of different antagonists on the growth of *Sclerotinia* sp.

In vitro antagonistic activity at different environmental conditions

Under the effect of 25 mM of NaCl, *B. mycoides* was the most inhibitor to the all investigated phytopathogenic fungi (Figure 9) and the strain *Enterobacter* had the lowest inhibition potent to reduce the growth of the tested phytopathogenic fungi.

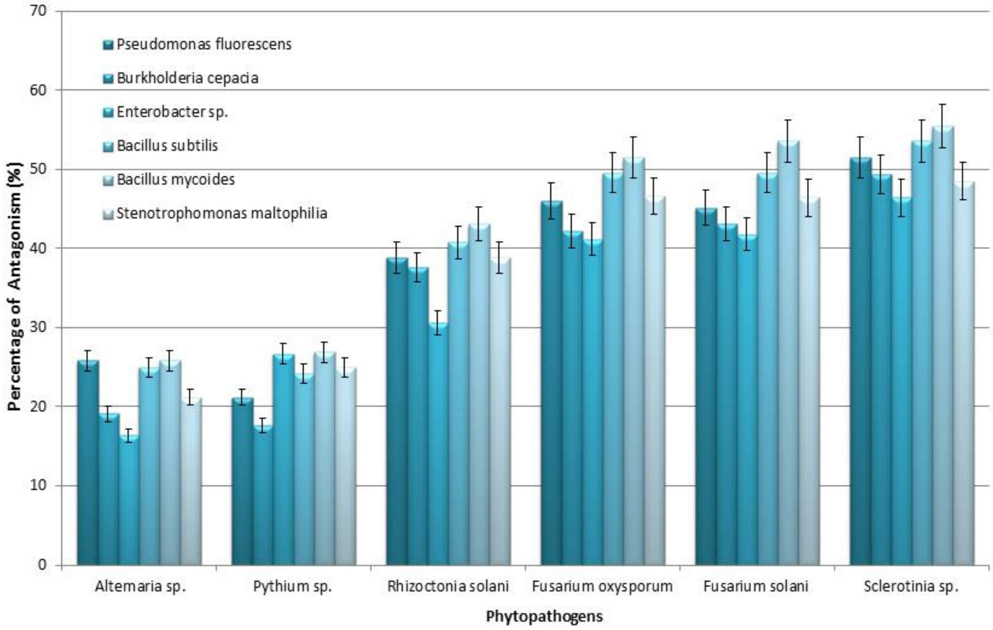

Figure 9: Effect of different antagonists on the growth of phytopathogens under the stress of NaCl salt.

Figure 10 shows that under the stress of 25 µM of $CdCl_2$, the strain *B. mycoides* was the most significant antagonist to reduce the growth of *Alternaria* sp., *Pythium* sp. and *Sclerotinia* sp., it was able to reduce the growth of *Alternaria* sp. and *Pythium* sp. more than the other antagonists (Figure 11) and *P. fluorescens* was significant inhibitor to reduce the growth of *Alternaria* sp. and *F. oxysporum* under the stress of $ZnCl_2$. The strain *Burkholderia cepacia* had the antagonistic potent to reduce the growth of *R. solani* and *F. oxysporum*.
Figure 12 demonstrates the effect of incubation temperature at 35°C on the antagonistic activity of the antagonists on the phytopathogenic fungi. It was found that at this temperature *Enterobacter* sp. strain had the lowest potent to reduce the growth of the tested fungi except at the case of *Sclerotinia* sp. which was inhibited more by the antagonist *B. mycoides*.
Also, it was found that *B. mycoides* inhibits significantly the growth of *F. solani* and *Alternaria* sp. *S. maltophilia* was the most inhibitor and growth reducer of *R. solani* and *F. oxysporum*. Figure 13. demonstrates the effect of alkaline pH on the antagonistic potent of different antagonists on the phytopathogenic fungi. It was found that pH 8.3 stimulates the antagonistic effects of the strain *Burkholderia cepacia* to reduce the growth of *R. solani*, *Alternaria* sp., *F. solani* and *Sclerotinia* sp., while *B. subtilis* was able to reduce the growth of *F. oxysporum* significantly.

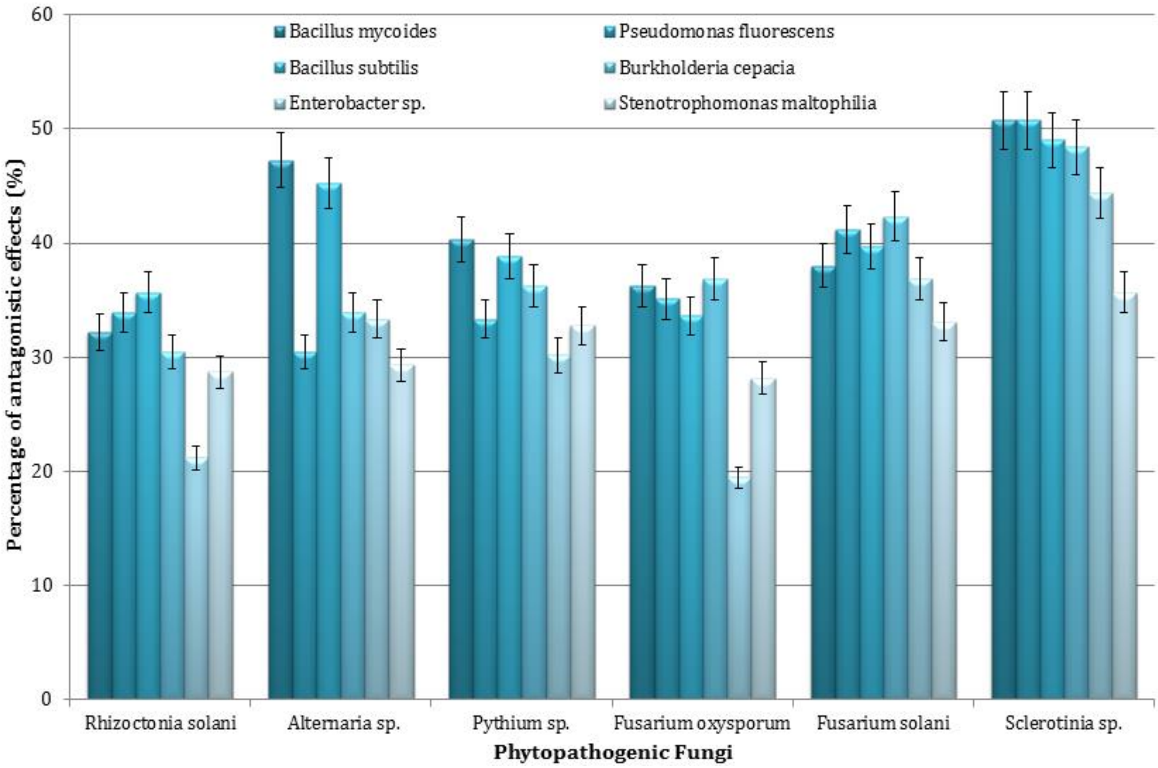

Figure 10: Effect of different antagonists on the growth of phytopathogens under the stress of $CdCl_2$.

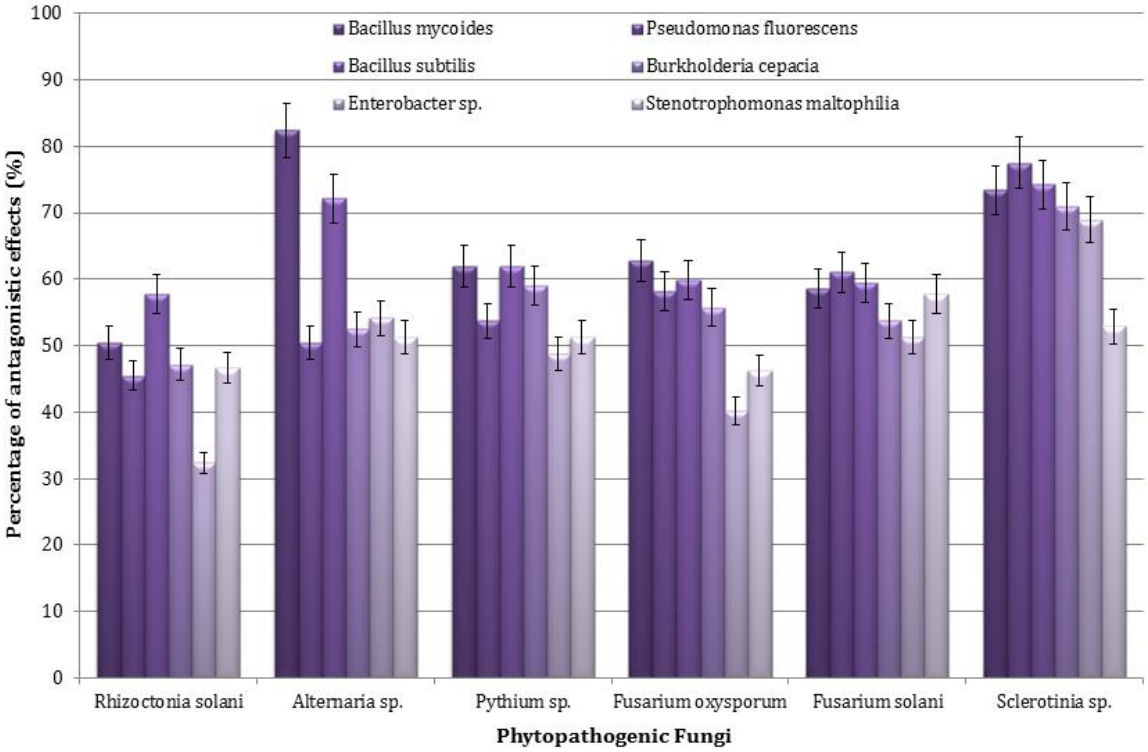

Figure 11: Effect of different antagonists on the growth of phytopathogens under the stress of $ZnCl_2$ salt.

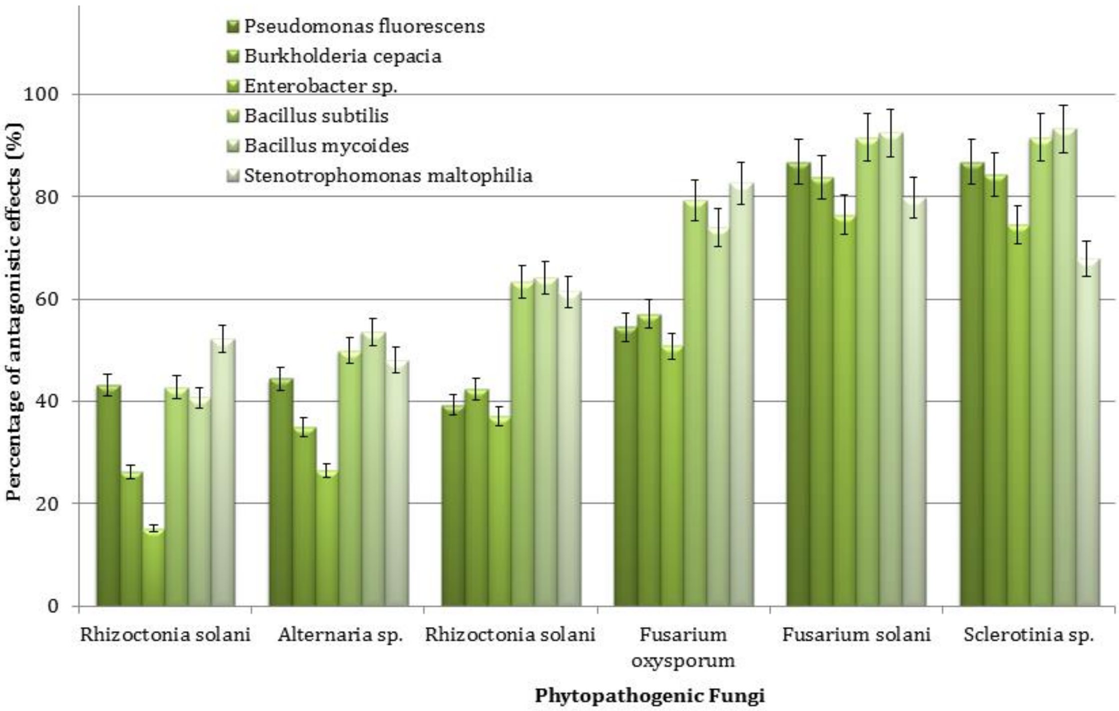

Figure 12: Effect of different antagonists on the growth of phytopathogens under 35°C.

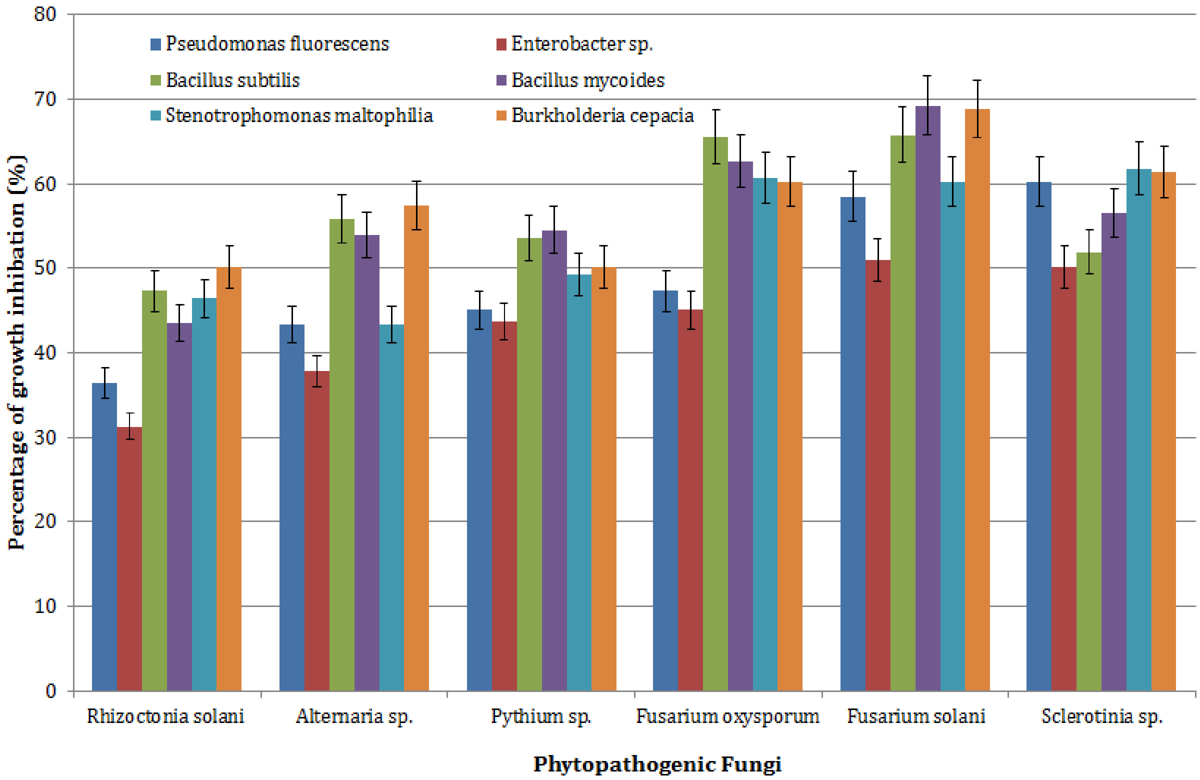

Figure 13: Effect of different antagonists on the growth of phytopathogens under pH 8.3.

DISCUSSION

However, the multi-functionality of soil is highly endangered as a result of the ongoing global change. Climate change induces not only an increase in temperature in the long run, but it is also associated with increased frequencies of extreme weather events, like prolonged drought periods or heavy flooding. Next to these, increased land use intensities, mining and pollution pose additional challenges. Furthermore, land use conflicts often reduce areas with high-quality soils due to urbanization and the associated sealing. Thus, the persistent threat of soil degradation driven by climatic and anthropogenic forces prioritizes the development of strict directives for the protection of soils, as recently promoted by the European Union. In this respect, the importance of developing robust, reliable and resilient bioindicators for monitoring of soil quality has been emphasized, in order to establish an early warning system of potential losses of the multi-functionality of soils.
Bayoumi Hamuda and Kecskés (2004) showed that in the antagonistic experiments there was no antagonistic effect among the tested microbiomes strains. Antagonistic relationships are the keys in the biocontrol of many soil borne phytopathogens and in the successful introduction and survival of soil microbeiomes and rhizosphere. Soil is a dynamic living matrix and an important resource for agricultural products. Soil is also a store-house of microbiomal activity, which is confined to aggregates with accumulated organic matter, the rhizosphere. The rhizosphere both contacts plant roots and supports high populations of active microbiomes and it has attracted much interest (Nautiyal and Dasgupta, 2007)
Siderophores chelate available iron from the soil; antibiotics discourage bacterial colonization; lytic enzymes degrade many organic compounds including chitin (main component of fungal cell walls); detoxification enzymes prevent damage from pathogenic toxins. Production of volatiles such as hydrogen cyanide, suppress the growth of fungal phytopathogens; the ability to successfully compete with phytopathogens for nutrients or

specific niches on the root; and the ability to induce systemic resistance (Compant et al., 2005). So, PGPR was found to be mainly involved in enhancing plant nutrition, stress tolerance or health (Vacheron et al., 2013). Since these PGPR inoculants exhibited multiple properties benefit to the host plants, they may be applied in the development of new, safe, and effective seed treatments as an alternative to chemical fungicides.

A considerable worldwide research has focused on the exploration of varied agro-ecological niches for the existence of native beneficial microbiomes. In the current study, PGPR rhizobacteria with *in vitro* PGPR traits were isolated from wastewater sludge amended rhizospheric soil of 2 different plant species. These potential PGPR microbiomes isolates were enumerated and screened *in vitro* for a broad spectrum for antagonistic potential against phytopathogenic fungi. Selected microbiomes strains scoring high rank as PGPR were identified and their phylogenetic affiliations were determined. Antagonistic potential against phytopathogenic fungi was selected as criteria to have a preliminary judgment for the isolates whether they possess PGP traits or not. Isolates having antagonist potentials were considered as good candidates for being PGPR because of their indirect effect for promoting plant growth via inhibition of various plant phytopathogens.

Lytic enzymes are another character associated with PGPR enabling them to limit fungal phytopathogens growth, as in vitro studies showed that the exposure of selected plant pathogenic fungi to lytic enzymes such as chitinase and protease for example can result in degradation of the structural matrix of fungal cell wall Mirza et al. (2001). In our study, it was observed that all selected antagonists were chitinase- and protease-producers. *Bacillus* spp. is known for their wide distribution in many soil types. Among all *Bacillus* spp. that have been isolated and characterized as PGPR, endospore-forming bacilli have received much attention for commercial purposes due to their stability in the environment. Mirza et al. (2001) reported the isolation of strains of *Enterobacter* spp. from rhizosphere of sugarcane and illustrated their ability to function as PGPR. *Enterobacter* spp. strains were also found in diversity of PGPR isolated from sugarcane cultivated in South of Brazil (2001). In an effort to study the diversity of PGPR associated with rhizospheric soil and roots of canola, Farina et al. (2012) found that *Pseudomonas* and *Enterobacter* were among the most abundant rhizospheric bacteria showing several PGPR traits. It has also been reported that *Pseudomonas* spp. is one of the most important bacteria inhabiting the rhizosphere of a diverse group of plants (Costa et al., 2006). It has been shown that, in comparison to other plant microenvironments, the rhizosphere is one of the main reservoirs of antagonistic bacteria (Berg et al., 2005) with pseudomonads as being most dominant bacteria showing antagonistic properties and therefore potential PGPR (Berg et al., 2006). However, in contrast to these reports, our results suggest that rhizoplane of wild plants in arid soil is a potential source for Pseudomonades with PGP properties rather than rhizosphere.

The reasons why soil bacteria and archaea, as well as fungi and other micro-eukaryotes have been - to a great extent - ignored in the discussion on indicators for soil life support functions are diverse. By definition, such indicators should allow easy measurement and be accurate for the purpose they were developed for. In addition, it would be advantageous if costs were kept low. Thus, there have been several past efforts to define biological indicators of soil quality, mainly focusing on the "visible" parts of the soil biota, i.e., the soil macrofauna (Stott et al. 2009). Whereas, such bioindicators have indeed become well established and found their way into several guidelines, bioindicators that describe the status of the soil microbiomes are still rare. The currently existing bioindicators are mostly based on so-called sum or black-box parameters, as exemplified by traditional parameters like microbial biomass, global or potential microbial activity patterns or assays that determine potential enzymatic activities (Nannipieri et al. 2003; see also Table 2).

Table 2 Overview of methods for studying soil microbiomes (optimized from van Elsas and Boersma 2011)

Method	**Specific for: species/ community/ system**	**Major pitfall**	**Interpretation of results**	**Advantages (technical)**	**Disadvantages (technical)**
Microbial biomass-direct microscopy	Community	Overall method	No information on specific soil microbial species or microbial groups	Easy, rapid	Low resolution
Microbial biomass-dilution plating	Species/ community	Only culturable microorganisms visible (only 1% of community)	Estimate of the nature/diversity of a limited number of strains in the community	Easy, cheap, and ability to further analyze colonies	Low resolution. Not representative
Microbial biomass-chloroform fumigation/ extraction	Community	No information on community changes.	Estimate of microbial biomass. No information on microbial community, functional or phylogenetic changes.	Cheap and fast. Parameter sensitive to changes in the use of soil	Low specificity
Microbial biomass-SIR (substrate induced respiration)	Community	Relies on activity of microorganisms, which can be low	Information on active, dominant community responding to substrate	Easy and cheap	Low sensitivity
FISH (fluorescence in situ hybridization)	Species	Opaque nature of soil and relative low cell densities hamper in situ visualization	Information on active, dominant community members	in situ technique: interactions and location visible	Artifacts due to soil matrix. Low resolution and low-throughput
PCR/qPCR	Species/ community	Reliant on existing primers	Proxies of organisms or genes amplified and/or quantified	Routine techniques of high sensitivity; allow detection and/or quantification	Several PCR biases and artifacts, i.e., inhibition, incomplete coverage
Microbiome fingerprinting-DGGE/TGGE*	Phylogenetic (species/ community)	Only species > 1% abundance are visible.	Estimate of the structure of limited (dominant) microbiota in the community	Well optimized and easy, bands excised for identity check.	Inter-gel comparison difficult. Artifacts
	Functional (species/ community)	Limited information on functional genes hampers primer design	Information on functional genes, but not on activity of those genes.	Same as above; higher resolution than phylogenetic DGGE/TGGE	Same as above
Microbial enzyme activities	Community	Limited information	No information on specific soil microbial species or microbial groups.	Easy, rapid, and cheap	Low specificity; only some methods are standardized
Microbial activity patterns	Community	Indicator of the overall microbial activity	No information on specific soil microbial species or microbial groups	Easy, rapid, cheap, and extensive database	Low specificity
Phospholipid fatty acid analysis (PLFA)	Community	No information on community changes.	Microbial groups	Routine technique a sufficient sensitivity; detection and/or quantification	Intermediate specificity
Phylochip/geochip microarrays*	Species/ community	Cross-hybridizations, difficult data analysis	Large amounts of information, information on function/activity if combined with RNA	All-in-once analysis in high-throughput. High potential for comparative studies	Costly, not possible to detect novel sequences
High-throughput sequencing*	Species/ community	Interpretations affected by artifacts/sequencing errors	Large amounts of information on members of the community at sequence level. Provides bioindicators of soil quality	All-in-once analysis in high-throughput. High potential for comparative studies	Method is error-prone.

Soil microbiome functions that support plant growth

Only a small percentage of the available volume or surface in soil harbors microbiomes. Moreover, microbiotas are usually quite inactive in bulk soil, yet show raised activities in soil "hot spots," such as the rhizosphere, mycosphere, drillosphere, and/or detritusphere.

For example, of the 10 bioindicators used to evaluate soil quality given by Andrews et al. (2004), only two (microbial biomass C and potential N mineralization) address microbiological soil properties. Recently, an alternative has been proposed, based on the use of specific ratios that report on function. Thus, the metabolic quotient (C-CO_2/microbial biomass C) or the ratio between enzyme activity and microbial biomass have come into focus (Nannipieri et al., 2012). However, there is still a lack of emphasis on soil microbiological processes, which becomes also apparent when methods to analyze soil quality, as standardized by ISO, are considered (https://www.iso.org/committee/54366/x/catalogue/completed).

Of the 52 methods proposed, most use aspects of the soil macrofauna and/or of plants as quality indicators. Also, 13 new methods that are under recent development do not include tools to analyze the soil microbiome and its functional characters. It is encouraging, though, to note that ISO standard 17601:2016, of December 2016, now describes methods that aim to determine the abundance of selected microbial gene sequences by quantitative PCR using soil microbiome DNA (https://www.iso.org/committee/54366/x/catalogue/completed).

A generic account of such methods, including their intricacies, is presented in Table 2. However, the selection of characters is lagging behind this development. Hence, taking into account the importance of the soil microbiomes for most soil life support functions, there is a strong need to implement new trait-based bioindicators that monitor such life support functions.

CONCLUSIONS

Rhizobacteria isolated from plants rhizosphere of 30% sewage sludge treated soil were found to harbour antagonistic activity against the investigated phytopathogenic fungi. These antagonistic rhizobacterial strains have broad spectrum of in vitro PGP abilities and antagonistic potentials in such environment. The results of in vitro studies should be considered at the time when the in vivo and field experiment studies will be done.

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PROTECTION THE PLANET: GLOBAL ECOSYSTEM PROBLEMS AND CLIMATIC CHANGES

Hosam E.A.F. BAYOUMI HAMUDA

Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest – Hungary
e-mail: bayoumi.hosam@uni-obuda.hu

Abstract
Pollution is one of the major problems persisting in our environment causing an increase in the morbidity and mortality, which ultimately affects the economic growth of a world. Therefore, environment quality sensing tools have become inevitable in everyday life. Environmental health concerns are a critical issue nowadays that needs joint efforts from multiple sectors to achieve better public health outcomes. The holistic approach, relevant to food safety and control of diseases (e.g. Covid-19) through usage of green technologies should be considered. The application of cleaner and effective technologies can be expanded to management and control pollution. The potential topics from the following research areas are expected: Global environmental health; environmentally friendly processes and their effects on human health; outdoor air quality, surface and ground water quality improvements; toxic substances and hazardous wastes reduction; environmental pollution, microbial degradation of pollutants, nanomaterials, nontoxicity and safety issues, food safety and agricultural products etc. Simultaneously, there is an increasing demand for natural bioproducts of therapeutic and industrial significance (in the areas of healthcare, environmental remediation, microbial biotechnology). Growing awareness and an increased attention on environmental issues such as climate change, energy use, and loss of non-renewable resources have carried out a superior quality for research that provides potential solutions to these problems. Emerging microbiome approaches potentially can significantly increase agriculture productivity and human healthcare and henceforth can contribute to meet several sustainable development goals. The aim of this study is to illustrate the novel research contributions on innovative approaches to manage, mitigate and valorize wastes produced by different sectors, with the aim of transforming our society towards a sustainable and circular bioeconomy. The present study discussed aspects including risk factors in atmospheric and water environment, public health improvement, changes of food trend, and living environment to elucidate the importance of environmental allergen

***Keywords**: environmental pollution, metal contamination, xenobiotic, clean technologies, public health*

INTRODUCTION

Environmental pollution resulting from agricultural practices and operations has become an issue of critical concern in recent years. Pollutant discharge from agricultural systems has been documented as one of the key non-point sources of pollution chiefly responsible for soil and water quality impairment in the worldwide. As major polluters, enterprises are expected to behave responsibly toward the natural environment. However, enterprises often do not pay enough attention to the environment and may even be environmentally irresponsible. Encouraging enterprises to actively accept environmental responsibility is the key to solving the problem of environmental pollution. Perhaps, nothing is more important today for businesses and societies than the management of the global and local environmental changes that are degrading all aspects of life—a trend at risk of worsening for future generations.

The main ambition of most nations in recent times is to reduce the environmental implications of greenhouse gas emissions which have resulted in global warming and climate change. Various chemical amendments have been effectively used to immobilize pollutants resulting from agroecosystems. Reduction in the mobility and solubility of contaminants such as P, Zn, Cu, Pd, Cd, has been achieved by the use of various pure and industrialwaste materials, limiting the environmental toxicity of these pollutants. However, the continuous addition of most of these amendments and their associated impurities could in turn have a detrimental effect on soil and water quality.

To reduce production costs and pursue profit maximization, enterprises tend to overdevelop and generate excessive emissions, which creates shocking problems such as air pollution, water pollution, land pollution, and resource depletion. Nowadays, air pollution is a burning problem for every part of the globe. More than 100 pollutants which pollute air have been identified. They may be in the form of solids, liquids or gases. They differ significantly from place to place depending upon the particular complex of contaminant source and atmospheric conditions. The air pollutants emitted from both natural as well as anthropogenic sources.

A series of serious problems has been caused by environmental pollution, and corporate environmental responsibility has received increasing attention. Contaminants such as nitrogen, phosphorus, dissolved organic carbon, arsenic, heavy metals, and infectious pathogens are often associated with agroeco systems. The environment has become ever more hazardous due to industrialization for city development in many countries. This includes the sky and the soil where humans reside. Tiny particles from vehicles (e.g., diesel exhaust particles, particulate matters (PM)), dusts containing ultrafine particles (e.g., diameter below 0.1 μm), smoking (e.g., first- and second-hand smoke), chemicals from factories (e.g., coloring dyes, cotton, epoxy resins, isocyanates), and the emerging electromagnetic field (EMF) in telecommunications.

Tiny particles such as $PM_{2.5}$ and PM_{10} have diameter 2.5 μm and 10 μm, respectively or below can pass through and are trapped in our lung cells. The trapped PM affects breathing rate as it agglomerates into insoluble particles in the lungs that obstruct airway, thereby inducing breathing difficulties linked to chronic obstructive pulmonary disease. Tiny particles of chemical sources such as coloring dyes have been reported to be allergic to some people. Carmine (e.g., red), tartrazine (e.g., yellow), and annatto (e.g., orange or yellow) have been used in food coloring for meat, or peanuts, and many other types of foods. The common symptoms of allergic associated with food coloring include severe headache, itchy skin, breathing difficulty, and chest tightness.

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Air pollution is one of the biggest environmental health problems in the world; accumulative studies have shown that air pollution was closely related to metabolism disorders. HbA1c is a stable indicator for blood glucose level monitoring. However, studies on the impact of ambient air pollution on HbA1c have inconsistent conclusions. Inorganic gaseous pollutants (such as ozone, nitrogen dioxide, and sulfur dioxide) and volatile organic compounds (VOCs) have been the focus of attention in many studies in the literature because of their serious effects on human health and the ecosystem. Especially, ozone (O_3) is of primary interest because of its phytotoxicity at ambient concentrations and widespread existence in Europe, particularly in the Mediterranean area.

The study is going to explore the influence of ambient air pollution on HbA1c. By searching keywords, a systematic literature retrieval was carried out on PubMed, Cochrane Library, Web of Science, and Embase databases up to April 2022. Pooled percentage change (%-change) and 95% confidence intervals (95% CI) were estimated using random effect models for particulate matter (PM) and nitrogen dioxide (NO_2).

LASER, and most importantly, mobile phones. Power and phones range from 10^1 to 10^4 Hertz (Hz), radiowaves range from 10^4 to 10^9 Hz, and LASER communication is at 10^{14} Hz. Some reports on triggered sensitivity have been linked to mobile phones which lie in the 2–4 GHz. However, the future is 5 GHz with yet unknown effect on our health. Previous study reported that weak magnetic field shares similarity with chemical reactions from drug, indicating that magnetic field may affect humans at molecular level. Symptoms that have been reported include headache, nausea, and dermatological symptoms. However, the reported symptoms are yet to be medically diagnosed.

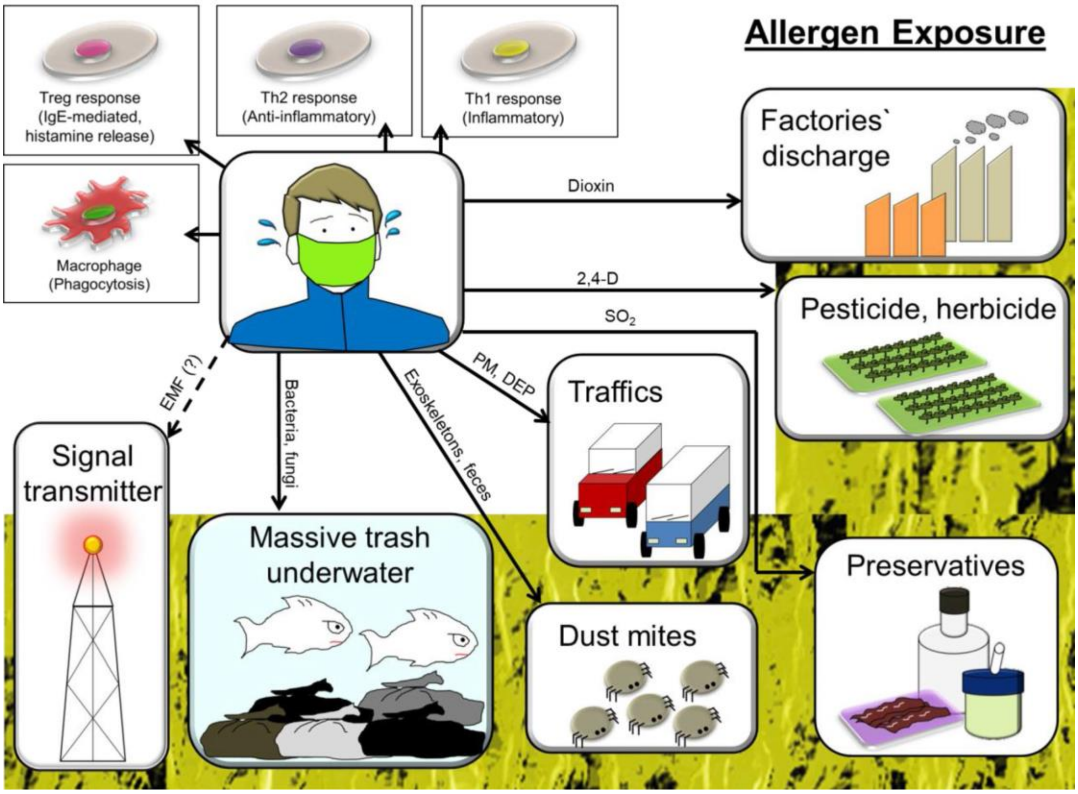

Figure 1. The currently known allergen exposures (Source: Yong et al., 2022[1])

HEAVY METALS IN THE ENVIRONMENT

Heavy metals generated by a variety of industiral practices can cause significant environmental harm if not efficiently eliminated from the wastes. These heavy metals adversely affect human health, the environment, and aquatic systems when they accumulate in living organisms at levels above the permitted limits.

Heavy metal accumulation in soil interrupts the normal functioning of soil ecosystems and plant growth [2,3]. Plants absorb various kinds of heavy metals when available in the soil or irrigation water [4]. Metals like manganese (Mn), magnesium (Mg), copper (Cu) and iron (Fe) is classified as plant essential metals. These metals are required in specific amount and their deficiency or elevated concentrations will result in toxic effects and reduce the plant productivity. For example, Mn is involved in splitting water molecules necessary for photosynthesis. Other metals like magnesium deficiency is responsible for cholorosis in plant leaves [5,6] and also induces oxidative stress [7]. Zinc (Zn) is essentially required for plants. However, too high concentrations can damage plants [5] and inhibit their growth. Zinc is responsible for chlorosis in leaves by reducing chlorophyll [8]. However, heavy metals including Cd and Pb are toxic metal and influence the plant growth adversely by affecting the leaves and root growth and inhibit enzymatic activities and resulted in reduce production [9,10]. Cadmium is considered as phytotoxic as it inhibits plant growth parameters including respiration, photosynthesis and water and nutrient uptake [11]. Further it reduces the rate of new cell production and root growth [12], inhibits the ant oxidative enzymes activities [13] and induces oxidative stress in cells [14]. Moreover, Cd induces changes in plants at all biochemical, physical and genetic levels, which are responsible for the reduction in the growth of plants [15], leaf chlorosis, and leaf or root necrosis [15] and ultimately plant death occurred [16]. Like Cd, Pb is also phytotoxic in nature. It affects the plants photosynthesis by reducing the chlorophyll content. This is because Pb reduces the uptake of chlorophyll-essential elements such as Mg and Fe, affecting chloroplast, changing essential enzymatic processes for photosynthesis and disturbing the closing of stomata [17]. Lead has significant impacts on seedling dry mass, root and shoot length, and weight [18,19]. It adversely affects the process of respiration and metabolism of plants [20]. Soils are contaminated in the environment with a number of heavy metals by natural (weathering and erosion of parent rock material or ore deposits) or artificial (wastewater irrigation, mining activities) sources. The presence of one contaminant can increase or decrease the impacts of others. To date, majority of studies have focused or investigated the effects of a single metal on plant species [21–23]. However, the study of plant to a mixture of heavy metals requires more attention throughout the world.

POLLUTION AND HUMAN HEALTH

Human exposure via the oral pathway (*i.e.*, eating food) is one the major routes for heavy metal exposure [24]. *Spinacia oleracea* is a member of the Caryophyllales order, comprising broad, green and leafy vegetables possessing large surface areas, relatively high growth rates and rather elevated heavy metal absorption rates. Recently, due to these unique characteristics, *S. oleracea* and other members of the Caryophyllales order have been researched in a number of scientific studies to observe their growth and toxicity responses to heavy metal contaminations [25–28]. *Spinacia oleracea* has an imperative position in the order due to large and expanded leafs, fast growth and by being a common part of the human diet. Nevertheless, there is a lack of information regarding growth behavior, metal accumulation, total protein content, fiber characteristics, moisture content and inorganic nutrients response to individual and combined heavy metals with respect to this plant. Therefore, it is necessary to unravel the response of *S. oleracea* to a range of individual and combined heavy metals.

Heavy metal contamination in soils is the cumulative results of intensive smelting and mining activities [29]. For instance, Liu et al. [30] reported that the concentrations of As, Cu, Pb, and Zn in four sampling regions of a typical Chinese smelting assembly greatly exceeded the nation limits of Soil

Environmental Quality Standard. Zhao et al. [31] also reported that the average concentrations of Cd, Cu, Pb, and Zn in mining and smelting–impacted soils from Baiyin district exceeded the background values of Gansu province. Previous studies have shown that about 40–70% of anthropogenic metals were emitted from smelters into the environment, including soils (Pacyna and Pacyna, [32]). It must be emphasized that Pb/Zn mineral deposits are widely distributed in China, and Pb/Zn smelting activities are responsible for the enrichment of heavy metals such as As, Cd, Cu, Pb, and Zn in soils [33].

As a consequence, the environmental impacts of smelter operations on the soils need to be identified and better quantified for the risk management and remediation of smelter–contaminated sites. At present, mineralogy studies have been successfully applied in the areas of pollution identification and risk assessment for soils, dusts, and slags in mining and smelting areas. Bari et al. [34] have revealed that the main As hosting minerals were identified as tooeleite, arsenopyrite, scorodite, and arsenolite. Palmer et al. [35] confirmed that As–rich minerals (arsenic trioxide) were generated from roaster stack emissions. Berryman and Paktunc [36] have indicated that Cr (VI) was closely related to the Ca– and Mg–rich micro–spherules in ferrochrome smelter dusts. Similarly, Ettler et al., [37] found that the high bioaccessibility of V, Pb, and Zn was mainly caused by the solubility of metal–rich Mn oxides, slag glass, hemimorphite, and carbonates. Despite the extensive global studies reported for heavy metal contamination in soils around smelters, limited literatures address the soil mineralogy as the potential control that influences element geochemistry in soils around smelters [38]. In addition, there remained poorly understood about the relationship between the metal hosting phases and the environmental behavior of heavy metals in smelter–impacted soils.

Among the heavy metal ions, e.g., Pb^{2+} and Co^{2+} represent a greater hazard to human health. Acute Pb^{2+} exposure, e.g., can result in newborn brain harm and nervous system, kidney, as well as vascular system disorders. Removing these harmful metals from polluted water is critical for both human health and environmental conservation. Associations between environmental pollutants such as heavy metals and harmful chemicals and adverse human health effects have emerged recently, but the links among environmental metals and respiratory diseases need more studies.

Cadmium is considered as one of the most toxic non-essential heavy metals that can cause negative impacts due to exposure in humans and other living organisms. It is occurring as pollutant in the environment resulting from industrial and agricultural procedures. Primary Cd^{2+} exposure routes include consumption of contaminated food and water, and inhalation from smoking. Studies show that exposure to Cd^{2+} has been linked with kidney, lung, breast, pancreas, prostate, and nasopharynx cancers. Pollution from plastic toys is one of the most important potential routes of exposure to toxic metals such as Cd^{2+} and Pb^{2+}.Regarding Pb^{2+}, the toxic effects of this metal in children have been associated with learning difficulties, attention deficit, low intelligence quotient (IQ), and antisocial behavior. Lead pollution can occur during the food production process through specific migration from packaging into the foods contained. With regard to Cd^{2+}, the main toxicological effects include renal damage, hypertension, emphysema, malformation, and impaired reproductive function. Exposure to Cd^{2+} can take place through occupational activities involving contact with the meta and by ingesting foods contaminated by this metal. Childern exposure to these heavy metals is a worldwide health problem, where children are especially vulnerable both because of their hand-to-mouth behavior and the fact their gastrointestinal and nervous systems are undergoing development.

ENVIRONMENTAL POLLUTION

Chemical pollution arising from heavy metals and metalloids is a growing global concern and a major cause of pollutionrelated diseases in the world today, especially in low- and middle-income countries.

Environmental pollution has become more diversified in recent years as technologies for urbanization is increasingly more advanced. Several environmental factors such as air and water pollutants have been linked to allergic symptoms. For instance, because of industrialization for city development in many countries, polluted soil or tiny particles in the air could result in an even more hazardous environment for people to reside. Aside from the aspects of environmental issues, other newly emerging factors such as the electromagnetic field (EMF) also require further investigation. Issues regarding environmental factors in the influence of immune system have become clinically critical.
The pollution does not stop in the atmosphere, but continues in the hydrosphere. Since a decade ago, global warming has become a concern for health and environment. On the lands, human civilizations thrive as new products along with heat-trapping air pollutants. To solve the heat trap in atmosphere, some countries have used aerosols. The amount of wastes include plastics, heavy metals, alloys, and chemicals (e.g., pesticides from farmland), nuclear materials (e.g., uranium-238 (half-life of 4.47 billion years), hydrogen-3 (half-life of 12.3 years), and carbon-14 (half-life of 5,730 years)), and various other materials are increasing quickly. However, for some of the wastes such as plastics, burning could potentially cause severe influence on the environment and thus could not be fully relied on [39]. Some of the wastes such as heavy metals are not decomposed [40]. To save the lands from being drowned by massive trash, the trash are in fact submerged in water [41]. The atmospheric pollution and the wastes that are kept underwater help breed bacteria, fungi, and other microorganisms that are yet to be discovered. The health concern due to sea pollution arises from the fact that fishes are being consumed worldwide. In some nations, aquatic lives are staple foods; in other nations, people live on the water as a lifestyle. The metals foundbreed bacteria, fungi, and other microorganisms that are yet to be discovered [42]. The health concern due to sea pollution arises from the fact that fishes are being consumed worldwide. In some nations, aquatic lives are staple foods; in other nations, people live on the water as a lifestyle. The metals found in contaminated water such as chromium, mercury, and tin are consumed by fish at the top of food chain [43]. In addition, fish contaminated with heavy metals has been associated with eczema in children [44]. However, one of the most toxic by-products from industrial waste is dioxin which is manufactured during paper bleaching, metal refining, and incineration. According to the US Environmental Protection Agency, dioxin can be found in the drinking water from factories discharge and waste incineration, and has been associated with allergy [45].

HYGIENE IMPROVEMENT

As modernization rapidly grows worldwide, an increased ways of sanitation which results to improved hygiene in personal and public environment. The applications of bactericidal agents, pesticides, as well as angenies have reduced bacterial and parasitic and other microbial infections. Reduction in microbial infections reflects the fact that less microbe's invasion in our immune system. An immune system that experiences reduced or no foreign invasion might be unable to act rapidly against foreign pathogen while being attacked the second time [46]. However, previous study suggested that the gut microbiota is linked to an IgE-mediated food allergy, rather than microbial infection [47].
The adaptive human immune system can be modulated by T helper 1 (Th1) (e.g., fighting against intracellular invaders such as virus and bacteria) or Th2 cells (e.g., triggered by extracellular invaders). The Th1 response activates macrophages to kill the invaders. Th1 cells secrete interferongamma (IFN-γ) to trigger Th1 development and suppress Th2 response. The Th2 is known as a humoral response which produces antibodies to generate isotype switch to fight against foreign pathogens. While Th1 cells secrete IFN-γ, Th2 cells secrete interleukin-10 (IL-10) to trigger Th2 response while inhibiting Th1 development. Since the antibodies are triggered from a humoral response, the immune system can store

a memory of the pathogens that have been encountered in an earlier period, such that identical pathogens can be killed efficiently upon the second encounter.

Evidence has shown that reduced microorganism infection can affect the Th1/Th2 response. If the Th2 response is less triggered, the immune system has reduced ability to fight various pathogens, the immune system is inclined to Th1 response, causing an autoimmune response [48].

CHANGES IN FOOD TREND

Globally, manufacturing of food products has become modernized in many ways. To prolong storage period, or to make foods taste better, foods are chemically processed Preservatives such as antioxidants (e.g., sulfur dioxide, sodium benzoate, and nitrates) are added in meat products and beverages to prevent bacterial infection. The beer and wines, sausages, meat patties for burgers, and even pickled vegetables can be preserved with sulfur dioxide to restrict oxidation. Unfortunately, some people are allergic to the added antioxidant.
To grow foods more efficiently, seedlings are cultivated with herbicides (e.g., 2,4-dichlorophenoxyacetic acid and glyphosate) or pesticides (e.g., rodenticide warfarin, permethrin, and carbaryl). The 2,4-dichlorophenoxyacetic acid (2,4-D) is an active ingredient in herbicides for removing unwanted vegetation. The 2,4-D has been linked to allergic wheezes as it is widely used in public parks, playground, and crops [49]. The pesticide warfarin is widely being used to kill rats. Since the 1970s, even stronger type of warfarin was being developed to overcome rats that were resistant to warfarin which was then called "Superwarfarin."

The molecule brodifacoum is found in the superwarfarin which restricts the function of vitamin K by stabilizing the inactive form of vitamin K, vitamin K epoxide (Card et al., [50]). Furthermore, warfarin was found to induce skin conditions such as dermatitis, urticaria, purpura, hemorrhagic necrosis, and purple toe syndrome (Kwong et al., [51]). In addition to food making, plasticizers are used in various cooking utensils, plastics, which can be dissolved after a period of time and be mixed in the lipids of foods during cooking. Phthalate ester is a plasticizer commonly used for increasing flexibility in plastics and has been associated with atopic dermatitis (Takano and Inoue, [45]). As a result, human consumes various types of molecules apart from the original foods themselves.

RESIDENTIAL ENVIRONMENT

Dust mites are prevalent in residential areas worldwide regardless of geographical locations. The factors that determine mites prevalence are dependent on their need to humidity and to avoid light. The prevalences of dust mites are added on by pets inside the residential areas. In addition to pets, the use of air conditions can stabilize humidity in the living environment. Clinical symptoms for dust miteassociated allergy include wheezing and breathing difficulty. *Dermatophagoides farinae*, *Dermatophagoides pteronyssinus*, *Euroglyphus maynei*, and *Blomia tropicalis* belong to the arachnid class. Components from the mites (e.g., exoskeletons, feaces) can affect skin through proteolytic effect on epithelial cells (Erban et al., [51]). The dust mites can activate the pattern recognition receptors which recognize conserved pathogen associated molecular patterns (PAMPs) to induce innate immune system. Clinical symptoms from dust mites include rhinitis, asthma, and atopic dermatitis.

POTENTIAL PREVENTION AND PUBLIC HEALTH APPROACHES OF HUMAN HEALTH

In prevention of respiratory diseases aroused by air pollution, approaches could be applied in the aspects of environmental policy and personal prevention (Pfeffer et al., [52]). As for personal prevention, avoidance of places with high risk of allergen exposure could be effective in lowering the adverse influence in respiratory system. Moreover, antioxidants could also serve as feasible option as pharmacotherapies for allergen-associated allergic reaction prevention (Pfeffer et al., [52]). For instance, in a previous translational study, vitamin D was reported to play a protective role in the pathogenesis of pollutant-induced inflammation (Pfeffer et al., [53]).

Other substances or medications such as vitamin C, vitamin E, N-acetylcysteine, and sulforaphane could also provide similar effect on antioxidant response (Pfeffer et al. [52]). However, given that there were many risk factors regarding the development of allergic diseases, it is important to consider the effect of confounders while setting allergic diseases as observational outcomes in studies (Paller et al. [54]). Therefore, while considering the preventive effect to pollutant-induced allergic reaction, potential influence of confounding biases should be noticed in studies. To further clarify the interaction between public health and allergens, future studies should focus on the effectiveness of different policy implement and the influence on environmental toxicant-associated pediatric allergic diseases.

As a conclusion, different environmental allergens pose various extent of risk in people. The influence does not only limit in respiratory system but also could potentially lead to systemic influence and changes in the comorbidity status (Gau et al. [55]). Identifying potential interaction between environmental pollution effects and allergy could be protective for future allergic statuses. Clarifying interactions between allergens, pollutions, and microbiomes could be effective in understanding the influence to the severity and onset time of allergic diseases (Burbank et al. [56]). The Global Burden of Disease study showed that air pollution is the fourth leading cause of death and disability [57]. More than 92% of the world's population lives in places with $PM_{2.5}$ concentrations higher than 10 μg/m^3, on the basis of an air quality standard announced by the World Health Organization (WHO) in 2005 (WHO [58, 59])

Accumulative studies have shown that ambient air pollution (including diameter ≤ 10 (PM_{10}) and ≤ 2.5 μm ($PM_{2.5}$), NO_2, ozone (O_3), etc.) is the biggest environmental problem caused by industrialization, increasing the risk of metabolic disorders (such as insulin resistance) and related diseases (such as type 2 diabetes) (Eze et al. [60,61]). In order to improve global air quality, a series of policies have been adopted to improve energy efficiency and reduce energy pollution, but the protective benefits of improving air quality are largely offset by harmful factors caused by aging population, economic polarization, climate change, and other factors (Geng et al. [62]). Meanwhile, health hazards can still be observed in Europe and America where air quality levels reach those of the WHO air quality guideline in 2005 (Strak et al. [63]), suggesting that the health effects of air pollution have been seriously underestimated.

HbA1c (HbA1c is a combination of hemoglobin and glucose with a slow, nonenzymatic reaction in red blood cells; the levels of HbA1c in the blood remain relatively stable for 2–3 months until the red blood cells are metabolized and was normally measured using a high-performance liquid chromatography throughout the blood sample (Riant et al. [64]) is a stable biomarker, which can reflect the average blood glucose level, and this meta-analysis showed that higher levels of HbA1c were significantly associated with the exposure to PM_{10}, $PM_{2.5}$, and NO_2. The subgroup analysis showed that exposure period, sample size, and Body Mass Index were associated with HbA1c in response to air pollution. Public awareness of the health impact of air pollution should be enhanced and the mechanism of the air pollution's effect on metabolism needs further exploration. According to Lauri [65], China's CO_2 effusions increased by

approximately 1.7% per year on average from 2015 to 2020. Irrespective of the economic consequences of the COVID-19 pandemic, the country's CO_2 exudates continued to surge by about 1.5% in 2020..
Nowadays, the world is experiencing carbon emission and climate change which knock down the environment and the economy, so all the countries raise their concern towards green technology innovation to restore the environmental degradation without compromising the growth and development. Environmental regulation plays a crucial role in attaining sustainable development as it improves energy efficiency and reduces pollution emissions.
Exposure to environmental chemicals and metals causing adverse health effects is a major concern leading to numerous conditions including hypertension, cardiovascular disease, sleep disorders, decrease in cognitive function, and allergies (Rahman et al., [66-72]). Exposure to heavy metals has been associated with chronic diseases likely due to oxidative stress and inflammation in the lungs causing tissue destruction [73]. Among occupational respiratory diseases, there has been a shift from exposure to mineral dust such as coal and silica in the 20th century to low-dose allergens and irritants. This has led to a change in respiratory diseases from pneumonoconiosis to occupational asthma. Approximately 15% of all chronic obstructive pulmonary disease (COPD) cases in western societies have been attributed to dust, fumes, vapor, or gas (De Matteis et al. [74]).
In 2018, it was found that pollution was responsible for 9 million deaths worldwide. And it was corresponded to 16% of the total global deaths, and to 21% of all deaths from cardiovascular disease, 26% of deaths due to ischaemic heart disease, 23% of deaths due to stroke, 51% of deaths due to chronic obstructive pulmonary disease, and 43% of deaths due to lung cancer" (Landrigan et al. [75].

HEALTH RISKS: INFECTIOUS DISEASES CLIMATIC CHANGES

Climate change is now becoming a critical public health challenge by increasing exposure to rising temperature, extreme weather, declined air quality, and new pests and pathogens. Actions can be taken to lessen the effects of climate change and to build resilience to reduce the impact on human health.
A multidisciplinary and collaborative effort from the scientific community is needed to establish a comprehensive understanding of these topics. Several studies explored some interesting topics on the relationship between climate change and human health. the direct and indirect effects of carbon emissions on public health; when the average temperature of the year exceeds 17.75°C, an increase in greenhouse gas emissions will have a more significant negative impact on public health. However, the climate change and environmental pollution problems induced by rapid economic development has caused a great threat to our human lives (Watts et al. [76]).

DISPOSAL OF HEALTHCARE WASTE

Globally, disposal of healthcare waste is a key issue of environmental sustainability. The amount of healthcare waste is increasing every day, and it is necessary to adequately dispose of this kind of waste. There are various treatments for healthcare waste disposal, of which incineration of healthcare waste is one of the solutions. Waste generated in healthcare institutions is classified into three main groups: municipal waste, healthcare wasteH and hazardous waste. At the same time, Healthcare waste represents very big challenges for public authorities Healthcare waste raises high levels of concern about public health and the environment. Improper management of healthcare waste can cause significant environmental pollution (Kumar, et al., [77]) and health problems in terms of the spread of diseases caused by viruses and microorganisms and can generate groundwater pollution as a result of continuous

disposal of untreated medical waste in municipal landfills (Lu, et al., [78]). Healthcare waste directly and indirectly affects health and the environment risking more risks (Geetha, et al., [79]).
Healthcare institutions do not have a different approach to healthcare waste which is often mixed with municipal waste (Lee, et al., [80]) which further has consequences for human health and the environment. HCW waste must be disposed of properly. There are different ways of treating healthcare waste such as: incineration, autoclaves, chemical disinfection, disposal in the ground, and deep burial (Geetha, et al., [79]). Process of selection of the best and most effective healthcare waste treatment technology has been the subject of huge research interest (Shi, et al., [81]), especially because of great environmental and financial effects. When choosing treatments for HCW management, it is necessary to provide a reliable and environmentally friendly healthcare waste management system that is, according to Aung, et al. [82], one of the most important topics on the agenda for health institutions and local communities.
However, healthcare waste incinerators have a role in increasing environmental air pollution (Datta, et al., [83]). Sometimes, there are conflicting criteria existing in the selection process; thus, the problem of incinerator selection can be done by applying the method of multi-criteria analysis which is a very useful tool for analyzing complex real-world problems.

ENVIRONMENTAL PERSISTENCE AND HEALTH IMPACTS

Recent research suggests a definite distinction between indoor and outdoor microplastics. However, knowledge of different microplastic kinds and relative exposure via inhalation to humans in outdoor and indoor locations is lacking. Notably, microplastics formed from various plastic types could have distinct features, and the relative health risk varies by environment. For example, outdoor polyethylene goods have recently become more popular. These products are generally of poor structure and recycled material, making them more susceptible to decay.
Particularly in the outdoor environment, the constant exposure to an open-air environment increases the risk of fragmentation and atmospheric mixing and thus facilitates microplastic's availability. It is reasonable to assume that breathable microplastics in indoor outdoor environments are more harmful than inhalable microplastics, whereas exposure to indoor breathable polyethylene - microplastics could be highly hazardous (Figure 2).

Figure 2. Occurrence, human exposure, and risk of microplastics in indoor and outdoor environments (Source: Mehmood et al., [83])

Exposure to these microplastics from the environment may pose a severe health risk to humans (Goodman et al. [84]). The size and shape of airborne microplastics determine their ability to be inhaled and their fate in the human body. Smaller, angular particles, for example, pass through membrane barriers more quickly than those with longer edges or irregular surfaces (Mehmood and Peng, [85]).
Those coarse microplastics (size: ≤ 10 μm) that can reach the human respiratory system and deposit in the upper airways or enter the intrathoracic cavity (≤ 10 μm) are called inhalable particles. On the other hand, fine microplastics (size: ≤ 10 μm) are called breathable particles and can reach and deposit in the deep lung (gas exchange zone in lungs) (Liao et al., [86]).
Mainly microplastics concentration, distribution, and transport are explained by anthropogenic and climatological factors, leaving physicochemical interaction with environmental attributes like ultraviolet (UV) radiation, oxygen, and other pollutants. Likewise, the variability of different microplastics and their corresponding levels in contrasting environments such as indoor and outdoor is also unclear (Mehmood and Peng, [85]). Several studies suggested that atmospheric microplastics contain a substantial concentration of polyethylene (Mehmood and Peng, [85]).
Subsequently, Zhang et al. [87] reviewed the intake of microplastics in humans and reported that the estimated range of daily microplastics intake of the individual is 0 to 5.7×10^3 items ⋅ m^{-3} (Liu et al., [88]), which was higher in indoor ($1.9 \times 10^3 – 1.0 \times 10^5$) than outdoor ($0–3.0 \times 10^7$).
In the case of polyethylene - microplastics, the dominant sources are (1) disintegration of outdoor plastic trash polluting cities (Zhou et al., [89]), (2) wind-driven microplastics mobility and fiber release from drying of cloths (Liu et al. [90]), (3) synthetic material cutting or grinding (Dilara and Briassoulis, [91]), (4) tires, (5) incomplete burning of plastic trash (Liu et al., [92]), (6) cyanobacterial and algal biodegradation, (7) surface water bubble bursting (Sarmah and Rout, [93]), and (8) polyethylene sheets (which are extensively used in farmland for mulching and greenhouse cover) that have been identified as critical agricultural microplastics (Wang et al., [94]).
Since most polyethylene - microplastics) emission sources are linked to the outdoor environment and considering the role of UV radiation in fragment formation of polyethylene, it can be concluded that atmospheric polyethylene - microplastics are mainly released from outdoor polyethylene sources, which is in reasonably good agreement with the findings of Gaston et al., [95]) who reported that polyethylene - microplastics concentration (12.6 ± 8.0 fragments per m^3) were twice in outdoor compared to indoor (5.6 ± 3.2 fragments per m^3) concentration, indicating higher polyethylene - microplastics level in outdoor. Moreover, Liu et al., [92] found that polyethylene - microplastics were higher in the breathing zone than in dust and upper atmosphere (above 83 m). Hence limited use of polyethylene -based products substantially reduces adverse health impacts such as respiratory and lung disorders.
In brief, a detailed health risk assessment of microplastics requires more work and needs to look at a wide range of microplastics for their toxicity and persistence in the breathing zone, relative exposure intensity, and tendency to reach the deeper respiratory tract. Indeed, it consumes a lot of effort and resources, but it is necessary.
Meanwhile, switching to or correcting outdoor use of polyethylene products could cut exposure to atmospheric microplastics by up to 50% in some cities worldwide. In addition, indoor microplastics concentrations are mainly influenced by direct emissions from indoor sources (toys, clothing, mats, curtains, kitchen tools, furniture, mattresses, and so forth) from outdoor sources by ventilation supplies. Besides, indoor environments may also influence transformation processes in pollutants (e.g., inter-zonal transport, mixing, coagulation, re-suspension, and phase change). Therefore, physicochemical changes attributed to microplastics transportation between indoor and outdoor environments may also be important to assess the corresponding changes in microplastics and associated chemical species.

CONCLUSIONS

The current article provided current evidences regarding the association between various pollutants and the potential diseases that could be induced. For people with high skin exposure to air pollutants such as PM2.5, PM10, or sulfur dioxide, potential onset of dermatological allergic events should be alerted. The detailed immunological mechanisms and clinical implications could potentially provide readers with clearer view to the interaction between allergic status and pollutants. For personal prevention, avoidance of contacting potential pollutant and consuming antioxidants could be possible approaches. It is also conculated that critical public health implications because increasing and widespread exposure to environmental heavy metals and their mixtures may be a key contributor to human health conditions. The management of HCW gets increasing importance due to the increasing amount of waste that occurs during the operation of healthcare institutions. There are different types of HCW that can be treated in different ways.

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