ÓBUDA UNIVERSITY
REJTŐ SÁNDOR FACULTY OF LIGHT INDUSTRY AND ENVIRONMENTAL ENGINEERING

ICEEE

14th ICEEE-2023
International Annual Conference

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

Proceedings Book

November 16 – 17, 2023

Obuda University
Budapest, Hungary

The 14th ICEEE-2023 International Annual Conference
Abstract and Proceedings Book
ISBN: 978-963-449-338-9

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2-DAY EVENT Online

International Annual Conference on

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

PROCEEDINGS BOOK

(PROGRAM, ABSTRACT & Full Papers)

Venue:
Obuda University
Budapest, Hungary

Date:
November 16 - 17, 2023

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

ISBN: 978-963-449-338-9

14th ICEEE–2023
International Annual Conference on
"Global Environmental Development & Sustainability: Research, Engineering & Management"

Considering 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 16th – 17th, 2023
RKK – Obuda University
Budapest, Hungary

The 14th ICEEE-2023 International Annual Conference
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Content

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INTRODUCTION

First, I wish to reflect on this year's achievements, and to thank all those who have contributed their time and effort to guarantee the quality of the content published in the Proceedings Book of the 14th ICEEE-2023 Conference.
The high quality of content published in this Proceedings Book of the 14th ICEEE-2023 has been reflected in the most successful of the recent volumes of the ICEEE Conferences since 2010.

The objective of the 14th ICEEE-2023 Conference is to analyse the issues of the global environmental development and sustainability management. The authors tried to answer the questions connecting to the above-mentioned phenomenon based on their experiences of selected global countries.

We have only one planet, and we are using its resources 50% faster than it can take. So, what about the future of the new and next generations! Future of humanity and the planet depends on successful resolution of the interconnected challenges of economic, social, cultural, and environmental sustainability. Our planet has a natural environment, known as 'Ecosystem' which includes all macrobiotas such as humans, plant and animal as well as microbiotas such as microorganisms, and non-living components such as atmosphere, hydrosphere and lithosphere including mountains, glaciers, rocks, galaxy, massive oceans and seas, etc. It also includes natural resources such as water, electric charge, fire, magnetism, and waste, etc.

Environmental problems are one of the most burning global issues. **First**, nature has no boundary. The environmental problems range from local to global. **Second**, Environmental problems relate to diverse issues. **Third**, this characteristic evolves from "cross-border" relations among different social sectors.
In the context of the **three** characteristics mentioned, **three** points can be identified.
First, worldwide is required to have systematic and holistic approaches and solutions covering multi-level governance from local to global. **Second**, worldwide ought to have multidisciplinary knowledge and information covering different social science fields and further connecting social and natural sciences. **Third**, worldwide needs multi-stakeholders' cooperation and collaboration across different social sectors. Sustainable Development Goals are a symbolic example illustrating the importance of these three characteristics of "cross-border." The 36th UNU-IAS Global Seminar offers the participants a valuable opportunity to learn about the contemporary and urgent challenge of the global environment and discuss how worldwide can grapple with it effectively and fairly.

Sustainable Engineering developments are resulting in resource depletion and environmental destruction. Modern technologies used in the engineering and manufacturing industry have a major

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impact on our life in past and present years. Due to the rapid changes in the engineering and manufacturing industry have been drastic changes in the environment. Human population has

increased from 2.6 billion in 1950 to more than 7.5 billion, while the boundaries between people have shifted drastically due to advances in human knowledge, technique process & societal change.
Human society requires protection and monitoring of the environmental quality. Environmental protection & waste management have effects on human health & ecosystems quality, requiring cooperation across different sectors to determine effective responses. By increasing the global population is rising at a staggering rate & demands ever more resources, while the bad management of environmental protection & waste management are making matters worse.

Integrating sustainable development is fully into higher education and research strategies. Higher education and research institutions play a key role in achieving the 2030 Development Agenda and related to the Global Sustainable Development Goals. "Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This time the Conference focus on the issues of "***Global Environmental Development & Sustainability: Research, Engineering & Management***".

This Conference of 14th ICEEE-2023 seeks to generate, accelerate, and mainstream education on sustainable development. To realise this goal, it seeks to:

- accelerate local and regional solutions to sustainability issues through education and training
- re-orient higher education towards education specifically on sustainable development
- conduct capacity building activities that support effective sustainable development education.

Environmental Sustainability decided to restructure itself around six foci:

1. Environmental Change Issues &; Assessments
2. Environmental Change & Global Sustainability
3. Ecosystem Dynamics & Sustainability.
4. Sustainability Governance & Transformation.
5. Sustainability Challenges; and
6. Sustainability Sciences.

The pollutions of environment are widespread across planet Earth and frequently contaminate air, water and soil used for continuing the life on the Earth and distribution for human consumptions, and for irrigating crops.
The modern environmental engineer is dedicated to keeping our air, soil and water clean of pollutants and wastes and promoting good health for human, animal and plant and these days,

protection against radioactive and toxic materials too; they also study the potential impacts of climate change and other environmental factors and pollution on the infrastructure and environmental health.

The terms climate change and global warming are often used interchangeably, but climate change refers to both the rise in global temperatures because of human activities and the many impacts this rise has on the Earth—such as more intense and frequent droughts and storms, melting glaciers and ice sheets, rising sea levels, warming seas (which can cause coral reef bleaching and disrupt the marine food chain), and ocean acidification.

The Global Environment Outreach Centre (GEOC was initially established in 1996 as the Global Environmental Information Centre (GEIC), founded on the recommendation of the Tokyo Conference on Global Environmental Action held in October 1994 to implement Agenda 21, a programme of action for sustainable development worldwide adopted at the UN Conference on Environment and Development (UNCED) held in Rio de Janerio, Brazil in 1992. Tokyo Declaration 1994 called for "the establishment of an integrated database and information network of social groups at the United Nations University in Tokyo, in close cooperation with UN and the Earth Council." On this basis, GEOC supports the involvement of major groups identified in Agenda 21 in the implementation of sustainable development. Focus is especially given to Chapter 27 of Agenda 21, "Strengthening of the role of non-governmental organizations: Partners for sustainable development." Based on this, GEOC conducts research and organizes international conferences in close cooperation with various stakeholders on internationally important agenda including the SDGs, Paris Agreement, Aichi Targets, etc. In doing so, GEOC also plays an important role to support the communications and outreach efforts of UNU-IAS.

Today, people around the world can connect online, and can access and disseminate vast amounts of knowledge and information quickly and easily. At the same time, increasing the availability of information & openness between these institutions has allowed greater understanding of the challenges facing the future of our global society with the increasing rate of the human population up to date.

The purpose of the 14th ICEEE-2023 Conference is to facilitate interactions within the research community to discuss latest developments in this rapidly advancing field and find ways to respond to increasing demands of professionals, communities and industries across the worldwide. It allowed the participants to have different issues addressed on *Sustainable and development of the Environmental Protection* by recognized global experts who are up to date with the latest developments in this field. This scientific meeting gives a great opportunity for students, researchers, industrialists and academic professionals to share latest research results in Environmental sustainability and development, environmental healthy as well as environmental

Protection and Management, network with their peers from around the globe and foster new connections that strengthen research and development activities in field of environmental quality.
Water contamination is a major threat to human health, whether it is from industrial, agricultural, or urban runoff. Coupled with inadequate access to safe water and sanitation services, this leads to impoverishment and diminished opportunities for individuals and communities.
To reduce the levels of water contamination and minimize exposure to these substances that result in morbidity, mortality, and an overall decrease in well-being and livelihoods, there is an urgent need to develop capacity for understanding the linkages between poor water quality and adverse health.

It is essential that water-health professionals understand how to deal with these issues to reduce contaminant levels and human exposure through the management and protection of water sources, water supplies, and water storage.

The Conference provided a platform for all the participants to voice their opinions and concerns as well as promoting discussions for collaborate in future.

The program of the 14th ICEEE-2023 Conference contains 93 presentations (7 plenary lectures, 3 Keynote Speakers, 2 Invited Speakers, 22 poster and 59 lectures) with 5 sessions. The research papers presented in this Proceedings Book volume cover the latest developments and findings in the fields of environmentally sustainable, environmental health, safety, energy, waste management, reclamation and rehabilitation and environmental protection.

Authors from over 28 countries with backgrounds in environmental sustainability, air, water, soil, energy, food, (bio)chemistry, (bio)engineering, (bio)technology and waste management, human and environmental health and environmental monitoring and hailing from the government, industry and academia, have contributed to this Proceedings Book.

The contents of this Proceedings Book will be of interest to scientists, engineers, consultants and government personnel who are responsible for the development and implementation of innovative approaches, techniques and technologies in the environmental industries. It will also benefit academic researchers, as it addresses the latest advances in fundamental research.

Participants in the Conference are contributed to the development of this Proceedings Book agreed on different key conclusions from their deliberations: Information that defines the scope of environmental sustainability, protection, development and waste management due to the human activities, their transport in the environment and the potential exposure of human's wastes is available in some detail. Intervention and prevention approaches for reducing exposures to hazard

materials. Of the methods for identifying sources of contamination, currently comparative risk assessment provides the most reliable tool for ranking risk and making judgments about where significant economic benefits might be realized. Methods and procedures for benefit: cost and environmental health effectiveness: cost analysis exists to support decision making taking economic benefits into account.

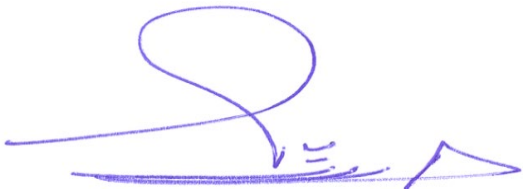
This Proceedings Book describes the latest advances, innovations and applications in the field of environmental protection and waste management as presented by leading researchers, engineers and practitioners at the International Annual Conference on *Global Environmental Development & Sustainability: Research, Engineering & Management (*14th ICEEE-2023), held now in Budapest, Hungary during November 16-17, 2023.

It provides 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 online to in VIII. International Symposium-2024 during May 4 – 5, 2024 and in the 15th ICEEE-2024

16th November 2023



Prof. Dr. Hosam Bayoumi Hamuda
Editor-in-Chief & President of ICEEE
Obuda University
Budapest, Hungary

SCOPE OF THE 14th ICEEE CONFERENCE

The continuous environmental degradation has become a one of the massive threats for environmental sustainability as well as prosperity for the countries across the world irrespective to the stage of economic development. The common problems before the nations are environmental degradation and climate change. However, the root cause of this problem is inevitable which is continuous energy consumption for economic growth. But the energy sector is important for the prosperity of the nation as well as the sustainability of the environment.

In this scenario, it has become a debatable question as to how to sustain the quality of environment without hampering the pace of economic progress. The environmental degradation is not a country-specific issue, and both developed and developing countries are victim of the climate change and serious consequences are expected in the future.
Moreover, demand for natural resources has been increasing which puts more stress on the environment in terms of adverse climate change, loss of biodiversity, soil degradation and increasing levels of overall pollution which ultimately creates a social and economic threat.
Ecological footprint is considered a developed aggregate factor for environmental quality and has been used in literature since the past two decades.
Appropriate use of natural resources which can help to generate environment friendly ecosystem and Sustainable Development Goals that are linked with climate change are determined by the human capital.
Between CO2 emissions and ecological footprint (EF), a debate has emerged regarding which indicator of environmental quality is suitable. Studies have considered CO2 emission as the proxy of environmental quality
In recent years, across all economic indicators, the economic complexity index), technological Innovation and human capital have garnered the attention of policymakers and academician. It is divided into five sectors:

- economic complexity index and environmental quality nexus,
- technological innovation and environmental quality nexus,
- human capital and environmental quality nexus,
- other determinants of environmental quality and
- CO_2 emission vs. ecological footprint.

The world economy has been subjected to enormous ecological strains because of human-induced ecological deterioration, which has resulted in climatic disruptions and poses a risk to all forms of

life on the planet. According to the empirical data, democracy and environmental restrictions have a favourable impact on ecological sustainability by reducing ecological-footprint, whereas economic expansion enhances ecological-footprint.

Over the past few decades, globalization has changed the world, and countries are now interconnected on a social, political, and economic level. In this 21st century, Sustainable Development agenda is an important issue which concentrates on the resources' intergenerational equity through the efficient utilization of natural resources. The idea of Sustainable Development refers to the fact that the future generation is not harmed while the current generation fulfils its need to develop. This idea also reflects the fact that all the resources should be utilized in a sustainable way so that future generations can have access to these resources. Sustainable Development requires the use of renewable energy instead of fossil fuel to tackle environmental degradation, promote economic growth and maintain social balance. It indicates attaining sustainability in its three pillars such as economic, environmental, and social.

If these are not maintained, a country cannot achieve Sustainable Development. Different countries are utilizing different techniques to achieve their sustainable development goals which are to be attained by 2030. The Sustainable Development Goals agenda were adopted in 2015 but still, almost all the developing countries are yet to fulfil their Sustainable Development Goal agenda. The reasons for the failure include poor level of governance and accountability, failure to adopt clean energy technologies as well as increasing population which require overreliance on fossil fuel sources which seem to be still abundant across the globe.

Many questions remain unanswered, even though the above studies do provide some clarity on the role of the indicated factors such as renewable energy, globalization index, population expansion, and democracy on either economic growth or environmental quality. However, how do these factors combinedly affect both the development and ecological impact?

While economic development-driven anthropogenic emissions pose challenges to ecological sustainability, the international life industry sector has appeared as a hot contestant to bring sustainability to the ecological systems across varying development levels.

The world economy has been subjected to enormous ecological strains because of human-induced ecological deterioration, which has resulted in climatic disruptions and poses a risk to all forms of life on the planet.

Climatologists termed it a climate change phenomenon, which causes sudden temperature anomalies and droughts in different geographical regions around the globe.

According to the current scientific consensus, one of the primary factors contributing to climate change is the steady rise in global average temperatures.

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Intergovernmental Panel on Climate Change (IPCC) (2022) holds greenhouse gas emissions (GHGEs) as the main villain in the process of propelling those temperatures. The 27 sessions of the United Nations Climate Change Conference or Conference of the Parties (COP) of the UNFCCC and the COP28 to be held in 2023 formulate strategies and nationally determined plans to comply with under 2°C temperatures objectives. Moreover, United Nations offer critically vital Sustainable Development Goals (SDGs), particularly the climate action targets (i.e., 13-SDG), to fulfill the climate change mitigation aims. The existing body of scientific knowledge focuses on various ecological indicators involving carbon emissions. Our comprehension of sustainable development might be strengthened by focusing on the specialized segments of ecosystems.

Our consumption and production activities are closely connected to the ecological landscape. In this regard, wastewater emissions from households and industries may contribute to the destruction of ecological sustainability. Thus, it would be worth investigating the role of domestic and international socioeconomic activities in determining ecological sustainability in the wake of a dream to realize a nature-friendly future for humans and all other living species.

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Themes of the Conference

The Conference welcomes scientific research, review and discussion papers dealing with environmental sustainability and development issues from such fields as the biological sciences, agriculture, geology, meteorology, energy, food sciences, soil and water sciences, geography, nutrition, physical sciences, economics, law, etc. The Conference particularly welcomes papers that highlight more than one dimension of sustainable development.

The Conference offers a platform for worldwide young and professional researchers and scientists from educational institutions, academia, industry and government to discuss proposals and disseminate results on ***Global Environmental Development & Sustainability***. The formation of lasting productive partnerships between the participants is also an objective of this Conference. This research Conference is open to all in the research and scientific community to discuss the Future Challenges and Directions regarding to the ***Global Environmental Development & Sustainability.***

Topics of the conference are related to the following sessions:

Oral and Poster Presntations

- ***Session (A) Healthcare: Risk & Management***
- ***Session (B) Soil Biology &Agricultural Land Uses***
- ***Session (C) Physicochemical Properties of Water & Sediments***
- ***Session (D) Circular Economy Strategy and Waste Management and Sustainable Energy Research & Applications***
- ***Session (F) Air Pollution and Ecosystems & Landscape***

BIBLIOGRAPHIC INFORMATION

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

CONFERENCE: ORGANIZATION AND COMMITTEES

Principal Organisers:

- *International Council of Environmental Engineering Education (ICEEE), Hungary*
- *Obuda University (OU), Hungary*
- *International Society of Waste Management, Air and Water (ISWMAW), India*
- *Green India Clean Environment Society (GICES), India*
- *Rejto Sandor Faculty of Light Industry and Environmental Engineering (RKK), Hungary*
- *Institute of Environmental Engineering and Natural Sciences (KTI), Hungary*
- *Hungarian Soil Science Society, Soil Biology Department (MTT, TB), Hungary*
- *Sunwo Plc, Energy Expert, Hungary*

The Conference is carrying out under the patronage of:

- *Prof. Dr. Levente KOVÁCS* — Rector, Obuda University
- *Dr. László KOLTAI* — Dean, Rejto Sandor Faculty of Light Industry & Environmental Engineering
- *Dr. Rita BODANE-KENDROVICS* — Vice Dean, Director, Institute of Environmental Engineering & Natural Sciences
- *Dr. Edit CSANÁK* — Vice Dean, Director of the Product Design Institute
- *Prof. Dr. Hosam BAYOUMI HAMUDA* — President, International Council of Environmental Engineering Education
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Contact Address:

Prof. Dr. Hosam E.A.F. Bayoumi Hamuda
President of ICEEE
Chairman of the Conference
Institute of Environmental Engineering & Natural Sciences
RKK, Obuda University
E-mail: bayoumi.hosam@uni-obuda.hu
WhatsApp/viber/messenger: +36-30-390-0813

ACKNOWLEDGMENT

Dear Guests and Colleagues

Thank you very much for your attendance in the 14th ICEEE-2023 International Annual Conference dealing with the Global Environmental Development & Sustainability: Research, Engineering & Management which was in Budapest during November 16 - 17, 2023 online in Budapest at Obuda University, Hungary.

14th ICEEE-2023 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 14th ICEEE-2023 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 lifestyle.

The 14th ICEEE-2023 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 2022, 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 Obuda University, Rejto Sandor 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 14th ICEEE-2023 International Annual Conference on "*Global*

Environmental Development & Sustainability: Research, Engineering & Management" which is going online here in Budapest today November 16th to 17th 2023 in Budapest - Hungary.

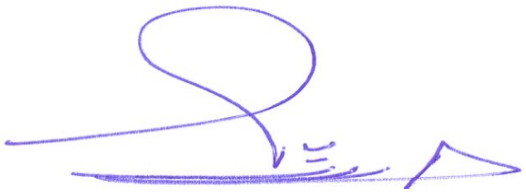
The main goals of the conference are to promote research and developmental activities in Environmental Protection and different fields of Natural Science; and to promote scientific information interchange between researchers, developers, engineers, students, and practitioners working in and around the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



Prof. Dr. Hosam Bayoumi Hamuda
Editor-in-Chief & President ofICEEE
Obuda University
Budapest, Hungary

IMPRESSUM

For the Program, Abstracts and the Proceedings Book of the papers of the 14th ICEEE-2023 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 14th ICEEE-2023 International Annual Conference are published in the Conference Proceedings Book with the ISBN 978-963-449-338-9 . in CD-ROM format and online (electronic) on 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, Obuda University, Budapest, Hungary.
– Publication year of the Proceedings is 2023.
– Important Website: www.iceee.hu
– The Conference is organised in the framework of the Hungarian Scientific Season (Hungarian Scientific Festival).

November 2023.

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

Awards of Conference
14th ICEEE-2023

14th ICEEE-2023 Excellence Awards for best papers: 14th ICEEE-2023 Excellence Awards for best papers and presentation was instituted sine the year 2010 and have been given to the researchers for significant papers, to municipalities, temples, industries for their significant achievement in environmental management and sustainable development as well as the protection of the environment from pollution. The awards of the 12th ICEEE-2021 Annual International Conference were given to the most outstanding researchers of the conference under below four categories.

SELECTION PROCESS

CRITERIA FOR THE SESSION'S BEST PRESENTATION AWARD

Every presentation was evaluated by two evaluators and 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 and the final decision was given by the Conference Chair. Below criteria were taken into consideration for this award and 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%)**

CRITERIA FOR THE BEST POSTER PRESENTATION AWARD

Every poster presentation is evaluated by a special evaluator based on below criteria and 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 and Abstract (15%)**
- **Content knowledge and organization (20%)**
- **Poster Design and Overall Visual Appeal (10%)**
- **Verbal Interaction (15%)**

CRITERIA FOR THE OVERALL BEST PRESENTATION AWARD AND 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 Conference 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%)**

AWARDS CEREMONY

Congratulations to all our 14th ICEEE-2023 International Annual Conference Awards winners

All the winners were presented with their awards during the awarding ceremony which was held on the second day of the conference along with the conference conclusion.

1. THE OVERALL BEST PRESENTATION AWARD

1. ***Smaine CHELLAT, Abderrahmane ABDERRAHMANE, Abdelmalek SAIDI, Messaoud HACINI, Ahcene BOUREFIS***
   A CASE STUDY OF NUCLEAR CONTAMINATION AND AGRICULTURAL ADAPTATION IN THE SAHARA DESERT: THE ENVIRONMENTAL CHALLENGES OF REGGANE

2. ***Rahul KUMAR***
   TEMPORAL AND SPATIAL IMPACT OF LOCKDOWN DURING COVID-19 ON AIR QUALITY INDEX IN HARYANA, INDIA

3. ***Sana AHMED, Sufia ZAMAN, Abhijit MITRA***
   NEAR SURFACE CARBON DIOXIDE LEVEL AND CARBON STORAGE POTENTIAL OF THE DOMINANT TREES OF KOLKATA, INDIA

4. ***Viktor SEBESTYÉN***
   SUSTAINABILITY EFFORTS AT THE UNIVERSITY OF PANNONIA

5. ***Afolabi, Oluwole OKIKIJESU***
   AWARENESS AND UPTAKE OF SUSTAINABLE LAND MANAGEMENT PRACTICES BY FARMERS IN ONA-ARA LOCAL GOVERNMENT AREA, OYO STATE, NIGERIA

6. *Tamás CSISZÉR*
QUALITY SERVICE - HOW QUALITOLOGY SERVES ENVIRONMENTAL PROTECTION

7. *Sushil AHLAWAT, Reena CHAUHAN*
STUDY OF READYMIX FORMULATION OF TEBUCONAZOLE 50% + TRIFLOXYSTROBIN 25% WG IN SOIL AT HARVEST TIME

8. *Cristina Gabriela MITINCU*
ENERGY TRANSITION IN EUROPEAN UNION. CHALLENGES AND OPPORTUNITIES TO ACHIEVE SUSTAINABLE DEVELOPMENT GOALS (SDGS)

9. *Abdelfettah GHERIB, Nabil CHARCHAR, Oussama BELAHMADI, Ala ABDESSAMED, Inês DOMINGUES*
DEVELOPMENTAL, BEHAVIORAL AND BIOCHEMICAL MARKERS OF ANTHRACENE AND PB2+ EXPOSURE TO ZEBRAFISH ELEUTHERO-EMBRYOS

2. THE BEST YOUNG RESEARCHERS AND STUDENT PRESENTATION AWARD

The best presentation award was given to the most outstanding presentation presented by the young researchers and participants who have registered under the Ph.D. student. The winners were:

10. *Rainiel Bryan V. DOMASIAN, Christian Paul P. dela CRUZ, Ofelia B. MANINGAS, Karen A. MANAIG, Victoria E. TAMBAN*
ASSESSMENT OF HEAVY METAL POLLUTION AND WATER QUALITY ON HANDWATER PUMPS TOWARDS WATER SAFETY AND SECURITY

11. *Zunaira TEHSEEN*
PLANT ALLEVIATES CARBON TETRACHLORIDE-INDUCED NEPHROTOXICITY IN RATS

12. *Kamelia Hesni BENOTMANE, Mehdi BOUKHEROUFA, Salsabil ABBASSI, Feriel Sakraoui-BOUKHEROUFA*
BIO-MONITORING OF WILD BOAR (SUS SCROFA) IN URBAN AND PERI-URBAN AREAS URBAN AREAS OF THE CITY OF ANNABA

13. *Ledianë DURMISHI*
FOSTERING SUSTAINABLE FARMING PRACTICES AMIDST CLIMATE CHANGE CHALLENGES FOR FARMERS

14. *Nathalie PANO, Nada NEHME, Jalal HALWANI, Konstantinos KARANTININIS, Lama El CHAMI*
LEBANESE CONSUMERS BEHAVIOR AND EFFECT ON FOOD WASTE

15. *Bethelhem GEBREMEDHIN GEBREEGZIABHER*
ECOSYSTEM BASED FLOOD MITIGATION STRATEGY AND LIVELIHOOD IMPROVEMENT FOR HUMAN SETTLEMENTS ON THE HILLY AREAS OF ADDIS ABABA; IN THE CASE OF KECHENE MEKETEYA DISTRIC

16. *SIMRET AREGA, ALAZAR ASSEFA*
MICRO-WATERSHED LEVEL BLUE-GREEN INFRASTRUCTURE AS FLOOD CONTROL SOLUTION AT LOWER KEBENA RIVER WATERSHED

17. *Pooja, Sushil AHLAWAT, Reena CHAUHAN, Ankisha, Nisha KUMAR*
RESIDUE, DISSIPATION DYNAMICS, DECONTAMINATION, AND RISK ASSESSMENT OF CHLORANTRANILIPROLE IN OKRA AND SOIL USING GC-MS/MS

18. *ANKISHA, Sridevi TALLAPRAGADA, R. K. CHUGH, POOJA, Pooja POOJ*
ROLE OF ARBUSCULAR MYCORRHIZAL FUNGI IN ALLEVIATING HEAVY METAL STRESS: A REVIEW

19. *Ishrat GULL*
CHANGES IN SOIL PROPERTIES UNDER FRUIT TREE SPECIES IN SEMI-ARID ZONE OF INDIA

20. *Sara MOGHNIE*
EVALUATION OF BURIAL BEHAVIOR OF GEOMATERIALS IN PEATLANDS USING THE PPLICATION OF UNSUPERVISED LEARNING TOOL

21. *Matavya BISHNOI, Bhanu Singh PANWAR*
HIDDEN HISTORY OF ENVIRONMENTAL PHILOSOPHER-GURU JAMBHESWER?

.
Budapest, 22nd of November 2023.

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

The certificates will be sent to all the awardees in email by 17th of December 2023. In case of non-receipt of the certificate, please write to us with your contact details to: Bayoumi.hosam@uni-obuda.hu

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

Modes of Conference Attendance & Presentation: Online

14th ICEEE–2023
International Annual Conference

November 16 – 17, 2023

RKK – Obuda University
Budapest, Hungary

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Conference
Scientific PROGRAM

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Budapest – Hungary
with
Workshop Special Session:
Environmental Health and Climatic Change
(How humanity can solve climate change, alleviate poverty, and save biodiversity)

ISBN: 978-963-449-338-9

Information about the Conference

- The technical programme of the Conference will consist of plenary, keynote, invited lectures, contributory papers, discussions with senior scientists and poster presentation and at the end, there will be a Workshop.
- Conference Language: **English**
- The Conference is **Free of Charge**
- The ICEEE-2023 Conference will be held through **Microsoft Teams**.
- The time of the Conference is related to the **Hungarian time**.

Online (Microsoft Teams)

Time of Presentations

Presentation Type:	Total Allotted Time:
Plenary speaker	25 min
– Keynote speaker	15 min
– Invited speaker	10 min
– Poster	5 min

Conference:
General Scientific Program

16. 11. 2023 (Thursday)

Registration online **(08:00 am – 09:00 am)**

09:00 am – 09:30 am

Opening Ceremony

Plenary Session	**(09:30 am – 11:30 am)**
Lunch Break	**(11:30 am – 12:15 pm)**

For all sessions

Oral Scientific Sessions	**(12:15 pm – 14:30 pm)**
Poster Session	**(14:30 pm – 16:20 pm)**

17 11. 2023 (Friday)

Continuation of the presentation for all sessions

Registration online	**(08:00 am – 09:00 am)**
Plenary, Keynote & invited Session	**(09:00 am – 11:20 am)**

11:20 pm – 12:00 pm

Workshop Special Session:

Environmental Health and Climatic Change

(How humanity can solve climate change, alleviate poverty, and save biodiversity)

12:00 pm – 12:15 pm

Closing ceremony

ISBN: 978-963-449-338-9

Details of Frist Day

16th of November 2023 (Thursday)

09:00 am – 09:30 am

Opening Ceremony

President, International Council of Environmental Engineering Education, Conference Chair

– *Prof. Dr. Hosam BAYOUMI HAMUDA*

– *Dr. Rita BODÁNÉ-KENDROVICS*

Vice Dean, Director, Institute of Environmental Engineering & Natural Sciences

– *Dr. Edit CSANÁK*

Vice Dean, Director of the Product Design Institute

– *Dr. László KOLTAI*

Dean, Rejto Sandor Faculty of Light Industry & Environmental Engineering

– *Prof. Dr. László GULACSI*

– *Prof. Dr. Sadhan Kumar Ghosh*

Vice-Rector, Obuda University

Honour guest of the Conference

ISBN: 978-963-449-338-9

Frist Day
Details of sessions of the Conference

Plenary Session (09:30 am – 11:30 am)
16th of November 2023 (Thursday)

CHAIR: RITA BODÁNÉ-KENDROVICS

09:30 – 10:00

SANNIDHYA KUMAR GHOSH[1], SADHAN KUMAR GHOSH[2]

[1]Structural Project Engineer, DCI Engineers, Denver, USA, [2]Sustainable Development & Circular Economy Research Centre, International Society of Waste Management, Air and Water (ISWMAW), Kolkata, India

Decarbonisation in Construction Sectors towards environmental Sustainability

10:00 – 10:30

BHANU. S. PANWAR[1], VIKASH AHLAWAT[2], MANTAVYA BISHNOI[3], OLHA. A. KHLIESTOVA[4], KATARZYNA EWA BUCZKOWSKA[5]

[1,2]Department of Soil Sciences, [3]Department of Food Science, CCS Haryana Agricultural University, Hisar, India, [4]Department of Material Science, Faculty of Mechanical Engineering, Technical University of Liberec, Liberec, Czech Republic, [5]Department of Materials Technology and Production Systems, Faculty of Mechanical Engineering Lodz University of Technology, Poland

Nickel: Beneficial or toxic element in soil-plant?

10:30 – 11:00

SÁNDOR JÓZSEF ZSARNÓCZAI

Obuda University, Rejto Sandor Faculty of Light Industry and Environmental Engineering Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary

Carbon dioxide emissions in some developed and developing economies between 1990-2021

11:00 – 11:30

LYUDMYLA SYMOCHKO[1,2,3], HOSAM E.A.F. BAYOUMI HAMUDA[4]

[1]University of Coimbra, Coimbra, Portugal, [2]Uzhhorod National University, Uzhhorod, Ukraine, [3]Institute of Agroecology and Environmental Management, NAAS, Kyiv, Ukraine, [4]Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary

Effects of pharmaceutical contamination in the environment: challenges and ways of solutions

ISBN: 978-963-449-338-9

For all sessions

Session (A)
Healthcare: Risk & Management
(12:15 pm – 14:35 pm)

CHAIR: **HOSAM E.A.F. BAYOUMI HAMUDA**

KEYNOTE SPEAKERS:

12:15 – 12:30 **RAINIEL BRYAN V. DOMASIAN, CHRISTIAN PAUL P. DELA CRUZ, OFELIA B. MANINGAS, KAREN A. MANAIG, VICTORIA E. TAMBAN**

Laguna State Polytechnic University, Los Banos Campus, Philippines

Assessment of heavy metal pollution and water quality on handwater pumps towards water safety and security

12:30 – 12:45 **RASHMI RATHORE**

Working online globally, and physically in different parts of country, Sikkim, India

The fast fashion pandemic-contaminating the global environment

INIVTED SPEAKERS

12:45 – 12:55 **FILIPPOS SEWUNET ADMASU**

KLATASDS-MOE, School of Statistics, East China Normal University, Shanghai, China

Identifying key factors affecting neonatal mortality in Ethiopia using machine learning models

12:55– 13:05 **ZUNAIRA TEHSEEN**

Quaid-e-Azam University, Islamabad, Pakistan

Plant alleviates carbon tetrachloride-induced nephrotoxicity in rats

13:05 – 13:15 **ZUNAIRA TEHSEEN**

Quaid-e-Azam University, Islamabad, Pakistan

Attenuation of carbon tetrachloride induced nephrotoxicity in rats by *Indigofera cordifolia*

13:15– 13:25 **SAID NAWAZ KHAN**

Hazara University, Abbottabad, Pakistan

Coprological study for identification of GI Helminth parasite in domestic ruminants

13:25 – 13:45 **KUNAL JOON**

Noida International Institute of Medical Sciences, Greater Noida, India

Virus is living and its treatment

13:45 – 13:55 **KUNAL JOON**

Noida International Institute of Medical Sciences, Greater Noida, India

How do cell determine at what size to grow

13:55– 14:05 **KAMELIA HESNI BENOTMANE, MEHDI BOUKHEROUFA, SALSABIL ABBASSI, FERIEL SAKRAOUI-BOUKHEROUFA**

University of Badji Mokhtar, Annaba, Algeria

Bio-Monitoring of wild boar (SUS SCROFA) in urban and peri-urban areas of the city of Annaba

14:05 – 14:15 TANUSHREE SARKAR, SUMAN BAKSHI

Nuclear Agriculture & Biotechnology Division, Bhabha Atomic Research Centre, Mumbai, India.

Insight into the ammonium transporter (AMT) family genes in pearl millet: The key players for enhancing nitrogen use efficiency to ensure food security

14:15 – 14:25 JYOTI SIHAG, POONAM YADAV

Department of Human Development and Family Studies, I. C. College of Community Science, CCS Haryana Agricultural University, India

Traditional healthy foods and practices during pregnancy in India

14:25 – 14:35 HOSAM E.A.F. BAYOUMI HAMUDA[1], LYUDMYLA SYMOCHKO[2,3,4]

[1]Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary, [21]University of Coimbra, Coimbra, Portugal, [3]Uzhhorod National University, Uzhhorod, Ukraine, [4]Institute of Agroecology and Environmental Management, NAAS, Kyiv, Ukraine

Probiotic gut microbiomes and mental health disorders

ISBN: 978-963-449-338-9

Session (B)
Soil Biology & Agricultural Land Uses
(12:15 pm – 13:40 pm)

CHAIR: **BORBÁLA BIRÓ**

KEYNOTE SPEAKER:

12:15 – 12:30 **ÁGNES BÁLINT[1], GLÓRIA BERNVALNER[2], VIKTÓRIA KALCSÓ[2], XUECHU WANG[3], CSABA MÉSZÁROS[4]**

[1]Institute of Environmental Engineering and Natural Sciences, Obuda University, Budapest, Hungary, [2]Szent István University, Gödöllő, [3]Doctoral School of Environmental Sciences, Hungarian University of Agricultural and Life Sciences, Gödöllő, Hungary, [4]Institute of Mathematics and Basic Science, Hungarian University of Agricultural and Life Sciences, Gödöllő, Hungary

Effect of acid rain and heavy metal pollution on garden cress (*Lepidium sativum*)

INVITED SPEAKERS:

12:30 – 12:40 **ISHRAT GULL**

Department of Soil Science, Chaudary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

Importance of fruit tree species in maintaining and improving soil organic matter under semi-arid conditions of India

ORAL PRESNTATIONS

12:40 – 12:50 ZOUBIR BELHIMER, AZZEDINE BOUZENOUNE, ABDELHAKIM BOUCHAIR, OUMEIMA BENMEBAREK

Geological Engineering Laboratory, Faculty of Natural and Life Sciences, University of Jijel, Jijel, Algeria

Microscopic and mineralogical characterization of the polymetallic mineralizations (FE-CU-BA) of the BENI FELKAÏ MASSIF (Eastern Babors, Northeastern Algeria)

12:50 – 13:00 OLUWOLE OKIKIJESU AFOLABI

Federal University of Technology, Akure, Nigeria

Awareness and uptake of sustainable land management practices by farmers in ONA-ARA local government area, Oyo State, Nigeria

13:00 – 13:10 LEDIANË DURMISHI

Doctoral School of Economics and Regional Sciences, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary

Fostering sustainable farming practices amidst climate change challenges for farmers

13:10 – 13:20 HOSAM E.A.F. BAYOUMI HAMUDA[1], BORBÁLA BIRÓ[2]

[1]Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary, [2]Hungarian University of Agriculture & Life Sciences, Budapest, Hungary

Role of soil fauna as indicators of sustainable agroecosystem management

13:20 – 13:30 HOSAM E.A.F. BAYOUMI HAMUDA

[1]Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary

Impacts of pesticides on food safety and environmental toxicology

13:30 – 13:40 **ZOLTÁN NAÁR**

Tokaj-Hegyalja University, Sárospatak, Hungary

Sensitivity of *Trichoderma* population to toxic metal pollution in soils

13:30 – 13:40 **SHWETA[1], SRIDEVI TALLAPRAGADA[1], NITA LAKRA[2], VINOD GOYAL[1], ANITA KUMARI[1]**

[1]*Department of Botany and Plant Physiology, College of Basic Sciences and Humanities, Chaudhary Charan Singh Haryana Agricultural University, Hisar-125004, Haryana, India*

[2]*Department of Molecular Biology & Biotechnology, Chaudhary Charan Singh Haryana Agricultural University, Hisar-125004, Haryana, India*

Screening of different varieties of *Brassica juncea* under slat stress condition

ISBN: 978-963-449-338-9

Session (C)
Physicochemical Properties of Water & Sediments
(12:15 pm – 13:05 pm)

CHAIR: **CSABA MÉSZÁROS**

12:15 – 12:25 **RUQAYAH ALI GRMASHA[1,2,3,4], OSAMAH J. AL-SAREJI[1,2,4], MÓNIKA MEICZINGER[1], CSILLA STENGER-KOVÁCS[3,5], KHALID S. HASHIM[4,7]**

[1]Sustainability Solutions Research Lab, Faculty of Engineering, University of Pannonia, Veszprém, Hungary, [2]Environmental Research and Studies Center, University of Babylon, Babylon, Al-Hillah, Iraq, [3]University of Pannonia, Faculty of Engineering, Center for Natural Science, Research Group of Limnology, Veszprem, Hungary, [4]The School of Civil and Environmental Engineering graduate, University of New South Wales, Sydney, Kensington NSW 2052, Australia, [5]ELKH-PE Limnoecology Research Group, Veszprém, Hungary, [6]School of Civil Engineering and Built Environment, Liverpool John Moores University, UK, [7]Department of Environmental Engineering, College of Engineering, University of Babylon, Babylon, Al-Hillah, Iraq

Sustainable system of MWCNTS for multifunctional PAHS and PHACS removal from different water matrices

12:25 – 12:35 **OSAMAH J. AL-SAREJI[1,2], MÓNIKA MEICZINGER[1], RUQAYAH ALI GRMASHA[1,2,3], VIOLA SOMOGYI[1], ENDRE DOMOKOS[1], KHALID S. HASHIM[4,5]**

[1]Sustainability Solutions Research Lab, Faculty of Engineering, University of Pannonia, Veszprém, Hungary, [2]Environmental Research and Studies Center, University of Babylon, Babylon, Iraq, [3]Research Group of Limnology, Center for Natural Science, Faculty of Engineering, University of Pannonia, Veszprém, Hungary, [4]School of Civil Engineering and Built Environment, Liverpool John Moores University, Liverpoo, UK, [5]Department of Environmental Engineering, College of Engineering, University of Babylon, Babylon, Iraq

Highly efficient removal of pharmaceuticals from water by laccase immobilized on orange peels

ISBN: 978-963-449-338-9

12:35 – 12:45 **TAMÁS KLOKNICER**

Óbuda University, Inno-Water Zrt, Budapest

Monitoring biofilm parameters on MBBR technologies with light microscope and image processing

12:45 – 12:55 **SEIFU KEBEDE DEBELA**

Jimma Institute of Technology, Jimma University, Jimma, Ethiopia

Prioritization of sediment yield at sub-watershed level using SWAT model in Finca'aa watershed, Abay Basin, Ethiopia

12:55 – 13:05 **MAHMOUD TOUAHRI, BOUALEM BOUSELSAL**

Laboratory of Underground Oil, Gas and Aquifer Reservoirs, Department of Earth and Universe Sciences, University of Kasdi Merbah, Route de Ghardaia, Ouargla, Algeria.

Hydrochemical analysis of groundwater in the Hassi Messaoud region

ISBN: 978-963-449-338-9

Session (D)
Circular Economy Strategy and Waste Management and Sustainable, Energy Research & Applications
(12:15 pm – 14:15 pm)

CHAIR: **SÁNDOR J. ZSARNÓCZAI**

12:15 – 12:25 **CHAOJUN YANG[1], AMBERBIR WONDIMU[1], GETACHEW ALEMU[2], WANG AO[1]**

[1]School of Mechanical Engineering, Jiangsu University, Zhenjiang, China, [2]School of Energy and Power Engineering, Jiangsu University, Zhenjiang, China

Numerical investigation on simplified magnetic gear for green energy application

12:25 – 12:35 **IZHAR ULLAH**

Hazara University Mansehra, Pakistan

Biosystematics and Geospatial Distribution of Spider (*Arachnida: Araneae*) Fauna in District Battagram

12:35 – 12:45 **NYÁRY GÁBOR**

National University of Public Service, Budapest, Hungary

Green cyber: the convergence of sustainability and cybersecurity in the circular economy

12:45 – 12:55 **TAMÁS CSISZÉR**

Obuda University, Budapest, Hungary

Quality Service - How Qualitology Serves Environmental Protection

12:55 – 13:05 **RENALDA BERNARD MLAY**

Renie Fresh. Arusha, Tanzania

Capsicum value chain analysis in Tanzania

13:05 – 13:15 **SÁNDOR J. ZSARNÓCZAI, RITA BODÁNÉ KENDROVICS**

Obuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Science, Budapest, Hungary

Regional development in regions of France in 2020s

13:15 – 13:25 **SÁNDOR J. ZSARNÓCZAI, KRISZTINA DEMÉNY**

Obuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Science, Budapest, Hungary

Economic conditions in regions of Italy in 2020s

13:25 – 13:35 **NATHALIE PANO[1], NADA NEHME[2], JALAL HALWANI[3], KONSTANTINOS KARANTININIS[3,4], LAMA EL CHAMI[2]**

[1]Lebanese University, Doctoral School of Science and Technology, Hadath, Lebanon, [2]Lebanese University, Faculty of Agricultural Engineering and Veterinary Medicine, Dekwene, Lebanon, [3]Lebanese University, Water & Environment Science Lab, Tripoli, Lebanon, [4]Swedish University of Agricultural Sciences, Alnarp, Sweden

Lebanese consumers behavior and effect on Food waste

13:35 – 13:45 **YEMANE G. ASFAHA, FELEKE ZEWGE, TEKETEL YOHANNES, SHIMELIS KEBEDE**

Adama Science and Technology University, Addis Ababa, Ethiopia

Dual-Stage solar powered electrocoagulation and electrooxidation process for textile wastewater treatment

13:45 – 13:55 **GBOLADE EVELYN AGBOMUSERIN, S.D.Y. ALFRED, FELICIA ITUNU WOLE-ALO**

Federal University of Technology, Akure, Nigeria

Analysis of rural household heads attitudes towards family planning methods in Ondo State, Nigeria

13:55 – 14: 05 **FELICIA ITUNU WOLE-ALO, O.O. FASINA, GBOLADE EVELYN AGBOMUSERIN**

Federal University of Technology, Akure, Nigeria

Access to modern energy cooking services and energy poverty among rural household in Ondo State, Nigeria

14:05 – 14:15 **ABDUSSALAM ASHO UR KHALIF[1], FERENC LIGETVÁRI[2]**

[1]Doctoral School of Economic and Regional Sciences, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary, [2]Debrecen University, Debrecen, Hungary

Some econometric analysis of main gas emissions from different economic sectors in the past two decades: a case study in Hungary

Session (E)
Air Pollution and Ecosystems & Landscape
(12:15 pm – 14:40 pm)

CHAIR: **ÁGNES BÁLINT**

KEYNOTE SPEAKERS:

12:15 – 12:30 **RAHUL KUMAR**

College of Agriculture, CCS Haryana Agricultural University, Rewari, Haryana, India

Temporal and spatial impact of lockdown during COVID-19 on air quality index in Haryana, India

12:30 – 12:45 **SANA AHMED[1], SUFIA ZAMAN[1], ABHIJIT MITRA[2]**

[1]Department of Oceanography, Techno India University, West Bengal, EM 4 Salt Lake, Sector V, Kolkata, India, [2]Department of Marine Science, University of Calcutta, Kolkata, India

Near surface carbon dioxide level and carbon storage potential of the dominant trees of Kolkata, India

12:45 – 13:00 **BELKASIM KHAMEISS[1,2], AHMED MUFTAH[2], MENAM ABDELGALIL[3]**

[1]Kansas Geological Survey, Lawrence, KS, United States, [2]Faculty of Science, Earth Sciences Department, University of Benghazi, Benghazi, Libya, [3]Department of Geology, University of Tubroq, Libya.

Scleractinian corals from the Benghazi formation in as Sahabi area and from Al jaghbub formation in Tubroq area, Libya: implications for coral diversity and biogeography

INVITED SPEAKERS:

13:00 – 13:10 PAWEŁ ŚWISŁOWSKI, MAŁGORZATA RAJFUR

University of Opole, Opole, Poland

The use of mosses in active biomonitoring in urban areas

ORAL PRESNTATIONS

13:10 – 13:20 SLIMANI CHAHID, FARHAOUI MOHAMED

Law School, ESSOR Lab, Sidi Mohamed Ben Abdellah University, Fez, Morocco

Role of the environment on real estate valorisation

13:20 – 13:30 BETHELHEM GEBREMEDHIN GEBREEGZIABHER

Ambo University, Ambo, Ethiopia

Ecosystem based flood mitigation strategy and livelihood improvement for human settlements on the hilly areas of Addis Ababa; in the case of Kechene Meketeya district

13:30 – 13:40 BETHELHEM GEBREMEDHIN GEBREEGZIABHER

Ambo University, Ambo, Ethiopia

Identification, mapping and assessment of hillside flood vulnerability; In the case of Kechene Meketeya distric, Addis Ababa

13:40 – 13:50 SIMRET AREGA, ALAZAR ASSEFA

Ambo university, Ambo, Ethiopia

Characterization, classification and quantification of runoff, in the case of lower Kebena River watershed, Addis Ababa, Ethiopia

13:50 – 14:00 **SIMRET AREGA, ALAZAR ASSEFA**

Ambo university, Ambo, Ethiopia

Micro-watershed level blue-green infrastructure as flood control solution at lower Kebena River watershed

14:00 – 14:10 **NORBERT BERECZ**

Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary

Hungary on green path

14:10 – 14:20 **YANINA L. ROMERO[1], JANETTE BESSEMBINDER[2], NICK C. VAN DE GIESEN[3], FRANS H.M. VAN DE VEN[4]**

[1]Beuningen, The Netherlands, [2]Climate Services, Royal Netherlands, Meteorological Institute, De Bilt, The Netherlands, [3]Water Management of the Faculty of Civil Engineering and Geosciences, Delft University of Technology, Delft, The Netherlands, [4]Water Management of the Faculty of Civil Engineering and Geosciences, Delft University of Technology, Delft, The Netherlands

A relation between extreme daily precipitation and extreme short-term precipitation

14:20 – 14:30 **RUDOLF SZABÓ[1], LÓRÁNT SZABÓ[2]**

[1]Rejtő Sándor Foundation, Budapest, Hungary, [2]Institute of Environmental Engineering and Natural Sciences, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Óbuda University, Budapest, Hungary

World's lightweight future

14:30 – 14:40 **ZOLTÁN BORSI, TIBOR TELEKESI, KATALIN A. FŐGLEIN**

KTI Institute for Transport Sciences and Logistics Nonprofit Ltd, Budapest, Hungary

Development of particle measurement technology at periodical technical inspection (PTI)

Poster Session

(14:30 pm – 16:30 pm)

MODERATOR: **HOSAM E.A.F. BAYOUMI HAMUDA**

14:30 – 14:35 **POOJA, SUSHIL AHLAWAT, REENA CHAUHAN, POOJA, ANKISHA, NISHA KUMARI**

Choudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

Residue, dissipation dynamics, decontamination, and risk assessment of chlorantraniliprole in okra and soil using GC-MS/MS

14:35 – 14:40 **SUSHIL AHLAWAT, REENA CHAUHAN**

Department of Entomology, College of Agriculture, CCS Haryana Agricultural University, Hisar, India

Study of readymix formulation of tebuconazole 50% + trifloxystrobin 25% wg in soil at harvest time

14:40 – 14:45 **ANKISHA, SRIDEVI TALLAPRAGADA, R. K. CHUGH, POOJA, POOJA POOJA**

Department of Botany and Plant Physiology, Choudhary Charan Singh Haryana Agricultural University, Hisar, India

Role of arbuscular mycorrhizal fungi in alleviating heavy metal stress: a review

14:45 – 14:50 **ISHRAT GULL**

Department of Soil Science, Chaudary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

Changes in soil properties under fruit tree species in semi-arid zone of India

14:50 – 14:55 **SHABNAM MORADI, MOHAMADREZA SEIFI, HESHMAT OMIDI**

Agriculture Department, Arak, Iran

The effect of phosphorus, potassium, and humic acid fertilizers on some growth, functional, and physiological traits of chicory (*Cichorium intybus* L.) under climatic conditions in Arak

14:55 – 15:00 **SARA MOGHNIE**

American University of the Middle East, Kuwait, Kuwait

Evaluation of burial behavior of geomaterials in peatlands using the application of unsupervised learning tool

15:00 – 15:05 **CRISTINA GABRIELA MITINCU**

University of Bucharest, Bucharest, Romania

Energy transition in European Union: Challenges and opportunities to achieve sustainable development goals (SDGS)

15:05 – 15:10 **CSABA CENTERI, ALEXANDRA KRUSE, PIERRE-FRANCOIS TOULZE**

Department of Nature Conservation and Landscape Management, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary

Transhumance as sustainable food resource

15:10 – 15:15 **CSABA CENTERI, VIKTÓRIA VONA, MÁRTON VONA, ZSOLT BIRÓ**

Department of Nature Conservation and Landscape Management, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary

New data on moles' impacts on agricultural soils

15:15– 15:20 **WELELA MEKA KEDIR**

Mattu University, Mattu, Oromia, Ethiopia

Biopolymer for active biodegradable food packaging

ISBN: 978-963-449-338-9

15:20 – 15:25 **ABDELFETTAH GHERIB, NABIL CHARCHAR, OUSSAMA BELAHMADI, ALA ABDESSAMED, INÊS DOMINGUES**

Laboratory of Ecotoxicology and Environmental Biomonitoring, Biotechnology Research Centre, Constantine, Algeria; Laboratory of Biology and Environment, Department of Biology and Plant Ecology, University of Brothers Mentouri Constantine 1, Constantine, Algeria; Department of Biology & Centro de Estudos do Ambiente e do Mar, University of Aveiro, Campus Universitário de Santiago, Aveiro, Portugal

Developmental, behavioral and biochemical markers of anthracene and Pb^{2+} exposure to zebrafish eleuthero-embryos

15:25– 15:30 **MEKUANINT GETACHEW[1], HENOK MULATU[2]**

Hirna Regional Veterinary Laboratory, Oromia Regional State, Ethiopia, [2]Habro District Livestock and Fisheries Development Office, Oromia Regional State, Gelemso, Ethiopia

Review on the impact of climate change on approach to epidemiology of livestock diseases control

15:30 – 15:35 **KENZA IRINISLIMANE**

Mechanical engineering department, M'Hamed Bougara University, Boumerdes, Algeria

Representation of industrial risk

15:35 – 15:40 **RENÁTA CSIZMADIA, HOSAM E.A.F. BAYOUMI HAMUDA**

Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary

Ecotoxicological impacts of fungicides on beneficial soil microorganisms

15:40 – 15:45 **IZABELLA VARGA, HOSAM E.A.F. BAYOUMI HAMUDA**

Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary

A bibliometric analysis on synthetic cannabinoids and their adverse effects on human health

ISBN: 978-963-449-338-9

15:45 – 15:50 **FRUZSINA KIS-PRUMIK KOVÁCSNÉ, HOSAM E.A.F. BAYOUMI HAMUDA**

Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary

Microbial antagonists against phytopathogens: In vitro experiment

15:50 – 15:55 **BARBARA KÖVICS, HOSAM E.A.F. BAYOUMI HAMUDA**

Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary

Distribution Types of Lichens in Hungary: Comparison of lichen in Eastern Bakony and Debrecen Forest

15:55 – 16:00 **BOGLÁRKA JUHÁSZ, HOSAM E.A.F. BAYOUMI HAMUDA**

Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary

Soil microbiomes inoculants for sustainable agriculture: Limitations and opportunities for plant growth

16:00 – 16:05 **REENA CHAUHAN, SUSHIL AHLAWAT**

Department of Entomology, College of Agriculture, CCS Haryana Agricultural University, Hisar (HYN), India

Persistence Behaviour of Premix formulation of Tebuconazole 50% + Trifloxystrobin 25% WG on Green Pea

16:05 – 16:10 **WONDIMU BARANA, SODESSA SOMA, NIGUSSIE WORKU**

Arba Minch University, Ethiopia

Design, Development and Performance analysis of evaporative cooler for arid climate area

16:10 – 16:15 **WONDIMU BARANA, SODESSA SOMA, NIGUSSIE WORKU**

Arba Minch University, Ethiopia

Design and Development of Biogas laboratory for Arba Minch University

16:15 – 16:20 **MATAVYA BISHNOI[1], BHANU SINGH PANWAR[2]**

[1]School of Science, Western Sydney University, Sydney, Australia
[2]Green India Clean Environment Society, Hisar, Haryana, India

Hidden history of environmental Philosopher-Guru Jambheswer?

16:20 – 16:25 **RÓBERT FEJES, RÓBERT KURDI, VIKTOR SEBESTYÉN**

Sustainability Solutions Research Lab, Faculty of Engineering, University of Pannonia, Veszprem, Hungary

Modeling approaches for municipal solid waste prediction

16:25 – 16:30 **SARA MOGHNIE[1,2*], JALAL HALWANI[1], KHALED YOUNES[2], LAURENT GRASSET[3]**

[1]Water & Environment Science Lab, Lebanese University, Tripoli, Lebanon
[2]Department of Chemistry, American University of the Middle East, Kuwait
[3]IC2MP, Poitier University, France

Development of the new approaches for the molecular characterization of organic matter within a peat BOG

ISBN: 978-963-449-338-9

Details of Second Day

17th of November 2023 (Friday)
Plenary, Keynote and Invited Speaker Session (09:00 am – 11:20 am)

PLENARY SESSION

CHAIR: ÁGNES BÁLINT

09:00 – 09:30

BORBÁLA BIRÓ[1], HOSAM E.A.F. BAYOUMI HAMUDA[2]

[1]Department of Agrienvironmental Studies, Hungarian University of Agriculture & Life Sciences, Budapest, Hungary, [2]Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary

Soil health bioindicators in European agroecosystems

09:30 – 10:00

SMAINE CHELLAT[1], ABDERRAHMANE ABDERRAHMANE[2], ABDELMALEK SAIDI[2], MESSAOUD HACINI[2], AHCENE BOUREFIS[1]

[1]Geology and Environment Laboratory, University of Constantine 1, Constantine, Algeria, [2]Geology of Saharan laboratory, Department of earth sciences, Faculty of Hydrocarbon. University Kasdi Merbah Ouargla, Algeria

A case study of nuclear contamination and agricultural adaptation in the sahara desert: The environmental challenges of Reggane city

10:00 – 10:30

LEOCADIE ODOULAMI, RICHARD KOUKOU, HENRI VODOUNON TOTIN

University of Abomey-Calavi, Bénin, Abomey-Calavi, Bénin

Problematic of drain sludge in Grand-Nokoue in the Republic of Benin (West Africa)

KEYNOTE SPEAKER:

10:30 – 10:45 **VIKTOR SEBESTYÉN**

University of Pannonia, Veszprém, Hungary

Sustainability efforts at the University of Pannonia

10:45 – 11:00 **HOSAM E.A.F. BAYOUMI HAMUDA**

Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary

Impacts of global climate change on human health

INVITED SPEAKER:

11:00 – 11:10 **REETU[1], RAHUL KUMAR[2]**

[1]Department of Zoology, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India, [2]Zoology, College of Agriculture, Bawal-123501, Rewari, CCS Haryana Agricultural University, India

Effect curcuma longa on Aeromonas hydrophila affected fish

11:10 – 11:20 REETU[1], RAHUL KUMAR[2], R.K. GUPTA, TEJPAL DAHIYA

[1]Department of Zoology, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India, [2]Zoology, College of Agriculture, Bawal-123501, Rewari, CCS Haryana Agricultural University, India

Ameliorative effect Moringa oleifera leaves on Aeromonas hydrophila infected fish

ISBN: 978-963-449-338-9

11:20 am – 12:00 pm

Workshop Special Session

MODERATOR: **HOSAM E.A.F. BAYOUMI HAMUDA**

Topic: Environmental Health and Climatic Change

(How humanity can solve climate change, alleviate poverty, and save biodiversity)

HOSAM E.A.F. BAYOUMI HAMUDA

Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary

Application impacts of wastewater solid sludge in agriculture on soil fertility, innovation technology and life cycle assessment under climatic changes

12:00 p.m. – 12:15 p.m.

Closing ceremony

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The First Day
Thursday, November 16, 2023

Plenary Session

DECARBONISATION IN CONSTRUCTION SECTORS TOWARDS ENVIRONMENTAL SUSTAINABILITY

Sannidhya Kumar GHOSH[1], Sadhan Kumar GHOSH[2]

[1]*Structural Project Engineer, DCI Engineers, Denver, USA*,
sghosh@dci-engineers.com, sannidhya.ghosh@colorado.edu
[2]*Sustainable Development & Circular Economy Research Centre, International Society of Waste Management, Air and Water (ISWMAW), India, sadhankghosh9@gmail.com, +91 9830044464*

Abstract: *The construction industry is responsible for a significant portion of the global carbon emission and global energy usage. With the increase in the global temperature over the last two decades, reduction the total embodied carbon in the construction industry has been a new challenge. The 2020 global status report for buildings and construction, it has been reported that while the total final energy consumption of the global buildings sector remained at the same level in 2019 compared to the previous year, CO_2 emissions from the operation of buildings have increased to their highest level yet at around 10 Gt CO_2, or 28% of total global energy-related CO_2 emissions. Emissions from the buildings construction industry, this share increases to 38% of total global energy related CO_2 emissions. A built environment produces carbon emission not only in its construction phase but also during its operation, occupancy and end of life. Strategies are being developed and initiated by Structural and Construction engineers to reduce Scope 1, 2, and 3 emissions and embodied carbon. Structural design companies are aiming to achieve SE 2050 by using alternative construction materials, design optimization, material reduction and conducting LCAs. Construction companies are striving to reuse building materials, use alternate sources of fuel for construction machinery, reduce heavy transportation to and from site etc. Green building design guidelines are provided by the US Green Building Council and the LEED and Indian GBC rating systems, help reduce carbon emission during the operational and occupancy phase of a bult environment. The US government has implemented a series of Green Building Tax incentives to encourage the built-environment and the construction industry and the owners to indulge in more environmentally friendly practices. To be on track to achieving a net-zero carbon building stock by 2050, the IEA estimates that direct building CO_2 emissions would need to decrease by 50% and indirect building sector emissions decline through a reduction of 60% in power generation emissions by 2030. These efforts would need to see building sector emissions fall by around 6% per year from 2020 to 2030. For comparison, the global energy sector CO_2 emissions decreased by 7% during the pandemic. This study will investigate the problems, issues, regulations and implementation strategies for decarbonization in Construction Sectors.*

Keywords*: Net Zero, Building, LCA, Green Building, emissions*

Biography

Sannidhya Kumar Ghosh, PhD (USA), serves as Structural Project Engineer at DCI Engineers Ltd, Denver. He did his MS and PhD from the Department of Civil, Env. and Architectural Eng, University of Colorado Boulder, USA where he served as the instructor & postdoc. His research areas include circular economy, concrete and building design in high seismic region, earthquake characteristics, impact of material ageing during earthquake, structural dynamics, C&D waste management, etc.

Sadhan Kumar Ghosh PhD (Eng.) Research Director of Sustainable Development & Circular Economy at International Society of Waste Management, Air and Water (ISWMAW). He is an internationally renowned researchers and consultant in the field of WM, CE, green manufacturing, etc.

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NICKEL: BENEFICIAL OR TOXIC ELEMENT IN SOIL-PLANT?

Bhanu. S. PANWAR[1], Vikash AHLAWAT[2], Mantavya BISHNOI[3], Olha. A. KHLIESTOVA[4], Katarzyna EWA BUCZKOWSKA[5]

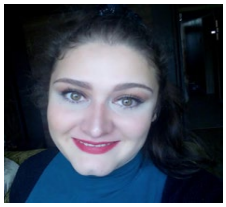
[1,2]Department of Soil Sciences, [3]Department of Food Science, CCS Haryana Agricultural University, Hisar, India
[4]Department of Material Science, Faculty of Mechanical Engineering, Technical University of Liberec, Liberec, Czech Republic.
[5]Department of Materials Technology and Production Systems, Faculty of Mechanical Engineering Lodz University of Technology, Poland.

Abstract: *The sustainability of a healthy agricultural ecosystem is prerequisite for protecting the food chain from bioaccumulation of hazardous substances e.g., heavy metals. Among the pollutant elements, Nickel is of great environmental concern as it is hazardous and highly carcinogenic in excesses intake by plants from polluted soils. Screen house study was carried out to evaluate the effect of chelating agent (EDTA @ 2 mmol kg-1 (5 split doses), FYM, vermicompost and microbial inoculants (Azotobacter and Pseudomonas, Bio-mix) on the phytoremediation capability of Indian mustard from Ni (100 µ g g-1) enriched sandy loam soil. The results revealed that FYM and vermicompost led to higher biomass production as compared to unamended soil. The bioinoculants also contributed to augmentation of biomass production but not significantly. The EDTA led to decrease in biomass as compared to FYM and vermicompost. The Ni concentration increased significantly in Brassica juncea with the application of EDTA. The application of FYM and vermicompost increased concentration of Ni. The seed treatment with bioinoculants was helpful in increasing concentration but was not much effective. The highest concentration of Ni was recorded in EDTA treatment. The concentration of Ni was higher in root as compared to shoot. Among all the treatment combinations, vermicompost with bioinoculants treatment combination led to higher uptake of Ni. The EDTA and FYM also increased uptake of Ni, but it was very less as compared to vermicompost. The results suggested that vermicompost combined with bioinoculants is best for increasing uptake of Nickel. The EDTA and FYM as implications were helpful in phytoremediation of Ni metal from polluted soils. [10], conducted greenhouse experiments using two cultivars of Brassica species (Brassica juncea and Brassica carinata) on both natural and artificially contaminated soils containing Ni. Both natural and amended soils were treated with disodium salt of EDTA @ 0 and 1 g kg-1 soil and found that application of EDTA created conditions that favoured transformation of Cd and Ni less soluble form to more plant available forms in both natural and metal amended soils. However, there is a strong need for further investigation in this aspect, with hyperaccumulator genomics.*

Keywords*: Brassica Juncea, EDTA, FYM, Nickel, Microbial inoculants, Vermicompost*

Biography

Professor Dr. B.S. Panwar, President, Green India Clean Environment Society-GICES-India



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CARBON DIOXIDE EMISSIONS IN SOME DEVELOPED AND DEVELOPING COUNTRIES BETWEEN 1990 AND 2021

Sándor J. ZSARNÓCZAI

Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Science, Doberdó u. 6, H-1034 Budapest, Hungary,
e-mail: zsarnoczaisandorjozsef@gmail.com, demeny.krisztina@rkk.uni-obuda.hu

Abstract: *Recently because of the global warming resulted by mostly carbon-dioxide gas emission based on the human activity, therefore the mitigating gas emission became important by global cooperation of countries. In the period of 1990 and 2021 the study analyses the volume of carbon-dioxide emissions and its corelations with economic features of selected economies, which have significant role in field of gas emissions and mitigating gas emissions. Economic features of United States, United Kingdom, Japan, Russia, Germany, France, Italy, China, India, Iran, Saudi Arabia, Sweden, Hungary, Poland, Austria, Turkey, Brazil and Egypt are included in the analyse. The research method is based on the statistical program for social sciences (SPSS). China has share by 32.9% in global carbon-dioxide emissions, while the United States has share by 12.6% and the EU-27 has share by 7.3% and India has share by 7.0% at the same time 2021. The study proofs that the total investment in 2021 has strong correlations with CO_2 emissions Mt CO_2/year, in 2021 and CO_2 emissions per capita ton CO_2/cap/year, in 2021. The solution for the mitigating carbon-dioxide emissions is to develop advanced green environment friendly technology for using renewable energy resources.*

Keywords*: Economic variables, global warming, green technology, investment, renewable energy*

Biography

Sándor J. Zsarnóczai CSc, in 1991 economic sciences, Hungarian Academy of Sciences, Budapest and Dr. of University, World Economics, Budapest Corvinus University of Economics. In 2017 Habilitate Doctor, in social sciences, in Management and Business Administration, Kaposvár University. From 1987 work at Szent István University in Gödöllő. From 2017 work at Óbuda University. Participation at Doctoral School. Research areas: Economics, EU Study, Regional economics, Environmental economics. He published 220 publications with 260 independent citations, of which 200 foreign language citations. His publications were published in English, Arab, Spanish, Russian languages. International scientific conferences in Turkey, Canada, Moldavia, Czech Republic, Slovakia, Lithuania, Romania. Research project in Finland, Sweden, Denmark, Italy, Spain, France.

EFFECTS OF PHARMACEUTICAL CONTAMINATION IN THE ENVIRONMENT: CHALLENGES AND WAYS OF SOLUTIONS

LYUDMYLA SYMOCHKO[1,2,3], HOSAM E.A.F. BAYOUMI HAMUDA[4]

[1]University of Coimbra, Coimbra, Portugal,
[2]Uzhhorod National University, Uzhhorod, Ukraine,
[3]Institute of Agroecology and Environmental Management, NAAS, Kyiv, Ukraine,
[4]Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary

Abstract: *Soil is the cornerstone of our food production, providing humanity with a staggering 98.8% of its food supply. Within this vital ecosystem, the soil microbiome emerges as a crucial player, wielding significant influence in the development and dissemination of antibiotic resistance in humans. Modern agroecosystems stand out as one of the primary sources of Antibiotic-Resistant Microorganisms (ARM).*
Our research findings highlight the significant repercussions of consistently applying organic fertilizers containing antibiotic remnants, which disrupt the intricate balance of the soil microbiome. This disruption not only alters both the functional and taxonomic diversity of microorganisms but also leads to a notable increase in oligotrophic and pedotrophic microbiota populations, coupled with a stark reduction in nitrogen-fixing microbiota.
The contamination of agroecosystems by pharmaceuticals has triggered a surge in populations of antibiotic-resistant microorganisms. Monitoring studies reveal that external factors contribute to the formation of an environmental resistome, fostering the spread of antibiotic-resistant microorganisms. Over a five-year period, the prevalence of antibiotic-resistant bacteria has surged by 2.28 times, with ESKAPE pathogens experiencing a 2.21-fold increase. Modern agroecosystems serve as hotspots for the proliferation of pathogenic and opportunistic microorganisms, including ESKAPE pathogens with multiple antibiotic resistances, posing a grave threat to human health.

Keywords*: Contamination, Environment, Ecosystems, Microbiome, Resistome.*

Biography

Biography: *Lyudmyla Symochko is Ecologist and Environmental microbiologist, currently working as an Invited Professor at the University of Coimbra, Portugal. Lyudmyla Symochko got her master's degree in Ecology and Environment Protection in 2000. Doctor's degree in Ecology (2005). She is Associate Professor (with habilitation) in Biodiversity Conservation and Ecology. Since 2010 she has focused on autecology and synecology research 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 provides risk assessment to ecosystems and human health. Author of over 250 scientific publications, including 5 books.*

SOIL HEALTH BIOINDICATORS IN EUROPEAN AGROECOSYSTEMS

BORBÁLA BIRÓ[1], HOSAM E.A.F. BAYOUMI HAMUDA[2]

[1]Department of Agrienvironmental Studies, Hungarian University of Agriculture & Life Sciences, Budapest, Hungary, [2]Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary

Abstract: *There are 5 main topics, missions, that can have an outstanding attention in the European Community. It is including the human- and environmental health, the fate against the global change, especially considering of the people in the large towns. One of the topics is the soil, that can have the same attention, due to the fact, that the soil-degradation can threaten our living and of our food. Half of the soil organic matter (SOM) content in Hungary lost recently as consequence of intensive agricultural production. The SOM on the other hand is in connection and is in positive correlation with almost all soil functioning parameters and ecosystem services. The soil quality can be assessed and monitored regularly, however beside the soil-physical-chemical parameters, little attention was given up till now to the soil-biological ones.*

The lecture is showing the facilities of soil-quality-fertility assessments and highlighting the importance of soil-health, that is being in positive correlation with the human-environmental health. Considering that health parameters, the involvement of food-quality and food-safety aspects can be suggested, including well-developed assessment methods. In case of the soil-plant systems, focus should be given to the beneficial microorganisms, such as the PGPR (plant-growth-promoting rhizo)-bacteria, that are known to enhance yield parameters and protect the plants against the so-called "soil-borne plant pathogens". Those microbes are part of the healthy soils and some of them are known to develop a beneficial symbiosis with the crops. Such bacteria are the Biological Nitrogen-fixers (BNf) and the Phosphor-solubilizing and spore-forming Bacillus genus. Among the endophytes, the arbuscular mycorrhiza fungi (AMF) are known to have a beneficial symbiosis more than 80 % of plants/crops. The symbiosis might offer several parameters for monitoring the real functioning of any soil-plant ecosystems. In case it is missing from a degraded soil, the inoculation with those beneficial microorganisms can be a possibility. In the EU Mission of "Soil Health and Food", several soil-physical-chemical parameters were suggested for soil-landscape monitoring. It was an advantage, that soil-biological investigation, including the PGPR and AMF microorganisms are part of the potential monitoring parameters. We should protect our soils, as the Report of the mission is mentioning: "Caring for Soil Caring for life".

Keywords*: soil-quality, soil-health, mission, symbiosis, soil-protection*

Biography

Dr. Borbala Biro is professor emerita at the Hungarian University of Agriculture and Life Sciences, Institute of Environmental Protection, Dept of Agri-environmental Studies. She was one of the 15 top experts of the European Union. Mission of "soil Health and Food" and participated on preparing a report of soil-monitoring facilities. Her expertise is including of the use of beneficial microorganisms as biofertilizers and biopesticides in degraded and polluted soils. She has published more than 500 papers and member of the Horticultural Doctors-School in the University.

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A CASE STUDY OF NUCLEAR CONTAMINATION AND AGRICULTURAL ADAPTATION IN THE SAHARA DESERT: THE ENVIRONMENTAL CHALLENGES OF REGGANE CITY

Smaine CHELLAT[1], Abderrahmane ABDERRAHMANE[2], Abdelmalek SAIDI[2], Messaoud HACINI[2], Ahcene BOUREFIS[1]

[1]Geology and Environment Laboratory, University of Constantine 1, Road Ain El Bey Zouaghi Slimane Constantine 25 000, Algeria
[2]Geology of Saharan laboratory, Department of earth sciences, Faculty of Hydrocarbon. University Kasdi Merbah Ouargla, Algeria
**Corresponding author: smaine.chellat@gmail.com*

Abstract: *Reggane is located in the TOUAT area, one of the three major regions of the wilaya of Adrar, along with GOURARA (Timimoune) and TIDIKELT (Aoulef). It is located in a depression that is regarded one of the Saharan platform's synecisms, marked by high aridity; hence, the water is too far away, roughly 30m from the surface. An agricultural occupation characterizes this region. Nuclear tests conducted during the French colonial period in 1960, 80 kilometres south of Reggan, left radioactive pollution. The presence of contamination is demonstrated by XRD diffractometric tests performed on the river deposits of Wadi Reggane, which reveal elements Ra and Cs delivered by the winds or other pathways. These sediments are far from the explosion site, yet there are signs of contamination; they lie on a plate (bedrock) of a continental sandstone interfile nature of Albian age, which has been exploited for its water richness in agronomy and irrigation. According to the original zoning, it is a low-risk region, however depending on the time the elements are delivered day after day, different zoning of the area is required.*

Keywords: *Reggan, Nuclear contamination, Dust, Wind, Water, Albian.*

Biography

CHELLAT Smaine Professor at the University of Constantine 1, Faculty of Earth Sciences, Geography and Spatial Planning, Department of Geological Sciences, between 1999 to 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

PROBLEMATIC OF DRAIN SLUDGE IN GRAND-NOKOUE IN THE REPUBLIC OF BENIN (WEST AFRICA)

Leocadie ODOULAMI, Richard KOUKOU, Henri Vodounon TOTIN

University of Abomey-Calavi, Benin, Abomey-Calavi, Benin,
leocadieo@yahoo.com, telephone +229 95960784

Abstract: *One of the difficulties for the inhabitants of Grand-Nokoué in Benin is the managing fecal sludge and sanitation. This work aims to analyze the production conditions and treatment of fecal sludge in this Grand-Nokoué complex. Documentation and field surveys using observations, investigations were carried out in 1000 households with or without independent sanitation services. For this purpose, the visit sites were targeted, as well as the emptiers, agents of the treatment sites and municipal authorities and sampled survey households. The data and information collected were analyzed and descriptive methods were used for their processing under Windows 16.*
The result is that 91.78% of households have latrines in Grand-Nokoué. More than 51.74% of these households have ventilated pit latrines and septic tanks, but 48.26% continue to use non-watertight traditional type latrines. The rest of the households, i.e. 08.22%, use public latrines, latrines they do not own or defecate in the open. This would facilitate the proliferation of several disease vectors and environmental pollution. However, private companies and individuals invest in the emptying and transport of sludge on undersized sites or without real control standards. Likewise, sludge treatment stations with adequate standards are almost non-existent in Grand-Nokoué. It appears that measures to raise awareness among residents on hygiene and sanitation are being carried out, including the construction of more adequate latrines, the use of protective equipment by emptiers and the construction of water stations. treatment of fecal sludge meeting standards and participatory management.

Keywords*: Benin, Grand-Nokoué, Faecal sludge, insufficient treatment, poorly respected standards*

Biography

Sessions of Keynote, Invited, Oral and Poster Presntations

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- **Session (B) Soil Biology &Agricultural Land Uses**
- **Session (C) Physicochemical Properties of Water & Sediments**
- **Session (D) Circular Economy Strategy and Waste Management and Sustainable Energy Research & Applications**
- **Session (F)Air Pollution and Ecosystems & Landscape**

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ASSESSMENT OF HEAVY METAL POLLUTION AND WATER QUALITY ON HANDWATER PUMPS TOWARDS WATER SAFETY AND SECURITY

Rainiel Bryan V. DOMASIAN*, Christian Paul P. dela CRUZ, Ofelia B. MANINGAS, Karen A. MANAIG, Victoria E. TAMBAN

Laguna State Polytechnic University,
Los Banos Campus, Philippines
Corresponding Author's email: rvdomasian@gmail.com

Abstract: *The presence of these heavy metals in water sources is a growing concern due to its potential adverse effects on human health. This study examines the assessment of heavy metal contamination within hand water pumps from the Municipality of Los Baños, Laguna. The study used handheld X-ray fluorescence spectroscopy as a tool to detect and quantify heavy metals. It examined also the key physicochemical parameters, including pH, conductivity, total dissolved solids (TDS), temperature, salinity, and dissolved oxygen (DO) using water quality multiparameter equipment which within the permissible limits for drinking water. The presence of Cr in hand water pumps were exceeded the permissible limit set by the DENR while Cu, As, Ba, Cd, Pb and Hg potentially exist risk. The findings recommended to establish a routine monitoring program to ensure that water safety and security are maintained. Furthermore, to consider developing and implementing policies and regulations specific to heavy metal contamination in water sources, with a focus on safeguarding the health and well-being of the community*

Keywords*: Heavy Metals, Hand Water Pumps, Drinking Water, Water Quality*

Biography

Rainiel Bryan V. Domasian is a graduate of Bachelor of Secondary Education Major in Biological Science at LSPU Los Banos. He finished his master's degree in environmental science at the University of the Philippines Los Banos Laguna, Philippines. He is currently a college instructor at the Laguna State Polytechnic University Los Banos. Also, Mr. Domasian is the Unit head for Extension and Training Services and Curriculum Instruction Development. His research interest includes educational management, environmental pollution (heavy metals), and product development.

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THE FAST FASHION PANDEMIC- CONTAMINATING THE GLOBAL ENVIRONMENT

Rashmi RATHORE

Sikkim, India (Working online globally, and physically in different parts of country), dmtheimagedoctor@gmail.com, +91-9555250502
Department of Soil Science, Chaudary Charan Singh Haryana Agricultural University, Hisar, Haryana, India, ishratgull04@gmail.com, 9149518891

***Abstract**: Fashion is one of the world's most important industries, driving a significant part of the global economy. Also, it is the most resource intensive. Revenue in 2023 for the global market is 1.7 trillion dollars which is mostly utilised for fast fashion. Fast fashion has made it possible for the masses to enjoy different styles globally, though at the cost of the environment, human health & economy. Textile production alone contributes more to climate change than international aviation and shipping combined. The world produces 92 million tons of textile waste every year (excluding fast fashion accessories). 36% of GenZ buys a new cloth every month. 70% of the world market has a synthetic cloth base which means it can only be recycled and is not truly biodegradable. Unfortunately, only 12% of all this waste gets recycled and rest all ends in landfills. It's not only contaminating the environment but also burning a huge hole in the resource pool. Fashion should not only be affordable to the individual but also to the global environment. Apart from the regulations Government and environmental organisations must implement, as an Image Consultant, I can suggest few innovative solutions to help the environment in long run. The solutions include, creating awareness about carbon footprint of every fashion article, creating gender fluid fashion, reintroducing classic styles, promoting the concept of calculating cost per wear for every purchase, creating clothing clusters to achieve multiple looks with minimum garment pieces, repair & reuse and reinforcing the concept of uniforms for all major organisations globally. We can break the speed of fast fashion industry by helping masses understand the difference between needs and wants in terms of fashion. Let's create a chic world with the help of image management and heal the environment from the super contagious fashion pandemic.*

***Keywords**: Fast Fashion, Textile Waste, Image Management, Affordable Fashion, Fashion Carbon Footprint, Repair & Reuse*

Biography

Dr Rashmi Rathore is healing, empowering and transforming lives by bringing health, image management and soft skills training together with her brand "The Image Doctor". She is a practicing medical doctor with MD in the subject of Repertory. She has been an Associate professor with Bhartiya Homeopathic Medical College. She is also an Internationally Certified Image consultant and Soft Skills trainer. She is a Train the Trainer certified consultant. After winning multiple beauty pageants at national level, she is practicing as a Pageant coach too. She is the joint secretary to the NGO, Society for Rural Improvement and has worked with multiple national level NGOs on various burning issues including the environment. She has also been a student of environmental science for one year with reputed Delhi University, India and scored second position in university exams. She is an active member of German New Medicine, Vigyan Bharti India and Army wives'

welfare association. Being married to an army officer, she has been travelling far and wide across the nation and has stayed in 14 States & 6 union territories. She draws her experience by working with multiple organisations and cultures globally.

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EFFECT OF ACID RAIN AND HEAVY METAL POLLUTION ON GARDEN CRESS (*Lepidium sativum*)

Ágnes BÁLINT[1]*, Glória BERNVALNER[2], Viktória KALCSÓ[2], Xuechu WANG[3], Csaba MÉSZÁROS[3]

[1]Institute of Environmental Engineering and Natural Sciences, Obuda University, Budapest, Hungary, e-mail: balint.agnes@uni-obuda.hu
[2]Szent István University, Gödöllő, Páter K. u.1.
[3]Doctoral School of Environmental Sciences, Hungarian University of Agricultural and Life Sciences, Gödöllő, Hungary, e-mail: victorwxch@gmail.com
[4]Institute of Mathematics and Basic Science, Hungarian University of Agricultural and Life Sciences, Gödöllő, Hungary, e-mail: Meszaros.Csaba@uni-mate.hu

Abstract: *The risks to our environment are countless. Among these, heavy metal pollution and acid rain are important. Heavy metals are found in nature, but their more significant presence is due to anthropogenic impacts. They usually occur in the soil, from which they can enter plants under the right conditions and pass through the food chain to humans. Acid rain is caused by a few atmospheric gases, most of which are also released into the environment by human activity (mainly industrial).*
Zinc and cadmium were used in our studies. Garden cress (Lepidium sativum) has been used to monitor the effects of heavy metals and acid rain. The statistical analysis was evaluated using SPSS 14.0. Regarding the physical parameters, the treatments reduced root length and stem length compared to the control, but nitric acid caused an increase in leaf area. At the same time, the average leaf area was 29.53 mm^2 for the control and 33.67 mm^2 for the nitric acid treatment. The phosphoric acid and phosphoric acid-silicic treatments showed significant differences compared to the other data. Regarding vitamin C, the cadmium and phosphoric acid contaminated samples contained the least amount of 6.17 mg/100g fresh plant. The highest vitamin content was observed in samples treated with nitric acid, with a value of 23.83 mg/100g fresh garden cress. However, significant differences were also found between treatments. In conclusion, zinc and nitric acid treatments had a stimulating effect on the plants. Still, phosphoric acid, especially cadmium, harmed their physical parameters and vitamin C content.

Keywords*: acid rain, heavy metals, garden cress, pollution, Vitamin C*

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. 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 fertiliser, and Experimental and theoretical modelling of transport processes.

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TEMPORAL AND SPATIAL IMPACT OF LOCKDOWN DURING COVID-19 ON AIR QUALITY INDEX IN HARYANA, INDIA

Rahul KUMAR

Assistant Professor of Zoology, CCS Haryana Agricultural University, College of Agriculture, Bawal-123501, Rewari, Haryana, India

Abstract: *This study presents the evaluation of air quality in different districts of Haryana. Geo-spatial techniques were used to estimate gaseous and particulate pollutant's spatial and temporal variation during complete nationwide lockdown period and same month of previous year 2019 (March to May). Data of six fixed pollutants were collected from Central Pollution Control Board (CPCB). In this context, the data of air pollutants (PM_{10}, $PM_{2.5}$, O_3, NO_x, SO_2, and CO) were analyzed for 2019 and 2020. The Spatio-temporal distribution of the Air Quality Index (AQI) clearly depicts difference in lockdown and unlock period. The result was showed that the air quality was very poor to satisfactory in 2019, and an improvement was observed from satisfactory to good in 2020 due to COVID-19 lockdown. Based on result, it will be concluded that automobile and industry are the major contributor in increase the pollutant concentration. Deadline for sending the abstract is October 15. 2023.*

Keywords*: Air Quality Index, lockdown, COVID-19*

Biography

Work: *Metabolomics, Pesticides and earthworm, fish health management, sustainable development*

NEAR SURFACE CARBON DIOXIDE LEVEL AND CARBON STORAGE POTENTIAL OF THE DOMINANT TREES OF KOLKATA, INDIA

Sana AHMED[1], Sufia ZAMAN[1], Abhijit MITRA[2]

[1]Department of Oceanography, Techno India University, West Bengal, EM 4 Salt Lake, Sector V, Kolkata 700091, India
[2]Department of Marine Science, University of Calcutta, 35 B.C. Road, Kolkata 700019, India
Email: sanahmed85@gmail.com, Email: abhijit_mitra@gmail.com
Email: zamansufia123@gmail.com, Dr. Sana Ahmed: + 91 7044925859
Dr. Sufia Zaman: +91 6291373582, Dr. Abhijit Mitra + 91 8584929005/ 9831269550

Abstract: *The present study is a first order monitoring, carried out during February 2022 to assess the role played by the major urban tree species in lowering the level of near-surface atmospheric carbon dioxide at five selected sampling stations in the megacity of Kolkata (India). Seventeen dominant tree species common in the five sampling sites were surveyed, out of which the highest and the lowest mean value of Above Ground Stem Biomass (AGSB) was exhibited by Eucalyptus globus and Alstonia scholaris respectively. The mean Above Ground Stem Carbon (AGSC) also exhibited similar trend with highest value of 2641.03 tha^{-1} by Eucalyptus globus and lowest value of 53.95 tha^{-1} by Alstonia scholaris. The near-surface atmospheric CO_2 level showed the highest value of 418 ppm (at Moulali) and the lowest value of 403 ppm (at Park Circus).*

The study highlights the potential of urban trees to store carbon in the form of biomass. This can be an effective ecofriendly roadmap to retard the rising trend of carbon dioxide in the near-surface atmosphere of the highly urbanized city of Kolkata sustaining some 15 million populations.

Keywords: *Atmospheric CO_2, Urban tree species, Above Ground Stem Biomass (AGSB), Above Ground Stem Carbon (AGSC)*

Biography

Dr. Sana Ahmed (M.Sc., PhD) Citizenship: *Indian*
Official Address: *Department of OceanographyTechno India University, Salt Lake, Kolkata 700 091, West Bengal (India)*
Residential Address: *8, Gora Chand Road Beniapukur Police StationKolkata 700014, West Bengal, (India)*
Date of Birth: *24th November 1986*
Mobile (WhatsApp). +91 7044925859
Email: sanahmed85@gmail.com
Present position: *Faculty Member, at Department of Oceanography, Techno India University, West Bengal, Salt Lake city, Sector V, Kolkata 700 091 (INDIA)*
At a glance in ResearchGate (to see research Interest):

https://www.researchgate.net/profile/Sana-Ahmed-49. At a glance in Linkedin: https://www.linkedin.com/in/dr-sana-ahmed-62613819/Paper Published- 14

SUSTAINABILITY EFFORTS AT THE UNIVERSITY OF PANNONIA

Viktor SEBESTYÉN

University of Pannonia, Veszprem, Hungary, sebestyen.viktor@mk.uni-pannon.hu, +36 88 624 000

Abstract: *The University of Pannonia (UP) considers sustainability to be a priority area of research, for which the leadership has decided to embark on the rugged path of a sustainable university and to become one of the leading higher education institutions in the field of sustainability and the circular economy. To achieve our goals, we have created a Sustainability Competence Center, which carries out its conscious development and dissemination activities in cooperation with a cross-departmental sustainability work group to continuously improve our performance. The aim of the work is to introduce the UP framework for the integration of sustainability aspects into decision-making processes and everyday life, which covers the research and education portfolio, facility management and community events in an integrated manner.*

Keywords*: sustainable education, green university, waste management, sustainability framework*

Biography

Viktor Sebestyén is a Senior Researcher at the Sustainability Solutions Research Lab at the University of Pannonia in environmental engineering. He graduated with bachelor's degree in environmental engineering (2011), and he has master's degree in environmental engineering (2013), Occupational Safety and Health (2016), Noise- and Vibration Control Engineering (2019). He received a PhD degree in Bio, Environmental and Chemical Engineering (2019). His research interest covers a wide spectrum of environmental issues, nevertheless his profession is the data- and model driven decision support of the Sustainable Development Goals.

IMPACTS OF GLOBAL CLIMATE CHANGE ON HUMAN HEALTH)

Hosam E.A.F. BAYOUMI HAMUDA

Institute of Environmental Engineering and Natural Sciences,
Rejto Sandor Faculty of Light Industry and Environmental Engineering
Obuda University, Budapest, Hungary
bayoumi.hosam@uni-obuda.hu, WhatsApp/viber/messenger: +36303900813

***Abstract**: Global climate change is directly affecting the main environmental components: water, air, weather, and ecosystems. Changes in precipitation, temperatures, and melting of ice caps already occurred and will create new changes in the availability and quality of environmental elements and the human health. The purpose of this discussion is to understand the impacts of global climate change on human health and how the world manages both mitigate and adapt of climatic changes on the biosphere. Also, it is organized around the categories of human health consequences of global climate change such as asthma, respiratory allergies, air quality diseases, cancer, cardiovascular disease and stroke, food-, water-borne, vector- borne and zoonotic diseases, nutrition, weather and heat-related morbidity and mortality, human developmental impacts, mental health and stress-related disorders, neurological diseases and disorders, etc. These risks give early warnings and greater public awareness of population's health risk from global climate change, which should translate into more successful mitigation and adaptation strategies. Today, human community need a coordinated global approach will bring the unique skills, capacities, and missions of the various agencies together to maximize the potential for discovery of new information and opportunities for success in providing key information to support responsive and effective decisions on climate change and health.*

***Keywords**: global climate changes, public health, environmental and human health*

Biography

Currently, Prof. Dr. Hosam Bayoumi Hamuda is working at Obuda University, Sandor Rejto Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences (Budapest, Hungary) since 2008. He was Senior Researcher and Deputy Director of Research Group for Environmental Microbiology of Hungarian Academy of Sciences (Budapest) between 1997 and 2004. Briefly, He received the degrees of B.Sc. (1978, Chemistry and Botany), M.Sc. (Biological Sciences) from Garyounis University (Benghazi, Libya), University Doctor (1987, Agricultural Sciences-Soil Microbiology) and PhD in Biological Sciences (1999) from Gödöllő University of Agricultural Sciences (Gödöllő, Hungary) and C.Sc. in Biological Sciences (1994) from Hungarian Academy of Sciences, Budapest, Hungary. He received the Doctor Habilitation Degree in Environmental Sciences (2007) and the Professor degree from Szent István University (2008, Gödöllő, Hungary). Also, University Doctor Degree in Natural Sciences from Eötvös Loránd University (1995, Budapest). Prof. Hamuda was awarded many times from different organisations, e.g., the Society of Hungarian Microbiologists (MMT), the Hungarian Professors Council (MPV), etc. and he is a member of many Hungarian and International Organisations.

Prof. Hamuda was the general secretory and now is the president of International Council of Environmental Engineering Education (ICEEE) originated since 2010 (Budapest, Hungary) and Member of the International Society of Development and Sustainability (Japan), Society of MMT, Soil Science and Agrochemistry Committee of the Agricultural Sciences Department of IV of the Hungarian Academy of Sciences (Budapest) and Association of Hungarian Medical Societies (MOTESZ) and others. He was the director of MSc program titled: Microbial Science and Biotechnology (Szent István University, Gödöllő, Hungary) from 2000 to 2008 and Director of PhD Program titled: Agricultural-, Environmental Microbiology and Soil Biotechnology until from 2007 to 2015 and now a member of the Environmental Sciences Doctor's School at Szent István University and Doctoral School on Materials Sciences and Technologies at Obuda University. Prof. Hamuda is acting as editorial member, reviewer of many international journals, and he organize many international conferences and symposiums. He delivered more than 120 plenary and keynote lectures in international events and a member of scientific committee of more than 100 conferences. He is the editor in chair of more than 15 Proceedings Books of International Conferences. Research Interest Topics: 1. Microbial biotechnology: solid waste and wastewater management. Soil Biotechnology: rhizosphere index, soil microbial biomass and enzymatic activities. soil health, and soil biodiversity. Soil security, biocontrol and biofertilizers. microbial inoculants. Colonization of Plant Growth-Promoting Rhizomicrbiota. Nitrification inhibitors and crop quality. 2. Monitoring of soil organic matter. Econanotoxicology. Roles of engineered metal oxide nanoparticles in soil. 3. Public health and healthcare. Bioengineering and Environmental Health. Probiotics, antibiotics, xenobiotics, and human gut microbiomes. Impacts of xenobiotics: pesticides and other pollutants on soil biological activities 4. Climatic changes and global security.

IDENTIFYING KEY FACTORS AFFECTING NEONATAL MORTALITY IN ETHIOPIA USING MACHINE LEARNING MODELS

Filippos Sewunet ADMASU[1]

KLATASDS-MOE, School of Statistics, East China Normal University, Shanghai, China,
fliphoes@gmail.com

Abstract: *Neonatal mortality, defined as death within the first 28 days of life, is a major contributor to overall child mortality. Reducing neonatal mortality is therefore critical for improving child survival rates. This study aimed to identify key factors influencing neonatal mortality in Ethiopia using traditional and machine learning models. We analyzed data from the 2019 Ethiopian Mini Demographic and Health Survey, focusing on neonatal birth outcomes. Descriptive results showed that 4% of children experienced neonatal mortality. We built classification models including binary logistic regression and machine learning algorithms such as lasso binary logistic regression, support vector machines, and random forests to predict neonatal mortality based on influential factors. The random forest model demonstrated superior performance in identifying important influencing factors compared to other models. The random forest model found that breastfeeding, child's age, home delivery, parity, antenatal care, maternal age at marriage, and birth size were significantly associated with neonatal death. These findings indicate that promoting breastfeeding, skilled birth attendance, and antenatal care while reducing adolescent pregnancy may substantially lower neonatal mortality in Ethiopia. The machine learning approach enables more accurate identification of at-risk newborns to target interventions. This model can inform policies and strategies to improve neonatal survival in Ethiopia.*

Keywords*: Neonatal mortality, Machine learning, Influencing factors, Demographic Health Survey, Ethiopia*

Biography

I obtained my bachelor's degree in statistics from Addis Ababa University in 2017 and started working as an assistant lecturer. In 2019, I completed my master's degree in statistics at East China Normal University. Currently, I am a third-year PhD candidate in statistics at East China Normal University, focusing my research on developing causal inference methods for multivariate outcomes and treatments. As a biostatistician, I am passionate about applying statistical methods to solve real-world health problems. Outside of academics, I am a dedicated soccer fan and enjoy watching TV series in my spare time.

IMPORTANCE OF FRUIT TREE SPECIES IN MAINTAINING AND IMPROVING SOIL ORGANIC MATTER UNDER SEMI-ARID CONDITIONS OF INDIA

Ishrat GULL

Department of Soil Science, Chaudary Charan Singh Haryana Agricultural University, Hisar, Haryana, India, ishratgull04@gmail.com, 9149518891

***Abstract**: Soil is the most significant non-renewable dynamic natural resource and is crucial for agriculture. It is important to keep it healthy and productive because it is the home of terrestrial life. The basic goal of sustainable agriculture is to maintain and increase productivity while protecting the quality of the soil. Arid and semi-arid regions make up over 70% of India's total arable land. Physical restrictions in these areas, including erratic and low rainfall, high temperature, low fertility, salinity of the soil and groundwater, impede dependable agricultural output. Due to rising socioeconomic demands and population growth, the agricultural production system is under increased pressure, which ultimately results in unanticipated changes in land use. To meet these demands and keep the soil fertility at its optimum, it is essential to choose a balanced land use. Different land uses have influence on a various soil property, which also affect the availability and dynamics of nutrients. These changes may be due to many factors but dynamics of soil organic matter have drawn a lot of attention due to its importance in improving soil quality. Tree-based land uses have often been shown to be more efficient in soil carbon sequestration because of the higher canopy cover, continuous supply of organic matter in the form of leaf litters, other depositions from roots and maintenance of an environment favourable for microbial activity. The conversion of forests, orchards and grasslands into croplands resulted in decreased soil organic carbon levels. Guava, bael, mango and jamun are important perennial crops grown under semi-arid conditions in India. Fruit trees, which are generally deciduous, enrich the soil, alleviate runoff and soil erosion and help to improve overall soil quality. Fruits are a great source of vitamins, minerals and antioxidants and can be very helpful in addressing the issue of nutrition.*

***Keywords:** land use, fruit trees, soil properties, semi-arid zone*

Biography

M.Sc. Soil Science

EFFECT OF *CURCUMA LONGA* ON *AEROMONAS HYDROPHILA* AFFECTED FISH

REETU[1]*, Rahul KUMAR[2]

[1]Department of Zoology, College of Basic Sciences and Humanities, Chaudhary Charan Singh Haryana Agricultural University, Hisar-125004, Haryana, INDIA
[2] Zoology, Chaudhary Charan Singh Haryana Agricultural University, College of Agriculture, Bawal, Rewari-123501, Haryana, INDIA
** Corresponding author. rdmsczoohau07@gmail.com*

Abstract: *Bacteria are the major reason for disease in fish. They cause high economic losses to farmers. Aeromonas hydrophila is a gram-negative bacterium, which causes a broad spectrum of infections in fishes. The pathogenicity of A. hydrophila arises from its diverse virulence factors, including adhesins, exotoxins, and hemolysins, facilitating adherence to host tissues, evasion of the immune system, and tissue damage. Upon infection, fish exhibit clinical signs such as haemorrhages, ulcers, fin rot, and systemic manifestations, leading to high mortality rates within affected populations. Curcuma longa, commonly known as turmeric, has been widely recognized for its medicinal properties and therapeutic potential in various biological systems. It contains a compound called curcumin, which is attributed to many of its health benefits. However, while turmeric is known for its anti-inflammatory, antioxidant, and potential anticancer effects. C. longa also has antibacterial properties, and it was observed that it ameliorative effect on the haematological parameter in A. hydrophila-infected fish. It was concluded that C. longa cured the A. hydrophila-infected fish.*

Keywords*: curcumin, pathogenicity, antibacterial properties, haemorrhages*

Biography

APPLICATION IMPACTS OF WASTEWATER SOLID SLUDGE IN AGRICULTURE ON SOIL FERTILITY, INNOVATION TECHNOLOGY AND LIFE CYCLE ASSESSMENT UNDER CLIMATIC CHANGES

HOSAM E.A.F. BAYOUMI HAMUDA

Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary
bayoumi.hosam@uni-obuda.hu, WhatsApp/viber/messenger: +36303900813

Abstract: *Solid wastewater sewage sludge (SWSS)is formed as a by-product at a wastewater treatment plant (WWTP) and represents a heterogeneous mixture. This complex material consists of solid organic and inorganic matters and colloids, which have been separated from the wastewater during the treatment process. SWSS from WWTP is recovered by compost production, the application directly to agricultural and forest land, production of growing materials, and energy recovery. Despite the widespread use of SWSS as an organic amendment to improve soil stability and plant productivity, relatively little is known about how the different sludge stabilization processes affect the microbial composition and diversity of the sludge and the soil microbial populations as well as plant performance. However, dewatered SWSS is considered harmless and suitable for agriculture, because of high content of organic matter and biogenic elements, which increases soil fertility and is essential for plant growth and development and for soil microbiota. Therefore, the use of SWSS on agricultural land is the best way to recycle the nutrients it contains, thus making the SWSS an important biological resource for sustainable agriculture. Another important issue is related to the abundance of hazardous and very persistent materials, such as heavy metals, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, halogenated hydrocarbons, polychlorinated dibenzo-p-dioxins and dibenzofurans, pesticides, personal care products, hormonal compounds, drugs and their metabolites, microplastics, and nanoparticles. The annual emission limit values for dry matter, heavy metals, total nitrogen, and total phosphorus are the maximum mass of these materials that can be applied per hectare of SWSS on average/year. The aim of this study was to summarize the main aspects of SWSS amendment for its application in agriculture, with emphasis on process efficiency, safety, and feasibility. The use of SWSS as a soil treatment has been shown to increase the activity of soil enzymes, for example, arylsulfatase, acid and alkaline phosphatase, urease, protease, cellulase, β-glucosidase, etc. Basal respiration and the fluorescein diacetate hydrolysis activity, phosphate solubilizing agents, cellulose-decomposers increased with increasing the dose of SWSS. The addition of SWSS to soil increases the C_{mic}/Ct_{otal} and N_{mic}/N_{total} ratios in the soil. At the same time, application of SWSS containing heavy metals decreased C_{mic}/C_{total} ratio. This impact can be developed greater in sandy soil than in clayey soils. The impact of SWSS on plant growth differs depending on the SWSS application method, that is, at the soil surface "mulching" or mixed homogeneously with soil. The amendment of SWSS on the surface has some advantages, that is, the water evaporation is limited by forming a physical barrier that allows soil moisture to be retained longer. Due to those, the biological and chemical processes of organic matter transformation intensified. For example, the best yield of wheat, maize, sunflower, barley, tomato, broad bean and common bean plants was obtained when SWSS is applied at the clayey-silty soil surface as*

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compared to homogeneously mixed SWSS with soil. The obtained results illustrate increases in plant crop biomass, average leaf surface area and leaf length as well as chlorophyll a+b content. Plant response to SWSS in dependence on SWSS application rate, plant species, soil type, and experiment conditions. The composition of the SWSS and the concentration of pollutants in it predetermine the possibilities of its use. The presence of heavy metals, organic pollutants, and/or pathogens are the main issues associated with the reuse of SWSS. Summarizing our experimental data on optimization of SWSS amendment and its application in agriculture, as well as recent findings of other authors in this field, the following conclusions were drawn. The technology, which was newly developed offers an innovative and comprehensive solution to the problem of SWSS disposal and soil degradation, which includes aspects of agriculture, healthcare, epidemics, ecology, economics, and the social sphere. Costs can be recuperated through SWSS treatment service fees and fertilizer sales. SWSS can replace mineral fertilizers in crop production. Attention should be paid to the amount and ratio of mineral elements available to the plant during plant growth. SWSS is recommended for plants with a longer vegetation period due to the slow release of nutrients. A phytotoxic effect may occur during seed germination. Therefore, the complexity of sewage sludge can be reduced by employing integrated biorefinery approaches that will result in circular bioeconomy and industrial ecology solutions.

***Keywords**: circular economy, fertilizer, life-cycle assessment, plant growth, soil stability and quality*

Biography

Currently, Prof. Dr. Hosam Bayoumi Hamuda is working at Obuda University, Sandor Rejto Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences (Budapest, Hungary) since 2008. He was Senior Researcher and Deputy Director of Research Group for Environmental Microbiology of Hungarian Academy of Sciences (Budapest) between 1997 and 2004. Briefly, He received the degrees of B.Sc. (1978, Chemistry and Botany), M.Sc. (Biological Sciences) from Garyounis University (Benghazi, Libya), University Doctor (1987, Agricultural Sciences-Soil Microbiology) and PhD in Biological Sciences (1999) from Gödöllő University of Agricultural Sciences (Gödöllő, Hungary) and C.Sc. in Biological Sciences (1994) from Hungarian Academy of Sciences, Budapest, Hungary. He received the Doctor Habilitation Degree in Environmental Sciences (2007) and the Professor degree from Szent István University (2008, Gödöllő, Hungary). Also, University Doctor Degree in Natural Sciences from Eötvös Loránd University (1995, Budapest). Prof. Hamuda was awarded many times from different organisations, e.g., the Society of Hungarian Microbiologists (MMT), the Hungarian Professors Council (MPV), etc. and he is a member of many Hungarian and International Organisations. Prof. Hamuda was the general secretory and now is the president of International Council of Environmental Engineering Education (ICEEE) originated since 2010 (Budapest, Hungary) and Member of the International Society of Development and Sustainability (Japan), Society of MMT, Soil Science and Agrochemistry Committee of the Agricultural Sciences Department of IV of the Hungarian Academy of Sciences (Budapest) and Association of Hungarian Medical Societies (MOTESZ) and others. He was the director of MSc program titled: Microbial Science and Biotechnology (Szent István University, Gödöllő, Hungary) from 2000 to 2008 and Director of PhD Program titled: Agricultural-, Environmental Microbiology and Soil Biotechnology until from 2007 to 2015 and now a member of the Environmental Sciences Doctor's School at Szent István University and Doctoral School on Materials Sciences and Technologies at Obuda University. Prof. Hamuda is acting as editorial member, reviewer of many international journals, and he organize many international conferences and symposiums. He delivered more than 120 plenary and keynote lectures in international events and a member of scientific committee of more than 100 conferences. He is the editor in chair of more than 15 Proceedings Books of International Conferences. Research Interest Topics: 1. Microbial biotechnology: solid waste and wastewater management. Soil Biotechnology: rhizosphere index, soil microbial biomass and enzymatic activities. soil health, and soil biodiversity. Soil security, biocontrol and biofertilizers. microbial inoculants. Colonization of Plant Growth-Promoting Rhizomicrbiota. Nitrification inhibitors and crop quality. 2. Monitoring of soil organic matter. Econanotoxicology. Roles of engineered metal oxide nanoparticles in soil. 3. Public health and healthcare. Bioengineering and Environmental Health. Probiotics, antibiotics, xenobiotics, and human gut

microbiomes. Impacts of xenobiotics: pesticides and other pollutants on soil biological activities 4. Climatic changes and global security.

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PLANT ALLEVIATES CARBON TETRACHLORIDE-INDUCED NEPHROTOXICITY IN RATS

Zunaira TEHSEEN

NARC, Islamabad, Pakistan, zunairatehseen13@gmail.com, +92 3402747545

Abstract: *Plants have been used to treat a variety of illnesses since the dawn of human civilization because of their therapeutic and medicinal capabilities. Secondary metabolites such as alkaloids, flavonoids, phenolic compounds, terpenoids, and others, are thought to be the cause of their pharmacological potential. Both qualitative and quantitative investigation of the methanolic extract of I. cordifolia was performed in-vitro and in-vivo.*

The presence of important phytochemicals such as flavonoids, coumarins, alkaloids, saponins, tannins, quinones, glycosides, and many others was observed through qualitative analysis of the samples. These findings were then supported by in-vitro antioxidant assays, which showed the ICM to be an effective root of antioxidant and anti-inflammatory agents. For in-vivo investigation, rats with CCl_4 induced toxicity get an oral dose of methanolic extract. The study evaluated the plant's impact on three levels: biochemically, histologically, and molecularly. It assessed antioxidant enzymes, protein content, and oxidative species in tissue homogenate, measured serum biomarkers for renal functionality, and examined kidney tissue sections under a light microscope. The expression of a few genes (XBPu, XBPt, XBPs, IL-6, Bcl2, TNF-a, TGF-β, Chop, Casp-3, B-actin) crucial in preserving the physiological and structural integrity of nephrons was then investigated.

By enhancing renal functionality, as seen by upsurge in albumin levels and a decline in urea and creatinine levels in serum, ICM demonstrates its nephroprotective action, and it's also efficient in restoring the biological system's antioxidative status by balancing the levels of antioxidant enzymes (CAT, SOD, POD, and GSH reductase), protein content, and oxidative species (TBARs, nitrite, and hydrogen peroxide). Additionally, it reversed the levels of expression of the afore mentioned genes that had been changed by CCL_4-induced toxicity and oxidative stress. Following study, it was shown that ICM is a good source of antioxidants and has nephroprotective qualities against both acute and chronic kidney disorders.

Keywords*:* CCl_4, Nephrotoxicity, *Indigofera Cordifolia*, Methanolic extract, Nephroprotection

Biography

Zunaira Tehseen, an MPhil in Biochemistry, has made significant contributions to pharmacology and environmental sciences. She gained expertise in disease diagnostics and plant genetics through internships at pathology and plant genomics labs. Her passion for environmental stewardship extends beyond academia, as she actively participates in awareness campaigns and community outreach programs. Zunaira's passion for making a difference in the world led her to explore pathology and plant genomics labs, enhancing her diagnostic

skills and appreciation for biodiversity. Her dedication to positive change can shape the future of our planet.

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ATTENUATION OF CARBON TETRACHLORIDE INDUCED NEPHROTOXICITY IN RATS BY *INDIGOFERA CORDIFOLIA*

Zunaira TEHSEEN

NARC, Islamabad, Pakistan, zunairatehseen13@gmail.com, +92 3402747545

Abstract: *Plants have been used for treating various illnesses since ancient times due to their therapeutic and medicinal properties. The methanolic extract of I. cordifolia was investigated in-vitro and in vivo, revealing the presence of phytochemicals such as flavonoids, coumarins, alkaloids, saponins, tannins, quinones, and glycosides. In vivo, rats with CCl_4-induced toxicity were given an oral dose of the methanolic extract, and the plant's impact was evaluated biochemically, histologically, and molecularly. The study found that ICM enhanced renal functionality by increasing albumin levels and decreasing urea and creatinine levels in serum. It also restored the biological system's antioxidative status by balancing antioxidant enzymes, protein content, and oxidative species. Furthermore, it reversed the expression of genes affected by CCL_4-induced toxicity and oxidative stress. Overall, ICM is a valuable source of antioxidants and has nephroprotective qualities against both acute and chronic kidney disorders.*

Keywords*: CCl4, Nephrotoxicity, Indigofera Cordifolia, Methanolic extract, Nephroprotection*

Biography

Zunaira Tehseen, an MPhil in Biochemistry, has made significant contributions to pharmacology and environmental sciences. She gained expertise in disease diagnostics and plant genetics through internships at pathology and plant genomics labs. Her passion for environmental stewardship extends beyond academia, as she actively participates in awareness campaigns and community outreach programs. Zunaira's passion for making a difference in the world led her to explore pathology and plant genomics labs, enhancing her diagnostic skills and appreciation for biodiversity. Her dedication to positive change can shape the future of our planet.

VIRUS IS LIVING AND ITS TREATMENT

Kunal JOON

Noida International Institute of Medical Sciences (*NIIMS), Greater Noida, India, email: kunaljoon37@gmail.com telephone: +919992201535*

***Abstracts**: A viral test is done to find infection causing viruses. Viruses grow only in living cell. Viruses causes disease by destroying or damaging the cells they infect, damaging the body's immune system Changing the genetic material (DNA) of the cells they infect or causing inflammation that can damage an organ. Viruses cause many types of diseases, such as human immunodeficiency virus (HIV), cold sores, chicken pox, measles, flu and some cancer*
Nuclear medicine: Benefits of nuclear Medicine:
Nuclear medicine is the medicine made of nutrients mixed and generated immune cells are mixed together and these medicines is generated in body to make new immune fight against virus.
What are nuclear proteins in virus?
When energy is released, a high amount of transformation occurs, and nucleus is transformed in nuclear proteins. Benefits of forward rolling of DNA:
New characteristics of a particular organism grow faster and lead to proper development of organism.
DNA backward rolling:
DNA backward rolling leads to the deforming the cells and lead to formation of two organism again.

***Keywords**: DNA forward rolling DNA backward rolling DNa combination and nuclear medicine*

Biography

I am Dr Kunal Joon Working on this research for 5 years and found virus treatment and found it living

HOW DO CELL DETERMINE AT WHAT SIZE TO GROW

Kunal JOON

Noida International Institute of Medical Sciences (NIIMS), Greater Noida, India,
email: kunaljoon37@gmail.com telephone: +919992201535

Abstract: *DNA ARCHITECTURE THEORY*
Zygote contains a DNA as an architecture and form cells of ectoderm, mesoderm and endoderm
DNA contains a gene and act as an architecture for cell
It act as a digital clock for the cell division
1 DNA base pair supplies energy to the cell for division as when the cell divides before cytoplasmic division chromosome divides and during chromosome division a huge amount of energy is released
2 this energy is supplied for division of organelle and accurate amount of energy is released by DNA for cell to divide it is during S phase
3 During meiotic when chromosome pair up then energy is released.
DNA as a digital clock
1 for cell division DNA act as a digital clock
2 During zygote formation or during cell division. DNA stores information for when to cell to divide
3 During normal condition due to absence of T loop normal human cell divides within 24 hours.
DNA as a cell division machinery
1 DNA starts the procedure of cell division
2 as when cell gets stimulated for systemic division than DNA first one to get stimulated and cell prepare for process for mitosis or meiosis process

Keywords*: DNA architecture, DNA as a clock; cell division, DNA forward rolling; DNA backward rolling*

Biography

I am Dr. Kunal Joon working on cell cycle for 2 years and found mysteries of cell cycle that is how cell determine at what size and at what time to grow

BIO-MONITORING OF WILD BOAR (*SUS SCROFA*) IN URBAN AND PERI-URBAN AREAS URBAN AREAS OF THE CITY OF ANNABA

Kamelia Hesni BENOTMANE, Mehdi BOUKHEROUFA, Salsabil ABBASSI, Feriel Sakraoui-BOUKHEROUFA

University of Badji Mokhtar, Annaba, Algeria, kameliabenotmane@gmail.com, (+213)0662278216

Abstract: *The wild boar (Sus scrofa) is a typical synurbic species that serves as a model for analyzing the processes and impacts related to biological invasions. In this preliminary study, we conducted a monitoring of the species in the urban environment of the city of Annaba, to identify hotspots of the species' density and to provide local managers with some recommendations to avoid potential negative impacts, both material and sanitary. We therefore chose sector 3 of the city of Annaba to conduct a survey and counting of individuals frequenting this site, from the beginning of January to the end of April. The encountered specimens were counted, geolocated, and then overlaid on a map using the SasPlanet program. The results obtained generally show a hotspot of attendance located in the neighbourhoods of Sidi Achour and des Hongrois, both located near the forest. The results also show an increase in the population after the regulatory hunting period, suggesting that the latter has no effect on regulating the density of the species.*

Keywords*: Sus scrofa - Urban environment - Hunting - City of Annaba - SasPlanet program - hotspots*

Biography

PhD student in Ecology, Member of DAFEC Research Team (Animal Diversity and Ecosystem Functioning) and affiliated to laboratory of "Soil and Sustainable Development" Department of Biology / Faculty of Sciences Badji Mokhtar University, Annaba, Algeria.

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INSIGHT INTO THE AMMONIUM TRANSPORTER (AMT) FAMILY GENES IN PEARL MILLET: THE KEY PLAYERS FOR ENHANCING NITROGEN USE EFFICIENCY TO ENSURE FOOD SECURITY

Tanushree SARKAR*, Suman BAKSHI

Nuclear Agriculture & Biotechnology Division, Bhabha Atomic Research Centre, Mumbai-400085, India.

Abstract: *Nitrogen use efficiency (NUE) in plants measures their ability to optimize nitrogen uptake and utilization for growth and development. Efficient nitrogen use involves minimizing losses to the environment, contributing to enhanced plant productivity and sustainable agricultural practices. Plants primarily absorb nitrogen from the soil as ammonium (NH_4^+). AMmonium Transporters (AMTs) play a key role in transporting ammonium into plants as plasma membrane proteins. Pearl millet (Pennisetum glaucum (L.) R. Br.) holds significance as a resilient and nutrient-rich cereal crop, contributing to food security in various regions due to its adaptability to diverse climates and nutritional value. In this study, genome-wide identification and in-silico analyses of Pearl millet AMT family genes (PgAMTs) were performed. Sequence analyses revealed variations in PgAMTs at nucleotide and protein levels. While all PgAMTs comprise an ammonium transporter domain (PF00909), the number of transmembrane helices varied. Phylogenetic analysis established that PgAMTs belong to two subfamilies, AMT1 and AMT2 (AMT2/AMT3/AMT4). Ka/Ks analysis suggested that segmental duplications have significantly contributed to PgAMT evolution. Furthermore, the analysis of syntenic blocks underscores the significant conservation of AMTs in structure and function across most Poaceae species. Promoter analysis of P. glaucum AMTs indicated that their promoters have cis elements related to anaerobic induction, growth hormones, light response, biotic stress, drought stress, and several endogenous signals related to plant growth and development. This research provides insights into the structural and functional aspects of AMTs in pearl millet, serving as a foundation for utilizing AMTs to modify NUE strategies.*

Keywords*: Nitrogen use efficiency, growth and development, endogenous signals*

TRADITIONAL HEALTHY FOODS AND PRACTICES DURING PREGNANCY IN INDIA

Jyoti SIHAG*, Poonam YADAV

Department of Human Development and Family Studies
I. C. College of Community Science, CCS Haryana Agricultural University-125004
**Email: - sihagjyoti1998@gmail.com; +919306861456*

Abstract: *The birth of a new-born is a moment of tremendous joy for the mother, and every mother has the complete right to experience it. In India, pregnancy is considered a normal physiological phenomenon, and often hospital check-ups are only done when a medical issue is being faced by the women. There are situations when this behaviour puts the mother and child in danger. Complications from pregnancy are on the rise in developing nations like India. Poor maternal nutritional status of women before and during pregnancy due to their own childhood under nutrition, low level of BMI at conception, inadequate gestational weight gain due to poor dietary choices has serious implications on the mother and the baby. Most Indian culinary customs and traditions have their roots in long-standing traditions and conventions. This often leads to hindrance in the consumption of healthy foods which can help in the prevention of chronic diseases during this stage and as well as at a later period of life. This review study reveals the important traditional healthy foods across various regions of Indian which can be beneficial during the gestational period and focuses on pregnancy beliefs among women. Using different combinations of terms linked to recommended foods during pregnancy, relevant papers were found from Science Direct, PubMed, and Google Scholar.*

Keywords*: pregnancy, traditional foods, maternal health, nutritional factors, Indian Health foods, Indian women, food practices*

Biography

PROBIOTIC GUT MICROBIOMES AND MENTAL HEALTH DISORDERS

HOSAM E.A.F. BAYOUMI HAMUDA[1], LYUDMYLA SYMOCHKO[2,3,4]

[1]Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary, [2]University of Coimbra, Coimbra, Portugal, [3]Uzhhorod National University, Uzhhorod, Ukraine, [4]Institute of Agroecology and Environmental Management, NAAS, Kyiv, Ukraine
bayoumi.hosam@uni-obuda.hu, WhatsApp/viber/messenger: +36303900813

Abstract: *Mental health is one of the United Nations' Sustainable Development Goals, and mental disorders mainly include anxiety, depression, bipolar disorder, autism spectrum disorder, schizophrenia, and eating disorders. According to estimates from the World Health Organization (WHO), approximately 10% of the world's population suffers from various mental diseases each year. Worldwide, financial and health burdens on society are increasing annually. Therefore, understanding the different factors that can influence mental illness is required to formulate novel and effective treatments and interventions to combat mental illness. Mental health conditions have been linked closely to an imbalance of microbiota in the gut, leading to disruption of the microbiome (dysbiosis). Several neurotransmitters, such as gamma-aminobutyric acid, serotonin, and glutamate, are produced in the gut, which are associated with anxiety and depressive symptoms. Mental health and the gut have been linked closely, and many mental illnesses have been associated with gut dysbiosis. Mental disorders can influence the study, work, and normal life of patients, and lead to suicide in severe situations. Moreover, mental disorders can affect the normal life of family members of the patients. Mental disorders have emerged as a significant public health concern worldwide, and lead to a huge medical burden and economic loss. Probiotics are living microorganisms that when administered in adequate amounts confer health benefits on the host. Psychobiotics are probiotics that can specifically bestow mental health benefits. This idea has been extended to include prebiotics, that promote the proliferation of beneficial bacteria in the gastrointestinal tract. The combination of probiotics and prebiotics is often described as synbiotics. Synbiotics redefined as a mixture comprising live microorganisms and substrate(s) selectively utilized by host microorganisms that confers a health benefit on the host. Given probiotic's potential to offer novel, personalized treatment options for mood disorders, further, better targeted research in psychiatric populations is needed to address concerns about the exact mechanisms of probiotics, dosing, timing of treatment, and possible differences in outcomes depending on the severity of anxiety and depression. The human gut contains many bacteria, which engage in the host's physiological activities including nutrient absorption, immune protection, and metabolic regulation. Intestinal epithelial cells greatly contribute to the stabilization of the symbiotic relationship between the intestinal bacteria and the host by constructing a mucosal barrier, secreting immune mediators, and delivering bacterial antigens. The abundance of probiotics e.g., Lactobacillus and Bifidobacterium. The gut microbiota changes could be associated with disease severity and haematological markers such as inflammatory markers and liver function markers. Changes in the gut microbiome can affect cognitive and psychological functions via the microbiota–gut–brain (MGB) axis. Probiotic supplements are*

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thought to have largely positive effects on mental health when taken in sufficient amounts; however, despite extensive research having been conducted, there is a lack of consistent findings on the effects of probiotics on mental health and the associated microbiome alterations. Increasing evidence suggests that the gut microbiome and the MGB axis play a crucial role in modulating psychiatric disorders. Therefore, treatments such as probiotics that potentially alter the composition and function of the gut microbiome, might have desired beneficial effects in human mental health. The aim of our study is to systematically review the most recent literature of the last 10 years to clarify whether probiotics could improve metal health. It was found that the gut–brain axis is a system which encompasses a bidirectional communication between the gut and the brain involving the neural, immune, endocrine, and metabolic pathways. Gut-produced cytokines can reach the brain through the bloodstream and although it is doubtful that they would cross the blood–brain barrier (BBB) under normal physiological conditions, there is growing evidence that they can affect parts of the brain where the BBB is inadequate, such as the hypothalamus; for instance, cytokines interleukin-1 (IL-1) and IL-6 trigger the release of cortisol by activating the hypothalamic–pituitary–adrenal axis. In addition, gut microbiota is the primary source of short-chain fatty acids, which modulate brain health and behaviour via the immune system, having a beneficial anti-inflammatory and mental health role by inducing T cell differentiation, controlling inflammatory cytokine production, and influencing serotonin and other neurotransmitter production. The gut microbiome can metabolize glutamate to produce certain beneficial metabolites, such as GABA and serotonin, which are known molecules thought to reduce anxious and depressive states; despite not being able to cross the BBB, they can nevertheless pass through the intestinal mucosal layer and have an indirect effect on brain function via the enteric nervous system. Our survey indicates that most of the most recent literature suggests a beneficial role of probiotics in the treatment of depression and anxiety, despite the existence of a substantial number of less positive findings. The present study provides the potential clinical use of probiotics (including prebiotics/psychobiotics/synbiotics) as a therapeutic tool in the treatment of metal disorders. Moreover, probiotic treatment appeared to be helpful not only in patients with an active psychiatric illness, but also in healthy individuals experiencing stressful life events, which is in line with existing meta-analytic evidence. But due to demographic differences, dosage, host diet, genetics, age, medication use, and the severity of the initial symptoms, which could influence the self-reported date, as demonstrated in older studies. The gut microbiota and its metabolites could play an important role in mental health through the MGB axis. Thus, probiotics might serve as an additive therapy for depression. At present, most studies about gut microbiota with mental disorders focused on the genus level, and more studies on gut microbiota should be carried out at the species level in the future, because the different species in the same genera could have different effects on mental disorders. Due to the potential significant differences in the composition of the gut microbiome among individuals, it is crucial to accurately identify the changes of featured microbes that occur in everyone with mental disorders, which is important for personalized treatment of mental disorders through targeting gut microbiota. Meanwhile, further elucidation and investigation of the underlying mechanisms of action is imperative. This topic *is helpful for the public to choose natural dietary products to maintain mental health, and for natural dietary products to be developed into pharmaceuticals and functional foods for the prevention and treatment of several mental disorders.*

***Keywords**: probiotics; anxiety; depression; gut microbiomes; alterations; prebiotics; psychobiotics, mental health, gut-brain axis*

Biography

Currently, Prof. Dr. Hosam Bayoumi Hamuda is working at Obuda University, Sandor Rejto Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences (Budapest, Hungary) since 2008. He was Senior Researcher and Deputy Director of Research Group for Environmental Microbiology of Hungarian Academy of Sciences (Budapest) between 1997 and 2004. Briefly, He received the degrees of B.Sc. (1978, Chemistry and Botany), M.Sc. (Biological Sciences) from Garyounis University (Benghazi, Libya), University Doctor (1987, Agricultural Sciences-Soil Microbiology) and PhD in Biological Sciences (1999) from Gödöllő University of Agricultural Sciences (Gödöllő, Hungary) and C.Sc. in Biological Sciences (1994) from Hungarian Academy of Sciences, Budapest, Hungary. He received the Doctor Habilitation Degree in Environmental Sciences (2007) and the Professor degree from Szent István University (2008, Gödöllő, Hungary). Also, University Doctor Degree in Natural Sciences from Eötvös Loránd University (1995, Budapest). Prof. Hamuda was awarded many times from different organisations, e.g., the Society of Hungarian Microbiologists (MMT), the Hungarian Professors Council (MPV), etc. and he is a member of many Hungarian and International Organisations. Prof. Hamuda was the general secretory and now is the president of International Council of Environmental Engineering Education (ICEEE) originated since 2010 (Budapest, Hungary) and Member of the International Society of Development and Sustainability (Japan), Society of MMT, Soil Science and Agrochemistry Committee of the Agricultural Sciences Department of IV of the Hungarian Academy of Sciences (Budapest) and Association of Hungarian Medical Societies (MOTESZ) and others. He was the director of MSc program titled: Microbial Science and Biotechnology (Szent István University, Gödöllő, Hungary) from 2000 to 2008 and Director of PhD Program titled: Agricultural-, Environmental Microbiology and Soil Biotechnology until from 2007 to 2015 and now a member of the Environmental Sciences Doctor's School at Szent István University and Doctoral School on Materials Sciences and Technologies at Obuda University. Prof. Hamuda is acting as editorial member, reviewer of many international journals, and he organize many international conferences and symposiums. He delivered more than 120 plenary and keynote lectures in international events and a member of scientific committee of more than 100 conferences. He is the editor in chair of more than 15 Proceedings Books of International Conferences. Research Interest Topics: 1. Microbial biotechnology: solid waste and wastewater management. Soil Biotechnology: rhizosphere index, soil microbial biomass and enzymatic activities. soil health, and soil biodiversity. Soil security, biocontrol and biofertilizers. microbial inoculants. Colonization of Plant Growth-Promoting Rhizomicrbiota. Nitrification inhibitors and crop quality. 2. Monitoring of soil organic matter. Econanotoxicology. Roles of engineered metal oxide nanoparticles in soil. 3. Public health and healthcare. Bioengineering and Environmental Health. Probiotics, antibiotics, xenobiotics, and human gut microbiomes. Impacts of xenobiotics: pesticides and other pollutants on soil biological activities 4. Climatic changes and global security.

MICROSCOPIC AND MINERALOGICAL CHARACTERIZATION OF THE POLYMETALLIC MINERALIZATIONS (FE-CU-BA) OF THE BENI FELKAÏ MASSIF (EASTERN BABORS, NORTHEASTERN ALGERIA)

Zoubir BELHIMER[1], Azzedine BOUZENOUNE[1], Abdelhakim BOUCHAIR[1], Oumeima BENMEBAREK[1]

[1]Geological Engineering Laboratory (LGG), Faculty of Natural and Life Sciences, University of Jijel, 18000 Jijel, Algeria, belhimerzbr@gmail.com , (+213)6 59 10 47 85

Abstract: *The Babors range of the Tellian domain of northern Algeria is characterized by the presence of several mineralized scaled carbonate massifs of Jurassic age. The aim of this work is to determine the composition and the mineralogical characteristics of the polymetallic mineralization of one of those mineralized massifs, taking the Beni Felkaï massif as a case study. This latter is located in the eastern part of the Babors range, known as Eastern Babors, 33 km southeast of the city of Bejaia in northeastern Algeria. The mineralization of the Beni Felkaï massif are carbonate hosted. The host rocks are highly fractured dolomites and dolomitic limestones of lower Liassic age in contact with Triassic formations. In addition to the main cluster iron mineralization previously mined, a minor copper-barium mineralization is associated. Metallographic examination of around twenty ore polished sections indicates that the polymetallic mineralization of the Beni Felkaï massif are composed of hematite, goethite and limonite for Fe-mineralization and gray copper and barite for Cu-Ba mineralization. Gray copper is often altered into azurite and malachite. Calcite and quartz are the main gangue minerals. X-ray diffraction analyses have been carried out on several selected ore samples. These analyses are consistent with microscopic observations and reveal that the gray copper is tetrahedrite. The present study shows that the Beni Felkaï massif of Eastern Babors contains main Fe-mineralization associated with minor Cu-Ba mineralization both hosted by Liassic carbonate rocks. The former are composed of iron oxides and hydroxides, while the latter are composed of tetrahedrite and barite. The association of iron and copper-barium mineralization in Liassic carbonate rocks is well known not only in the Babors range, but also in the whole Tellian domain of northern Algeria, especially in its eastern part. They are most likely epigenetic hydrothermal mineralization.*

Keywords*: iron mineralization, copper-barium mineralization, hydrothermal, Liassic, carbonate-hosted, Tellian domain.*

Biography

Zoubir Belhimer is a Ph.D. student in geology (mineral resources, geomaterials and environment) at the Faculty of Natural and Life Sciences of Mohamed Seddik Benyahia University of Jijel, Algeria. I am currently working on polymetallic mineralizations hosted by Jurassic carbonate rocks in the eastern Babors region of northeastern Algeria.

AWARENESS AND UPTAKE OF SUSTAINABLE LAND MANAGEMENT PRACTICES BY FARMERS IN ONA-ARA LOCAL GOVERNMENT AREA, OYO STATE, NIGERIA

Afolabi, Oluwole OKIKIJESU

Federal University of Technology, Akure, Nigeria, afolabioluwoleokikijesu@gmail.com, +2347039555365

Abstract: *Sustainable land management practices are indispensable in the global pursuit of food security, environmental conservation, and poverty alleviation. Therefore, the study examined the awareness and uptake of sustainable land management practices (SLMP) by arable crop farmers in the study area. Specifically, the study identified the socio-economic characteristics of the farmers in the study area; SLMP awareness among the farmers; and SLMP adopted by the arable crop farmers in the study area. The two-stage sampling procedure was employed to collect data from hundred (100) arable crop farmers. Thereafter, data collected were analysed using descriptive statistics and Chi-square. The findings revealed that the mean age of the respondents was 43 years, with a mean household size of about 5 members. Majority (73%) of the respondents had formal education and a mean year of experience of about 15. The study also revealed that the most popular SLMP adopted by the farmers were the use of chemical fertilizers, crop rotation and intercropping. The result indicated that education level, farm size, household size, farm income, awareness of sustainable soil management practice, distance to the market (output), distance to the market (input), credit/loan access, access to extension services, average price of product, average price of the input for each practice and subsidies on input for each practices had significant influence on the adoption intensity of SLMPs. The study therefore concluded that the respondents are aware of and adopted SLMP in the study area. Finally, it suggests that targeted interventions, such as improved access to extension services and credit facilities, can enhance the adoption of SLMPs among farmers. Additionally, promoting education and awareness about these practices can further facilitate their adoption, contributing to more sustainable agricultural practices in the region.*

Keywords*: Awareness, Uptake, Sustainable Land Management Practices*

Biography

Afolabi, Oluwole Okikijesu is an agricultural economist with research focus in environmental economics. He had B.Agric.Tech in Agricultural Economics and Extension and M. Agric.T ech degree in Agricultural and Resource Economics (Environmental Economics option) from Federal University of Technology, Akure (FUTA). He is presently on his PhD degree programme in Agricultural and Resource Economics from the same University. His M. Agric. Tech thesis was on effect of market access on the adoption of sustainable soil management practices in Oyo State, Nigeria. Afolabi joined the services of FUTA in January

2022 as Teaching Assistant and has been gathering experiences in both academic, research and consultancies.

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FOSTERING SUSTAINABLE FARMING PRACTICES AMIDST CLIMATE CHANGE CHALLENGES FOR FARMERS

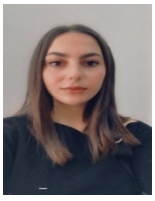
Ledianë DURMISHI

Doctoral School of Economics and Regional Sciences, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary,
Durmishi.Lediane@phd.uni-mate.hu

Abstract: *Climate change is having an influence across the planet. Some of the main climate change impacts include agriculture loss, rising sea levels, water scarcity, disasters, extreme weather, and global warming. The most serious negative impact of climate change is global warming, impacted by the rise of temperatures. The average temperature of the Earth's surface is presently roughly 1.1°C higher than it was in the late 1800s. The most recent decade (2011-2020) was the warmest on record, and the last four decades have been warmer than any prior decade since 1850, impacting people's lives. Climate change has disastrous consequences, particularly for populations who rely on farming and agriculture for a living. Prolonged drought or other extreme weather events, such as floods, have the potential to destroy crops and cattle, leaving families unable to care for their children and looking for alternatives. The benefits and drawbacks of climate change effects may differ depending on location, individual crops, and regional temperature. The poorest farmers and the poorest nations are most at risk due to the current climatic changes, which are already negatively impacting food production and quality. This is because they rely on natural resources for existence daily and have little capacity to deal with the extremes brought on by climate change, and often destitute families have no choice but to flee their homes. Developing strong agricultural methods benefits not just the climate and communities, but also farm owners and businesses. This paper shows alternative technologies to foster sustainable farming practices. Another way of fighting and developing resilience to climate vulnerability is by thinking and acting locally. Local production of goods and food, for instance, can reduce waste, lower transportation costs, and support regional economies. The transportation footprint can be significantly reduced by using bicycles, walking, and effective public transportation, for instance.*

Keywords*: climate change impacts, farmers, food security, sustainable practices.*

Biography



Ledianë Durmishi received her BSc in Agriculture Economics at the University of Hasan Prishtina, in Kosovo in 2021. Furthermore, she received her master's degree in Rural Development Engineering at the Hungarian University of Agriculture and Life Sciences in Hungary in 2023. Currently, she is a Ph.D. student at the Hungarian University of Agriculture and Life Sciences in the Doctoral School of Economics and Regional Sciences. Her research interests include climate change, economic development, and rural development.

ROLE OF SOIL FAUNA AS INDICATORS OF SUSTAINABLE AGROECOSYSTEM MANAGEMENT

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

Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary, [2]Hungarian University of Agriculture & Life Sciences, Budapest, Hungary
bayoumi.hosam@uni-obuda.hu, WhatsApp/viber/messenger: +36303900813

***Abstract**: Industrial development has resulted in an increased release of chemical pollutants and other agents into the environment, causing damage to the environment and increasing the risk of negative impacts on human health through the application and the contamination of various pesticides in agriculture internally or externally found in the food and crop production under unlimited monetarization. Pesticides and toxicants have an important role in the treatment and prevention of disease in animals (including humans) and in plants. But because of their nature and effects on the biosphere, their side-effects on the health of biosphere they are usually investigated in thorough safety and toxicology monitoring, the environmental impacts of the manufacture and use of them are less well understood and have only recently become a topic of research interest. Some pesticides can affect on microbiomes as well as the fauna including the insects and some animals well below the concentrations that are usually used in safety and efficacy examinations. In addition, breakdown products and the combination of different biologically active compounds may have unanticipated effects on the environment. Although it may be safe to assume that these substances do not substantially harm humans, we have only recently begun to research whether and how they affect a wide range of living organisms in the environment and what this means for environmental health.*

***Key words**: Pesticides, food and crop production, human health, microbiomes*

Biography

Currently, Prof. Dr. Hosam Bayoumi Hamuda is working at Obuda University, Sandor Rejto Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences (Budapest, Hungary) since 2008. He was Senior Researcher and Deputy Director of Research Group for Environmental Microbiology of Hungarian Academy of Sciences (Budapest) between 1997 and 2004. Briefly, He received the degrees of B.Sc. (1978, Chemistry and Botany), M.Sc. (Biological Sciences) from Garyounis University (Benghazi, Libya), University Doctor (1987, Agricultural Sciences-Soil Microbiology) and PhD in Biological Sciences (1999) from Gödöllő University of Agricultural Sciences (Gödöllő, Hungary) and C.Sc. in Biological Sciences (1994) from Hungarian Academy of Sciences, Budapest, Hungary. He received the Doctor Habilitation Degree in Environmental Sciences (2007) and the Professor degree from Szent István University (2008, Gödöllő, Hungary). Also, University Doctor Degree in Natural Sciences from Eötvös Loránd University (1995, Budapest). Prof. Hamuda was awarded many times from different organisations, e.g., the Society of Hungarian Microbiologists (MMT), the Hungarian Professors Council (MPV), etc. and he is a member of many Hungarian and International Organisations. Prof. Hamuda was the general secretory and now is the president of International Council of Environmental Engineering Education (ICEEE) originated since 2010

(Budapest, Hungary) and Member of the International Society of Development and Sustainability (Japan), Society of MMT, Soil Science and Agrochemistry Committee of the Agricultural Sciences Department of IV of the Hungarian Academy of Sciences (Budapest) and Association of Hungarian Medical Societies (MOTESZ) and others. He was the director of MSc program titled: Microbial Science and Biotechnology (Szent István University, Gödöllő, Hungary) from 2000 to 2008 and Director of PhD Program titled: Agricultural-, Environmental Microbiology and Soil Biotechnology until from 2007 to 2015 and now a member of the Environmental Sciences Doctor's School at Szent István University and Doctoral School on Materials Sciences and Technologies at Obuda University. Prof. Hamuda is acting as editorial member, reviewer of many international journals, and he organize many international conferences and symposiums. He delivered more than 120 plenary and keynote lectures in international events and a member of scientific committee of more than 100 conferences. He is the editor in chair of more than 15 Proceedings Books of International Conferences. Research Interest Topics: 1. Microbial biotechnology: solid waste and wastewater management. Soil Biotechnology: rhizosphere index, soil microbial biomass and enzymatic activities. soil health, and soil biodiversity. Soil security, biocontrol and biofertilizers. microbial inoculants. Colonization of Plant Growth-Promoting Rhizomicrbiota. Nitrification inhibitors and crop quality. 2. Monitoring of soil organic matter. Econanotoxicology. Roles of engineered metal oxide nanoparticles in soil. 3. Public health and healthcare. Bioengineering and Environmental Health. Probiotics, antibiotics, xenobiotics, and human gut microbiomes. Impacts of xenobiotics: pesticides and other pollutants on soil biological activities 4. Climatic changes and global security.

IMPACTS OF PESTICIDES ON FOOD SAFETY AND ENVIRONMENTAL TOXICOLOGY

Hosam E.A.F. BAYOUMI HAMUDA

Institute of Environmental Engineering and Natural Sciences,
Rejto Sandor Faculty of Light Industry and Environmental Engineering
Obuda University, Budapest, Hungary
bayoumi.hosam@uni-obuda.hu, WhatsApp/viber/messenger: +36303900813

***Abstract**: Industrial development has resulted in an increased release of chemical pollutants and other agents into the environment, causing damage to the environment and increasing the risk of negative impacts on human health through the application and the contamination of various pesticides in agriculture internally or externally found in the food and crop production under unlimited monetarization. Pesticides and toxicants have an important role in the treatment and prevention of disease in animals (including humans) and in plants. But because of their nature and effects on the biosphere, their side-effects on the health of biosphere they are usually investigated in thorough safety and toxicology monitoring, the environmental impacts of the manufacture and use of them are less well understood and have only recently become a topic of research interest. Some pesticides can affect on microbiomes as well as the fauna including the insects and some animals well below the concentrations that are usually used in safety and efficacy examinations. In addition, breakdown products and the combination of different biologically active compounds may have unanticipated effects on the environment. Although it may be safe to assume that these substances do not substantially harm humans, we have only recently begun to research whether and how they affect a wide range of living organisms in the environment and what this means for environmental health.*

***Key words**: Pesticides, food and crop production, human health, microbiomes*

Biography

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SENSITIVITY OF *TRICHODERMA* POPULATION TO TOXIC METAL POLLUTION IN SOILS

ZOLTÁN NAÁR

University of Tokaj, Sárospatak, Hungary

Abstract: *The effect of artificial heavy metal treatments (Cd, Cu, Ni, and Zn) on the species composition of Trichoderma fungi in brown forest soil was studied over four years. The changes in the heavy metal sensitivity of Trichoderma fungi isolated from polluted soil were also investigated. Major alterations in the species abundance were detected. A general tendency of the decline of T. harzianum (dominant species of control) along with the marked increase in the rate of T. viride was observed in all four years. After four years, the isolation was repeated on Czapek-Dox agar containing 0.1-9.0 mM of the respective heavy metals to compare Trichoderma and other fungi in situ heavy metal sensitivity. In mixed culture, Aspergillus, Penicillium, and Fusarium proved to be more tolerant than Trichoderma; they grew at 3—6 mM, whereas Trichoderma only at 0.1-0.5 mM, which is lower than that tolerated in pure culture. The changes in the composition of the Trichoderma population are likely caused by decrease in the fitness of the species due to the heavy metal pollution resulting in diminished competitive ability against other soil microbes. This was supported by the population data obtained from the laboratory treatment of soil. The Trichoderma species composition changed after three months, and data for the next three months showed a similar tendency of changing in the dominancy of T. harzianum and T. viride. The propagule number of rare Trichoderma species decreased to the detection limit during six months.*

Keywords*: Trichoderma species, artificial soil pollution, competitive ability*

Biography

Dr. Zoltán Naár Ph.D., microbiologist, microbial ecologist. Fields of research: soil microbial ecology of biological plant protection, food microbial ecology, food technology and safety.

SCREENING OF DIFFERENT VARIETIES OF *BRASSICA JUNCEA* UNDER SLAT STRESS CONDITION

SHWETA[1]*, Sridevi TALLAPRAGADA[1], Nita LAKRA[2], Vinod GOYAL[1], Anita KUMARI[1]

[1]Department of Botany and Plant Physiology, College of Basic Sciences and Humanities, Chaudhary Charan Singh Haryana Agricultural University, Hisar-125004, Haryana, INDIA
[2]Department of Molecular Biology & Biotechnology, Chaudhary Charan Singh Haryana Agricultural University, Hisar-125004, Haryana, INDIA
**Corresponding author.* rawalshweta25@gmail.com

Abstract: *The family Brassicaceae is considered one of the ten most economically important plant families. About 100 species of crops belong to the genus Brassica, which includes plants used for food such as rapeseed (Brassica napus L.), mustard (Brassica juncea L.), cabbage (Brassica oleracea L.), and turnip rape (Brassica rapa L.). Brassica juncea L. often known as "Indian mustard," is India's second-largest oil seed crop after soybean. Salinity stress is a critical factor impacting plant growth, distribution, and production via influencing several intracellular processes such as photosynthesis, ion homeostasis, protein, and lipid synthesis as well as hormonal and metabolic imbalance. The salt-affected soils contain excessive concentrations of either soluble salts or exchangeable sodium or both due to inadequate leaching of base forming cations. Salinity stress can result in the production of free radicals like superoxide ions, hydrogen peroxide (H_2O_2), and singlet oxygen, as well as a decrease in plant defense enzymes, an imbalance in sodium haemostasis, decreased iron uptake, and a decrease in the absorption of phenols and other trace elements. So, in this study 24 varieties of B. juncea were taken to check the effect of salinity on crop. Among 24 varieties, 4 varieties were selected on basis of root and shoot length, germination %, speed of germination, seedling vigour, fresh weight (g/plant), dry weight (g/plant).*

Keywords*: Germination %, Indian mustard, Salinity stress, Seedling vigour,*

Biography

Work: Physiology of Crop, Sustainable development

A SUSTAINABLE SYSTEM OF MWCNTS FOR MULTIFUNCTIONAL PAHS AND PHACS REMOVAL FROM DIFFERENT WATER MATRICES

Ruqayah Ali GRMASHA[1,2,3,4*], Osamah J. AL-SAREJI[1,2,4], Mónika MEICZINGER[1], Csilla STENGER-KOVÁCS[3,5], Khalid S. HASHIM[6,7]

[1]Sustainability Solutions Research Lab, Faculty of Engineering, University of Pannonia, Egyetem str. 10, Veszprém H, 8200, Hungary
[2]Environmental Research and Studies Center, University of Babylon, Babylon, Al-Hillah, Iraq
[3]University of Pannonia, Faculty of Engineering, Center for Natural Science, Research Group of Limnology, H-8200 Veszprem, Egyetem u. 10, Hungary
[4]The School of Civil and Environmental Engineering graduate, University of New South Wales, Sydney, Kensington NSW 2052, Australia
[5]ELKH-PE Limnoecology Research Group, H-8200 Veszprém, Egyetem utca 10, Hungary
[6]School of Civil Engineering and Built Environment, Liverpool John Moores University, UK
[7]Department of Environmental Engineering, College of Engineering, University of Babylon, Babylon, Al-Hillah, Iraq
**Corresponding author: Ruqayah Ali Grmasha, ruqayah.grmasha@unswalumi.com*

Abstract: *This study aimed to evaluate the effectiveness of a system consisting of modified multiwall carbon nanotubes (M-MWCNTs) in removing pollutants from different water sources. The research specifically used Ciprofloxacin (Cip), benzo[a]pyrene (Bap), and anthracene (Ant) as representative model pollutants. The most favorable conditions for removal were determined to be a pH of 5, a temperature of 25°C, and a dose of 1.6 g/L of MWCNTs. Under the given circumstances, the chosen pollutants demonstrated a removal rate over 90% throughout four treatment cycles in both synthetic water and polluted lake water when treated with MWCNTs. The adsorption process is tested to be governed by electrostatic attraction and precipitation processes. At a pH of 5, MWCNTs display a cationic charge, while Ciprofloxacin (Cip), benzo[a]pyrene (Bap), and anthracene (Ant) are present in their deprotonated states.*

Keywords*: Adsorption, Ciprofloxacin, benzo[a]pyrene, anthracene, removal.*

Biography

Ruqayah is a researcher in the field of Environmental engineering. Her research is focusing on
- Polycyclic aromatic hydrocarbons (PAHs)
- Removal of pollutants from water
- Health risk assessment
- Dust contamination
- Particulate matter (PM)

HIGHLY EFFICIENT REMOVAL OF PHARMACEUTICALS FROM WATER BY LACCASE IMMOBILIZED ON ORANGE PEELS

Osamah J. Al-SAREJI[1,2*], Mónika MEICZINGER[1], Ruqayah Ali GRMASHA[1,2,3], Viola SOMOGYI[1], Endre DOMOKOS[1], Khalid S. HASHIM[4,5]

[1]Sustainability Solutions Research Lab, Faculty of Engineering, University of Pannonia, Egyetem Str. 10, H-8200 Veszprém, Hungary
[2]Environmental Research and Studies Center, University of Babylon, Babylon, Al-Hillah 51001, Iraq
[3]Research Group of Limnology, Center for Natural Science, Faculty of Engineering, University of Pannonia, Egyetem u. 10, H-8200 Veszprém, Hungary
[4]School of Civil Engineering and Built Environment, Liverpool John Moores University, Liverpool L3 2ET, UK
[5]Department of Environmental Engineering, College of Engineering, University of Babylon, Babylon, Al-Hillah 51001, Iraq
**Corresponding author: osamah.al-sareji@unswalumni.com*

Abstract: *The use of laccase in enzymatic degradation has attracted significant attention due to its environmentally advantageous method of lowering pharmaceutical substances in aqueous solutions. The study investigated the immobilization of laccase enzyme onto biochar derived from agricultural waste, namely orange peels. The immobilized laccase system was analyzed using several methods, including scanning electron microscopy and energy dispersive X-ray spectroscopy, specific surface area (S_{BET}), Boehm titration, proximal and ultimate analysis, and point of zero-charge (pH_{PZC}) analysis. The immobilization of laccase led to substantial improvements in stability, particularly in terms of storage, temperature, and pH, as compared to laccase that was not bound. Significantly, the use of immobilized laccase shown remarkable efficacy in eliminating these pollutants for a maximum of six consecutive cycles. The findings demonstrate the practicality of using activated carbon derived from orange peels as a cost-efficient alternative for immobilizing laccase. This innovative approach has the capability to be scaled up and effectively address the removal of organic pollutants from water sources.*

Keywords*: Laccase, Adsorption, removal, process improvement.*

Biography

Osamah is working removal of emerging pollutants. He is widely recognized at the University of Babylon and University of Pannonia for his excellent research in this area. He served as a reviewer for several reputable journals. He has published over 23 scholarly works. Currently, he is affiliated with the University of Pannoina, where he pursues his Environmental Engineering fieldwork. The topics of research include:
- Removal of emerging pollutants from water and effluent
- Health risk assessment
-Enzyme immobilization
- Dust contamination

- Particulate matter (PM1 and PM2.5 pollution)
- Polycyclic aromatic hydrocarbons (PAHs)

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MONITORING BIOFILM PARAMETERS ON MBBR TECHNOLOGIES WITH LIGHT MICROSCOPE AND IMAGE PROCESSING

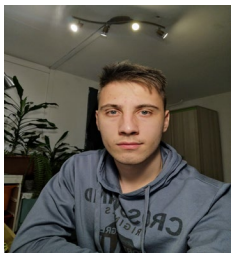
Tamás KLOKNICER

Obuda University, Inno-Water Zrt., Budapest, Hungary. kloknicer@gmail.com, +36306383651

Abstract: *In the modern world, energetically optimized, decentralized and environmentally friendly solutions are needed more and more. The trend of urbanization leads to ever growing suburban towns and stagnating or decreasing cities, due to the spreading idea of home office and the need of home-grown foods. These areas around big cities present great opportunities for industrial companies and storages to settle, as more space costs less money, however well-educated workforce is available. This means that the small wastewater treatment plants of suburban towns can't handle the increasing amount of wastewater in terms of both hydraulical capacity and organic matter. In the R&D project MICROBI we developed a special MBBR material, which has relatively high surface area compared to other materials. In MBBR technologies it is hard to monitor the growth of the biofilm in terms of mass, surface area used by bacteria and diameter of biofilm, which are important parameters that determine the efficiency and capacity of the carrier material. To measure these parameters TTC paint was applied to the biofilm samples, then I took light microscope pictures, calibrated the photos' pixels to mm, and with Image Pro processing program I separated the biofilm from unsettled material parts. With this new combination of methods, I can improve the monitoring of these systems and provide useful data for the challenges of modelling MBBR systems. With this data it is possible to determine more accurate kinetics for this special biofilm material, which makes this new technology even more useful, and applicable in the wastewater cleaning process. In the future this knowledge can be a part of a small (50-100m^3/day), autonomous wastewater cleaning technology that can provide smart, local solution for biological wastewater treatment.*

Keywords*: Biotechnology, MBBR, Wastewater, biofilm monitoring,*

Biography



My name is Tamás Kloknicer and I finished my bachelor in 2020 at Óbuda University, as an environmental engineer. My topic was freshwater qualification via macroinvertebrates. Next, I went to University of Debrecen to study Hydrobiology, and I continued my work field, to better understand the biological quantification system, and develop my knowledge in monitoring the urbanization effect on macroinvertebrates. During my studies I worked at Inno-Water Zrt, which is a R+D and consulting company on the fields of freshwater, wastewater. Now I'm on my PhD studies at Óbuda University, material sciences doctoral school. My work is about this new MICROBI technology, and to develop special kinetics for MBBR type systems.

PRIORITIZATION OF SEDIMENT YIELD AT SUB-WATERSHED LEVEL USING SWAT MODEL IN FINCA'AA WATERSHED, ABAY BASIN, ETHIOPIA

Seifu Kebede DEBELA

Jimma University, Jimma, Ethiopia, kebed2seif@gmail.com, +251917032664

Abstract: *Soil loss is one of the most important concerns that experts are looking into for successful watershed management. The goal of this research is to use a modelling approach to estimate the spatial sediment yield and identify hotspot locations at the sub-watershed level within the Finca'aa watershed in the Abay River Basin, Ethiopia, from 1999 to 2017. The constructed rating curve from measured discharge—sediment loading was used to generate sediment data for the calibration and validation process. Model sensitivity analysis, calibration, and validation were performed using the Sequential Uncertainty Fitting version-2 (SUFI-2) technique. The calibration and validation are based on adjusted sediment sensitive parameters from 2001 to 2009 and 2010 to 2017, respectively. The coefficient of determination (R^2) and Nash–Sutcliffe (ENS) through calibration and validation period were 0.84 and 0.79 and 0.79 and 0.74, respectively. The model has strong capacity to predict annual average sediment yield and identify vulnerable locations at the sub-watershed level from the Finca'aa watershed, according to the model performance criteria. As a result, yearly average soil loss for the entire watershed is 41.2t/ha/year and sub-watersheds (1, 8, 11, 14, 17, and 20) are among the 21 sub-watersheds with very significant soil erosion, contributing roughly 28 percent of the watershed's sediment yield. Primarily, greater attention for conservation should be given for these sub-watersheds. The outcome is very important for planners and resource managers in terms of immediate and long-term planning through integrated water resource management (IWRM).*

Keywords*:* Finca'aa watershed · Sensitivity parameters · Sub-basins · SWAT model · Prone area

Biography

Seifu Kebede Debela (MSc. Ass. professor)

He is senior lecturer and researcher at Faculty of Civil and Environmental Engineering, Jimma Institute of Technology, Jimma University, Ethiopia. He has published 11 original articles on high index journals on areas of environment like sediment, wastewater treatment, forest cover changes due to climate, and infrastructure like water distribution system, etc. Research interests: wastewater treatment, climate change impacts on water resources, watershed management, hydrology, environmental pollution control, etc.

HYDROCHEMICAL ANALYSIS OF GROUNDWATER IN THE HASSI MESSAOUD REGION

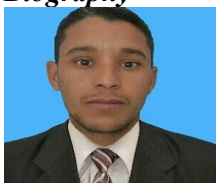
Mahmoud TOUAHRI, Boualem BOUSELSAL

Laboratory of Underground Oil, Gas and Aquifer Reservoirs, Department of Earth and Universe Sciences, University of Kasdi Merbah, Route de Ghardaia, BP 511, 30000, Ouargla, Algeria. Taibet-Touggourt - Algerien, mahmoudtouahri30@gmail.com, +213665173935

Abstract: *In this study of hydrochemical analysis of groundwater in the Hassi Messaoud region, we utilized three key diagrams: Piper, Chadha, and Schoeller-Berkaloff. The main findings can be summarized as follows: The Piper diagram revealed that the Continental Intercalaire aquifer (CI) is dominated by a chloride-sodium-potassium facies with sulfate-sodium components, the Complex Terminal Mio-Pliocene aquifer (CTM) shows a chloride-sodium-potassium facies, and the Complex Terminal Senonian aquifer (CTS) exhibits a chloride and calcium-magnesium sulfate facies. According to the Chadha graph, 83% of samples from CI and CTM fall into field 3 (Na-Cl-SO4), while 57% of samples from (CTS) are in field 2 (Ca-Mg-Cl-SO4). The Schoeller-Berkaloff diagram indicates that CI and (CTM) are mainly influenced by silicate weathering, with Ca/Mg values greater than 1, while (CTS) samples have Ca/Mg ratios closer to 1, suggesting a greater influence of carbonic dissolution. Additionally, base exchanges play a significant role in mineralization, leading to excess sodium and a deficit of calcium and magnesium. Human activities, notably the use of fertilizers and pesticides, have resulted in elevated nitrate and sulfate concentrations, particularly in the Mio-Pliocene aquifer (CTM). These findings emphasize the complex interplay of geological and anthropogenic factors on groundwater quality in the region.*

Keywords*: Hydrochemical Analysis, Groundwater, CI, CTM, CTS, Anthropogenic Impact.*

Biography



First Name: Mahmoud
Last Name: Touahri
Nationality: Algerian
Qualification: PhD student University Kasdi Merbah-Ouargla
Specialty: Hydrogeology
Laboratory of Underground Oil, Gas and Aquifer Reservoirs, Department of Earth and Universe Sciences, University of Kasdi Merbah, Route de Ghardaia, BP 511, 30000, Ouargla, Algeria
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NUMERICAL INVESTIGATION ON SIMPLIFIED MAGNETIC GEAR FOR GREEN ENERGY APPLICATION

Chaojun YANG [1], Amberbir WONDIMU[2*], Getachew ALEMU[3], Wang AO[4]

[1,2,4]*School of Mechanical Engineering, Jiangsu University, Zhenjiang, China*
[3]*School of Energy and Power Engineering, Jiangsu University, Zhenjiang, China*
Email address:ambirewondimu@gmail.com

Abstract: *Energy is regarded as one of the most vital aspects of our lives. With growing concern about global warming and the energy issue, wind power generation has gained attraction. It is considered one of the most promising green and replaceable energy resources. The current global issue of environmental pollution demands alternative new technologies that curb challenges due to the climate crisis. To solve this problem, the world must develop an optimal mechanism to increase the capacity of existing energy sources. The wind turbine uses mechanical gears to transfer the mechanical torque and speed to the generator unit. The existing types of gear have many disadvantages, such as higher energy loss and higher acoustic noise, causing environmental pollution, frequent maintenance, higher volume, and being unable to serve in harsh environmental conditions. Therefore, this paper presents a numerical investigation of a new and simplified design of magnetic gear for the wind turbine that replaces the existing mechanical gear and avoids most of the above-mentioned critical design problems. The proposed magnetic gear is free of friction, has no acoustic noise, and minimum volume and weight, resists harsh environmental conditions such as corrosion, and is effective in terms of using less quantity of magnetic materials as compared to the existing gears in energy applications.*

Keywords*: Green energy, new and simplified magnetic gear model, wind turbine*

Biography

My name is Amberbir Wondimu, I am from Ethiopia. I am a Senior Lecturer and Researcher at Haramaya University, Ethiopia, and now a PhD Candidate in Mechanical Engineering since 2021 at Jiangsu University China. My research area is the Design and Application of Magnetic Gear for Wind Turbine Power Generation and Transmission. https://orcid.org/0000-0002-5386-0034

GREEN CYBER: THE CONVERGENCE OF SUSTAINABILITY AND CYBERSECURITY IN THE CIRCULAR ECONOMY

Gábor NYÁRY

National University of Public Service, Budapest, Hungary, nyary.gabor@uni-nke.hu, +3630 9 613920

Abstract: *There is a phenomenon still novel, but at the same time very much moving towards the centre of our focus when thinking about the future of sustainability. It is the gradual – nevertheless rapid – convergence of the concept of sustainability and cyber. „Cyber", in our post-modern World, inevitably translates into „security". When we say cyber, we must mean cybersecurity. Cyberspace is a much-contested space among nations, and the playing filed of choice for organized crime. The most prized target for both categories of malicious actors is critical infrastructure. Basic elements of a circular economy, of a sustainable world are par excellence „critical infrastructure", the mainstay of the future of modern eco-friendly and eco-aware society. There is another, equally important, side of this same coin, however. Green technologies are very much resource intensive (think of the enormous processing capacity needs of AI) and thoroughly interlinked with satellite technologies, robotics, sensor technologies – at the very end: all computer systems and networks. The future of eco-friendly solutions must therefore incorporate the all-important concept of (cyber)security-by-design. But first: a green version of society-wide cybersecurity awareness.*

Keywords*: sustainable society, critical infrastructure, cybersecurity, awareness*

Biography

Trained in History and Portuguese Studies at the ELTE University of Budapest, I obtained my PhD degree in History. I taught social history and world system theories at my home Faculty, then worked as a television journalist and producer for some years. Later, I joined an international consulting firm as a communications and business development director, working on large World Bank and EU international development projects. For half a decade, I managed the European Union's major communication projects for the Ministry of Foreign Affairs in Hungary. As a board member of the Zoltán Magyary e-Public Administration Association, I have been dealing with the interaction of ICT technologies and international relations since the mid-2000s. Since 2018, I have been professor of History and Practice of Diplomacy, Digital Diplomacy, Historical Geopolitics and Grand Strategy at the Milton Friedman University in Budapest. I am also a research fellow at the Cybersecurity Research Institute of the Hungarian Public Service University, investigating the issues of cyberspace geopolitics, cyberdiplomacy. From the beginning of the programme, I am the subject area leader and professor for cyberspace national security issues at the prestigious Hungarian Diplomatic Academy. My present research focus is emerging technologies – emerging threats: from outer

space cybersecurity through smart cities' issues till the big questions of Artificial Intelligence's impact on global and regional security and sustainable economy.

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QUALITY SERVICE - HOW QUALITOLOGY SERVES ENVIRONMENTAL PROTECTION

Tamás CSISZÉR

Óbuda University, Budapest, Hungary, csiszer.tamas@uni-obuda.hu, +36 (1) 666-5907

Abstract: *Traditional Quality Science and Engineering, also known as Qualitology, focuses on the ability of organizations, processes, and products to meet stakeholder requirements. There have been lots of tools and techniques developed, helping professionals mainly in their quality development programs. Based on these results, other management systems, such as environment, health and safety, and information security, have also emerged. Some so-called integrated management systems, which combine regulations and procedures, aim to organize processes of relevant operation. The key to integration is an essential but often forgotten part of Qualitology: the quality service approach. This poster briefly introduces the Harmonized production, the Commitment & Flexibility, the Support & Motivation, and the Hurdles & Effects elements of the Quality Service Method, highlighting its connection to environmental protection.*

Keywords*: quality science, quality engineering, Qualitology, quality service, environmental protection*

Biography

Dr. Tamás Csiszér PhD is chemical technician, light industry engineer, and doctor of material science and technologies. His professional fields are quality engineering, process improvement, network science, and the application of laser technologies in material processing. He works as an associate professor at Óbuda University in Budapest. He teaches subjects in the fields of material and engineering sciences.

CAPSICUM VALUE CHAIN ANALYSIS IN TANZANIA

Renalda Bernard MLAY

Renie Fresh. Arusha, Tanzania, reniebm@gmail.com, +255 688916535

Abstract: *The analysis of the vegetable capsicum value chain in Tanzania's Arusha and Kilimanjaro regions is the main topic of this report. The plant under investigation was the capsicum (Capsicum annum). The number of smallholder farmers working in the horticultural sector in the nation has increased over the past five years because of government and non-governmental organizations' support, which has encouraged the production of capsicums using costly greenhouses—protective farming techniques—instead of open fields. Thus, the study set out to investigate capsicum value chains by comprehending current practices in these regions; identifying factors for enhancing the competitiveness of capsicum smallholders; maximizing income earning opportunities through the application of value chain thinking; and assessing the influence of the current value chain on the performance of smallholder capsicum farmers. To comprehend the primary challenges farmers face in gaining access to lucrative markets, information on the value chain of capsicum was gathered using both primary and secondary data A total of 83 respondents from various segments of the capsicum chain, including input dealers, farmers, traders, wholesalers, retailers, and consumers, were contacted and interviewed. Accordingly, the study suggests that for a value chain to be effective, its participants should cooperate and have a thorough understanding of one another's businesses. A value chain that is collaborative in nature will yield greater benefits than the current uncoordinated one, in which each link works to achieve its own objectives and only considers the needs of the next or previous link. By working together, the members of the capsicum chain will be able to improve quality and standards for a premium reward at the end, identify and solve problems together, learn about each other's businesses, and concentrate on the needs of the customers. A chain that is more transparent will encourage more investment along its length, ensure equitable pie distribution, and benefit farmers more.*

Keywords*: Capsicum; Smallholders; Value chain;*

Biography

REGIONAL DEVELOPMENT IN REGIONS OF FRANCE IN 2020S

Sándor J. ZSARNÓCZAI[1], Rita BODÁNÉ KENDROVICS[2]

Obuda University, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Science, Doberdó u. 6, H-1034 Budapest, Hungary
e-mail: zsarnoczaisandorjozsef@gmail.com, bodane.rita@rkk.uni-obuda.hu

Abstract: *Study analyses some main economic features of NUTS 2 regions of France, which concern very strong correlations among economic variables as regional gross domestic product, real growth rate of regional gross value added, tertiary educational attainment, age group 25-64, employment rate of the age group 20-64, unemployment rate, employment in high-tech sectors as high-technology manufacturing and knowledge-intensive high-technology services in total employment for researched period 2015 and 2021 based statistical methods. Innovative prosperity of the economy can be enforced by increasing considerable share of employment in high-tech sectors based on increasing share of tertiary educational attainment, age group 25-64. The first regions are Île de France, Midi-Pyrénées, Rhône-Alpes and Alsace in France, because the employment in high-tech sectors by NUTS 2 regions in total employment was 8%, 7% and 5% accompanying with highly employment more than 70% and tertiary educational attainment, age group 25-64 more than 38%-50%. The innovative prosperity in highly developed economies should be based on highly level employment in high-tech sectors and tertiary educational attainment to increase regional GDP and real growth rate of regional gross value added to realise balanced development for all regions of any economy.*

Keywords*: economic variables, employment, high-tech sectors, innovative prosperity, real growth rate, tertiary educational attainment*

Biography

Sándor J. Zsarnóczai CSc, in 1991 economic sciences, Hungarian Academy of Sciences, Budapest and Dr. of University, World Economics, Budapest Corvinus University of Economics. In 2017 Habilitate Doctor, in social sciences, in Management and Business Administration, Kaposvár University. From 1987 work at Szent István University in Gödöllő. From 2017 work at Óbuda University. Participation at Doctoral School. Research areas: Economics, EU Study, Regional economics, Environmental economics. He published 220 publications with 260 independent citations, of which 200 foreign language citations. His publications were published in English, Arab, Spanish, Russian languages. International scientific conferences in Turkey, Canada, Moldavia, Czech Republic, Slovakia, Lithuania, Romania. Research project in Finland, Sweden, Denmark, Italy, Spain, France.

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ECONOMIC CONDITIONS IN REGIONS OF ITALY IN 2020S

Sándor J. ZSARNÓCZAI[1], Krisztina DEMÉNY[2]

Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Science, Doberdó u. 6, H-1034 Budapest, Hungary,
e-mail: zsarnoczaisandorjozsef@gmail.com, demeny.krisztina@rkk.uni-obuda.hu

Abstract: *The study analyses some economic features of NUTS 2 regions in Italy in fields of regional gross domestic product, real growth rate of regional gross value added per capita, the tertiary educational attainment, based on the age group 25-64, employment rate of the age group 20-64, unemployment rate and employment in high-tech sectors between 2015-2021. High-technology sectors should be developed based on high-technology manufacturing and knowledge-intensive high-technology services in total employment. Employment can be more successful and productivity if the educated level of the employees is higher level. Skilled workers can realise more developed high-technology manufacturing industry based on wider-side knowledge. Aims of the study are to analyse the difference among developed levels of NUTS 2 regions in Italy using* ***statistical analyses based on statistical data base. In*** *Emilia-Romagna in North-Italy the employment rate was 71% in 2015 and increased to highest level by 73% in 2021, while the unemployment rate decreased from 10% in 2015 to 7% in 2021. The solution can be realised for decreasing North-South economic and social conflicts in Italy and large difference among developed levels by more capital-inflow to the Southern regions to create more jobs and increase educated level accompanying with increasing foreign direct investment.*

Keywords*: Development, employment, gross value added, high-technology, North-South conflict, tertiary educational attainment*

Biography

Sándor J. Zsarnóczai CSc, in 1991 economic sciences, Hungarian Academy of Sciences, Budapest and Dr. of University, World Economics, Budapest Corvinus University of Economics. In 2017 Habilitate Doctor, in social sciences, in Management and Business Administration, Kaposvár University. From 1987 work at Szent István University in Gödöllő. From 2017 work at Óbuda University. Participation at Doctoral School. Research areas: Economics, EU Study, Regional economics, Environmental economics. He published 220 publications with 260 independent citations, of which 200 foreign language citations. His publications were published in English, Arab, Spanish, Russian languages. International scientific conferences in Turkey, Canada, Moldavia, Czech Republic, Slovakia, Lithuania, Romania. Research project in Finland, Sweden, Denmark, Italy, Spain, France.

LEBANESE CONSUMERS BEHAVIOR AND EFFECT ON FOOD WASTE

Nathalie PANO[1], Nada NEHME[2], Jalal HALWANI[3], Konstantinos KARANTININIS[3], Lama El CHAMI[2]

Lebanese University, Beirut, Lebanon, Nathaliepano@gmail.com, 009613071723, 0046760449658
[1]Lebanese University, Doctoral School of Science and Technology, Hadath, Lebanon
[2]Lebanese University, Faculty of Agricultural Engineering and Veterinary Medicine, Dekwene, Lebanon
[3] Lebanese University, Water & Environment Science Lab, Tripoli, Lebanon
[3] Swedish University of Agricultural Sciences, Alnarp, Sweden

Abstract: *Food waste occurs at almost every stage of the food supply chain from farm to fork. However, the amount of food wasted from households represents the largest proportion in developed countries. The study aims to investigate and analyze the consumer attitudes, behaviour, and perception regarding food waste in Lebanon, to develop policy recommendations that support the cause. A door-to-door survey was conducted with 773 participants. The questionnaire constitutes 37 questions categories into 1) participants demographic characteristics, 2) Attitude and culturally relevant behaviours related to food waste, and 3) Effects of economical and pandemic changes on food waste. Results show that more than 80% of consumers consider food waste as a problem from different perspective and 95% of them aim to reduce their food waste. 81,2% and 91% of consumers have the intention and the willingness to change their behaviour to prevent food waste accordingly.*

However, when looking at their purchasing behaviour and attitude, 56.1% of consumers go for food shopping daily, and 30.8% don't prepare a shopping list before buying. They don't respect the minimal food waste prevention guidelines for food shopping. In addition, the results show that 18,5% of consumers only buy fruits and vegetables with irregular shape. An additional 7,8% can be attained if the prices of those products are reduced. Those results, confirm that raising awareness at consumers level is crucial to ensure a behaviour change leading to food waste reduction. But also retails pricing strategies play an important role in this area.

Keywords: *Food waste; Consumers, Retails, Purchase-Behaviours, Lebanon*

Biography

Nathalie Pano *is an agricultural engineer holding a Master of Science in Project Engineering and Public Policies. Nathalie has more than 12 years of professional experience in managing international development projects in the field of agriculture, food system and circular economy. In addition, she conducted different research project in related fields such as natural resource management, green consumerism, and food system sustainability. Currently Nathalie is PhD candidate conducting her research on Food system transformation toward a resilient system that can face climate change challenges focusing on food waste.*

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DUAL-STAGE SOLAR POWERED ELECTROCOAGULATION AND ELECTROOXIDATION PROCESS FOR TEXTILE WASTEWATER TREATMENT

Yemane G. ASFAHA

Water Science and Technology at Adama Science and Technology University, Ethiopia

Abstract: *Water is called the elixir of life and is used for various domestic and manufacturing operations. The demand for water is growing worldwide with a decreasing ratio of rainfall each year and rapid population growth, generating huge quantities of potentially hazardous wastewater from various sources and a rise in polluting industries. Among different dye-consuming industries, textile industries are the major industries that consume a huge quantity of dyes and different hazardous chemicals. Globally, the textile industries consume about 56% of the total synthetic dyes produced. The figure exhibited that the textile industry is the major consumer of synthetic dyes and discharges large amounts of dye-laden wastewater into the environment. The wastewater discharged from the textile dyeing industry is challenging to treat using conventional treatment methods as these effluents are complex, toxic to microorganisms, and recalcitrant to biodegradation. Various studies have demonstrated that the integrated electrocoagulation-electrooxidation (EC-EO) process is efficient for eliminating different pollutants. However, no study has been conducted on the dual-stage process of EC and EO using the mesh iridium dioxide-coated onto titanium (IrO2/Ti) electrode for remediation of textile wastewaters, like Vivizol red 3BS 150% reactive dye that is extensively used in the cotton textile industry. In addition, a very concentrated dye solution, equivalent to textile effluent, was used to test the efficacy of the treatment method, which is also lacking in other studies. Furthermore, the current global concern related to the energy crisis and climate change encourages people/researchers to develop and use renewable and environmentally friendly energy as a power source. Therefore, to address this problem, renewable energy-based, dual-stage solar-powered electrocoagulation (EC) and electrooxidation (EO) process were evaluated for its capability to remove colour, total organic carbon (TOC), and chemical oxygen demand (COD). Aluminum (Al) and IrO2/Ti electrodes were selected as anode/cathode for EC and EC-EO experiments, respectively. The results were evaluated based on the interaction effects of operating parameters of the treatment methods on the percentage of COD, TOC, and color removal. The dual-stage EC-EO process obtained 97% COD, TOC, and color removal efficiency. In addition, the results of the combined spectroscopy analysis confirm the complete degradation of organic contaminants to carbon dioxide and water. Moreover, the optimum operating conditions are tested for real industrial wastewater effluents and show excellent performance in removing pollutants. Likewise, the optimal working conditions were also evaluated directly powered by solar energy and found to have an equivalent removal rate to conventional electricity. Thus, this study demonstrated that the treatment method using mesh IrO2/Ti electrodes is a promising technology to meet the discharge limit for textile industrial effluents. Moreover, this study can provide an essential solution for remote regions that are not connected to the public electricity network. Furthermore, because of its high performance in removing recalcitrant and toxic pollutants with low operating costs,*

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this technology is recommended to extend its application to other emerging pollution abatement measures in the community and industry.

Keywords: *Cotton Textile Wastewater; Electrocoagulation; Electrooxidation; Dual-stage EC-EO; Solar Power; FTIR and NMR; Dye Degradation Extent*

Biography

Dr. Yemane G Asfaha is an Assistant Professor of Water Science and Technology at Adama Science and Technology University, Ethiopia. Dr. Yemane received his Ph.D. in Water Science and Technology from an internationally accredited Africa Center of Excellence for Water Management program, Addis Ababa University, in July 2022. In addition, he received his Master of Science Degree in Water Resources Engineering from Arba Minch Institute of Water Technology, Arba Minch University, in 2012 and a Bachelor of Science Degree in Agricultural/Water Engineering from Hawassa University in 2008. Dr. Yemane is an experienced researcher and lecturer with more than fifteen years of experience in various academic positions, community service, and consultancy services and projects. His research focus areas and interests are diversified but focused on industrial wastewater treatment, electrochemical treatment, environmental chemistry, biological treatment, environmental science and engineering, water quality, material characterization, adsorption, catalytic surface modification, solid-waste management, advanced oxidation process, water quality monitoring and modeling, water and wastewater treatment technologies, desalination, urban and rural water supply and sanitation challenges, urban river pollution and possible remediation options, groundwater quality, renewable energy, and environmental impact assessment. Apart from conducting research, developing curricula, and supervising undergraduate and graduate students, Dr. Yemane has taught various courses in the Department of Water Resources Engineering/Water Supply and Environmental Engineering Program and the Department of Civil Engineering. Furthermore, his research title was awarded the best research paper of the 2022 Water Conference organized by the Florida International University and featured on national television called Fana Television (https://www.youtube.com/watch?v=nv1n3XiBVH0). Dr. Yemane has published over seven research articles and one book chapter in peer-reviewed high-impact factor journals. Dr. Yemane has presented various research works at regional and international conferences.

ANALYSIS OF RURAL HOUSEHOLD'S ATTITUDE TOWARDS FAMILY PLANNING METHODS IN ONDO STATE, NIGERIA

Gbolade Evelyn AGBOMUSERIN[1], S. D. Y. ALFRED[2], F. I. WOLE-ALO[3]

Federal University of Technology, Akure, Nigeria, evelyngbolade@gmail.com, 08130848676

Abstract: *With the current economic crisis precedented by the COVID-19 pandemic, there has been population explosion in Nigeria. So, the study analysed the attitude of rural household heads towards family planning methods in Ondo State, Nigeria. A multistage sampling procedure was used to select 150 household heads. Quantitative and qualitative data was gathered for the study using a well-structured and validated questionnaire. Data were analysed using descriptive statistics while hypothesis was tested with inferential statistics. Findings from the study showed that majority (77.3%) of the respondents were male, married (78.7%) and with a mean age of 40 years. It was established that all (100%) of the respondents were aware of family planning. Findings revealed that 92.7% of the rural household heads adopted the modern family planning methods while the remaining 7.3% adopted the indigenous family planning methods. Results showed that withdrawal method (53.3%) was the most adopted method of family planning despite its high risk of failure, and this was attributed to side effects like bloated stomach, irregular and coagulated menstruations, infertility, increased body fat gotten from using modern family planning methods like contraceptive pills, injections, implants and emergency pills ($\bar{X}$=2.43). Also, Withdrawal method was favoured because of the skin-to-skin contact pleasure it provides which condoms fails to give them ($\bar{X}$=3.23). Further finding revealed that the respondents had favourable attitude towards family planning practices with a grand mean of 3.68. There was no significant difference in the attitude (p=0.273) of the respondents in the three Local Government Areas. It was concluded that the respondents have favourable attitude towards family planning methods. It was recommended that more scientific research should be done on hormonal family planning methods with the goal of reducing the side effects it has on its users.*

Keywords*: Rural Household heads, Family planning methods, Adoption, Awareness and Attitudes*

Biography

Agbomuserin Gbolade Evelyn born on 10th of February 1996 in Ondo State is an agricultural extensionist who specializes in research work and field survey. Also, she is an experienced data enumerator and analyst. She received her bachelor's and master's degree in the field of Agricultural Extension and Communication Technology from the Federal University of Technology Akure. She lives in Akure City and some notable of her works includes Choice of ICT Tools for Cocoa Marketing among Small-Scale Farmers and the contribution of Shea Butter Processing to the Income Generation of Rural Dwellers in Kwara State, Nigeria.

ACCESS TO MODERN ENERGY COOKING SERVICES AND ENERGY POVERTY AMONG RURAL HOUSEHOLD IN ONDO STATE, NIGERIA

Felicia Itunu WOLE-ALO[1], O. O. FASINA[2], Gbolade Evelyn AGBOMUSERIN[3]

Federal University of Technology, Akure, Nigeria, fiwolealo@futa.edu.ng., 08034130029

Abstract: *This study examined energy poverty among rural households in Ondo State. A multi-staged sampling technique was used to select one hundred respondents. Data revealed majority (58%) of the respondents were female with a mean age 37.6 years. Most (50%) were married and (64%) had formal education. Majority (78%) of the respondents were farmers. The study revealed that majority (84%) of the respondents used kerosene in cooking while 53% of the respondent's preferred kerosene to other energy resources because of its dual function in lighting, cooking and affordability. A larger percentage (96%) used kerosene in cooking. An average of ₦3,584 was spent on energy resources per month. Major factors perceived to contribute to energy poverty were government inadequacies in providing electricity ($\bar{x}$ = 4.12) and poverty ($\bar{x}$ = 4.01). Majority (63%) of the respondents were energy poor. Results showed that household size ($r = 0.270$, $p < 0.05$) and household income ($r = 0.537$, $p < 0.05$) significantly influenced the amount the respondents' household spent on energy resources. The study therefore recommended that the government should focus on rural electrification to reduce energy poverty and increase the rural dwellers' standard of living.*

Keywords*: Access, Modern energy, cooking services, affordability and rural households*

Biography

Wole-Alo Felicia Itunu born on 23rd of August, 1980is a researcher in the field of Gender and Agricultural extension and Rural Development at the Federal University of Technology. She received her master's degree and doctorate degree from the Federal University of Technology. She currently lives in Akure city and some of her notable works includes Small-scale farmers' perception on organic farming status in Ondo state, Nigeria Assessing the future of agriculture in the hands of rural youth in Oriade local government area of osun state, Nigeria Utilization of modern cassava processing techniques among small holder rural women processor in Ondo State, Nigeria, etc.

SCLERACTINIAN CORALS FROM THE BENGHAZI FORMATION IN AS SAHABI AREA AND FROM AL JAGHBUB FORMATION IN TUBROQ AREA, LIBYA: IMPLICATIONS FOR CORAL DIVERSITY AND BIOGEOGRAPHY

Belkasim KHAMEISS[1,2], Ahmed MUFTAH[2], Menam ABDELGALIL[3]

[1]Kansas Geological Survey, Lawrence, KS, United States belkasimkhameiss@outlook.com
[2]Faculty of Science, Earth Sciences Department, University of Benghazi, Benghazi, Libya. Ahmed.alkowafi@uob.edu.ly
[3]Department of Geology, University of Tubroq, Libya. Monam.wesly@tu.edu.ly

Abstract: *The most recent investigation has revealed that Miocene Scleractinian corals were well preserved in two exposed geological rock units in Northeast Libya, namely the Benghazi Formation in the As-Sahabi area and the Al Jaghbub Formation in Tubroq area. The collected corals include two hermatypic species, these are Echinopora gemmacea and Montastraea pelouaensis which were common during the early-middle Miocene (Aquitanian-Serravallian). These two species suggest that the Benghazi and Al Jaghbub Formations coral community thrived in shallow, subtropical reefs with a Mediterranean-Tethys paleobiogeographic connection. These corals taxa lived in the upper photic zone with more sophisticated prerequisites, such as robust substrates, clean waters, steady marine salinity, and temperature about 18°C. The documentation of these two taxa highlights the diversity and morphological variability of the scleractinia corals in northeast Libya. This could pave the way for future research efforts focused on coral taxonomy, diversity, and biogeography in the region. The interaction between barnacles and coral demonstrates the competitive dynamics at play in coral reef ecosystems and the adaptive potential of coral colonies is also discussed.*

Keywords*: Al Jaghbub Formation, Coral, Taxonomy, As-Sahabi area, Libya*

Biography

Dr. Belkasim Khameiss, Postdoctoral Researcher Collaborative for STEM Education and Outreach, Ball State University Teacher College and Inspire Academy of Muncie (2021-2022). PhD., Department of Environment, Geology, and Natural Resources, Ball State University, Muncie, IN. Unpublished dissertation (2020). Paleogene Foralgal Reefs: The Once and Future Reefs? M.Sc., Department of Earth and Atmospheric Sciences Earth Science, University of Northern Colorado, Greeley, CO. Unpublished thesis (2013). Middle Tertiary Reefs in Northeastern Libya: Fossil Clues to Dating and Paleoenvironments. B. Sc., Department of Earth Sciences, Benghazi University, Benghazi, Libya. Unpublished thesis (2007). Geology of Wadi Al Hdadea, Ras Al Hilal Area, Al Jabal Al Akhdar, Northeast Libya. currently Post Doc Researcher – Kansas Geological Survey- University of Kensas

THE USE OF MOSSES IN ACTIVE BIOMONITORING IN URBAN AREAS

Paweł ŚWISŁOWSKI, Małgorzata RAJFUR

University of Opole, Opole, Poland, pawel.swislowski@uni.opole.pl, rajfur@uni.opole.pl, +48774016042

Abstract: *The issue of using mosses in active biomonitoring of urban areas was presented. This topic is important because of the increasing use of indicator organisms in assessing environmental pollution, including air pollution, in relation to expensive methods of classical pollution monitoring.*
The following objectives were established: to carry out studies on the effect of heavy metals present in the moss-water solution system on the condition of mosses and bioaccumulation of elements; to evaluate the homogeneity of the chemical composition of mosses on the basis of their analysis for heavy metal pollution; to test selected methods of exposure of moss samples in an urbanized area; assessing the influence of environmental factors on the concentrations of heavy metals accumulated in mosses exposed by the selected method; conducting an assessment of air pollution by heavy metals using mosses, within the framework of active biomonitoring and by the classical method [assessment of air pollution by analysing heavy metals in the particulate matter]. The research was carried out in selected urbanized areas in the Opole and Swietokrzyskie provinces.
Based on the research performed, it was concluded that an important preparatory element prior to exposure of moss samples is their prior proper conditioning in demineralized water. Statistical analyses have shown that the most effective method of moss exposure for active biomonitoring is the moss-bag technique. It is important to measure and control the vital parameters of mosses based on, among other things, the measurement of chlorophyll content combined with the measurement of photosynthetic activity, to call the exposed samples a living organism and not to work on the devitalized natural sorbent of air pollutants. The time of exposure, the species chosen for testing, along with other abiotic factors, are several elements that affect the quality of the results of the biomonitoring studies carried out. The feasibility of the practical application of mosses for monitoring air pollution indoors as well as in open areas in short- and long-term biomonitoring to identify characteristic sources of pollution and their identification is demonstrated. A summary of research using mosses in the biological monitoring of atmospheric aerosol ties the applicability of this research to the classical method of air monitoring.

Keywords: *active biomonitoring, mosses, heavy metals, moss bag technique, organismal vitality, chlorophyll*

ROLE OF THE ENVIRONMENT ON REAL ESTATE VALORISATION

Slimani CHAHID, Farhaoui MOHAMED

Law School, ESSOR Lab, Sidi Mohamed Ben Abdellah University, Fez, Morocco
farhaouimed@gmail.com, 002126612366884

***Abstract*:** *Environment plays a key role in the development. Sustainable development needs to manage and preserve environmental resources to meet the needs with the required quantity and the quality. Moreover, the environment affects not only well-being of the population but also it is a determinant factor in real estate valorising. The water, forest, mountains, soil, air and snow are some factors, which increase the real estate values both in urban and rural areas. Furthermore, they have very interesting impacts on real estate valorisation. Studies examining the impacts of environment on real estate valorisation are few. This paper seeks to fill that void by examining the effects of aspects related to environment on property values: water, soil, air. Environment plays a great role in determining the real estate value by property appraisers. This paper tries to provide tools to help appraisers in assessing market price considering the environment as one of the most important factors of value and to determine the influence of environmental amenities may have on property final market value. To discuss this issue, the analytical method is used. Many appraisers' reports, research's findings and courts decisions related to real estate value influenced by environment are analysed, discussed and compared to many studies findings.*

Keywords: *Appraiser, environment, property value, real estate appraisal, valorisation.*

Biography

Farhaoui Mohamed has completed his PhD in Sciences at the age of 40 years from My Ismail University, Meknes, Morocco. He is a head of water production department at the National Office of Electricity and Drinking Water. He has published more than 12 papers in reputed journals and has been serving as an editorial board member of reputed journals all over the world. He continues his studies in law and tries to use scientific background to explain law decisions and help appraisers to assess the real estate value using scientific information.

ECOSYSTEM BASED FLOOD MITIGATION STRATEGY AND LIVELIHOOD IMPROVEMENT FOR HUMAN SETTLEMENTS ON THE HILLY AREAS OF ADDIS ABABA; IN THE CASE OF KECHENE MEKETEYA DISTRIC

Bethelhem GEBREMEDHIN GEBREEGZIABHER

Ambo University, Ambo, Ethiopia, bethi.gebre3@gmail.com, +251912358998

Abstract: *It is a known fact that communities residing in unplanned areas with steep slopes are at risk of being exposed to hillside runoff. After identifying the factors that cause flooding and assessing the level of vulnerability in Meketeya district, it was found that most of the residents are vulnerable to hillside flooding. Besides the hydrological location of the residents, the economic capacity of the household makes them more vulnerable to flooding. As a result, this study aims to develop an ecosystem-based flood mitigation strategy and a livelihood improvement scheme for the residents of Meketeya district. The study recommends various ecosystem-based solutions that not only reduce flood risk and vulnerability but also provide socio-economic and environmental benefits. To evaluate the hydrological impact of this approach, Hec-HMS software was utilized. The integration of the proposed design solution into the existing urban fabric has resulted in a significant reduction in surface runoff depth, with a decrease of 23% observed by simulated data. In this regard, there is a possibility to harvest 2958.2 m^3 of water for irrigation, and 31,372 m3 of water will recharge the aquifer. This finding demonstrates the effectiveness of the design solutions in mitigating the negative effects of urbanization on the environment. This finding demonstrates the effectiveness of the design solution in mitigating the negative effects of urbanization on the environment. Such outcome is important for policy makers and academic institutions seeking to advance development and address the challenges posed by urbanization.*

Keywords*: Flooding, hillside settlements, vulnerability, ecosystem approach and co-benefit*

Biography

Bethelhem Gebremedhin is a lecturer at Ambo University. She holds a master's degree in urban design and development from Addis Ababa University. Bethelhem wrote her master's degree thesis on Water Sensitive Urban Design Solution, which focuses on hillside flood mitigation strategy. She believes that nature-based source control methods can be a solution to mitigate onsite and downstream impacts. She enjoys participating in various workshops on creating water-resilient cities. Additionally, she provides suggestion for urban design work, encouraging sustainable methods and design solution to be incorporated. Bethelhem aims to influence and impact the community in which she lives and works by encouraging sustainable urban design solutions to be implemented in day-to-day life. She works part-time at Heritage Watch Association on climate change awareness creation (develop & gives training) and mitigation measure projects (designing and consulting design solutions).

IDENTIFICATION, MAPPING AND ASSESSMENT OF HILLSIDE FLOOD VULNERABILITY; IN THE CASE OF KECHENE MEKETEYA DISTRIC, ADDIS ABABA

Bethelhem Gebremedhin GEBREEGZIABHER

Ambo University, Ambo, Ethiopia, bethi.gebre3@gmail.com, +251912358998

Abstract: *Due to high rate of urbanization in Addis Ababa unplanned hillside development is increasing dramatically. It is well-known that unplanned development and increasing the impervious surface of the land in upper & middle river catchment cause & increase flood impact in the area as well as in downstream catchment. The Meketeya district residents are among the vulnerable communities in the middle Kebena River catchment & their livelihood assets were seriously affected and damage from the recurrent flooding. The study aims to identify factors triggers flooding, degree of vulnerability, and its impact on their livelihood. The consequence of flooding assessed on 6.1 hectares and runoff depth is estimated using WCN-SLCN method by considering the biophysical characteristics the study area. The study catchment was delineated by Hec-Geo HMS software using high-resolution DEM of 5x5m cell size. Line-map obtained from the Addis Ababa plan commission to identify built-up area coverage and the level of imperviousness. Soil map of the study area & rainfall amount used as input data for runoff simulation. Verification and validation of computer simulation models were conducted based on field observation, questionnaire-based surveys with residents and in-depth interviews with the local authorities. To measure their degree of vulnerability towards hillside flooding key indicators consist of social, economic, environmental, and physical components were used. The simulation modelling results of the study revealed that the runoff response increased from 9.8% in 2005 to 35.6% in 2020 due to increments in imperviousness and rainfall amount. About 61.8 % of the buildings within the hydrological catchment are exposed to hillside flooding but 48.9% of the buildings are highly vulnerable to hillside flooding. Based on the rainfall-runoff simulation & FVA results indicated that besides the location of the area, the economic capacity of the household makes the residence vulnerable to hillside flooding.*

Keywords: Flooding, hillside settlements, simulation, vulnerability, livelihood

Biography

Bethelhem Gebremedhin is a lecturer at Ambo University. She holds a master's degree in urban design and development from Addis Ababa University. Bethelhem wrote her master's degree thesis on Water Sensitive Urban Design Solution, which focuses on hillside flood mitigation strategy. She believes that nature-based source control methods can be a solution to mitigate onsite and downstream impacts. She enjoys participating in various workshops on creating water-resilient cities. Additionally, she provides suggestion for urban design work, encouraging sustainable methods and design solution to be incorporated. Bethelhem aims to influence and impact the community in which she lives and works by encouraging sustainable urban design solutions to be implemented in day-to-day life. She works part-time at Heritage Watch Association on climate change

awareness creation (develop & gives training) and mitigation measure projects (designing and consulting design solutions).

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CHARACTERIZATION, CLASSIFICATION AND QUANTIFICATION OF RUNOFF, IN THE CASE OF LOWER KEBENA RIVER WATERSHED, ADDIS ABABA, ETHIOPIA

SIMRET AREGA[1,2], ALAZAR ASSEFA[2]

Ambo university, Ambo, Ethiopia, Simarega@gmail.com, +251910288827

Abstract: *Current storm water management practices in Addis Ababa are more conventional that eliminate storm water runoff generated from impervious areas (Adugna et al., 2019). The objective of the study is to map and to characterize the lower Kebena river catchment with respect to its natural landscape and built structures; to classify sub-watersheds and quantify runoff for each sub watersheds. The study used interviews, observations and GeoSWMM and SWMM5 tools for modeling of runoff volume from each sub-watershed. Non-probability sampling techniques and purposeful method was used to select sample units. The research found out that, many factors are affecting, surface runoff volume of lower Kebena river catchments. However, high levels of imperviousness and land use parameters have more effect on runoff volume than slope and other parameters in the study area. Based on on-site observation and the respondents of the interview, flooding is a very common and serious problem during the rainy seasons of the case study area. The study concludes that current conventional approach is failed on solving the flooding issue in study area; therefore, it is essential to incorporate a sustainable storm water management approach. Based on the result of physical study, there is an opportunity to retrofit the existing buildup area with Blue-Green Infrastructure (BGI) measure. The study recommends that BGI components should be applied on existing private parcels, public parks, river buffer, and roads (local roads, sidewalks, street medians) throughout the lower Kebena catchment, and contribute to the watershed-level effectiveness in runoff reduction.*

Keywords*: Runoff, BGI, imperviousness, land uses, Slope and infiltration*

Biography

Simret Arega is a Lecturer at Ambo University. She is engaged in research and practice in the fields of sustainable urban design with principal areas of expertise in water sensitive urban design. Simret is committed to creating spaces that foster community engagement and enhance the overall quality of life for their users. She is currently volunteering at heritage watch Ethiopia on project bases. She is working on climate change and sustainability issues, by designing flood mitigation measures (rain garden) on heritage project site; by developing climate change programs and giving training for children during the rainy season.

MICRO-WATERSHED LEVEL BLUE-GREEN INFRASTRUCTURE AS FLOOD CONTROL SOLUTION AT LOWER KEBENA RIVER WATERSHED

SIMRET AREGA[1,2], ALAZAR ASSEFA[2]

Ambo university, Ambo, Ethiopia, Simarega@gmail.com, +251910288827

Abstract: *Blue-Green Infrastructure is a concept to flood risk management that incorporates natural systems that provide the ecological and amenity value associated with urban greening. The lower Kebena river catchment is one of the densely developed watersheds in Addis Ababa affected by flooding. The main objective of the study is to explore opportunities for integration of blue-green network. Specifically, Integrate Blue green network and evaluate performance of proposed Blue Green solutions in the entire lower Kebena catchment. The study used simulation to evaluate runoff generated from the entire catchment before and after blue green infrastructure integration. The simulation result of the current biophysical characteristics of the watershed proved the situation as well with the higher level of imperviousness of the catchment 52.5 %, total runoff 262.84mm, the peak runoff 67.2 CMS, and the total infiltration rate of 122.93mm/hr. After Blue-green application, the simulation model result showed, reduction of imperviousness to 37.23 % (reduced by 15.3 %), total runoff became 182.16 mm (reduced by 29.9%) and, peak runoff also become 48.19 CMS (reduced by 28.37%) and total infiltration becomes 203.74mm/hr. (increased by 65%). Therefore, blue green infrastructure can effectively reduce peak runoff and volumes at the micro-watershed-scale. The research concludes that Blue-Green Infrastructure components could be retrofitted on existing urban fabrics of the entire lower Kebena Catchment for flood control and greening. The micro-watershed level, it could be scaled up and implemented at a larger spatial scale, for citywide storm water management and greening.*

Keywords*: Imperviousness, surface flooding, Micro-watershed, retrofitting & scale up*

Biography

Simret Arega is a Lecturer at Ambo University. She is engaged in research and practice in the fields of sustainable urban design with principal areas of expertise in water sensitive urban design. Simret is committed to creating spaces that foster community engagement and enhance the overall quality of life for their users. She is currently volunteering at heritage watch Ethiopia on project bases. She is working on climate change and sustainability issues, by designing flood mitigation measures (rain garden) on heritage project site; by developing climate change programs and giving training for children during the rainy season.

A RELATION BETWEEN EXTREME DAILY PRECIPITATION AND EXTREME SHORT-TERM PRECIPITATION

Yanina L. ROMERO[1], Janette BESSEMBINDER[2], Nick C. van de GIESEN[3], Frans H.M. van DE VEN[4]

[1]Beuningen, The Netherlands, p.bronkhorst8@upcmail.nl, +310648114433
[2]Climate Services, Royal Netherlands Meteorological Institute (KNMI), De Bilt, The Netherlands, bessembi@knmi.nl
[3]Water Management of the Faculty of Civil Engineering and Geosciences, Delft University of Technology, Delft, The Netherlands, N.C.vandeGiesen@tudelft.nl, +310152787180
[4]Water Management of the Faculty of Civil Engineering and Geosciences, Delft University of Technology, Delft, The Netherlands, F.H.M.vandeVen@tudelft.nl

Abstract: *The Royal Netherlands Meteorological Institute (KNMI) published the KNMI'06 Climate Scenarios in 2006. These scenarios give the possible state of the climate in The Netherlands for the next century. Projections of changes in precipitation were made for a time scale of one day. The urban drainage sector is, however, more interested in projections on shorter time scales. Specifically, time scales of one hour or less. The aim of this research is to provide projections of precipitation at these shorter time scales based on the available daily scenarios. This involves an analysis of climate variables and their relations to precipitation at different time scales. Based on this analysis, one can determine a numeric factor to translate daily projections into shorter time scale projections. Eventually, this synthetic data can be used as an input for an urban drainage model. With such a drainage model and synthetic data for design storms the effects of climate change on the systems' performance can be assessed and the efficiency of adaptive measures can be investigated.*

Keywords*: correlation, extreme, precipitation, ratio, urban, variables*

Biography

Eng. Yanina L. Romero has a MSc from Water Management at Delft University of Technology, The Netherlands. She is published in Climatic Change which has had numerous worldwide citations. Ms. Romero has worked as a software consultant, AutoCad drafter, advisor at diverse engineering firms and as a wastewater policy worker. She has reviewed papers for diverse journals including Theoretical and Applied Climatology. She currently attends online conferences and won the award for best young researcher at the 12th ICEEE conference. Ms. Romero resides with her husband in The Netherlands.

DEVELOPMENT OF PARTICLE MEASUREMENT TECHNOLOGY AT PERIODICAL TECHNICAL INSPECTION (PTI)

Zoltán BORSI, Tibor TELEKESI, Katalin A. FŐGLEIN*

KTI Institute for Transport Sciences and Logistics, Non-Profit LTD., Research Centre for Sustainable Transport
Department for Air Quality and Propulsion Systems
**Corresponding author: foglein.katalin@kti.hu*

Abstract: *It has now become clear, one of the most dangerous air pollutants is nano particles from vehicles. The test requirements took this fact into account; by limiting the number of emitted particles, new cars emit an order of magnitude less starting from the Euro 5b type approval requirement. From the Euro 5b level, it is necessary to use the particle filter on diesel cars, at the same time, there was no such requirement anywhere for cars in operation until recently. For various reasons, it is common to manipulate and remove the particle filter. This cannot be determined with us during the current periodic technical inspection or road inspection. Neither a measurement method nor an instrument was available until recently, in Hungary. The objective of the topic was to explore the international situation, examine the possible measurement procedures, map the existing instruments, perform measurements with a suitable instrument, and make a proposal regarding the possibility of introduction in Hungary. During the practical measurements, we performed measurements with TSI, TEN and AVL instruments. We carried out many measurements on different types of cars in different operating conditions. During the measurements, we examined both gasoline and diesel vehicles.* We found that:

• the emissions of diesel and gasoline cars with well-functioning particle filters are below 10,000 particles/cm^3.
• particle emissions are the smallest at idle. We had several measurements when the number of particles in the exhaust gas was smaller than that of the intake air at idle speed.
• flawless particle filters filter with excellent efficiency, emissions are very low for Euro 6 vehicles.
• increasing the speed increases the number of particles.
• the cold start, the thermal state of the engine, has little influence on the evaluation compared to the recommended limit value. Although the emission increases slightly in cold operation, it is still very far from the recommended limit for a well-functioning system.
• the repeatability of the measurements is adequate, enabling a reliable assessment.

Keywords*: P*eriodic Technical Inspection, PTI, particle, particulate filter, *GPF, DPF*

Biography

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RESIDUE, DISSIPATION DYNAMICS, DECONTAMINATION, AND RISK ASSESSMENT OF CHLORANTRANILIPROLE IN OKRA AND SOIL USING GC-MS/MS

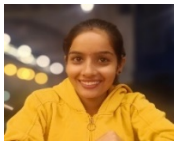
Pooja, Sushil AHLAWAT*, Reena CHAUHAN, Ankisha, Nisha KUMARI

Choudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India
**Corresponding Author E-mail: sushilahlawat21@gmail.com*
1st Author E-mail: poojaagroiya234@gmail.com

Abstract: *Chlorantraniliprole is a relatively new systemic insecticide that is proving to be quite effective against the Lepidoptera pest, especially in vegetable crops. As a result, a method was developed and validated for quantifying chlorantraniliprole (CAP) residue in chilli fruit using gas chromatography-tandem mass spectrometry (GC-MS/MS) in SCAN/MRM mode with a triple Quadrupole analyzer. this method is environment conscious, outlay, selective, and factual. To series of requirements enumeration and authentication of the analyte, two MS-MS transitions were obtained. Within the ranges tested (0.005-0.5 μgmL^{-1}), all standard curves exhibited a strong linearity ($r > 0.99$). Field trials were carried out at both the standard dose (30 ga.i. ha^{-1}) and its double (60 ga.i. ha^{-1}) for the purpose of assessing its dissipation, half-life, preharvest interval, risk assessment for human health, and decontamination behaviour. For single (T_1) and double (T_2) doses, the initial CAP residue deposits in the okra fruit were 0.077 and 0.140 mg kg^{-1} and vanished below quantifiable levels (0.01 mg kg^{-1}) on days 7 and 10 days for single (T_1) and double (T_2) doses, respectively Dissipation dynamics of chlorantraniliprole followed first-order degradation kinetics with a half-life of 1.90 and 1.92 days at respective doses. Preharvest interval (PHI) of 1 days was recommended by considering FSSAI MRL (0.3 $mgkg^{-1}$ for both molecules) for safe consumption of okra fruits. Dietary risk quotient was calculated to assess dietary risk to human beings and the value less than 1 on day of treatment indicates minimal risk to human health on okra consumption treated with chlorantraniliprole. Statistical analysis was carried out to look at the significant differences between various treatments during the dissipation and decontamination of okra which concludes statistically significant difference ($p < 0.05$) between dosage, time, and processes. The maximum CAP residue was reduced by 84 -38.89 % when a basic decontamination method was used. Residue level of respective molecules in soil was found below limit of quantification (LOQ) at both doses.*

Keywords*: Chlorantraaniliprole, Dissipation, Decontamination, MRM, PHI, Dietary risk quotient*

Biography



I, Pooja, currently pursuing Ph.D. in Department of Chemistry, CCSHAU, Hisar under the guidance of Dr. Sushil, a highly respected professional in the field of Pesticide Residue Analysis. I have qualified the CSIR NET – JRF (Chemical Science) June-2020. I possess a diverse range of skills in use of Origin, SPSS, MS-Excel, MS-Word and have a strong command over instrumental techniques such as GC, GC-MS/MS, HPLC, and

UV-VIS Spectrophotometer, demonstrating their proficiency in handling and operating these instruments.

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STUDY OF READYMIX FORMULATION OF TEBUCONAZOLE 50% + TRIFLOXYSTROBIN 25% WG IN SOIL AT HARVEST TIME

Sushil AHLAWAT, Reena CHAUHAN

Department of Entomology, College of Agriculture, CCS Haryana Agricultural University, Hisar (HYN), India, reenavansh82@gmail.com

Abstract: *A field study was conducted to check the residues of trifloxystrobin, its metabolite (CGA 321113) and tebuconazole in soil at the time of harvest. Readymix formulation of tebuconazole 50% + trifloxystrobin 25% WG was sprayed on the green pea crop thrice at the interval of seven days @ 350- and 700-ml ha^{-1}. First application was done at time of fruit initiation stage. Samples of soil were collected at the time of harvest from the field of green pea crop to check the residual contamination and processed in Pesticide Residue Laboratory. For extracting out the residues from the soil samples column chromatography method was used. Residues were analysed by using the instrument Gas chromatography for trifloxystrobin and CGA321113 while Gas Chromatography Tandem Mass Spectrometry used for tebuconazole. It was concluded from the results that the residues of ready-mix formulation were below the limit of quantification (0.05 mgkg^{-1}), so there is no carry forward of residues to next crop and safe from the environmental point of view.*

Keywords*: Harvest; Residues; Readymix formulation; Soil; Metabolite*

Dr. Sushil Ahlawat working as Senior Residue Chemist in Department of Entomology, College of Agriculture, CCS Haryana Agricultural University, Hisar. Her area of expertise is Pesticide Residue Analysis, Analytical chemistry, Environmental and toxicology. She oversees all India network project on pesticide residues (ICAR), CCS HAU, Hisar. She has already guided 3 Ph.D. students and 8 M.Sc.

Many folds expertise in extension activities, farmer Melas, Radio/Tv talks and Invigilators duties in performing examinations for undergraduate, post graduate and PhD Scholars.

ROLE OF ARBUSCULAR MYCORRHIZAL FUNGI IN ALLEVIATING HEAVY METAL STRESS: A REVIEW

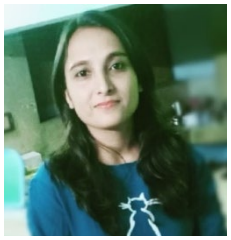
ANKISHA, Sridevi TALLAPRAGADA*, R. K. CHUGH, POOJA, Pooja POOJ[1]

Department of Botany and Plant Physiology, Choudhary Charan Singh Haryana Agricultural University, Hisar, India (125004)
1st Author Email: lambaankisha8817@gmail.com ,8059915350

Abstract: *The buildup of heavy metals (HMs) in plant tissues is a rapidly increasing environmental threat. The morpho-physiological and biological characteristics of a plant are negatively impacted by heavy metals including cadmium, arsenic, mercury, and lead, which are well-documented environmental contaminants. Heavy metals due to mobile nature integrated into the food chain and impact human well-being. HMs have detrimental effects on plant growth and productivity through various mechanisms, including interference with nutrient activity, impact on plant morphology and physiology, inhibition of soil microbes' growth (including symbiotic microbes like rhizobia), and alteration of soil properties. Arbuscular mycorrhizal fungi (AMF) exhibit symbiosis with the host plant. The bidirectional exchange of resources in mycorrhizal symbiosis is both a characteristic and a functional requirement. Arbuscular mycorrhizal fungi enhance plant resilience to heavy metal toxicity by increasing their heavy metal stress tolerance. AMF is an ecofriendly method that enhances soil health and safeguards plants from abiotic and biotic stresses, contributing to sustainable productivity. The manuscript focuses on the uptake of heavy metals, accumulation, and arbuscular mycorrhizal impact in alleviating heavy metal stress in plants. It demonstrates the different methods employed by AMF to reduce the negative effects of HMs on plants. It provides valuable insights for future research programs.*

Keywords*: Arbuscular mycorrhizal fungi, Heavy Metal Stress, Antioxidant, Mineral nutrition*

Biography



I, Ankisha, currently pursuing PhD, in Botany, Department of Botany and Plant Physiology, CCS HAU, Hisar, under the guidance of Dr. Sridevi Tallapragada. I possess a diverse range of skills in use of Origin, SPSS, MS-Excel, MS-Word and have a strong command over instrumental techniques such as AAS-spectrophotometer, EC-meter, pH-meter and UV-VIS Spectrophotometer, demonstrating their proficiency in handling and operating these instruments.

CHANGES IN SOIL PROPERTIES UNDER FRUIT TREE SPECIES IN SEMI-ARID ZONE OF INDIA

Ishrat GULL

Department of Soil Science, Chaudary Charan Singh Haryana Agricultural University, Hisar, Haryana, India, ishratgull04@gmail.com, 9149518891

Abstract: *Soil is the most significant non-renewable dynamic natural resource and is crucial for agriculture. It is important to keep it healthy and productive because it is the home of terrestrial life. The present study, entitled "Changes in soil properties under fruit tree species in semi-arid zone" was carried out in 2022-2023 at the experimental farm of the Department of Horticulture, CCSHAU, Hisar, with the objective to study the effect of fruit tree species on physical, chemical and biological properties of soil. Soil samples were collected from soils under four fruit tree species and bare site (control) at four depths (0-15, 15-30, 30-60 and 60-90 cm) to analyse different soil properties. Experiment was laid out in RBD design with four replications. Four fruit tree species namely Mangifera indica, Psidium guajava, Syzygium cuminii and Aegle marmelos were selected for the study. The results of the present investigation showed that nutrient levels were higher at the surface layer (0-15 cm) of soil and decreased with increasing depth. Soil pH and EC reduced significantly under jamun and guava orchards by 5.8% and 81.9%, respectively over control. Jamun orchard recorded highest OC, N, total N, S and DTPA extractable Fe, Mn, Zn while as available P, K, total P, K, DTPA extractable Cu were found to be highest in bael orchard. Soils under bael orchard recorded the highest total Fe, Mn and Cu content while the total Zn was found to be highest in soils under guava orchard. MBC and dehydrogenase activity increased by 43.8% and 71.8% in jamun, 41.4% and 59.3% in bael, 39.6% and 54.6% in guava and 33.5% and 53.1% in mango, respectively over control. Highest percent increase in alkaline phosphatase and urease activity was by jamun (45.8% and 40.3%), followed by bael (38.3% and 39%) and lowest in control. Highest bulk density and penetration resistance was observed in mango orchard and lowest in jamun orchard. Highest water holding capacity was recorded in jamun (40.6%), followed by bael (38.8%), guava (38.5%) and mango (36.3%).*

Keywords*: fruit trees, soil properties, semi-arid zone, soil depth*

Biography

M.Sc. Soil Science

THE EFFECT OF PHOSPHORUS, POTASSIUM, AND HUMIC ACID FERTILIZERS ON SOME GROWTH, FUNCTIONAL, AND PHYSIOLOGICAL TRAITS OF CHICORY (CICHORIUM INTYBUS L.) UNDER CLIMATIC CONDITIONS IN ARAK

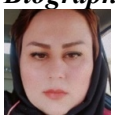
Shabnam MORADI, Mohamadreza SEIFI, Heshmat OMIDI

Agriculture Department, Razi Street 3433, Arak, Iran, Shabnammoradi.62@gmail.com, 0098 9183676115

***Abstract**: A factorial experiment was conducted in 2017 using a randomized complete block design (RCBD) in three replications to detect the effect of phosphorus, potassium, and humic acid fertilizers on some growth, functional, and physiological traits of chicory under the climatic conditions in Arak, Markazi province, Iran. Experimental factors were three levels of Sangral® phosphorus fertilizer (0, 8, and 12 kg/ha), sulphate potassium fertilizer (0, 10, and 15 kg/ha), and powder Humax humic acid (0, 0.5, and 2 kg/ha). Moreover, the following traits were examined: bush height, number of secondary meristems, leaf area index, number of flowers, flower yield, shoot yield, biological yield, flower harvest index, level of photosynthetic pigments, and free proline content. According to the results, the highest leaf area indices were observed in the treatments P1K2H1, P3K1H2, P1K1H3 and P3K2H3 (with the mean of 2.83, 2.84, 2.84, and 2.9, respectively). Compared to the control group, they revealed 29.6, 29.9, 29.9, and 31.3% increases, respectively. The lowest leaf area index was observed in the treatment P1K3H3 with the mean of 1.76. The maximum number of flowers was obtained in the treatment P3K2H2 with the mean of 49.11 per plant, indicating a 40.6-percent increase compared to the control treatment. The highest flower yield was in the P1K2H1 treatment with the mean of 330.6 kg/ha, suggesting a 35.0-percent increase compared to the control treatment. The highest total chlorophyll content was observed in the treatment P3K2H2 with the mean of 39.5 µg/g FW, revealing a 28.7-percent increase compared to the control treatment. The highest content of free proline was in the treatment P2K3H3 with the mean of 0.97 µmol/g FW, suggesting a 61.2-percent increase compared to the control treatment. In general, compared to the control group, the three compounds significantly increased the yield, yield components, and the content of photosynthetic pigments. According to the findings, the combined application of all three fertilizers had reducing effects at high concentrations and causes toxicity in the plant.*
Accordingly, the application of 8 kg of Sangral® phosphorus fertilizer per hectare, 10 kg of sulphate potassium fertilizer per hectare, and 0.5 kg of powder Humax humic acid is recommended for the cultivation of chicory.

***Keywords**: Proline, Photosynthetic pigments, Leaf area index, Flower yield*

Biography



Dr. Shabnam Moradi is University Professor, employer of agricultural department, Arak, Iran.

EVALUATION OF BURIAL BEHAVIOR OF GEOMATERIALS IN PEATLANDS USING THE PPLICATION OF UNSUPERVISED LEARNING TOOL

Sara MOGHNIE

American University of the Middle East, Kuwait, Kuwait, Sara_mog@hotmail.com, +965-66358030

Abstract: *Peatlands are terrestrial ecosystems with an elevated level of waterlogging. They are characterized by a high level of organic matter (OM) and are a significant source of carbon dioxide (CO_2) and methane (CH_4) under anoxic conditions. The main components of organic macromolecules in peatland are mainly lignin and polysaccharides. As greater concentrations of lignin are found to be strongly related to the high CO_2 and CH_4 concentrations under anoxic conditions in the surface peat, the need to study the degradation of lignin under anoxic and oxic conditions has emerged. In this study, we evaluated the lignin degradation in soils using cupric oxide (II) under alkaline conditions. Then, we applied PCA for the molecular fingerprint of 11 major phenolic sub-units produced by alkaline oxidation of the lignin in the investigated peat sample called "Sagnes". The development of various characteristic indicators for lignin degradation state based on the relative distribution of lignin phenols was measured using Gas chromatography following the degradation. To achieve this aim, Principal Component Analysis (PCA) has been applied for the molecular fingerprint composed of the phenolic sub-units, yielded by CuO-NaOH oxidation. This approach aims to remove bias between intercorrelated proxies and potentially revealing patterns that were hidden from the conventional 2D statistical perspective. One PCA was applied for the mass fraction of the different phenolic sub-units and allowed for a separation to be made between the ecological layers and their interfaces. With regard to factors, it allowed for the compilation of two indicators: one for change in vegetation and the other for the degradation of lignin in a peat core along depth. The different results were confirmed by a high correlation along with bulk elemental analysis proxies. The population was composed of the depth peat samples, and the variables were the 11 phenolic subunits.*

Keywords*: Peatland, PCA, Lignin, CuO-NaOH oxidation, Organic matter*

Biography

I'm PhD candidate of Chemistry in the faculty of science. I obtained my master's degree in Biochemistry from Kuwait University in 2014. I have been working as a chemistry Lab instructor at the American University of the Middle East since 2015. Recently, I'm participating in a study targeting the application of artificial intelligence techniques for the assessment of the efficiency of chemical and thermochemical depolymerization methods for Lignin valorization. This granted me a point of interest for PhD. I currently published 2 papers related to this field.

ENERGY TRANSITION IN EUROPEAN UNION. CHALLENGES AND OPPORTUNITIES TO ACHIEVE SUSTAINABLE DEVELOPMENT GOALS (SDGS)

Cristina Gabriela MITINCU

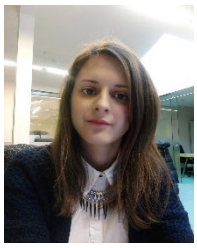
University of Bucharest, Bucharest, Romania, cristinamitincu@gmail.com, +40756316543

Abstract: *The energy transition process remains a cornerstone of future development, given the importance of renewable energy sources for supporting environmentally and socially sustainable economic growth. Thus, the study aims to analyze whether the National Energy and Climate Plans (NECPs), as the central European Union climate and energy governance mechanism, address Sustainable Development Goals to understand the societal challenges and support the transition towards a low-carbon society. More specifically, this study wants to: (1) develop a comprehensive analytic framework to assess the potential of the NECPs to promote energy transition as a way to achieve the SDGs; (2) apply this analytic framework to the NECPs adopted by all European Union Member States to identify (i) the most important opportunities and challenges for countries to promote energy transition as a way to achieve SDGs, and (ii) how the potential trade-offs and synergies of the energy transition are linked to the SDGs; (3) suggest evidence-based recommendations that need to be addressed by policymakers for better integration of the SDGs into the NECPs when planning for targets, updates on policies, and measures directed towards energy transition. Methodologically, we analyze and evaluate the national priorities, ambitions, and targets, as well as the accompanying policies and measures for the five dimensions of the Energy Union considered in the 27 NECPs based on the SDGs Index.*

The results highlighted that are important opportunities and challenges for European Union countries to promote energy transition as a way to achieve SDGs. Thus, our study might be useful to understand how the SDGs can be better integrated into the NECPs to create an adequate framework to improve the quality of these policy documents.

Keywords*: Energy transition; NECPs; Renewable energy sources; SDGs*

Biography



Cristina-Gabriela Mitincu has a PhD in Urban Ecology from the University of Bucharest since 2022. She has published her research findings in journals with large international visibility and high level of relevance for the field of Geography, Environmental Sciences and Environmental Planning, including 7 published papers in ISI listed journals (3 as main author and 4 as co-author, all of them in Q1 Web of Science), and 1 book (as co-author). Since 2018, as Research Assistant and Postdoctoral Researcher, she has been included in the teams of four national and European research grants.

BIOPOLYMER FOR ACTIVE BIODEGRADABLE FOOD PACKAGING

Welela Meka KEDIR

Address: Mattu University, Mattu, Ethiopia,
Email: Welelameka008@gmail.com
Telephone: +251909255370

Abstract: *In this study the bioplastic was prepared form starch, chitosan, spider was and its composite. The essential oils of Rosmarinus officinalis were encapsulated to enhance the biological application. The prepared composite film was characterized using physicochemical, mechanical, X-ray diffraction and FTIR spectroscopy. The biodegradability of the synthesized film was also evaluated for 60 days in soli under laboratory condition. The composite film contains spider web, and essential oil showed a significant increment on mechanical properties. The physicochemical such as moisture, solubility, swelling, transmittance, opacity and water vapor permeability results of the prepared bioplastic were comparable with the control plastic. However essential oil encapsulated film was a better characteristic. The antimicrobial activity of the prepared film was tested against S. aureus and C. albican strains. A greater zone of inhibition was recorded on the composite film which was encapsulated with Eos. Moreover, the EOs based film was a greater antioxidant activity with the inhibition range of 60-7-%. Addition of SW and EOs to the CH/ST film were significantly increase the shelf life of Injera and tomato. However, extraordinary result was observed on EOs based film to enhance the shelf life of Injera and tomato for 7 and 10 days respectively, without significant loss of their physicochemical properties. There was a great reduction on weight and growth of microorganism after 60 days of evaluation. The XRD result of CH film revealed that high crystalline structure of CH was affected addition of starch, chitosan and essential oils and the formation of a broad amorphous peak. The FTIR spectral of the extracted CH samples and the prepared film revealed that there was a presence of various functional groups. In general, the CH/ST/SW and CH/ST/SW/EOs composite film have greater mechanical, biological, physicochemical and potential improvement of food shelf life either coating or packaging application.*

Keywords*:* Encapsulation, Biopolymer, spider web, Essential oils, Bioactive packaging

Biography

My name is Welela Meka, and I am from Ethiopia. I am graduated from Jimma University in master's degree in organic chemistry. Currently working as a lecturer of organic chemistry at Mattu University, Ethiopia. My research interest is related to natural product, synthetic and polymer chemistry. I have more than eight publications within reputable journal which is related to a particular filed of studies. My research experience is isolation and biological application of secondary metabolite, synthesis and characterization of organic compounds, and biopolymer for food packaging and drug delivery application. Moreover, I have good experience on various

spectroscopic (such as NMR, FTIR, XRD, SEM, CC, GC-MS) and software (such as SPSS, Origen, Chemdrow, Mstrnova, and Graph pad prism).

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DEVELOPMENTAL, BEHAVIORAL AND BIOCHEMICAL MARKERS OF ANTHRACENE AND PB2+ EXPOSURE TO ZEBRAFISH ELEUTHERO-EMBRYOS

Abdelfettah GHERIB, Nabil CHARCHAR, Oussama BELAHMADI, Ala ABDESSAMED, Inês DOMINGUES

Laboratory of Ecotoxicology and Environmental Biomonitoring, Biotechnology Research Centre (CRBt), Constantine, Algeria.
Laboratory of Biology and Environment (LBE), Department of Biology and Plant Ecology, University of Brothers Mentouri Constantine 1, Constantine, Algeria.
Department of Biology & Centro de Estudos do Ambiente e do Mar (CESAM), University of Aveiro, Campus Universitário de Santiago, Aveiro, Portugal.
***Corresponding author:** a.gherib@crbt.dz*

***Abstract**: This work aimed to determine the toxicity of anthracene and lead on the survival, development, and behaviour of zebrafish (Danio rerio) eleuthero embryos. The OECD guideline (TG 236) was used to perform fish embryo toxicity (FET) experiments. Moreover, acetylcholinesterase activity (AChE) was investigated as a biomarker of neurotoxicity. The video monitoring device Zebrabox® (Viewpoint, France) was used to assess the effects of these chemicals on the behaviour of 120 hpf larvae. According to obtained data, both chemicals have a moderate toxic effect on fish embryo survival: Pb^{2+} 96h-LC50 value was 76.51 mg/L. Anthracene 96h-LC50 value was 133.35 mg/L. No significant developmental malformations were observed for both chemicals. In term of behaviour, Anthracene decreased total swimming distance (TSD) and total swimming time (TST) in light and dark periods at concentrations of 3.2, 6.4, 12.8 and 25.6 mg/L, indicating hypoactivity. However, Pb^{2+} affected locomotion by increasing distance travelled in rapid movements after 120 hpf exposure at 0.1, 1 and 10 mg/L suggesting hyperactivity. Furthermore, after 120 hpf exposure, AChE was not responsive nor sensitive to Pb^{2+} and anthracene, suggesting that effects at the neuronal level manifested in locomotion impairments are not mediated by the disruption of AChE.*

***Keywords**: PAHs, Biomarkers, Behaviour, FET, Lead, AChE and development.*

Biography

PhD in Biology and Environmental Biotechnology and Environment. Abdelfettah GHERIB is a permanent researcher, currently works at the Biotechnology Research Centre (CRBt) of Constantine, Algeria. I was named as Director of Biotechnology and Environment Research Division in May 2021.

REVIEW ON THE IMPACT OF CLIMATE CHANGE ON APPROACH TO EPIDEMIOLOGY OF LIVESTOCK DISEASES CONTROL

Mekuanint GETACHEW[1], Henok MULATU[2]*

[1]Hirna Regional Veterinary Laboratory, Oromia Regional State, Ethiopia
Email: getachewmekuanint@yahoo.com, Telephone Number: +251935661121
[2]Habro District Livestock and Fisheries Development Office, Oromia Regional State, Gelemso, Ethiopia, Email: @gmail.com, Telephone Number: +251912363554

Abstract: *The livestock sector globally is highly dynamic. In developing countries, it is evolving in response to rapidly increasing demand for livestock products. In developed countries, demand for livestock products is stagnating, while many production systems are increasing their efficiency and environmental sustainability. Currently, the world is facing several challenges, of which Global climate change is a priority area. Agriculture and livestock are amongst the most climate sensitive economic sectors in the developing countries. Climates comprises many factors including temperature, rainfall, humidity, winds and altitude hat can have both direct and indirect effects on animal production and health. It can also affect the quality and quantity of feedstuffs such as pasture, forage and grain and the severity and distribution of livestock diseases and parasites. Infectious diseases of animals are of huge socioeconomic and public health importance. The earth's temperature has risen at an average of 0.3 to 0.7°C since 1900 & 20-30% of all vertebrate animals are expected to get extinct if the average temperature rises by 2-3°C. The early consequences of global climate change (GCC) are well documented. However, future impacts on ecosystem health, and on the health of humans, domestic animals, and wildlife, are much less well understood. A two-pronged approach must be adapted to tackle the alarming situation arising out of climate change impacts. Adaptation may involve the measures for future adaptation to the disease onslaught and the Mitigation focuses on reducing the level of agents/factors leading to the climate change. One health concept in one health triad needs to be followed in spirit to avert the otherwise sure to come impacts of climate change.*

Keywords*: Impacts, Climate Change, Infectious Disease, Livestock*

Biography

Henok Mulatu - Epidemiologist@Habro District livestock office Talksabout one health, veterinary medicine, disaster risk reduction, veterinary epidemiology, and antimicrobial resistance. Good computer skills, Good in Statistical Analysing software (STATA, SPSS, EPI-info), Believe, create and encourage teamwork and collaboration in different cultural working environment.

Henok Mulatu - Epidemiologist@Habro District livestock office Talks about one health, veterinary medicine, disaster risk reduction, veterinary epidemiology, and antimicrobial resistance Talks about hashtag one health, hashtag veterinary medicine, hashtag disaster risk reduction, hashtag veterinary epidemiology, and hashtag antimicrobial resistance.

Habro District Livestock and Fish Resource Development Office, Haramaya University, Oromia Region, Ethiopia.

REPRESENTATION OF INDUSTRIAL RISK

Kenza IRINISLIMANE

Mechanical Engineering Department, M'Hamed Bougara University, Boumerdes, Algeria
k.irinislimane@univ-boumerdes.dz, 06.99.95.80.82

Abstract: *A risk is not the result of a single cause but of the interaction of several situations. As a result, a comprehensive risk management decision-making process is required. This Process, which is iterative, aims to identify, evaluate, neutralize and manage events undesired that can be generated by the system or its environment. We proceeded to the elaboration of an application table of the AMDEC method. This table allowed us to identify potential risks, to assess their criticality and to assess the impact of these risks on the company's activities. In addition, we have implemented corrective and preventive actions, and we track their effectiveness using a monitoring chart.*
We analyzed the results obtained using the SWOT method. Based on these results, we have made recommendations to ensure optimal results. In addition, we have improved some aspects of risk and opportunity management procedures.

Keywords*: Environment, risk, recommendation, management*

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ECOTOXICOLOGICAL IMPACTS OF FUNGICIDES ON BENEFICIAL SOIL MICROORGANISMS

RENÁTA CSIZMADIA, HOSAM E.A.F. BAYOUMI HAMUDA

Institute of Environmental Engineering and Natural Sciences,
Rejto Sandor Faculty of Light Industry and Environmental Engineering
Obuda University, Budapest, Hungary
bayoumi.hosam@uni-obuda.hu, WhatsApp/viber/messenger: +36303900813

Abstract: *Unsafe disposal of pesticide waste at agricultural land has serious consequences for the environment and public health. The excessive application of chemicals in the world today is considered as a major factor to various ecological problems and undesired environmental effects. Many techniques were used to study the ecotoxicological assays of such chemicals. In present research work, the effects of five fungicides (Kolfugó 25 WP with 25% Carbendazim, Captan 50 WP with 50% Captan, Dithane DG with 75% Mancozeb, Ipam 40 with 40% Metam-ammonium and Thiram with 42% Thiram) with four concentrations (0, 0.5X, X, and 2X, where X is the recommended applied dose in agricultural field and on the basis of 1 hectare containing 3 000 000 kg soil) on some important soil biological processes including microbiological (such as microbial biomass carbon, nitrogen, phosphorus, total counts of aerobic heterotrophic bacteria, filamentous fungi, cellulose-decomposers and phosphate-solubilizing microbes) and biochemical (soil respiration and the activities of dehydrogenase, urease, phosphatase and β-glucosidase) investigations after 4 weeks incubation period at 28±2°C in pot experiments containing 1 kg agricultural clay loam brown forest soil originated from Gödöllő and the moisture content was kept in approximately 45%. From this experiment, the following conclusions were drawn the followings: Kolfugó 25 WP had no effects on the investigated soil biological parameters even at the double applied field recommended dose (2X) followed by Dithane DG, Ipam 40, Captan 50 WP and the strongest fungicide was Thiram. The 2X applied dose of Thiram and Captan 50 WP had negative effects on the population of phosphate-solubilizes and the activities of dehydrogenase and β-glucosidase. Microbial biomasses were almost highest at X dose applied concentration of all investigated fungicides. Lower doses of investigated fungicides do not have deleterious effect. The populations of aerobic heterotrophic bacteria, filamentous fungi and cellulose-decomposers were higher than the control soil and maximal populations were at 0.5X. Soil respiration (CO_2-production) and the enzymatic activities of urease and phosphatase were increased by increasing the investigated doses of all tested fungicides. The results indicated that the field recommended rates of tested fungicides are the most appropriate doses, which have no harmful impacts on soil microbiological and biochemical properties. It can be concluded that among the five fungicides, Thiram has a greater influence than Captan on the investigated soil biological parameters at 2X applied doses. On the other hand, the rates of soil respiration, soil enzyme activities (urease and phosphatase) and microbial biomass carbon, nitrogen and phosphorus were increased significantly by the fungicide treatments. Soil urease activity was increased by the fungicide treatments. The present study showed that fungicides impacted microbiological and biochemical activity in soil. It stimulated the counts of heterotrophic bacteria and actinobacteria in both loamy sand and sandy loam, while its inhibitory effect was found for fungi.*

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Fungicides also affected soil biochemical properties. It proved to be an inhibitor of phosphatase, catalase and dehydrogenase activities. Fungicide exerted variable effects on urease and phosphatase activities. Soil supplementation with such preparations had a varied impact on soil biological activity. More investigations are required using different soil types and other fungicides.

***Keywords**: fungicides, soil microbial biomass, soil enzymatic activities, soil respiration*

Biography

Currently, Prof. Dr. Hosam Bayoumi Hamuda is working at Obuda University, Sandor Rejto Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences (Budapest, Hungary) since 2008. He was Senior Researcher and Deputy Director of Research Group for Environmental Microbiology of Hungarian Academy of Sciences (Budapest) between 1997 and 2004. Briefly, He received the degrees of B.Sc. (1978, Chemistry and Botany), M.Sc. (Biological Sciences) from Garyounis University (Benghazi, Libya), University Doctor (1987, Agricultural Sciences-Soil Microbiology) and PhD in Biological Sciences (1999) from Gödöllő University of Agricultural Sciences (Gödöllő, Hungary) and C.Sc. in Biological Sciences (1994) from Hungarian Academy of Sciences, Budapest, Hungary. He received the Doctor Habilitation Degree in Environmental Sciences (2007) and the Professor degree from Szent István University (2008, Gödöllő, Hungary). Also, University Doctor Degree in Natural Sciences from Eötvös Loránd University (1995, Budapest). Prof. Hamuda was awarded many times from different organisations, e.g., the Society of Hungarian Microbiologists (MMT), the Hungarian Professors Council (MPV), etc. and he is a member of many Hungarian and International Organisations. Prof. Hamuda was the general secretory and now is the president of International Council of Environmental Engineering Education (ICEEE) originated since 2010 (Budapest, Hungary) and Member of the International Society of Development and Sustainability (Japan), Society of MMT, Soil Science and Agrochemistry Committee of the Agricultural Sciences Department of IV of the Hungarian Academy of Sciences (Budapest) and Association of Hungarian Medical Societies (MOTESZ) and others. He was the director of MSc program titled: Microbial Science and Biotechnology (Szent István University, Gödöllő, Hungary) from 2000 to 2008 and Director of PhD Program titled: Agricultural-, Environmental Microbiology and Soil Biotechnology until from 2007 to 2015 and now a member of the Environmental Sciences Doctor's School at Szent István University and Doctoral School on Materials Sciences and Technologies at Obuda University. Prof. Hamuda is acting as editorial member, reviewer of many international journals, and he organize many international conferences and symposiums. He delivered more than 120 plenary and keynote lectures in international events and a member of scientific committee of more than 100 conferences. He is the editor in chair of more than 15 Proceedings Books of International Conferences. Research Interest Topics: 1. Microbial biotechnology: solid waste and wastewater management. Soil Biotechnology: rhizosphere index, soil microbial biomass and enzymatic activities. soil health, and soil biodiversity. Soil security, biocontrol and biofertilizers. microbial inoculants. Colonization of Plant Growth-Promoting Rhizomicrbiota. Nitrification inhibitors and crop quality. 2. Monitoring of soil organic matter. Econanotoxicology. Roles of engineered metal oxide nanoparticles in soil. 3. Public health and healthcare. Bioengineering and Environmental Health. Probiotics, antibiotics, xenobiotics, and human gut microbiomes. Impacts of xenobiotics: pesticides and other pollutants on soil biological activities 4. Climatic changes and global security.

A BIBLIOMETRIC ANALYSIS ON SYNTHETIC CANNABINOIDS AND THEIR ADVERSE EFFECTS ON HUMAN HEALTH

Izabella VARGA*, Hosam E.A.F. BAYOUMI HAMUDA

Institute of Environmental Engineering and Natural Sciences, Obuda University, Budapest, Hungary
**vargaiza2003@gmail.com, 06306740366*

***Abstract**: Synthetic cannabinoids is a group of compounds that do not resemble cannabinoids (the active ingredients of wild hemp) but are able to bind to cannabinoid receptors. These are often sold as designer drugs in the illegal drug trade or sold as a drug whose sedative effect is the same as that of marijuana. If these synthetic cannabinoids are sprinkled in liquid form on the dried fraction of various plants of your choice or infused with plant fraction or other neutral base that can be used with a carrier material, then they are misleadingly marketed as synthetic marijuana. The first synthetic cannabinoids were synthesized by Roger Adams in the 1940's. Users of the drug burn the plant fragments impregnated with these compounds, producing smoke, and then inhale the smoke. Products containing synthetic cannabinoids have been legislated in almost every country in the world and their trade is prohibited. In most cases, synthetic cannabinoid consumption requires emergency care. The most common symptoms are rapid heartbeat, high blood pressure, nausea, blurred vision, hallucinations and increased excitement. Other symptoms include epileptic seizures and acute psychosis.*

***Keywords:** Synthetic cannobionides, drug, sedative effect, marijuana. plant fraction, emergency healthcare.*

MICROBIAL ANTAGONISTS AGAINST PHYTOPATHOGENS: IN VITRO EXPERIMENT

FRUZSINA KIS-PRUMIK KOVÁCSNÉ, HOSAM E.A.F. BAYOUMI HAMUDA

Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary
bayoumi.hosam@uni-obuda.hu, *WhatsApp/viber/messenger: +36303900813*

Abstract: *The plant rhizosphere is a major soil ecological environment for plant – microbe interactions involving colonization of different microorganisms in and around the roots of the growing plant. This colonization may either result in associative, symbiotic, neutralist or parasitic interactions, depending upon the plant nutrient status in the soil environment. The use of in vitro selected antagonistic strains which produce the best performance in the real soil-plant systems is highly encouraged therefore in the study. Under the impacts of different environmental factors such as low and high temperature degrees, different pH values, the presence of alkaline and heavy metal ions in the cultural medium, the antagonistic activity of the eight potential antagonists were individually tested in vitro for their antagonistic activity against the plant pathogens Rhizoctonia solani, Alternaria tenuis, Pythium ultimum, Fusarium oxysporum, F. solani and F. dianthy and for the production of hydrolytic enzymes (chitinase and protease). In general, these interactions were greater between the two species of Bacillus and the two species of Pseudomonas and one Enterobacter sp. and the tested phytopathogenic fungal strains as an example of bacteria – fungi interaction as well as between the two species of Trichoderma strains one Saccharomyces cerevisiae and the tested phytopathogenic fungi as an example of fungi – fungi interaction. All antagonists assigned to show different patterns of antagonistic activity. The P. putida showed antagonistic activity lower than P. fluorescens against Alternaria tenuis, Fusarium oxysporum, F. dianthy, F. solani, Pythium ultimum and Rhizoctonia solani. Bacillus subtilis and Bacillus mycoides as well as Saccharomyces cerevisiae antagonists showed a high range of antagonistic activity and suppressed all phytopathogenic fungi better than other potential rhizomicrobial strains. The proteolytic activity and chitinolytic activity of antagonists were detected. Almost, all tested potential antagonists showed variation in the size of clearing zones on skim milk agar plates, suggesting proteolytic activity. The strains of antagonists also demonstrated the chitinolytic activity. Significant correlations were found in the production of hydrolytic enzymes, which is known to be an important mode of action in antagonism and the antagonistic activity of the strains. Moreover, a correlation was observed between the production of lytic enzymes and the range of fungal pathogens antagonized in vitro. The antagonist potential P. putida is considerably lower than in fluorescent Pseudomonas strain but had the ability to suppress the plant pathogenic fungi. It was found that the effect of tested environmental factors did not highly reduce the antagonistic activity of the investigated antagonists, while under the effect of some factors, the activity was increased. Best temperature which stimulated the antagonistic activity is 25°C. The divalent alkaline metal ions were more promote the antagonistic activity than the monovalent metal ions. The results of this study clearly show that the increase of mycelial growth inhibition by the antagonists was directly proportional with the ionic diameters of the*

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assayed ions Na, K, Ca and Mg). At pH value 6.8, the antagonistic activity was at maximum. The heavy metal ions Cd, Cu, Pb and Zn showed the different degree of antagonism against the tested plant pathogenic fungi. From the above-mentioned results, we come to give final conclusions and remarks that: At low or high of temperature and pH values, the antagonistic activity of selected rhizomicrobial strains against the tested phytopathogenic fungi is established. Combination of several mechanisms, i.e., competition, restraint of the pathogen enzymes, and induced resistance, is probably responsible for the multiple effect of the biocontrol agent. It may be assumed that multiple mechanisms are involved in other biocontrol systems, but in most cases only part of the possible mechanisms has been elucidated, and the hydrolytic enzyme assay is important to evaluate the ability to antagonize the plant pathogens.

***Keywords**: microbial antagonists, phytopathogens, in vitro experiment, biocontrol agent, PGPR, ecological factors, hydrolytic enzymes*

Biography

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DISTRIBUTION TYPES OF LICHENS IN HUNGARY: COMPARISON OF LICHEN IN EASTERN BAKONY AND DEBRECEN FOREST

BARBARA KÖVICS, HOSAM E.A.F. BAYOUMI HAMUDA

Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary
bayoumi.hosam@uni-obuda.hu, *WhatsApp/viber/messenger: +36303900813*

Abstract: *The presence or absence of lichens (epiphytes) serves as an indicator of the condition of an ecosystem and the degree to which it is contaminated by various agents, such as agrochemicals and metals. Evaluating the use of lichens as bioindicators of agrochemical contamination could provide a more comprehensive perspective of current contamination levels. Monitoring was conducted over a 4-month period in two study areas: Csór area of Eastern Bakony and in the Debrecen Forest. Data on the presence and abundance of lichens in each study area were recorded at morphological and distributions, size, and colour monitoring points. Moreover, a multivariate analysis was performed to compare the lichen communities in both areas. Searching for an ideal biomonitor species as well as intercomparison with other recommended biomonitors is always an actual question. It is of great importance for biomonitoring to select and investigate the species that are widely distributed and available for sampling without worrying about the species vanishing due to overharvesting. Biomonitoring of air pollutants using cryptogams (mosses and lichens) could be a complementary approach to assess long-term atmospheric deposition of the pollutants across urban, industrial, and remote areas. Air pollution is considered one of the most important environmental problems. In this study, research was carried out only on lichens distributions. Lichens are extremely important in ecology because they have many positive effects on habitats and ecosystems. Key aspects of the ecological importance of lichens include air quality improvement, soil formation, nutrient cycling, biodiversity, food source, soil stabilization and environmental monitoring. Since the use of lichens as bioindicators requires specific conditions and research objectives, it is important to consider the associated advantages and disadvantages when designing and evaluating studies. Lichens were and are still used for many other purposes. They occur in agriculture as feed, in the food industry, in the pharmaceutical industry, in the production of cosmetic products, and in the decoration of apartments or houses and objects. Attention should be paid to its use in the pharmaceutical industry due to its antibiotic and antiseptic effects. Research has also proven that substances can be found in some lichens that can also be an antidote to cancer. Lichen has been known in the field of medicine for a very long time, it has been used as medicine since before our era. Iceland lichen and lung lichen, which are also better known in our country, are mainly used for respiratory diseases. In this study, we searched for lichen species living in the Csór area of Eastern Bakony and in the Debrecen Forest and compared their properties. These two places have different natural properties, for example, their soil structure is different, while Bakony's soil is limestone, while Nagyerdő is clayey and loess. On September 29, 2023, and October 20, 2023, we found lichen species of different looks, colours, and sizes in the Debrecen Forest. We managed to photograph a total of 37 lichen colonies and lichen species. The collection and identification of lichen samples found in the Debrecen Forest are: Physcia caesia, Physcia adscendens,*

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Physcia stellaris, Xanthoria parietina, Peltigera canina, Hypogymnia physodes, Rhizocarpon geographicum, Candelariella vitellina, Lepraria incana, Parmelia caperata, and Parmelia saxatilis. The second investigated area is the area of Eastern Bakony, also within it, on the Csór side. we examined here on October 16, 2023, between 2:30 p.m. and 6:22 p.m., looking for lichens. In this part, we found species considered rare in Hungary. The collection and identification of lichen samples found in this area are: Xanthoria parietina, Physcia adscendes, Physcia caesia, Physcia stellaris, Hypogymnia physodes, Parmelia caperata, and four sample under the identification processes, they are recognized as new lichens in Hungary. The morphological characteristics of all lichens were recorded. It can be clearly seen that Physcia caesia was the most dominant lichen species at the first site, and Xanthoria parietina at the second site. Based on the quantity and quality of the lichens, It can be concluded that the air quality in terms of sulphur dioxide and carbon monoxide is different in the two investigated locations. It is clear to the naked eye that in the Csóri area of Kelet Bakony, the study showed much larger and more beautiful colonies, as well as lichen species that are rare in Hungary. In the Debrecen Forest near the fence, the size of the colonies was quite small, but moving towards Békás Lake, where there is no vehicular traffic in the area, and lichens of different species and colours appeared on the trees. In conclusion, this research underscores the importance of lichens as precise indicators of environmental health and contamination by agrochemicals and metals.

***Keywords**: Air quality, environmental pollution, epiphytes, biodiversity, new records*

Biography

Currently, Prof. Dr. Hosam Bayoumi Hamuda is working at Obuda University, Sandor Rejto Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences (Budapest, Hungary) since 2008. He was Senior Researcher and Deputy Director of Research Group for Environmental Microbiology of Hungarian Academy of Sciences (Budapest) between 1997 and 2004. Briefly, He received the degrees of B.Sc. (1978, Chemistry and Botany), M.Sc. (Biological Sciences) from Garyounis University (Benghazi, Libya), University Doctor (1987, Agricultural Sciences-Soil Microbiology) and PhD in Biological Sciences (1999) from Gödöllő University of Agricultural Sciences (Gödöllő, Hungary) and C.Sc. in Biological Sciences (1994) from Hungarian Academy of Sciences, Budapest, Hungary. He received the Doctor Habilitation Degree in Environmental Sciences (2007) and the Professor degree from Szent István University (2008, Gödöllő, Hungary). Also, University Doctor Degree in Natural Sciences from Eötvös Loránd University (1995, Budapest). Prof. Hamuda was awarded many times from different organisations, e.g., the Society of Hungarian Microbiologists (MMT), the Hungarian Professors Council (MPV), etc. and he is a member of many Hungarian and International Organisations. Prof. Hamuda was the general secretory and now is the president of International Council of Environmental Engineering Education (ICEEE) originated since 2010 (Budapest, Hungary) and Member of the International Society of Development and Sustainability (Japan), Society of MMT, Soil Science and Agrochemistry Committee of the Agricultural Sciences Department of IV of the Hungarian Academy of Sciences (Budapest) and Association of Hungarian Medical Societies (MOTESZ) and others. He was the director of MSc program titled: Microbial Science and Biotechnology (Szent István University, Gödöllő, Hungary) from 2000 to 2008 and Director of PhD Program titled: Agricultural-, Environmental Microbiology and Soil Biotechnology until from 2007 to 2015 and now a member of the Environmental Sciences Doctor's School at Szent István University and Doctoral School on Materials Sciences and Technologies at Obuda University. Prof. Hamuda is acting as editorial member, reviewer of many international journals, and he organize many international conferences and symposiums. He delivered more than 120 plenary and keynote lectures in international events and a member of scientific committee of more than 100 conferences. He is the editor in chair of more than 15 Proceedings Books of International Conferences. Research Interest Topics: 1. Microbial biotechnology: solid waste and wastewater management. Soil Biotechnology: rhizosphere index, soil microbial biomass and enzymatic activities. soil health, and soil biodiversity. Soil security, biocontrol and biofertilizers. microbial inoculants. Colonization of Plant Growth-Promoting Rhizomicrbiota. Nitrification inhibitors and crop quality. 2. Monitoring of soil organic matter. Econanotoxicology. Roles of engineered metal oxide nanoparticles in soil. 3. Public health and healthcare. Bioengineering and Environmental Health. Probiotics, antibiotics, xenobiotics, and human gut microbiomes. Impacts of xenobiotics: pesticides and other pollutants on soil biological activities 4. Climatic changes and global security.

SOIL MICROBIOMES INOCULANTS FOR SUSTAINABLE AGRICULTURE: LIMITATIONS AND OPPORTUNITIES FOR PLANT GROWTH

Boglárka JUHÁSZ, Hosam E.A.F. BAYOUMI HAMUDA

Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary
bayoumi.hosam@uni-obuda.hu, WhatsApp/viber/messenger: +36303900813

Abstract: *The pot experiment was carried out for four weeks in three replicates under laboratory conditions with temperature 23±2°C and 16/8 photoperiod (day/night) and the soil moisture content were kept being almost 45%. The microbial inoculations were done with two weeks old seedling of tomato plants and the growth parameters were measured after four weeks more. This study shows that soil with sharply contrasting physical and chemical composition and properties, are metabolically active and contain substantial numbers of microorganisms. This has important implications for our understanding and modelling of the healthy growth of tomato seedlings. A greater knowledge of subsoil processes is needed to assess the contribution of subsoil biogeochemical cycles of elements for example the nitrogen, phosphorus, sulphur and carbon, as well as further developments and harmonisation of methods in order to account for potential changes in surface-applied chemicals or wastes and their metabolites as they move down to ground water and their effects on the growth of plant crops as well as the crop production. This is the further task. Generally, the results showed that by increase the application of microbial inoculants to the soil the enzymatic and microbial activities increased. Plate count technique was done to estimate the total aerobic heterotrophic bacterial numbers, aerobic endospore-forming bacteria, yeast and phosphate solubilizers under the influence of the microbial inoculation to the two weeks old tomato seedlings in the rhizosphere of each treatment. The results indicated that the triple microbial inoculants were improve the numbers of rhizosphere microbial contents than the double and single inoculation. Results showed that the application of triplet inoculant increases the total microbial counts, while the double inoculant Pseudomonas and Bacillus subtilis increases the count number of endospore-forming bacteria, and phosphate solubilizers. Also, the results showed that the double inoculant Pseudomonas and Saccharomyces cerevisiae increases the total yeast count in the rhizosphere. Hydrolytic enzymes activities (phosphatase), oxidoreductase activities (dehydrogenase) and indole acetic acid production, were used as measures of soil perturbation. Our results strength the direct relationship between microbial activity and dehydrogenase activity, and dehydrogenase activity can be related to the metabolic state of microbial population of the soil. It was found that by increasing the application of microbial content, the organic C, total N, dehydrogenase and phosphatase activities were increased, but there was no significant variation in the bacterial communities. It was found that dehydrogenase, protease, phosphatase and FAD activities were at highest activity when the soil was inoculated by the triple inoculants followed by the double and single inoculants. In conclusion, addition of microbial inoculants especially the triple inoculant had the most stimulatory effects on*

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the growth of tomato seedling plants, general microbial population, some enzymatic activities and some special microbial groups in soils such as phosphate solubilizers.

***Keywords**: microbial inoculants, tomato seedlings, pot experiment, soil enzymatic activities, microbial contents, soil physicochemical properties*

Biography

Currently, Prof. Dr. Hosam Bayoumi Hamuda is working at Obuda University, Sandor Rejto Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences (Budapest, Hungary) since 2008. He was Senior Researcher and Deputy Director of Research Group for Environmental Microbiology of Hungarian Academy of Sciences (Budapest) between 1997 and 2004. Briefly, He received the degrees of B.Sc. (1978, Chemistry and Botany), M.Sc. (Biological Sciences) from Garyounis University (Benghazi, Libya), University Doctor (1987, Agricultural Sciences-Soil Microbiology) and PhD in Biological Sciences (1999) from Gödöllő University of Agricultural Sciences (Gödöllő, Hungary) and C.Sc. in Biological Sciences (1994) from Hungarian Academy of Sciences, Budapest, Hungary. He received the Doctor Habilitation Degree in Environmental Sciences (2007) and the Professor degree from Szent István University (2008, Gödöllő, Hungary). Also, University Doctor Degree in Natural Sciences from Eötvös Loránd University (1995, Budapest). Prof. Hamuda was awarded many times from different organisations, e.g., the Society of Hungarian Microbiologists (MMT), the Hungarian Professors Council (MPV), etc. and he is a member of many Hungarian and International Organisations. Prof. Hamuda was the general secretory and now is the president of International Council of Environmental Engineering Education (ICEEE) originated since 2010 (Budapest, Hungary) and Member of the International Society of Development and Sustainability (Japan), Society of MMT, Soil Science and Agrochemistry Committee of the Agricultural Sciences Department of IV of the Hungarian Academy of Sciences (Budapest) and Association of Hungarian Medical Societies (MOTESZ) and others. He was the director of MSc program titled: Microbial Science and Biotechnology (Szent István University, Gödöllő, Hungary) from 2000 to 2008 and Director of PhD Program titled: Agricultural-, Environmental Microbiology and Soil Biotechnology until from 2007 to 2015 and now a member of the Environmental Sciences Doctor's School at Szent István University and Doctoral School on Materials Sciences and Technologies at Obuda University. Prof. Hamuda is acting as editorial member, reviewer of many international journals, and he organize many international conferences and symposiums. He delivered more than 120 plenary and keynote lectures in international events and a member of scientific committee of more than 100 conferences. He is the editor in chair of more than 15 Proceedings Books of International Conferences. Research Interest Topics: 1. Microbial biotechnology: solid waste and wastewater management. Soil Biotechnology: rhizosphere index, soil microbial biomass and enzymatic activities. soil health, and soil biodiversity. Soil security, biocontrol and biofertilizers. microbial inoculants. Colonization of Plant Growth-Promoting Rhizomicrbiota. Nitrification inhibitors and crop quality. 2. Monitoring of soil organic matter. Econanotoxicology. Roles of engineered metal oxide nanoparticles in soil. 3. Public health and healthcare. Bioengineering and Environmental Health. Probiotics, antibiotics, xenobiotics, and human gut microbiomes. Impacts of xenobiotics: pesticides and other pollutants on soil biological activities 4. Climatic changes and global security.

PERSISTENCE BEHAVIOUR OF PREMIX FORMULATION OF TEBUCONAZOLE 50% + TRIFLOXYSTROBIN 25% WG ON GREEN PEA

Reena CHAUHAN, Sushil AHLAWAT

Department of Entomology, College of Agriculture, CCS Haryana Agricultural University, Hisar (HYN), India, reenavansh82@gmail.com

Abstract: *The role of pesticides in augmenting agricultural output has been well perceived from last few years and these inputs have been considered as essential inputs in agricultural outputs. There are number of reports which shows the presence of pesticide residues above maximum residue levels (MRLs), have their adverse effects on our environment. Therefore, a research trial was conducted to study the persistence and residue level of trifloxystrobin, its metabolite (CGA 321113) and tebuconazole in green pea. For this foliar application of premix formulation of tebuconazole 50% + trifloxystrobin 25% WG was applied thrice in the interval of seven days @ 350- and 700-ml ha^{-1}. Residues were analyzed on GC and GC-MS/MS, results showed that in the immature pea pods residues of trifloxystrobin, CGA321113 and tebuconazole persisted from 7 to 10 days after last application of both the dose (350 and 700 mLha^{-1}), respectively. After that residue were found below limit of quantification (<0.05 mg/kg). Half-life value ranged from 1.55 to 3.61 days. Residues of tebuconazole and trifloxystrobin found on 1st day only in succulent seeds (shelled) after last application in single dose while in double dose residues reached below LOQ after 5 days of last application. Matured pods with seeds, matured seeds (shelled), and dry fodder (without root and pod) were found free from residues of trifloxystrobin, CGA321113 and tebuconazole on both the doses.*

Keywords*: Green pea; Residues; Pesticides; Persistence; Metabolite*

Dr. Reena Chauhan working as a Chemist in the Department of Entomology, College of Agriculture, CCS Haryana Agricultural University, Hisar. She has eight years of expertise in Pesticide Residue Analysis and have more than 40 publications published in the International Journals. She has received two best oral presentation awards and one excellence award in research.
Project in hand "Strengthening of Laboratory Facilities for Advance Rese Health in Natural/ Organic Farming based Agricultural System"

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HIDDEN HISTORY OF ENVIRONMENTAL PHILOSOPHER-GURU JAMBHESWER?

Matavya BISHNOI[1], Bhanu Singh PANWAR[2]

[1]School of Science, Western Sydney University, Sydney, Australia
[2]Green India Clean Environment Society, Hisar, Haryana, India

Abstract: *The **Jambhoji** was born in Pipasar village located in Nagaur district of Rajasthan. He founded the Bishnoi sect in 1485 at Samarthal Dhora village near Nokha in Bikaner district of Rajasthan. His teachings were in **POETIC FORM, KNOWN AS SHABADWANI**. His teachings are covered by 29 principles and 120 shabads. Eight of the twenty-nine principles are strict guidelines for the protection of the environment, biodiversity, ecology and at the same time they inspire good animal husbandry and compassion for living things. These principles strictly prohibit the killing of animals, cutting of green trees, sterilization of bulls, and inspire the conservation of all life forms. Guru Jambheshwar urged his followers not to wear clothes dyed with 'indigo' as the color for dyeing is obtained by cutting down bushes. Jambhoji used his mind and weaved the movement of environment conservation into religious philosophy. In the present times when the world is facing environmental crisis, then the teachings of Jambhoji prove to be very important. Keywords: Jambhoji, Bishnoi, Sabadvani, Environment, Conservation, Khejarli. Some medieval sages in their teachings gave paramount importance to the promotion and protection of water, forests and animals in the desert. Guru Jambhoji and Siddha Jasnathji guided the society to ensure environmental protection by establishing new sects in Indian desert. Jambhoji propounded the principles of conservation of forests and animals. Hence, he can be considered as the leader of the environmental movement in the state. The word environment was not in vogue during the time of **GURU JAMBHOJI AND SIDDHA JASNATHJI,** but both were much ahead of their time in terms of environmental protection. Knowing the importance of environmental protection, these visionary saints issued the mandate in the language of the common man and played an epoch-making role in establishing ecological balance in the desert region. The Bishnoi sect termed the act of anti-religious acts by human beings to harm the trees and animals that grow and thrive on sandy soil with great difficulty. Along with cleaning the body, He called for keeping the mind ideologically free from pollution. He also considered the act of creating imbalance by tampering with the environment and creating discrimination or disharmony at the social level in the category of pollution. An epoch-making contribution was made by the Bishnoi sect for environmental protection and upliftment of moral values.*

Keywords*: Jambhoji, Bishnoi, Tree, drought, desert, hunting,*

Biography

Mantavya Bishnoi, Ph. D. Scholar, Food and Nutrition, School of Science, Western Sydney University, Sydney, Australia

Professor Dr. Bhanu Singh Panwar, Green India Clean Environment Society, Hisar, India

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MODELING APPROACHES FOR MUNICIPAL SOLID WASTE PREDICTION

Róbert FEJES, Róbert KURDI, Viktor SEBESTYÉN

Sustainability Solutions Research Lab, Faculty of Engineering, University of Pannonia, Egyetem str. 10., Veszprem H-8200, Hungary

Abstract: *Monitoring the volume of municipal solid waste and improving the waste management system is a challenge, as environmental, economic, and social subsystems together determine its dynamics. From simple linear correlation to machine learning and deep learning techniques, there are countless methods for system modelling. Through these models, we have the potential to determine future quantities and qualities more accurately. Model building is aided by various explanatory variables such as GDP, population, tourism, employment.*
The aim of this work is to review and explore models and procedures for predicting changes in the quantity and quality of municipal solid waste, to examine the explanatory variables, to analyze the relationship between the number of observations and the correlation between models, and to select key variables and the optimal model structure by identifying the advantages and disadvantages of the techniques used.

Keywords*: waste management, prediction model, municipal solid waste, artificial intelligence, explanatory variables,*

Biography

DEVELOPMENT OF THE NEW APPROACHES FOR THE MOLECULAR CHARACTERIZATION OF ORGANIC MATTER WITHIN A PEAT BOG

Sara MOGHNIE[1,2]*, Jalal Halwani[1], Khaled YOUNES[2], Laurent GRASSET[3]

[1]Water & Environment Science Lab, Lebanese University, Tripoli, Lebanon
[2]Department of Chemistry, American University of the Middle East, Kuwait
[3]IC2MP, Poitier University, France

Abstract: *Peatlands are terrestrial ecosystems with an elevated level of waterlogging. They are characterized by a high level of organic matter (OM) and are a significant source of carbon dioxide (CO_2) and methane (CH_4) under anoxic conditions. The main components of organic macromolecules in peatland are mainly lignin and polysaccharides. As greater concentrations of lignin are found to be strongly related to the high CO_2 and CH_4 concentrations under anoxic conditions in the surface peat, the need to study the degradation of lignin under anoxic and oxic conditions has emerged.*
In this study, we evaluated the lignin degradation in soils using cupric oxide (II) under alkaline conditions. The development of various characteristic indicators for lignin degradation state based on the relative distribution of lignin phenols was measured using Gas chromatography following the degradation. To achieve this aim, we applied PCA for the molecular fingerprint of 11 major phenolic sub-units produced by alkaline oxidation of the lignin in the investigated peat sample called "Sagnes". Principal Component Analysis (PCA) has been applied for the molecular fingerprint composed of the phenolic sub-units, yielded by CuO-NaOH oxidation. This approach aims to remove bias between intercorrelated proxies and potentially revealing patterns that were hidden from the conventional 2D statistical perspective. In this study, we aimed to seek the efficiency of PCA for the estimation of lignin degradation along a peat core. In this ecosystem, two main phases of OM exist, preservation or degradation. PCA was applied for the mass fraction and allowed for a separation to be made between the ecological layers and their interfaces. The different results were confirmed by a high correlation.

Keywords*:* New approaches, molecular characterization, organic matter, *principal component analysis*

Biography

I'm PhD candidate of Chemistry in the faculty of science. I obtained my master's degree in Biochemistry from Kuwait University in 2014. I have been working as a chemistry Lab instructor at the American University of the Middle East since 2015. Recently, I'm participating in a study targeting the application of artificial intelligence techniques for the assessment of the efficiency of chemical and thermochemical depolymerization methods for Lignin valorization. This granted me a point of interest for PhD. I currently published 2 papers related to this field.

AMELIORATIVE EFFECT OF *MORINGA OLEIFERA* LEAVES ON *AEROMONAS HYDROPHILA* INFECTED FISH

REETU[1*], Rahul KUMAR[2], R. K. GUPTA[1], Tejpal DAHIYA[1]

[1]Department of Zoology, Chaudhary Charan Singh Haryana Agricultural University, Hisar-125004, Haryana, INDIA
[2] Zoology, Chaudhary Charan Singh Haryana Agricultural University, College of Agriculture, Bawal, Rewari, Haryana, INDIA
Ritu[1]: rdmsczoohau07@gmail.com; +918307039630*
Rahul Kumar[2]: drrkr321@gmail.com; +917404133861
R.K. Gupta[1]: gupta_raj123@yahoo.com; +919812096774
Tejpal Dahiya[1]: dahiyahau@gmail.com; +919467482165

Abstract: *Diseases are major problems in fish and in this bacterial disease cause high economic losses to farmers. Fish infections caused by the gram-negative bacteria Aeromonas hydrophila are responsible for high mortality having clinical symptoms such as haemorrhages, ulcers, fin rot, and systemic manifestations. However, their infection may be cured by using different medicinal plants. From ancient times medicinal plants were used to cure antibacterial diseases in humans and other animals. Among them, Moringa oleifera leaves have been studied for their potential effects on various organisms, including fish. Moringa leaves are rich in iron, flavonoids, polyphenols and vitamins like vitamin A and B12 that ameliorate the infection caused by A. hydrophila by changing the hematological parameters. It was observed that experimentally A. hydrophila-infected fish was cured by Moringa oleifera leaves. It was concluded that Moringa oleifera eaves also have antibacterial potential in the fish.*

Keywords: *antibacterial, Diseases, hematological parameters, infected fish, ulcers,*

Biography

Abstract of
Workshop Special Session

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ENVIRONMENTAL HEALTH AND CLIMATIC CHANGE

(How humanity can solve climate change, alleviate poverty, and save biodiversity)

Hosam E.A.F. BAYOUMI HAMUDA

Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary
bayoumi.hosam@uni-obuda.hu, WhatsApp/viber/messenger: +36303900813

***Abstract**: Climate change is happening due to natural factors and human activities. It expressively alters biodiversity, agricultural production, and food security. Mainly, narrowly adapted and endemic species are under extinction. Accordingly, concerns over species extinction are warranted as it provides food for all life forms and primary health care for more than 60–80% of humans globally. Nevertheless, the impact of climate change on biodiversity and food security has been recognized, little is explored compared to the magnitude of the problem globally. When an environmental variation occurs on a timescale shorter than the life of the plant any response could be in terms of a plastic phenotype. However, phenotypic plasticity could buffer species against the long-term effects of climate change. Furthermore, climate change affects food security particularly in communities and locations that depend on rain-fed agriculture. When an environmental variation occurs on a timescale shorter than the life of the plant any response could be in terms of a plastic phenotype. However, phenotypic plasticity could buffer species against the long-term effects of climate change. Furthermore, climate change affects food security particularly in communities and locations that depend on rain-fed agriculture. Accordingly, agricultural yields in Africa alone could be decline by more than 30% in 2050. Solving food shortages through bringing extra land into agriculture and exploiting new fish stocks is a costly solution, when protecting biodiversity is given priority. Mitigating food waste, compensating food-insecure people conserving biodiversity, effective use of genetic resources, and traditional ecological knowledge could decrease further biodiversity loss, and meet food security under climate change scenarios.*

***Keywords**: climatic changes, biodiversity, food security, Mitigating food waste, genetic resources*

Biography

Currently, Prof. Dr. Hosam Bayoumi Hamuda is working at Obuda University, Sandor Rejto Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences (Budapest, Hungary) since 2008. He was Senior Researcher and Deputy Director of Research Group for Environmental Microbiology of Hungarian Academy of Sciences (Budapest) between 1997 and 2004. Briefly, He received the degrees of B.Sc. (1978, Chemistry and Botany), M.Sc. (Biological Sciences) from Garyounis University (Benghazi, Libya), University Doctor (1987, Agricultural Sciences-Soil Microbiology) and PhD in Biological Sciences (1999) from Gödöllő University of Agricultural Sciences (Gödöllő, Hungary) and C.Sc. in Biological Sciences (1994) from Hungarian Academy of Sciences, Budapest, Hungary. He received the Doctor Habilitation Degree in Environmental Sciences (2007) and the Professor degree from Szent István University (2008, Gödöllő, Hungary). Also, University Doctor Degree in Natural

Sciences from Eötvös Loránd University (1995, Budapest). Prof. Hamuda was awarded many times from different organisations, e.g., the Society of Hungarian Microbiologists (MMT), the Hungarian Professors Council (MPV), etc. and he is a member of many Hungarian and International Organisations. Prof. Hamuda was the general secretory and now is the president of International Council of Environmental Engineering Education (ICEEE) originated since 2010 (Budapest, Hungary) and Member of the International Society of Development and Sustainability (Japan), Society of MMT, Soil Science and Agrochemistry Committee of the Agricultural Sciences Department of IV of the Hungarian Academy of Sciences (Budapest) and Association of Hungarian Medical Societies (MOTESZ) and others. He was the director of MSc program titled: Microbial Science and Biotechnology (Szent István University, Gödöllő, Hungary) from 2000 to 2008 and Director of PhD Program titled: Agricultural-, Environmental Microbiology and Soil Biotechnology until from 2007 to 2015 and now a member of the Environmental Sciences Doctor's School at Szent István University and Doctoral School on Materials Sciences and Technologies at Obuda University. Prof. Hamuda is acting as editorial member, reviewer of many international journals, and he organize many international conferences and symposiums. He delivered more than 120 plenary and keynote lectures in international events and a member of scientific committee of more than 100 conferences. He is the editor in chair of more than 15 Proceedings Books of International Conferences. Research Interest Topics: 1. Microbial biotechnology: solid waste and wastewater management. Soil Biotechnology: rhizosphere index, soil microbial biomass and enzymatic activities. soil health, and soil biodiversity. Soil security, biocontrol and biofertilizers. microbial inoculants. Colonization of Plant Growth-Promoting Rhizomicrbiota. Nitrification inhibitors and crop quality. 2. Monitoring of soil organic matter. Econanotoxicology. Roles of engineered metal oxide nanoparticles in soil. 3. Public health and healthcare. Bioengineering and Environmental Health. Probiotics, antibiotics, xenobiotics, and human gut microbiomes. Impacts of xenobiotics: pesticides and other pollutants on soil biological activities 4. Climatic changes and global security.

MANUSCRIPTS OF THE ACCEPTED PAPERS

NICKEL: BENEFICIAL OR TOXIC ELEMENT IN SOIL-PLANT?

B. S. PANWAR[1], VIKASH AHLAWAT[2], MANTAVYA BISHNOI[3], OLHA. A. KHLIESTOVA[4], KATARZYNA EWA BUCZKOWSKA[2,5]

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

***Abstract**: The sustainability of a healthy agricultural ecosystem is prerequisite for protecting the food chain from bioaccumulation of hazardous substances e.g., heavy metals. Among the pollutant elements, Nickel is of great environmental concern as it is hazardous and highly carcinogenic in excesses intake by plants from polluted soils. Screen house study was carried out to evaluate the effect of chelating agent (EDTA @ 2 mmol kg^{-1} (5 split doses), FYM, vermicompost and microbial inoculants (Azotobacter and Pseudomonas, Bio-mix) on the phytoremediation capability of Indian mustard from Ni (100 µ g g^{-1}) enriched sandy loam soil. The results revealed that FYM and vermicompost led to higher biomass production as compared to unamended soil.The bioinoculants also contributed in augmentation of biomass production but not significantly. The EDTA led to decrease in biomass as compared to FYM and vermicompost. The Ni concentration increased significantly in Brassica juncea with the application of EDTA. The application of FYM and vermicompost increased concentration of Ni. The seed treatment with bioinoculants was helpful in increasing concentration but was not much effective. The highest concentration of Ni was recorded in EDTA treatment. The concentration of Ni was higher in root as compared to shoot. Among all the treatment combinations, vermicompost with bioinoculants treatment combination led to higher uptake of Ni. The EDTA and FYM also increased uptake of Ni but it was very less as compared to vermicompost. The results suggested that vermicompost combined with bioinoculants is best for increasing uptake of Nickel. The EDTA and FYM as implications were helpful in phytoremediation of Ni metal from polluted soils. [10], conducted greenhouse experiments using two cultivars of Brassica species (Brassica juncea and Brassica carinata) on both natural and artificially contaminated soils containing Ni. Both natural and amended soils were treated with disodium salt of EDTA @ 0 and 1 g kg^{-1} soil*
and found that application of EDTA created conditions that favored transformation of Cd and Ni less soluble form to more plant available forms in both natural and metal amended soils. However, there is a strong need for further investigation in this aspect, with hyperaccumulator genomics.

***Keywords:** Brassica Juncea, EDTA, FYM, Nickel, Microbial inoculants, Vermicompost*

INTRODUCTION

Nickel is a functional constituent of eight enzymes, including Glx I (EC 4.4.1.5) l ARD (EC 1.13.11.54), Ni-SOD (EC 1.15.1.1.) Hydrogenase (EC 1.12.98.2), MRC (EC 2.8.4.1), CODH (EC 1.2.99.2), ACS (EC 2.3.1.169), and urease (EC 3.5.1.5) (i.e., urea amidohydrolase), that is extremely important to N metabolism in plants (27). As a Ni-metalloenzyme, urease assists in the hydrolysis of urea. Nickel

works as a cofactor to enable urease to catalyse the conversion of urea into the ammonium ion, which plants can use as a source of N. Without the presence of Ni, urea conversion is impossible. Nickel is accumulated in plant organs or tissues, such as leaves. The legume plants grown in nutrient solutions containing urea as the N source developed necrotic lesions on the leaflet tips (Plate 2). The crop plants accumulated 2.5% urea dry weight in the leaves.The leaf tip necrosis symptom of Ni deficiency is even more frequent and extensive when plants are highly dependent on biological N fixation for their N. This concentrated urea kills leaf cells, resulting in the development of necrotic lesions on the legume leaf tips (Plate 2). Nickel-deficient cowpea develops similar symptoms of leaf chlorosis and leaf tip necrosis (Plate 3). These symptoms suggest that urea is formed during normal N metabolism, regardless of the original N source. Application of Ni increases leaf urease activity and prevents urea accumulation. [20} Nickel deficiency also results in delayed nodulation and reduced efficiency of N fixation.This finding suggests leguminous plants might have a unique requirement for Ni. Therefore, for leguminous crops such as green bean and cowpea, Ni fertilization might be needed, particularly for those soils with high Zn or copper (Cu) concentrations, or with pH > 6.7 (Brown 2006).

In Ni-deficient pecans, a key morphological symptom of Ni deficiency is the development of "mouse-ear" leaves (Figures 3 and 4). On branches of Ni-deficient pecans, leaf expansion is both delayed and decreased; bud-break is greatly reduced; and leaves present bronzing, chlorosis, resetting, and tip necrosis (Figures 1–4). It seems likely that these symptoms are linked to oxalic and lactic acid toxicity, which accumulates because Ni deficiency disrupts pecan's carbon metabolism. The Ni-deficient pecan plants accumulated twice as much organic acid as Ni-sufficient plants. They found that lactic acid increased 3.2-fold and oxalic acid increased 2.4-fold, compared to levels in Ni-sufficient pecans. These accumulations disrupted the conversion of certain organic acids to other metabolites necessary for normal growth and development. This disruption of carbon metabolism might also be associated with diminished plant resistance to certain diseases [15, 21].

Additionally, a positive effect of Ni application on disease tolerance has been clearly documented. It is thought that nickel may either exert a direct sanitary effect on pathogens themselves, or that nickel may stimulate plant disease-resistance mechanisms. Although Ni's mode of action in plant protection is unclear, it was shown that direct application of Ni to the roots of cowpea, which contained only 0.03 mg kg^{-1} Ni dry weight, effectively reduced leaf- fungal infection by 50% [17)].

BIOAVAILABLE FORM OF NICKEL

Human use of Ni has been traced as far back as 3500 BCE. However, it was first isolated and classified as a chemical element from Kupfernickel by the Swedish mineralogist and chemist,
A. F. Cronstedt, in 1751. Nickel has five valences: 0, +1, +2, +3, and +4. Among these, onlyNi^{2+} is considered an available form for plants.

NICKEL CONCENTRATION IN SOILS

Nickel comprises approximately 3% of the earth's crust composition and is the twenty-fourth most abundant element [22]. Total Ni concentration commonly ranges from 5 to 500 mg kg^{-1}, with an average of 50 mg kg^{-1} in soils. However, Ni concentrations in dried biosolids (also referred to as treated sewage sludge) or soil near metal refineries are in arange from 24,000 to 53,000 mg kg^{-1}. Soils for crop production contain 3–1,000 mg kg^{-1}. Because Ni^{2+} is the available form of Ni for plants, total Ni concentration is not a useful measure for Ni bioavailability. Positive 2-valence Ni ion (Ni^{2+}) readily oxidizes and becomes unavailable. Thus, plants grown in high-pH soils are vulnerable to Ni deficiency. Additionally, excessive use of Zn and Cu may induce Ni deficiency in soil because these three elements

share a common uptake system. Over liming, which raises pH excessively,also causes soil deficient in plant-available Ni. Thus, in soils that have to be high pH, either naturally or artificially, Ni fertilization may be needed to ensure good crop quality and yield.

SOIL TESTING FOR NICKEL

Several soil test methods have been tried for predicting the crop's need for Ni fertilizer. Manyextractants have been employed to determine the soil's concentration of exchangeable Ni, including diethyltriaminepentaacetic acid (DTPA), $BaCl_2$, $Sr(NO_3)_2$, and ammonium acetate. The DTPA method is the most used and effective for a variety of soils. However, standards for Ni-deficient soils have not been established. Nickel deficiency can occur because of excessive use of competing ions, such as Zn and Cu, unfavourable conditions, such as high pH, or use of intensively oxidized soils for crop production. In Florida, the background level of Ni in agricultural surface soils statewide has been reported as 8 mg/kg, which ismuch lower than that of agricultural surface soils (17 mg/kg) and soil in general (50 mg/kg) nationwide [24]. However, there has been no survey for Ni nutrition in crop production. No one knows whether there is a Ni deficiency problem in plant industries because nickel is a new micronutrient. However, pecan plants grown in Georgia have recently shown typical symptoms of Ni deficiency [31]. The information and photos included in this publication may help the Florida plant industries identify and correct this nutrient disorder.

NICKEL UPTAKE AND TRANSPORT

Plants have two transport systems (Brown 2006): low affinity and high affinity. With the low-affinity transport system, plants can absorb Ni^{2+} ions at the low concentration of 4.4 partsper billion (ppb), which is approximately 0.6 ounces Ni per million gallons of water. With thehigh-affinity transport system, plants can take up 1.8 parts per million (ppm) of Ni^{2+} ions, which is 237.7 ounces per million gallons of water. Nickel is readily translocated within theplant, probably as a complex with organic acids, such as citrate, at pH < 5, or with an amino acid, such as histidine, at pH > 6.5. When plants experience Ni deficiency, the symptoms usually show up first on mature leaves (Plate 2 and 3). Also, due to the transportability of Ni^{2+} ions, up to 70% of Ni in shoots can be transported to seeds [17].

PLANT TISSUE NICKEL CONTENT

The Ni concentration in plant leaves ranges from 0.05 to 5 mg kg^{-1}, which is equal to 0.05–5 ppm on a dry weight basis. The critical Ni concentration in plant tissues required for normal shoot growth of urea-fed tomato and zucchini is about 1 ppm. Nickel concentrations = 10 ppm are generally considered to be toxic to sensitive species or cultivars. Table 1 contains a Ni-sufficiency range for several vegetable and fruit crops [17]

NICKEL FERTILIZATION

As a micronutrient, also called a nano nutrient, Ni is required by plants at low concentration (Theuer 2009). Most annual plants have a requirement for Ni on the order of 0.5 lb per acre, compared with nitrogen (N) at 80–200 lb per acre. Application of Ni fertilizers (Ni^{2+}) might be needed in the following growth conditions: (1) urea is the primary N source used for the crop production systems; (2) high applications of other metals, including Zn, Cu, Mn, iron (Fe), calcium (Ca), or magnesium (Mg), have been made for many years; or (3) leguminous crops are being grown in soils poor in mineral content or

with a pH > 6.7. Soluble salts like nickel sulfate ($NiSO_4$), which contains the Ni^{2+} ion, are suitable fertilizers to prevent or correct plant Ni deficiency. Applying a foliar spray at a concentration of 0.03–0.06 ppm Ni is sufficient. An application of 0.5 lbs Ni per acre is all that is required (NIPAN LLC 2011). Also, municipal biosolids fertilizer is a good source of Ni. Table 2 summarizes Ni fertilizer sources.

Nickel (Ni) is a vital trace element for plant growth, plants are unable to complete their life cycle without an appropriate supply of this metal. However, Ni at toxic level has detrimental effects on plants by disturbing many physiological processes like photosynthesis, root growth, enzymatic activity, and mineral nutrition. People also pay attention to removing fromthe environment plant mining.

With the addition of biomass amendments, the microbial community structure is improved that accelerates the phytodegradation process. The scope, behaviour, and mechanisms of biomass amendments toward remediation of organic and inorganic contaminants and the opportunities for enhanced phytoremediation by applying biomass amendments are alsoreviewed [1]. With references to literature that the availability of nickel for plant uptake varies quite markedly between soils and is also substantially plant species specific. Nickel in agricultural soil is added with industrial effluents, sewage sludge and fertilizers. Nickel is often found in high concentration in polluted soil with Cd and Zn. The soluble contents of Ni in the soil differed significantly between several plant species grown in pots, the maximum differences being four-fold was observed [3].

Indian mustard (Brassica juncea) accumulates high amount of Pb, Cu, Cd, Ni and Zn in shoots [2] but on the contrary the Ni accumulation in plants and its translocation from roots toshoots was low and did not correlate with Ni contamination of soil [7].

Microbial populations can change complexes of heavy metals to affect their availability to theplant through release of chelating agents, acidification, phosphate solubilization, which have potential to enhance phytoremediation processes [5]. Application of farmyard manure (FYM) or compost or biological wastes is a common practice and traditionally followed in Indian agriculture. Integrated approach, involving, plants (hyper accumulators), suitable chemical and biological amendments, and microbial strains should be required for successful remediation of heavy metal contaminated soils [12]. Amongst the commercial crops grown inIndia, Indian mustard (Brassica juncea L.) has been reported to produce higher biomass and accumulate significant number of heavy metals in their tissues when induced through the addition of chelating agents [2]. FYM, vermicompost, chelating agents and bioinoculants (N_2 fixer and phosphorus solubilizing bacteria) and their interaction leading to changes in concentration and uptake of Ni into plants from contaminated soil is to be studied for proper understanding of their role in chemically enhanced phytoextraction. Phytoremediation is considered as an environmentally friendly, gentle management for polluted sites as it uses implications of organic, inorganic, synthetic and biological processes to treat the pollutant. In contrast to most other remediation technology, phytoremediation appears attractive because it is not invasive and delivers intact biologically active soil [13].

The present screen house study was conducted to observe the effect of chelating agents and bioinoculants on phytoremediation of nickel by Brassica Species.

MATERIALS AND METHODS

Collection and Processing of Soil Samples:

The bulk surface sample (0-15) of a sandy loam soil was collected from the experimentalarea of the Department of Soil Science, CCS Haryana Agricultural University, Hisar, Haryana. It was dried, ground to pass through a 2mm stainless steel sieve and mixed thoroughly. The processed soil sample was used for laboratory and screen house studies. Its physico-chemical properties are given in sub table I.

Physico-chemical characteristics of experimental soil

Properties	Contents
(A) Sand (%)	61.3
(B) Silt (%)	19.0
(C) Clay (%)	18.6
Textural class	Sandy loam
pH (1:2)	8.1
$EC_{1:2}$ (dS m^{-1})	0.4
Organic	0.36
CEC [Cmol (P^{+}) kg^{-1}]	12.7
$CaCO_3$ (%)	0.33
Available nutrients (kg ha^{-1})	
(A) Nitrogen	190.4
(B) P_2O_5	17.7
K_2O	200.6
DTPA extractable metal (mg kg^{-1})	
Fe	38.70
Mn	9.78
Zn	0.48
Cu	0.36
Cd	0.25
Ni	0.92
Pb	1.01
Total Metals (mg kg^{-1})	
Cd	3.15
Ni	11.25

Chemical composition of experimental FYM

Properties	Content
Nitrogen (%)	1.23
Phosphorus (%)	0.61
Potassium (%)	1.90
Organic carbon (%)	29.34
C/N Ratio	24.88
Total metal (mg kg^{-1})	
Ni	4.29

Chemical composition of the experimental vermicompost

Properties	Content
Nitrogen (%)	1.75
Phosphorus (%)	0.68
Potassium (%)	0.93
Organic carbon (%)	16.18
C/N Ratio	11.40
Total metal (mg kg^{-1})	
Ni	34

Collection and Processing of Farmyard manure:

The bulk sample of well decomposed farmyard manure (FYM) was taken from the manure pit of Dairy Farm, CCS Haryana Agricultural University, Hisar. The chemical composition ofFYM used is given in sub-Table II.

Collection and Processing of Vermicompost

The bulk sample of a well decomposed Vermicompost (VC) from department of Agronomy, CCS Haryana Agricultural University, Hisar. The chemical composition of Vermicompost used is given in sub table III.

Screen house Studies:

Screen house experiments were conducted to study the phytoremediation of nickel (Ni) byI n d i a n mustard (*Brassica juncea* L.) as affected by chelating agents and bioinoculants from metal enriched soil. The experimental details given below:

Imposition of Treatments:

The processed soil sample was equally divided into two halves and one half was artificially spiked with Ni using $NiCl_2$ as a source of Ni. These two bulk soil samples were spread evenly on polythene sheets placed over the raised platform of screen house. Pre- calculated amount $NiCl_2$ (i.e., 100 mg Ni/250 ml distilled water) were dissolved in distilled water. The solution so prepared were sprinkled over the uniformly spread soils at the rate of 250 ml solution per kg of soil. After sprinkling this solution, the soil samples were covered with plastic sheet for 48 hours to minimize evaporation for proper equilibration. Thereafter the covers were taken off the soils were allowed to dry to workable moisture content. Each soil sample was thus thoroughly mixed, respread uniformly over the plastic sheet and moistened to near field capacity moisture content using distilled water. This cycle was repeated thricefor proper equilibration and uniform enrichment of both soils with added Ni respectively. The Ni enriched bulk soil samples were then air dried and divided in eight equal lots. One lot was kept as such. Second lot was treated with well decomposed dry farmyard manure (FYM) @ 2% by weight.

The third lot was treated with well decomposed dry vermicompost (VC) @ 2% by weight and fourth lot was kept for Ethylenediaminetetraacetic acid (EDTA) treatment @ 2mmol kg^{-1} (0.4 mmol daily for 5 days in 5 split dose) at 40 days after sowing (DAS). The remaining four lots were also treated with above said treatments. In addition to those treatments, last four lots were also treated with N_2 fixer (i.e., Azotobacter sp.) and Phosphorus solubilizing Bacteria (i.e., Pseudomonas sp.) as seed treatment

at the time of sowing. FYM and vermicompost @ 2% by weight will be mixed uniformly in Ni- spiked soils one week before sowing.

Screen House study:

1. Bulk spiked soil with 100 mg Ni kg^{-1} soil
2. FYM / vermicompost / chelating agents treatment combinations:
   - A. Control (Non-spiked soil)
   - B. Ni-spiked soil (Ni_{100})
   - C. Ni-spiked soil (Ni_{100}) + FYM @ 2%
   - D. Ni-spiked soil (Ni_{100}) + Vermicompost @ 2%
   - E. Ni-spiked soil ($_{Ni}100$) + EDTA @ 2 mmol kg^{-1} soil at 40 DAS (Day aftersowing)
3. Bioinoculants treatment combinations:
   - A. Control + PSB + N_2 fixer
   - B. Ni-spiked soil + PSB + N_2 fixer
   - C. Ni-spiked soil + PSB + N_2 fixer + FYM @ 2%
   - D. Ni-spiked soil + PSB + N_2 fixer + Vermicompost @ 2%
   - E. Ni-spiked soil + PSB + N_2 fixer +EDTA @ 2 mmol kg^{-1} soil at 40 DAS
4. op: Indian mustard (*Brassica juncea* L.) Variety: Laxmi
5. Number of treatments: 5 + 5 = 10
6. Replication: 3
7. Number of pots: 10x3= 30
8. Experimental design: CRD
9. Harvesting stage: Two weeks after chelating agent application

Five kg capacity earthen pots lined with polythene were used to grow the crop. The polythenelining was provided mainly to avoid leaching of soil solution and interaction of metals with the earthen pots. All, pots were filled with 5 kg of thoroughly mixed air-dried soil. In each pot basal doses of N, P, K, Fe, Mn, Zn and Cu @ 50, 50, 60, 10, 5, 5 and 5mg kg^{-1} soil through Urea, KH_2PO_4, $MnSO_4.H_2O$, $FeSO_4.7H_2O$, $ZnSO_4.7H_2O$, and $CuSO_4.5H_2O$, respectively, in solution form @ 5oo ml solution in each pot separately. After 24 hours, the nutrient treated soil from each pot was separately taken out, mixed thoroughly and refilled.

Indian mustard (Brassica juncea L.), variety Laxmi, was taken as the test crop. Before sowing,half of the total seeds were inoculated with microbial inoculants (Azotobacter sps. andPseudomonas sps.). Twenty inoculated seeds of this crop were sown in each pot on 22th Oct. 2013.

Thinning was done to 5 plants per pot on 10th day of seeding and plants were allowed togrow up to 8 weeks from the date of sowing (i.e., up to blooming stage). The pots were irrigated deionized water as and when required.

In the present study, EDTA, FYM and vermicompost were used as chelating agents. EDTA (Disodium salts) was applied at the rate of 2 mmol per kg soil (0.4mmol daily for 5 days in 5 split doses) in twelve pots filled with the Ni treated soil in 40th day of sowing.

Composite soil samples from each pot were taken before sowing and after harvesting of plants with stainless steel tube auger. These soil samples were air dried, ground, sieved and stored in polyethylene bags for their chemical analysis.

Analytical methods and procedures

Physicochemical soil properties and manure analysis were determined by International Standard methods. To determine Ni in plants samples, 0.5 g of ground and well mixed plant material was digested in diacid mixture of nitric acid and perchloric acid in 4:1 ratio. After digestion, the volume was made to 25 ml with double distilled water, filtered and stored in well washed plastic bottles. Nickel was estimated by using the procedure of [8] and all the estimation for Ni in aliquot were made by using Atomic Absorption Spectrophotometer (AAS) (GBC-932 plus).

RESULT AND DISCUSSION

Toxicity symptoms

A higher level of Ni in plants leads to a decrease in water content in dicot and monocot plant species. Hence, Ni toxicity in plants is attributed to decline in water content. Ni toxicity is closely related to the inhibition of protein and chlorophyll processes.

There was no adverse effect of germination of seeds in Nickel spiked soil. In overall, growth of Brassica juncea was better in FYM and vermicompost amended soil as compared to unamended Ni enriched soil. The plants grown in FYM or vermicompost treated soil bore a healthy look as compared to others which might be attributed to additional supply of essential nutrients contained in FYM or vermicompost. Growth of plants were stunted, number of branches was less, leaves were narrow and small in Ni spiked and EDTA treated soil as compared to FYMor vermicompost treated soil.
The growth of Brassica juncea in bioinocualants treatment was better in all treatments as compared to untreated soils.

With the addition of chelating agent (EDTA) after 40 days after sowing, plants did not show wilting symptoms as EDTA was applied in five equal split doses
i.e., 0.4 mmol/kg daily for five days.

Dry matter yield

Roots

The data of dry matter yield of roots and shoots of Brassica juncea as influenced by different treatment in Ni contaminated soil are presented in Table 1 and Fig 1. The mean dry matter yieldof roots ranged from 3.00 to 4.58 g pot^{-1}. The maximum mean dry matter yield of roots (4.58 gpot^{-1}) was recorded in Control+M (unspiked soil) treatment.

Other than unspiked soil treatments,the mean dry matter yield of roots was recorded highest (4.29 g pot^{-1}) in Ni_{100}+VC+M treatmentwhich is statistically at par with Ni_{100}+FYM+M, Ni_{100}+FYM and Ni_{100}+VC. The least dry matteryield of roots was observed in Ni_{100}+EDTA treatment (3.00 g pot^{-1}) which is statistically at parwith Ni_{100}+EDTA+M treatment.

Shoots

The data in Table 1 and Fig 1, further revealed that the dry matter yield of shoot of Brassica juncea was also influenced variably by different chelating agents at both the growth stages. The highest mean dry matter yield of shoots (41.70 g pot^{-1}) was obtained in Control+M treatment but among the Ni_{100} spiked soil, the higher mean dry matter yield, 39.20 g pot^{-1}was recorded in Ni_{100}+VC+M treatment and the least, 26.80 g pot^{-1}, in Ni_{100}+EDTA treated soil.

Table 1: Dry matter yield (g pot-1) of roots and shoots of *Brassica juncea* as influenced by different chelating agents and bioinoculants in Ni enriched soil, M: Microbial inoculants VC: Vermicompost

Treatment	Root	Shoot
Control	4.47	40.48
Ni100	3.27	29.38
Ni_{100}+FYM	3.80	31.35
Ni_{100}+VC	4.21	38.27
Ni_{100}+EDTA	3.00	26.80
Control+M	4.58	41.70
Ni_{100}+M	3.40	29.53
Ni100+FYM+M	3.93	32.00
Ni_{100}+VC+M	4.29	39.20
Ni_{100}+EDTA+M	3.22	27.29
CD at 5%	0.50	0.51

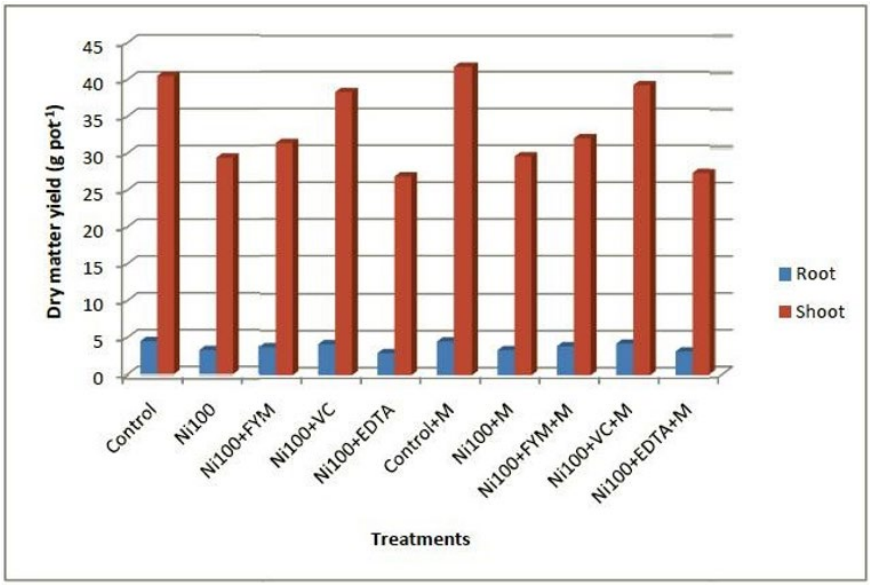

Fig. 1 Dry matter yield (g pot-1) of roots and shoots of Brassica juncea as influenced by different chelating agents and bioinoculants in Ni enriched soil

The highest dry matter production was observed in control+ M in both roots and shoots. In roots and shoots the dry matter increased in all treatments compared to Ni_{100}+ EDTA in roots and shoots and the trend was Ni_{100}+ VC+ M > Ni_{100}+ VC > Ni_{100}+FYM +M > Ni_{100}+FYM > Ni_{100}+ M > Ni_{100}. The dry matter was higher in shoots than in roots. The decline in dry mattermay be attributed to impaired functioning of leaf photosynthetic apparatus and transpiration rates due to unfavorable effect of excess nickel. Excess Ni also induces alteration in leaf chlorophyll content and reduces membrane permeability associated with enhanced extracellular per oxidize activity and creating nutrient imbalances. The results

agree with [9], [6].

CONCENTRATION OF NICKEL IN ROOTS AND SHOOTS

Concentration of Ni in roots

The data pertaining to the effect of different treatments on Ni concentration of roots and shoots of Brassica juncea as affected by different combinations are presented in Table 2 and Fig 2. Application of all the chelating agents significantly increased the Ni content in roots in comparison to control (Ni_{100}). In absence of bioinoculants application, concentration of Ni in roots was significantly high in Ni_{100}+EDTA treatment with a value of 97.52 µg g^{-1}, whereas least was obtained in control (unspiked soil) treatment which was 5.67 µg g^{-1}.

With the application of bioinoculants, the concentration of Ni in roots increased, Nickel concentration in bioinoculants treated pots followed the order: Ni_{100}+EDTA+M > Ni_{100}+VC+M > Ni_{100}+FYM+M > Ni_{100} +M > Control + M. The mean value of Ni concentration in roots point out that Ni concentration in roots was maximum under EDTA with microbe's treatment with a mean value of 99.56 µg g^{-1}. VC with microbes' treatments led to Ni concentration of 92.64 µg g^{-1} while FYM with microbes 71.27 µg g^{-1}. Ni_{100}treatment (spiked soil) where no complexing agent was applied, 54.33 µg g^{-1} Ni concentrations was obtained.

CONCENTRATION OF NI IN SHOOTS

Nickel concentration of shoots of Brassica juncea is also influenced differentially by chelating agents (Table 2 and Fig 2). The highest mean Ni content in shoots was 54.47 µg g^{-1}in plants grown on Ni_{100}+EDTA+M treated soil and the least is observed in Control and Control+M treatments which is 2.50 and 2.87 µg g^{-1}. Application of FYM and vermicompost

led to an increase in Ni concentration in Brassica juncea shoot by 38.71 and 76.55% in Ni_{100}+FYM and Ni_{100}+VC treatment over Ni_{100} treatment. With the application of bioinoculants, the Ni concentration in shoots also increased significantly.

Table 2: Nickel concentrations (µg g^{-1}) in roots and shoots of Brassica juncea as influenced by soil different chelating agents and bioinoculants in Ni enriched

Treatment	Root	Shoot
Control	5.67	2.50
Ni100	52.18	22.78
Ni100+FYM	68.45	31.60
Ni100+VC	88.29	40.22
Ni100+EDTA	97.52	53.35
Control +M	6.92	2.87
Ni100+M	54.33	24.26
Ni100+FYM+M	71.27	34.15
Ni100+VC+M	92.64	43.68
Ni100+EDTA+M	99.56	54.47
CD at 5%	0.55	0.47

M: Microbial inoculants VC: Vermi Compost

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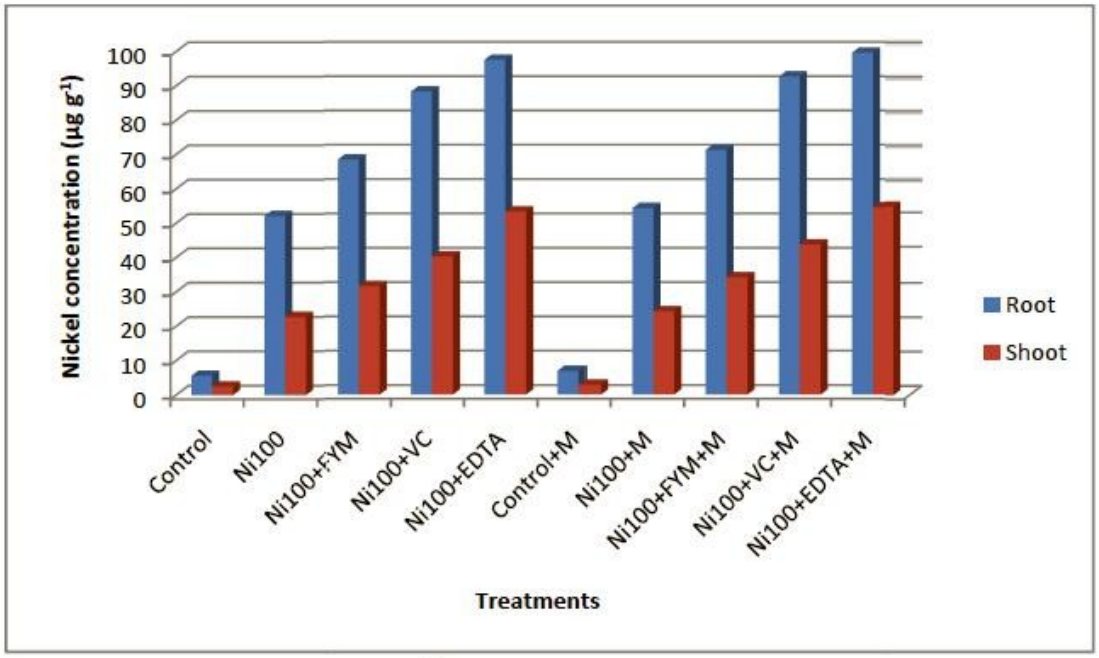

Fig. 2: Nickel concentration (µg g^{-1}) in roots and shoots of *Brassica juncea* as influenced by different chelating agents and bioinoculants in Ni enriched soil

The highest concentration was observed in Ni_{100}+ EDTA+M in both roots and shoots. Inroots and shoots the trend of Ni concentration was Ni_{100}+ EDTA > Ni_{100}+ VC+ M > Ni_{100}+ VC > Ni_{100}+FYM +M > Ni_{100}+FYM > Ni_{100}+ M > Ni_{100} > control. EDTA increases the solubility and mobility of Ni thereby increasing its availability for absorption by plant roots. The roots accumulated higher Ni concentration than other part of the plant which may be due to restricted translocation of Ni from roots to above parts of the plant. These findings are corroborated with those of [11] who indicated that heavy metals usually accumulate more in root than aerial parts.

UPTAKE OF NI IN ROOTS AND SHOOTS

Uptake of Ni in roots

The data on the uptake of Ni by roots and shoots of Brassica juncea as influenced by different treatments in Ni spiked soil is presented in Table 3 and Fig 3. Application of vermicompost led greater Ni uptake in root of Brassica juncea. In absence of bioinoculants application, the root uptake was highest in Ni_{100}+VC treatment with a value of 371.66 µg pot^{-1}, whereas minimum uptake in the control soil (unspiked soil) i.e. 25.18 µ g pot^{-1}. In Ni_{100}+EDTA and Ni_{100}+FYM treatments, the uptake of Ni into the roots was 292.58 and 260.02 µg pot^{-1}, respectively. Nickel uptake in bioinoculants treated pots followed the order:

Ni_{100}+VC+M > Ni_{100}+EDTA+M > Ni_{100}+FYM+M > Ni_{100}+M > Control+M.
The mean value of Ni uptake by roots points out that Ni uptake of roots was maximum under VC with microbes' treatment with a mean value of 397.44 µ g pot-1. EDTA with microbes' treatmentsled to an uptake of 320.56 µg pot^{-1} which is statistically significantly with Ni_{100}+FYM+M treatment.

Uptake of Ni in shoots

The data regarding uptake of Ni by shoots in relation to different complexing agents and bioinoculants treatments are reported in Table 3 and Fig 3.

In absence of bioinoculants application, the shoots uptake was significantly high in Ni_{100}+VCtreatment with a value of 1539.22 µg pot^{-1}, whereas minimum uptake in Control soil (unspiked soil) which was 101.13 µg pot^{-1}. In Ni_{100}+EDTA and Ni_{100}+FYM treatments, the uptake of Ni into the shoots was 1429.76 and 990.65 µg pot^{-1} respectively.

Application of bioinoculants led to an increase in shoots dry matter yield. Due to release of chelating agent, siderophores and acidification, it led to a greater movement of Ni in shoots. Nickel uptake in bioinoculants treated pots followed the order: Ni_{100}+VC+M > Ni_{100}+EDTA+M > Ni_{100}+FYM+M > Ni_{100}+M > Control+M.

The mean value of Ni uptake by shoots points out that Ni uptake of shoots was significantly higher under vermicompost with microbial treatment with a mean value of 1712.27 µg pot^{-1}. FYM with microbial treatments led to an uptake of 1092.86 µg pot^{-1} while EDTA with microbial treatment was 1486.51 µg pot^{-1}. The least was in Control and Control+M treatments (un-spiked soil).

Table 3: Nickel uptake (µg pot^{-1}) of roots and shoots of Brassica juncea as influenced by different chelating agents and bioinoculants in Ni enriched soil

Treatment	Root	Shoot
Control	25.18	101.13
Ni_{100}	170.65	669.30
Ni_{100}+FYM	260.02	990.65
Ni_{100}+VC	371.66	1539.22
Ni_{100}+EDTA	292.58	1429.76
Control+M	31.66	119.66
Ni_{100}+M	184.79	716.41
Ni_{100}+FYM+M	280.09	1092.86
Ni_{100}+VC+M	397.44	1712.27
Ni_{100}+EDTA+M	320.56	1486.51
CD at 5%	34.31	25.42

M: Microbial inoculants *VC: Vermi Compost*

The uptake of Cd in roots and shoots was higher in treatment and the order was Cd_{100} + VC+M > Cd_{100}+VC > Cd_{100}+EDTA +M > Cd_{100}+EDTA> Cd_{100}+ FYM+M > Cd_{100}+ FYM > Cd_{100}+ M > Cd_{100} > Control. The reason may be ascribed to the fact that vermicompost binds metals and increase uptake by providing nutrients such as sodium, magnesium, iron, zinc, manganese and copper which can serve as a natural fertilizer giving high yield of biomass and microbial consortium helped the overall growth of the mustard plant. Similar results were confirmed by [4].

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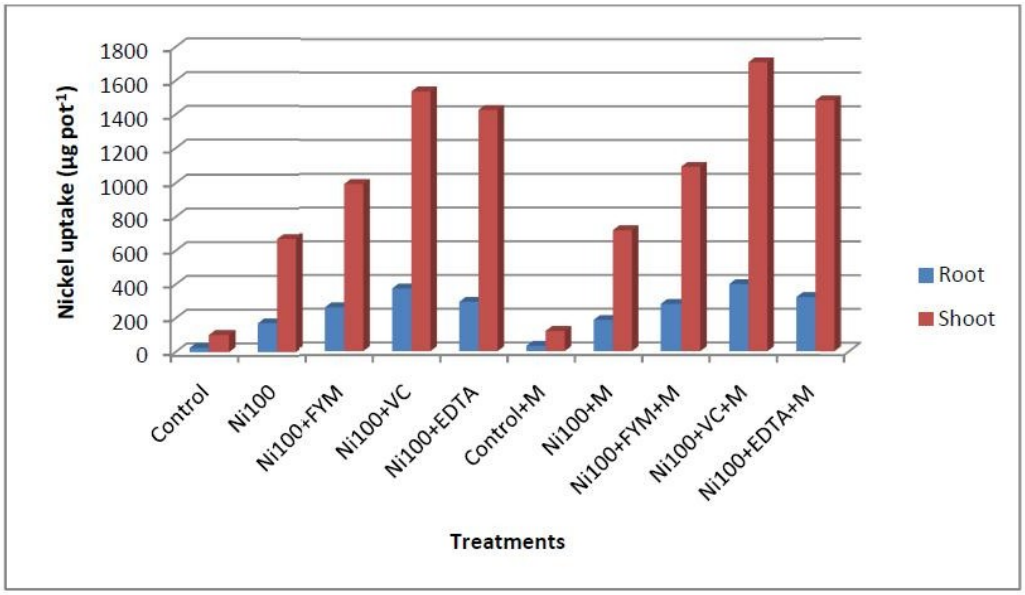

Fig. 3: Nickel uptake (µg pot-1) of roots and shoots of Brassica juncea as influenced by different chelating agents and bioinoculants in Ni enriched soil.

HOW DO PLANTS USE INORGANIC MINERALS FOR NUTRITION?

- Nickel is recognized as the seventeenth element essential for plant growth and development [23]. Plants' Ni requirement is the lowest of all essential elements at < 0.5 mg per kg of dry weight, making it an essential plant micronutrient.
- With the high-affinity transport system, plants can take up 1.8 parts per million (ppm) of Ni 2+ ions, which is 237.7 ounces per million gallons of water. Nickel is readily translocated within the plant, probably as a complex with organic acids, such as citrate, at pH < 5, or with an amino acid, such as histidine, at pH > 6.5.
- Nickel is accumulated in plant organs or tissues, such as leaves. In 1983, D. L. Eskew and colleagues reported that legume plants grown in nutrient solutions containing ureaas the N source developed necrotic lesions on the leaflet tips (Plate 2). The crop plants accumulated 2.5% urea dry weight in the leaves.
- Plants use inorganic minerals for nutrition. Complex interactions involving weathering of rock minerals, decaying organic matter, animals, and microbes take place to form inorganic minerals in soil. Roots absorb mineral nutrients as ions in soilwater

NICKEL FERTILIZERS

Essentially under all normal field conditions, it is unlikely that application of nickel fertilizer will be required. Exceptions to this concept occur when urea is the primary source of nitrogensupply, in species in which ureides play an important physiological role (2), when excessive applications of Zn, Cu, Mn, Fe, Ca, or Mg have been made over many years (2) and perhaps also in nitrogen-fixing crops grown on mineral-poor or highly nickel-fixing (high pH, high lime) soils. In experiments utilizing highly purified

nutrient solutions or tissue-culture media, supplemental nickel may also be beneficial. In all these cases, the nickel demand is quite low and can be satisfied easily with NiSO4 or other soluble nickel sources including Ni– organic complexes (Bruce Wood, personal communication). In solution-grown plants and asa supplement to foliar urea applications, a nickel supply of 0.5 to 1 μM is sufficient.
Nickel is currently being applied to many fields in sewage sludge (48,69). In general, this usage does not represent a threat to human health, as its availability to crop plants is typically low. The total extractable nickel in these amended soils can also be controlled by selection of plant species and management of soil pH, moisture, and organic matter (65).
In recent years, a great deal of attention is being focused on nickel-accumulating plants that can tolerate otherwise nickel-toxic soils and accumulate substantial concentrations of nickel, up to 5% on a dry weight basis (70). Three nickel hyperaccumulators showed significantly increased shoot biomass with the addition of 500 mg Ni kg-1 to a nutrient-rich growth medium, suggesting that the nickel hyperaccumulators have a higher requirement for nickel than other plants (71). Considerable attention is also being focused on utilizing hyperaccumulating species for phytoremediation and Phyto mining, where they can be grownin a nickel-contaminated soil and then harvested and exported from the field. To date,however, this approach has not been successful owing to the small size and slow growth rate of many of the hyperaccumulating species. With a better understanding of the genetic basis ofmetal hyperaccumulation, it may be possible to transfer this trait into a fast-growing agronomic species and hence develop an effective phytoremediation strategy.

NICKEL CONCENTRATION IN SOILS

Nickel comprises approximately 3% of the earth's crust composition and is the twenty-fourth most abundant element [22]. Total Ni concentration commonly ranges from 5 to 500 mg kg^{-1}, with an average of 50 mg kg^{-1} in soils. However, Ni concentrations in dried biosolids (also referred to as treated sewage sludge) or soil near metal refineries are in arange from 24,000 to 53,000 mg kg^{-1}. Soils for crop production contain 3–1,000 mg kg^{-1}.
Because Ni^{2+} is the available form of Ni for plants, total Ni concentration is not a useful measure for Ni bioavailability. Positive 2-valence Ni ion (Ni^{2+}) readily oxidizes and becomes unavailable. Thus, plants grown in high-pH soils are vulnerable to Ni deficiency. Additionally, excessive use of Zn and Cu may induce Ni deficiency in soil because these three elements share a common uptake system. Over liming, which raises pH excessively,also causes soil deficient in plant-available Ni. Thus, in soils that have to be high pH, either naturally or artificially, Ni fertilization may be needed to ensure good crop quality and yield.

NICKEL NUTRITION IN PLANTS

Nickel is a nutrient essential for both monocotyledons and dicotyledons. However, American Association of Plant Food Control officials did not recognize Ni as essential until 2004. Nickel is recognized as the seventeenth element essential for plant growth and development (Liu 2001). Plants' Ni requirement is the lowest of all essential elements at < 0.5 mg per kg ofdry weight, making it an essential plant micronutrient. Nickel is required for plants at such low concentrations that analytical technologies were not available until the mid-1970s.

Nickel is unique among plant nutrients because its functions in plant growth and developmentwere described in detail before nickel was added to the list of essential elements. Nickel is a key component of selected enzymes (described below) involved in N metabolism and biological N fixation. Plants

suffering from Ni deficiency show necrosis initiating from thetip of the leaf (Plate 1–4). This symptom can be reversed or corrected by applying a dilute Ni solution (Plate 5). It is observed that Ni significantly increased yields of potato [28], bean, and wheat grown in the acidic sands found in Romney Marshes of England, which have very low concentrations of manganese (Mn), Ni, and zinc (Zn). Similar soils are prevalent in the southeastern United States, including Florida.

Plate 1. Severe leaflet tip necrosis due to nickel deficiency in nitrogen-fixing plants. Credit: Patrick Brown, University of California, Davis

Plate 2. Nitrogen-fixing cowpea seedlings grown hydroponically with (left) or without (right) nickel and supplied with no inorganic nitrogen source. Without nickel, cowpea plants developed pronounced leaf tip necrosis and marked yellowing. These symptoms closely resemble those of nitrogen deficiency.

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Plate 3. Ni-deficient pecan develops "mouse ear," a symptom of nickel deficiency. Credit: M. L. Wells, University of Georgia, 201

Plate 4. Branches of Ni-sufficient (left) and Ni-deficient (right) pecan plants Credit: Bruce Wood, USDA-ARS, Byron, GA

Plate 5. Effect of spring foliar application of Ni on severity of mouse-ear symptoms of pecan trees. The branch on left side of the tree was sprayed with nickel (II) sulfate (3.35 µg Ni L-1 as NiSO4•6H2O) Ni, whereas the right branch of the tree was not treated. Credit: Bruce Wood, USDA-ARS, Byron, GA

CONCLUSION

The overall, growth of Brassica juncea was better in FYM or vermicompost (VC) amended soil as compared to unamended Ni enriched soil. The growth was little suppressed in EDTA applied soil whereas it was better in bioinoculants treated soil. The application of FYM and vermicompost (VC) increased the dry matter yield of Brassica juncea either alone or in combination with bioinoculants. The application of EDTA caused a significant decrease indry matter yield. Application of bioinoculants increased the dry matter yield of both root and shoot but not significantly because show greater sensitivity toward Nickel. Ni concentration was observed maximum under EDTA with bioinoculants treatments, but uptake of Ni was observed in vermicompost (VC) with bioinoculants treatment. Phytoremediation, the use of plants for cleaning metal polluted soils, is an environment friendly and equally protective of human health, environment and considered a good alternative to previous techniques for clean-up of contaminated soils.

SUMMARY

- Nickel is the most recently discovered micronutrient, also known as a Nano nutrient; plants require it in small amounts.
- Leguminous crops like bean and cowpea require more Ni than other crops because nickel plays an important role in nodulation and N fixation.
- If Ni deficiency occurs, it will likely be associated with soils having pH > 6.7 or soils that have received excessive applications of Zn, Cu, Mn, Fe, Ca, or Mg.
- Nickel deficiency appears as leaflet-tip necrosis, or "mouse-ear" leaves.
- Nickel is a challenging plant nutrient with which to work because it readily oxidizes to unavailable forms in the soil.
- The easiest and most effective strategy to correct acute Ni deficiency is foliar spraying with a dilute solution of NiSO4 or other water-soluble Ni fertilizer.
- Municipal biosolids can be effectively used as a Ni fertilize

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CARBON DIOXIDE EMISSIONS IN SOME DEVELOPED AND DEVELOPING COUNTRIES BETWEEN 1990 AND 2021

ZSARNÓCZAI, J. Sándor

Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Science, Doberdó u. 6, H-1034 Budapest, Hungary,
e-mail: zsarnoczaisandorjozsef@gmail.com

Abstract: *Recently because of the global warming resulted by mostly carbon-dioxide gas emission based on the human activity, therefore the mitigating gas emission became important by global cooperation of countries. In the period of 1990 and 2021 the study analyses the volume of carbon-dioxide emissions and its corelations with economic features of selected economies, which have significant role in field of gas emissions and mitigating gas emissions. Economic features of United States, United Kingdom, Japan, Russia, Germany, France, Italy, China, India, Iran, Saudi Arabia, Sweden, Hungary, Poland, Austria, Turkey, Brazil and Egypt are included in the analyse. The research method is based on the statistical program for social sciences (SPSS). China has share by 32.9% in global carbon-dioxide emissions, while the United States has share by 12.6% and the EU-27 has share by 7.3% and India has share by 7.0% at the same time 2021. The study proofs that the total investment in 2021 has strong correlations with CO2 emissions Mt CO2/year, in 2021 and CO2 emissions per capita ton CO2/cap/year, in 2021. The solution for the mitigating carbon-dioxide emissions is to develop advanced green environment friendly technology for using renewable energy resources.*

Keywords*: Economic variables, global warming, green technology, investment, renewable energy*

INTRODUCTION

The global economic growth in the world economy sharply resulted increase of the carbon-dioxide gas emissions for latest decades. Therefore, the global common force is needed based on wide-side international cooperation for decreasing gas emission from sides of highly developed and developing countries. In all over the world the fossil carbon-dioxide gas emission has increased by 67% since 1990 by the end of 2021, while the number of populations of the world increased by 48%. Aim of study is to show that by the end of 2021 the carbon-dioxide gas emissions increased more than the increasing growth of populations of the world, which mostly resulted by intensive increase of carbon-dioxide gas emissions in the developing countries. Also, the study emphasizes participation of the selected countries in all carbon-dioxide emissions. China has share by 32.9% in global in this gas emission, while the United States (US) has share by 12.6% and the EU-27 has share by 7.3% and India has share by 7.0% in the same time 2021 (IMF 2023). China has only alone created carbon-dioxides gas emissions more than one of all together US and EU-27 by the end of 2021. Also, dominate role of China in field of the carbon-dioxide fossil gas emissions is proofed by 8.727 of China in fields of CO2

emissions per capita ton CO2/cap/year, in 2021, while data of the world in this field was only 4.811 and in case of EU-27 was by 6.254.
The study analyses between 1990 and 2021 based on the data base (Table 1) correlations among the economic growth and its influences on the carbon-dioxide gas emission either in field of all this carbon dioxide gas emission of some countries or in field of per capita gas emission in cases of some selected significant economies in four continents. These economies, which are follows as the United States, the United Kingdom, Japan, Russia, Germany, France, Italy, China, India, Iran, Saudi Arabia, Sweden, Hungary, Poland, Austria, Turkey, Brazil, Egypt. These countries with their economic power capacity could globally play important role for decreasing carbon-dioxide gas emissions having greenhouse gas affecting therefore, in order to mitigate global worming resulted by the human activity.
Hypotheses of the study, which are as follows:
The study emphasizes that CO2 emissions growth rate Mt CO2/year, for period of 1990-2021 (EmissMt8) has correlations with CO2 emissions growth rate per capita ton CO2/cap/year for period of 1990-2021 (EmissCapit9) and growth rate of populations for the period of 2021 and 1990 (PopuGrow11).
Also, study provides proof that how much total investment in percent of GDP in 2021 (TotInvest216) has correlations with CO2 emissions growth rate Mt CO2/year for period of 1990-2021 (EmissMt8) and CO2 emissions growth rate per capita ton CO2/cap/year for period of 1990-2021 (EmissCapit9).
Study proofs important correlation between GDP consequently growth rate at constant price, either in 1990 or 2021 (GDPgrow901 and GDPgrow212).
Also, from importance of the study the correlation can be considerable between CO2 emissions growth rate per unit of GDP PPP ton CO2/k USD/year (EmiPeUn10) and the population growth rate for period of 1990-2021 (PopuGrow11).
The study analyses that the total investment in percent of GDP in 1990 and 2021 (TotInvest905 and TotInvest216) have any possible correlations with unemployment rate, in percent of total labour force in 1990 and 2021 (Unempl903 and Unempl214) and general government gross debt in percent of GDP in 2021 (GenGovDeb7).
There are some questions concerning objectives of the study can emerge. How does the *total investment in percent of GDP* have influences on the measure of the total volume of carbon-dioxide emissions and per capita in cases of selected countries? How does the total investment in percent of GDP have influences on unemployment rate in the researched period and selected countries?
The study used many sides actual statistical sources, which mostly came for the UN International Monetary Fund, World Economic Outlook Database, and some National Statistics Offices concerning the selected countries of the article.
The important international initiative was the *Paris Agreement* is a *legally binding international treaty on climate change*. It was adopted by 196 Parties at the UN Climate Change Conference (COP21) in *Paris, France, on 12 December 2015*. In the Agreement partners declared that its overarching goal is to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" and pursue efforts "to limit the temperature increase to 1.5°C above pre-industrial levels." Also partners of the Agreement emphasized the climate finance is needed *for mitigation*, because large-scale investments are significantly required to reduce gas emissions. *By 2030, zero-carbon solutions* could be competitive in sectors representing over *70% of global emissions* (UN Climate Change, 2023).
By the end of 2021 the EU-27 was the third largest carbon-dioxide emissions (EC, JRC 2022), because its 7.3% share was in global after China by 32.9% and US by 12.6% and then other significant countries were Inda by its share 7.0%, Russia by its share 5.1% and Japan by its share 2.9%. Emissions of China in 2021 were more than five times larger than in 1990, which accounted for 10.7% in 1990. In China in 2021 sectors the most contributing to fossil CO2 emissions were power generation by 44% and other industrial combustion by 27%. Also, in China CO2 emissions per GDP PPP (Purchase power parity) amounted to 0.501ton CO2/k US dollar, as highest CO2 intensity of top emitting economies (EC, JRC 2022).

In US transportation (28% of 2021 greenhouse gas emissions) – The transportation sector generates the largest share of greenhouse gas emissions. Greenhouse gas emissions from transportation primarily come from burning fossil fuel for our cars, trucks, ships, trains, and planes. Over 94% of the fuel used for transportation is petroleum based, which includes primarily gasoline and diesel (IPCC 2022 and more detailed in IPCC 2014, Intergovernmental Panel for Climate Change).
The EU has exceeded the target to reduce its greenhouse gas emissions by 2020 comparably to gas emission in 1990. This target was by 20% for decreasing CO2 equivalent gas emissions by the end of 2020, but EU-27 decreased by 30% (EP 2023, European Parliament).
The EU-27 realised 27% decrease in field of CO2 emissions growth Mt CO2/year, 31% decrease in field of CO2 emissions growth per capita ton CO2/cap/year, and 55% decrease in field of CO2 emissions growth per unit of GDP PPP ton CO2/k USD/year, while the population growth increased only by 6% for period of 1990-2021. These results were positive and better than in case of the world, because globally in the world 67% increase in field of CO2 emissions growth Mt CO2/year, 13% increase in field of CO2 emissions growth per capita ton CO2/cap/year, and 36% decrease in field of CO2 emissions growth per unit of GDP PPP ton CO2/k USD/year, while the population growth considerably increased by 48% for period of 1990-2021. The difficulty *at global level is that even the CO2 emissions growth per capita increased in this period* and not decreased based on the considerable population increase. The global results in these fields could be dangerous for target of green policy given by UN and Paris Agreement.
The above-mentioned strategy concerning mitigating CO2 emissions needs for considerable green investment providing more jobs to increasing employment level accompanying with less CO2 emissions. Naturally the mitigation for gas emissions should be based on the support of highly developed economies for developing economies in field of the green technological transfer in order that these developing countries could implement targets of UN to decrease burden of human activity and consumption on the natural environment.

MATERIALS AND METHODS

Objectives of the study concerning the analysing methods, as statistical program for social sciences (SPSS), which was prepared in detailed by Salcedo – McCormick (2017). The analysing method is based on SPSS including *main economic variables* concerning economic features of selected countries. These economic variables are as GDP constant price in 1990 (GDPgrow901), GDP constant price in 2021 (GDPgrow212), Unemployment rate, in percent of total labour force in 1990 (Unempl903), Unemployment rate, in percent of total labour force in 2021 (Unempl214), Total investment, in percent of GDP in 1990 (TotInvest905), Total investment, in percent of GDP in 2021 (TotInvest216), General government gross debt in percent of GDP in 2021 (GenGovDeb7), CO2 emissions growth rate Mt CO2/year (EmissMt8), CO2 emissions growth rate per capita ton CO2/cap/year (EmissCapit9), CO2 emissions growth rate per unit of GDP PPP ton CO2/k USD/year (EmiPeUn10), Population growth rate in percent (PopuGrow11) for period of 1990-2021.
This analyse-method can clearly overview correlations among economic variables as features of researched selected countries based on the original statistical data base in *Table 1* (IMF October 2023) for the given period by owned calculation. The up-half-part of the *Table 2* provides overview for values of correlations among economic variables. If values of correlations are over 0.800 (80%) these correlations are *very strong* among the variables, but if these values between 0.500 and 0.800 (50%-80%) correlations are *strong*. If values are under the level of 0.500 (50%) correlations are not important for this analysing. Naturally if the values are closed to the level of 0.500 from downside, the analyse can be accepted.
The Table 3 KMO and Bartlett's Test shows the bartlett's test of sphericity approx. chi-square more than 100, as 133.897 and the value of significancy is quietly zero, as the best, which provide that the data base is correct for analysing. Also, the Table 4: Total Variance Explained shows that the first four component cumulative

provide 77.465 value, which is over than 60.000, also this strengthens that the data base is satisfactory for analysing.

Table 5: Rotated Component Matrix selects eleven variables as economic features of the selected countries in the study into four components, of which correlations are demonstrated in towards figures in the scheme of REGR factor score, namely in the Figure 1 the EmissCapit9, TotInvest216, EmissMt8 are at horizontal line "X" and the EmiPeUn10, PopuGrow11, Unempl214 and Unempl903 are at vertical line "Y". In the Figure 2 the GDPgrow212 and GDPgrow901 are at vertical line "Y". In the Figure 3 the GenGovDeb7 and TotInvest905 are at vertical line "Y". Naturally at horizontal line "X" economic variables are the same in all of three figures for the coordinate system. All of calculations are owned based on the data base coming from International Monetary Fund, World Economic Outlook Database, October 2023 and National Statistics Office.

The Figure 4 provides clustering system for the selected countries into five clusters, namely Cluster-1 (9 countries): United States, United Kingdom, Japan, Germany, France, Italy, Sweden, Hungary, Poland; Cluster-2: Russia; Cluster-3: Austria; Cluster-4: China; and Cluster-5 (6 countries): India, Iran, Saudi Arabia, Turkey, Brazil, Egypt. Each cluster includes countries, of which economic features are closed to each-others. In that case when only one country is included in a cluster, this means that its economic features or characters are very special and different from one of the other economies. Naturally the author/authors can decide that how much clusters are calculated in the study, as dendrogram using ward linkage of the Figure 4 shows.

For example, also, countries can be selected into two clusters, when one cluster includes 11 countries, namely United States, United Kingdom, Japan, Germany, France, Italy, Sweden, Hungary, Poland, Russia and Austria. In this case the other cluster includes 7 countries, namely China, India, Iran, Saudi Arabia, Turkey, Brazil and Egypt. Generally, five clusters can be chosen for selecting countries in order to separate them in detailed in their economic features or characters.

STATISTICAL ANALYSIS

Table 1: Selected countries in fields of GDP growth rate, unemployment rate, total investment, general government gross debt, CO2 emissions growth Mt CO2/year, CO2 emissions growth per capita ton CO2/cap/year, CO2 emissions growth per unit of GDP PPP ton CO2/k USD /year and population, in percent in Million between 1990-2021, 1990 = 100

Lines	**X**			**Y**							
Countries	**9**	**6**	**8**	**10**	**11**	**4**	**3**	**1**	**2**	**7**	**5**
United States	*-29*	*21*	*9*	*-45*	*32*	*5*	*6*	*2*	*6*	*126*	*22*
United Kingdom	*-52*	*18*	*-43*	*-67*	*18*	*5*	*7*	*1*	*8*	*105*	*23*
Japan	*-9*	*26*	*-7*	*-27*	*1.3*	*3*	*2*	*5*	*2*	*255*	*36*
Germany	-37	23	-35	-57	4	4	6	6	3	70	27
France	-32	25	-22	-50	16	9	8	3	6	113	24
Italy	-28	21	-26	-38	3	10	9	2	7	150	23
Sweden	-44	26	-33	-75	-16	9	2	1	6	30	27
Russia	*-17*	*23*	*-19*	*-37*	*-3*	*5*	*5*	*-9*	*6*	*16*	*-10*
Hungary	*-24*	*31*	*-30*	*-57*	*-8*	*4*	*2*	*-3*	*7*	*76*	*27*
Poland	-14	22	-14	-71	-0.1	3	6	-7	7	54	25
Austria	-8	28	5	-37	14	6	3	28	28	83	27
China	*322*	*43*	*414*	*-67*	*22*	*5*	*5*	*4*	*9*	*72*	*34*
India	175	31	341	-25	61	7	6	6	9	84	26
Iran	131	41	247	40	50	9	14	14	5	42	33

Saudi Arabia	57	25	240	43	116	7	4	15	4	29	16
Turkey	91	32	200	-23	57	12	8	9	12	42	24
Brazil	49	20	114	8	44	13	6	-4	5	90	19
Egypt	56	15	185	-23	82	7	8	2	3	90	27
Average	32.6	26.2	84.8	-33.8	27.4	6.8	6	4.2	7.4	84.8	23.9
Countries	9	6	8	10	11	4	3	1	2	7	5

Source: International Monetary Fund, World Economic Outlook Database, October 2023, National Statistics Office.

Note: Ordering List of economic variables concerning the Figures 1,2,3

In 1991 in Saudi Arabia the general government gross debt in % of GDP was 40%.

GDPgrow901 = GDP constant price, in 1990, growth rate in percent change, in national Currency

GDPgrow212 = GDP constant price, in 2021, growth rate in percent change, in national currency

Unempl903 = Unemployment rate, in percent of total labour force in 1990

Unempl214 = Unemployment rate, in percent of total labour force in 2021

TotInvest905 = Total investment, in percent of GDP in 1990

TotInvest216 = Total investment, in percent of GDP in 2021

GenGovDeb7 = General government gross debt in percent of GDP in 2021

EmissMt8 = CO2 emissions growth Mt CO2/year, in percent by the end of 2021, for period of 1990-2021, 1990= 100

EmissCapit9 = CO2 emissions growth per capita ton CO2/cap/year, in percent by the end of 2021, for period of 1990-2021,1990= 100

EmiPeUn10 = CO2 emissions growth per unit of GDP PPP ton CO2/k USD/year, in percent by the end of 2021, for period of 1990-2021, 1990 = 100

PopuGrow11 = Population Million, growth in percent by the end of 2021, for period of 1990-2021, 1990 = 100

Table 2: Correlation Matrix

		GDPgrow901	**GDPgrow212**	**Unempl903**	**Unempl214**	**TotInvest905**	**TotInvest216**	**GenGovDeb7**	**EmissMt8**	**EmissCapit9**	**EmiPeUn10**	**PopuGrow11**
CoRrelation	GDPgrow901	1.000	**.606**	.070	.117	.377	.357	-.007	.286	.200	.408	.378
	GDPgrow212		1.000	-.170	.053	.055	.222	-.145	.003	.060	-.141	-.102
	Unempl903			1.000	**.429**	.067	.128	-.134	.277	.223	.391	.320
	Unempl214				1.000	-.058	.037	-.205	.242	.146	**.433**	.339
	TotInvest905					1.000	.373	**.420**	.228	.282	-.087	-.007
	TotInvest216						1.000	-.225	**.596**	**.715**	.156	.013
	GenGovDeb7							1.000	-.261	-.199	-.115	-.217
	EmissMt8								1.000	**.949**	.461	**.681**
	EmissCapit9									1.000	.264	.435
	EmiPeUn10										1.000	**.744**

	PopuGrow11											1.000

Source: International Monetary Fund, World Economic Outlook Database, October 2023, National Statistics Office, by owned calculation

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.486
Bartlett's Test of Sphericity Approx. Chi-Square	133.897
df	55
Sig.	.000

Source: International Monetary Fund, World Economic Outlook Database, October 2023, National Statistics Office, by owned calculation

Table 4: 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	3.742	34.018	34.018	3.742	34.018	34.018	2.672	24.290	24.290
2	1.995	18.140	52.158	1.995	18.140	52.158	2.665	24.225	48.514
3	1.428	12.981	65.139	1.428	12.981	65.139	1.693	15.392	63.906
4	1.356	12.326	**77.465**	1.356	12.326	77.465	1.491	13.559	77.465

Extraction Method: Principal Component Analysis.

Source: International Monetary Fund, World Economic Outlook Database, October 2023, National Statistics Office, by owned calculation

Table 5: Rotated Component Matrix[a]

	Component			
	1	2	3	4
EmissCapit9	.940			
TotInvest216	.852			
EmissMt8	.852			
EmiPeUn10		.873		
PopuGrow11		.829		
Unempl214		.653		
Unempl903		.615		
GDPgrow212			.909	
GDPgrow901			.845	

GenGovDeb7				.849
TotInvest905				.804

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Source: International Monetary Fund, World Economic Outlook Database, October 2023, National Statistics Office, by owned calculation

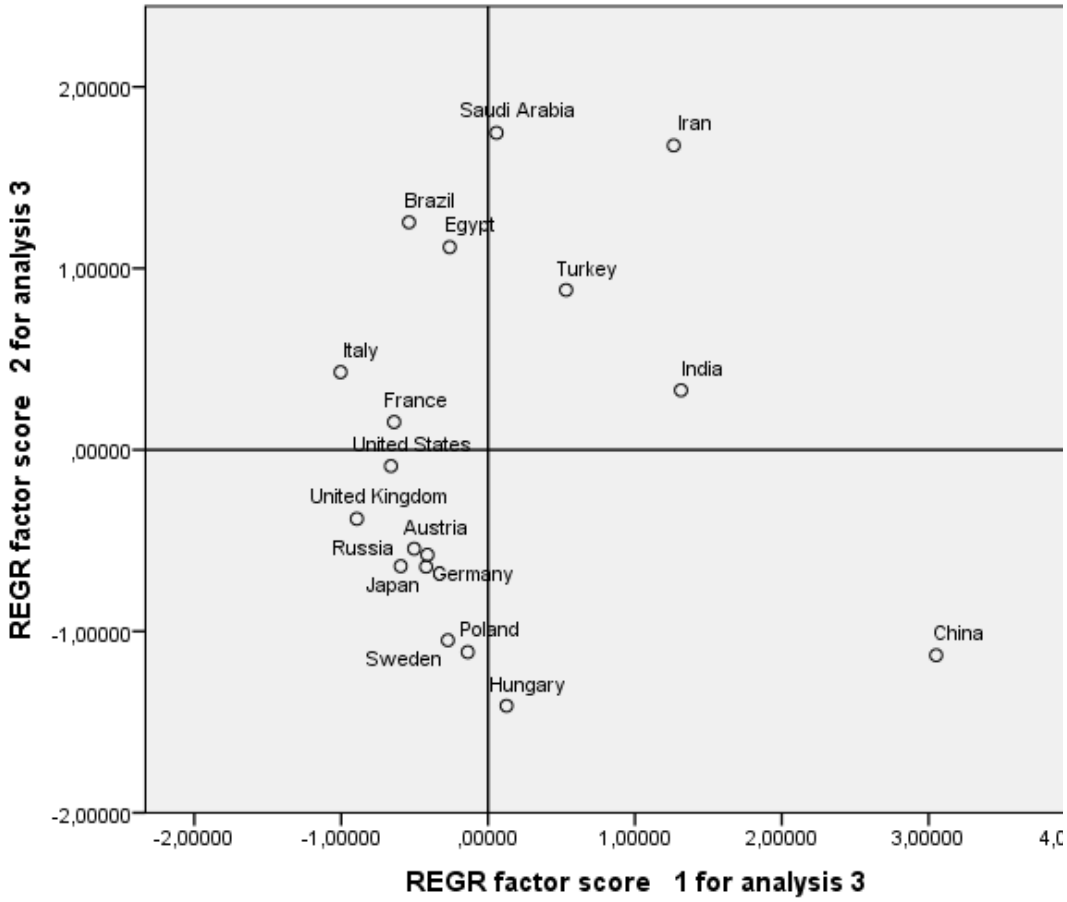

Figure 1: REGR factor score concerning the economic variables EmissCapit9, TotInvest216, EmissMt8 at horizontal line "X" and EmiPeUn10, PopuGrow11, Unempl214 and Unempl903 at vertical line "Y"
Source: International Monetary Fund, World Economic Outlook Database, October 2023, National Statistics Office, by owned calculation

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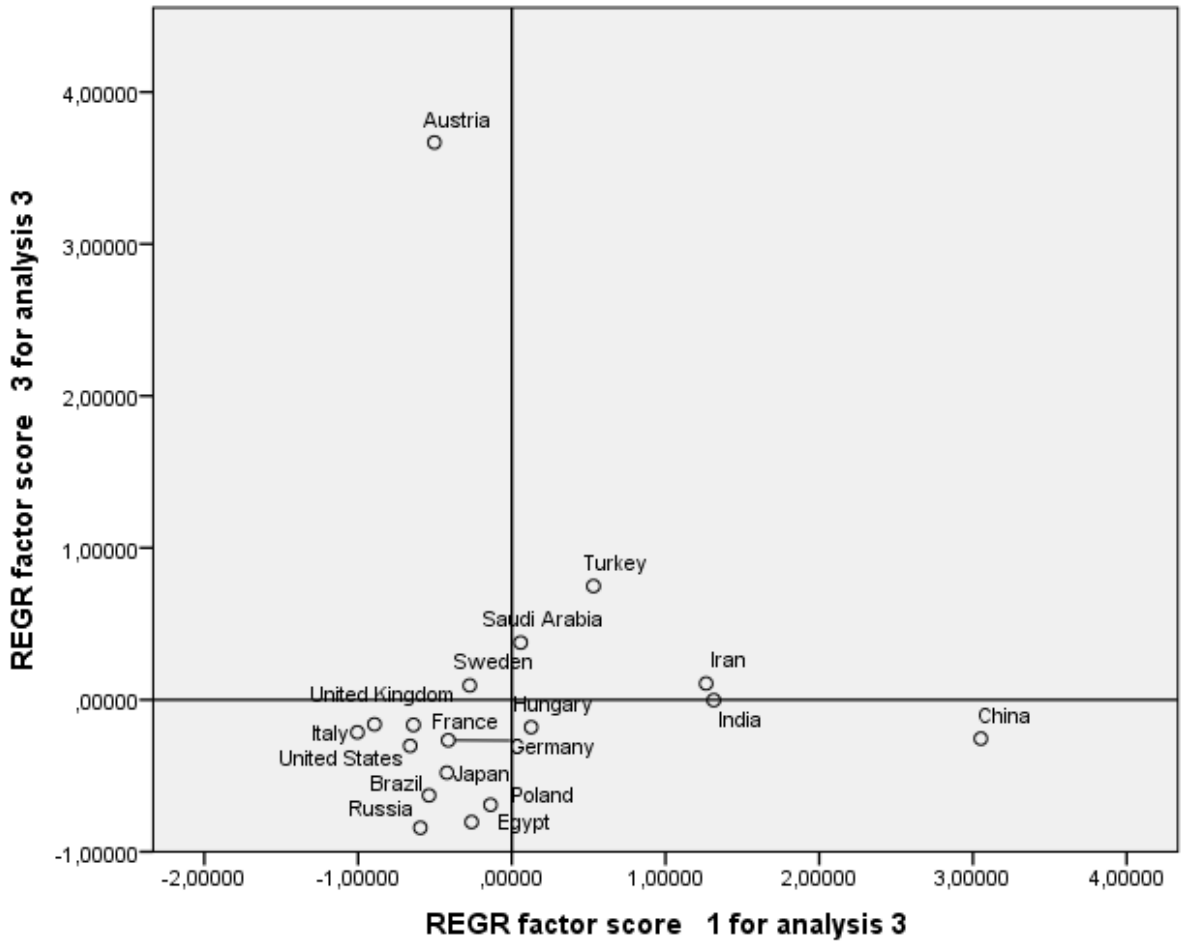

Figure 2: REGR factor score concerning the economic variables EmissCapit9, TotInvest216, EmissMt8 at horizontal line "X" and GDPgrow212 and GDPgrow901 at vertical line "Y"
Source: International Monetary Fund, World Economic Outlook Database, October 2023, National Statistics Office, by owned calculation

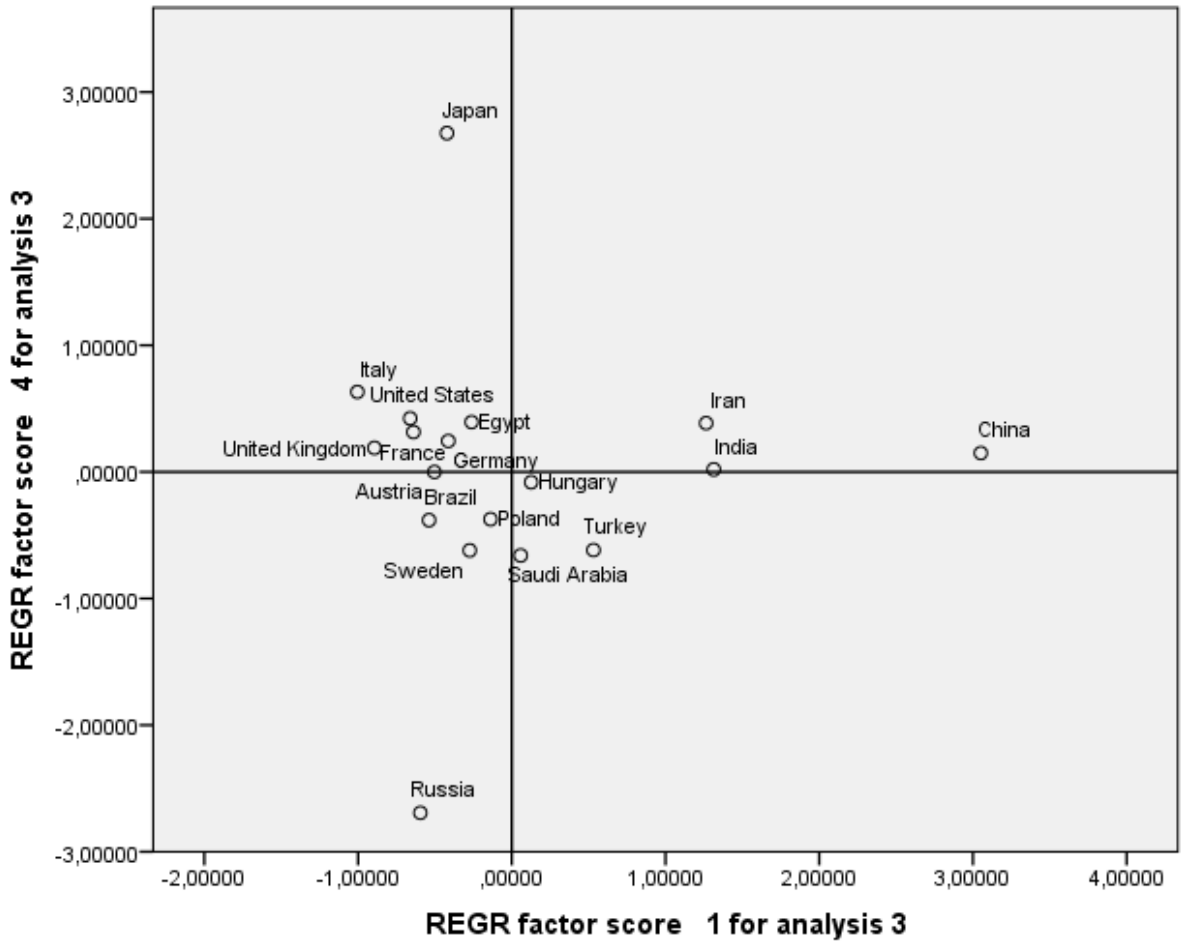

Figure 3: REGR factor score concerning the economic variables EmissCapit9, TotInvest216, EmissMt8 at horizontal line "X" and GenGovDeb7 and TotInvest905 at vertical line "Y"
Source: International Monetary Fund, World Economic Outlook Database, October 2023, National Statistics Office, by owned calculation
Economic variables namely the general government gross debt in percent of GDP in 2021 (GenGovDeb7) and the total investment, in percent of GDP in 1990 (TotInvest905) at line "Y" in this research

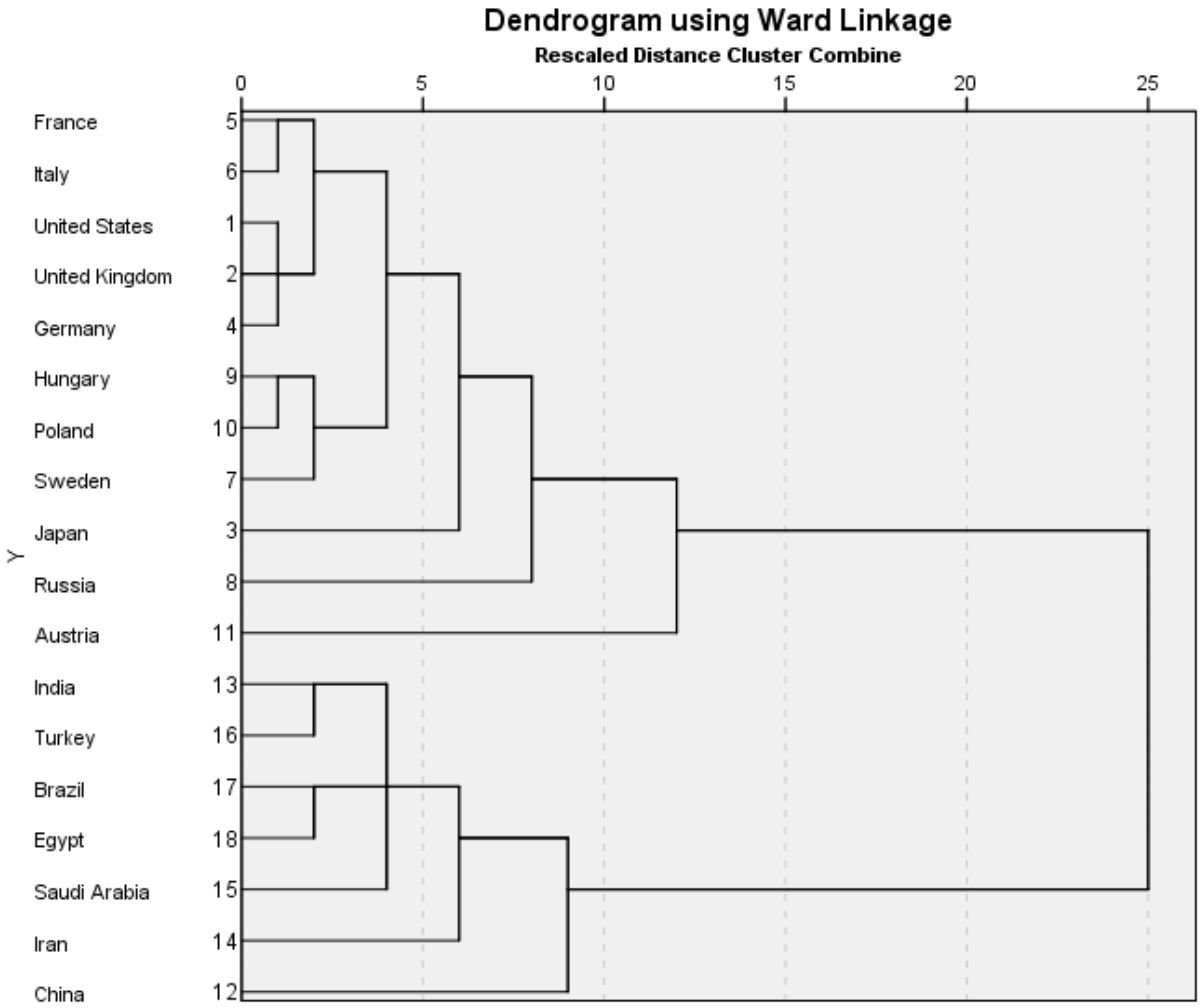

Figure 4: 18 countries are selected into five clusters of the scheme of dendrogram using ward linkage
Source: International Monetary Fund, World Economic Outlook Database, October 2023, National Statistics Office, by owned calculation
Cluster-1 (9 countries): United States, United Kingdom, Japan, Germany, France, Italy, Sweden, Hungary, Poland
Cluster-2: Russia
Cluster-3: Austria
Cluster-4: China
Cluster-5 (6 countries): India, Iran, Saudi Arabia, Turkey, Brazil, Egypt

RESULTS AND DISCUSSION

The study overviews main correlations *among economic variables* during the researched period of 1990-2021, in cases of the 18 selected countries, of which have important economic role and influences on the changing trend of the global economic prosperity. From this point of view their economic feature as variables can have

such kind of correlations, which means how each economic variable can make influence on the other one. The correlations of their economic variables can also show mutual influences of selected countries on each-others. According to the *Table 2* showing correlations among different economic variables, in cases of values of correlations are more than 0.800 (80%) the correlations are ***very strong***, namely CO2 emissions growth Mt CO2/year, (EmissMt8) has very strong correlation with CO2 emissions growth per capita ton CO2/cap/year (EmissCapit9) for period of 1990-2021. This means that when carbon-dioxide emissions growth generally increases also, the carbon-dioxide emissions growth per capita increases.

In cases of developed economies CO2 emissions Mt (EmissMt8) has decreased by the end of 2021 for period of 1990-2021, and the US is except, whereby the end of 2021 carbon-dioxide emissions growth little has *increased* by 9% while the carbon-dioxide emissions growth per capita sharply decreased by 29%. Also, in 1990 in Austria carbon-dioxide emissions growth little *increased* by 5% while the CO2 emissions growth per capita little decreased by 8%.

Chine has increased the top level in fields of carbon-dioxide emissions growth by 414% and per capita by 322% for the researched period in spite that population growth increased by 22% in the same time, which was not so considerable in international comparison and the carbon-dioxide emissions growth per unit of GDP PPP (power purchase parity) ton CO2/k USD/year (EmiPeUn10) considerably decreased by 67%. This last one is a favourable result in international compare, because only Sweden had more than his level by decreasing 75% and United Kingdom (UK) was at the same level. But the carbon-dioxide emissions growth remained at highly level in China.

The correlations among variables are ***strong*** between 0.500 and 0.800 (50% - 80%) in some cases, which are follows:

The *CO2 emissions growth* per unit of GDP PPP ton CO2/k USD/year (EmiPeUn10) has strong correlation by 0.744 (74%) with population growth (PopuGrow1) in percent for period of 1990-2021.

The *total investment*, in percent of GDP in 2021 (TotInvest216) has strong correlations by 0.715 (71%) with CO2 emissions growth per capita ton CO2/cap/year (EmissCapit9) for period of 1990-2021, because the investment increases even in percent of GDP, naturally the carbon-dioxide emissions also increase and in average increasing rates of these two economic variables are closed to each-other (Table 1; IMF 2023).

The *CO2 emissions growth* Mt CO2/year (EmissMt8) has strong correlation by 0.681 (68%) with population growth (PopuGrow11) for period of 1990-2021.

GDP growth rate (GDPgrow901) has strong correlation by 0.606 (60%) with GDP growth rate (GDPgrow212) for period of 1990-2021.

The *total investment*, in percent of GDP in 2021 (TotInvest216) has strong correlations by 0.596 (59%) with CO2 emissions growth Mt CO2/year (EmissMt8)

The other correlations are not important for analyses in the study, because the values of correlations among economic variables under level 0.500 (50%).

In the *Figure 1*, the variables are the CO2 emissions growth per capita ton CO2/cap/year, for period of 1990-2021 (EmissCapit9) and the total investment, in percent of GDP in 2021 (TotInvest216) and CO2 emissions growth Mt CO2/year, for period of 1990-2021 (EmissMt8) at line "X" in all of three Figures 1,2,3 of coordinate system.

While the CO2 emissions growth per unit of GDP PPP ton CO2/k USD/year, for period of 1990-2021 (EmiPeUn10), population growth in percent for period of 1990-2021 (PopuGrow11), the unemployment rate, in percent of total labour force in 2021 (Unempl214) and the unemployment rate, in percent of total labour force in 1990 (Unempl903) are at line "Y" in this coordinate system.

In this Figure 1 trends of *CO2 emissions growth per capita* for period of 1990-2021 (EmissCapit9) was by 322% and the *CO2 emissions growth Mt* CO2/year, for same period (EmissMt8) by 414% at top level in China. Also, the total *investment of China in percent of GDP in 2021* (TotInvest216) was at top level by 43% within the selected countries of this research, and then Iran (41%), Hungary (31%), India (31%) and Turkey (32%).

Some developing countries of this study as India (341%) Iran (247%), Saudi-Arabia (240%), Turkey (200%) Egypt (185%) have increased their CO2 emissions growth Mt CO2/year, for period of 1990-2021 (EmissMt8), when these countries moderately increased CO2 emissions growth per capita ton (EmissCapit9) in India by 175%, in Iran (130%), in Turkey (91%), in Saudi Arabia by 57%, in Egypt by 56% and in Brazil by 49% for the same period. Also, their total investment, in percent of GDP in 2021 (TotInvest216) was considerable, but total investment was not so much higher than in cases of highly developed economies.

Also, this was fortunate for China, that the population growth has been by 22% for the researched period comparably with other developing countries, where this was so much higher in Saudi Arabia by 116%, in Egypt by 82%, in India by 61%, in Turkey by 57% and in Iran by 50%, in Brazil by 44%. But naturally in case of China, when the population growth was moderate comparably with other developing economies, this resulted the highly level of CO2 emissions growth per capita. In other countries because of the population growth was more therefore, gas emission could be less than in case of China. Finally, the demand is to decrease all of the CO2 emissions growth.

In highly developed economies and newly developed economies CO2 emissions growth Mt CO2/year, for same period (EmissMt8) *has mostly been decreasing* as in United Kingdom by 43%, in Germany by 35%, in Sweden by 33%, in Hungary by 30% and in Italy, France, Russia, Poland, Japan. In selected countries only United State by 9% and Austria by 5% increased very moderately the whole CO2 emissions. Therefore, all of the developed economies have decreased CO2 emissions growth per capita

for the same period. The CO2 emissions growth could decrease in spite that the total investment in percent of GDP in 2021 (TotInvest216) considerably increased, for example in Hungary by 31% as at top level of developed economies, in Austria by 28%, in Japan and Sweden by 26%, also in US by 21%, which last one is very considerable concerning the economic measure of US.

The population growth in percent for period of 1990-2021 (PopuGrow11) has been little increasing in the developed economies, as in US by 32%, in United Kingdom by 18%, in France by 16% and in Austria by 14%. But in some developed economies the population decreased like in Sweden by 16%, in Hungary by 8%and in Poland by 0.1%. In Japan population increased only by1.3%, as stagnating level. In spite this population decreasing trend the CO2 emissions growth per capita ton CO2/cap/year EmiPeUn10 sharply decreased for the period.

Also, the CO2 emissions growth per unit of GDP PPP ton CO2/k USD/year has decreased for period of 1990-2021 (EmiPeUn10) in these highly developed, which shows that the developing trend of modern advanced technology could be efficient to decrease of the cost of gas emissions. This considerably decreased in China by 67%, moderately decreased in India, Turkey and Egypt, but in cases of other countries, Iran, Saudi Arabia and Brazil increased.

This condition shows the importance of the advanced green technology transfer for interest of developing countries based on the wider global international cooperation.

The *Figure 1* shows positions of selected 18 countries in coordinate system, where the first session up-right is positive section. The variables are the CO2 emissions growth per capita ton CO2/cap/year, for period of 1990-2021 (EmissCapit9) and the total investment, in percent of GDP in 2021 (TotInvest216) and CO2 emissions growth Mt CO2/year, for period of 1990-2021 (EmissMt8) at line "X" and also CO2 emissions growth per unit of GDP PPP ton CO2/k USD/year, for period of 1990-2021 (EmiPeUn10), population growth in percent for period of 1990-2021 (PopuGrow11), the unemployment rate, in percent of total labour force in 2021 (Unempl214) and the unemployment rate, in percent of total labour force in 1990 (Unempl903) are at line "Y", which increase or little decrease in countries of this session namely India, Iran, Turkey, Saudi Arabia.

In countries of the second session up-left side, namely in Egypt, Brazil, France, Italy the variables, namely CO2 emissions growth per capita ton CO2/cap/year, for period of 1990-2021 (EmissCapit9) and the total investment, in percent of GDP in 2021 (TotInvest216) and CO2 emissions growth Mt CO2/year, for period of 1990-2021 (EmissMt8) at line "X" generally decreases or little increase. But in these countries CO2 emissions growth per unit of GDP PPP ton CO2/k USD/year, for period of 1990-2021 (EmiPeUn10), population growth

in percent for period of 1990-2021 (PopuGrow11), the unemployment rate, in percent of total labour force in 2021 (Unempl214) and the unemployment rate, in percent of total labour force in 1990 (Unempl903) at line "Y" remained in increasing or little decreasing growing rate.
In countries of the third session down right-side, namely in China, Hungary, variables, namely CO2 emissions growth per capita ton CO2/cap/year, for period of 1990-2021 (EmissCapit9) and the total investment, in percent of GDP in 2021 (TotInvest216) and CO2 emissions growth Mt CO2/year, for period of 1990-2021 (EmissMt8) at line "X" generally increase or little decrease. But in these countries CO2 emissions growth per unit of GDP PPP ton CO2/k USD/year, for period of 1990-2021 (EmiPeUn10), population growth in percent for period of 1990-2021 (PopuGrow11), the unemployment rate, in percent of total labour force in 2021 (Unempl214) and the unemployment rate, in percent of total labour force in 1990 (Unempl903) at line "Y" remained in decreasing or little increasing growing rate.
In countries of the fourth session down left-side, as negative session, namely in United States, United Kingdom, Austria, Russia, Germany, Japan, Poland, Sweden, variables, namely CO2 emissions growth per capita ton CO2/cap/year, for period of 1990-2021 (EmissCapit9) and the total investment, in percent of GDP in 2021 (TotInvest216) and CO2 emissions growth Mt CO2/year, for period of 1990-2021 (EmissMt8) at line "X" generally decrease or little increase. But in these countries CO2 emissions growth per unit of GDP PPP ton CO2/k USD/year, for period of 1990-2021 (EmiPeUn10), population growth in percent for period of 1990-2021 (PopuGrow11), the unemployment rate, in percent of total labour force in 2021 (Unempl214) and the unemployment rate, in percent of total labour force in 1990 (Unempl903) at line "Y" remained in decreasing or little increasing growing rate.
China and Hungary are selected into the third session down right-side under line "X", because *in China* the CO2 emissions growth Mt and CO2 emissions growth per capita ton increases, but CO2 emissions growth per unit of GDP PPP ton considerably decreased and unemployment rate in 1990 and 2021 also were at little lower level.
In Hungary CO2 emissions growth Mt and CO2 emissions growth per capita ton little decreased and the total investment, in percent of GDP in 2021 considerably increased at line "X", but at line "Y" the CO2 emissions growth per unit of GDP PPP ton considerably decreased, number of populations little decreased, while unemployment rate in 1990 and 2021 were as little positive values, not decreased.
Therefore, countries are selected into these four different kinds of sessions depending on their economic features/ variables based on the statistical data-base in Table 1 (IMF October 2023; National Statistics Office).
The question can emerge that how competition generally is between United States and China in field of CO2 emissions growth and its economic background.
As the data-base of Table 1 show that United States has little increased CO2 emissions growth by 9% and decreased CO2 emissions growth per capita ton by 29% for the researched period 1990-2021. While China has considerably increased CO2 emissions growth by 414% and increased CO2 emissions growth per capita ton by 322% for the same period 1990-2021.
In order that differences of both can be understood, it is important to think and know that how the top advanced developed technology of China is produced, for how long-time length and how this top technology as same is produced based on fossil or green, as renewable energy resources. Naturally this top technology to be produced probably can be longer time period in China than in case of US. Also, we must not forget that any top technology in case of China, when this will be adapted in whole society of China, this is a large society, because its measure is about 1.5 billion inhabitants mostly 5 times more than population of US. Also, the basic question that how measure of the atom-energy peacefully using in both of countries.
In order that China can arrival the economic developed level of US, it should be important for China to extend development trend in whole China including regional and rural development even based on the One belt and One road. Because this project is very costly within the country, therefore, this project should be extended as cross border project and international one including some main countries of two continents, as Asia and Europe. Naturally the regional and rural development of China should be accompanying with developing

infrastructure including transport, even train, foreign trade increasing, connecting important international seaports, heavy industry and machinery industry, centralising heavy industry into main large metropolises in China. When China develops the infrastructure within One belt and One road at present as the US developed infrastructure in American continent mostly one or two centuries before, China should develop this infrastructure probably shorter time length with a population more than US by 5 times.

From side of US is that since the beginning of 1970, the general developing trend started in every five-year period to introduce the highly level top advanced technology into the whole society of US. This means that the *top technology should be introduced into whole economic and social development of US to remain the international competitiveness of US*. Also, this means that the US should change top technology in every five-year period to realise the continuous international competitiveness of the country. Every after five-year period the country and its large companies, transnational and multi-national corporations under American leadership should sell the earlier top technologies for other less companies or other countries of world economy.

The competition between two large countries US and China is not easy. China has a good position to obtain wide-side economic influences on the world economy.

In the ***Figure 2***, the economic variables namely the GDP growth rate in 2021, at constant price (GDPgrow212) and the GDP growth rate in 1990, in percent change, in national currency at constant price (GDPgrow901) are at *line "Y"* of the coordinate system.

In the first session up right-side as positive section of the coordinate system GDP growth rate in 2021, at constant price (GDPgrow212) and the GDP growth rate in 1990, in percent change, in national currency at constant price (GDPgrow901) at *line "Y"* of the coordinate system increased or little decreased in India, Iran, Turkey and Saudi Arabia.

In the second session up left-side as positive-negative section of the coordinate system GDP growth rate in 2021, at constant price (GDPgrow212) and the GDP growth rate in 1990, in percent change, in national currency at constant price (GDPgrow901) at *line "Y"* of the coordinate system increased or little decreased in cases of Austria and Sweden.

In the third session down right-side as positive-negative section of the coordinate system GDP growth rate in 2021, at constant price (GDPgrow212) and the GDP growth rate in 1990, in percent change, in national currency at constant price (GDPgrow901) at *line "Y"* of the coordinate system decreased or little increased in cases of China and Hungary.

In the fourth session down left-side as *negative section of the coordinate system* GDP growth rate in 2021, at constant price (GDPgrow212) and the GDP growth rate in 1990, in percent change, in national currency at constant price (GDPgrow901) at *line "Y"* of the coordinate system decreased or little increased in cases of Egypt, Brazil, France, Italy, United States, United Kingdom, Russia, Germany, Japan and Poland.

The Figure 2 shows that China had considerable CO2 emissions – even per capita – comparably to the GDP growth rate in period of 1990-2021, therefore this country is the third quarter (down right-side) of the coordinate. Hungary had considerably less CO2 emissions than in case of China, therefore Hungary closed to the line "X", but GDP growth rate of Hungary was decreasing 3% in 1990, but sharply increased by 7% in 2021, which was higher level than in case of Germany by 3% in 2021.

Austria had considerable the same biggest increasing GDP growth rate by 28% either in 1990 and 2021 within the selected countries, but this resulted only little increasing CO2 emissions MT by 5% in 1990 and little decreasing CO2 emissions per capita by 8%, in period of 1990-2021. Therefore, Austria is in the second quarter (up left-side) of the coordinate system. Turkey had considerable GDP increasing rate by 9% in 1990 and 12% in 2021, and India had 6% in 1990 and 9% in 2021 in field of GDP growth rate accompanying with considerable CO2 emissions for the researched period.

Some of selected countries, are in the fourth quarter (down left-side) of the coordinate system, because they had decreasing rate in CO2 emissions in the researched period with less GDP growth rate in 2021 as US (by 6%), UK (8%), Italy (7%), France (6%), Russia (6%), Germany (3%) and Japan (2%), than comparably to GDP growth rate of China, India and Turkey in 2021.

Naturally the total investment in percent of GDP could also make influences on the GDP growth rate. For example, China had total investment 34% of GDP in 1990 and 43% of GDP in 2021, which realised 4% in 1990 and 9% GDP growth rate in 2021 with considerable increasing CO2 emissions for the researched period. The US had total investment 22% of GDP in 1990 and 21% of GDP in 2021, which realised 2% in 1990 and 6% in 2021 in field of GDP growth rate with considerable little increasing CO2 emissions Mt by 9% and decreasing CO2 emissions per capita by 29% for the researched period, 1990-2021. *In case of Hungary* total investment was 27% in 1990 and 31% in 2021 in percent of GDP, which realised decreasing rate of GDP by 3% in 1990 and increasing GDP growth rate 7% in 2021 with considerable decreasing CO2 emissions MT by 30% and decreasing CO2 emissions per capita by 24% for the researched period, 1990-2021.
This also shows that increasing rate of GDP depends on the measure in share of investment in GDP, but in developed economies the CO2 emissions mostly decreased and in developing economies the CO2 emissions increased.
In the ***Figure-3*** in the first session up right-side of the coordinate system the economic variables namely the general government gross debt in percent of GDP in 2021 (GenGovDeb7) and the total investment, in percent of GDP in 1990 (TotInvest905) at line "Y" increased or little decreased in cases of China, India and Iran.
In the second session up left-side of the coordinate system the economic variables namely the general government gross debt in percent of GDP in 2021 (GenGovDeb7) and the total investment, in percent of GDP in 1990 (TotInvest905) at line "Y" increased or little decreased in cases of Japan, Egypt, Italy, Germany, Austria, France, United States and United Kingdom.
In the third session down right-side of the coordinate system the economic variables namely the general government gross debt in percent of GDP in 2021 (GenGovDeb7) and the total investment, in percent of GDP in 1990 (TotInvest905) at line "Y" decreased or little increased in cases of Hungary, Turkey and Saudi Arabia.
In the fourth session down left-side of the coordinate system the economic variables namely the general government gross debt in percent of GDP in 2021 (GenGovDeb7) and the total investment, in percent of GDP in 1990 (TotInvest905) at line "Y" decreased or little increased in cases of Brazil, Poland, Sweden and Russia.

CONCLUSIONS AND PROPOSALS

For the researched period the increasing global total CO2 emissions growth also can have resulted increasing CO2 emissions per capita, which in developing countries was based on significantly more increasing rate of CO2 emissions growth than increasing rate of their populations, while in cases of developed economies the total CO2 emissions growth considerably decreased and their populations little increased. This means that the *developing countries have mostly been responsible for the global increasing CO2 emissions*. By the end of 2021 within the selected countries, the *investment of developing countries* in percent of GDP had influences on increasing the CO2 emission, while in the developed economies more investment percent of GDP than in developing countries resulted decreasing trends of CO2 emissions at total and per capita levels. Therefore, the investment had strong correlations with CO2 emissions in selected countries in the researched period. But the *investment in percent of GDP* either in 1990 or in 2021 has not resulted influences on the *unemployment rate*, therefore this has not any important correlations with the unemployment rate in these selected countries.
International cooperation is needed at global level mostly among countries, which are highly developed economies accompanying with low level of carbon-dioxide gas emission with developing and renewal industrial countries accompanying with highly level of carbon-dioxide gas emission. International cooperation with China is significant to extend new green advanced technology to mitigate gas emission, because China has been the first biggest carbon-dioxide emission in the world economy for the researched period.
The *One Belt and One Road* project is very considerable project provided by China, because most of this large international wide-side investment is based on the *green investment* to use renewable energy resource as *electric energy use*. Within this project the electric train network is cross whole China and cross borders

including many countries of Asia and Europe, which can represent for using green energy. Also, the project can ensure *emerge of rural areas of Chine* by connecting main towns and large cities of China based on the *extending electrical network*.

In order that China can be a real one of the largest industrial and highly developed economies, China should extend electric energy use, as *green energy* and *rural development* within regional development process. The building electric network under title of *One Belt and One Road* can ensure both of main strategic aims.

The United States of American would not have realised its considerable economic prosperity for the latest centuries if US had not develop the whole country-side train network. In that time the train line worked by using fossil energy, but in actual century the green energy should be used in order that China successfully faces large environmental conservation challenges.

Also, *One Belt and One Road* project can make countries be more closed to each-others in order to extend their economic cooperation and foreign trade by closing their different regions, cities, villages, rural areas, strategic towns and seaports, even international airports.

The electric green energy in China is a base for all different kinds of economic sectors.

Also, the main resource of the green electric energy can be the solar energy by setting up network of solar panels even in main train railway stations closed to main cities or possible local markets, where greenhouses can be built to ensure fruits and vegetables for local populations. In this case the network of solar panels can locally ensure the green energy resource for the operating train network and greenhouses of food production for local populations. Therefore, these greenhouses can be built closed to local markets as surrounding areas of main cities and large towns in China.

Generally based on the international experiences these greenhouses of fruits and vegetables are built around large cities in order that the transport district can be shorter to local markets by less transport cost.

The One Belt and One Road can ensure special train wagons for freezing food products including fruits and vegetables for the long journey travel to far marketing places of either inside China or neighbour countries.

Additionally, to above mentioned favourable features of the One Belt and One Road there will be other kind of train wagons, mainly for providing health services, because in the village areas and rural areas, most of them the hospital health care and services are absent. These health care service wagons can ensure basic health services and beyond basic services, can decrease health difficulties because of absence of hospitals in rural areas.

The US built Pan-American network road including US and most of Latin South and Central America, when China built *One Belt and One Road* project for Asian and European countries based on similar aims as Pan-American network road. The US built Panama water channel to connect Pacific Ocean and Atlantic Ocean, while China would like to build another water channel for sea-ship transport in Nicaragua little more north than the Panama one, which can make cheaper trade transport even by 10% or 20% for Atlantic and Pacific regions of the US. This possible now international water channel can be more profitable for US companies than using Panama channel. Also, at present China financed by credit for the 40% of general government debt of US for several years. Additionally, to share of China, Japan financed by credit for about 20% of general government debt of US in the same time.

In history, *China has exported low-cost products for the US* for about one and half decades after the II. World War, when the US could not transfer and restructure its economic sectors because of the considerable military cost and large share of the military sector in percent of GDP. The low-level price imported products of China could contribute to relative wealth of the American society for this period after the war.

Since the beginning of 1970s China has sent *many students for BSC-MCS-PhD* study programs into most of highly developed economies and many of developing countries based on the scholarship scheme financed by Government of China. Naturally many of students from China could follow their works after their study in those countries to stimulate economic cooperation among China and those countries further. Finally, the mankind can win by the green energy and can successfully face challenges of the difficulties of environmental

conservation based on the wide-side international cooperation in field of highly developed technological transfer.

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A CASE STUDY OF NUCLEAR CONTAMINATION AND AGRICULTURAL ADAPTATION IN THE SAHARA DESERT: THE ENVIRONMENTAL CHALLENGES OF REGGANE CITY

Smaine CHELLAT Abderrahmane ABDERRAHMANE[2], Abdelmalek SAIDI[2], Messaoud HACINI[2], Ahcene BOUREFIS[1]

[1]Geology and Environment Laboratory, University of Constantine 1, Road Ain El Bey Zouaghi Slimane Constantine 25 000, Algeria
2Geology of Saharan laboratory, Department of earth sciences, Faculty of Hydrocarbon. University Kasdi Merbah Ouargla, Algeria
**Corresponding author: smaine.chellat@gmail.com*

Abstract: *Reggane is located in the TOUAT area, one of the three major regions of the wilaya of Adrar, along with GOURARA (Timimoune) and TIDIKELT (Aoulef). It is located in a depression that is regarded one of the Saharan platform's synecisms, marked by high aridity; hence, the water is too far away, roughly 30m from the surface. An agricultural occupation characterizes this region. Nuclear tests conducted during the French colonial period in 1960, 80 kilometers south of Reggan, left radioactive pollution. The presence of contamination is demonstrated by XRD diffractometric tests performed on the river deposits of Wadi Reggane, which reveal elements Ra and Cs delivered by the winds or other pathways. These sediments are far from the explosion site, yet there are signs of contamination; they lie on a plate (bedrock) of a continental sandstone interfile nature of Albian age, which has been exploited for its water richness in agronomy and irrigation. According to the original zoning, it is a low-risk region, however depending on the time the elements are delivered day after day, different zoning of the area is required.*

Keywords: *Reggan, Nuclear contamination, Dust, Wind, Water, Albian*

INTRODUCTION

Algeria's Reggane, a city in the TOUAT area of the wilaya of Adrar, is located in a depression with exceptionally dry weather. With groundwater lying around 30 meters below the surface, this area struggles with a lack of water supplies. Due to the utilization of a continental sandstone interfile for irrigation, the region has an agricultural vocation despite its aridity.
Reggane, however, also addresses a problem with the ecology brought on by nuclear tests carried out during the time of French colonization. About 80 kilometres south of the city, these trials contain radioactive pollution. This paper will examine the environmental effects of nuclear pollution in Wadi Reggane, concentrating on the presence of elements like Ra and Cs in river deposits. It will also be considered if it is necessary to update the area's zoning considering the transportation of these components.

Nuclear tests were carried out close to Reggane during the 1960s French colonial era. Although these tests attempted to further France's nuclear program, the surrounding ecosystem suffered greatly as a result. These experiments, which were conducted 80 kilometers south of the city, dispersed radioactive substances into the air, water, and land.

RESULTS

The river sediments of Wadi Reggane show one of the primary effects of the nuclear testing. Radioactive elements including Ra and Cs have been found in these deposits during XRD diffractometric investigations. These substances have been moved by winds or other means, proving that the nuclear tests have left a persistent pollution.

Agricultural Adaptation and Water Resources: Reggane nevertheless pursues a career in agriculture despite the difficulties presented by severe aridity and the potential for radioactive contamination. Due to its abundant water content, the continental sandstone interfile of the region, which is of Albian age, has been extensively exploited, serving as a vital resource for irrigation and agronomy.

However, Reggane's agricultural industries continue to face serious water supply issues. Farmers find it challenging to recover enough water to meet their demands since groundwater, which is located around 30 meters below the surface, is inaccessible. As a result, the region's sustainable agriculture depends on cutting-edge water management strategies including drip irrigation and water-saving measures.

DISCUSSION AND RECOMMENDATION

Revision of Zoning and Addressing Contamination Risks: Reggane's current zoning designates the region as a low-risk zone based on outmoded assessments. To properly represent the current contamination threats, the zoning must be evaluated considering the ongoing transit of radioactive materials. The fluvial sediments of Wadi Reggane include radioactive materials, which suggests that contamination has migrated beyond of the local area of the nuclear test site. These components have been able to travel to locations farther away from the explosion site thanks to wind erosion and other transport processes. Therefore, it is essential to carry out fresh research to determine the level of pollution and reevaluate the dangers of residing and farming in the area.

There are several procedures that must be performed to address the contamination hazards. Priority one for determining exposure levels and potential health hazards for the local population is continuous monitoring of radioactive materials in the environment. This will facilitate the development of suitable safety regulations and rules for citizens as well as agricultural operations.

The second step is to start cleanup work to stop the spread of radioactive pollution. Contaminants can be kept from spreading too widely and from being transported farther by using strategies including soil stabilization, encapsulation, and re-vegetation.

Public awareness programs are also essential for informing the community about the dangers of nuclear pollution and supporting safe behaviours. Farmers and locals should get the necessary instruction and directives for the management and disposal of potentially hazardous products.

CONCLUSION

Reggane, which is located in the Sahara Desert, has several environmental difficulties. A legacy of radioactive pollution left over from French colonial nuclear tests coexists with the city's agricultural industry, which is reliant on water from the continental sandstone interfile.

It is obvious that the current zoning of Reggane has to be reviewed in light of the discovery of radioactive materials in fluvial deposits distant from the test site. The continued dangers presented by the nuclear contamination are brought to light by the movement of these substances due to wind erosion and other processes.
Further investigation should be conducted to determine and track the level of contamination, remediation methods should be used to reduce dispersion, and nearby residents should be made aware of the dangers posed by radioactive materials.

Reggane may work toward sustainable agriculture practices and a safer living environment for its citizens by tackling environmental concerns and implementing proactive actions.

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THE FAST FASHION PANDEMIC CONTAMINATING THE GLOBAL ENVIRONMENT

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The Image Doctor, *India*
Working both online & offline globally
dmtheimagedoctor@gmail.com, *+91-9555250502*

Abstract: *Fashion is one of the world's most important industries, driving a significant part of the global economy. Also, it is the most resource intensive. Revenue in 2023 for the global market is 1.7 trillion dollars which is mostly utilised for fast fashion. Fast fashion has made it possible for the masses to enjoy different styles globally, though at the cost of the environment, human health & economy. Textile production alone contributes more to climate change than international aviation and shipping combined. The world produces 92 million tons of textile waste every year (excluding fast fashion accessories). 36% of GenZ buys a new cloth every month. 70% of the world market has a synthetic cloth base which means it can only be recycled and is not truly biodegradable. Unfortunately, only 12% of all this waste gets recycled and rest all ends in landfills. It's not only contaminating the environment but also burning a huge hole in the resource pool. Fashion should not only be affordable to the individual but also to the global environment. Apart from the regulations Government and environmental organisations must implement, as an Image Consultant, I can suggest few innovative solutions to help the environment in long run. The solutions include, creating awareness about carbon footprint of every fashion article, creating gender fluid fashion, reintroducing classic styles, promoting the concept of calculating cost per wear for every purchase, creating clothing clusters to achieve multiple looks with minimum garment pieces, repair & reuse and reinforcing the concept of uniforms for all major organisations globally. We can break the speed of fast fashion industry by helping masses understand the difference between needs and wants in terms of fashion. Let's create a chic world with the help of image management and heal the environment from the super contagious fashion pandemic.*

Keywords*: Fast Fashion, Textile Waste, Image Management, Affordable Fashion, Fashion Carbon Footprint, Repair & Reuse*

FOREWORD

Warm greetings to everyone reading this paper. I am Dr. Rashmi Rathore, primarily a medical doctor. Reading my introduction might bring questions to many of you, so as why a medical doctor is writing and researching on environment? Thus, I am sharing a brief story of my life journey. Apart from practicing medicine, I am also an internationally certified image consultant and soft skills trainer. I have won multiple pageants at different times in life and now I am practicing as a pageant coach too. I am associated with multiple NGOs

and have worked on various burning issues of our society. I have been a student of environmental studies with the esteemed Delhi University, India. I have lived in 14 states and 6 union territories of India and thus worked with different organisations, people, cultures, skill sets and their respective social, climatic, administrative and personal problems. Thus, I draw my experience from working both online and offline, and both in my country and globally.
When I started my journey with the fashion world, it was very fascinating to see larger than life designs and accessories and experience them on myself. However, as a student of environment, I always wondered over the utility of these costumes which I was wearing on ramp, once the event was over. And that is when I started studying and researching on the impact of fashion on environment. Further entering the medical world, my research got more depth by studying patients coming from various textile related industries, patients with skin allergies from synthetic materials used and people living in near textile waste areas and landfills.

However, when I stepped further up as an image consultant, I realised looking stylish and chic genuinely does not need too much of expenditure in terms of resources, money and the environment around. It's all about learning the art and science of image management. Image management helps in creating an appropriate wardrobe (according to your professional & personal lifestyle), which aligns with your personality, makes you look attractive and is affordable both to you and the environment. Also, good clothing is not only about looking pretty, handsome or glamourous, it must help you move forward towards your goals and help you achieve greater success in life while still being cordial with the environment.
Every piece of article we use on our body sends a message to people around us, image management helps us in sending the desired messages and reading the messages correctly which others are exhibiting. Styling, grooming, personality development and image management has become a matter of great importance for masses in the last decade as people are focussing highly on 'self', personal development and growth. Thus, we are seeing a huge boom in appearance related industries including fashion, accessories and cosmetics. Knowing the difference between needs & wants can to make a huge difference to the economy and the environment both. Actual clothing needs are reasonable and are influenced by our environment, lifestyle and personal style. Physical needs tend to be "real needs." Clothing wants, however, are endless and are influenced by values, attitudes, friends, and peers. Display and media advertising expose us to endless goods and services that make us dissatisfied with what we have. Social and aesthetic needs may more often be wants. It is essential to *reconsider actual needs versus wants if you hope to resist the temptation to acquire and overextend your resources.*

Learning how clothes can be used as a resource for playing all your life roles appropriately and achievement of your goals can be a game changer in everyone's life. However, opting for sustainable measures is the only way to have a healthy planet. *The good news is that image management skills can be learned and then practiced becoming almost automatic.* And thus, I am propagating the message of practicing image management for greater success in life and a healthy planet.

INTRODUCTION

The term 'fashion' originates from the Latin word 'Facere,' which means 'to make,' and describes the manufacturing, mixing, and wearing of outfits adorned with specific cultural aesthetics, patterns, motifs, shapes, and cuts, allowing people to showcase their group belonging, values, meanings, beliefs, and ways of life.

Fashion is a term used interchangeably to describe the creation of clothing, footwear, accessories cosmetics, and jewellery of different cultural aesthetics and their mix and match into outfits that depict distinctive ways of dressing (styles and trends) as signifiers of social status, self-expression, and group belonging.
Fast fashion *is the business model of replicating recent ramp trends and high-fashion designs, mass-producing them at a lower cost, and bringing them to retail quickly, while demand is at its highest.*
Fast fashion has allowed all segments of society, irrespective of class, income or background to engage in the hedonistic and psychogenic pleasures of fashion. At no other time in human history has fashion been so accessible to so many people across our society.
Then, why am I calling it a **PANDEMIC**?

Because a **pandemic** is an epidemic of an infectious disease that has spread across a large region, for instance multiple continents or worldwide, affecting a substantial number of individuals.
The exploitation of animals in the name of fashion – the world has an opinion on it! Because it concerns a very small segment of society.
How about the effect of fashion/garment industry on environment?
Not many want to discuss about the same. Why? Because it concerns all of us. Any solution will require us to bring change at an individual level. It will mean changing our lifestyles forever, at various stages from the purchase of a fashion product till its final decomposition.

HISTORY/BACKGROUND

From ancient times to present day, fashion & methods of textile production have evolved continually. The most agreed date of usage of textile clothing is believed to be nearly 50,000years ago. During the 18th century, distinction was made between dressing for formal occasions and daily wear. And with it came more experimentation and detailing in garment production, this paved a way for structural fashion designing. During the industrial revolution,

fabric production was mechanised. Sewing machines emerged in the 19th century, streamlining clothing production. The 20th century is marked by new applications for textiles as well as inventions in synthetic fibres and computerized manufacturing control systems.
The changing lifestyles, activities, and demands of the 20th century favoured clothing producers who could more effectively make their products with desired properties, such as increased strength, elasticity, or durability. These properties were implemented through mechanical solutions, such as different weaving and knitting patterns, by modifications to the fibres, or by finishing of the textiles.
In the 2010s, the global textile industry has come under fire for unsustainable practices. The textile industry is shown to have a negative environmental impact at most stages in the production process. Advancements in textile treatment, coating, and dyes have unclear effects in human health, and textile contact dermatitis is increasing in prevalence among textile workers, and regular people.

DISCUSSION

Every garment piece has a lifespan and a story. Since the time the design is conceived in the mind of the designer to the time it ends up in a landfill. It can be divided mainly into two phases- from thought conception to production and postproduction till decomposition.
A lot has been spoken, written and debated in last 50 years about the first phase of a garment's life span. However, the phase post purchase has recently come in light. In previous times, once the garment was

purchased or handmade it was worn multiple time, maybe every alternate day in most middle class & poor families. If it survived the test of time, it was passed through generations and worn amongst siblings and cousins of same family during different growing years. The costume pieces were considered heirloom assets and were preserved well and repeated for every important occasion.

Once it used to get worn out, it was recycled into various daily use items like grocery bags, table mats, door mats etc. If it could survive this test too, then it was repurposed as a mopping or dusting cloth, before finally disintegrating into smaller pieces for nature to play its role on it. And since they were mostly natural fibres, nature did its job at a good pace.

The renaissance period made fashion more elaborate and exquisite. Clothes used to separate people into different classes. However, the industrial revolution, technology and synthetic compositions changed the garment story completely. The World War 1 forced people to adopt austere measures to cut costs and elaborate styles gave way to more practical designs and dresses. After World War 2 the common man adopted the factory-made clothes almost completely.

Fast forward today, the same garment which happily lived in our wardrobe and served us for years in different forms has a life span of only a day and at times only few hours. All thanks to – Fast Fashion! Now even the underprivileged also do not want to accept used garments. They also have surplus. Also, the fast fashion garments technically don't help them survive better through the change in seasons because of the synthetic base.

Kids fashion, which has seen a huge boom in the last decade, is a great topic for debate. And is also an offspring of fast fashion.

Everything we wear has an embedded environmental cost in terms of energy, water, land and chemicals used. This depends on multiple factors. The fibres that are used and whether they were grown or made, the production methods used, how they are processed into yarn, transported, dyed, printed and made into clothes. The environmental price tag for our clothes is largely determined during the design and production phase. Choice of synthetic fibre and design of garments can result in significant differences in the emission of plastic microfibres to the environment. The best opportunity within the clothing lifecycle to increase longevity is at the design stage, as changes to design practices can have a significant impact on how long items remain wearable.

Scholars have identified an increase in the rate at which consumers purchase new clothing, as well as a decrease in the lifespan of clothing. Fast fashion has been suggested to contribute to increased levels of textile waste. Fast fashion is mostly defined as inexpensive clothing produced rapidly by mass market retailers in response to latest trends.

Today everyone wants to be unique, where once people wanted to look alike. Fashion has evolved – from being a response to cultural changes to reflecting a person's individuality. Social 'conformation' is no longer the goal of fashion.

One thing is common for fashion through the centuries and holds still to this day – those with wealth and influence continue to hold the power to influence the course of fashion history. Earlier it was the royals, today it is the celebrities and big corporations and brands. But the common people also have a larger say than ever in the history of fashion – their tastes drive the market for fashion.

Fashion is one of the world's most important industries, driving a significant part of the global economy. However, it is also the most resource intensive. Revenue in 2023 for the global market is 1.7 trillion dollars which is mostly utilised for fast fashion. **Fast fashion** has made it possible for the masses to enjoy different styles globally, unfortunately at the cost of the environment, human health & economy. The world is now obsessed with the idea of fashion, trends, styling & looking perfect all the time. More than a *want* it has become a *basic need* for masses globally!

STATISTICS

Let's review some important statistics:

- Textile production alone contributes more to climate change than international aviation and shipping combined.
- Fashion is the second most polluting industry in the world after oil.
- It produces 2.1 billion tons of carbon emissions each year.
- It takes 2000 gallons of water to make only 1 pair of jeans.
- The world produces 92 million tons of textile waste every year (excluding fast fashion accessories). Which means this figure does not include any waste from the shoe, bag, jewellry, cosmetic etc industries.
- 36% of GenZ buys a new cloth every month.
- 70% of the world market has a synthetic cloth base which means it can only be recycled and is not truly biodegradable.
- 87% of materials used in clothing, end up in the landfill. Which means one truckload every second.
- The worst part is, only 1% of the discarded clothes go back to recycling
- Fashion industry casuses 20% of global water wastage
- Fashion industry is the source of 35% microplastic waste in oceans
- Plastic packaging, is a huge matter of concern
- **Fast Fashion** is not only contaminating the environment but also burning a huge hole in the resource pool.

Every garment has a different shelf life and thus a different speed of decomposition. The speed of decomposition depends on various factors like, basic fibres, synthetic composition, percentage of dyes, decorative elements and their composition, wear and tear during usage and much more. However, the primary factor is always the basic fibre. For example, a pure cotton t shirt will take nearly 5 weeks to decompose. A denim garment which is most common of all wardrobes, takes nearly a complete year to decompose. Polyester takes anything between 20-200 years and for a fibre like spandex, we still do not know the exact age of decomposition.

The more natural fibre used with least artificial ingredients and techniques the quicker the decomposition. The carbon footprint of various garments at different stages of production is highly alarming and should be a matter of concern for not only environmentalists but everyone.

A polyester shirt has more than double the carbon footprint of a cotton shirt (5.5 kg CO2e vs. 2.1 kg CO2e). One kilogram of cotton - equivalent to the weight of a shirt and pair of jeans - can take as much as 10,000–20,000 litres of water to produce. The fashion industry is projected to use 35% more land for fibre production by 2030— an extra 115 million hectares that could be left for biodiversity or used to grow crops to feed an expanding population. Production of fibres by polymer extrusion or agriculture makes the largest contribution to the carbon footprint of clothing. The greatest quantity of water is used during the growing and production of fibres.

SOLUTIONS AND RECOMMENDATIONS

The best place to look for a perfect garment is our wardrobe, and the best garment is the one that we already have. The speed of fast fashion can be slowed down by various measures at individual level and strict laws by government and environmental agency.

Fashion shouldn't cost the earth. But the fashion industry has marked its own homework for too long. Voluntary corporate social responsibility initiatives have failed significantly to improve pay and working conditions or reduce waste. The scientific warnings are stark on sustainability. Overconsumption and climate change are driving mass extinction. We need a new economic model for fashion. Business as usual no longer works. The Government should change the law to require companies to perform due diligence checks across their supply chains. Government needs to provide clear economic incentives for retailers to do the right thing. The Government must reform taxation to reward fashion companies that design products with lower environmental impacts and penalise those that do not. Moving from conventional to organic cotton and from virgin polyester to recycled PET (in garments designed to minimise shedding) would help to reduce the negative impact of the clothing industry.

The Government must change the system to end the throwaway society. Often it is more expensive to repair an item than buy a new one. Many of us also lack the skills to perform more than basic clothing repairs. The Government should make fashion retailers take responsibility for the waste they create and reward companies that take positive action to reduce waste. However, as an image consultant I have some interesting ways to bring this change. They are as follows:

1. **Creating awareness about carbon footprint** of every fashion article – much like the care details are tagged with every article
2. **Reintroducing & popularising classic styles and crafts** – to bring back the attention of consumers to their own wardrobes, thus saving the economy, resources and environment from the fast fashion pandemic directly.
3. **Reinforcing the concept of uniforms** for all major organisations globally – thus decreasing the demands by consumers and breaking the vicios cycle of high demand – high supply
4. Creating **gender fluid fashion** – creating garments which can be worn by both genders, thus increasing the utility of the same garment
5. Promoting the concept of **calculating cost per wear** for every purchase – the more a garment is worn the cost per wear keeps reducing. This simple mathematics will urge people to make the maximum use of every purchase they make.
6. **Creating clothing clusters** to achieve multiple looks with minimum garment pieces - If someone doesn't like repeating clothes- it provides a new look every time. Clustering is a money saver. Clustering reduces impulse purchase.
7. **Brands must promote sustainable fashion** – brand promotion and celebrity involvement in creating and spreading the right message towards reducing the impact of fast fashion on environment can bring a great difference.
8. **Education sector should pay an active role in creating sustainable fashion** – fashion institutes must cultivate a generation of creators, professionals, and visionaries who not only possess the art of crafting chic attire but also uphold ethical and ecological ideals. They must delve into inventive materials, ethical sourcing, and eco-conscious production methods. From upcycling and repurposing to embracing sustainable fashion technologies, the institutes must foster a culture of creativity harmonized with nature.

   They should comprehend the ramifications of fast fashion on our environment and society and stay determined to be part of the remedy.
9. Following the 5R's of sustainability:
   a) **Reduce** – reduce the purchase. Define the requirement and understand the difference between needs versus wants.
   b) **Repair** – means valuing the garment, which is always a great idea to have value for money
   c) **Repeat** – there is no shame in repeating the outfit, even the celebrities are doing so. A good trick is not to post pictures of the same on social media if you don't like being seen in the same garment frequently.

d) **Rent** – if it's a occasion which requires a costume piece or special dress, better to rent than buy. It saves both money and environment.
e) **Recycle** – as much as you can. As many times as you can. Until a garment can longer serve any purpose to your household. And then instead of randomly dumping it anywhere, pass it to an agency which works for recycling garments. There are multiple such organisations now in every corner of the world.

CONCLUSION

Sustainability as a fashion statement represents a contemporary approach to clothing that combines ethical values with style. It emphasizes responsible production, eco-friendly materials, and fair labour practices. By making sustainable choices, individuals can express their commitment to a healthier planet while looking fashionable. This shift towards conscious consumption not only benefits the environment but also supports a more equitable and ethical fashion industry. Sustainability isn't just a choice; it's a reflection of who we are. Ethical and stylish clothing is more than just a fashion statement; it's a commitment to a better world.

In the realm of fashion, fads may come and go, but our unwavering commitment to sustainability should remain constant. When we embrace sustainable fashion, we make a conscious choice to minimize our impact on the planet. We must select materials that promote environmental well-being, adopt production methods that reduce waste, and endorse brands that prioritize openness and ethical conduct. True style isn't about fleeting trends; it's about timeless choices that resonate with our values and endure through time.

Sustainability as a fashion statement isn't just about what we wear; it's about the impact we create. We must pledge to support a brighter, greener, and more equitable future. Together, we can make ethical and stylish clothing the norm, not the exception, because fashion should always be a reflection of our best selves.

In today's context, fashion isn't solely about looking good; it's about feeling good about your choices as a consumer or designer, knowing they can be transformative. Sustainability is more than just a fashion statement; it's an emblem of our commitment to forging a greener, more stylish future.

As we nurture the next generation of fashion leaders, we have to make sure that they'll redefine not only style but also the industry's ecological footprint. Sustainability shouldn't merely be an abstract concept for them; it should be an ethos, a dynamic statement of their pledge to fashion's brighter, eco-conscious future.

With an increased awareness and understanding of yourself and your wardrobe needs, you can avoid the accumulation of the wardrobe orphans and feel secure in the knowledge that the clothing in your closet will present you attractively and appropriately wherever you go and whatever you do. Your wardrobe will be an aid to you in the advancement of your goals and objectives and not a burden on the planet!

SUMMARY

Let's summarize

- **Fashion should be affordable** to the individual, but more so **to the environment.**
- Looking good should go hand in hand with feeling good about what you wear, and eco-conscious fashion can be both ethical and chic.
- We can **break the speed** of fast fashion industry by helping masses understand the difference between *needs* and *wants* in terms of dressing.
- **Image management** teaches how to dress attractively in a very affordable manner.
- Let's create a chic world with the help of image management and heal the environment from the super contagious ***fast fashion pandemic.***

And let's practice what Vivienne Westwood said, ***"Buy less, choose well, make it last"!***

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STUDY OF THE EFFECTS OF ACID RAIN AND HEAVY METAL POLLUTION ON GARDEN CRESS (LEPIDIUM SATIVUM)

Ágnes BÁLINT[1]*, Glória BERNVALNER[2], Viktória KALCSÓ[2], Xuechu WANG[3], Csaba MÉSZÁROS[3]

[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
[2]Szent István University, Gödöllő, Páter K. u.1., e-mail: missgloria86@gmail.com*; e-mail:* kalcsovick@gmail.com
[3]Hungarian University of Agricultural and Life Sciences, Doctoral School of Environmental Sciences, Gödöllő, Hungary. e-mail: victorwxch@gmail.com; Meszaros.Csaba@uni-mate.hu

Abstract: *Countless threats threaten our environment. Among these, it is essential to highlight the loads caused by heavy metals and acid rain. Heavy metals are found in nature, but their more incredible appearance is due to anthropogenic effects. They usually appear in the soil, from which they can enter the plants under the right conditions, thus passing through the food chain to humans. Acid rain is caused by acid gases entering the atmosphere, most of which also enter the environment during human activity. Zinc and cadmium were used among the heavy metals as pollutants during our tests. Zinc is an essential trace element. The living organism needs it in small quantities for proper functioning. It is also essential for industry and is used to make protective coatings and alloys. On the other hand, cadmium is a highly toxic element used in producing coatings and batteries. Garden cress (Lepidium sativum) was used as a test organism to observe the effects of heavy metals and acid rain. This plant was chosen because it has a short vegetation period and contains a lot of vitamin C. After several experimental setups, we finally investigated the effects of acid rain, heavy metals, and their combined impact on the plant's physical parameters and vitamin C content, which was determined using an HPLC device. The measured data were evaluated using Microsoft Excel 2007 and SPSS 14.0 programs. Regarding the physical parameters, it can be said that compared to the control, the treatments reduced the root length and stem length, but the nitric acid rain caused an increase in the leaf area. While the average leaf surface in the control is 29.53 mm^2, it is 33.67 mm^2 in the nitric acid treatment. It can be said that phosphoric acid and phosphoric acid-heavy metal treatments show a significant difference compared to the other data. Regarding vitamin C, the samples contaminated with cadmium and phosphoric acid contained the least amount, 6.17 mg/100g of fresh plant. The most vitamins were found in the samples treated only with nitric acid, the value of which is 23.83 mg/100g of fresh garden cress. However, significant differences can also be discovered between individual treatments. In the end, it can be said that the zinc and nitric acid treatments had a stimulating effect on the plants, but the phosphoric acid and especially the cadmium treatments negatively affected both their physical parameters and their vitamin C content.*

Keywords: *acid rain, heavy metals, garden cress, pollution, Vitamin C*

INTRODUCTION

The environment plays an essential role in our lives because the environment around us affects our quality of life. In our environment, harmful emissions are becoming increasingly widespread and causing enormous damage. Their composition varies widely, and some pollutants can be highly toxic. Monitoring and testing can help to detect and eliminate harmful effects and their sources and can also play a role in prevention.
Harmful phenomena include pollution from heavy metals and acid rain. The impact of human activities mainly causes these two environmental problems. While heavy metal pollution is caused using heavy metal-containing raw materials, waste dumping, mining and metallurgy, and motor vehicles, acid rain is mainly caused by the release of Sulphur dioxide, nitrogen oxides, etc. into the atmosphere from industry and transport. These acid gases can be produced by natural processes or artificially.
Thanks to advances in science, we can now also analyse precipitation. Precipitation is regularly analysed in many places worldwide, and observations show that pH values are decreasing. Acidification is not only damaging to the artificial environment but can also cause problems in the living world. Acid precipitation can acidify surface waters and soils and mobilise heavy metals.
Heavy metals can accumulate mainly in the soil, damaging plants and entering the food chain.
We have chosen to study heavy metals and acid rain because, thanks to industrialisation and development, these problems are no longer localised. In addition, it was considered essential to understand the impact of these phenomena and use living organisms to illustrate and explore the effects also occurring in nature.
The test organism used in the experiment was the garden cress (*Lepidium sativum*). Several experimental settings were tested: plants were treated with zinc, cadmium, and acid rain solutions. The study aimed to observe the effect of acid rain and heavy metals on the physical parameters of the plants (root and stem length, leaf area) and the vitamin C content. Vitamin C can be an excellent tracer to detect stress effects on the plant.

Characterisation of heavy metals

The metals and elements of metallic character are found to the left of the boron-asthate line in the periodic table, except for hydrogen. Metals can be divided into light and heavy metals. One of the many definitions is that light metals have a density of less than 5 g/cm^{3,} and heavy metals have a density of more than 5 g/cm^3. From another point of view, aluminum (Al) and its alloying metals, such as titanium (Ti), are called light metals, and elements with a higher atomic number than iron (Fe) are called heavy metals [1].
Heavy metals and their compounds can significantly affect biological processes. We can also group metals according to their bioavailability and toxicity. They can be divided into three groups: essential elements, readily bioavailable toxic elements, and toxic metals that are difficult to bio avail. Essential heavy metals, i.e., essential heavy metals, can cause deficiency diseases at low doses and intoxication at high doses [2].
Essential elements are involved in the structure of the living organism and the processes involved in the functioning of life. They can be found in our food and provide the amounts living organisms need [3]. These elements include iron (Fe), copper (Cu), zinc (Zn), chromium (Cr), manganese (Mn), and molybdenum (Mo) [4].
On the other hand, toxic elements harm living organisms, even in minimal amounts [2]. Cadmium (Cd), cobalt (Co), chromium (Cr), mercury (Hg), molybdenum (Mo), and lead (Pb) are considered toxic heavy metals. Their effects are affected by their form and the medium in which they are found [4].
Heavy metals can also be present in our food and our household items. They are also used in spraying agents, technical equipment, fuels, and health care [3].
The heavy metals are not only found in the artificial environment but also nature. In nature, heavy metals are known to form part of the lithosphere. They can be deposited on the soil and above-ground plant organs by adhering to the surface of particulate matter [5].

The elimination of heavy metals from the body is a long process, but in the meantime, they can accumulate in the body, such as in the bones, liver, brain, kidneys, and even in the hair and skin. They can reduce the body's resistance, manifesting as allergic or inflammatory symptoms [2].
In recent decades, attention to heavy metals has shifted from health effects to environmental pollution. Over the years, it has also become clear that nature cannot tolerate their presence indefinitely [6].
Creation of acid rain. Human activity is mainly pollution resulting from the conversion of fossil fuels, primarily emitted to the atmosphere by transport and industry. The average acid rain contains one-third nitric and two-thirds sulphuric acid [7].
Acidic substances can spread in the atmosphere in two ways. Vertical displacement is caused by ordered (convection) and disordered (turbulent) motions. In addition, contaminants can also spread horizontally due to ordered (advection) movement in the direction of wind speed [8].
Power plants and domestic heating mainly emit sulphur of anthropogenic origin. It can be released during natural volcanic activity and decomposition processes. According to Horváth [8], Sulphur dioxide (SO_2) levels in heavily polluted areas can be thousands or even tens of thousands of times above the natural limit.
The most common formation of Sulphuric acid in the atmosphere is as follows. Oxygen atoms (O) released from ozone oxidise Sulphur dioxide (SO_2) to form Sulphur trioxide (SO_3). Sulphur trioxide (SO_3) reacts with moisture in the air to form sulfuric acid (H_2SO_4) [8].
Nitrogen oxides (NOx, N_2O) are not the only nitrogen-containing substances released into the air, but also other nitrogen-containing substances such as ammonia (NH_3) or ammonium ion (NH_4^+) through biological decomposition, fertilisation, industry, and transport. Nitrogen oxides (NOx, N_2O) can be involved in various reactions. Nitrogen dioxide (NO_2) can be decomposed by photolysis and then reacted with the hydroxyl radical (OH) formed by the photolysis of nitric acid (HNO_3) to form nitric acid (HNO_3). Another possible formation of nitric acid (HNO_3) is when nitrogen dioxide (NO_2) is oxidised and subsequently reacts with another nitrogen dioxide (NO_2) molecule. The resulting nitric pentoxide (N_2O_5) reacts with water to form nitric acid (HNO_3) [9].

Several researchers have found that acid rain can also contain phosphoric acid formed from phosphorus compounds and the already-known nitric and sulphuric acids. For example, Velikova et al. [10] used a mixture of sulphuric and phosphoric acid in their research. While other researchers have used a mixture of sulfuric acid and nitric acid in their experiments, such as [11-14]. Wen et al. [15] investigated the effect of lanthanum ion (La^{3+}) and acid rain using a 1:4.7 ratio of sulfuric acid to nitric acid. In addition, wheat cultivars have been tested [16] with a pH 4.5 solution.

The Impact of Acid Rain
The development of acid rain and its environmental impact was already known in industrialised countries at the end of the 19th century. The first law regulating emissions of harmful substances to the environment was passed in England in 1863. It was known as the Alkali Act and required the reduction of emissions of hydrochloric acid. Nevertheless, acid deposition became a problem in the 20th century [17].
The term 'acid rain' was introduced by Robert Angus Smith [18], a British researcher, in 1872. Nowadays, the term acid rain is replaced by acid deposition. Studies show that half of the gases in the atmosphere that cause this problem are released into the atmosphere naturally and the other half artificially [19].
The effects of acid rain are often not immediate, and it can take years before the damage it causes is noticeable. One reason for this is that most of the time, the effects occur much further away from the point of release. An example is Sweden, where 90% of the Sulphur deposition likely originated from other European countries, mainly England [17]. Menz and Seip [20] also mention the massive deforestation in Scandinavia in the 1970s. Its impact is not always uniformly strong, depending on the medium it enters. When in contact with other substances, the effects of pollution can be cumulative (additive), mutually reinforcing (synergistic), and mutually attenuating (antagonistic). The damage can be of two types: direct and indirect. Direct effects occur

when buildings and sculptures are damaged. Indirect effects can be caused by damage to the living and non-living Environment. Most often, a combination of both types of impact occurs. Summarising the effects of acid rain and atmospheric dry deposition, we can say that they affect biota diversity and the species composition of communities [21].
Part of soil acidification is a natural process that can result from the buoyant water balance of the area and the uptake of nutrients by plants. Soil acidification can result from human activity, such as crops and fertilisers' tillage calcium (Ca) uptake. In addition, acid rain, which is becoming more frequent, is responsible for soil acidification and has an increasing impact [22].
A study by Hordijk and Kroeze [23] found that the acidity of precipitation has changed from an average pH of 5.6 to 4.5 but found areas where this value may be even lower. Zhang and Jiang studied precipitation in China and found that 43.13% of the samples tested were highly acidic, i.e., pH lower than 4.5.
With such pH values, it is no wonder that the environment and nature suffer severe, often irreversible, damage. Kádár [25] reports that many lakes have become acidified, resulting in the partial or complete extinction of flora and fauna.

The adverse effects not only affect nature but also human health. In this case, we are no longer talking about acid rain but about inhaling acidic pollutants. It is a well-established fact that there is a correlation between the pollution of an area and the mortality rates in that area. Sulphuric acid aerosols pose a risk because they can be inhaled and reach the most hidden part of the lungs [8].
The first UN Conference on the Environment was convened in Stockholm in 1972 in response to the increasing damage. During the negotiations, it was agreed to establish the United Nations Environment Program (UNEP), which created a global international monitoring network. Later, European countries established the European Monitoring and Assessment Program, which models and measures sedimentation on a continental scale [17].
In Hungary, the concentrations of Sulphur and nitrogen compounds responsible for acidification in both air and precipitation have been monitored since the 1970s. Observations show that Sulphur dioxide (SO_2) concentrations have decreased since the 1980s due to industry decline. Nitrogen dioxide (NO_2) and nitrate (NO_3^-) concentrations have also decreased due to the decline in chemical activity.
In Hungary, the pH of rainfall averages 4.6. Regular testing of rainwater in the country started in 1965. The laboratory of the Central Institute of Atmospheric Physics and the country's ten regional background pollution monitoring stations were also included in the WMO system. In most places, an automatic measuring system collects monthly total precipitation [26].

MATERIALS AND METHODS

Garden Cress (Lepidium sativum)

Taxonomic position and relationship: the garden cress belongs to the family *Angiospermatophyta*, class *Dictyledonopsida*, and is a species of the genus *Lepidium*, a member of the family *Brassicaceae*. The genus is characterised by its ovoid or rounded, smooth, two-seeded, bearded fruits, which are compressed on the sides. It has bulging, erect stems and is a perennial or annual plant, usually found in temperate and subtropical areas.

Appearance. The stem under the petiole is yellowish, sometimes pale green, straight, 10-15 mm long, 1-1.2 mm in diameter. The stem elongates in poor light conditions. In this case, the stems drop from the weight of the stem and produce additional leaves when lying down.
Root: The axis of the central root system is the radicle, which can be up to 6-10 mm in diameter at the root neck. The root is rich in ramifications, but the soil compactness influences this. It increases its branching in compacted soils, while in less compacted soils, it penetrates deeper.

Shoots and stems: usually grow to a height of 40-80 cm before flowering. The stem is rough and becomes woody after flowering. Stems are glabrous, cylindrical, and bluish green. On its stems of uniform length, the lateral shoots shorten in length towards the tip.

***Leaves**:* Variegated, bluish-green, and scattered on the stem. The edges may be irregularly toothed or serrated. Leaf plates are winged-veined, with veins slightly bulging on the backhand side.
Inflorescence and flower. The flowers are small, 3-5 mm in diameter, white.

***Fruit and seed**:* The cress has a bearded fruit, which is broad-oval and flattened. The fruit is biconvex, containing 1 to 1 seed, rarely 2. The seed is smooth, reddish-brown, and obliquely oval.
Germination: They germinate quickly at room temperature, but the process slows as the temperature drops. Experiments have shown that only 33% of seeds germinate at 0-10°C [27].

***Ecological requirements**:* Heat and light. Above 20°C, the cassava grows most rapidly if light conditions suit it.
***Water**:* it requires moist soil to grow. It needs a moist soil to grow.
***Soil**:* Prefers black meadow soils, sandy loam, or slightly bound chalky soils. It grows well with a good lime content but dies in waterlogged areas. It thrives in slightly acidic conditions with a pH of 6-6,8 and swards. It is not an excellent pre-sowing crop because it is very demanding on the soil [27].
***Physiological effects**:* garden cress is believed to have a blood-purifying and metabolic-improving effect. It contains essential oils, vitamin C, and plant antibiotics. The flowering period is around June-July [28].
***Scientific uses**:* They found the plant suitable for their experiments because of its short growing season and ability to absorb contaminants from the soil.
Gianazza et al. [29] investigated the effect of cadmium on growth and proteins in garden cress. The effects of acid rain and heavy metals on different edible plants were complemented by microplastic pollution [30]. They observed plant germination in these contaminated soils. Arambašić et al. [31] investigated the acute toxicity of heavy metals in several test organisms, such as garden cress.

Figure 1. Garden Cress (*Lepidium sativum*)

Vitamin C
Vitamins are essential for the human body to function correctly. Vitamins are made up of small molecules with different chemical compositions, but they also have the essential property of being biologically active and organic compounds. Vitamins, like heavy metals, are also characterised by their deficiency and excessive

intake. They can enter the human body with food. They can be found in green peppers, tomatoes, potatoes, lettuce, and cabbage, as well as in fruits such as blueberries, blackberries, currants, rosehips, citrus fruits, and garden cress [32].
Vitamin C has a lactone ring in its structure, which gives it many carbohydrate properties. It is chemically a γ-lactone of 2-deoxy-2-keto-L-gulonic acid. Its acidic character is due to the two enol hydroxyl groups it contains. It has a strong reducing effect. It is a colourless, crystalline compound, soluble in water.
However, it is easily oxidised in aqueous solution, catalysed by metal ions. Vitamin C can be found in plants and animals but cannot be produced by humans [33]. In most animal species, vitamin C is formed similarly to plants, mainly by enzymes. These enzymes are usually found in the liver of animals but also the kidneys of birds, for example [34].

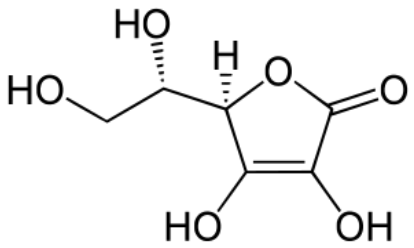

Figure 2. Ascorbic acid (Source: [35])

Vitamin C plays a role in cell biochemical processes as a hydrogen donor and is an important antioxidant. Once in the body, approximately 85% of it is absorbed, during which it promotes iron absorption. The pure form of the vitamin was first extracted from peppers by Albert Szent-Györgyi. His research in this field earned him the Nobel Prize in Physiology and Medicine in 1937 [36].
The disease that occurs in its deficiency is scurvy. It is characterised by dry skin, indigestion, gingival atrophy, and consequent tooth decay. Long-term deficiency increases the risk of cardiovascular disease and cancer [33]. Studies have shown that it may also play a role in detoxification processes. It is also required to form bone marrow, cartilage, bone, spleen, liver cells and even tooth dentin [34].

Soil

The soil used for the study was "Hahot" soil (No. 02.5/2138/2/2009) (110 g). The soil characteristics were as follows (Table 1):

Table 1. Characteristics of "Hahot" soil (No 02.5/2138/2/2009)

Quality parameters	Values
Volumetric mass (kg/dm^3)	no more than 0.6
pH (in a suspension of 10%)	5.9-7.0±0.5
Dry matter content (m/m %)	at least 45.0
Organic matter content in dry matter (m/m %)	at least 75.0
Total water-soluble salt content (g/kg)	no more than 2.0
Grain composition below 20 mm in dry matter (m/m %).	100.0
Total nitrogen (N) content in dry matter (m/m %)	at least 2.5
Total phosphorus pentoxide (P_2O_5) content in dry matter (m/m %)	at least 0.2
Total potassium oxide (K_2O) content in dry matter (m/m %)	at least 0.3
Arsenic (As) content in dry matter (mg/kg)	no more than 15. 0

Treatments

In the studies, plants were treated with two types of acid rain, a mixture of nitric acid and sulfuric acid or phosphoric acid and sulfuric acid ([10-13]. Another group was contaminated with zinc, cadmium and a mixture of the two metals.

In the third setup, the garden cress was divided into two groups. One group was treated with phosphoric acid rain and one heavy metal each, and all contaminants were applied simultaneously. The other group was treated similarly, except the acid rain here was a mixture of nitric acid. Some of the garden cress was applied as a control (i.e. they did not receive any contamination). The treatments were repeated in three replicates.

The names and abbreviations are shown in Table 2.

Table 2. The names and abbreviations of the different treatments

Name	Abbreviations
Control	Control
Zink	Zn
Cadmium	Cd
Zink-Cadmium	ZnCd
Phosphorous acid rain	ARP
Nitric acid rain ARN	ARN
Zinc phosphoric acid	ZnARP
Cadmium phosphoric acid	CdARP
Zinc-cadmium phosphoric acid	ZnCdARP
Zinc nitric acid	ZnARN
Cadmium nitric acid	CdARN
Zinc-cadmium nitric acid	ZnCdARN

Planting

The experiment was set up by sowing 3400 seeds of garden cress ("Bioorganik Online" Ltd., from controlled organic farming, HU-ÖKO-01, controlled by "Biokontroll Hungária" Ltd.) seeds in a 440 cm^3 plastic container. Before planting, the seeds were soaked in distilled water for half an hour. The seeds were then spread evenly over the soil surface. The soaked seeds germinated quickly after a 24-hour dark phase. While the garden cress was growing, the pots were rotated and changed during the treatments to ensure even light coverage for each pot and the plants were grown accordingly for six days. Preliminary experiments have shown that the vitamin C content of 6-day-old cress was the highest [37], hence the choice of a 6-day growing period.

Acid rain

Stock solutions have been prepared to produce the rain. The stock solutions were 0.5 moles of sulphuric acid, 0.33 moles of phosphoric acid and 1 mole of nitric acid. Two acid rain solutions were prepared for the tests. A 1:4.7 mixture of 0.5 molar sulfuric acid and 0.33 molar phosphoric acid [15] was chosen as one of the rains. In the previous ratio, the other rain contained nitric acid and sulfuric acid (e.g., [12]). Subsequently, the solutions were adjusted to pH 4.5 using distilled water [16] because precipitation is considered acid rain from this value. 15 cm^3 of acid rain was mixed into the soil.

Heavy metals

The soil was contaminated with zinc ($ZnCl_2$) and cadmium ($CdCl_2$) during the experiment. The contamination limit for zinc in the soil medium is 200 mg/kg dry matter according to the Decree 6/2009 of the Joint Decree of the Ministry of Agriculture, Forestry, Environment and Water Management of the Ministry of Agriculture,

Forestry, Environment and Water Management. The solutions were adjusted to concentrations corresponding to these limits so that this contaminant was 15 cm^3 of solution and then mixed into the soil.

Combined treatment

The test plants were treated simultaneously with zinc + cadmium solution ($ZnCl_2$, $CdCl_2$) and different combinations of heavy metals and acid rain. Some horticultural grasses received nitric acid, zinc, nitric acid, cadmium, and metals simultaneously. These treatments were also carried out with phosphoric acid.
For the adjustments, the solutions were prepared so that the concentration of impurities in 15 cm^3 was by heavy metal Chapter for the metals, and the acid precipitates were present in the proportions mentioned in the Acid Rain Chapter.

Preparing plant samples for vitamin C measurement

Preparation of garden cress requires care and precision because the vitamin C in the plant decomposes rapidly in response to UV light, heat and oxygen in the air. Several methods of vitamin C extraction are available in the literature [38-39]. The recipe is a modified version published by [40].
The plants were removed from the pots and prepared to determine vitamin C content. The roots were removed first because only the leaves and stems of the cassava were consumed. From the plants, 2 g were weighed out with analytical precision. After measurement, 150 µl of glacial acetic acid and a small amount of high-purity quartz sand were rubbed into a pulp and filtered through a 0.45 µm filter into 5 mL brown volumetric flasks. The samples were filtered once more and loaded into centrifuge tubes.

The HPLC instrument used for the measurement

A JASCO PU 980i INTELLIGENT pump equipped with a Rheodyne 7010 injector with a 20µl loop was used for the HPLC measurement. BST Rutin C18 MS 120x4 mm column and C18 pre-column were used for the measurement. The instrument detector was JASCO UV-2077. JASCO ChromPass Chromatography Data System, version 1.7.403.1, data acquisition and system control software were provided with the HPLC instrument.
For the separation, 2% acetic acid was used as a mobile phase with a flow rate of 1 mL per minute. The measurement was performed at room temperature. The results were detected at 243 nm.

STATISTICAL ANALYSIS

Description

After the completion of the experiment, all experimental data was collected and recorded in Excel form. Data processing was done with the help of Excel forms.

Analysis of Variance

ANOVA (Table 1) one-way analysis of variance SPSS 14. was performed.

RESULTS

Compared to the control plants, it is noticeable that the emergence of the treated cresses is not uniform. Among the treatments, the zinc-treated samples are the most like the control group. The combined treatments had the most substantial effect, where the number of hatched plants was significantly less.

Fan and Wang [11] observed the effect of acid rain mixed with 0.5 mL sulfuric acid and 1 mL nitric acid in a 10:1 ratio on germination. All plants showed visible traces of treatment. They found significant inhibition of germination at pH 2, like our experience.

Results of the comparison of physical parameters
Effect of treatments on root length

Figure 3 shows the variation in root length dimensions. Figure 3 shows that compared to the control plants, the root length of garden cress treated with cadmium and nitric acid rain did not differ significantly, but the root length decreased on average due to the other treatments.

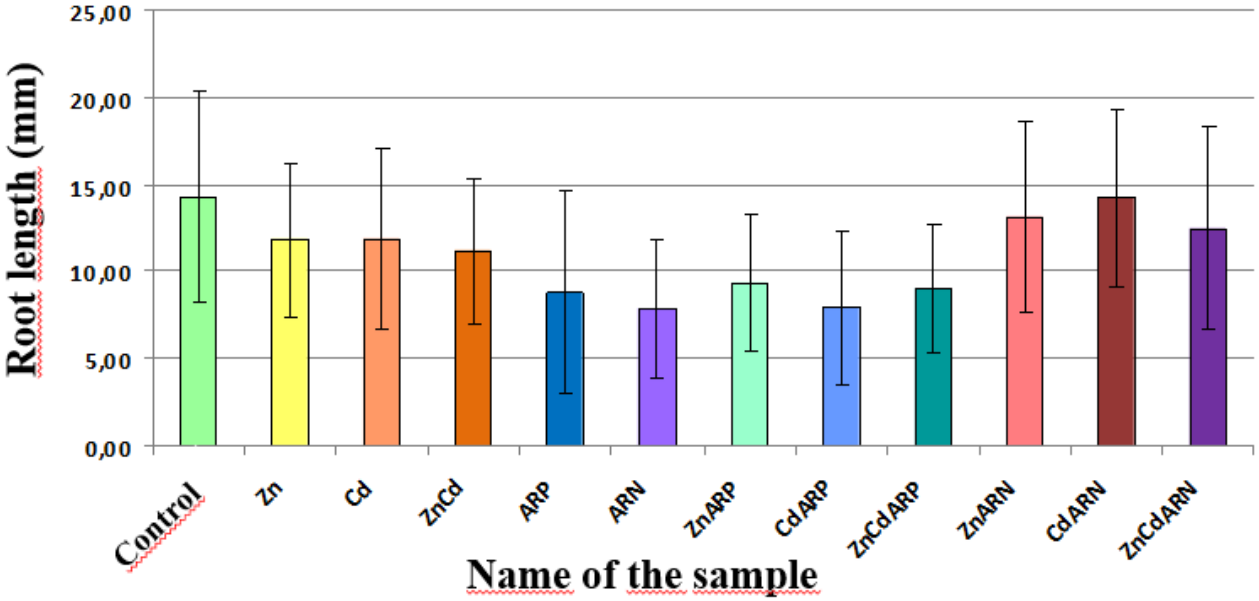

Figure 3. Root length of samples treated with heavy metal and/or acid rain

To support the conclusions drawn from Figure 3, the root length was also evaluated using a statistical software package (SPSS 14.0 version). Statistical analysis (Table 3) shows that the treatments differ significantly ($LSD_{5\%}$=2.283).

Table 3. Variance table: change in root length because of treatments.
Dependent variable: root length

Factor	SQ	FG	MQ	F	Sig.	$LSD_{5\%}$
Corrected model	3008.613(a)	25	120.345	5.076	.000	
Correction factor	65450.046	1	65450.046	2760.576	.000	
Treatment	2673.131	11	243.012	10.250	.000	2.02
Replication	335.481	14	23.963	1.011	.441	
Error	12186.341	514	23.709			
Total	80645.000	540				
Corrected total	15194.954	539				

It can be said that the root length of all treatments except ZnARN, CdARN and ZnCdARN was significantly shorter compared to the root length of the control samples. The Zn treatment significantly differed from all other treatments except Cd, ZnCd, ZnARN and ZnCdARN samples, with longer root lengths in all treatments except the control.
In the case of Cd treatment, except for Zn, ZnCd, ZnARN, and ZnCdARN treatments, it was significantly different from the other treatments, namely significantly longer root length, except for control and CdARN treatments. The root length of the Zn+Cd combination treatment differed significantly from the control, ARP, ARN, CdARP, and CdARN samples only, except for the control and CdARN, which had longer root length than the others.
The ARP treatment has a significantly shorter root length than most samples. On the other hand, ARN, ZnARP, CdARP, and ZnCdARP treatments do not have significantly different root lengths. The root length of ARN treatment is significantly shorter compared to the root length of the majority of samples. The ARP, ZnARP, CdARP, and ZnCdARP treatments do not differ significantly from the ARN treatment in root length.

Effect of treatments on stem

The variation in stem length is illustrated in Figure 4. The stem lengths of the plant decreased as a result of the treatments compared to the control. From the figure, the highest values were measured for the control and the lowest value was associated with the phosphoric acid treatment.

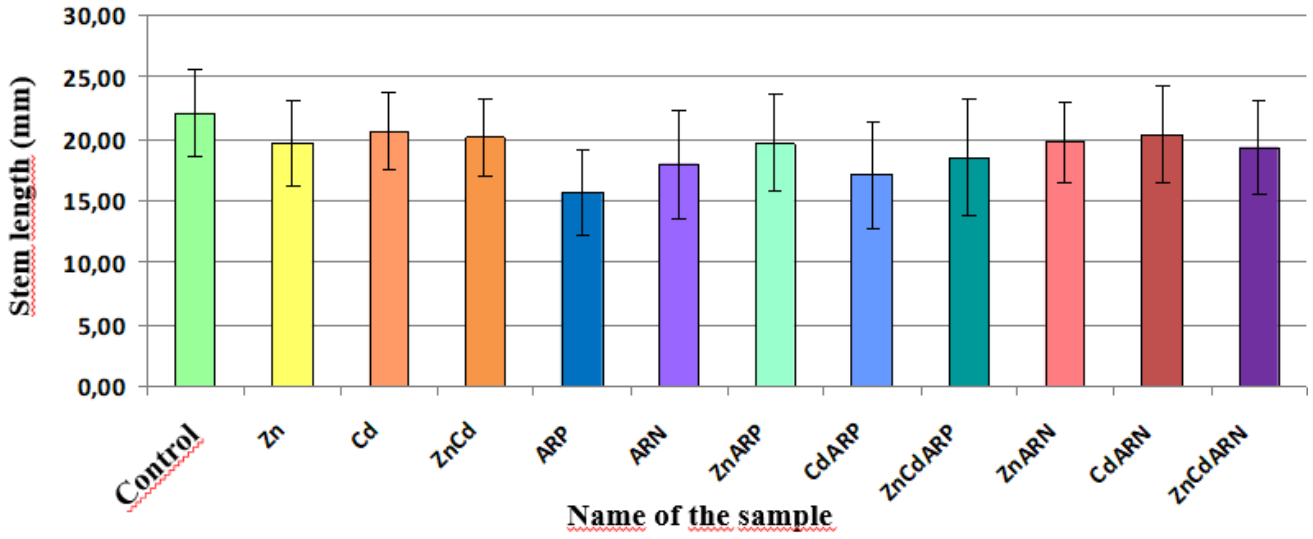

Figure 4: Stem length of samples treated with heavy metal and/or acid rain

Statistical analysis was carried out to confirm the conclusions drawn from Figure 4. The statistical analysis (Table 4.) shows that the treatments differ significantly ($LSD_{5\%}$=2.008).

Table 4. Variance table: change in stem length as a result of treatments.
Dependent variable: stem length

Factor	SQ	FG	MQ	F	Sig.	$LSD_{5\%}$
Corrected model	1625.052(a)	25	65.002	4.461	.000	
Correction factor	198988.807	1	198988.807	13655.317	.000	
Treatment	1453.637	11	132.149	9.069	.000	1.575
Replication	171.415	14	12.244	.840	.625	
Error	7490.141	514	14.572			
Total	208104.000	540				
Corrected total	9115.193	539				

Effect of treatments on leaf area

Figure 5 shows the variation in leaf area dimensions. Figure 5 shows that compared to the control plants, the leaf area of garden cress treated with cadmium and nitric acid rain did not differ, but the leaf area decreased on average due to the other treatments.

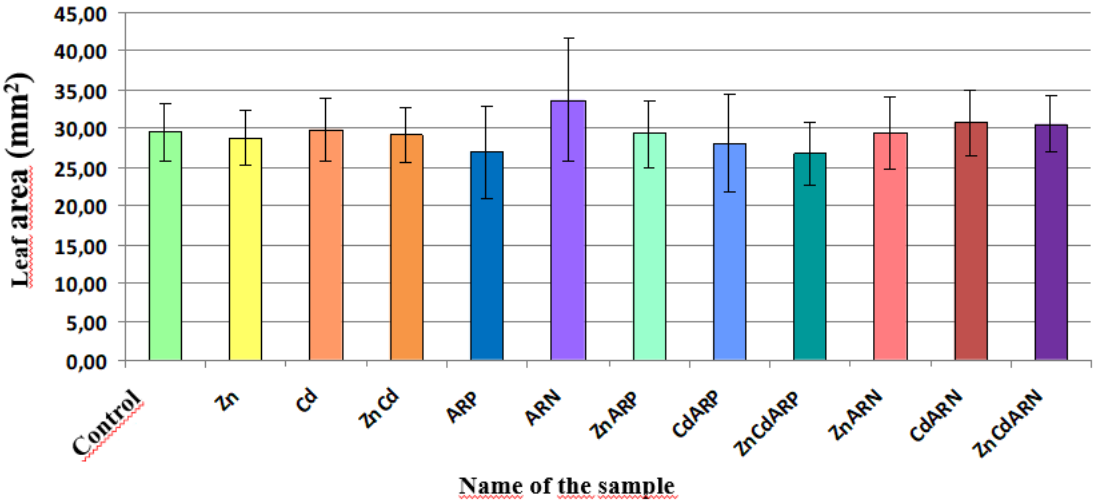

Figure 5. Physical parameters of samples treated with heavy metal and/or acid rain

Compared to the leaf area of control samples, ARP, ARN, and ZnCdARP samples were significantly smaller, except for the ARN treatment leaf area. The leaf area of the other treatments was not significantly different from the control.

For the Zn treatment, the leaf areas of ARN and ZnCdARP were significantly different; namely, the ARN leaf area was significantly higher, while the ZnCdARP leaf area was significantly smaller for the Zn treatment.

The leaf area measured for the Cd-contaminated samples significantly differs for ARP, ARN, and ZnCdARP treatments. The leaf area is significantly smaller for ARP ZnCdARP and significantly higher for ARN than for Cd.

For ZnCd treatment, the leaf area measured for ARP, ARN, and ZnCdARP treatments is significantly different, which was also observed for Cd samples.

The ARP treatment leaf area is significantly smaller than that of most samples. However, the Zn, CdARP, and ZnCdARP treatments are not significantly different in leaf area. ARN treatment leaf area is significantly more significant compared to the other treatments. In this case, the largest leaf area was measured.
The results of the statistical analysis are presented in Table 5.

Table 5. Variance table: change in leaf area after different treatments.
Dependent variable: leaf area

Factor	SQ	FG	MQ	F	Sig.	$LSD_{5\%}$
Corrected model	1979.763(a)	25	79.191	3.341	.000	
Correction factor	466872.007	1	466872.007	19695.313	.000	
Treatment	1673.104	11	152.100	6.416	.000	2.008
Replication	306.659	14	21.904	.924	.532	
Error	12184.230	514	23.705			
Total	481036.000	540				
Corrected total	14163.993	539				

Results of the comparison of vitamin C content
Figure 6. shows that most vitamin C was measured in the garden cress treated with nitric acid rain. The control samples contain very low amounts of antioxidants. The conclusions were supported by statistical analysis.

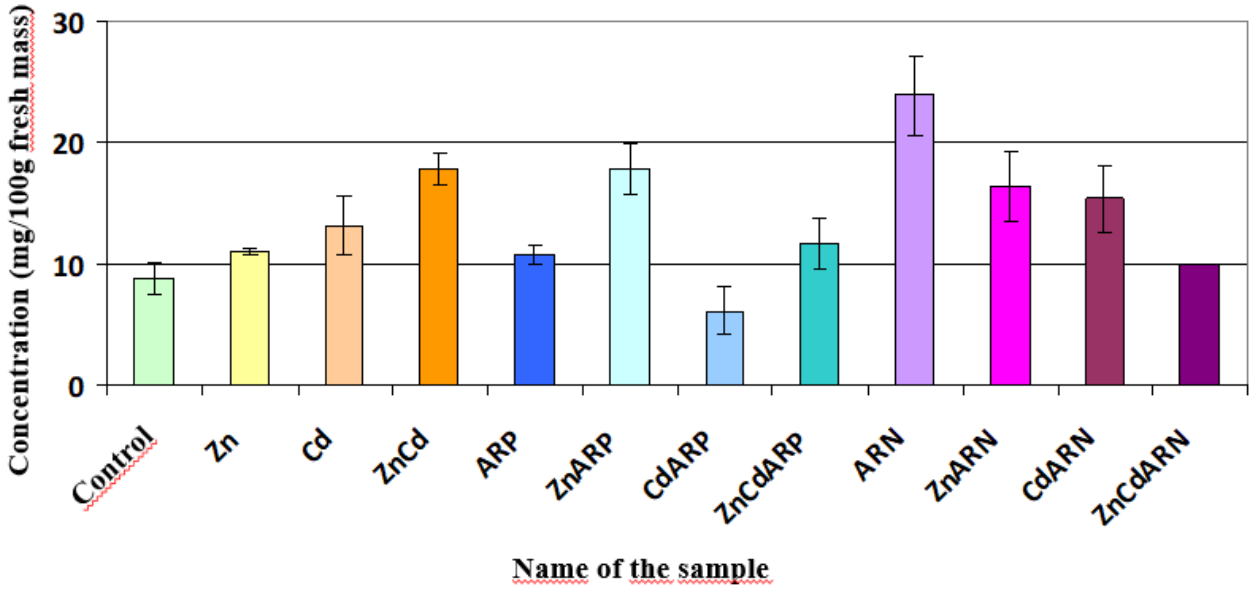

Figure 6. Vitamin C content of garden cress treated with heavy metals and / or acid rain

Statistical analysis was performed to support the conclusions drawn from Figure 6. The variance table (Table 6) shows that the treatments differed significantly ($LSD_{5\%}$=3.535).

Table 6. Variance table: trends in vitamin C content in response to treatments.
Dependent variable: vitamin C

Factor	SQ	FG	MQ	F	Sig.	$LSD_{5\%}$
Corrected model	735.173(a)	13	56.552	13.629	.000	
Correction factor	4990.378	1	4990.378	1202.660	.000	
Treatment	716.605	11	65.146	15.700	.000	3.535
Replication	13.765	2	6.883	1.659	.223	
Error	62.242	15	4.149			
Total	6180.634	29				
Corrected total	797.415	28				

The vitamin C content of the control samples is the lowest and significantly different from the measured values of the Cd, ZnCd, ZNARP, ARN, ZnARN, and CdARN treatments. The Zn treatment differs significantly from the vitamin C contents of ZnCd, ZNARP, ARN, and ZnARN. The highest difference was measured for ARN. The vitamin C content measured for the control, ZnCd, ZnARP, and ARN treatments differed significantly for the Cd treatment. Except for the control, vitamin concentrations are higher. For ZnCd treatment, the vitamin C content measured for ZnARP, ZnARN, and CdARN treatments is significantly different. Only compared to the ARN treatment is the vitamin content lower. The vitamin C content of the ARP treatment is significantly higher than the CdARP treatment. The ZnCd, ZnARP, ARN, and ZnARN cases have significantly lower vitamin C content. ARN treatment had significantly higher vitamin content compared to the other treatments. The highest vitamin C concentration was measured in this case. Velikova et al. [10] studied the effect of phosphoric acid-sulphuric acid rain. They observed changes in peroxidase and catalase enzymes in bean seedlings. For all treatments, they found that acid rain significantly increased peroxidase and decreased catalase enzyme activity during the first hour after treatment, like our studies. Later, the activity of both enzymes increased.

CONCLUSIONS AND RECOMMENDATIONS

In our tests, we studied the effects of acid rain on the test organism. In addition, the effect of heavy metals on plants has been studied in our experiments, where we can observe the effect of metals and how they act in acidic media.

In the tests, we also observed the effect of the two heavy metals on each other, as they are antagonistic to each other, i.e., they can inhibit each other's action [41-42], and therefore the same type of compound (chloride) was chosen for both pollutants. Other researchers [43] used the same pollutants in their experiments with seed beans but in the form of acetate of the heavy metals. Their experimental results (measured by the fresh weight of the plant) showed that all cadmium, zinc, and acid rain treatments reduced growth, especially in high metal and acid concentrations. The combination of the three contaminants has a more severe toxic effect than if the contaminants acted alone, which we found.

The pollutants were tested in the soil. Others have also used this setup; for example, in 2004, Youn-Joo [44] tested the effects of cadmium contamination on several different plants by mixing a cadmium solution into the soil before sowing. His results showed that the highest concentration reduced germination, and that the cadmium content of the plants increased with each concentration—cucumber roots accumulated high levels of cadmium, followed by wheat and maise. Sorghum transported more cadmium from the root to the stem than other crops.

Smolińska and Cedzyńska [45] investigated the inhibition of mercury accumulation in garden cress. The results showed that the highest mercury concentrations were found in the plant's roots, but significant amounts were also found in the stems.
Based on the measurements and their evaluation, it can be said that nitric acid treatment showed an increase in leaf area and vitamin C content, probably due to good nutrient supply (nitrate supply) and that hyssop is not very sensitive to acid pH, surviving at pH 6-6.8 [27-28]. Still, it has been observed that it tolerates more acidic pH (pH=4.5) well. Vitamin C content showed a significant decrease with Cd and phosphoric acid treatments. However, it can also be said that nitric acid rain, zinc and their combined presence stimulated the test organisms' physical parameters and antioxidant content.
Both environmental problems could best be controlled by reducing emissions. This could be achieved by replacing current technologies with new, lower-emission technologies, filtering equipment, and using environmentally friendly energy sources.

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ATTENUATION OF CARBON TETRACHLORIDE INDUCED NEPHROTOXICITY IN RATS BY *INDIGOFERA CORDIFOLIA*

Zunaira TEHSEEN

NARC, Islamabad, Pakistan
E-mail: zunairatehseen13@gmail.com, +92 340 2747545

Abstract: *Plants have been used for treating various illnesses since ancient times due to their therapeutic and medicinal properties. The methanolic extract of I. cordifolia was investigated in-vitro and in vivo, revealing the presence of phytochemicals such as flavonoids, coumarins, alkaloids, saponins, tannins, quinones, and glycosides. In vivo, rats with CCl_4-induced toxicity were given an oral dose of the methanolic extract, and the plant's impact was evaluated biochemically, histologically, and molecularly. The study found that ICM enhanced renal functionality by increasing albumin levels and decreasing urea and creatinine levels in serum. It also restored the biological system's antioxidative status by balancing antioxidant enzymes, protein content, and oxidative species. Furthermore, it reversed the expression of genes affected by CCL_4-induced toxicity and oxidative stress. Overall, ICM is a valuable source of antioxidants and has nephroprotective qualities against both acute and chronic kidney disorders.*

Keywords: *CCl_4, Nephrotoxicity, Indigofera Cordifolia, Methanolic extract, Nephroprotection*

INTRODUCTION

Oxidative stress occurs when reactive oxygen species (ROS) outweigh antioxidant defences, leading to damage to proteins, DNA, and cell membranes. This accumulation contributes to disorders like cardiovascular diseases, neurodegenerative conditions, and inflammatory disorders. An aerobic lifestyle generates ROS, impacting an organism's health. The antioxidant system, including enzymes and compounds, defends against oxidative damage. Unpaired electrons in free radicals intensify chemical reactivity, potentially causing inflammation and tissue destruction. Increased ROS production can lead to lipid peroxidation, mutagenesis, and carcinogenesis (Griendling *et al.,* 2021). Carbon tetrachloride (CCl_4) is a toxic, non-flammable liquid used in industrial synthesis and solvents. Its free radicals, produced by cytochrome P450 2E1, cause toxicity, lipid peroxidation, and tissue damage. These radicals form covalent bonds with biomolecules, causing DNA damage, mutations, and lipid peroxidation. Exposure to CCl_4 increases reactive lipoperoxides and free radicals, cause organ damage (Shahat *et al.,* 2022).

Oxidative stress, caused by reactive oxygen and nitrogen species, is a major cause of chronic diseases. Antioxidants, found in fruits, vegetables, and medicinal plants, counteract this by preventing cellular damage. Polyphenols, carotenoids, vitamins C and E, and phenolics, flavonoids, and anthocyanins are common antioxidants with anti-inflammatory, anti-aging, and anticancer effects. Vitamin C, while acting as an antioxidant, also prevents scurvy and plays a role in protein modification and cell division (Zeb, 2020).

Non-steroidal anti-inflammatory drugs (NSAIDs) are commonly prescribed but often cause gastrointestinal issues in some users. This toxicity limits their widespread use, leading to concerns about inflammatory diseases. Herbal remedies, long used in traditional medicine, offer promise due to their multi-component nature and ability to target various cellular processes. Phytochemicals found in these remedies demonstrate anti-inflammatory properties by directly inhibiting TNF-α or interfering with its production through signalling pathways like MAPK or PI3K. Compounds like butein and hesperetin have been shown to prevent TNF-α secretion (Bindu *et al.,* 2020).

Indigofera species, widely used in traditional medicine, have been extensively studied for their pharmacological activities, revealing sixty isolated compounds with diverse bioactivities, including antioxidant and anti-inflammatory properties.

The focus on Indigofera Cordifolia explores its potential in alleviating CCl_4-induced kidney damage, utilizing comprehensive methods to analyze phytochemical composition, in vitro antioxidant and anti-inflammatory properties, and in vivo assessments in rat kidneys. Results indicate potential nephroprotective effects, supported by histological analysis, marker estimations, and RNA analysis revealing insights into apoptosis and inflammation markers, suggesting a therapeutic impact on kidney health (J *et al.,* 2017).

MATERIALS AND METHODS

Plant Collection

Indigofera cordifolia whole plant was collected from Quaid-i-Azam University Islamabad capital territory during August 2021. This plant was identified from plant taxonomist Dr. Mushtaq Ahmed, faculty of Biological Sciences QAU Islamabad, Pakistan. The Voucher sample of the plant has acquired Accession No.133365 by Herbarium of Pakistan, Quaid-I-Azam University, Islamabad.

Plant Extraction

The process began with collection and identification of the plant, followed by thorough cleaning to remove debris and dust. After shade drying for approximately two weeks, the plant was powdered using an electric grinder and further refined through a 60-mesh Willy Mill for uniform particle size. Methanol soaking for 2-3 weeks facilitated the extraction of phytocomponents, and subsequent filtration using Whatman's filter paper No. 1 removed plant debris. Distillation via a rotary evaporator removed the methanol, resulting in a semisolid plant extract. Further evaporation in petri plates led to the complete removal of moisture, yielding the dried *I. cordifolia* methanolic extract.

Phytochemical studies

ICME was analysed for the presence of Phenol (Harborne, 1998), Flavonoids (Awoyinka *et al.,* 2007), Tannins (Hagerman *et al.,* 1978), Anthocyanin and betacyanin (Mabry *et al.,* 1963), Alkaloids using Mayer's test (Tallent *et al.,* 1955), Glycosides test (Mir *et al.,* 2013), Anthraquinone (Andersen *et al.,* 1991), Sterols (Conforti *et al.,* 2008), Proteins (Rasmussen, 1935).

Determination of Total Phenolic and Flavonoid Contents

The spectrophotometric method was utilized to determine the total phenolic content. A 20µL aliquot from a plant sample stock solution was mixed with Folin-Ciocalteu reagent and sodium carbonate, incubated, and then analyzed using a microplate reader at 630 nm. A calibration curve with gallic acid served as a positive control to calculate Gallic Acid Equivalent (mg GAE/g DE), expressing the values as milligrams per gram of dry extracts. (Tawaha *et al.,* 2007).

Flavonoid content in plant extracts was determined via spectrophotometry, leveraging the formation of a yellow-coloured complex between flavonoids and aluminum chloride. Stock solutions at 1 mg/ml

concentration were prepared for flavonoid content measurement. A mixture of 10% AlCl3, 1 M potassium acetate, and plant sample was incubated and later analyzed at 415 nm wavelength for absorbance. The flavonoid concentration was assessed using a gallic acid standard curve as a reference (Pękal & Pyrzynska, 2014).

Animals and Treatments

Sprague-Dawley female rats that were six weeks old and weighed between 130-170 g were obtained from the animal house at Quaid-i-Azam University and were maintained at 26 ± 3 °C with a 12 hours dark/light cycle at Primate Facility of the Quaid-i-Azam University Islamabad, Pakistan. The study protocol was approved by Ethical Committee of Quaid-i-Azam University, Islamabad, for the animal care and experimentation. Before the trial began, they were maintained in a fasting state for a whole night. For four weeks on alternate days, CCl_4 was supplied intraperitoneally, whereas ICM and silymarin were given orally using pigeon feeding tubes.

The rats were divided randomly into seven groups containing 4 rats in each group (n=7) as follows: Group I (control); Group II was injected with CCl_4 (30% in olive oil) 1ml/Kg body weight; Group III received 30% CCl_4 (1ml/Kg bw) and intragastrically silymarin (100mg/kg body weight); Group IV and V received 30% CCl_4 i.p (1ml/Kg bw) and intragastrically ICM (400 and 200 mg/kg body weight respectively); Group VI and VII received only ICM intragastrically (400 and 200 mg/kg body weight respectively).

After completing the dosage, rats were given their standard diet for 24 hours without any further treatment. Following the conclusion of the treatment, the animals were euthanized, and blood was obtained through cardiac puncture using standard tubes, then centrifuged and the serum was stored in a refrigerator. The kidneys were extracted and rinsed in ice-cold saline solution (0.9%). After drying with blotting paper, the kidneys were divided into two segments. One portion was allocated for histological examination, while the second portion was treated with liquid nitrogen and preserved at -70°C for subsequent biochemical parameter analysis.

Serum Analysis

Inflammatory factors such as serum creatinine, albumin, urea, and total protein were assessed using commercial spectrophotometric kits. A kidney fragment was cut into 100 mg pieces and crushed in liquid nitrogen. For further homogenization, 1000µl of PO_4- buffer containing EDTA was added. The homogenate was centrifuged for 25 minutes at 12,000 rpm and 4°C. The top layer of the supernatant was removed and stored at 4°C for further tests. The pellet was intended to be discarded.

Catalase Assay (CAT), Superoxide Dismutase Assay (SOD), Peroxidase Assay (POD), Nitrite Assay, Hydrogen Peroxide Assay (H_2O_2), Reduced Glutathione Assay (GSH), Total Protein Estimation, and Lipid peroxidation estimation assay (TBARS) activities were measured using commercial kits and analysed spectrophotometrically with a StatFax 3000 ELISA reader. The results were calculated as per manufacturer instructions.

Histopathological Appraisal of Renal tissues

The kidney was surgically removed from a rat and stored in 10% formalin for histological analysis. The tissues were embedded in paraffin wax and cut into thin pieces. Ethanol was used to wash the sections, which underwent dehydration. Eosin and hematoxylin staining were performed, and the sections were photographed using a DIALUX 20EB microscope and an automated HDCE 50B system.

Molecular Assessment

The study utilized tissue preservation at -70ºC for RNA extraction and reverse transcription-polymerase chain reaction (RT-PCR) to evaluate *I. cordifolia's* molecular efficacy against CCl_4-induced nephrotoxicity using a

triazole reagent-based method (Rio *et al.,* 2010). The comparative CT approach was used to determine the relative expression levels of Rela in kidney samples.

DATA ANALYSIS

The data was analyzed with Graph Pad Prism (version 5, Graph Pad Software Inc., La Jolla, CA). The results are shown as mean ± SD for six independent rats in each group.

RESULTS

Phytochemical Investigation

By using various tests designed specifically for phytochemicals, the methanolic fraction of *I. cordifolia* was qualitatively examined for a variety of phytochemicals (phenols, flavonoids, coumarins, saponins, tannins, anthocyanin and betacyanin, glycosides, alkaloids, terpenoids, anthraquinones, sterol, and proteins). Table 1 below provides an illustration of these phytochemicals' presence.

Table 1. Qualitative evaluation of *I. cordifolia*

Phytochemicals	ICM
Phenols	++
Flavonoids	+++
Coumarins	+
Saponins	-
Tannins	-
Anthocyanin	+
Betacyanin	+++
Alkaloids	++
Terpenoids	-
Glycosides	+++
Anthraquinones	-
Sterol	-
Proteins	+++

Phytochemicals in ICM; indicated by (+) component present, (-) component absent, (++) moderate concentration, (+++) maximum concentration.

Quantitative assessment of Total Phenolic (TPC) and Total Flavonoid Content (TFC)

The equivalents of standards like mg of gallic acid equivalent/g of dry extract (mg GAE/g dry sample) and mg of catechin equivalent/g of dry extract (mg CE/g dry sample) were calculated via the standard regression lines of gallic acid and catechin to determine the TPC and TFC of *I. cordifolia* (Table 2).

Table 2. The total phenolics and total flavonoids content of *I. cordifolia*

Sample	TPC expressed as mg GAE/g of extract	TFC expressed as mg CE/g of extract
ICM	381.66 ± 8.33	120.0 ± 2.0

TPC and TFC are presented in terms of IC_{50}. Values are expressed in their means along with S.D. (Mean ± S.D.) which are significantly different based on p-value<0.05

ICM Effects on Rat's Body Weight

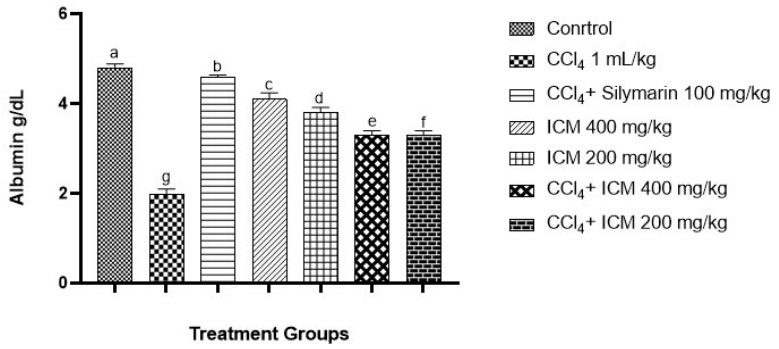
Table 3. Results of ICM different treatments on the rats' % growth in body and organ weight

Treatment groups	Initial body weight (g)	Final body weight (g)	% Increase	Absolute kidney weight (g)	Relative kidney weight (mg/g)
Control	1.34±1.53	180 ± 1.7	25.55 ±1.36^{f}	0.93 ±0.117^{f}	5.16 ± 0.09^{cd}
CCl_4 (1ml/kg)	163 ± 1.53	213 ± 1.68	23.47 ±1.83^{g}	1.68±0.034^{b}	7.88 ± 0.49^{a}
CCl_4 + Silymarin (100mg/kg)	165 ±1.37	245 ± 1.52	32.65 ±2.48^{b}	1.33 ±0.055^{d}	5.42 ± 0.19^{cd}
ICM (400mg/kg)	132 ± 1.12	182 ± 1.62	27.47 ±1.92^{e}	0.95 ± 0.22^{f}	5.21 ± 0.05^{d}
ICM (200mg/kg)	139 ±1.47	204 ± 1.78	31.86 ±1.57^{d}	1.17 ±0.074^{e}	5.73 ± 0.31^{c}
CCl_4 + ICM (400mg/kg)	172 ± 1.09	264 ± 2.23	34.84 ±2.86^{a}	1.93 ± 0.082^{a}	7.31 ± 0.05^{b}
CCl_4 + ICM (200mg/kg)	151 ± 1.53	222 ± 1.49	31.98 ±1.41^{c}	1.64 ± 0.027^{c}	7.38 ± 0.3^{b}

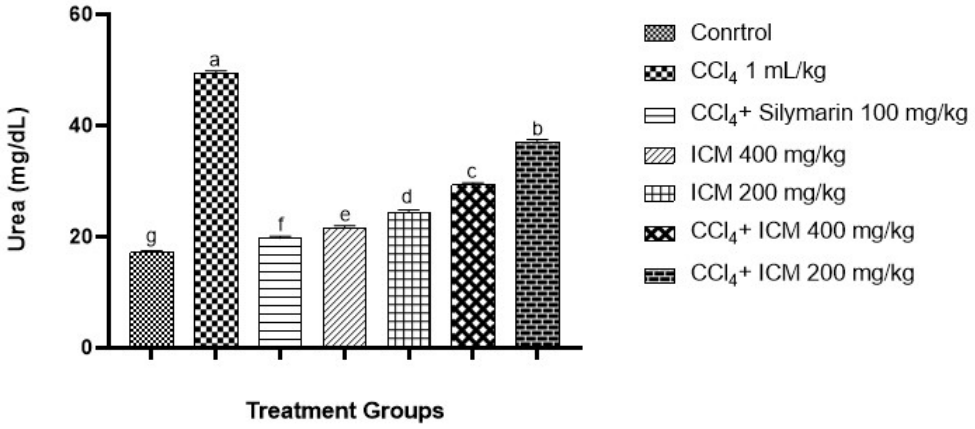
The values are expressed as mean ± SD (n=7). The superscripts (a – f) above each value represent the significant difference (p<0.05) among means. CCl_4; tetrachloromethane, ICM; *I. Cordifolia* methanol extract.

Nephroprotective effect of ICM on renal serum markers and protein

The study evaluated serum markers to assess the protective effect of intracellular matrix (ICM) against nephrotoxicity. Nephrotoxicity causes kidney function loss, affecting the kidney's ability to process and eliminate chemicals. Albumin protein is discharged in urine due to its inability to be reabsorbed from renal tubules, leading to hypo-albunimea or decreased serum albumin levels. Protein breakdown results in the production of urea and creatinine, which are not eliminated by the kidneys and increase serum levels. Control groups and those with oral administration of standard drug (Silymarin) showed higher albumin and lower levels of urea and creatinine, while reverse patten was observed in CCl_4-administered groups. High dose (400mg/kg) of ICM was found to be more effective than low dose (200mg/kg) in reversing nephrotoxicity conditions. The protein content increased at ICM when CCl_4 was administered in low and high doses.

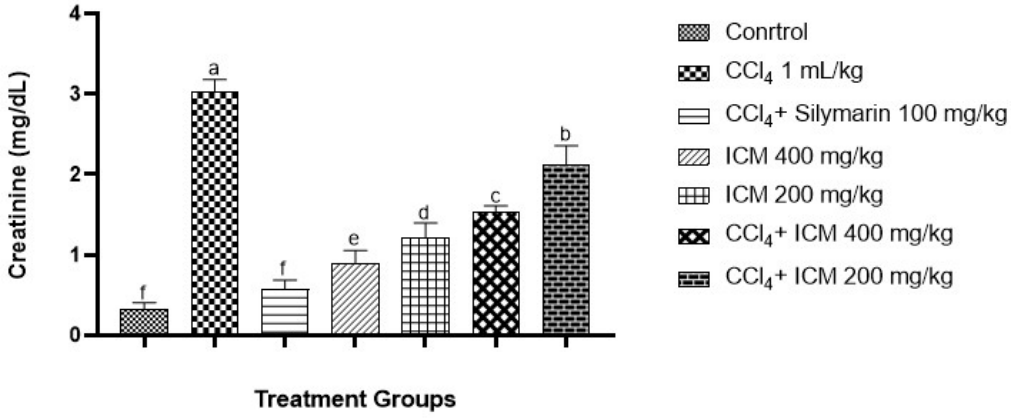


(a)

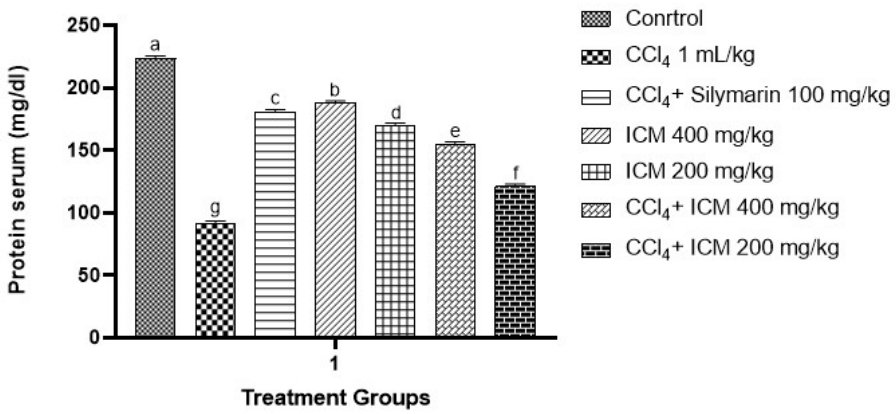


(b)

Figure 1. Nephroprotective effects of ICM on albumin (a) and urea (b) levels



(a)



(b)

Figure 2. Nephroprotective effects of ICM on creatinine (a) and protein (b) levels

Nephroprotective Effect of ICM on Antioxidant Enzymes

Catalase, superoxide dismutase, and peroxidase are antioxidant enzymes that protect against oxidative stress, reducing kidney damage caused by hydrogen peroxide and superoxide.

Table 4. Nephroprotective effect of ICM treatment on antioxidant enzymes

Groups	CAT (U/min)	SOD (U/min)	POD (U/min)
Control	19.58 ± 0.93^{a}	8.66 ± 0.14^{a}	3.87 ± 0.78^{a}
CCl_4 (1ml/kg)	5.83 ± 0.77^{e}	3.62 ± 0.03^{g}	1.28 ± 0.03^{g}
CCl_4 + Sily. (100mg/kg)	17.55 ± 0.97^{b}	7.26 ± 0.09^{b}	3.01 ± 0.08^{b}
ICM (400mg/kg)	16.06 ± 0.75^{bc}	6.59 ± 0.53^{c}	2.83 ± 0.06^{c}
ICM (200mg/kg)	14.83 ± 1.16^{c}	6.09 ± 0.29^{d}	2.67 ± 0.14^{d}
CCl_4 + ICM (400mg/kg)	12.75 ± 0.88^{d}	5.38 ± 0.065^{e}	2.38 ± 0.05^{e}
CCl_4 + ICM (200mg/kg)	11.55 ± 0.73^{d}	4.35 ± 0.05^{f}	2.13 ± 0.12^{f}

Values are expressed as Mean ± S.D (n=7) raised to superscripts designating their significance based on p-value<0.05

GSH and Total Protein Content

CCl_4 treatment significantly reduced protein and GSH levels in rats compared to control and standard drugs. This is due to increased ROS generation, which leads to protein digestion, glomerular filtration, and slower reabsorption, reducing tissue protein content and increasing urine protein excretion.

Table 5. Nephroprotective effect of ICM treatment on GSH and protein content

Groups	GSH content (µmol/mg)	Total Protein (µmol/mg)
Control	25.59 ± 1.04^{a}	11.43 ± 0.18^{a}
CCl_4 (1ml/kg)	3.22 ± 0.22^{g}	5.96 ± 0.10^{g}
CCl_4 + Sily. (100mg/kg)	19.88 ± 1.21^{b}	10.15 ± 0.02^{b}
ICM (400mg/kg)	16.75 ± 0.33^{c}	9.61 ± 0.20^{c}
ICM (200mg/kg)	11.12 ± 1.12^{d}	8.73 ± 0.35^{d}
CCl_4 + ICM (400mg/kg)	9.51 ± 0.14^{e}	8.16 ± 0.09^{e}
CCl_4 + ICM (200mg/kg)	5.08 ± 0.62^{f}	6.93 ± 0.08^{f}

Values are expressed as Mean ± S.D (n=7) raised to superscripts designating their significance based on p-value<0.05

Protective role of ICM on H2O2, Nitrite, and TBAR's content

CCl_4 treatment significantly increased the quantity of oxidative species, including lipid peroxides, nitrite ions, and hydrogen peroxide, due to the oxidation of membrane lipids, proteins, and DNA damage.

Table 6. Nephroprotective effect of ICM on levels of oxidative species

Groups	H_2O_2 (µg/µL)	Nitrite (nM/min/mg)	TBAR's (nM/min/mg)
Control	3.29 ± 0.08^{f}	7.10 ± 1.93^{e}	73.77 ± 3.1^{f}
CCl_4 (1ml/kg)	7.41 ± 0.21^{a}	13.49 ± 0.23^{a}	183.31 ± 5.0^{a}
CCl_4 + Sily. (100mg/kg)	$3,48 \pm 0.13^{ef}$	8.15 ± 0.15^{de}	77.50 ± 2.8^{ef}
ICM (400mg/kg)	3.59 ± 0.11^{e}	8.61 ± 0.36^{de}	81.66 ± 2.9^{e}
ICM (200mg/kg)	4.24 ± 0.17^{d}	$9.54 \pm 1.^{05cd}$	98.36 ± 4.0^{d}
CCl_4 + ICM (400mg/kg)	4.99 ± 0.09^{c}	10.32 ± 0.24^{bc}	119.69 ± 1.7^{c}
CCl_4 + ICM (200mg/kg)	5.45 ± 0.12^{b}	11.84 ± 0.25^{b}	132.05 ± 2.7^{b}

Values are expressed as Mean ± S.D (n=7) raised to superscripts designating their significance based on p-value<0.05

Histopathological Analysis of Kidney

A study on renal tissues revealed morphological changes in kidney nephrons, including cellular enlargement, widening of the bowman's capsule, hydropic degeneration of proximal convoluted tubules, and deterioration

of glomerular capillaries and tubular cells. Normal nephrons were observed in control rats and rats given standard medication. Low doses of intracellular matrix (ICM) cannot restore normal nephron architecture. However, a high dose of ICM can mitigate toxicity's negative effects on nephron structure. Plant doses also showed different impacts compared to normal rats and regular medication.

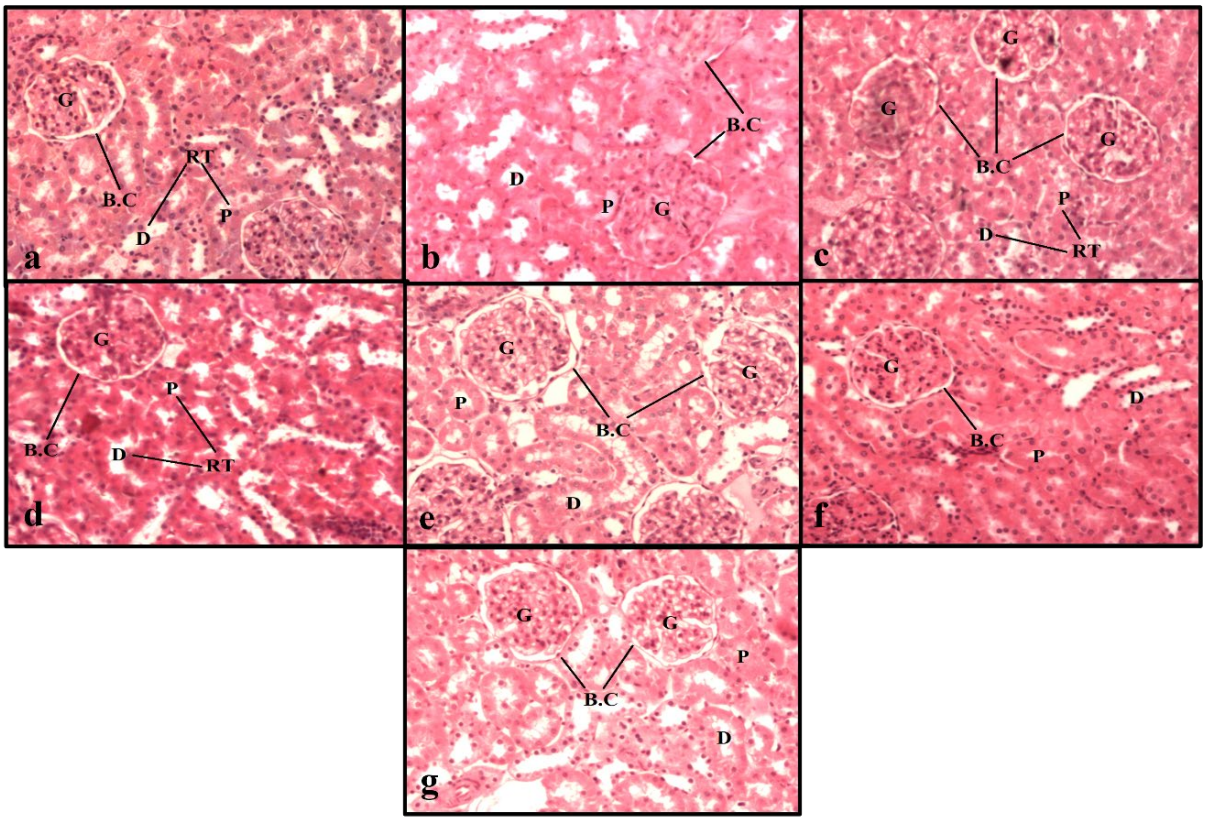


Fig 3. Nephroprotective effect of ICM on CCl_4 induced nephrotoxicity.
(a) Control group showing normal glomeruli (G) surrounded by Bowman's capsule (BC) and normal renal tubules.
(b) CCl_4 group (1 ml/kg b.w.) showing hypercellularity of glomeruli and widening of the Bowman's space. Some renal tubules exhibited vacuolar degeneration, and their lumens were filled with cellular debris, glomerular and tubular necrosis; normal histological appearance was observed in
(c) CCl_4 + silymarin,
(d) ICM (400 mg/kg b.w.), and
(e) ICM (200 mg/kg b.w.); groups treated with (f) CCl_4+ ICM (400 mg/kg) and (g) CCl_4+ ICM (200 mg/kg) prevented CCl_4 induced damage in glomeruli distal tubules and proximal tubules. ICM: *Indigofera cordifolia*; CCl_4: carbon tetrachloride; b.w.: body weight.

Molecular Analysis

Nephrotoxicity is a condition where renal cells damage the glomerulus and tubular cells, leading to kidney injury. This damage results in apoptosis, cellular uptake and efflux, vascular injury, oxidative stress, and inflammation. The deterioration of renal cells leads to altered molecular pathways, causing gene up- or down-

regulation. Nephrotoxicity also increases levels of TNF-α and reactive oxygen species, promoting oxidative stress, vascular damage, and apoptotic pathways.

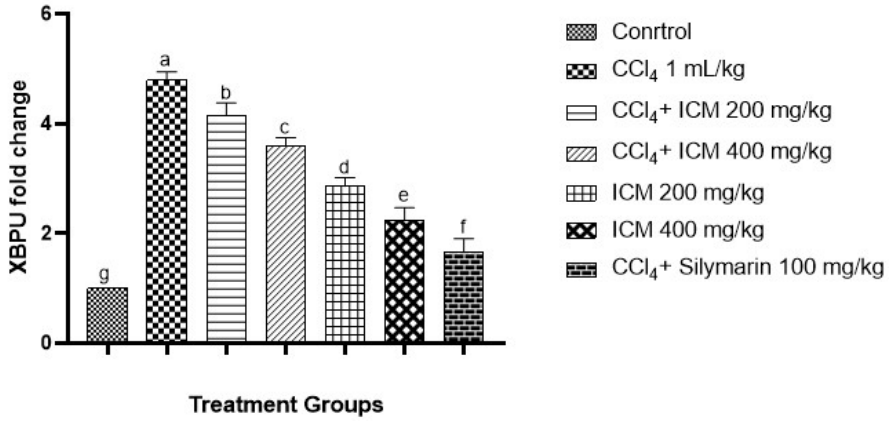


Figure 4. Effect of ICM on XBPu (ER stress maker), evaluated as fold change

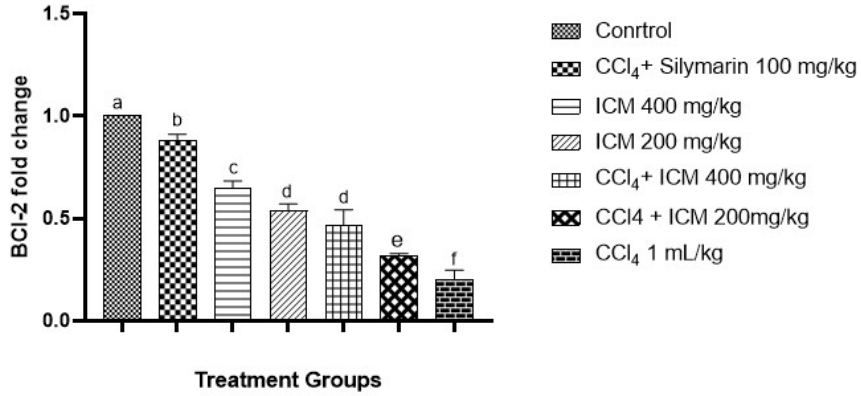


Figure 5. Effect of ICM on Bcl-2 (anti apoptotic maker), evaluated as fold change

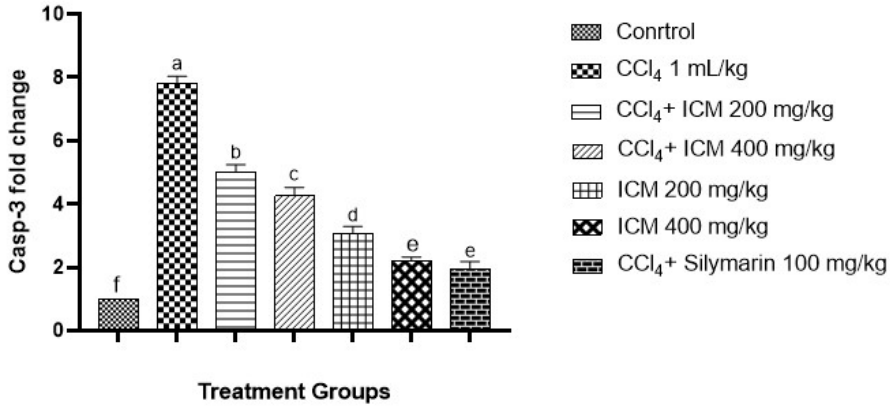


Figure 6. Effect of ICM on Casp-3 (apoptotic maker), evaluated as fold change

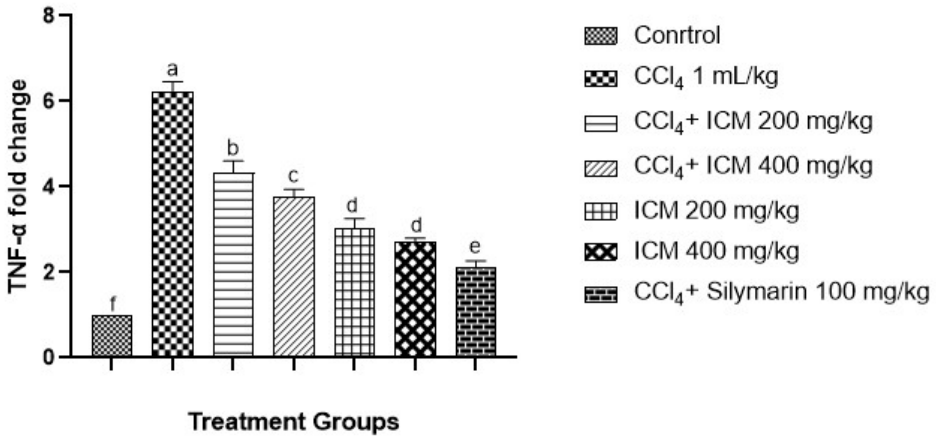


Figure 7. Effect of ICM on TNF- α (pro-inflammatory maker), evaluated as fold change

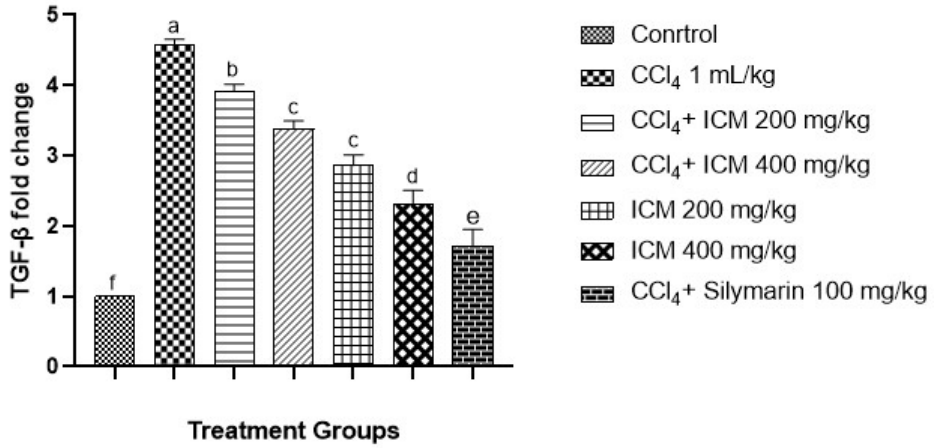


Figure 8. Effect of ICM on TGF-β (anti-inflammatory maker), evaluated as fold change.

DISCUSSION

Chronic renal disease is associated with increased oxidative stress and inflammation, contributing to kidney injury and potential damage to distant tissues, leading to the development of concurrent illnesses. Lowering oxidative stress and inflammation is crucial, given the cyclical and systemic nature of the damage (Tucker *et al.,* 2015). Kidney failure is defined by a GFR less than 15 mL/min per 1.73 m^2 or the need for dialysis or transplant, with associated risks including cardiovascular disease, acute renal injury, infection, cognitive decline, and physical function impairment (Hailpern *et al.,* 2007). Oxidative stress arises when cells cannot eliminate excess free radicals, leading to tissue damage. CCl_4 intoxication generates free radicals in various tissues, initiating a chain reaction that damages membranes and interferes with cellular processes (Pham-Huy *et al.,* 2008; Khan *et al.,* 2009; Halliwell and Gutteridge, 1984; Halliwell, 2007; Adewole *et al.,* 2007). Medicinal plants with anti-nephrotoxic properties, such as Nigella sativa, Ginkgo biloba, and Tephrosia purpurea, exhibit nephroprotective effects (Rad *et al.,* 2017). *I. cordifolia* is utilized in Pakistan and other regions for treating kidney disorders, with its whole plant extract showing well-established nephroprotective

benefits. The plant contains various phytochemicals, including high concentrations of flavonoids and glycosides. In in-vitro experiments, the extract demonstrated antioxidant activity against NO free radicals and OH ions, with notable IC_{50} values. The plant extract, known as ICM, exhibited anti-inflammatory properties in the egg albumin assay. In in-vivo tests using rats induced with CCl_4, ICM, particularly at a high dose of 400 mg, showed significant nephroprotective effects by reducing oxidative stress, repairing tissue damage, and restoring normal morphological properties (Jagetia *et al.,* 2004; Adewole *et al.,* 2007). In assessing nephroprotective efficacy, serum indicators Albumin, Urea, and Creatinine were measured, showing alterations due to CCl_4-induced nephrotoxicity. Silymarin and high doses of ICM (400mg/kg) restored normal functionality by reversing abnormal levels of indicators. ICM demonstrated effectiveness in elevating anti-inflammatory enzymes and reducing oxidative stress, as evidenced by changes in catalase, peroxidase, superoxide dismutase, nitrite, TBARs, H_2O_2, GSH, and protein levels. At the molecular level, ICM exhibited nephroprotective effects by influencing gene expression related to the EMT pathway, oxidative injury, and inflammation. Histopathological examinations confirmed ICM's restorative effects on renal structure in CCl4-induced nephrotoxicity (Khan *et al.,* 2010; Lu *et al.,* 2019).

CONCLUSION

The methanolic extract of *I. cordifolia* (ICM) has been shown in this study to have considerable levels of egg denaturation inhibitory activity against proteins, supporting its anti-inflammatory and antioxidative potential against ions and oxidative free radicals. By replenishing serum indicators, antioxidant enzymes, and gene expression in renal tissues by neutralizing generated oxidative stress, oral dosing of ICM to CCl_4-induced nephrotoxicity in rats exerts nephroprotective effect.

FUTURE PERSPECTIVE

We believe that this investigation has shed light on the therapeutic potential of *I. cordifolia* against the kidney-damaging effects of CCl_4. It is also necessary to chemically characterize the phytoconstituents that give *I. cordifolia* plants their nephroprotective effects. Additionally, research is required to determine whether the plant can treat several diseases and whether it can harm other organs. ICM has phytoconstituents that have therapeutic value, and their derivatives can be generated to treat a variety of pathogenic disorders.

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NUMERICAL INVESTIGATION ON SIMPLIFIED MAGNETIC GEAR FOR GREEN ENERGY APPLICATION

Yang CHAOJUN[1], Amberbir WONDIMU[2]*, Getachew ALEMU[3], Wang Ao[4]

[1,2 4]School of Mechanical Engineering, Jiangsu University, Zhenjiang, China
[3]School of Energy and Power Engineering, Jiangsu University, Zhenjiang, China

Corresponding Author: Amberbir Wondimu,
Jiangsu University, School of Mechanical Engineering, Zhenjiang, China, Email:
ambirewondimu@gmail.com

ABSTRACT: *Energy is widely recognized as a crucial component of our daily lives. As concern regarding global warming and energy scarcity continue to grow, wind power generation has become increasingly attractive. It is hailed as a highly promising and sustainable source of green energy. The pressing global issue of environmental pollution necessitates the development of innovative technologies that can address the challenges posed by the climate crisis. In the context of wind turbines, mechanical gears play a vital role in transferring mechanical torque and speed to the generator unit. However, these conventional gears suffer from various drawbacks. They result in significant energy loss and generate high levels of acoustic noise, leading to environmental pollution. Additionally, they require frequent maintenance, occupy a large volume, and are unsuitable for harsh environmental conditions. To overcome these critical design problems, this study introduces a novel and simplified magnetic gear design for wind turbines. By replacing existing gears, the proposed magnetic gear reduces the design challenges. The magnetic gear operates without friction, thereby eliminating acoustic noise and minimizing both volume and weight. Furthermore, it exhibits resistance to harsh environmental conditions such as corrosion. Moreover, the new magnetic gear proves to be more efficient in terms of utilizing a reduced quantity of magnetic materials compared to the existing gears used in wind energy applications.*

Key words: Conventional magnetic gear, green energy, new and simplified magnetic gear, wind turbine

INTRODUCTION

The gearbox can transfer mechanical power as a speed reduction or multiplier. Despite their effects on energy conservation and environmental awareness, wind energy conversion systems and electric vehicles are the two most researched and pertinent applications. In a wind energy generation and transmission system, the gearbox is the main part, and its primary function is to increase the speed conveyed by the low-speed, high-torque shaft, from the rotor shaft to the high-speed, low-torque shaft that drives the electric generator to match the rotation speed required by this machine [1]. Gearboxes play a crucial role by efficiently converting speeds and torques to meet specific application requirements of wind power systems. Mechanical gearboxes were used for this purpose. However, with advancements in science and technology, magnetic gears have taken over this responsibility in most applications. Mechanical gears are commonly used in wind turbine power drive systems

(Fig. 1a) due to their lower investment cost. However, they require continuous lubrication, produce noise, and have a heavier weight and larger size compared to magnetic gear drive designs (Fig.1b). Mechanical gear failures are more prevalent in transmission drive designs, leading to production interruptions, higher operational expenses, and reduced lifespan of wind turbines. Moreover, as the need for energy in society grows, wind energy is becoming more and more popular as a sustainable, green, and advantageous power source [1-4].

According to a recent study, the dependability of wind power systems across the globe has been examined, and it has been found that the mechanical gear component raises the most substantial level of apprehension. The primary reason for this concern is the significant amount of time that wind power systems remain non-operational after a failure, which exceeds the downtime caused by other components. Moreover, the mechanical gear requires frequent maintenance, which presents difficulties and incurs substantial expenses, particularly on offshore wind turbine sites located in remote areas [5-7]. Magnetic gears have gained considerable research interest as a promising solution to address this problem, owing to their multitude of benefits compared to conventional mechanical gears [8, 9]. A primary advantage lays in their ability to operate without any physical contact, thereby eliminating friction, reducing maintenance, and minimizing both noise and vibrations [10].

Numerical investigation on the new MG for wind turbine power conversion system is critically studied by comparing the simulation results of both the existing and new MG model and lastly, suggests newly modeled MG for the wind energy conversion system.

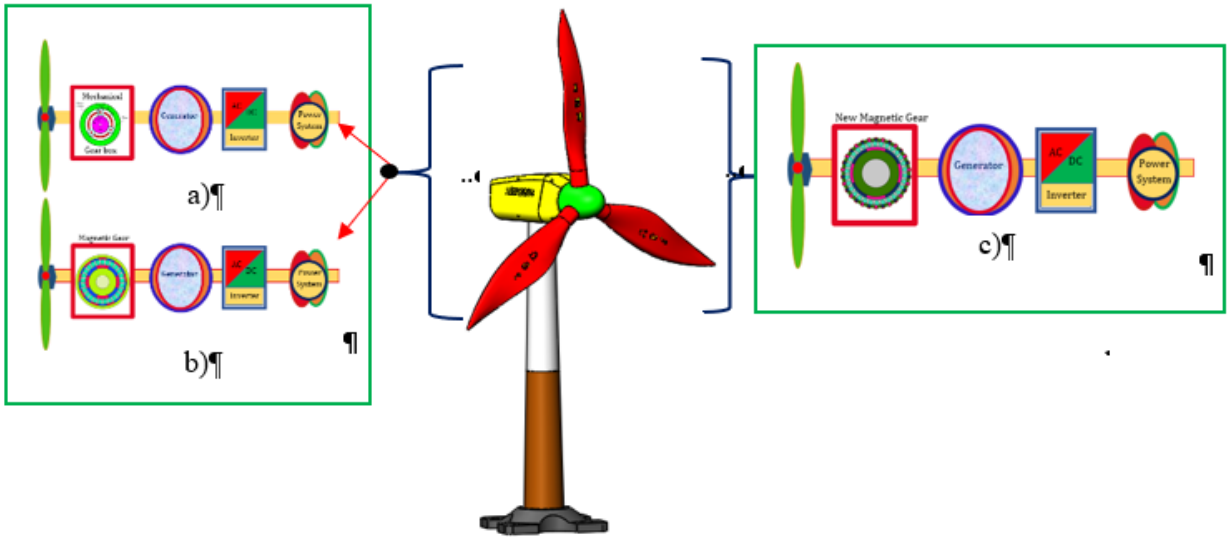

Fig.1. Wind energy generation path, a) Mechanical gear, b) Existing MG, c) New model of MG drive system of wind turbine.

PROBLEM DESCRIPTION

Wind turbine gearboxes have become a significant cause of wind turbine downtime, and the frequency of gearbox failures increases as the power level rises [11], [12]. As a result, wind turbine gearboxes have failed to reach their intended design lifespan of 20 years. Researchers have been diligently investigating different aspects to tackle this critical challenge. They have primarily focused on analyzing magnetic gear permanent magnet materials, MG structure, PM installation techniques, magnetic modulator ring profiles, and other possible improvements. The study focused on rare earth PM materials that demonstrate better performance and lower cost compared to non-rare earth materials of similar size and structure [13]. Moreover, coaxial

magnetic gears and conducted a thorough analysis, revealing that the thickness of the inner rotor's PM has a more significant influence on torque capacity than the permanent magnet of the outer rotor [14]. Likewise, findings indicate that torque is significantly influenced by the distance between the inner rotor and the surrounding air gap. This increased torque fluctuation caused the magnetic gear to become extremely unstable when transmitting torque [15]. As the study suggests utilization of high-temperature superconductors in the modulation ring of MG challenging operating conditions and excessively high cost make superconductors unsuitable for implementation in wind turbines [16]. However, the following design challenges are still visible in the existing magnetic gear of the wind turbine transmission drive system:

- High volume and weight,
- Continues costly consumption of permanent magnets,
- Significant loss on the outer rotor and unable to serve in harsh environmental conditions.

Hence, our new magnetic gear design has a solution to the mentioned design challenges.

PROPOSED SOLUTION

To address the shortcomings of mechanical gear and existing magnetic gear systems currently available, a new design is proposed. This new design involves the utilization of segmented PMs on the outer rotor, combined with a new modulator design as depicted in **Fig. 2.** Furthermore, electrical steel sheets are incorporated to effectively reduce the loss encountered by the permanent magnets on the low-speed rotor. Moreover, these electrical steel sheets also function to protect the structure from detrimental environmental factors like corrosion. As a result, this design is an exceptionally effective alternative to existing MGs in wind turbines, as depicted in **Fig. 3(a–c)**.

The initial stage involves the structural modeling of magnetic gears, followed by an analysis of their volume, weight, and crucial magnetic properties along both radial and tangential directions. This analysis is conducted using a nonlinear 2D Finite element method. Careful insulation and coating with sheets made of silicon steel can be applied to increase the performance of the low and high-speed rotor iron yokes, as well as the pole pieces.

Table 1. Structural design parameters of magnetic gear

Parameters	Units	Value	Parameters	Units	Value
Outer rotor outer radius (R_6)	mm	70	Outer poles (LSR)	Pairs	17
Outer rotor inner radius (R_5)	mm	65	Inner poles (HSR)	Pairs	4
Outer radius of pole piece (R_4)	mm	64	Modulators (Q)	No.	21
Inner radius pole piece (R_3)	mm	49	Axial length (L)	mm	60
Inner rotor outer radius (R_1)	mm	20	Inner rotor PM thickness (R_2-R_1)	mm	5
Airgap thickness inner/outer	mm	1	Stack length of pole pieces	mm	15
Thickness of modulator	mm	15	Remanence of PMs	T	1.2
Gear ratio	-	4.25	PMs material	-	NdFeB
Width of electrical steel sheet	degree	0.8	Max rated power	kW	1.5-5
Length of electrical steel sheet	mm	1.75	Outer rotor low speed	rpm	200-300
Inner rotor high-speed	rpm	1100-2200			

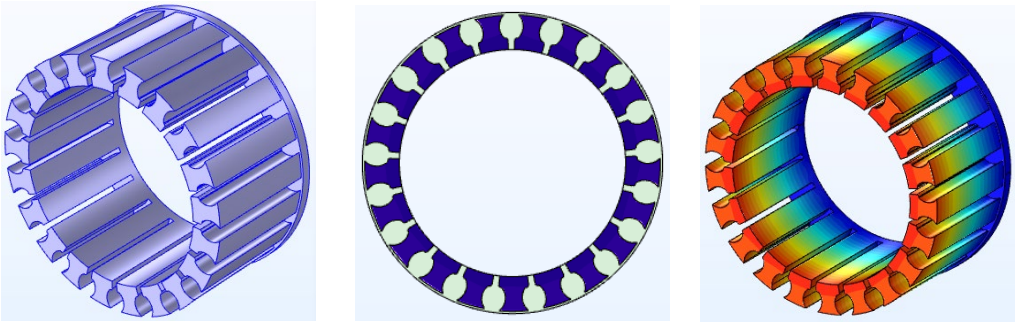

Fig. 2. Proposed new modulator model **a)** 3D, **b)** 2D, **c)** Stress distribution on modulator

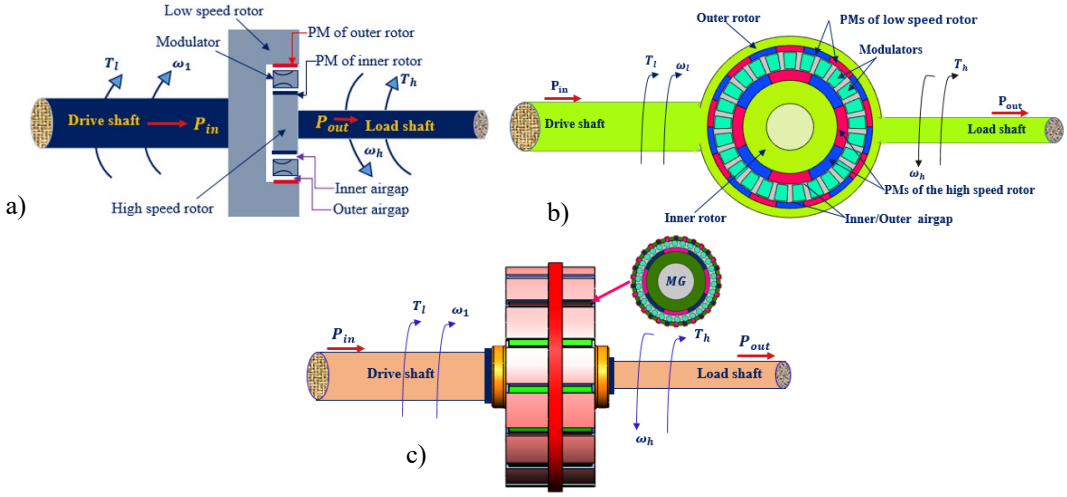

Fig. 3. Topologies of magnetic gear, a) Basic components, b) Existing model, c) New MG model

Hence, this research provides the following three key importance over the existing magnetic gear drives:

- Reduced the volume and weight of recently existing modulator of wind turbine drive system.
- Reduced continuous consumption of PMs therefore it is a cost-effective design,
- Reduced the loss on the outer rotor by inserting electrical steel lamination and able to serve in harsh environmental conditions.

MATHEMATICAL ANALYSIS AND THEORY OF MAGNETIC GEAR

Magnetic gear is consists of three main rings: A high-speed rotor ring with P_{in} of PMs pole pairs, A low-speed rotor ring with PMs pole pairs, and A fixed modulator ring with n_s pole pieces lays in between the two rotors (P_{in} = 4, P_{out}= 17, n_p = 21).

The magnetic gear consists of two air-filled regions, specifically the internal air gap between the inner high-speed rotor and the ferromagnetic modulation ring, and the external air gap between the outer rotor and the magnetic modulation ring. Within this configuration, the magnetic modulation ring serves a unique purpose. It efficiently modulates the magnetic field generated by the permanent magnets (PMs) on both the inner and outer rotors within the air gaps.

The process of synchronization enables the magnetic fields to engage and enhances the transmission of torque. By incorporating the magnetic modulation ring, the magnetic fields within the inner and outer air gaps are

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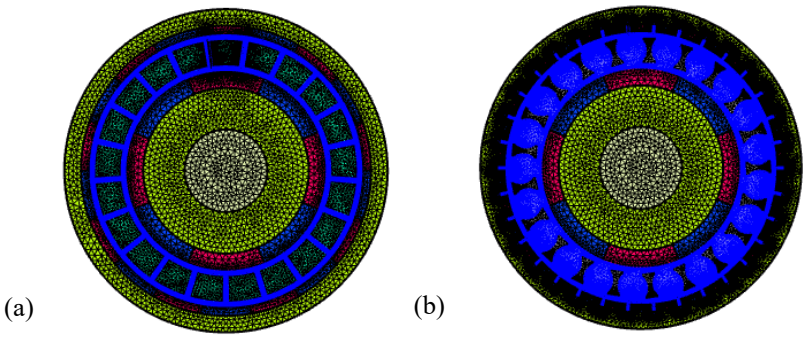
adjusted to generate a diverse range of harmonic components derived from the essential wave components. These harmonics possess their own distinct unique pole pairs and particular speeds within the air gap.



(a) (b)

Fig. 4. Mesh generation for a) existing and b) new magnetic gear mode

MATHEMATICAL REPRESENTATION OF MODEL

In magnetic gears, the correlation among the numbers of pole pairs and adjustment of permanent magnets is as follows:

$$P_i\omega_i + P_0\omega_0 = n_p\omega_p \tag{1}$$

Where, ω_{in}[rpm] is the speed of the high-speed rotor, ω_{out} [rpm] is the speed of the low-speed rotor in [rpm] and the speed of the modulator is zero ($\omega_p = 0$), which means it is stationery component.

$$N_p = P_i + P_o \tag{2}$$

P_i and P_o were the pairs of PM assembled poles on the high and low speed rotors respectively; N_S is the measure of modulators number. When the model is operating, the modulator remains undeviating ($\omega_p = 0$) and the high and low speed rotors rotate in opposite directions, and the gear ratio becomes

$$G_r = -\frac{P_o}{P_i} \tag{3}$$

Fig. 5 depicts, the flux density due to the PMs the low-speed rotor, with magnetic strengths, can be articulated as:

$$\lambda_0(t,\theta) = A\cos[P_0 * (\omega_0 t - \theta]] * \cos[nP_0 * (\omega_0 t - \theta)] \tag{4}$$

In Eq. (1-9), the subscript "o'' shows outer rotor and "i" is for inner rotor, λ_0 & λ_i the flux line, A & B are the highest amplitude of the flux, P_0 & P_i are the quantity of pole pairs, ω_0 & ω_i are the angular speed, and θ the mechanical angle for a fixed frame of reference, *n* is defined as a modulation factor, and α (a constant) is the spatial angle revealing the angular separation among the high and low speed rotor magnetic fields at time (t) is zero. It should be emphasized that the magnitude of *n* is a real number and not certainly an integer. Likewise, for the high-speed rotor, where the magnetic flux is not modulated, so the magnetic flux equation can be given as:

$$\lambda_i(t,\theta) = B\cos[P_i * (\omega_i t - \theta - \alpha] \tag{5}$$

Based on trigonometry relations among variables, Eq. (4) can be rearranged and simplified as:

$$\lambda_0(t,\theta) = \frac{A}{2}\{\cos[(P_0 * (\omega_0 t - \theta)] + [nP_0 * (\omega_0 t - \theta)] + \cos[P_0 * (\omega_0 t - \theta)] - [nP_0 * (\omega_0 t - \theta)]\} \tag{6}$$

$$\lambda_0(t,\theta) = \frac{A}{2}[\{\lambda_{01}(t,\theta)\} + \{\lambda_{02}(t,\theta)\] \tag{7}$$

But

$$\lambda_{01}(t,\theta) = \cos[\{(1+n)P_0 * (\omega_0 t)\} - \{(1+n)P_0 * \theta\}]$$
$$\lambda_{02}(t,\theta) = \cos[\{(1-n)P_0 * (\omega_0 t)\} - \{(1-n)P_0 * \theta\}] \quad (8)$$

To have torque, the two magnetic fields $\lambda_{01}(t,\theta)$ and $\lambda_{02}(t,\theta)$ needs to react with each other. Especially, determining torque equation, can be done by multiplying these two quantities in equation 8 with sin (α) function, and it becomes the standard torque equation among two magnetic fields.

$$T = \frac{A}{2}\{\lambda_{01}(t,\theta) * \lambda_i(t,\theta)\}$$
$$= \frac{AB}{2}\{\cos[(1+n)P_0 * (\omega_0 t)] - [(1+n)P_0 * \theta]\} * \cos[P_i * (\omega_i t - \theta - \alpha)]\} \quad (9)$$

COMPARISON ON MAGNETIC GEAR MODELS

Finite Element Analysis

The analysis of the two magnetic gear models through numerical methods allows us to ascertain the line distribution of magnetic inductance as depicted in Fig. 5. It becomes evident that the magnetic lines of induction within the iron yoke of both the high and low speed rotors are considerably less dense in the segmented magnetic gear model compared to the existing magnetic gear. However, the magnetic flux lines surrounding the outer rotors of the segmented magnetic gear are evidently denser than those found in traditional magnetic gears. This redesign of the magnetic gears allows for a reduction in the thickness of the outer yoke and reduces the continued consumption of PM, resulting in a smaller volume of magnetic gears.

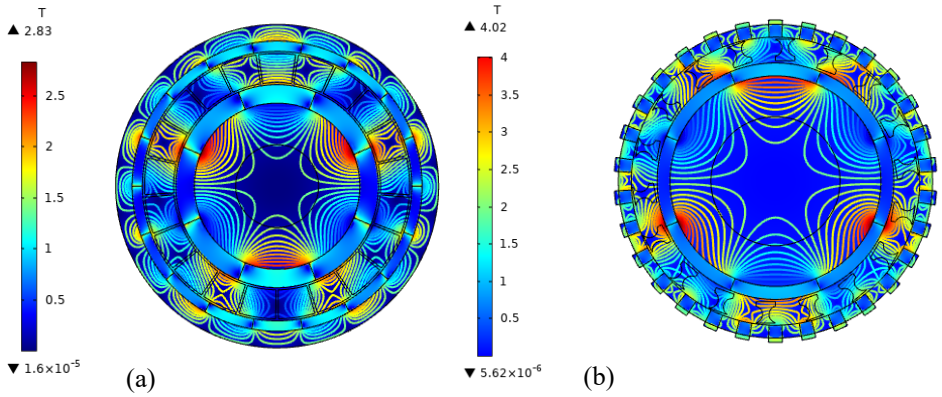
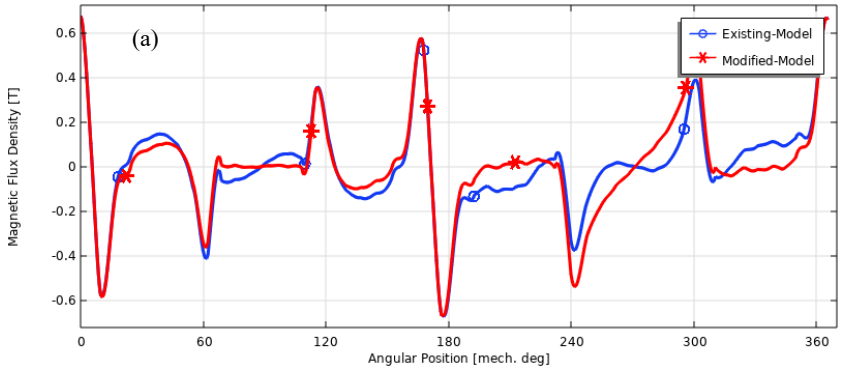


Fig. 5. Magnetic flux lines distribution plot for a) Existing MG model and b) New MG model



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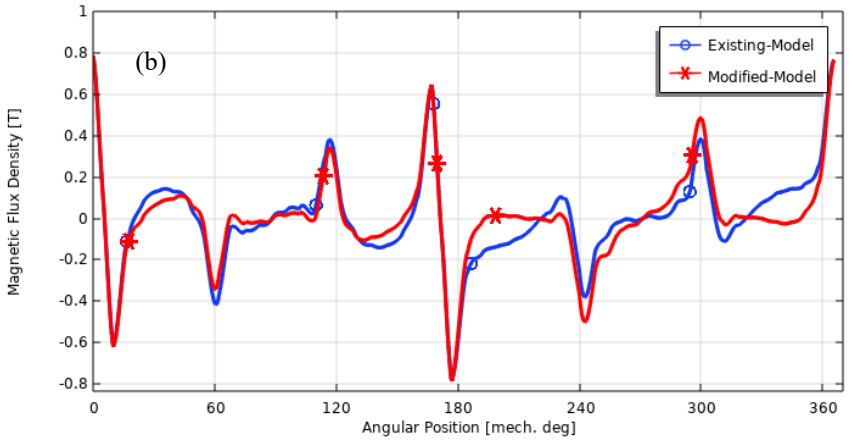

Fig. 6. Magnetic flux density plot of outer airgap (a) Radial, and (b) Tangential

In Fig. 6**,** illustrating the comparison between the tangential and radial magnetic flux distribution inside the outer air gaps of the two MGs and shows the new MG have better magnetic flux density than the existing one which is due to the reduction of loss on the outer rotor using magnet segmentation and lamination. The waveform diagram effectively demonstrates the interplay among the four pairs of inner rotors PM, along with the presence of 17 outer rotor permanent magnets, as visualized in Fig. 7.

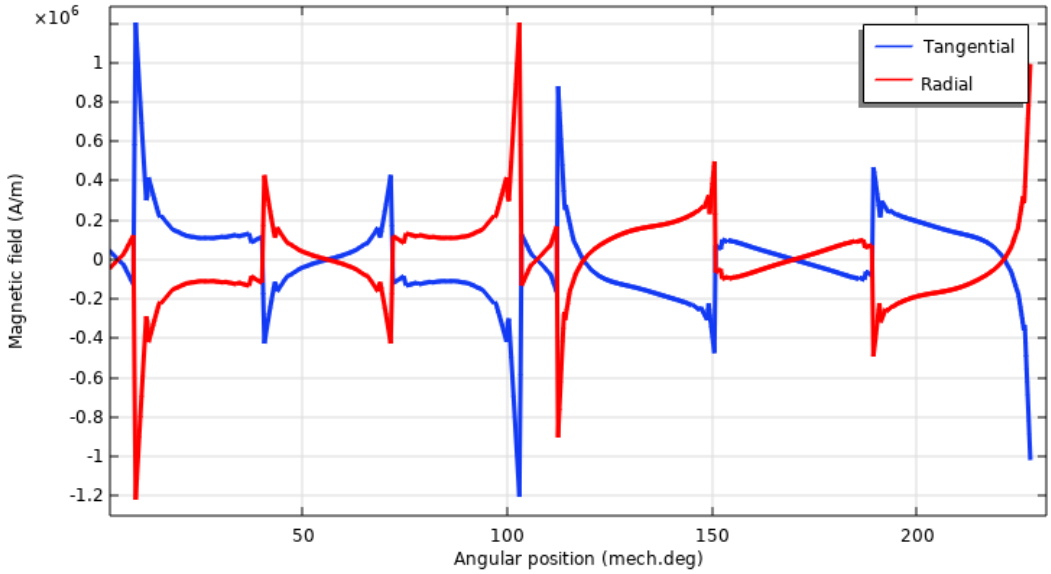

Fig. 7. Magnetic field versus angular position line plot of outer airgap radial, and tangential

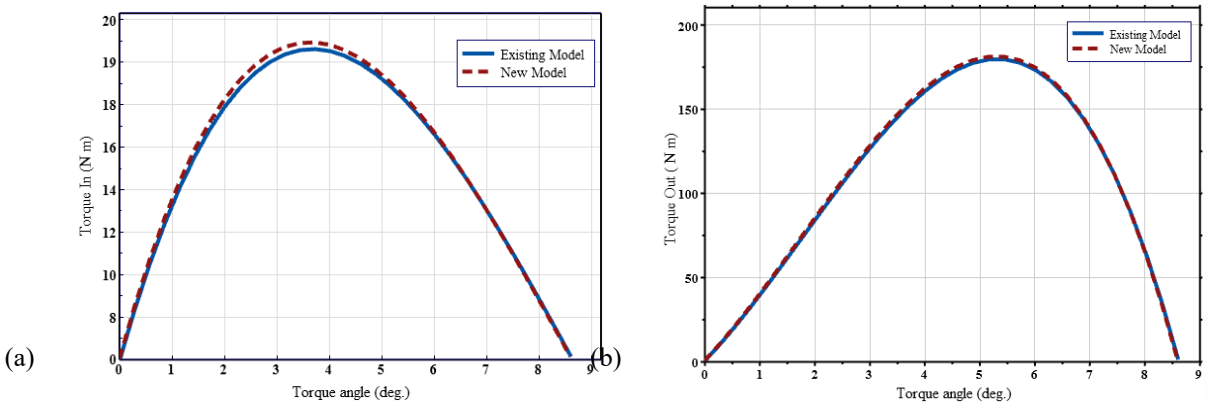

Fig. 8. Electromagnetic Torque Characteristics of a) input and b) output rotor shaft respectively

The input (Fig. 8a) and output (Fig. 8b) torque diagram derived through careful analysis conducted using finite element software. Notably, the peak value of the torques for both input and output rotor have shown significant improvement (1.522% and 1.408%) respectively due to design change in modulator shape, outer rotor PM segmentation and electrical steel lamination of the outer rotor signifies the magnitude of both input and output torque. Moreover, comparison between the existing and new MG in a wind turbine drive system shows the newer design has a notable effect on reducing the volume and weight of the modulator, outer permanent, and outer rotor components of the MG. This study significantly contributes to reducing the overall weight of the MG by 5.734% and the total volume by 4.189% of the existing MG model in wind energy, see Table 2. These reductions obviously impact the cost and torque performance.

Table 2. Summary on comparison of the two models of magnetic gears

MG Components		Parameters	Conventional Model	New -Model	Change Made (%)
1	Inner rotor	Mass (Kg)	20.046	20.046	-
		Volume (m^3)	$2.570*10^{-3}$	$2.570*10^{-3}$	-
		Weight(N)	196.450	196.450	-
2	Inner rotor PM	Mass(Kg)	0.775	0.775	-
		Volume (m^3)	$1.020*10^{-4}$	$1.020*10^{-4}$	-
		Weight(N)	7.605	7.605	-
3	Modulator Ring	Mass (Kg)	6.799	6.675	1.841
		Volume (m^3)	$8.902*10^{-4}$	$8.707*10^{-4}$	2.210
		Weight(N)	67.679	66.750	1.382
4	Outer rotor PM	Mass (Kg)	0.965	0.483	66.574
		Volume (m^3)	$1.272*10^{-4}$	$6.36*10^{-5}$	67
		Weight(N)	9.650	4.826	66.648
5	Outer rotor	Mass (Kg)	1.065	0.495	73.077
		Volume (m^3)	$1.367*10^{-4}$	$6.36*10^{-5}$	72.990
		Weight(N)	10.654	4.953	73.057
		Total volume (m^3)	$3.826*10^{-3}$	$3.669*10^{-3}$	4.189
		Total weight (N)	292.038	275.758	5.734

CONCLUSION

The numerical investigation and comparison of the new and existing magnetic gear is done by using cost and time effective computational tool FEA. Newly designed magnetic gears have maximum the torque. Moreover, this new design has less volume, low weight, low consumption of PM and lesser loss as compared to the existing conventional MG in wind power drive system. And, PMs Segmentation has substantially enhanced

the torque performance of new MG. The environmental shielding nature of the electrical steel lamination allows for a unilateral increase in magnetic field, which minimizes the amount of loss in low-speed rotor yokes and enables it to serve in harsh environmental conditions due to its corrosion-resisting nature. Therefore, this new MG design is best for both offshore and onshore wind turbine energy conversion systems.

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QUALITY SERVICE - HOW QUALITOLOGY SERVES ENVIRONMENTAL PROTECTION

Tamás CSISZÉR

Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering

Abstract: *Traditional Quality Science and Engineering, also known as Qualitology, focuses on the ability of organizations, processes, and products to meet stakeholder requirements. Lots of tools and techniques have been developed, helping professionals mainly in their quality development programs. Based on these results, other management systems, such as environment, health and safety, and information security, have also emerged. Some so-called integrated management systems, which combine regulations and procedures, aim to organize processes of relevant operation. The key to integration is an essential but often forgotten part of qualitology: the quality service approach. This paper briefly introduces the Harmonized production, Commitment and flexibility, Support and motivation, and the Hurdles and effects elements of the Quality Service Method, highlighting its connection to environmental protection.*

Keywords: *quality science, quality engineering, qualitology, quality service, environmental protection*

INTRODUCTION

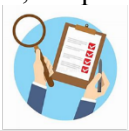
This paper introduces Quality Service (QS), the heart of Qualitology, also known as Quality Science, from an environmental protection perspective. In the first part of our work, the most widely known approaches of Qualitology are defined. They are Quality Checking, Quality Control, Quality Assurance, and Quality Management. Then, the most relevant pillars of quality service are introduced as a potential solution to the environmental protection issues. Finally, the most critical aspects of the transition to the Quality Service Method are described briefly.

APPROACHES OF QUALITOLOGY

The four main approaches of Qualitology are Quality Checking, Quality Control, Quality Assurance, and Quality Management. 0 shows where these methods are mainly applied, what they want to detect, how they do that, with what kind of tools, by whom, why, i.e., for what, and when, i.e., in what sort of production. They can be defined in the following way:

- **Quality checking** is the detection and correction of product failures by quality controllers with sampling and qualification techniques to stop wrong products in individual or serial production.
- **Quality control** is the detection and correction of the out-of-control status of individual processes by the process team with statistical methods to avoid wrong production, in mass production.
- **Quality assurance** is the prevention, detection, and correction of nonconformity of process system by the whole organization with regulation to build trust, in standardized production.

- **Quality management** is the prevention, detection, and correction of target loss of the system of processes and organization by the whole organization with goal statements and development programs to achieve goals, in optimized production.



	Q. Checking	Q. Control	Q. Assurance	Q. Management
Where?	Products	Individual processes	Process system	System of processes and organization
What?	Failure	Out-of-control status	Nonconformity	Target loss
How?	Detection, correction	Detection, correction	Prevention, detection, correction	Prevention, detection, correction
With?	Sampling, qualification	Statistics	Regulations	Goals, development
By?	Q. controller	Process team	Organization	Organization
Why?	Stop wrong product	Avoid wrong production	Build trust	Achieving goals
When?	Serial production	Mass production	Standardized production	Optimized production

Figure 1. The four main approaches of Qualitology. The table shows where these methods are mainly applied, what they want to detect, how they do that, with what kind of tools, by whom, why, i.e., for what, and when, i.e., in what sort of production.

Environmental protection has certainly not been taken into consideration in every method. Quality Checking, Control, or Assurance deals with it if any of the acceptance criteria of products or processes is related to it. Quality Management copes with the environment as a stakeholder, so if technology has a potentially hazardous impact, the organization must run relevant processes and actions to monitor and reduce it. Moreover, if the company implements an integrated management system, which includes the environmental management system, it has to meet stricter requirements. However, one can see that the business needs often overwrite any other aspects, so regardless of environment-related issues such as climate change, pollution, energy transition and renewables, hydric stress and water scarcity, and waste management, etc., there is not enough resource and willingness to optimize operation to address these problems.

QUALITY SERVES ENVIRONMENTAL PROTECTION

As we saw previously, environmental protection can be considered a stakeholder. When planning processes, relevant needs, expectations, and requirements must be collected and understood. Their sources are laws, other regulations, and self-imposed goals. Based on them, the strategy and the operation are planned and created according not only to business-related but environment-related aspects as well. It means that the output of a task must meet environmental protection requirements, too. To ensure this, one should consider the whole operation as a network of activities and services among them. This approach is called Quality Service (QS). The QS approach is the heart of Qualitology, which can help to focus on the most important requirements. The definition of Quality Service is based on the following fundamental postulate:

1. Production is a network of activities and their outputs.
2. Every output, even a product, is a service or a set of services when handed over or provided;
3. A service is qualified by its attributes.
4. Attribute quality is based on quality-related services provided by others (predecessors, leaders, successors) that can affect it.

5. Quality Service is the output of activities aiming to help others in:
   - … managing hurdles & effects.
   - … ensuring support & motivation.
   - … maintaining commitment & flexibility.
   - … harmonized production regarding their activities.

It means that the QS approach supports and motivates people to manage hurdles and effects regarding the services of activities and maintain the commitment and flexibility of the whole organization to provide quality service in harmonized production. [0]

	Q. Checking	Q. Control	Q. Assurance	Q. Management	Q. Service
Where?	Products	Individual processes	Process system	System of processes and organization	**Services of activities**
What?	Failure	Out-of-control status	Nonconformity	Target loss	**Hurdles & Effects**
How?	Detection, correction	Detection, correction	Prevention, detection, correction	Prevention, detection, correction	**Support & Motivation**
With?	Sampling, qualification	Statistics	Regulations	Goals, development	**Commitment & Flexibility**
By?	Q. controller	Process team	Organization	Organization	**Organization**
Why?	Stop wrong product	Avoid wrong production	Build trust	Achieving goals	**Quality Service Provision**
When?	Serial production	Mass production	Standardized production	Optimized production	**Harmonized production**

Figure 2. Quality Service - the fifth approach of Qualitology.

The QS has four pillars: 1) Harmonized production; 2) Commitment and Flexibility; 3) Support and Motivation; 4) Hurdles and Effects. [0]

Figure 3. The four pillars of Quality Service: Harmonized production, Commitment and flexibility, Support and motivation, Hurdles and effects.

To maximize the service quality, we need harmonized production, where activities are aligned in a service network with capacity synchronization, efficient energy consumption and material usage, and pragmatic operation.

In addition, we need committed and flexible staff with open minds for improvement opportunities who can cooperate and make consensus while initiating and accepting positive changes. We must provide them with a supporting and motivating environment by ensuring competencies and functions in production, by regulating with easy-to-understand and easy-to-handle Service Oriented Documentation, which is a combination of SOP (Standard Operating Procedure) and SLA (Service Level Agreement), and by assessing performance based on the quality of activity services.

Finally, yet importantly, we must focus on serving and helping our successors and linked partners to maximize the positive and minimize the negative impacts of our operation.

Every pillar has a message for environmental protection. By harmonization, commitment, flexibility, support, motivation, and a service-oriented attitude, we can result in less waste production, less harmful emissions, and less energy consumption.

In a harmonious operation, the requirements and goals of the business, environmental protection, safety, and other fields are handled by their priorities, which are influenced by their connections to organization culture, strategy, and value addition. In many cases, these goals cannot be achieved, and these requirements cannot be met together, so resources must be able to make decisions and concentrate their efforts on the most essential ones.

It needs people committed to service orientation, which means they are ready to produce their outputs based on the prioritized requirements. Their slogan should be the following: ‘If everyone does his or her best, the whole community will benefit from it.’ The idea behind it is that the number of ‘services’ anybody uses is more than what they provide.

People who own this way of thinking can also address and solve problems, including environmental protection ones, in a flexible way, generating and implementing improvements initiated by a consensus of different interests. It can only work if the management supports this approach. This means that people must have the right to assess their and their predecessors’ performance, analyze situations, and make decisions regarding prioritization and the operation. Even more, management must motivate employees to accept this responsibility and not be afraid of ‘breaking the rules’ and doing tasks differently.
Finally, when someone makes the above decisions, positive and negative effects must be identified, analyzed, and handled. As we mentioned earlier, effects in connection to environmental protection must be considered as well.

This is the essence of the Quality Service approach from an environmental protection perspective. In this approach, the natural environment is one of the most important stakeholders. [0]

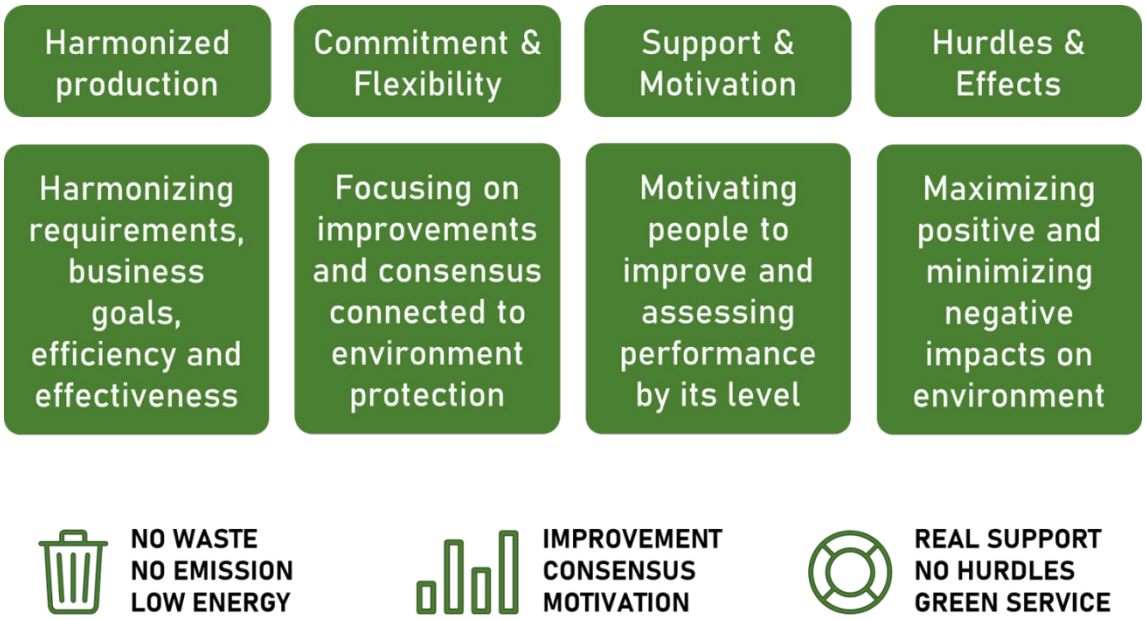


Figure 4. QS messages for environmental protection.

If we want to move from traditional approaches to Quality Service, we need to change our way of thinking. We must focus on services instead of products, effects instead of failures, harmonization instead of standardization, and commitment instead of goals. [0]

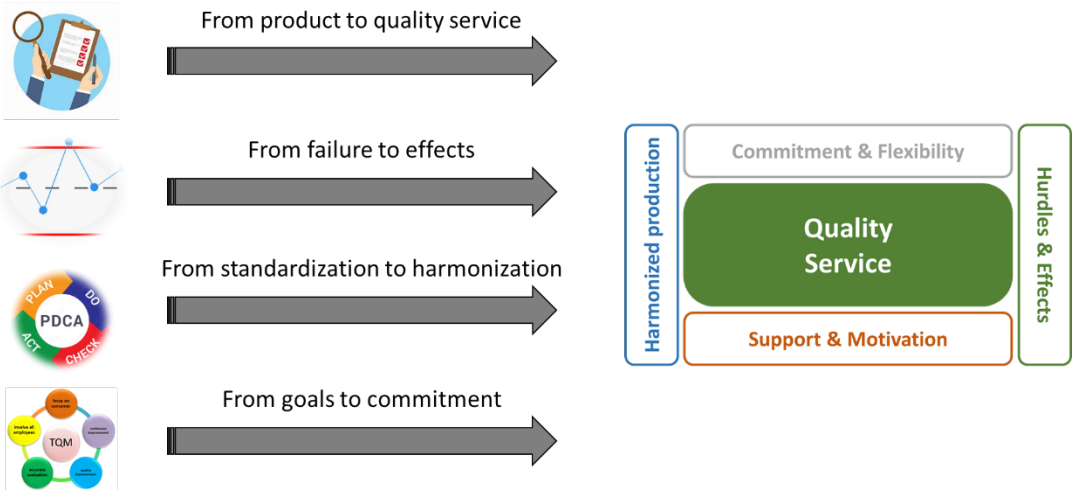


Figure 5. Transition to Quality Service

CONCLUSIONS

Implementing the Quality Service approach, the heart of Qualitology is one of the best ways to manage our operation. It helps harmonize different goals and requirements, ensures a committed and flexible staff, and provides appropriate management support and a motivated environment. Due to this, organizations can

maximize positive and minimize negative effects not only on business but on environmental protection as well.

ADITIONAL DATA ABOUT AUTHOR

Corresponding author:
Tamás CSISZÉR
Institute of Media Technology and Light Industry, Rejtő Sándor Faculty of Light Industry and Environmental Engineering
96/B Bécsi út
1034, Budapest, Hungary
Phone: +36 20 9316998
E-mail: csiszer.tamas@uni-obuda.hu

REGIONAL DEVELOPMENT IN REGIONS OF FRANCE IN 2020S

Sándor J. ZSARNÓCZAI, Rita BODÁNÉ KENDROVICS

Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering,
Institute of Environmental Engineering and Natural Science, Doberdó u. 6, H-1034 Budapest, Hungary,
e-mail: zsarnoczaisandorjozsef@gmail.com, bodane.rita@rkk.uni-obuda.hu

Abstract: *Study analyses some main economic features of NUTS 2 regions of France, which concern very strong correlations among economic variables as regional gross domestic product, real growth rate of regional gross value added, tertiary educational attainment, age group 25-64, employment rate of the age group 20-64, unemployment rate, employment in high-tech sectors as high-technology manufacturing and knowledge-intensive high-technology services in total employment for researched period 2015 and 2021 based statistical methods. Innovative prosperity of the economy can be enforced by increasing considerable share of employment in high-tech sectors based on increasing share of tertiary educational attainment, age group 25-64. The first regions are Île de France, Midi-Pyrénées, Rhône-Alpes and Alsace in France, because the employment in high-tech sectors by NUTS 2 regions in total employment was 8%, 7% and 5% accompanying with highly employment more than 70% and tertiary educational attainment, age group 25-64 more than 38%-50%. The innovative prosperity in highly developed economies should be based on highly level employment in high-tech sectors and tertiary educational attainment to increase regional GDP and real growth rate of regional gross value added to realise balanced development for all regions of any economy.*

Keywords*: economic variables, employment, high-tech sectors, innovative prosperity, real growth rate, tertiary educational attainment*

INTRODUCTION

The study analyses some main economic features of NUTS 2 regions of France, which concern regional gross domestic product, real growth rate of regional gross value added (RGVA), tertiary educational attainment, age group 25-64, the employment rate of the age group 20-64, unemployment rate and the employment in high-tech sectors as high-technology manufacturing and knowledge-intensive high-technology services in the total employment for the researched period of 2015-2021.

The study overviews regions in France, namely Île de France, Centre - Val de Loire, Bourgogne, Franche-Comté, Basse-Normandie, Haute-Normandie, Nord-Pas-de-Calais, Picardie, Alsace, Champagne-Ardenne, Lorraine, Pays-de-la-Loire, Bretagne, Aquitaine, Limousin, Poitou-Charentes, Languedoc-Roussillon, Midi-Pyrénées, Auvergne, Rhône-Alpes, Provence-Alpes-Côte d'Azur, Corse, Guadeloupe, Martinique, Guyane. La Réunion, Mayotte, of which last five French regions are out of Europe.

In this case study the *Hypotheses, which are as follows:*
1. The study would like to give proof that unemployment rate 15 years or over in 2015 by NUTS 2 French regions, (UnEmp157) has very strong correlations with unemployment rate 15 years or over by NUTS 2 regions in 2021 (UnEmp218). [TGS00010].

2. Unemployment rate 15 years or over in 2015 (UnEmp157) can have very strong negative correlations with employment rate of the age group 20-64 in 2015 (Empl216). [TGS00102].

3. The study analyses possible strong correlations of employment rate of the age group 20-64 in 2015 (Empl155) with unemployment rate 15 years or over in 2015 (UnEmp157), and with unemployment rate 15 years or over in 2021 (UnEmp218) and with employment rate of the age group 20-64 in 2021 (Empl216). [TGS00010], [TGS00102].

4. The study analyses correlation of tertiary educational attainment, age group 25-64 in 2015 (Tertiary153) with tertiary educational attainment, age group 25-64 in 2021 (Tertiary214), with the employment in high-tech sectors in total employment in 2021 (EmHiT2110) and with employment in high-tech sectors in total employment in 2015 (EmHiT159). [TGS00039], [TGS00109].

General economic conditions of France resulted different influences on development of regions, from which there were important features, namely GDP growth increased by 5.7%, *GDP per capita* increased by 3.8% between 2015-2021. In France *general government budget deficit* was –(minus) 3,6% in GDP in 2015, which increased to –(minus) 8.9% in 2020, but this decreased to –(minus) 6.5% by the end of 2021 (Trading Economics, 2022), (INSE 2023). The *general government consolidated gross debt* was 96% in 2015 and 113% in 2021 in percentage of gross domestic product (GDP) (nama_10_gdp), [SDG_17_40].
Further analyses of the study review the correlation levels and measures in cases of economic variables concerning features of NUTS 2 regions of France within the researched period.

LITERATURE REVIEW

The international literature widely overviewed the employment issue in OECD countries, even when pandemic medical crisis resulted considerable difficulties. The Ukrainian war started at the beginning of 2022, which increased the economic crisis and its negative influences on the further prosperity in the EU and also in France. Naturally France could not eliminate all negative influences of pandemic, global economic and energy crisis resulted by the Ukrainian war on economy of France. In spite that the researched period of this study is before the Ukrainian war, this became important later.

Indeed, labour survey data in many countries do not capture the full extent of disruption to employment because most of OECD countries provided unprecedented job retention schemes for the pandemic (OECD, 2020), (OECD, COVID-19). At the peak of the crisis, job retention schemes in OECD countries provided support to roughly 20% of workers who were employed before the pandemic; support measures have receded substantially (OECD 2021a), (OECD 2021b). Unemployment rate has considerably decreased in most of NUTS 2 regions of France for period of 2015-2021, which can be resulted by increasing rate of GDP in France in the same period. Decrease of unemployment rate was stimulated by increasing rate in investment with compensation of employees.

In France the *employment* was 68.3% in 2021, but in 2015 the employment was under 65%. Also, the employment issue is a considerable to realise somehow balance density and number of populations among

regions by realising investments based on creating jobs to avoid much population concentration into some largest establishments (Fadic et al 2019; Gluschenko 2017). The gross fixed capital formation was declined by result of pandemic in 2021 to level of 110 billion euro, but this sharply increased to level of 145.8 billion euro by the end of 2022 to realise more employment rate in France (Trading Economics, 2022).
In France the unemployment was 8%, but in January of 2023, this was only 7.2% in 2021 less than before (Trading Economics, 2022). Some authors (An et al. 2022) emphasized the cyclical sensitivities of unemployment, which could make negative influences on economic development. But in France the unemployment rate was not so serious difficulty for the performance, in spite that the pandemic (Arnaud 2021) also resulted crisis in France.

Labour productivity was 86% in July of 2020 (100% was in 2010), and increased to the level of 102.74% in July of 2021, then this little decreased to the level of 100.7% in July of 2022. Harmonised consumer prices increased from 112.8% in 2020 to the level of 121% in July of 2022 (Trading Economics, 2022). Generally, the data about the economy of France mostly were favourable, because the data base of the country show a well seen prosperity of the France economy. Because GDP growth considerably increased. GDP growth has increased since 2010 (2010= 100) to level of 104.4% in 2020 and 113.8% in 2022 (Eurostat 2023). In France *general government budget deficit* in percentage of GDP has increased since 2015 from level of -3.6%, even -9.0 in 2020 because of pandemic, then this one decreased to level of -4.7% in 2022, but its level was more than in 2015.
The share of the *general government consolidated gross debt* in percentage of GDP sharply increased in the researched period, to which the pandemic and the Ukrainian war contributed. The support system concerns new trends of the public management focusing extending employment, as other authors also declared (Hegedűs-Molnár 2020).
But positive result of France in the economy was that the *compensation of employees* increased, the employment rate has increased accompanying with increasing productivity for the latest years, and the unemployment rate only little increased, which was not so considerable within the researched period (Trading Economics, 2022).
Jestl (2022 June) declared that "Industrial robots show negative employment effects in local manufacturing industries, but positive employment effects in local non-manufacturing industries. The replacement effect captures the substitution of human labour by adopting technological advances in the production process. Given negative employment effects on the manufacturing industry, the negative replacement effect seems to dominate the positive robot-induced productivity effects in the manufacturing industry" (p. 33.)
We agreed on the argument of Jestl on importance of substitution of human labour by adopting high-tech and innovative technology, because this adaptation can increase the level of the developed productivity for competitiveness of the manufacturing industry at the national and the international markets. Naturally the employment can grow in fields of service and non-industrial sectors in the same time in order to increase the employment level even in regions NUTS 2 in France. This process can be seen in developing trend of high-tech sectors by increasing level of the tertiary educational attainment for age group 25-64.

METHODOLOGY

The study needs for using wide-side statistical analyse to cover the considerable correlations among the economic variables as features of NUTS 2 regions in France within the researched period of 2015-2021. Data of *Table 1* and *Table 2* show the general growing rate of economic features of regions in given years, which can be seen in detailed in with descripting notes. The statistical method was originally prepared by **Pallant (2020 April).**

Table 1: Regional gross domestic product, real growth rate of regional gross value added (RGVA) at basic prices, tertiary educational attainment age group 25-64, employment rate of the age group 20-64, unemployment rate, employment in high-tech sectors by NUTS 2 regions in percentage in 27 regions of France in percent. General government gross debt in percentage of GDP, and compensation of employees at current prices, million euro in percent between 2015-2021.

Regions	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Île de France-I.	*14*	*6*	*46*	*54*	*72*	*76*	*10*	*8*	*7*	*8*
Alsace	13	5	32	38	73	75	9	7	4	5
Pays-de-la-Loire	17	9	32	39	73	77	9	6	3	4
Bretagne	19	10	33	40	74	76	8	6	4	4
Aquitaine	17	8	34	40	71	75	10	7	4	3
Midi-Pyrénées	10	2	40	44	71	74	9	6	4	7
Rhône-Alpes	17	9	38	45	73	75	9	7	5	5
Provence-Alpes-Côte d'Azur	17	8	35	41	68	72	11	8	4	4
Mayotte*II.	*41*	*33*	*28*	*32*	*44*	*58*	*25*	*20*	*1*	*1*
Languedoc-Roussillon	18	10	31	38	64	67	13	11	3	3
Corse	17	10	23	28	62	70	12	9	2	2
Poitou-Charentes	14	6	27	33	70	72	10	9	2	2
Centre - Val de Loire III.	*11*	*3*	*29*	*33*	*69*	*75*	*11*	*7*	*4*	*4*
Auvergne	13	5	29	30	71	74	9	7	3	3
Franche-Comté	10	3	26	33	70	73	9	7	5	5
Bourgogne	10	2	26	36	70	74	9	7	2	2
Limousin	8	1	30	37	72	74	9	6	2	2
Basse-Normandie	8	1	27	35	71	74	8	6	3	3
Picardie	7	1	24	32	69	69	11	10	2	2
Haute-Normandie	6	-2	28	34	69	74	11	8	3	3
Nord-Pas-de-Calais IV.	*12*	*5*	*28*	*36*	*63*	*69*	*14*	*9*	*2*	*3*
Champagne-Ardenne	8	-1	24	31	64	70	13	9	2	1
Lorraine	8	1	30	31	67	69	12	9	2	2
Guadeloupe*	3	-4	22	23	54	58	24	17	2	2
Martinique*	5	1	26	29	59	62	18	13	2	2
Guyane*	15	-1	20	18	53	49	22	15	1	1
La Réunion*	16	-12	21	24	54	55	24	18	1	1

* Regions of France out of the Europe, in Africa and Latin-America
I.-II.-III.-IV. = numbers of quarters of the score with list of regions, see the *Figure 1*
Source: Eurostat, 2022, [SDG_17_40], [TEC00013] [TGS00003], [TGS00010], [TGS00037], [TGS00039], [TGS00102], [TGS00109]

Note about the economic variables in the period of 2015-2021, in percent

RGDP1= Regional gross domestic product by NUTS 2 regions - million EUR [TGS00003]
RGDPCap2 = Real growth rate of regional gross value added (RGVA) per capita at basic prices by NUTS 2 regions [TGS00037], annual index, 2015 = 100
Tertiary153 = Tertiary educational attainment, age group 25-64 by sex and NUTS 2 regions [TGS00109], annual, in 2015, in percent, Tertiary education (levels 5-8), from 25-64, Total
Tertiary214 = Tertiary educational attainment, age group 25-64 by sex and NUTS 2 regions [TGS00109], annual, in 2021, in percent, Tertiary education (levels 5-8), from 25-64, Total
Empl155 = Employment rate of the age group 20-64 by NUTS 2 regions [TGS00102], in 2015, in percent, Total
Empl216 = Employment rate of the age group 20-64 by NUTS 2 regions [TGS00102], in 2021, in percent, Total
UnEmp157 = Unemployment rate by NUTS 2 regions [TGS00010], in 2015, in percent, Total, 15 years or over
UnEmp218 = Unemployment rate by NUTS 2 regions [TGS00010], in 2021, in percent, Total, 15 years or over
EmHiT159 = Employment in high-tech sectors by NUTS 2 regions [TGS00039], in 2015, High-technology sectors (high-technology manufacturing and knowledge-intensive high-technology services), Percentage of total employment
EmHiT2110 = Employment in high-tech sectors by NUTS 2 regions [TGS00039], in 2021, High-technology sectors (high-technology manufacturing and knowledge-intensive high-technology services), Percentage of total employment

Table 2: Correlation Matrix

		RGDP1	RGDPCap2	Tertiary153	Tertiary214	Empl155	Empl216	UnEmp157	UnEmp218	EmHiT159	EmHiT2110
Correlation	RGDP1	1.000	**.831**	.172	.137	-.370	-.173	.270	.344	-.049	-.053
	RGDPCap2		1.000	.322	.326	-.138	.128	-.016	.067	.111	.094
	Tertiary153			1.000	**.935**	**.559**	**.614**	**-.523**	**-.505**	**.808**	**.847**
	Tertiary214				1.000	**.657**	**.743**	**-.648**	**-.608**	**.794**	**.801**
	Empl155					1.000	**.916**	**-.963**	**-.952**	**.651**	**.602**
	Empl216						1.000	**-.939**	**-.920**	**.661**	**.604**
	UnEmp157							1.000	**.976**	**-.598**	**-.550**

UnEmp218								1.000	**-.589**	**-.554**
EmHiT159									1.000	**.916**
EmHiT2110										1.000

Source: Eurostat, 2022, [SDG_17_40], [TEC00013] [TGS00003], [TGS00010], [TGS00037], [TGS00039], [TGS00102], [TGS00109]

The *Table 2* shows different levels of the corelations among economic variables in the case study. The *very strong correlations* are at the levels of values from 0.800 to 1.000 by the other words between 80% and 100%. The strong correlations among economic variables are from 0.500 to 0.800, as between 50% and 80%. Correlations among economic variables under the level of 0.500 are not important from point of view of analyses in this study. Negative values among economic variables mean the contradicting correlations, when given negative economic variable increases the other non-negative variables decrease or opposite. Naturally the given negative variable is direct proportional to other negative one.

The *Table 3* rotated component matrix shows the different economic variables of the study selected into two components, which are presented in *the coordinate system* in ***Figure 1***. The economic variables of the component-1 are lying at the line "X" as horizontal, while variables of the component-2 are lying at the line "Y" vertical line. In *Figure 1* economic variables of the component-1 are Tertiary153 and Tertiary214, tertiary educational attainment, age group 25-64; Empl155 and Empl216, employment rate of the age group 20-64; UnEmp157 and UnEmp218, unemployment rate 15 years or over; EmHiT159 and EmHiT2110, employment in high-tech sectors in total employment. Variables of the component-2 are RGDP1, regional gross domestic product by NUTS 2 regions and RGDPCap2, real growth rate of regional gross value added (RGVA) per capita.

Table 3: Rotated Component Matrix[a]

	Component	
	1	2
Empl216	.920	
Empl155	.905	
UnEmp157	-.892	
Tertiary214	.882	
UnEmp218	-.878	
EmHiT159	.855	
EmHiT2110	.834	
Tertiary153	.823	
RGDP1		.917
RGDPCap2		.873

a= Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Source: Eurostat, 2022, [SDG_17_40], [TEC00013] [TGS00003], [TGS00010], [TGS00037], [TGS00039], [TGS00102], [TGS00109]

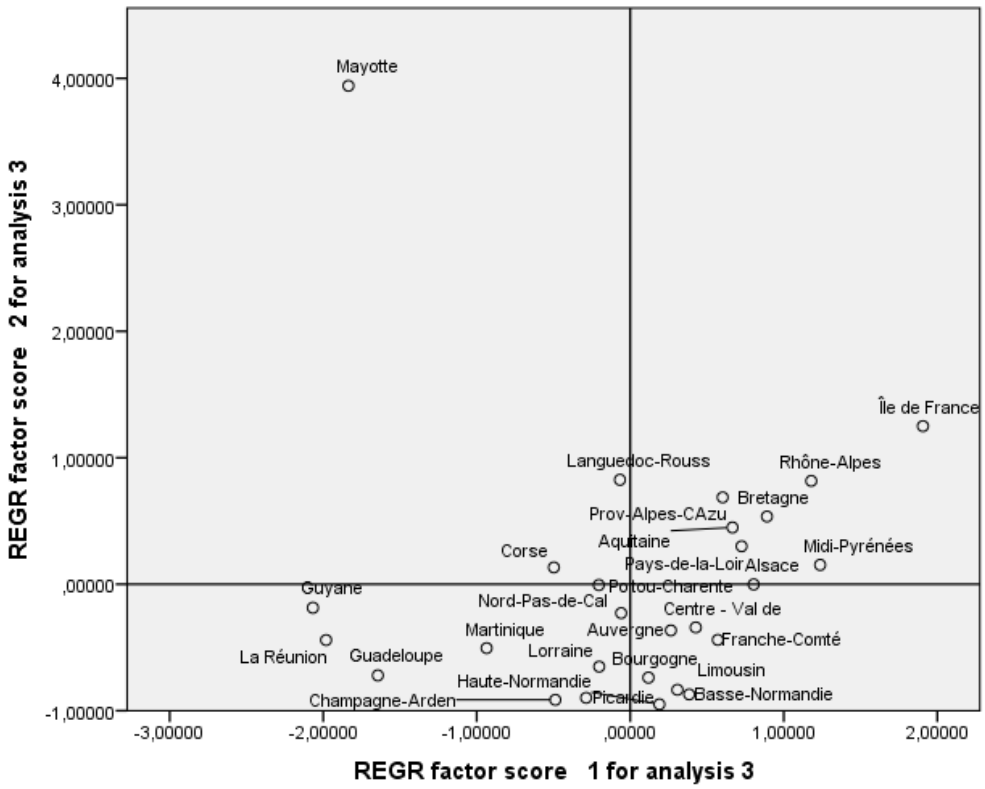


Figure 1: Correlations among the economic variables of regions in France at Line X: Tertiary153, Tertiary214, Empl155, Empl216, UnEmp157, UnEmp218 EmHiT159, EmHiT2110, and at Line Y: RGDP1, RGDPCap2

Source: Eurostat, 2022, [SDG_17_40], [TEC00013] [TGS00003], [TGS00010], [TGS00037], [TGS00039], [TGS00102], [TGS00109]

RESULTS AND DISCUSSION

There are some main results concerning hypotheses can be overviewed based on the analysing data concerning the NUTS 2 regions of France in the researched period.

1. The analyse proofed that *unemployment rate 15 years or over in 2015* (UnEmp157) had very strong correlations by 0.976 with unemployment rate 15 years or over in 2021 (UnEmp218) by NUTS 2 regions. [TGS00010]

2. The *unemployment rate 15 years or over in 2015* (UnEmp157) had very strong *negative correlations* by -0.939 with employment rate of the age group 20-64 in 2015 (Empl216). This means that in those regions of France, where the unemployment rate decreased, the employment rate consequently very strongly increased by increasing the investments and creating jobs. [TGS00102]

3. The analyse proofed the very strong *negative correlations* of *employment rate of the age group 20-64 in 2015* (Empl155) by -0.963 with unemployment rate 15 years or over in 2015 (UnEmp157), also, this has very strong negative correlations by -0.952 with unemployment rate 15 years or over in 2021 (UnEmp218) and also, it's very strong correlations by 0.916 with employment rate of the age group 20-64 in 2015 (Empl216). [TGS00010], [TGS00102]

4. The analyse proofed very strong correlation of tertiary educational attainment, age group 25-64 in 2015 (Tertiary153) by 0.935 with tertiary educational attainment, age group 25-64 in 2021 (Tertiary214), by 0.847 with the employment in high-tech sectors in total employment in 2021 (EmHiT2110) and by 0.808 with employment in high-tech sectors in total employment in 2015 (EmHiT159). [TGS00109], [TGS00039].
The analyse also strengthened that the regional gross domestic product (RGDP1) has very strong correlation by 0.831 with real growth rate of regional gross value added (GVA) per capita, (RGDPCap2). [TGS00003], [TGS00037].
Tertiary educational attainment age group 25-64 in 2021 (Tertiary214) has really very strong correlation by 0.801 with employment in high-tech sectors in total employment in 2021 (EmHiT2110). [TGS00039], [TGS00109].
Also, there are very strong negative contradicting correlations between employment rate of the age group 20-64 in 2021(Empl216) by -0.920 with unemployment rate 15 years or over in 2021 by NUTS 2 regions (UnEmp218). [TGS00010], [TGS00102].

There some important *strong correlations* between 0.500 and 0.800 (50% - 80%) are among the economic variables as features of the NUTS 2 regions in France [TGS00010], [TGS00102], which are as follows:

- Tertiary214 with Empl155 by 0.657, Empl216 by 0.743, EmHiT159 by 0.794, UnEmp157 by -0.648 and UnEmp218 by -0.608.
- Empl216 with EmHiT159 by 0.661 and EmHiT2110 by 0.604.
- Empl155 with EmHiT159 by 0.651 and EmHiT2110 0.602; and
- Tertiary153 with Empl216 by 0.614.

In the coordinate system correlations can be followed in cases of NUTS 2 regions of France. In *Figure 1* in the *first quarter – up-right* –regions are Île de France, Rhône-Alpes, Bretagne, Provence-Alpes-Côte d'Azur, Aquitaine, Pays-de-la-Loire, Alsace and Midi-Pyrénées. This quarter is a positive section, which means that the economic variables concerning the features of the NUTS2 regions in cases of two components at X and Y lines are increasing or little decreasing, but *only two negative variables* as unemployment 15 years or over in 2015 and 2021 (UnEmp157 and UnEmp218) decrease or little increase. In cases of regions of this first quarter the employment rate of the age group 20-64 by NUTS 2 regions increased mostly more than 70% either in 2015 or 2021, and in case of tertiary educational attainment, age group 25-64 the share was 32%-46% in 2015 and this share increased to level of 38%-54% in 2021. In the same time the growing rate in fields of regional GDP was between 10%-17%, while real growth rate of regional gross value added per capita (RGDPCap2) was only by 2%-10%, which was less increased than the previously mentioned economic variables in the researched period. [TGS00102]

In the *second quarter – up-left* –regions are Mayotte, Languedoc-Roussillon, Corse, and Poitou-Charentes.
In the *third quarter – down-right* – the regions are Centre - Val de Loire, Auvergne, Franche-Comté, Bourgogne, Limousin, Basse-Normandie and Picardie. This quarter, where the economic variables concerning the features of NUTS 2 regions in case of component at X line are increasing or little decreasing, but only two negative variables as unemployment 15 years or over in 2015 and 2021 (UnEmp157 and UnEmp218) decrease or little increase. Economic variables concerning the features of NUTS 2 regions in cases of component at Y line are decreasing or little increasing.
In the *fourth quarter – down–left* - regions are Nord-Pas-de-Calais, Martinique, Lorraine, Haute-Normandie, Champagne-Ardenne, Guadeloupe, La Réunion and Guyane. This quarter is a negative section, which means that the economic variables concerning features of NUTS 2 regions in cases of two components at X and Y lines are decreasing or little increasing, but only two negative variables unemployment 15 years or over in 2015 and 2021 as UnEmp157 and UnEmp218 increase or little decrease.

In the first quarter the unemployment rate by NUTS 2 regions [TGS00010], in cases of 15 years or over less was between 8%-11% in 2015 and decreased little to 6%-8% in 2021. Also, in fields of employment in high-tech sectors in total employment was between 3%-7% in 2015 and somehow at the same level of 3%-8% in 2021 in regions in the first quarter, which share consequently increased in this period and this was considerably higher comparably to share of employment in high-tech sectors in total employment than in other regions of France. In cases of *Tertiary153 and Tertiary214, tertiary educational attainment, age group 25-64*, the share was considerably higher in regions of this first quarter than in regions of other three quarters in coordinate system.

Data show that *employment rate of age group 20-64 in percent* was at very highly level in regions of the first quarter more than in the other regions in France in researched period between 2015 and 2021. This considerable share of employment could be stimulated by highly level in share of the *tertiary educational attainment,* age group 25-64 in percent either in 2015 or in 2021. Also, tertiary educational attainment in regions of first quarter had role in creating considerable share of *employment in high-tech sectors* more than in cases of other regions of France. It can be declared that *innovative prosperity of the economy* can be stimulated and enforced by increasing considerable share of employment in high-tech sectors, which can be resulted mostly by increasing share of tertiary educational attainment, age group 25-64. Share of *tertiary educational attainment, age group 25-64* was considerably higher in regions of the first quarter, which resulted more development process than in other regions of France.

CONCLUSION

Tertiary educational attainment, age group 25-64 in 2021 could successfully stimulate extending increasing *employment in high-tech sectors* with providing adequate bases for the prosperity of industrial sectors, even in fields of high-tech sectors for *further innovative development* at national and regional levels in France during the researched period. It is important to emphasize that employment in high-tech sectors in total employment (EmHiT159) by NUTS 2 regions *in 2015* has very strong correlation by 0.916 with employment in high-tech sectors in total employment (EmHiT2110) by NUTS 2 regions *in 2021* [TGS00039]. This shows that high-technology sectors in total employment have consequently been extending in French regions for 2015-2021 based on increasing innovative investments implemented in these sectors.

Therefore, the tertiary educational attainment ensured more highly educated human resources for industry, while this strengthened high-tech development for further longer time. Based on results of analysing the first region in France is Île de France, then Midi-Pyrénées**,** Rhône-Alpes and Alsace. Because in Île de France percent of employment in high-tech sectors in total employment by NUTS 2 regions was 8% accompanying with highly employment share in age group 20-64 more than 70% in 2015 and in 2021 [TGS00102]. Also, share of age group 25-64 more than 50% in field of tertiary educational attainment as top level in France. Also, share of high-tech sectors in total employment was 7% in Midi-Pyrénées region, 5% and 5% in Rhône-Alpes and Alsace regions with highly level in fields of employment and tertiary educational attainment age group 25-64, which was at the best level in France.

All these favourable increasing regions could enforce prosperity in fields of innovative technological development accompanying with increase in fields of regional GDP and real growth rate of regional gross value added per capita in France in the researched period. Naturally other regions of France could realise considerable development by 10% and 18% in regional GDP growth but less employment in high-tech sectors and tertiary educational attainment in age group 25-64, because of increasing service sectors in the same time, for example by 18% in Languedoc-Roussillon and by 17% in Provence-Alpes-Côte d'Azur and Corse regions.

41% growing regional GDP in Mayotte mostly resulted by tourism (Table 1), [SDG_17_40], [TEC00013], [TGS00003]. Innovative prosperity in highly developed economies should be based on the highly level employment in high-tech sectors and tertiary educational attainment in age group 20-64 to increase regional GDP and real growth rate of regional gross value added per capita based on harmonized balanced development for all regions of any national economy.

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ECONOMIC CONDITIONS IN REGIONS OF ITALY IN 2020S

ZSARNÓCZAI, J. Sándor, DEMÉNY, Krisztina

Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering,
Institute of Environmental Engineering and Natural Science, Doberdó u. 6, H-1034 Budapest, Hungary,
e-mail: zsarnoczaisandorjozsef@gmail.com, demeny.krisztina@rkk.uni-obuda.hu

Abstract: *The study analyses some economic features of NUTS 2 regions in Italy in fields of regional gross domestic product, real growth rate of regional gross value added per capita, the tertiary educational attainment, based on the age group 25-64, employment rate of the age group 20-64, unemployment rate and employment in high-tech sectors between 2015-2021. High-technology sectors should be developed based on high-technology manufacturing and knowledge-intensive high-technology services in total employment. Employment can be more successful and productivity if the educated level of the employees is higher level. Skilled workers can realise more developed high-technology manufacturing industry based on wider-side knowledge. Aims of the study are to analyse the difference among developed levels of NUTS 2 regions in Italy using statistical analyses based on statistical data base. In Emilia-Romagna in North-Italy the employment rate was 71% in 2015 and increased to highest level by 73% in 2021, while the unemployment rate decreased from 10% in 2015 to 7% in 2021. The solution can be realised for decreasing North-South economic and social conflicts in Italy and large difference among developed levels by more capital-inflow to the Southern regions to create more jobs and increase educated level accompanying with increasing foreign direct investment.*

Keywords*: Development, employment, gross value added, high-technology, North-South conflict, tertiary educational attainment*

INTRODUCTION

The study analyses the main important economic features of NUTS 2 regions in Italy from point of view of regions regional gross domestic product, real growth rate of regional gross value added (GVA) per capita, the tertiary educational attainment, based on the age group 25-64, employment rate of the age group 20-64, unemployment rate and employment in high-tech sectors between 2015-2021. High-technology sectors mean high-technology manufacturing and knowledge-intensive high-technology services in percentage of total employment in each region. Importance of the study that the employment can be more successful and productivity if the educated level of the employees is higher level as it can be possible. Therefore, the skilled workers can realise more developed high-technology manufacturing industry based on wider-side knowledge. The aims of the study are to analyse the difference among developed levels of NUTS 2 regions in Italy and to cover their differences from point of view of economic growth and educational conditions concerning possible prosperity of high-technological manufacturing. The high-technological production is the base for the further economic prosperity of any region and nation. Importance of objective in this study also is that Italy is the third biggest nation in European Union, as one of three most important EU member states after Germany and

France. Also, Italy is a member of the G-7 countries, which have dominant role for the European and the international economic development. It can be mentioned that Italy is a member state in euro zone including the European Union. Most of Northern part of Italy – mostly including Lombardia – is a part of the highest developed areas in the EU.
The wide side analyse needs for using statistical analyses to cover exact differences among NUTS 2 regions of Italy. Names of regions of Italy, on which the study focuses are namely Piemonte, Valle d'Aosta/Vallée d'Aoste, Liguria, Lombardia, Provincia Autonoma di Bolzano/Bozen, Provincia Autonoma di Trento, Veneto, Friuli-Venezia-Giulia, Emilia-Romagna, Toscana, Umbria, Marche, Lazio, Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia and Sardegna.

The *Hypotheses* concerning the study can be summarised in the researched period of 2015-2021, which are as follows:
1 Provide proof that the employment rate of the age group 20-64 by NUTS 2 regions of Italy in 2015 (Empl155) has important correlations with employment rate of the age group 20-64 by NUTS 2 regions in 2021, (Empl216) and with unemployment rate by NUTS 2 regions 15 years or over in 2015 (UnEmpl157) and also, with unemployment rate by NUTS 2 regions 15 years or over in 2021 (UnEmpl218), [TGS00102], [TGS00010].

2 The unemployment rate by NUTS 2 regions of Italy and 15 years or over *in 2015* (Unempl157) has any strong correlations with unemployment rate by NUTS 2 regions, 15 years or over in 2021 (Unempl218), [TGS00010].

3 Tertiary educational attainment, age group 25-64 in the NUTS 2 regions of Italy *in 2015* (Tertiary153) has important correlation with tertiary educational attainment, age group 25-64 in NUTS 2 regions *in 2021* (Tertiary214), [TGS00109].

4 The employment in high-tech sectors by NUTS 2 regions of Italy *in 2015*, namely as the high-technology sectors means high-technology manufacturing and knowledge-intensive high-technology services, in percentage of total employment (EmHiT159) has any important correlation with employment in high-tech sectors by NUTS 2 regions, in percentage of total employment *in 2021* (EmHiT2110), [TGS00039].

5 Also, provide proof that the regional gross domestic product by NUTS 2 regions of Italy (RGDP1) has strong correlations with real growth rate of regional gross value added (GVA) per capita (RGVACap2).

6 The employment rate of the age group 20-64 by NUTS 2 regions of Italy *in 2021* (Empl216) has somehow contradicting strong correlation with unemployment rate by NUTS 2 regions from 15 years or over *in 2015* (UnEmpl157) and with unemployment rate by NUTS 2 regions from 15 years or over in 2021 (UnEmpl218). [TGS00010], [TGS00102].

Additionally, to above mentioned correlations among economic variables, naturally there are other important strong correlations among economic variables as features of regions of Italy, which provide clearer and wider exact differences among NUTS 2 regions of Italy in fields of their economic development levels. These should be proofed that some economic variables also have important correlations with other economic variables during the researched period in this study, which are as follows:

The regional gross domestic product by NUTS 2 regions (RGDP1) has any correlations with employment rate of the age group 20-64 by NUTS 2 regions in 2015 and 2021 (Empl155), (Empl216), and unemployment rate

by NUTS 2 regions,15 years or over in 2015 and in 2021 (UnEmp157), (UnEmp218). [TGS00010], [TGS00102].

It should be proofed that the (RGVACap2) has any correlations with employment rate of the age group 20-64 by NUTS 2 regions in 2015 and 2021 (Empl155), (Empl216), and unemployment rate by NUTS 2 regions,15 years or over in 2015 and in 2021 (UnEmp157), (UnEmp218). [TGS00010], [TGS00102].
The tertiary educational attainment, age group 25-64 by NUTS 2 regions in 2015 (Tertiary153) has correlations with employment rate of the age group 20-64 by NUTS 2 regions in 2015 and in 2021 (Empl155), (Empl216), and, the employment in high-tech sectors by NUTS 2 regions in 2015 and 2021 (EmHiT159) and (EmHiT2110). [TGS00039], [TGS00102], [TGS00109]

The tertiary educational attainment, age group 25-64 by NUTS 2 regions in 2021 (Tertiary214)
has any correlations with employment rate of the age group 20-64 by NUTS 2 regions in 2015 and 2021 (Empl155), (Empl216), and unemployment rate by NUTS 2 regions,15 years or over in 2015 and in 2021 (UnEmp157), and, with the employment in high-tech sectors by NUTS 2 regions in 2015 and 2021 (EmHiT159) and (EmHiT2110). [TGS00010], [TGS00039], [TGS00102], [TGS00109].
Finally, the study would like to declare that how much importance of the tertiary educational attainment, age group 25-64 is in the prosperity of high-technology sectors in the NUTS 2 regions of Italy during the researched period.

The education system based on the tertiary educational attainment accompanying with the *individual and collective five elements of teacher professionalism* consisting of 1-professional knowledge and competences, 2-commitment to a high standard of practice as well as lifelong learning, 3-professional exchange, collaboration and identity, 4-responsibility and autonomy and 5-status and standing of the profession. (Brodén 2022 December), (OECD Forthcoming), (van der Vlies, 2020).

Naturally the higher education is the centre of the attention in the educational strategy of tertiary educational attainment as other authors declared (Viberg et al. 2018).
Some other authors focus on the correlations between innovation and economic development based on the productivity. Innovation indicators include the ratio of patents owned by foreign residents and the number of patent applications in each industry in the technology sector. Government and higher education have higher R&D (research-development) expenditures than private and non-profit sectors. (Raghupathi – Raghupathi 2017). In the study of innovation systems, a regional innovation system (RIS) encourages the rapid diffusion of knowledge, skills and best practice within a geographic area larger than a city, but smaller than a nation. Simply put, innovation can lead to higher productivity, meaning that the same input generates a greater output. As productivity rises, more goods and services are produced – in other words, the economy grows (Mohamed et al. 2022).

Our opinion is that the digital technology by using computer system became important issue in the tertiary educational attainment and some other post-graduating study programs, which can make be easier for participants of education to available knowledge of study materials. The higher educational level can provide more possibility for developing innovation at levels of national economies and economic development of regions. The innovation can increase productivity of economies leading increase of their international competitiveness. This study can provide example for the developing innovation by tertiary educational attainment in cases of regions of Italy.

Šabić - Vujadinović (2017) declared that key factors of development include: natural and human resources, level of technological development, capital, knowledge, institutional and legislative framework, values, ethics

and commitment. Regional or cohesion policy is an important mechanism for sustainable economic development (see more in Muresan – Gogu 2012).

Our opinion emphasizes that the *regional development is equal* to the innovation of technology and skilled human resources based on the tertiary educational attainment. The natural resources are alone, which cannot be enough without technological development of which the essence is the innovation.
Therefore, this case study focuses on the regional innovative development accompanying with education, even tertiary educational attainment in cases of regions in Italy. Also, naturally the sustainable economic development needs for equilibrium between the given natural resources and their using methods and measures implemented by human society. It should be time for renewing of natural resources. The innovative technological development should have attention for sustainability of natural resources.

Hegedűs – Molnár (2020) wrote about the new public management concerning the reducing the role of the state and supporting deregulation and marketization to develop national economy (see more in Claessens et al 2018). Csiszári-Kocsír (2022) analysed the possible apply of the digital technology in bank sector, which technology can be useful for the companies to create their better performance for the near future. Therefore, the bank sector based on using digital technology can help companies to develop their innovative progress in their economic activities at national and regional economic levels (also Garai-Fodor - Csercsa 2022). Naturally the digital technology continuously extends in wide-side bank sector, which can be more favourable in cases of companies to develop regional economics based on wider knowledge of human resources needing for tertiary educational attainment (see more in Pintér et al 2021; Thakor 2020).

From point of view of *our opinion* is that deregulation and marketization can stimulate increasing self-management of companies to introduce more productive innovative technologies in their performance even at regional economic level. Also, the digital technology can stimulate more progress in the economic activities of companies for local and regional levels, which can be useful for all performance of the society.
In the following chapters the analyse overviews correlations among different NUTS 2 regions of Italy based on their economic features as economic variables mentioned before in the hypotheses.

MATERIAL METHOD

The case study analyses the economic variables as features of NUT 2 regions of Italy for the period of 2015-2021 by the main variables based on the statistical analyses.

The main variables used in this case study, which are as follows: regional gross domestic product (RGDP1); real growth rate of regional gross value added (GVA) per capita (RGVACap2); tertiary educational attainment, age group 25-64 by sex, annual, in 2015, tertiary education (levels 5-8), (Tertiary153); tertiary educational attainment, age group 25-64 by sex, annual, in 2021, tertiary education (levels 5-8), (Tertiary214); employment rate of the age group 20-64 in 2015 (Empl155); employment rate of the age group 20-64 in 2021 (Empl216); unemployment rate in 2015 and 15 years or over (UnEmp157); unemployment rate in 2021 and 15 years or over (UnEmp218); employment in high-tech sectors in 2015, high-technology sectors (high-technology manufacturing and knowledge-intensive high-technology services), percentage of total employment (EmHiT159); employment in high-tech sectors in 2021 (EmHiT2110). [SDG_17_40], [TGS00003], [TGS00010], [TGS00037], [TGS00039], [TGS00102], [TGS00109], (Table 1; Eurostat, 2022).

Table 1: Main economic conditions of NUTS 2 regions, regional gross domestic product, real growth rate of regional gross value added (GVA) per capita 2015 = 100, tertiary educational attainment, age group 25-64, employment rate of the age group 20 64, unemployment rate and employment in high-tech sectors by NUTS 2 regions in Italy in percent, million euro between 2015-2021

Regions	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Emilia-Romagna I.	*10*	*4*	*20*	*23*	*71*	*73*	*10*	*7*	*3*	*3*
Provincia Autonoma di Trento	12	6	19	22	71	72	10	7	3	4
Toscana	4	-2	19	21	70	70	11	10	3	4
Piemonte	7	1	17	20	68	70	14	10	4	4
Marche	7	1	18	22	67	69	12	9	3	3
Umbria	6	-1	20	22	68	69	14	7	2	3
Liguria	3	-4	20	22	67	68	14	13	3	3
Abruzzo	3	-1	17	21	59	62	12	10	3	3
Lombardia II.	*11*	*6*	*19*	*21*	*70*	*72*	*10*	*8*	*5*	*5*
Lazio	6	1	23	26	63	64	16	14	7	8
Provincia Autonoma di Bolzano/Bozen III.	*13*	*5*	*16*	*18*	*77*	*76*	*5*	*5*	*2*	*2*
Valle d'Aosta/Vallée d'Aoste	2	-4	16	19	71	72	12	10	3	4
Friuli-Venezia Giulia	8	1	18	21	68	72	10	7	2	3
Veneto	9	2	16	20	68	71	8	7	3	3
Basilicata IV.	*5*	*1*	*15*	*18*	*53*	*57*	*13*	*10*	*2*	*2*
Sardegna	4	-3	15	17	53	57	21	16	2	2
Molise	5	1	18	20	53	56	16	15	2	2
Puglia	8	1	13	16	47	50	23	18	1	2
Calabria	2	-6	16	16	42	45	26	21	1	2
Campania	6	-1	15	16	43	45	25	27	2	3
Sicilia	3	-4	13	15	43	44	27	25	2	2

Source: Eurostat, 2022, [SDG_17_40], [TEC00013], [TGS00003], [TGS00010], [TGS00037], [TGS00039], [TGS00102], [TGS00109]

Note: selection of NUT 2 regions based on four quarters of coordinate system in the Figure-1

Economic variables in the period of 2015-2021, in percent

RGDP1 = Regional gross domestic product by NUTS 2 regions - million EUR [TGS00003]

RGVACap2 = Real growth rate of regional gross value added (GVA) per capita at basic prices by NUTS 2 regions [TGS00037], annual index, 2015 = 100

Tertiary153 = Tertiary educational attainment, age group 25-64 by sex and NUTS 2 regions [TGS00109], annual, in 2015, in percent, Tertiary education (levels 5-8), from 25-64, Total

Tertiary214 = Tertiary educational attainment, age group 25-64 by sex and NUTS 2 regions [TGS00109], annual, in 2021, in percent, Tertiary education (levels 5-8), from 25-64, Total

Empl155 = Employment rate of the age group 20-64 by NUTS 2 regions [TGS00102], in 2015, in percent, Total

Empl216 = Employment rate of the age group 20-64 by NUTS 2 regions [TGS00102], in 2021, in percent, Total

UnEmp157 = Unemployment rate by NUTS 2 regions [TGS00010], in 2015, in percent, Total, 15 years or over

UnEmp218 = Unemployment rate by NUTS 2 regions [TGS00010], in 2021, in percent, Total, 15 years or over

EmHiT159 = Employment in high-tech sectors by NUTS 2 regions [TGS00039], in 2015, High-technology sectors (high-technology manufacturing and knowledge-intensive high-technology services), Percentage of total employment

EmHiT2110 = Employment in high-tech sectors by NUTS 2 regions [TGS00039], in 2021, High-technology sectors (high-technology manufacturing and knowledge-intensive high-technology services), Percentage of total employment

Pallant (2020 April) prepared the statistical analysing method used in this case study. Our statistical analyses introduced statistical data base in *Table 1* from the Eurostat (2022), which became further analysing steps, as correlation matrix in Table 2, **r**otated component matrix in Table 3.
The Figure -1 and Figure 2 show correlations among the economic variables in the coordinate system and Figure 3 shows dendrogram using ward linkage with rescaled distance cluster combine.

In the Table 2 the correlations in up-part of this table are important for the analysing, the significance in down -part of this table is not so important for our research.
In the *Table 2* the correlations are shown by different values among economic variables. If the values for correlations are between 0.800 and 1.000 (80%-100%), in this case the correlations are very strong, but between 0.500 and 0.800 these are only strong. When the values of correlations among economic variables are under level of 0.500 (50%), in this case the correlations are not important for the statistical analyses. When values of correlations among variables are *negative*, this means that the correlations of variables are inversely proportional the other positive variables and direct proportional to the other negative variables.

Table 2: Correlation Matrix

		RGDP1	**RGVACap2**	**Tertiary153**	**Tertiary214**	**Empl155**	**Empl216**	**UnEmp157**	**UnEmp218**	**EmHiT159**	**EmHiT2110**
Correlation	RGDP1	1.000	**.933**	.177	.246	**.514**	**.515**	**-.550**	**-.519**	.171	.126
	RGVACap2		1.000	.275	.385	**.519**	**.533**	**-.624**	**-.580**	.324	.238
	Tertiary153			1.000	**.937**	**.589**	**.580**	-.478	-.482	**.681**	**.700**
	Tertiary214				1.000	**.685**	**.693**	**-.622**	**-.630**	**.725**	**.702**
	Empl155					1.000	**.993**	**-.918**	**-.899**	.450	.395

	Empl216						1.000	**-.933**	**-.927**	.439	.375
	UnEmp157							1.000	**.948**	-.347	-.247
	UnEmp218								1.000	-.285	-.207
	EmHiT159									1.000	**.932**
	EmHiT2110										1.000
Sig. (1-tailed)	RGDP1		.000	.221	.141	.009	.008	.005	.008	.229	.293
	RGVACap2			.114	.042	.008	.006	.001	.003	.076	.150
	Tertiary153				.000	.002	.003	.014	.013	.000	.000
	Tertiary214					.000	.000	.001	.001	.000	.000
	Empl155						.000	.000	.000	.020	.038
	Empl216							.000	.000	.023	.047
	UnEmp157								.000	.062	.140
	UnEmp218									.105	.184
	EmHiT159										.000
	EmHiT2110										

Source: Eurostat, 2022, [SDG_17_40], [TEC00013], [TGS00003], [TGS00010], [TGS00037], [TGS00039], [TGS00102], [TGS00109]

The *Table 3* shows the rotated component matrix and selects the economic variables into three components by showing the negative variables. In this case the negative variables are UnEmp218 and UnEmp157, as unemployment rate in 2015 and in 2021, for 15 years or over. This means that if the unemployment rate increases the other variables decrease, namely for example the employment rate. Also, if the unemployment rate decreases the other variables increase, namely for example the employment rate.

The *Table 4* shows the cluster membership applied for NUT 2 region in Italy during the researched period. In this case-study this Table 4 shows that regions of Italy are selected into five clusters or even less than five. Generally, the authors decide that into how many clusters the regions are to be selected. In our study authors decide selection of the objectives researched – for example regions, or countries - into five clusters as an optimum measure.

Tables of this chapter provide such data, which are analysed in this study by giving the basic statistical data and showing the correlations and selection of variables into three components. In the further chapter figures show NUTS 2 regions of Italy and their positions in the coordinate system based on their economic features.

Table 3: Rotated Component Matrix[a]

Variables	Component		
	1	2	3
UnEmp218	-.926		
Empl216	.907		
UnEmp157	-.901		
Empl155	.890		
EmHiT2110		.954	
EmHiT159		.928	
Tertiary153		.796	
Tertiary214		.769	
RGDP1			.933
RGVACap2			.916
a = Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			

Source: Eurostat, 2022, [SDG_17_40], [TEC00013], [TGS00003], [TGS00010], [TGS00037], [TGS00039], [TGS00102], [TGS00109]

The main issues are for ordering list of regions of Italy, which are as follows:
- share of employment,
- tertiary educational attainment, age group 25-64,
- employment in high-tech sectors in percentage of total employment,
- regional gross domestic product,
- real growth rate of regional gross value added (GVA) per capita.

Ordering list of regions for the first ten regions:

Lombardia	/1
Provincia Autonoma di Trento	/2
Emilia-Romagna	/3
Piemonte	/4
Veneto	/5
Friuli-Venezia Giulia	/6
Marche	/7
Umbria	/8
Toscana	/9
Lazio	/10

Note: Regions of Italy selected into five clusters
Cluster-1: Piemonte, Lombardia, Provincia Bozen, Provincia Trent, Veneto, Friuli-Ven-Giul, Emilia-Romagna, Marche,
Cluster-2: Valle d'Aosta, Liguria, Toscana, Umbria, Abruzzo
Cluster-3: Lazio

Cluster-4: Molise, Basilicata, Sardegna
Cluster-5: Campania, Puglia, Calabria, Sicilia

Table 4: Cluster Membership

Case	5 Clusters	4 Clusters	3 Clusters	2 Clusters
1: Piemonte	1	1	1	1
2: Valle d'Aosta	2	2	1	1
3: Liguria	2	2	1	1
4: Lombardia	1	1	1	1
5: Provincia Bozen	1	1	1	1
6: Provincia Trent	1	1	1	1
7: Veneto	1	1	1	1
8: Friuli-Ven-Giul	1	1	1	1
9: Emilia-Romagna	1	1	1	1
10: Toscana	2	2	1	1
11: Umbria	2	2	1	1
12: Marche	1	1	1	1
13: Lazio	3	3	2	1
14: Abruzzo	2	2	1	1
15: Molise	4	4	3	2
16: Campania	5	4	3	2
17: Puglia	5	4	3	2
18: Basilicata	4	4	3	2
19: Calabria	5	4	3	2
20: Sicilia	5	4	3	2
21: Sardegna	4	4	3	2

Source: Eurostat, 2022, [SDG_17_40], [TEC00013], [TGS00003], [TGS00010], [TGS00037], [TGS00039], [TGS00102], [TGS00109]

RESULTS AND DISCUSSION

The case-study focuses on the analysing differences among NUTS 2 regions of Italy based on their economic variables as features to create ordering list of regions mostly from point of view of the employment in high-tech sectors and its economic background including the main educational conditions and economic development.

From point of view of the above mentioned aims the Figure-1 and Figure-2 can give wide-side overview for these differences of regions based on selecting regions into four quarters of the coordinate system.

Figure-1 focuses on correlations among the economic variables as economic features of regions in Italy, namely the component-1 lying at Line X includes unemployment rate by regions in 2015 and 2021 (UnEmp157, UnEmp218), employment rate of the age group 20-64 by regions in 2015 and 2021 (Empl155,

Empl216) and the component-2 lying at Line Y includes employment in high-tech sectors by regions in 2015 and 2021 (EmHiT159, EmHiT2110), and tertiary educational attainment, age group 25-64 in 2015 and 2021 (Tertiary153, Tertiary214).
In Figure-1 regions of Italy *in the first quarter* of the coordinate system are Piemonte, Provincia Autonoma di Trento, Liguria, Emilia-Romagna, Toscana, Abruzzo, Marche and Umbria.
In this first quarter at line X generally the unemployment rate decreases, or little increases, while the employment increases or little decreases in 2015 and 2021, essentially in the researched period. In this session the employment rate of the age group 20-64 in regions was at highly level between 59%-71% in 2015, while this increased to level between 62%-73% in 2021.

In the same period the unemployment rate 15 years or over was between 10%-14% in 2015 and this decreased to the level between 7%-13%. This trend shows the increasing growth of employment in 2021 comparably to 2015, while this has opposite to this trend in case of unemployment, where the unemployment could successfully decrease. While at line Y the employment in high-tech sectors by regions in 2015 and 2021 and tertiary educational attainment, age group 25-64 in 2015 and 2021 increase or little decrease.

Emilia-Romagna in North-Italy the employment rate was 71% in 2015 and increased to 73% in 2021, while the unemployment rate decreased from 10% in 2015 to 7% in 2021. The employment rate was the second biggest after 76% in Provincia Autonoma di Bolzano/Bozen in North Italy by the end of 2021. It should be mentioned that this autonomy province hardly is big than the Bolzano town among three Italian regions Veneto, Lombardia and Provincia Autonoma di Trento. Therefore, Bolzano cannot play important economic role in cases of regions.

In field of tertiary educational attainment, age group 25-64 in percent Emilia-Romagna had 20% in 2015, which increased to 23% in 2021, which was the second one after 26% in 2021 in *Lazio including Rome*. But Lazio has serious difficulty, because the unemployment rate was 14% in 2021, as by two times more than in case of unemployment rate in Emilia-Romagna. The highly level of unemployment rate in Lazio could provide less favourable economic prosperity by 6% increasing rate in regional gross domestic product and only 1% increasing rate in field of real growth rate of regional gross value added (GVA) per capita between 2015 and 2021. But Emilia-Romagna had better results by 10% in regional GDP and by 4% in regional GVA per capita in the same period. Increase of regional GVA per capita in Emilia-Romagna was the fourth after 6% in Lombardia, 6% in Trento and 5% in Bolzano more than 1% in Lazio.

Lazio has generally better position by 26% as top level in all of Italy in field of tertiary educational attainment, age group 25-64, because of capital of Italy is Rome in this region, which can create the wide-side university and high school education system opposite to other regions. But this favourable position could not considerably ensure better economic prosperity for Lazio against Bolzano, Trento, Lombardia, Emilia-Romagna and some other regions.

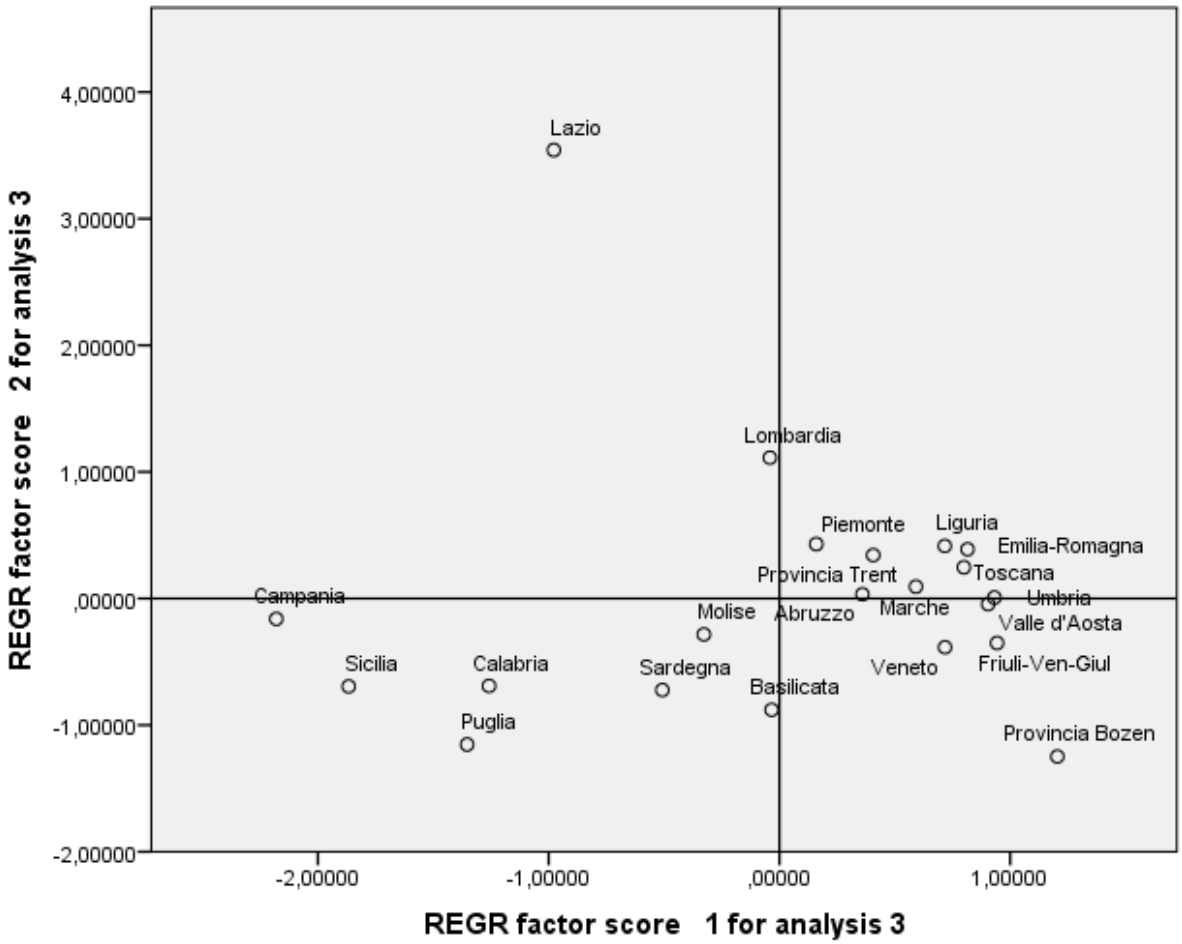

Figure 1: Correlations among the economic variables of regions in Italy at Line X, Component-1: UnEmp218, Empl216, UnEmp157, Empl155, and at Line Y, Component-2: EmHiT2110, EmHiT159, Tertiary153, Tertiary214

Source: Eurostat, 2022, [SDG_17_40], [TEC00013], [TGS00003], [TGS00010], [TGS00037], [TGS00039], [TGS00102], [TGS00109]

Lazio has 8% as the highest level in all of Italy in field of employment in high-tech sectors by the end of 2021, as the high-technology sectors (high-technology manufacturing and knowledge-intensive high-technology services), in percentage of total employment. But in Lazio the unemployment rate by 14% and employment rate by 64% resulted relatively highly level 8% in employment of high-technology sectors, while in case of Emilia-Romagna this was only 3%, which had resulted by highly level employment rate. Naturally if the employment rate in Lazio could have been more the employment in high-technology sectors had been closed the level of employment of high-technology sectors in Emilia-Romagna.

This means that the 8% in field of employment of high-technology sectors in Lazio could be realised by relatively low level of employment.

In spite that in those regions, where the employment rate of the age group 20-64 really is at highly level and the employment of high-technology sectors is somehow lower, the role of employment of high-technology sectors can have same importance comparably to case of Lazio.

From this point of view in Lombardia the employment rate was 72% in 2021, and the employment of high-technology sectors was 5%, in Trento these rates were 72% and 4%, in Emilia-Romagna these were 71% and 3% also in 2021. These regions could implement higher growing rate in fields of *regional GDP* and *regional GVA per capita* more than in case of Lazio by 6% in regional GDP growth and 1% in regional GVA growth per capita in the researched period. The regional GDP increased by 13% in Bolzano, 12% in Trento, 11% in Lombardia and 10% in Emilia-Romagna in the same time (*Figure 1; Figure 2*; Table 1), [SDG_17_40].
In Figure-1 regions of Italy *in the second quarter* of the coordinate system are Lazio and Lombardia. In this quarter generally the unemployment rate increases or little decreases, while the employment decreases or little increases in 2015 and 2021. While at line Y the employment in high-tech sectors by regions in 2015 and 2021 and tertiary educational attainment, age group 25-64 in 2015 and 2021 increase or little decrease.

In Figure-1 regions of Italy *in the third quarter* of the coordinate system are Valle d'Aosta/Vallée d'Aoste, Veneto, Friuli-Venezia-Giulia and Provincia Autonoma di Bolzano/Bozen. In this quarter at line X generally the unemployment rate decreases, or little increases, while the employment increases or little decreases in 2015 and 2021, essentially in the researched period. While at line Y the employment in high-tech sectors by regions in 2015 and 2021 and tertiary educational attainment, age group 25-64 in 2015 and 2021 decreased or little increases.

In Figure-1 regions of Italy *in the fourth quarter* of the coordinate system are Molise, Basilicata, Sardegna, Calabria, Puglia, Sicilia and Campania. In this quarter generally the unemployment rate increases or little decreases, while the employment decreases or little increases in 2015 and 2021. While at line Y the employment in high-tech sectors by regions in 2015 and 2021 and tertiary educational attainment, age group 25-64 in 2015 and 2021 decreased or little increases.

Generally, in the fourth quarter of the coordinate system the main economic variables or features of the regions have less favourable economic conditions, because *the unemployment is at very highly level* namely between 10%-27% and over 15% are in majority of regions. The unemployment rate is 27% at very highly level in Campania and 25% in Sicilia by the end of 2021 in spite that the unemployment rate has decreased since 2015, except in Campania, where the unemployment increased from 25% in 2015 to 27% in 2021. Also, tertiary educational attainment, age group 25-64 is between 15%-20% considerably under the average level of most of the regions of Italy by the end of 2021, which led to the low level of the employment in high-tech sectors between 2%-3% in the same time. The employment in high-tech sectors relatively is at very low, if we concern that the employment rate is also at very low level between 44%-57%, and 50% and under in cases of four regions are in Sicilia by 43%, in Campania by 45%, in Calabria by 45% and in Puglia by 50% by the end of 2021 (Figure 1).

In *Figure 2* somehow the regions are selected by little changes depending on the regional GDP growth and the regional GVA per capita. Friuli-Venezia Giulia and Veneto have a little better position by higher regional GDP by 8%-9% more than in cases of Umbria, Toscana, Lazio, Abruzzo and Liguria. Also, the regional GVA per capita decreased by 4% in Liguria, by 1% in Umbria and Abruzzo. In spite that the regional GVA per capita decreased by 2% in Toscana, but the employment in high-tech sectors is 4% by a little higher than in Friuli-Venezia Giulia and Veneto. In Toscana the relatively higher rate of employment in high-tech sector can a possible better prosperity for the near future than in cases of Friuli-Venezia Giulia and Veneto.

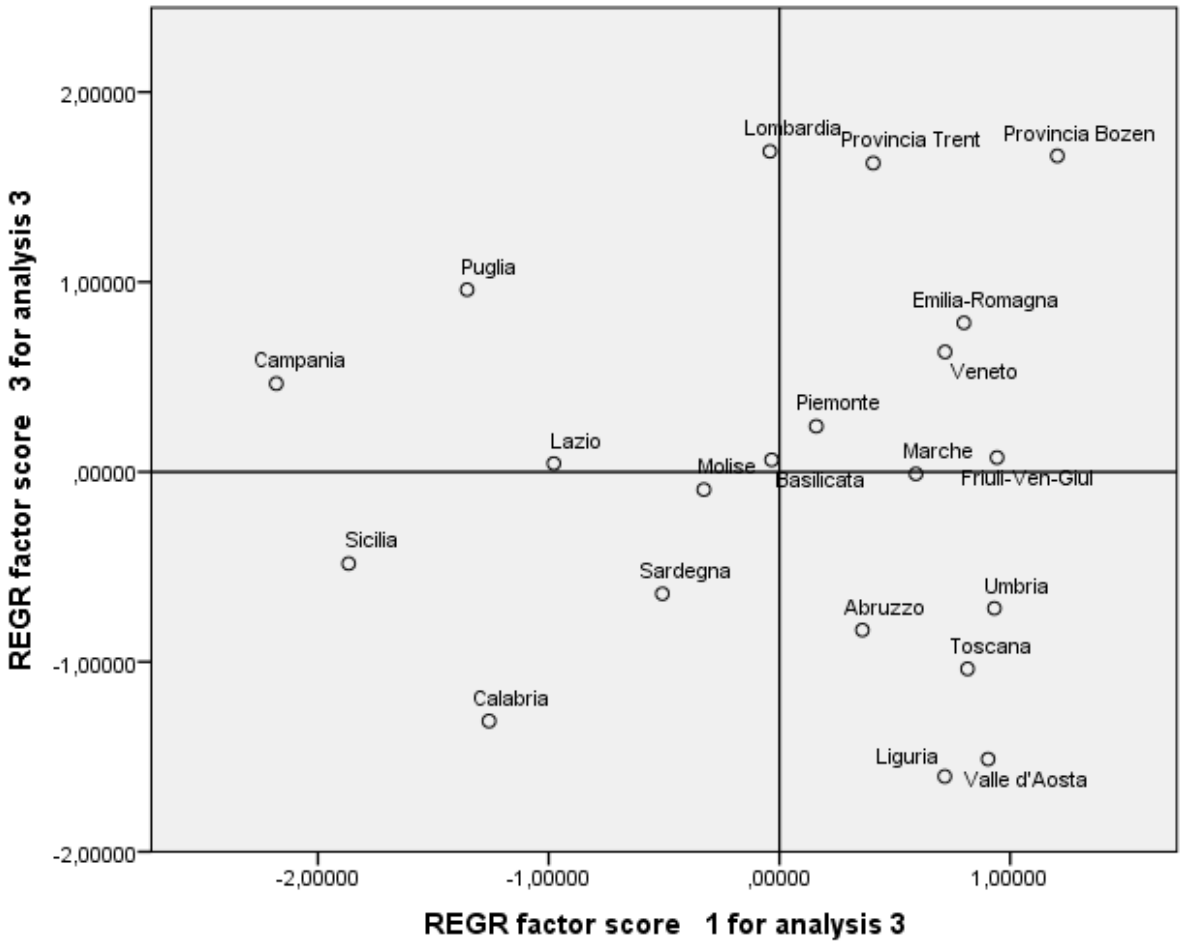

Figure 2: Correlations among the economic variables of regions in Italy at Line X, Componenet-1: UnEmp218, Empl216, UnEmp157, Empl155, and at Line Y, Componenet-3: RGDP1, RGVACap2
Source: Eurostat, 2022, [SDG_17_40], [TEC00013], [TGS00003], [TGS00010], [TGS00037], [TGS00039], [TGS00102], [TGS00109]

The ***Figure-2*** focuses on correlations among economic variables of regions in Italy, namely also the component-1 similarly to Figure-1, which is lying at Line X and includes unemployment rate by regions in 2015 and 2021 (UnEmp157, UnEmp218), employment rate of the age group 20-64 by regions in 2015 and 2021 (Empl155, Empl216). Also, the component-3 lying at Line Y includes regional gross domestic product by regions in Italy (RGDP1) and real growth rate of regional gross value added (GVA) per capita by regions in Italy (RGVACap2).

In Figure-2 regions of Italy *in the first quarter* of the coordinate system are Provincia Autonoma di Bolzano/Bozen, Provincia Autonoma di Trento, Emilia-Romagna, Veneto, Piemonte, Friuli-Venezia-Giulia and Marche. In general, in this quarter of the coordinate system at line Y the regional gross domestic product by regions (RGDP1) and real growth rate of regional gross value added (GVA) per capita by regions of Italy (RGVACap2) increase or little decrease.

In Figure-2 regions of Italy *in the second quarter* of the coordinate system are Basilicata, Lombardia, Lazio, Puglia and Campania. Also, in general, in this quarter of the coordinate system at line Y the regional gross

domestic product by regions (RGDP1) and real growth rate of regional gross value added (GVA) per capita by regions of Italy (RGVACap2) increase or little decrease.
In Figure-2 regions of Italy *in the third quarter* of the coordinate system are Umbria, Abruzzo, Toscana, Valle d'Aosta/Vallée d'Aoste and Liguria. But, in general, in this quarter of the coordinate system at line Y the regional gross domestic product by regions (RGDP1) and real growth rate of regional gross value added (GVA) per capita by regions of Italy (RGVACap2) decrease or little increase.
In Figure-2 regions of Italy *in the fourth quarter* of the coordinate system are Molise, Sardegna, Calabria and Sicilia. Also, it is the same as according to the third quarter, in general, in this quarter at line Y the regional gross domestic product by regions (RGDP1) and real growth rate of regional gross value added (GVA) per capita by regions of Italy (RGVACap2) decrease or little increase.

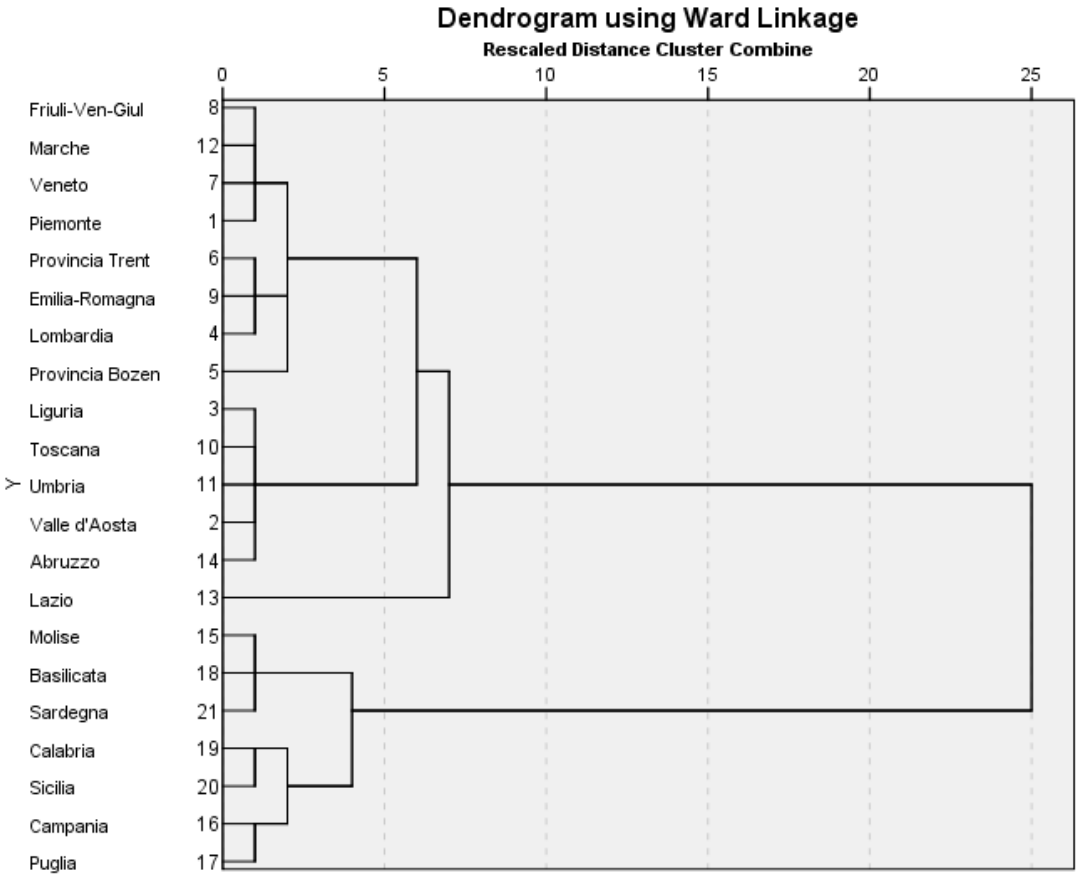

Figure 3: Dendrogram using Ward Linkage. Rescaled Distance Cluster Combine.
Clusters of regions based on their economic variables in Italy between 2015-2021
Source: Eurostat, 2022, [SDG_17_40], [TEC00013], [TGS00003], [TGS00010], [TGS00037], [TGS00039], [TGS00102], [TGS00109]

Essentially it can be declared that in Italy in the researched period the highly level in employment rate, lower level in unemployment accompanying with relatively highly level in *tertiary educational attainment*, age group 25-64 can result considerable highly level in employment in high-tech sectors in regions, which could lead to acceptable increasing regional GDP and regional GVA per capita. The larger share of *gross value-added products* in the *export* should be more as same as the larger share of *regional gross value-added products* should be more in the *regional GDP*. The gross value-added products can more successfully be developed by

increasing highly developed technology to increase the competition of national and regional economic levels. This economic strategy should be realised in implementation of performance at national and regional economic levels.

According to the Table 4 the ***Figure 3*** also, shows the selection of the regions into five clusters. Naturally the selection of regions can be implemented into clusters less than five one, even one region can be one cluster or also, all regions can be selected into one cluster.

According to hypotheses above mentioned the main results of study can be summarised, which are as follows:
1 Based on the results of the analyses it is proofed that the employment rate of the age group 20-64 by NUTS 2 regions of Italy in 2015 (Empl155) has important very strong correlations by 0.993 (as 99.3%) with employment rate of the age group 20-64 by NUTS 2 regions in 2021 (Empl216) and by contradicting (minus) 0.918 (-9.18) with unemployment rate by NUTS 2 regions 15 years or over in 2015 (UnEmpl157) and also, by contradicting (minus) 0.899 (-89.9%) with unemployment rate by NUTS 2 regions in 2021 (UnEmpl218), [TGS00102], [TGS00010].
2 The unemployment rate by NUTS 2 regions of Italy and 15 years or over *in 2015* (Unempl157) has very strong correlations by 0.948 (94.8%) with unemployment rate by NUTS 2 regions in 2021 (Unempl218), [TGS00010].
.3 Tertiary educational attainment, age group 25-64 in the NUTS 2 regions of Italy *in 2015* (Tertiary153) has very strong important correlations by 0.937 (93.7%) with tertiary educational attainment, age group 25-64 in NUTS 2 regions *in 2021* (Tertiary214), [TGS00109].
4 The employment in high-tech sectors by NUTS 2 regions of Italy *in 2015*, namely as the high-technology sectors means high-technology manufacturing and knowledge-intensive high-technology services, in percentage of total employment (EmHiT159) has very important correlation by 0.932 (93.2) with employment in high-tech sectors by NUTS 2 regions in percentage of total employment *in 2021*(EmHiT2110), [TGS00039].
5 It is proofed that the regional gross domestic product by NUTS 2 regions (RGDP1) has very strong correlations by 0.933 with real growth rate of regional gross value added (GVA) per capita (RGVACap2).
6 The employment rate of the age group 20-64 by NUTS 2 regions of Italy *in 2021* (Empl216) has *contradicting very strong correlation* by (minus) 0.933 (as -93.3%) with unemployment rate by NUTS 2 regions from 15 years or over *in 2015* (UnEmpl157) and by (minus) 0.927 (-92.7%) with unemployment rate by NUTS 2 regions from 15 years or over in 2021 (UnEmpl218). [TGS00010], [TGS00102].

All the hypotheses can be accepted based on the results of this case-study.
There are some economic variables also have important correlations with other economic variables during the researched period in this study, which are as follows:
The regional gross domestic product by NUTS 2 regions (RGDP1) has strong correlations by 0.514 with employment rate of the age group 20-64 by NUTS 2 regions in 2015 (Empl155), and by 0.515 with employment rate in 2021 (Empl216), and by -0.550 with unemployment rate by NUTS 2 regions,15 years or over in 2015 (UnEmp157), and by -0.519 with unemployment rate in 2021 (UnEmp218). [TGS00010], [TGS00102].
The (RGVACap2) has strong correlations by 0.519 with employment rate of the age group 20-64 by NUTS 2 regions in 2015 (Empl155), and by 0.533 with employment rate in 2021 (Empl216), and by -0.624 with unemployment rate by NUTS 2 regions,15 years or over in 2015 (UnEmp157), and by -0.580 with unemployment rate in 2021 (UnEmp218). [TGS00010], [TGS00102].
The tertiary educational attainment, age group 25-64 by NUTS 2 regions in 2015 (Tertiary153) has strong correlations by 0.589 with employment rate of the age group 20-64 by NUTS 2 regions in 2015 (Empl155), and by 0.580 with employment rate in 2021 (Empl216), and also, the by 0.681 with employment in high-tech

sectors by NUTS 2 regions in 2015 (EmHiT159) and by 0.700 with employment in high-tech sectors in 2021 (EmHiT2110). [TGS00039], [TGS00102], [TGS00109]
The tertiary educational attainment, age group 25-64 by NUTS 2 regions in 2021 (Tertiary214)
has strong correlations by 0.685 with employment rate of the age group 20-64 by NUTS 2 regions in 2015 (Empl155), and by 0.693 with employment rate in 2021 (Empl216), and by -0.622 with unemployment rate by NUTS 2 regions,15 years or over in 2015 (UnEmp157), and
by -0.630 with unemployment rate in 2021 (UnEmp218); and also, by 0.725 with the employment in high-tech sectors by NUTS 2 regions in 2015 (EmHiT159) and by 0.702 with employment in high-tech sectors in 2021 and (EmHiT2110). [TGS00010], [TGS00039], [TGS00102], [TGS00109].

These data show that also, how much these correlations are important among the economic variables in this case study.
Based on the analysing the ordering list for the first 10 of NUTS 2 regions of Italy can be declared as these are as follows: Lombardia /1; Provincia Autonoma di Trento /2; Emilia-Romagna /3; Piemonte /4; Veneto /5; Friuli-Venezia Giulia /6; Marche /7; Umbria /8; Toscana /9; and Lazio /10.

Naturally the prosperity can be stimulated by increasing rate of tertiary educational attainment, age group 25-64, which can provide wide-side knowledge for the human resources for employees and create larger possibility for development of *high-technology manufacturing and knowledge-intensive high-technology services*. Generally, either tertiary educational attainment or high technology are needed for the productivity of companies, economic development and future prosperity of any economy and any region to realise *more competition* at the national and international markets.
Also, the main issue is for any economy and region, even NUTS 2 regions in Italy, to create as much as *highly level of employment in high-tech sectors* based on the highly level in employment and lowest level in unemployment.

CONCLUSIONS

Generally, the NUTS 2 regions of Italy are selected by different economic developed levels, which resulted *North-South economic and social conflicts in Italy*. In Northern regions of Italy mostly are more developed than the Southern regions. This can be followed by highly level employment, educational developed level, employment in high-tech sectors, which can stimulate toward developing process in regional GDP prosperity and real growth rate of regional gross value added (GVA) per capita from point of view of lower-level unemployment in Northern region more favourable than in Southern regions.
Naturally the number of populations and the technological developed level can make influence on the real growth rate of regional gross value added (GVA) per capita at the same time.

Generally, different economic developed levels in Italy from point of view of North-South conflict are very considerable comparably to other EU-member states. There is a Northern region, for example Lombardia is a part of the highest economic developed regions of the EU, while in some Southern regions, for example in Campania, Sicilia, Calabria in Italy the unemployment rate is the highest level in the EU-27.
In field of North-South conflict in Italy from point of view of different economic levels resulted the domestic population migration to concentrate of population of Northern regions accompanying with *increasing foreign direct investment* in these Northern regions. The solution can be realised for decreasing large difference among developed levels by more capital-inflow to the Southern regions to create more jobs and increase educated level with other post graduating courses for the life-long period education. Also, the high-tech should moderately be extending in Southern regions.

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SCLERACTINIAN CORALS FROM THE BENGHAZI FORMATION IN AS SAHABI AREA AND AL JAGHBUB FORMATION IN TOBRUQ AREA, LIBYA: IMPLICATIONS FOR CORAL DIVERSITY AND PALEOGEOGRAPHY

Belkasim KHAMEISS[1&2], Ahmed MUFTAH[2], Menam ABDELGALIL[3]

[1]Kansas Geological Survey, Lawrence, KS, United States
[2]Faculty of Science, Earth Sciences Department, University of Benghazi, Libya
[3]Department of Geology, University of Tubroq, Libya

Abstract: *The most recent investigation has revealed that Miocene Scleractinian corals were well preserved in two exposed geological rock units in Northeast Libya, namely the Benghazi Formation in the As-Sahabi area and the Al Jaghbub Formation in Tubruq area. The collected corals include two hermatypic species, these are Echinopora gemmacea and Montastraea pelouaensis which were common during the early-middle Miocene (Aquitanian-Serravallian). These two species suggest that the Benghazi and Al Jaghbub Formations coral community thrived in shallow, subtropical reefs with a Mediterranean-Tethys paleobiogeographic connection. These corals taxa lived in the upper photic zone with more sophisticated prerequisites, such as robust substrates, clean waters, steady marine salinity, and temperature about 18°C. The documentation of these two taxa highlights the diversity and morphological variability of the scleractinia corals in northeast Libya. This could pave the way for future research efforts focused on coral taxonomy, diversity, and biogeography in the region. The interaction between barnacles and coral demonstrates the competitive dynamics at play in coral reef ecosystems and the adaptive potential of coral colonies is also discussed.*

Keywords: *Al Jaghbub Formation, Coral, Taxonomy, As-Sahabi area, Libya.*

INTRODUCTION

Extensive research has investigated the global evolutionary trends of scleractinian corals to gain insights into the environmental determinants shaping their growth and distribution while unravelling their intricate evolutionary lineage (Pandolfi and Jackson, 2006; Novak et al., 2013). To comprehend the extinction events faced by certain reef-building coral species, it is imperative to meticulously scrutinize the environmental dynamics responsible for these occurrences. Moreover, coral reefs exhibit remarkable resistance to erosion attributed to both organic and physical processes, largely owing to their safeguard against sedimentation originating from terrestrial sources (Hayward, 1977). In the Miocene periods, the Mediterranean Sea hosted a diverse array of corals within shallow-water carbonate settings. These corals underwent a transformative journey, evolving from modest biological formations into expansive skeletal reefs, influenced by a spectrum of structural and sedimentary variables. Both zooxanthellate and azooxanthellate corals have held a substantial presence in the benthic makeup of the Mediterranean Basin across its Mesozoic and Cenozoic chronicles (El-Sorogy et al., 2020). These corals exhibit high sensitivity to environmental changes, leading to fluctuations in their diversity, reef-building capabilities, and geographical distribution across time. Despite the presence of

Cenozoic fossil records in the peri-Mediterranean regions, our comprehension of the historical narrative concerning Mediterranean corals remains incomplete.
The growth and proliferation of these corals are intricately tied to the complex paleogeographic and climatic shifts in their past, which encompassed transitions toward colder habitats and modified patterns of biological circulation (El-Sorogy, 2008; Karabıyıkoğlu et al., 2005; Khameiss, 2007; Khameiss et al, 2016; Khameiss et al, 2019).
The remnants of scleractinian coral hold invaluable information about past climates and reef environments. Factors such as seawater temperature, depth, nutrient levels, and wave patterns have all played a role in the growth and distribution of corals. Our research has three main objectives. Firstly, we aim to accurately identify specimens from two coral species, *Echinopora gemmacea* and *Montastraea pelouaensis*, found in early-middle Miocene deposits in the Benghazi and Al Jaghbub Formations. Secondly, we will thoroughly examine the physical attributes and population densities of these coral species. Finally, we aim to document the paleoenvironmental circumstances and geographical distribution of these corals. Our study will serve as a valuable reference point for future research on Libyan corals.

Location

The two studied localities (Fig. 1), a) the Sahabi Area which is located on the northeast part of Sirt Basin, in the north-south directed Ajdabiyah Trough, between P28 hill and P53 hill; b) The Wadi el Zeitun is located at 25 km east of Tobruk city which is located on the northeast corner of Libya in a province called Marmarica, precisely at the coordinates 32°00'58.35" N and 24°04'46.84" E.

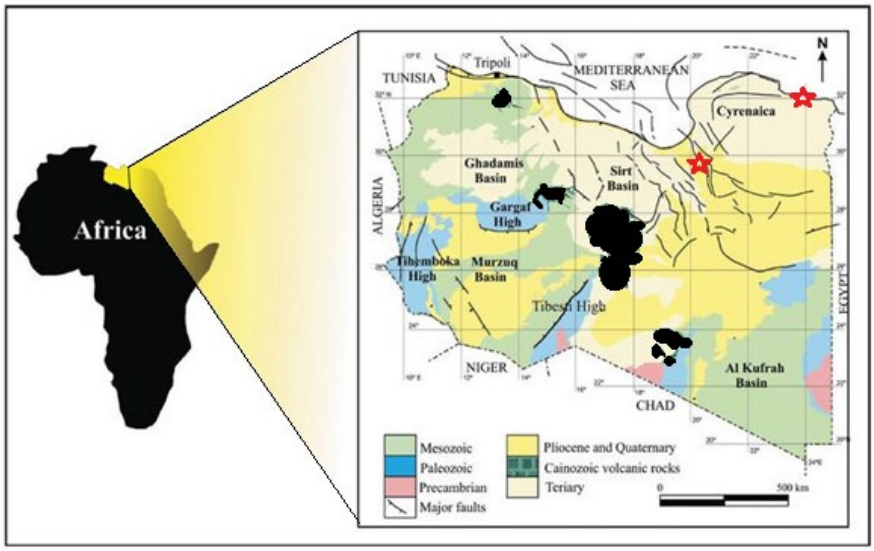

Figure 1: Geological map of Libya shows the two coral localities (red stars), (modified after Rusk 2001; Ramos et al. 2006).

Objectives of the study

1. Identification of the collected two scleractinian coral species from the visited localities at As Sahabi area in northcentral Sirt Basin and at Wadi Zeitun 20km east of Tobruk city.
2. Investigation of the effect and/or the relationship between coral and encrusted barnacles.
3. Determine the environmental importance of the identified taxa.
4. Investigate the distribution of identified coral species of the Miocene period in Libya, due to their importance in the age correlation.

GEOLOGICAL SETTING

Libya is located on the northern margin of the African Shield. Tectonically, about seven tectonic events (the Pan-African Orogeny, Infracambrian extension, Cambrian to Carboniferous alternating extension and compression, Late Silurian Caledonian Uplift, Late Carboniferous Hercynian Intraplate Uplift, Late Triassic–Early Jurassic and Early Cretaceous rifting, Late Cretaceous–Tertiary Alpine compression, and Oligocene–Miocene rifting) have been documented in Libya by Craig et. al., (2004).
The stratigraphic sequence of the As Sahabi area has resulted in a series of mixed layers of Miocene to Pleistocene El Shawaihdi et al., (2022) which are accumulated in response to the interplay between non-marine deposits of the Eo-Sahabi River in association with the relevant eco-systems and the shallow marine carbonates and evaporites (Fig. 2).

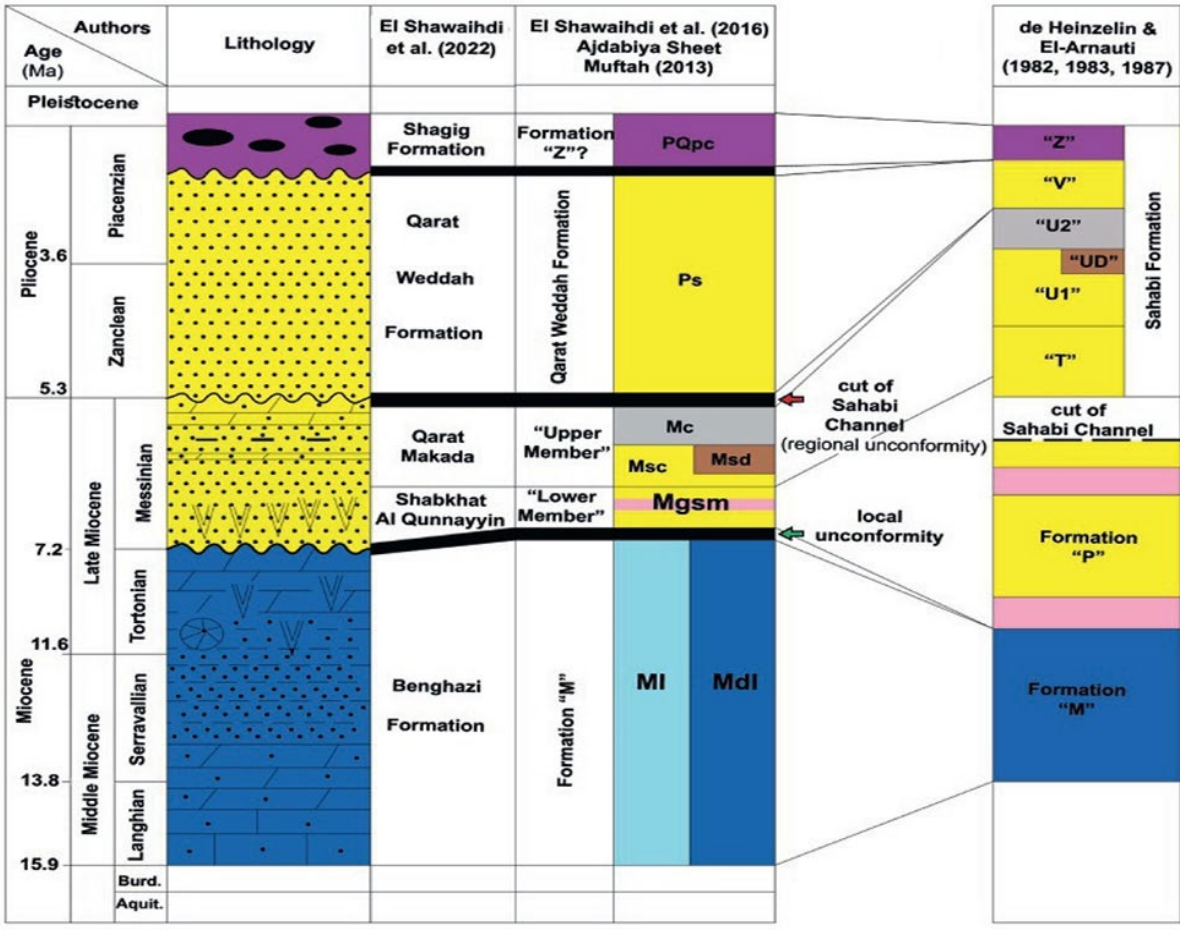

Figure 2: Stratigraphic correlation of Miocene – Pleistocene deposits of As Sahabi area, Sirt Basin, Libya (El Shawaihdi et al., 2022).

The northeastern part of Libya (i.e. Marmarica province) consists of sedimentary rocks deposited in shallow marine waters during the Paleocene to Miocene time. The studied Miocene sediments outcrop at Wadi el Zatun in the vicinity of Tobruk city Abdulsamad et al., (2018) are represented by the Oigo-Miocene Al-Faidiyah Formation and the overlying middle Miocene Al-Jaghbub Formation with an obvious disconformity surface in between (Fig. 3).

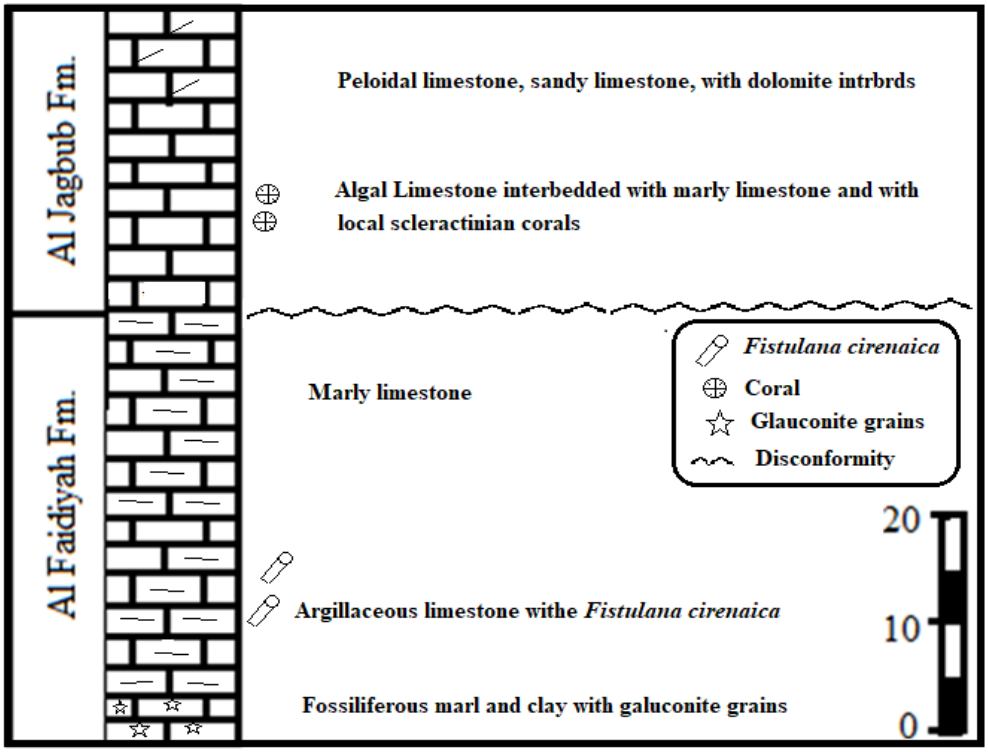

Figure 3: The stratigraphic section of Wadi el Zeitun in the vicinity of Tobruk, NE Libya (Modified after Abdulsamad et al., 2018).

RESULTS

Two scleractinian coral colonies are described in detail with the illustration, systematically are;
Class Anthozoa Ehrenberg, 1834
Subclass Zoantharia de Blainville, 1830
Order Scleractinia Bourne, 1900
Family Montastraeidae Yabe and Sugiyama, 1941
Genus *Montastraea* de Blainville, 1830
Montastraea pelouaensis (Chevalier, 1954)

Description
The colony has noticeable buds and grows to a significant size. The corallites range in size from 8 to 11 mm and have 24-48 septocostae that are often interconnected in three or four cycles. These septa are well-developed and can vary from 12 to 20 in number. They extend towards a porous columella and lack synapticulae. The coral wall is quite thick and displays septothecal attributes with a maximum thickness of 2.5 mm (Fig. 4).

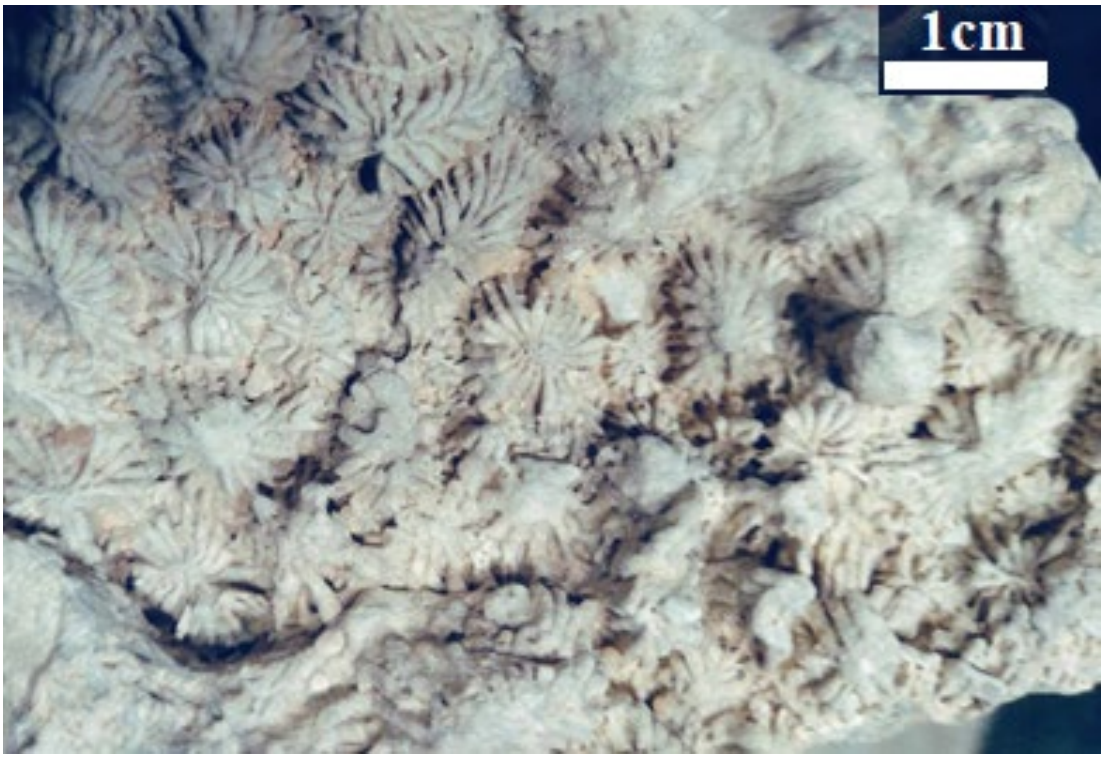

Figure 4: Close view of *Montastraea pelouaensis* Late Miocene (Tortonian) of Benghazi Formation in As Sahabi area, Sirt Basin, Libya.

Stratigraphic range
Late Miocene (Aquitanian - Serravallian).

Geographic distribution
From Late Miocene (Tortonian) of As Sahabi area, northern Sirt Basin of Libya El-Shawaihdi et al., (2022); early – middle Miocene (Aquitanian - Serravallian) strata of Aquitaine Basin of SW France Oosterbaan (1988); middle Miocene (Serravallina) strata of Hungary Oosterbaan (1988).

Family Merulinidae Milne Edwards and Haime, 1857
Genus Echinopora Lamarck, 1816
(Synonymised name Heliastraea Milne Edwards and Haime, 1857)
Echinopora gemmacea (Lamarck, 1816)

Description
The coral colonies that have been observed display a significant, rounded growth pattern with circular corallites ranging from 3.5 to 5 mm in diameter. These corallites have primary septa and well-developed costae. The colonies also have sizable columellae and no synapticulae. In addition, these specimens exhibit the presence of coenosteum and septothecal walls (Fig. 5).

Stratigraphic range
Middle Miocene (Langhian- Serravallian).

Geographic Distribution

From the Oligo-Miocene strat of Al Jaghubub Formation Tubrok area, Marmarica region of northeastern Libya; This coral species has a wide geographical range, spanning various regions and epochs. Research by El-Sorogy has documented its presence from the Miocene to the Holocene in the Red Sea. Kora and Abdel have recorded occurrences from the late Pliocene to the Pleistocene, while El-Sorogy, (1997) noted Pleistocene instances. In 2021, sightings were by Turak et al. in 2007 reported in Saudi Arabia, Eritrea, and Sudan. Elsewhere, Khalil et al. in 2021 documented its existence in the northern Red Sea near Hurghada, as well as in the Central-Northern Saudi Arabian Red Sea, Yemen, and the Southern Red Sea during the Late Pleistocene. According to Khalil et al. in 2021, this species is linked with the Red Sea in the Quaternary period. Beyond the Red Sea, Budd et al., (2010) have indicated occurrences in North Africa and Southeast Asia during the Pliocene to Pleistocene era, with numerous exceptionally preserved specimens being unearthed.

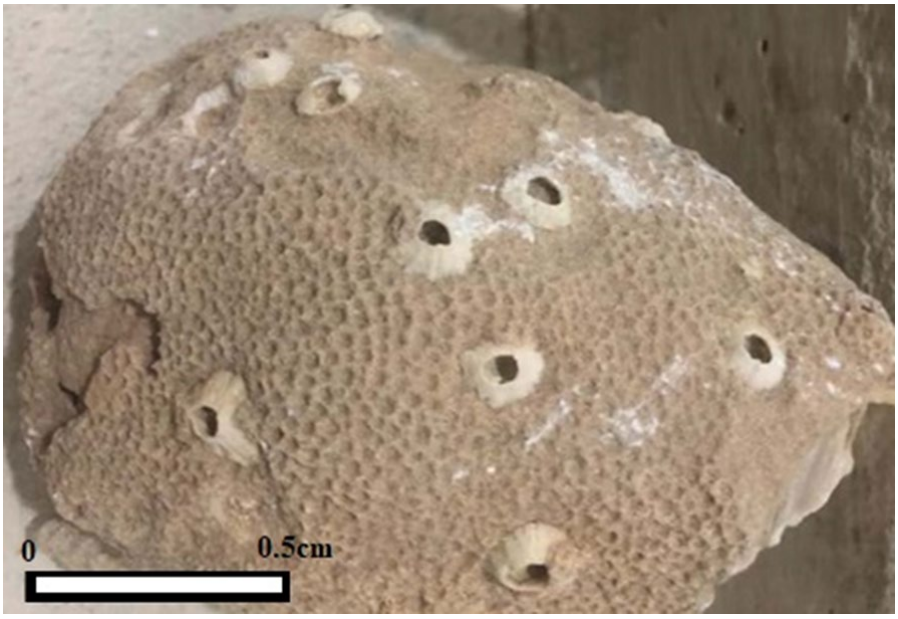

Figure 5: Close view of Echinopora gemmacea early-middle Miocene (Aquitanian-Serravallian), from Wadi el Zeitun in the vicinity of Tobruk, NE Libya.

DISCUSSION

It is widely acknowledged that well-preserved scleractinian corals and their constituent elements serve as accurate indicators for reconstructing historical environmental conditions. These organisms have played a pivotal role in unraveling past climatic and environmental contexts through their patterns and diversity, as demonstrated in various research studies (El-Sorogy, 1997; El-Sorogy, 2008; Brachert et al., 2006; Khameiss, 2020). Hard corals have held significant roles within shallow, warm-water marine ecosystems across diverse geographical regions (Perrin et al., 1998; El-Sorogy, 2008; Perrin and Bosellini, 2012; Bosellini et al., 2021). These environments offer ideal conditions for the flourishing of hard corals, with specific temperature and salinity levels being essential for their growth and survival. The temperature range of 23-29°C is widely acknowledged as optimal for numerous reef-building coral species. Within these conditions, coral polyps and their symbiotic zooxanthellae can thrive, facilitating ideal growth and reproductive processes (Dempsey et al. 2023; Khameiss, 2020).

Reef-building corals exhibit a preference for warm-water habitats, yet they are highly sensitive to abrupt temperature fluctuations. When the water temperature falls below 18°C, it can lead to detrimental impacts on their survival. Conversely, prolonged exposure to temperatures exceeding 40°C can induce coral stress, bleaching, and even mortality. These corals flourish in environments characterized by elevated salinity levels, typically ranging from 32 to 42 parts per thousand (ppt). This concentration of dissolved salts plays a pivotal role in various physiological processes of corals, as emphasized by the studies conducted by Guan et al. (2015) and Dempsey et al. (2023).

The coral order Scleractinia is a useful tool for investigating past environmental conditions in various marine settings, particularly in the Mediterranean area. Scientists can gather a wealth of information from the physical characteristics and geochemical markers found within the coral skeletons, such as stable isotopes, trace elements, and growth patterns. These skeletal structures act as archives, enabling researchers to gain insights into past variables like sea surface temperatures, oceanic chemistry, and sea level fluctuations. By studying coral skeletons, scientists can better understand climate dynamics, environmental changes, and the evolution of marine ecosystems in the Mediterranean and surrounding regions. Coral skeletons are highly regarded as natural archives for documenting the geological history of the Mediterranean and adjacent areas, thanks to their dual attributes of morphology and geochemistry. Several studies, including those by Vertino et al. (2014), Drinia et al. (2017), Chaix and Saint Martin (2008), Perrin and Bosellini (2012) Khameiss (2013) have highlighted the value of coral skeletons in providing a comprehensive understanding of historical shifts in oceanic conditions and coral communities' reactions to significant geological-scale alterations in the environment.

The coral species known as *Echinopora gemmacea* has been found in the Red Sea since the Miocene epoch and is still present in the Holocene era. It has also been discovered in sedimentary layers and deposits from the Late Pliocene to the Pleistocene. This species has a wide distribution, appearing in various regions such as Saudi Arabia, Eritrea, and Sudan. Researchers including El-Sorogy in 1997 and 2008, Khalil et al. (2021), and Kora and Abdel Fattah (2000) have documented its presence in these areas.

E. gemmacea is a species that thrives in the Central-Northern Saudi Arabian Red Sea, Yemen, and the Southern Red Sea. It can also be found in North Africa and Southeast Asia during the Pliocene-Pleistocene period. This species prefers shallow tropical and subtropical waters, usually between 1 to 25 meters in depth. It is commonly found in various reef environments, including fringing reefs, barrier reefs, and lagoons, where moderate to high water flow facilitates nutrient transport and waste removal. However, it's important to note that the fossil record for corals during the Quaternary period, which extends to the present, is limited. Nevertheless, fossilized remnants of *E. gemmacea* or closely related species may still be found in Quaternary deposits under specific conditions. (El-Sorogy, 2008; Budd et al., 2010; Huang et al., 2014; Khalil et al., 2021; Turak et al., 2007).

The *Montastraea pelouaensis* coral is well-known for its ability to build reefs. It forms large colonies made up of individual polyps, which grow in a massive or encrusting pattern. These colonies often have irregular shapes and are commonly found in shallow tropical marine environments, specifically in coral reef ecosystems. *M. pelouaensis* thrives in areas with moderate to high wave activity and can be found at depths ranging from a few meters to around 30 meters. Although its exact distribution is not entirely clear, this species has been identified in the Miocene deposits of the Aquitaine Basin in SW France. It may have also been discovered in other regions under different names (Chevalier, 1954; Oosterbaan, 1988; Oosterbaan, 1990; Hoeksema and Cairns, 2023).

Based on the research findings, it appears that the species identified within the Benghazi and Al Jaghbub Formations exhibit resemblances to coral populations in various Miocene-era locations. These areas encompass Greece, Iran, Saudi Arabia, Malta, Morocco, Algeria, France, Italy, Sicily, and Crete. The coral communities discovered in these regions share similarities with those unearthed in the Benghazi and Al Jaghbub Formations. This suggests that these areas experienced analogous environmental conditions and possessed interconnected geographical settings during the Miocene period. The presence of comparable coral fauna in these regions indicates the exchange of coral species across the Mediterranean during that era. These

correlations and parallels, as evident in the fossil record, furnish valuable insights into the historical distribution of coral communities, the interconnected geographical ties, and the paleoenvironmental context of the Mediterranean region.

Coral Community Environment

The reported species has similar environmental desiring conditions of shallow, subtropical reefs Mediterranean-Tethys paleobiogeographic connection in the upper photic zone, more specifically, robust substrates, clean waters, tidy marine salinity, and temperature around 18°C.

Barnacle and coral competitions

This text discusses barnacle colonization on coral surfaces and the subsequent coral regeneration that can encrust and cover the barnacles. This process demonstrates the complex interrelationships within marine ecosystems and highlights the importance of understanding the underlying ecological dynamics. Barnacles are marine crustaceans that attach themselves to rigid substrates, such as mollusks and coral, using a cementing substance and a rigid exoskeleton. They feed on plankton and detritus in the surrounding water. However, barnacle attachment to coral surfaces can have both positive and negative impacts.

Negatively, barnacles can compete with coral for resources and space (Fig. 6). Their calcified shells can block vital sunlight, which is required for coral photosynthesis, and the attachment process can damage coral tissue.

Positively, barnacles can serve as a nutritive resource for small fish or filter-feeding entities, thereby increasing the overall biodiversity of the coral reef ecosystem. Coral, being a living organism, can regenerate impaired or shaded regions over time. The pace of coral growth depends on various factors, such as water temperature, nutrient availability, and the coral species. Under favorable conditions, coral can restore the compromised or shaded portions of its structure. As coral rejuvenates, it can encrust or enshroud barnacles that are initially attached to its surface. This process occurs due to the coral's inherent growth and regenerative mechanisms.

The interaction between barnacles and coral demonstrates the competitive dynamics at play in coral reef ecosystems and the adaptive potential of coral colonies (Fig. 6). Successful coral regeneration and the subsequent crusting over of barnacles can ameliorate some of the adverse consequences of barnacle colonization. Understanding these interactions is essential for the conservation and management of coral reefs, which are pivotal marine ecosystems characterized by remarkable biodiversity and ecological significance.

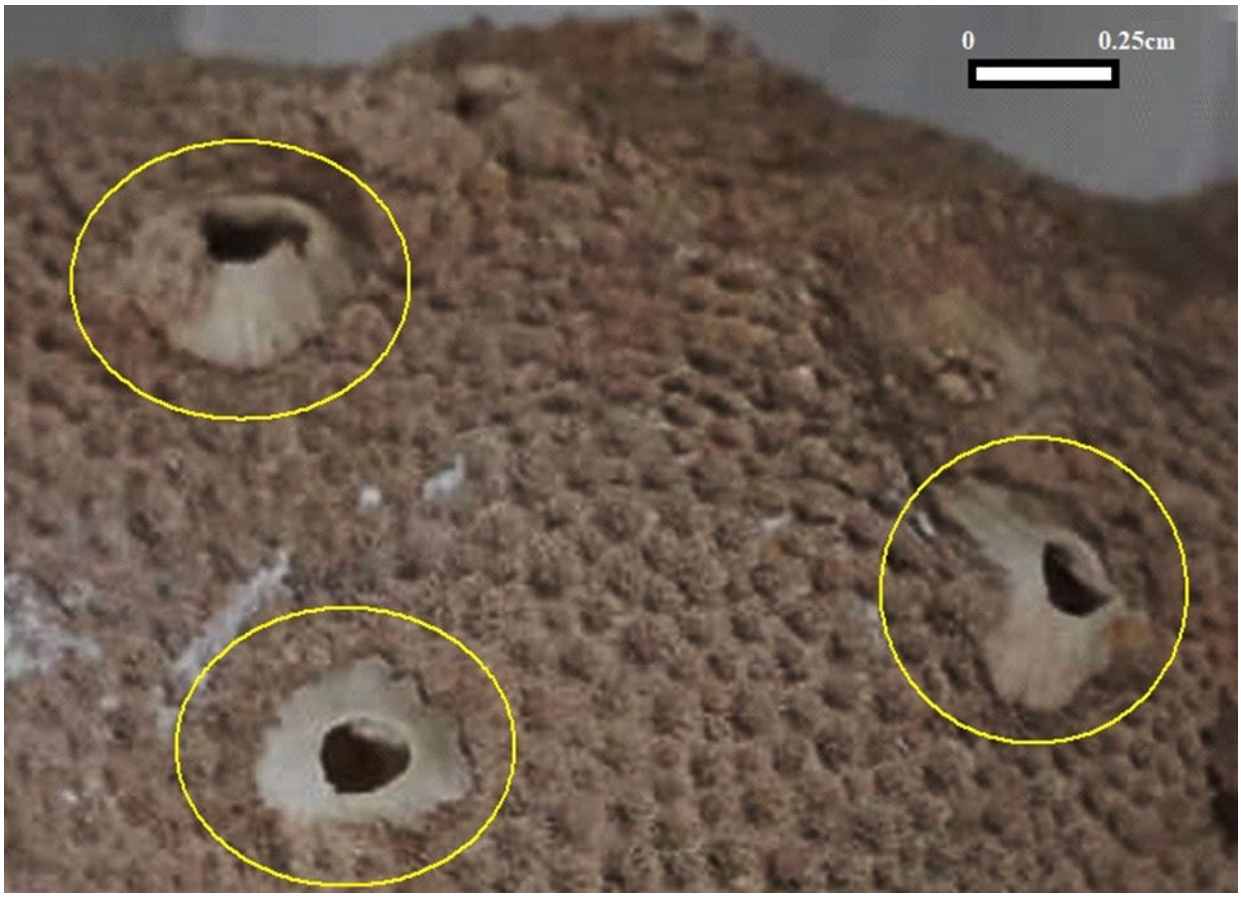

Fig. 6: A close-up view of the *Echinopora gemmacea* shows the attached barnacles (*Balanus* sp.,) and the subsequent coral crusting over coral.

CONCLUSION

This study identified morphological species from the Aquitanian-Serravallian stage of the early-middle Miocene period. These species were found in shallow tropical-subtropical reefs that existed in the Mediterranean-Tethys paleobiogeographic region. These organisms played a crucial role in shaping and maturing the fringing reefs in Northeast Libya, which were a part of the extensive Mediterranean-Tethys system. The region provided an environment conducive to the proliferation and evolution of these reef-building organisms due to favorable ecological conditions such as elevated water temperatures, clear and shallow waters, and suitable substrates for reef development.

These morphological species were closely associated with symbiotic algae called zooxanthellae, which are vital for the survival and sustenance of scleractinian corals. Typically, these corals grow in colonies, forming expansive and robust structures in the upper photic zone where sunlight supports photosynthesis. These corals predominantly inhabited shallow marine environments with tropical to subtropical characteristics at depths of up to 50 meters and required a solid substrate for attachment, often composed of rocks or the skeletal remnants of deceased corals. They thrived in clear water with normal salinity levels and required a minimum seawater temperature of 18°C for survival. Their optimal temperature range was between 22 to 26°C, indicative of moderate to high water energy, which implies the presence of relatively vigorous water currents within their

habitat. Successful coral regeneration of the reported *Echinopora gemmacea* and the subsequent encrusting over of barnacles can improve some of the adverse consequences of barnacle colonization.
Studying these morphological species provides invaluable insights into the paleoenvironmental context of the early-middle Miocene era, including factors such as water clarity, temperature regimes, depth profiles, and energy levels. This investigation enriches our understanding of ancient reef ecosystems and their evolutionary trajectories over geological time spans in the Mediterranean-Tethys region during the Early-Middle Miocene. It serves as a guiding compass for the scope of future research, highlighting domains \that warrant further exploration and contributing significantly to our knowledge of Libyan coral fossils.

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DEVELOPMENT OF PARTICLE MEASUREMENT TECHNOLOGY AT PERIODICAL TECHNICAL INSPECTION (PTI)

Zoltán BORSI, Tibor TELEKESI, Katalin A. FŐGLEIN*

KTI Institute for Transport Sciences and Logistics, Non-Profit LTD., Research Centre for Sustainable Transport
Department for Air Quality and Propulsion Systems
**Corresponding author: foglein.katalin@kti.hu*

***Abstract**: It has now become clear, one of the most dangerous air pollutants is nano particles from vehicles. The test requirements took this fact into account; by limiting the number of emitted particles, new cars emit an order of magnitude less starting from the Euro 5b type approval requirement. From the Euro 5b level, it is necessary to use the particle filter on diesel cars, at the same time, there was no such requirement anywhere for cars in operation until recently. For various reasons, it is common to manipulate and remove the particle filter. This cannot be determined with us during the current periodic technical inspection or road inspection. Neither a measurement method nor an instrument was available until recently, in Hungary. The objective of the topic was to explore the international situation, examine the possible measurement procedures, map the existing instruments, perform measurements with a suitable instrument, and make a proposal regarding the possibility of introduction in Hungary. During the practical measurements, we performed measurements with TSI, TEN and AVL instruments. We carried out many measurements on different types of cars in different operating conditions. During the measurements, we examined both gasoline and diesel vehicles. We found that:*

• the emissions of diesel and gasoline cars with well-functioning particle filters are below 10,000 particles/cm^3.
• particle emissions are the smallest at idle. We had several measurements when the number of particles in the exhaust gas was smaller than that of the intake air at idle speed.
• flawless particle filters filter with excellent efficiency, emissions are very low for Euro 6 vehicles.
• increasing the speed increases the number of particles.
• the cold start, the thermal state of the engine, has little influence on the evaluation compared to the recommended limit value. Although the emission increases slightly in cold operation, it is still very far from the recommended limit for a well-functioning system.
• the repeatability of the measurements is adequate, enabling a reliable assessment.

***Keywords**: Periodic Technical Inspection, PTI, particle, particulate filter, GPF, DPF*

INTRODUCTION

The objective of the topic was to explore the international situation, examine the possible measurement procedures, map the existing instruments, perform measurements with a suitable instrument, and make a proposal regarding the possibility of introduction in Hungary.

According to various foreign literature, the proportion of vehicles operating with defective particle filters is 6-10%, and they cause 80-85% of exhaust gas particle emissions.
During use, diesel particulate filters are not 100% regenerated, they become clogged after a while and should be cleaned or replaced, which is quite expensive.
In March 2023, the EU Commission's guidelines for measuring the number of particles in the technical inspection were published. It is expected that the ongoing renewal and amendment of the (EU) 2014/45 directive will require the test and the method. The recommended measurement method:

- Our own measurement results and very extensive foreign experience show that idling measurement is suitable for screening cars with faulty or removed particle filters. The test is carried out with the engine idling.
- A measurement takes 15 seconds, the average of which is formed by the instrument. This value is a reliable separation between a well-functioning filter and a faulty or removed filter. The short inspection time does not significantly increase the duration of the technical inspection. The test can be performed simply and quickly in 4-5 minutes.
- A single limit value can be applied to each vehicle. Recommended limit value is 250,000 particles/$cm^{3.}$
- Following foreign practice and the EU recommendation, we recommend testing those cars with diesel engines that already had a mandatory particle number limit at the time of type approval. This was from the Euro 5b level for the M1, N1 category, while for the M2, M2, N2, N3 cars it was from the Euro VI level. According to the domestic environmental protection classification, it refers to class 14, 15 and 16 vehicles.
- It would be advisable to introduce the test and collect the data in a specific, narrower circle, as a test, without consequences. Such a circle can be e.g. M1 and N1 category service cars.

Belgium, the Netherlands, Germany and Switzerland have recently introduced this type of control. The test methods introduced, the evaluation and the vehicle categories included in the application differ from country to country.

THE SOURCE OF PARTICLE EMISSION

In addition to the emission of gaseous pollutants, diesel-powered vehicles also emit partially visible pollutants – solid and volatile particles.

- incomplete combustion: during the combustion of diesel oil, droplet formation during atomization, atomization quality, ignition delay, emission during transient operating conditions (e.g. acceleration).
- metal particles from mechanical wear.
- substances derived from additives and other incombustible components.

The particles consist mainly of coal (about 40-45%) and hydrocarbons and sulfates from unburned fuel, lubricating oil (30-35%). In addition, the particles contain various debris (typically metals from motor wear) and particles from various additives. The aerodynamic diameter of diesel soot (fine particles) is typically 20-200 nm. With the appearance of sulfur-free diesel and low-ash motor oils, the proportions of the figure shifted. The amount of sulfate and ash is reduced. The current regulations limiting the number of particles only apply to solid particles.
Even with the most perfect mixture formation and combustion in the most modern diesel engines, particles are produced to such an extent that compliance with the emission limit value can only be achieved with the use of a particulate filter (DPF). The DPF was made necessary by the introduction of the Euro 5b (M1 vehicle category: from 2011.09) and Euro V (N1, N2, N3 vehicle categories: from 2014.01) emission limits. It should be mentioned here that direct injection gasoline engines also produce significant particulate emissions, so they must also be equipped with a particulate filter (GPF) to meet the Euro 6b (from 2017.09) emission limits.

In modern diesel engines, the mass of emitted particles has been reduced to such an extent compared to older designs that it is almost immeasurable with conventional equipment. As the particle size decreased, however, the number of pieces did not decrease, but rather increased. Therefore, the measurement and limitation of the number of particles was introduced.
Currently, particle emissions are limited only by the limit values for type approval testing. For vehicles in operation, only the so-called smoke measurement based on the principle of opacity (light transmission/light absorption) applies. Numerous literature data prove that there is no correlation between smoke measured by the opacity principle and the number of nano particles [1.], therefore it is necessary to find a new measurement method that can be used to determine excessive particle emissions during periodic technical tests or road inspections.

THE PHYSIOLOGICAL EFFECT OF PARTICLES

Nano particles emitted by internal combustion engines are harmful to health. Thanks to new engine technologies and particle filters, the total mass of the emitted particles has been significantly reduced, and due to the higher injection pressure, the particles from the exhaust gas have become smaller. With the advent of direct-injection gasoline engines, particulate emissions became not only a feature of diesel engines, but also appeared in the exhaust gas of gasoline engines to a similar extent.
Due to their high diffusion capacity, nanoparticles are deposited in the air sacs of the lungs, from where they enter the blood circulation, thus the whole body, increasing the frequency of cancer and vascular diseases. According to the data of the European Environmental Protection Agency related to 2022, at least 238,000 premature deaths can be linked to fine particles (PM2.5) in the EU. [2.] Particle filters play an important role in reducing this particulate emission, as they are very efficient.

THE PROBLEM OF PARTICLE FILTRATION, MANIPULATIONS

According to various foreign literature, the proportion of vehicles (moving machines) with defective particle filters is 6-10%, and they cause 70-85% of particle emissions. [1., 3.] Surveys conducted in different countries show some differences, however, it can be stated with certainty that if these vehicles could be filtered out, the particle emissions from vehicles would be significantly reduced and air quality would improve. (e.g., according to [4.], 15% high-emission vehicles cause 97% of particle emissions.). During use, diesel particulate filters are not 100% regenerated, they become clogged after a while and should be replaced, which is quite expensive. Even before that, filters are being manipulated and removed due to certain misconceptions.

Fig 1. Different types of damaged particulate filters

Typically occurring errors:

1. The particulate filter has been completely removed and replaced with a straight tube
2. Damaged, broken particle filter with limited filtering efficiency
3. There is a particle filter housing, but the filter element in it has been removed
4. Partially open particle filter with 20-50% filtration efficiency (e.g. drilled through)
5. Completely clogged filter (This level of clogging is a malfunction of the engine)

A vehicle operating without a particle filter can already be recognized by its exhaust. The end of the exhaust pipe of Diesel engines that are maintained and equipped with a properly functioning particulate filter is metallic inside, free of soot deposits, even after a hundred thousand kilometers. If the vehicle's exhaust is contaminated with soot, then the system is either faulty or previously malfunctioned.

MEASUREMENT TECHNIQUE OF NANO PARTICLES

The determination of the number of particles is possible based on two different measuring principles. The difficulty of nano particle measurement is that extremely small particles cannot be measured directly, it is possible based on some indirect method. The accuracy of the particle measurement is much lower than that of other measurements and its repeatability is also worse.

Condensation principle (CPC) particle counter

The principle of the measurement is that some kind of vaporized liquid (e.g. isopropyl alcohol, butanol) condenses on the small solid particles after they are cooled, thereby increasing the size of the particle several times (even tens of times), which the laser can already count. In the particle counter operating on the condensation principle, the sample flow of continuously sampled and pre-classified particles from the diluted exhaust gas is saturated with butanol in a heated saturation system. The temperature of the butanol-particle aerosol mixture leaving the heated saturation system is reduced by 17 °C in the CPC condenser section. In the cooled condenser, the butanol becomes saturated and condenses on the particles. The size of the particles increases significantly, so they - in the form of droplets - are already in the range that can be detected by an

optical sensor system. The particle concentration can be calculated by knowing the flow rate and the number of droplets counted.
For the operation of the instrument operating on this principle, the condensing liquid must be continuously provided.

Particle counter working on the principle of diffusion charging (DC)

In a particle counter that works on the principle of the diffusion charging process, the particles are excited by passing through an electric field - they are electrically charged and then discharged in a Faraday cage. The strength of the resulting current is related to the number of particles. The accuracy of a device operating on this principle is worse than that of an instrument operating on the condensation principle.

REQUIREMENTS FOR THE PARTICLE MEASURING INSTRUMENT USED IN THE PERIODIC TECHNICAL INSPECTION

If the particle measuring instrument technically meets the requirements, the fulfillment of the following other conditions can help to integrate it into the technical inspection and to insert it into the measurement process and to ensure that the time of the technical inspection does not increase significantly:

- The instrument should not be too expensive
- PC-controlled measurement procedure, continuous measurement analysis and data storage, with the possibility of data transfer
- Be simple and efficient: self-explanatory and clear operation, efficient measurement process
- Quick measurement option, ready for use at any time, no downtime
- It should be low maintenance, with as few consumable/wearing parts as possible
- Be robustly built for everyday workshop work and have a reliable design
- It should be suitable for daily continuous measurement, without maintenance during the day

REQUIREMENTS OF THE MEASUREMENT METHOD

An important part of the topic was the definition of the test method. To do this, we first conducted a literature search. Measurements performed during a technical test or road inspection have their own special aspects.

- If possible, apart from the measuring instrument, no other equipment, especially not expensive equipment, should be needed to perform it
- It was an aspect to think about a measurement that does not require a separate test bench to be installed in the test line, the vehicle can be measured without a load
- The inspection should be simple, with an easy-to-use instrument
- The instrument should be easily connected to the vehicle
- The process should be easily integrated into the technology of the exam
- The procedure should be suitable for clearly determining the state of the particle filter
- It is not necessary to measure with laboratory accuracy, but to decide whether the filter is working properly or whether it is on the vehicle at all
- No assembly or disassembly is possible.

After studying the international literature, we found that TNO (Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek) primarily conducted several years of thorough research, in the framework of which it examined the possible methods and found that the measurement carried out at idle speed can be suitable for a clear determination of the condition of the filter.

We therefore conducted our practical tests primarily in this regard, but since we had no experience in this regard, we wanted to examine other operating conditions as well. We wanted to evaluate how operating conditions other than idling, different thermal conditions of the engine affect the number of particles emitted, and how sensitive the result is to the test conditions. Therefore, we performed measurements at high rpm, with a cold or not warm engine and on a roller vehicle brake pad, at different constant speeds.

INTERNATIONAL SCOPE OF VIEW

Switzerland

For the first time in Switzerland, the measurement of the particle number during the periodic technical inspection was made mandatory for work machines. From 2015, the annual inspection of these machines is mandatory. Perfect ventilation cannot be ensured during tunnel construction, so the operation of excessively polluting machines cannot be allowed. The test method was developed based on several years of research by TNO, while the suitable measuring instrument was also developed by TSI with the involvement of TNO. That instrument became the TSI Model 3795-HC, which was approved by the Swiss Metrology Authority.
Measurement time: 5 seconds repeated three times
Limit value: 250,000 units/cm3
Based on many years of experience, nearly 10% of the examined machines failed the annual inspections.
Jan 2023 Mandatory for all diesel vehicles equipped with particle filters from 1: M, N, non-road mobile machines
Limit value: 250,000 units/cm^3

Netherlands

The planned date of introduction was July 1, 2022. [5.] Scope of application, all diesel passenger cars would be inspected, including light commercial vehicles below 3500 kg, also heavy commercial vehicles from Euro VI.
Test method requirements used would be idling measurement, repeated three times and averaged.
It is not necessary to condition the engine, the measurement can also be carried out in a cold, temporary or operating warm state.
Limit value: 1,000,000 units/cm^3
The introduction was eventually postponed, and the test would only be mandatory from 1 January 2023. for all M1, N1 and Euro VI heavy commercial vehicles.
Limit value: 1,000,000 units/cm^3

Belgium

Belgium essentially adopted the Dutch measurement method, but with the initial stricter limit, different assessment, but for fewer vehicle categories. [6.]
Implementation date was July 1, 2022. Scope of application is for M1 and N1 category, Euro 5b and 6 level vehicles.
Test method requirements as follows: idling measurement, repeated three times and averaged. It is not necessary to condition the engine, the measurement can also be carried out in a cold, temporary or operating warm condition.
The rating is quite interesting. If a vehicle emits more than 1 million particles per cm3, it gets 3 months to fix and retest. (It should be noted that there was a huge shortage of replacement filters in Belgium after the introduction of the tests. The parts trade was not prepared for the high demand.)

If a vehicle produces results between 250,000 and 1 million, it will be warned to check the particulate filter, but not required to undergo a new test.

Germany

It planned to introduce the measurement for Euro 6/VI diesel vehicles (both trucks and buses) from January 1, 2023 [7.]. However, a sufficient number of instruments were not available, so the introduction was postponed. In Germany approx. There are 16,000 exam places, and the manufacturers could not provide such a number of instruments in the relatively short time. According to the latest information, the inspection is mandatory from July 1, 2023.

European Union

In March 2023, the EU Commission published a recommendation regarding the particle number measurement during the periodic technical inspection. The recommendation states, among other things:
"During the periodic technical inspection of vehicles equipped with compression ignition engines and diesel particulate filters, Member States must carry out particle number measurements in accordance with the guidelines set out in the annex."
"This means diesel-powered light vehicles (Euro 5b and newer) registered for the first time after January 1, 2013, and heavy-duty diesel vehicles (Euro VI and newer) registered for the first time after January 1, 2014.
That is, the recommendation applies to diesel vehicles for which there was already a limit value for the number of particles for type approval.
The recommendation states that although the measurement would also be justified for direct-injection gasoline-powered vehicles, tests have not been carried out in this regard to see if the method and limit value recommended for diesels can be applied, so for now it only applies to diesel engines. In the longer term, gasoline-powered cars with particle filters will certainly also come into focus.

Commission Recommendation 2023/688 on particle number measurement during the periodic technical inspection of vehicles equipped with compression ignition engines

The test methods prescribed in European Parliament and Council Directive 2014/45/EU with regard to vehicle exhaust gas emissions, namely the light absorption test applied to compression ignition engines, are not adapted to newer vehicles equipped with particle filters. Laboratory tests show that even vehicles with faulty or tampered Diesel Particulate Filters (DPFs) can pass the light absorption test without detecting the malfunction.
On March 20, 2023, the Commission accepted the recommendation that, during the periodic technical inspection of vehicles equipped with compression ignition engines and diesel particulate filters, Member States must perform particle number measurements in accordance with the guidelines set out in the annex. The full recommendation is available at the link below [8.]

MEASUREMENT RESULTS

TSI Model 3795-HC

Irrespective of the fact that in the first step only the inspection of diesel cars comes into question during the technical test or during the road inspection, we wanted to examine all types of available vehicles to gain experience, to see the different engine designs, age, emission class, etc. what effect does it have on the particle number.

The instrument was developed for testing Swiss construction machinery and measures according to Swiss requirements. In practice, this meant taking three 15-second measurements in a row and averaging them. The results show that the repeatability of the measurements is generally acceptable, but in some cases, there are significant differences.
Explanation of abbreviations in the following table:
Idle (cold): Value measured after cold start of the engine. At the time of the measurements, this was approx. It meant starting the engine at an ambient temperature of around 10 °C.
Idle (warm): engine at operating temperature, according to the water thermometer on the vehicle's dashboard
Increased rpm: According to the rpm meter on the vehicle's dashboard, approx. 2000 f/min value
In the table, we have highlighted the egregious values in red.

Table 1. Results of TSI measurements

Type	Year	Gasoline (G) Diesel (D)	GPF /DPF	Measurement method	1. measurement pcs/cm^3	2. measurement pcs/cm^3	3. measurement pcs/cm^3	Average pcs/cm^3
Suzuki Ignis 1.3	2005	G	none	Cold	734	4300	4297	3110
				Warm	554	273	445	424
				Increased rpm	11048	4835	318	5400
Renault Trafic	2011	G	none	Cold	14283970	14445420	14446290	14.391.893
				Warm	4800562	4634123	4571359	4.668.681
				Increased rpm	21022930	21959710	22954600	21.979.080
Opel Ampera tölthető hibrid	2013	G	none	Cold	355752	281639	232878	290.090
				Warm	226252	225075	215656	222.328
				Increased rpm	3089288	3047395	3127935	3.088.206
Opel Astra Ecotec	2018	G	none	Warm	6227490	6237411	6466038	6.310.313
				Increased rpm	566765	409539	457834	478.046
Skoda Fabia (5J)	2020	G	GPF	Cold	23747	16317	14896	18320
				Warm	3451	3875	3734	3687
				Increased rpm	2468	2344	2155	2322
Ford Transit 2.5D	1996	D	none	Cold	9694227	10000980	9464417	9.719.875
				Warm	9357602	9000658	8102023	8.820.094
				Increased rpm	20329330	20652540	19572580	20.184.817
Nissan PICK UP	2004	D	none	Cold	20176970	20218970	20705690	20.367.210
				Warm	10624830	10595230	10620010	10.613.357
Toyota Avensis	2007	D	DPF	Cold	6497	6009	6844	6450
				Warm	6486	6887	6986	6786
				Increased rpm	9244	5706	5581	6844
VW Caravel	2020	D	DPF	Cold	82006	91711	88607	87441
				Warm	25357	26445	27227	26343
				Increased rpm	23001	23137	24678	23605

Examining the data in the table above, we can conclude the following:

- particle emissions are the smallest at idle.
- flawless particle filters filter with excellent efficiency.
- increasing the speed increases the number of particles.
- in the test bench measurement simulating road travel (Ford Focus 1.6), emissions increased slightly compared to idling. (Theoretically, we expected this, but the test of one vehicle is not representative.)
- the cold start, the thermal state of the engine, has little influence on the evaluation compared to the recommended limit value. Although the emission increases slightly in cold operation, it is still very far from the recommended limit.
- the repeatability of the measurements is adequate, enabling a reliable assessment. Although in some cases there is a considerable deviation in %, however, in the case of a well-functioning particle filter, the measured values are far from the recommended limit value.

TEN AEM

The Energotest company has created a software for the TEN instruments, which can be connected to a computer (or to the test line), and by using the OBD data, an evaluation far beyond the standard measurement and the result shown by the simple display can be performed. Thus, the instrument is also suitable for continuous measurement and data saving.

Table 1. Results of TEN measurements

Type	Year	Gasoline B Diesel G	DPF / GPF	PTI (Dutch) test [k #/cm3]	Increased rpm (~2000 rpm) [k #/cm^3]	Idle [k #/cm^3]
Suzuki Ignis 1,3	2005	G	none	2,3	17,2	0
Kia Ceed 1,4	2015	G	none	0,0	3	0,0
Opel Astra Ecotec	2018	G	none	> 5000	> 5000	> 5000
Skoda Fabia (5J)	2020	G	GPF	0,2	14,4-8,6	1,6
Toyota Avensis	2007	D	DPF	23,2	50,2	17,00
Peugeot 508	2013	D	DPF	> 5000	> 5000	> 5000
Opel Astra Ecotec	2018	CNG	none	25,3	28,2	18

Among the above results, the Peugeot 508, which showed a particle number of more than 5 million, as well as the Opel Astra Ecotec CNG, which showed similarly bad results as measured with the TSI instrument, should be singled out. It is not at all tuned for the gasoline mode, it emitted an amazingly large number of particles, over 5 million.

Evaluation of measurements made with the Energotest TEN instrument in the figures below, you can see a tabular presentation of the continuous measurements made on different car types.

The diagrams show:

- **rpm (blue)** on the left axis
- **particulate number (orange, in 1/1000 value)** on the right axis
- **engine temperature, if so, (gray)** if present is scaled on the right axis.

Where there is no rpm, the probe was not in the exhaust pipe. The horizontal axis contains the measurement time.

Gasoline vehicles:

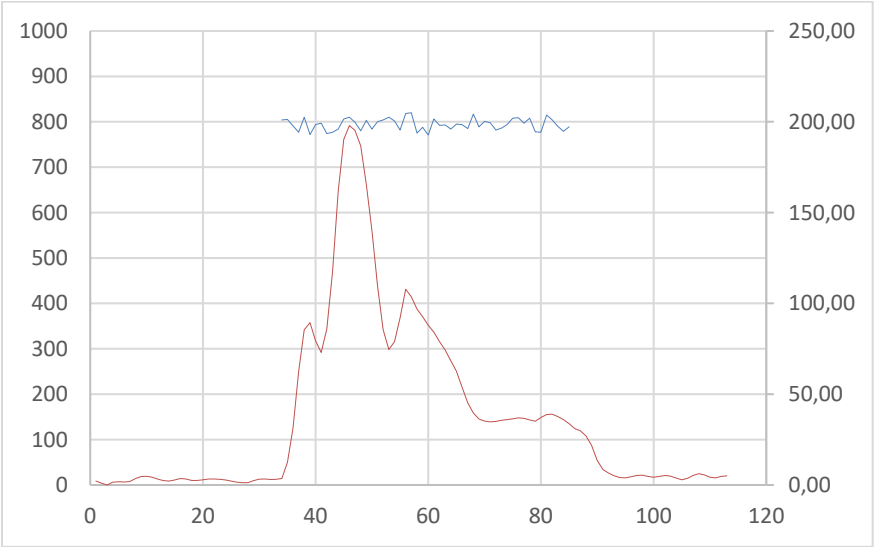

Fig. 2 Opel Combo C 1.6 Petrol (300,000 km of mileage): It would meet the limit of 250,000 pcs/cm^3.

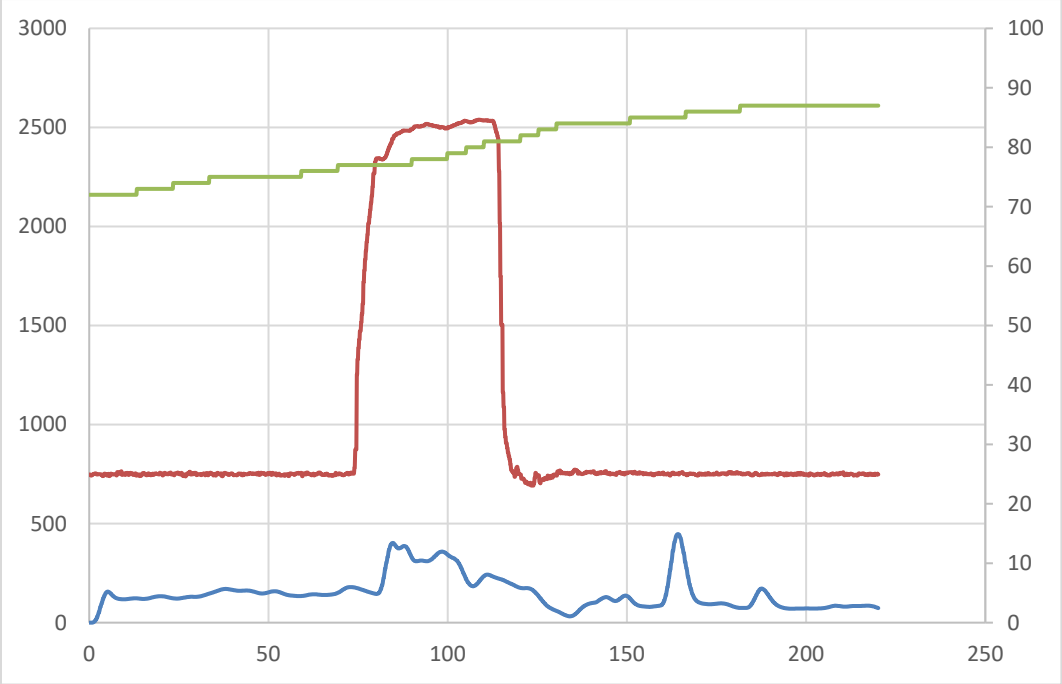

Fig. 3 VW 1.4 TSI Petrol (85,000 km of mileage): It would correspond to the limit of 250,000 pcs/cm^3.

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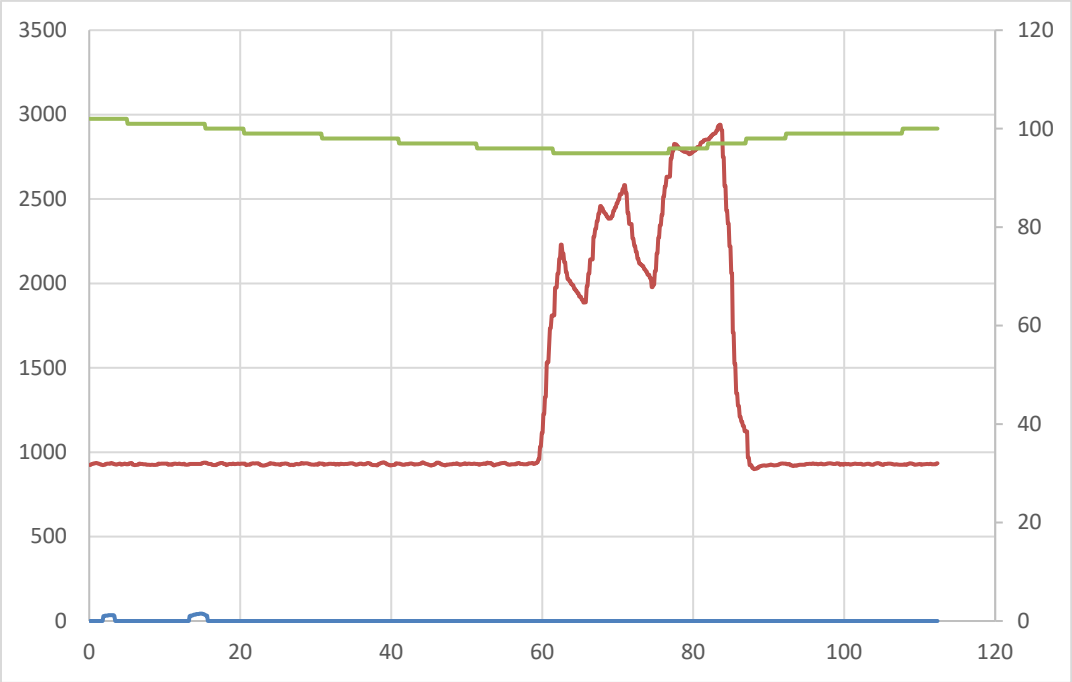

Fig. 4 VW Golf 1.5 TSI GPF petrol (10,000 km of mileage): It would meet the limit of 250,000 pcs/cm^3.

Diesel vehicles without particulate filter

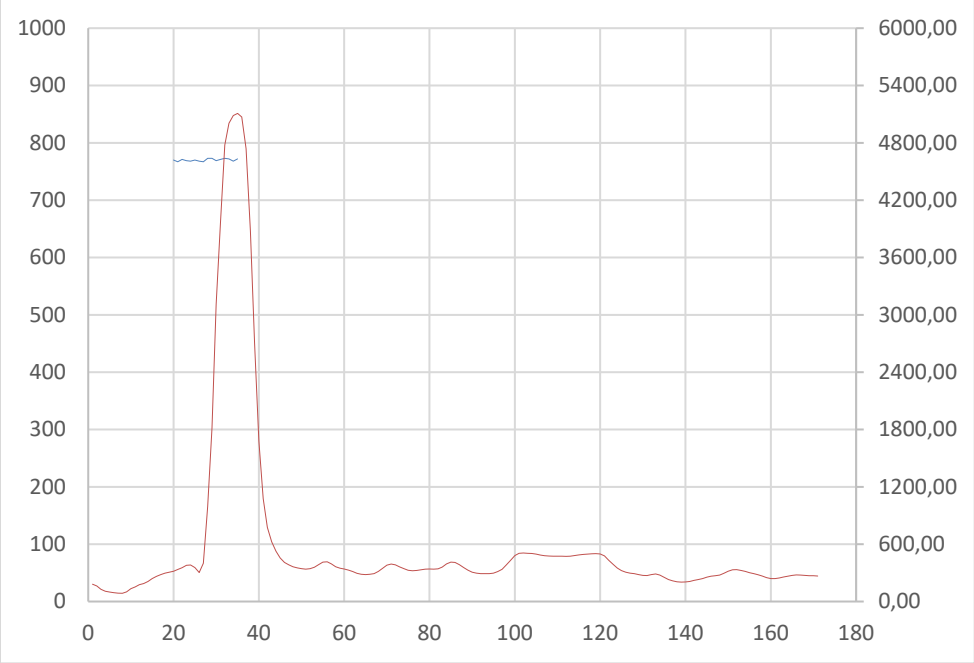

Fig. 5 Unable to measure, the probe tube was near the exhaust only

At the end of the measurement, the number of particles was still barely below 300,000 pcs/cm³ (after 2 minutes). (The number of air particles would be below 10,000 pcs/cm³.) The instrument had to be aerated for a long time.

Diesel vehicles with particulate filter

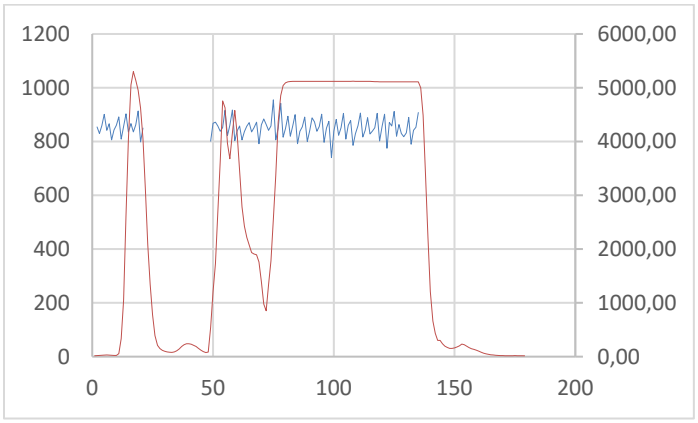

Fig. 6 Unable to measure, the probe tube was near the exhaust only

The official measurement on the instrument has not been completed because the value is too high, caused by the damaged filter. The set maximum is 5119.3 k pcs/cm3 (5.1 million)

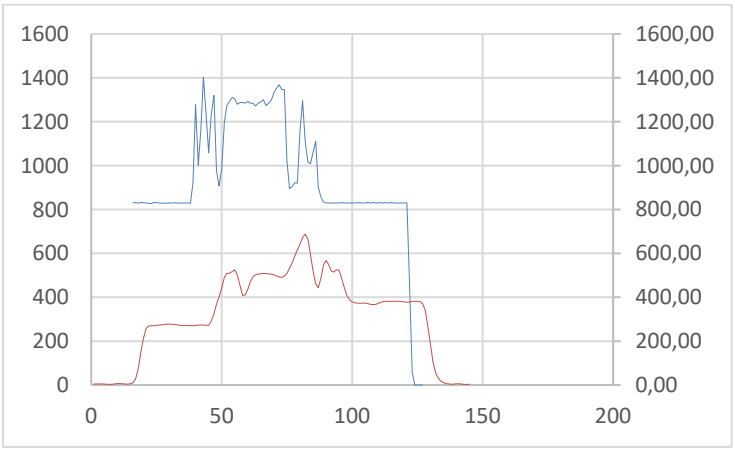

Fig. 7 Hyundai ix 20 2-year-old, 30.000 km of mileage. The vehicle met the Dutch limit of 1 million, but not the 250,000 pcs/cm³ recommended in other countries.

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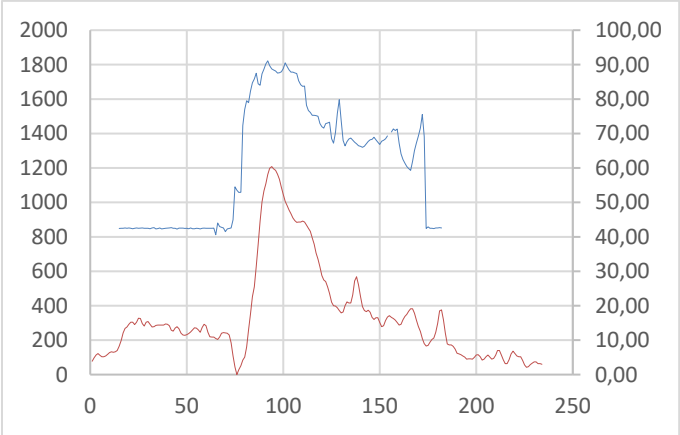

Fig. 8 Dacia Dokker, brand-new (1000 km of mileage) The vehicle meets the limit of 250,000 pcs/cm^3.

SUMMARY

Conclusions of measurement results

It should be noted that many problems with the particulate filter are caused by a significantly larger amount of soot coming from the engine than expected. This can usually indicate engine problems (e.g. injection carburettor, EGR system, burning of excess lubricating oil due to a possible mechanical problem, etc.), so we cannot blame the soot filter. Most of the time, the problem is not with the filter itself. Most of the errors, error codes, and dashboard indications related to the particle filter are caused by an electrical component failure, or by the fact that the particle filter becomes saturated faster than expected due to some other factor. This is most often caused by an exhaust gas recirculation error, a leak on the intake side, or an atomization error. Unfortunately, practice shows that many more people decide to eliminate a DPF than invest the energy and find out the root cause of the intense soot formation. Whatever problem we look at - whether it's diagnostics, fault finding, repair or DPF replacement - none of them are cheap. If the owner or operator neglected regular maintenance - this also costs money - and in addition used the vehicle with forced operation, the fault is guaranteed. The total repair of accumulated defects can reach 15-40% of the value of the vehicle. Thus, it is understandable that vehicles that have suffered such a fate end up on the used car market in Western Europe, from where they migrate to East-Central Europe. Of course, repairs everywhere cost money, so the final and cheapest solution is to eliminate the soot filter, which we know has harmful consequences.

CONCLUSIONS OF EXPERIMENTS

During the measurements, we also examined gasoline and diesel vehicles where possible. And within gasoline plants, there are also engines with direct and intake pipe injection.

Through the measurements, it is not a task to determine the exact reason behind the exceeding of the limit value. There have been cases (e.g.: the Volvo XC60 we measured, for which the measurement sheet is attached), that the vehicle indicated a DPF error code during the OBD reading, but the values were still correct. It follows that exceeding the limit value can be caused by another component, the measurement shows the symptom, not the cause.

We can state that a vehicle that shows adequate values in cold operation, idling, will certainly produce adequate values at operating temperature as well.

The emissions of diesel and gasoline vehicles equipped with well-functioning particle filters are below 10,000 particles/cm3. The smallest number can be seen at idle speed. We had several measurements when the number of particles in the exhaust gas was smaller than that of the intake air at idle speed. Emissions increase as engine speed or engine load increases.

The particulate emissions of direct injection gasoline engines are like those of diesel engines. It is no coincidence that the use of a particle filter has been mandatory for some time on these engines as well. Non-direct injection gasoline engines in good condition have low particulate emissions. Even without a particle filter, it is in the range of a few hundred - a few thousand pcs/cm3 at idle.
The particle filters filter excellently, their efficiency can reach 99%.

According to literature data, the emissions of well-functioning Euro 6 engines do not exceed 1 million pcs/cm3 even without a particle filter. In the case of faulty engine operation and a faulty particle filter, the emission is in the range of 1-3 million pcs/cm3. The emissions of older, smoky engines without particle filters can reach 10-30 million units/cm3. This already affects and endangers the instrument; extremely long aeration is required to restore the zero point. The limit value of 250,000 units/cm3 recommended at idle is completely reliable. With a well-functioning filter, the emission is orders of magnitude smaller than this, while in the case of a malfunction it is much higher. The faulty state is sharply separated from the good state. This limit value is suitable for filtering errors.

The repeatability of the measurements is adequate, although there is a difference between the values, their extent is far below the limit value, it does not affect the assessment of conformity. The applied test method (no-load idling) is suitable for the evaluation. The thermal state of the engine usually has little effect on the result. Although a smaller value can be measured when the engine is warm than when it is cold, this difference is usually far from the magnitude of the limit value.

The test is not very sensitive to engine temperature.
The instruments are portable, their warm-up time is short, and they are easy to use. Devices operating on the principle of the diffusion charging process require minimal maintenance and are also suitable for roadside inspections. The test can be performed simply and quickly in 2-3 minutes.

Determination of the fleet of vehicles subject to particle testing

With the foreign examples, we have seen that the category of the affected vehicles may differ from country to country. According to the EU recommendation, the particle number test should apply to vehicles that already had a particle number requirement during type approval. It is expected that this will also be included in the amendment of the technical inspection directive.

Unfortunately, the classification according to domestic environmental protection classes (Annex 5 of KöHÉM Decree 6/1990) does not exactly follow the UNECE or the Euro categories.
For heavy commercial vehicles (M2, M3, N2, N3), the particle number type test requirement is valid from the Euro VI classification. This corresponds to the Hungarian environmental protection class 16. No problem here.

According to a screening of the entire vehicle stock at the end of 2021, 40,233 diesel vehicles fall into this class. (The data for the end of 2022 is not yet available to us.)
The environmental protection class of Euro 6 M1 and N1 cars is also clear, this is environmental protection class 15. Based on the filtering of the vehicle stock, this means 211,835 diesel cars.
The number of diesel hybrid vehicles is relatively small (class 5N and 5P), 1,967 units.
The need to test the above vehicles can be clearly identified during the technical inspection.

The problem is with Euro 5 light vehicles (M1, N1). The Euro 5 category has two subcategories, Euro 5a and Euro 5b. The particle filter is required on diesel vehicles from the Euro 5b category. Euro 5a category vehicles have not yet been prescribed a limit value for the number of particles for type approval. In Hungary, both categories are classified in environmental protection class 14.

According to our knowledge, the vehicle register does not include whether the vehicle belongs to category 5a or 5b. At least, this cannot be established from the data received from the Ministry of the Interior. The date the vehicle was first put on the market can give some clues, but this is not 100% certain.

Table 3.

Introduction time M1, N1	Euro 5a	Euro 5b
Type approval, new types	september 1st 2009	september 1st 2011
Entry into force new vehicles, first registration	januar 1st 2011	januar 1st 2013

Dates of application of Euro 5 categories

Based on the above table, after January 1st, 2013, only vehicles of at least Euro 5b category can be put on the market for the first time. After this date, the vehicle placed on the market could not be of Euro 5a category. However, this does not mean that a Euro 5b category vehicle could not be placed on the market before January 1st, 2013. If environmental protection class 14 and the date of January 1st, 2013, are considered at the same time, then those Euro 5b category vehicles that were put on the market before this date are omitted. We cannot determine the number of this.

The entire domestic Euro 5 diesel M1, N1 stock together represents 258,028 vehicles based on the data at the end of 2021.

Proposal for the introduction of particle measurement in the technical inspection and road inspection

Our own measurement results and extensive foreign experience show that idling measurement is suitable for screening cars with defective or removed particle filters. Based on foreign practice, we recommend testing diesel vehicles as a first step. The implementation of the measurement differs slightly from country to country. The scope of application is also different. Basically, we recommend the EU recommendation method for domestic introduction, as this will certainly be implemented when the EU technical inspection directive is renewed.

If the exhaust system has more than one outlet, the test must be performed on both outlets. (We had the opportunity to measure a diesel vehicle with a double exhaust (Volvo C70), and we did not see any difference between the two branches.)

The limit value of 250,000 pcs/cm^3 means a safe separation between a well-functioning filter and a faulty or removed filter. The measurement time is short, the 3-minute measurement does not significantly increase the duration of the technical exam. The approved instruments are also suitable for roadside inspections, but in this case, attention must be paid to the potential disturbing effect of the regeneration process mentioned above.

Following the EU recommendation, we recommend the following for measurement in the technical inspection:

The particle number concentration test shall be applied to vehicles of category M and N equipped with a diesel particulate filter and shall determine the value of particles per cubic centimeter in the exhaust gases of a stationary vehicle with the engine running at low idle.

The test should not be performed during regeneration of the vehicle's diesel particulate filter.

At the start of the test, the vehicle:

- operating temperature, i.e. engine coolant temperature > 60 °C, but preferably > 70 °C (According to our own experience, the test result is not very sensitive to engine temperature if the vehicle is in good condition).
- A quick compliance test is possible when the temperature of the engine coolant is below 60 °C. If this vehicle is suitable, there is no need to continue with the warm-up. However, if the vehicle fails this test, the test must be repeated, and the vehicle must meet the engine coolant temperature and conditioning requirements.
- The probe must be placed at least 0.20 m into the outlet of the exhaust system. In justified exceptions, if sampling is not possible at this depth, the probe must be placed at least 0.05 m. The sampling probe does not come into contact with the walls of the exhaust pipe.
- If the exhaust system has more than one outlet, the test must be performed on all of them and the corresponding PN-PTI limit must be observed for each test. In this case, the highest particle number concentration measured at the various exhaust system openings shall be considered as the vehicle's particle number concentration.
- A stabilization period of at least 15 seconds when the engine is idling. Optionally, 2–3. before a stabilization period, they accelerate up to a maximum speed of 2,000 rpm.
- In the case of hybrid and plug-in hybrid electric vehicles, the internal combustion engine must be switched on (e.g. by switching on the air conditioning system of hybrids or by selecting the battery charging mode in the case of plug-in hybrids, or in another way).
- After the stabilization period, the emissions of the particle number concentration must be measured. The duration of the test is at least 15 s (the entire duration of the measurement). The test result is the average particle number concentration for the duration of the measurement. If the measured particle number concentration is more than twice the PN-PTI limit value, the measurement can be ended immediately, there is no need to wait for the 15 seconds to pass, and the test result must be reported.
- If the test result is less than or equal to the limit value of PN-PTI, the vehicle passed the test.
- If the test result is greater than the PN-PTI limit, the vehicle has failed.
- For the test described above, the recommended limit value is 250,000 particles/cm^3 for diesel vehicles with particle filters.
- Since the technical inspection stations of the county government offices received AVL-type particle measuring instruments last year, it would be advisable to introduce the test and collect the data in a specific, narrower circle, as a test, without consequences. Such a circle can be e.g. M1 and N1 category service cars.

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HIDDEN HISTORY OF ENVIRONMENTAL PHILOSOPHER-GURU JAMBHESWER?

Matavya Bishnoi[1], Bhanu Singh Panwar[2]

[1] *School of Science, Western Sydney University, Sydney, Australia*
[2] *Green India Clean Environment Society, Hisar, Haryana, India*

Abstract: *The **Jambhoji** was born in Pipasar village located in Nagaur district of Rajasthan. He founded the Bishnoi sect in 1485 at Samarthal Dhora village near Nokha in Bikaner district of Rajasthan. His teachings were in **POETIC FORM, KNOWN AS SHABADWANI**. His teachings are covered by 29 principles and 120 shabads. Eight of the twenty-nine principles are strict guidelines for the protection of the environment, biodiversity, ecology and at the same time they inspire good animal husbandry and compassion for living things. These principles strictly prohibit the killing of animals, cutting of green trees, sterilization of bulls, and inspire the conservation of all life forms. Guru Jambheshwar urged his followers not to wear clothes dyed with 'indigo' as the color for dyeing is obtained by cutting down bushes. Jambhoji used his mind and weaved the movement of environment conservation into religious philosophy. In the present times when the world is facing environmental crisis, then the teachings of Jambhoji prove to be very important. Keywords: Jambhoji, Bishnoi, Sabadvani, Environment, Conservation, Khejarli*

*Some medieval sages in their teachings gave paramount importance to the promotion and protection of water, forests and animals in the desert. Guru Jambhoji and Siddha Jasnathji guided the society to ensure environmental protection by establishing new sects in Indian desert. Jambhoji propounded the principles of conservation of forests and animals. Hence, he can be considered as the leader of the environmental movement in the state. The word environment was not in vogue during the time of **GURU JAMBHOJI AND SIDDHA JASNATHJI,** but both were much ahead of their time in terms of environmental protection. Knowing the importance of environmental protection, these visionary saints issued the mandate in the language of the common man and played an epoch-making role in establishing ecological balance in the desert region. The Bishnoi sect termed the act of anti-religious acts by human beings to harm the trees and animals that grow and thrive on sandy soil with great difficulty. Along with cleaning the body, He called for keeping the mind ideologically free from pollution. He also considered the act of creating imbalance by tampering with the environment and creating discrimination or disharmony at the social level in the category of pollution. An epoch-making contribution was made by the Bishnoi sect for environmental protection and upliftment of moral values.*

Keywords: *Jambhoji, Bishnoi, Tree, drought, desert, hunting*

INTRODUCTION

An about 600 years ago, an incidence followed an extended drought and widespread deforestation in thar region of India. The only son of a village headman, Jambhoji of village Pipasar, Bikaner in Rajasthan, had a

vision that the hard times were a result of the conflict with nature. He was Sant warrior and advocating to the criminal and tribes of area, not to killing of animals, cutting green trees and cremation to save firewood.
The dynasty ruler of that period, Maharajah Abhay Singh of Jodhpur wished to build a new palace and asked his man, Giridhar Das Bhandari, to fell the forest around Jalnadi. When, Bhandari's axemen approached the site, A village farmer lady Amrita Devi rushed to them, and pleaded in vain for the trees to be spared. In desperation, she then hugged the first tree that was to be cut and uttered the now-famous couplet of the Bishnois**, "A chopped head is cheaper than a felled tree."** Then she fell to an axe blow, but her three daughters stepped forward to take her place. They, too, met the same fate.
Mr. Bhandari sent for reinforcements, and, in turn, the community drummed the alarm in 84 villages. From 83 villages volunteers responded. By the end of the day, 290 men and 69 women from 49 villages were felled by the axemen. When the king, Abhay Singh was told the tale of Bishnoi bravery, he was filled with remorse. He stopped work on the palace, visited the people to apologise and promised them that they would never again be asked to provide timber, khejdi tree would ever be cut and hunting would not be permitted near a Bishnoi village.

Since then, the community have laid down their lives to protect trees the sacrifice of Amrita Devi of Jalnadi village, 25 km from Jodhpur, in 1731 is particularly memorable. Jalnadi is now known as Khejarli and a concrete tower there marks the spot where Amrita Devi fell

Women warrior for protecting the tree and self-immolation

BIO-PROFILE

Guru Jambheshwar / Jambhoji, (1451–1536) was the founder of the Bishnoi Panth. His philosophy was that God is a divine power that is everywhere. He emphasis on to protect plants and animals as they are important in order to peacefully co-exist with nature and part of universe/planet.
He was born to a Rajput family of Parmar clan in a remote village Pipasar, Nagaur in 1451.He was the only child of Thakur Lohat Panwar and Hansa Devi. For the first seven years of his life, the boy was considered silent and introverted. He spent 27 years of his life as a cow herder in thar desert of great India, Aryavert (Bharat).

Guru JambhoJi

House- Birthplace of Jambhoji, village Pipasar

FOUNDER OF SUB SECT-BISHNOI OF HINDU RELIGION

At the Age of the year 34, he founded the Bishnoi sub-sect of Vaishnavism in Samrathal Dhora (sand dune). His hypothesis was in the poetic form known as **SHABADWANI.** He preached for the next 51 years, travelling across the country, entire thar desert regions then including Afghanistan, Iran, Iraq, UAE and produced 120 Shabads, or verses, of **SHABADWANI**. The sect was founded after the big draught in Rajasthan in 1485. He had laid down 29 principles to be followed by the sect. Killing animals and felling trees were banned. The Prosopis cineraria, is also recognized to be sacred in community, revolves around 29 rules. Of these, eight prescribe to preserve biodiversity and encourage good animal husbandry, seven provide directions for healthy social behaviour, and ten are directed towards personal hygiene and maintaining basic good health. The other four commandments provide guidelines for worshipping Vishnu mandatory in morning and evening.

Legacy and commemoration made by Guruji further forwarded by Ch. Bhajan Lal Ji, former Agricultural Minister, Government of India and Chief Minister of Haryana State of India, Ch Poonam Chand ji Bishnoi, Ch. Ram Singh ji Bishnoi, DIG Bhagirath Ji Bishnoi and several noble Bhama Shah of country. It is there where the most sacred Bishnoi temple is built over samadhi of Guru Jambeshwar called **MUKAM**, Bikaner. The GJU-Hisar, Guru Jambeshwar University of Science and Technology, Hisar, Research, Teaching and Spiritual Institutes, Temples, Shrines, Schools, Colleges, Hospitals are named after this great philosopher of India.

Mukam Temple

BIRTH OF NEW SECT

Guru Jambheshwar was born in 1451 AD in a Rajput family of Panwar clan in a remote Rajasthani village Pipasar in Nagaur district.5 His father's name was Lohat ji Panwar, and mother's name was Hansa Bai. Jambhoji spent 27 years grazing cattle in the wilderness, sitting alone and meditating.7 During this time, he

became passionate about the pastoral landscape of the desert. After the death of his parents, in 1483, Jambhoji left his home and made Samarathal Dhora his penance. Advocating the worship of Lord Vishnu, Jambheshwar strictly prohibited animal killing and cutting of trees. He emphasized compassion toward nature and protection of wildlife as the supreme religious goal to his followers in the preaching. He was very keen on social welfare and helping others. In the year 1485, the western Rajasthan region experienced the worst drought and people started migrating to Malwa (MP) with their livestock. The death and destruction caused by an unusually long famine pierced the tender heart of saint. He then offered his help to bring back the drought-affected people and helped them with grain, fodder, agriculture and goods etc. He channelled his thoughts and feelings to love, compassion, equanimity and detachment. To help the suffering people of that time and to save religion

Followers of different religion, faiths, cases and classes accepted Bishnoism by taking Pahal and became Bishnoi. Regarded as a great saint, he preached love for all living beings through his 'shabads' (sayings). He also emphasized compassion toward nature and protection of wildlife as the supreme religious goal to his followers in the preaching. Guruji, kept the form of Bishnoi sect humanitarian in character. It is necessary for the followers of Bishnoi sect to follow twenty-nine rules. Bishnoism was based on main 29 principles or Bisno, from 'Bees' (Twenty) and Nau (Nine) and best practices taken from all religions and faiths. The influence of other religions and sects is clearly visible in his teachings. They have adopted the principles of non-violence and mercy from Jainism and burying the dead from Islam. The Vaishnava sect, Nanakpanth etc. have a clear influence on his teachings. He laid the foundation of the Bishnoi sect by coordinating the tenets of different religions and sects. He can be considered as the synthesizer and protector of various religious traditions and Indian folk culture. His teachings were very simple, logical, practical and effective. He believed in one God and did not believe in statue worshipping or leaving social responsibilities to achieve God. Guruji gave a simple way which ensures, *"**JIYE NE JUKTI AUR MARIYA NE MUKTI"*** means an art of living for this life and then Moksha or heaven after this life. He travelled a lot and did many welfares works to help and teach people. He was a true and visionary guru, social reformer, a follower of nonviolence, great environmentalist and believed in love and harmony not only between humans but also between nature.

Water harvesting during drought for cattles

LESSION FOR ENVIRONMENT PROTECTION

BISHNOISM as mentioned earlier revolves around 29 commandments. Out of these 29 commandments, eight aim to preserve biodiversity and encourage animal husbandry. Seven commandments provide directions to healthy social behaviour. Ten commandments are directed towards personal hygiene and maintaining basic good health. The other four rules are guidelines for worshipping God daily. Jambhoji has emphasized on cleanliness and purity in his rules.

THE SELF-IMMOLATION

The Khejri (Prosopis cineraria) tree has played a vital role in the ecology, especially in the Thar desert. It is known for its sacredness in Bishnoi Sect which provides food, fodder, and building materials. Bishnoi sacrificed their lives to conserve and protect the flora and fauna since the origin of the sect. Karma and Gora, two Bishnoi women from Ramsari Village, Jodhpur, Rajasthan, sacrificed themselves in 1604 AD to protect sacred Khejri tree. This sacrificial incident is known as the first "saka" (self-immolation) in the Indian history for the sake of a tree. Another instance of sacrifice to protect Nature and its trees was the Buchoji Bishnoi who sacrificed his life in around 1643 to protect felling of trees for celebrating the festival of Holi.

Mandatory daily Havan at Village

JAMBHOJI was a great visionary, who had foreseen the consequences of man's destruction of nature for economic development. He saw the need for environment protection and weaved his principles. His 29 commandments include higher moral values inlaying, a nature-based self-contained lifestyle, maintaining purity of natural resources. Eight rules are related to the protection of animals, birds, trees and environment. Jambhoji laid special emphasis on cleanliness, purity, environmental protection and human values in his teachings. Emphasis has been laid on abstaining from all forms of violence, not cutting down trees, not causing any harm to animals, not killing them, protecting the life of all living beings, etc. Jambhoji, endowed with foresight, made it a religious rule to link environmental protection with the daily routine and behavior of the people. He understood that the basis of ecological balance is environmental protection. Bishnoi has been

following the law of compassion for living beings and has been emphasizing on their upbringing and protection of wild animals. Even today wild animals like deer can be seen roaming freely in the villages of Bishnoi. Woman treats orphan animals as their own child. Tanka (rainwater harvesting structure) Oran (sacred groves), and freely roaming animals in Bishnoi villages are presenting wonderful examples of integrated rural ecosystem. The world has just woken up to the need to protect the environment, Bishnoi have been following sustainable conservation for centuries. Various ongoing environmental movements have also brought Bishnoi practices to the world stage. The world-renowned Chipko movement of Uttaranchal, known for its tree-hugging campaign to oppose felling of trees, was also inspired by the Bishnoi's sacrifice in the Khejarli massacre. Life is not possible without a clean environment. Jambhoji's teachings prove to be relevant in the present times when the world is grappling with various problems related to the environment. In the present context when forests are rapidly disappearing and environmental pollution is also spreading rapidly, the teachings of Jambhoji have an important role. Today the whole world is worried about the threat of global warning. Due to industrialization, urbanization, deforestation and pollution, man is creating an unsafe environment for his coming generations by unnecessarily attacking the components of nature. This danger was foreseen by Guru Jambhoji centuries ago and warned against it in the past. In the present context when forests are rapidly disappearing and environmental pollution is also increasing, the teachings of Jambhoji have an important role.

ENVIRONMENTAL MANAGEMENT IN INDIA

India's economic growth over the past few years has raised the prospect of eliminating extensive poverty within a generation. But this growth has been clouded by a degrading physical environment and the growing scarcity of natural resources that are essential for sustaining further growth and eliminating poverty. It is no coincidence that the poorest areas of the country are also the most environmentally stressed regions, with eroded soils, polluted waterways and degraded forests.

Simultaneously, rapid growth has unleashed greater public awareness and an unprecedented demand for the sound management of natural resources including water, forests and biodiversity. Environmental sustainability is rapidly emerging as the next major development and policy challenge for the country and will be central to the 12th five-year plan which is currently under preparation.

In rural areas poverty has become intertwined with resource degradation – poor soils, depleted aquifers and degraded forests. To subsist, the poor are compelled to mine and overuse these limited resources, creating a downward spiral of impoverishment and environmental degradation. There is growing pressure to better protect India's pockets of mega biodiversity which are increasingly recognized as being of immense significance for global biodiversity yet are increasingly threatened. Greater investment in the protection of

these natural assets would yield a double dividend of poverty alleviation and the improved sustainability of growth.
The health impacts from pollution are comparable to those caused by malnutrition and have a significant impact on productivity, health and quality of life. Environmental health challenges are largely caused by poverty-related risks associated with poor access to basic services, such as safe drinking water and sanitation and poor indoor air quality.

Sundarbans Sustainable Socio-Economic Development-the objective of the Non-Lending Technical Assistance is to assess measures that would build the resilience of the socio-economic and biophysical system and achieve long-term sustainable development. Historic sea level rise from deltaic subsidence, salinity intrusion, flooding, and nutrient loss in local soils have all conspired over the past century to render it one of the most hazardous areas in the Indian subcontinent.
Overall, in this article, we see an overlap of religious, personal and ecological attitudes in the Bishnoi examples and that the term “dharma” is used interchangeably to refer to one's religions, duty and socio-political order of the universe both by the founder and followers of the Bishnoi community.
Most Bishnoi community people are barely aware of the western scientific discourse about “global warming” or “biodiversity”. Still, they serve as one of the most powerful examples of environmentalism that is rooted in their dharmic tradition. Unlike other religious movements, the dharma of **Bishnois** is not just limited to their religious rituals or scriptures, but it includes natural resources beyond their religious sites as is evident from the examples of their sacrifices done in the farmlands of their villages.

Women in different time-periods have been made the object of desires either in the raj-durbar, in the market, or in the political setups. The secondary status of women has often been challenged by scholars at various time periods. There are many limitations of the widespread dominant literature of the women's movement which originated in the USA. The two important concepts that came out of these movements are Eco-feminism and Ecological Feminism. Eco-feminism is an activist and academic movement providing critical connections between the domination of nature and the exploitation of women. This movement grew during the New Social Movements wave in 1980 and 1990 in the USA. It had its worldwide implication in terms of raising awareness about the patriarchal dominating nature of capitalist societies across the western world. Hence, it also joined together the feminist and green movements together to save women and environment.

On the other hand, according to Cheney "the Ecological feminism refers to a sensibility, an intimation that feminist concerns run parallel to and are bound up with or perhaps are one with concern for a natural world which has been subjected to much the same abuse and ambivalent behaviour as have women" The take of Ecological Feminism is that there are substantial historical, symbolic and theoretical connections between the domination of women and the environment. In response to that the framework of Ecological Feminism provides a distinct feminist environmental ethic. It is within this framework that the next sections of this paper provide Indian environment ethics which are ingrained in the age-old religious philosophy of the Bishnoi Community.

Only a few great human beings have been able to accept women in their completeness as human beings. One among them is the philosophy of Guru Ji which is practiced even today by the Bishnoi community. In ***Jambhoji's*** philosophy, women are not self-pitying human beings. Rather, they are impartial, just, courageous and full of zest. These characteristics are usually associated with men in society. Disrespect toward them is not acceptable. He strongly opposed the old rudimentary ways of living which were very unkind toward women. The one who is not affected by the time and space during his existence can only bring change in that time. Because transcending the limitations imposed by the dimension of time brings new and innovative solutions to the existing problems. This is why in the time when ***Jambhoji*** lived, many kings, landlords, Thakur, don and even criminals who were disturbed by their worldly existence used to come to Jambhoji to listen to his philosophy. Therefore, it has been noted by scholars that the one who is strong in dedication and devotion wins this world.

In the above context, this paper discusses that the Ecological Feminism established in the Indian psyche is slightly different from the dominant western narratives of climate change. The research paper's problem, therefore, is "if the inculcation of religious sentiments into environmental causes can turn into an impactful, effective solution for many environments related problems". The profound basis for this is the preaching that man is a microcosm of the universe, therefore, everything done by an individual is reflected in the macrocosm and the higher reality is affected by his acts. Thus, man's evil infects nature. His degeneration precedes the

degradation of the ecosystem. If the equilibrium in nature is to be restored then man, the fulcrum of the world, must be reformed.

METHODOLOGY

This article is solely premised upon the field observations and discussions in Bikaner, Rajasthan. The historical and socio-cultural details are derived from the interviews conducted with Bishnoi women, community leaders and spiritual heads. The method of obtaining information was a detailed questionnaire-based interview along with multiple focus group discussions. The interviews were conducted with the women who belong to the Bishnoi community and who are actively taking forward the ethos of their community. Interviews were conducted across a span of different villages to cover a different portion of the Bishnoi population. Adding to this, multiple focus group discussions took place in the temple, wild-life protection centre, Self-help group women's households and community meetings.

The process of conducting interviews was face-to-face discussions with the women and other community people. These were mainly unstructured interviews which are described as conversations held with a purpose in mind-to gather data about a particular research study. The main objective in these kinds of interviews is mainly to build a bond with the respondents due to which there are high chances that the respondents remain 100% truthful with their answers. There are no specific guidelines as such to follow hence the researcher can ethically approach the participants to gain as much information as they can gain in their research. Since there is no guideline to be followed; the researcher is expected to keep the approach in check so that it does not sway away from the main research motive. To derive the necessary outcomes, the researcher keeps certain things in mind such as the main intent of the interview, taking into consideration the participant's interest and skills, and conversations within the permissible limits of research. There are many advantages of unstructured interviews in terms of flexibility for the researcher to develop a friendly rapport with the participants. This helps in gaining insights in extreme detail without much conscious effort. In the process, the participants can clarify all their doubts about the questions and the researcher can take the opportunity to explain better answers. There is no well-defined question by which the researcher must abide which in turn enhances the flexibility of research.

BACKGROUND

The leading proponent of the Eco-feminist movement in India is the renowned activist Vandana Shiva. She holds that, capitalism is responsible for the destruction of nature and women's work underlining the fact that

development does not benefit women and nature in the way that it perpetuates domination and centralization through patriarchal control. Adding to this, Shiva claims that modern science marginalizes the women's subsistence practices, knowledge of and dependency on nature for survival leading to physical and cultural uprooting of indigenous peoples from their ancestors' soil. As a result, this has caused an onslaught on local culture, which has fragmented and commodified into saleable entities on the global supermarket.

Like the above Indian Scholars, the Ecological Feminists have propagated an alternative formulation of the relationship of oppression between human and non-human groups. They proposed a different view of the social relationships which have been the systems of dominance. Their main agenda is to expose as well as denounce the binaries separating men and women, culture and nature while simultaneously equating women with nature. Certain kinds of domination have been justified through established hierarchies. The whole objective of the framework of Ecological Feminism is to deconstruct the traditional dichotomies that have operated in Favor of the perpetuation of hierarchies for the establishment of values and for the separation of realms such as human and non-human.

In the above context, Freya Matthews explains that “Eco-feminists have sought to overcome the dualist mind/matter system by proposing an alternative principle of individuation, one that defines entities in terms of their relations with one another”. This is the new emerging paradigm of Relationality that defines new entities and attributes in terms of their constitutive relation with one-another, retaining difference and distinctness and construing in terms of continuity. Matthews further adds that the theoretical dimension needs to be complimented with strategic implication which means the creation of new normative practices that cultivate both at the personal and social levels (The Dilemma of Dualisms).

This paper revolves around the fact that “the importance of religion and spirituality in certain communities and its reflection not only in the conception of nature but also in the practices of ethics of care” (Ruether, Gaia and God, Starhawk, Spretnak). Similarly, Matilde Martin studies “the influences of the precepts of Shinto, Japan's native religion and Confucianism in Watanabe's fiction wherein integrative models of the self are deployed which bind the spirits and forces of a natural Eco-system conceived as alive and in constant flow with the human world”. Adding to this, the spiritual dimension not only conveys the deconstruction of a hierarchical system of thought (nature vs. civilization; life vs. death; humans vs. non-human nature and animals) but also in a more practical manner in an ecological ethic of care that Martin sees in Watanabe's characters. In this context, the Bishnoi community is taken as a case study in this paper. The next sections of the paper analyse the various dimensions of the community and its leader's philosophy. It becomes a good case to propagate the Indian examples of Ecological Feminism. Although the prevailing Ecofeminism literature provides a good critique of inter-related social systems of domination, it severely lacks in providing any solution-based approach. Here, the framework of Ecological Feminism is much more significant.

This new framework helps in grasping the Indian approach to the environment cause. Since, within the Indian religious traditions there are many examples of the authority of female gurus-who are the women from social backgrounds which would not accept a woman in an authoritative role. In these communities' women occupy an ambivalent position.

Guru Jambheshwar who is very popular among the Bishnoi community people in Jodhpur spent as many as 27 years grazing cattle in the wilderness, sitting alone and meditating. He channelled his thoughts and emotions to love, compassion, equanimity, quietness and confidence. He also pondered over the miserable conditions of his people and the causes which had brought them down to a subhuman level. The death and destruction caused by the unusually long famine must have pierced the tender heart of Guru Jambhoji. The herds of blackbucks had completely disappeared due to animals hunted by the royal families of the time. At the age of 34, he observed that men conflicted with nature and ravaging the Earth that sustained him. He thought that his deep insight could foresee that if trees are protected, wild animal life would be sustained, and the community would survive. He wanted his land to be again covered by an abundance of Khejri and Kankeri trees; he wanted herds of blackbucks and Indian Gazelle to frolic again. He started to tell the people that it was not nature, but human intervention in nature that was the root cause of the destruction. He explained that the human exploitation of nature, felling of trees and killing of the wild animals on the pretext of civilization was the main cause of famines which in essence were man-made.
After the death of his parents, he left his home in 1484 AD and started living on the sand dune of Samrathal Dhora, of Mukam village situated in Nokha tehsil of Bikaner district of Rajasthan. He also emphasized compassion toward nature and protection of wildlife as the supreme religious goal to his followers in the preaching.

RELIGIOUS-BACKGROUND

The recondite philosophy and metaphysics behind Guru Jambhoji preaching are that man is a microcosm of the universe, therefore, everything done by an individual is reflected in the macrocosm, and the higher reality is affected by his acts. Thus, man's evil infects nature. His degeneration precedes the degradation of the ecosystem. If the equilibrium in nature is to be restored then man, the fulcrum of the world, must be reformed. Unless he sheds evil and begins to lead an orderly, purposeful life, the ecosystem could not be put back on the rails. For this reformation of humanity, he founded the Bishnoi sect in which people from all the castes were given entry.
The followers of this community perform the ritual of fire altar (Havan), every morning with love and devotion to attain heaven. This principle is directly related to the purification of nature. The offerings in Havan constitute coconut, dry wood of Khejri, pure ghee and a fragrant mixture containing gugal (Indian Bdellium, used as perfume and medicament). They release pure, fragrant particles in the atmosphere, cleansing them of impure,

bad-smelling, harmful gases, disease-causing agents and air pollutants. The religious incantations produce spiritual vibrations. The performance of the Havan is evident on all life cycle ceremonies, sacred days of the month, festivals and on Amavasya.

"Be compassionate towards all living beings, do not injure a green tree". These principles embody the ideology of non-violence and are interrelated. Protection of wildlife entails the protection of the forests, which is their natural habitat. The exploitation of one endangers the life of the other.

As a result, the followers of Guru Jambhoji have spearheaded a Crusade for five centuries in the cause of protection of green plants and animals against human encroachment. The most famous incident of mass sacrifice took place in village Khejarli of Jodhpur in 1730 A.D. when 363 Bishnois gave up their lives to save the auspicious green trees of Khejri. Since then, there have been many cases of Bishnois giving up their lives for the safety and endurance of deer, peacocks, partridges and other living beings. As a result, the state is also recognizing the micro-level efforts of Bishnois in eco-regeneration and eco-preservation.

Through his 29 commandments, the man was told, with vigor and passion, about the interrelation and interdependence of all life. Understanding the needs of mankind and livestock, Guruji found a simple way of teaching science and conservation principles to his followers, who were mostly rural, uneducated and farmers by incorporating them into religion. He knew beforehand, that for the simple, god-fearing people, this was the only way to learn and remember. The conservation principle was ingrained in this religious philosophy. His message is one of truth, non-violence, cleanliness, conservation of natural resources to maintain the ecological balance, tolerance, simplicity, right action and humanism, which hold good even today as well as in the past (Bishnoi literate).

Religion and science are complementary and supplementary to each other in the true sense. It would be good to recall what the greatest scientist had said, **"SCIENCE WITHOUT RELIGION IS BLIND AND RELIGION WITHOUT SCIENCE IS LAME".**

The media and information technology have turned the world into a village. This is the main reason that one incident occurring in any part of the world trembles the whole world like never before. The main medium is television through which the developed nations have propagated the principle of Globalization worldwide. The advertisements on television create unnecessary wants in the citizens of the less developed countries. This is why people have abandoned the life of simplicity and contentment. The nudity shown on television is making the youth very lazy and perverted. And they have been enslaved by various types of drugs and alcohol habits. Globalization has also made violence very trendy and handy. Today the world has become the marketplace of various destructive weapons. In such times a worldwide acceptable definition of violence will have to be formulated. The developing nations could not escape this manipulation of the developed world. As a result, economic imperialism through globalization has become a new reality. All of this needs a significant shift

through the inculcation of new ideas which can be taken from religious philosophy as well. These ideas need to be conjoined with the present-day crisis.
The reality of the world bank, international monetary fund and world trade organization are very mysterious. On the surface, these organizations pretend to help developing nations in removing poverty but in reality, they are controlled by the developed nations. The main values and principles of these organizations are dictated by the elites of the developed nations. Therefore, the long-term vision of these organizations is to indirectly pursue the interests of the developed nations.
This article recommends that India should propagate its culturally rooted principles such as the one in Jambhoji's commandments. India should strongly put these normative values in the international organizations and contribute to a new epistemology of knowledge in the counter effect of existing ones. This would make a paradigm shift at the level of the knowledge-power in which the developed nations manipulate the rest of the world. The new terminologies, concepts, agendas, goals should be formulated by deriving the knowledge from age-old communities in India. The people of these communities have even given their lives for the protection of the environment. They certainly would have had the vision of environmental protection long ago. The environment is not the only aspect in the domain of global issues. There are many other issues too which can be resolved through the help of the age-old principles, norms and values.
Today humanity is in despondency because of the poverty they are witnessing because of the domination of capitalist forces. Today, the individualistic monetary possession has become significant which is leading to the overly selfish nature of the people. The communitarian ways of living are diminishing in society. Jambhoji's commandments also advocated the service of other human beings.

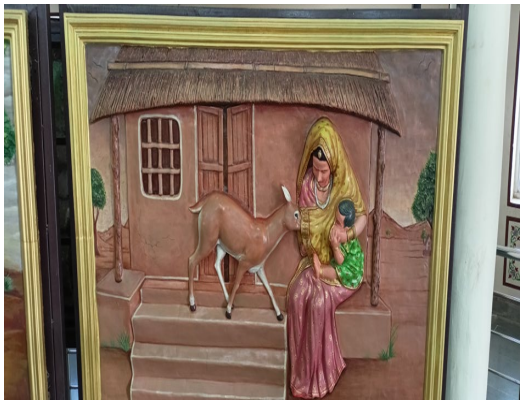
WOMEN AS SOLDIER OF ENVIRONMENT CONSERVATION

Society in collaboration with religious and political authority has relegated women merely in the bodily domains. Historically women have been looked at from a demean angle. As a result, it has got hold of the human psyche to view women as degraded human beings. The long historical brainwashing is the reason for this. Guru Jambhoji became a torchbearer for the upliftment of women's status within society. He raised their consciousness above the mere shackles of the male dominant and ego-centric ideology. He considered Sita to be a good, ideal woman who is sincere, silent, beautiful, kind and caring. She had to be protected, that is why so many men such as Ram, Lakshman, Garud, Vibhishan all risked their lives for her protection. She did not ask for it but they had so much respect for her that they waged the greatest war for her life. Even the wild animals had so much affection for her those monkeys, bears and other animal stood for her protection.

ENVIRONMENT, RELIGION AND WOMEN

The Indian path to environment protection**,** Jambhoji used his mind and weaved the movement of environment conservation into religious philosophy. He could be considered a very erudite and articulate policymaker. He knew that human beings are all the time striving toward any energy higher than the existing one. The human eagerness to be the best and highest version of themselves leads them to follow the religious commandments. The existing religious philosophy in the form of Vedas, Upanishad, Gita, Gurbani, Gorakhbani all had some

normative aspects about human existence. Although achieving and following all the norms was impossible, striving toward them gave human beings a purpose to live with zest and enthusiasm. This constant striving toward something that is highest in the human evolution theory made human beings religious in nature time and again in history. The strongest institutionalization, if there is any, then is religious institutions across the world. No part of the world is untouched by this human endeavour toward higher realms of existence. All these religions have been psychologically conjoined with other agendas be it imperialism, capitalism, terrorism. All these agendas have pursued human selfishness and egocentrism under the veil of religious commandments. With time the religion became subservient to the human agenda even when the objective was to lead humanity toward better. The subservience has made the religion of many parts of the world irrelevant and dogmatic. This emptiness and shallowness had left humanity in a very dark vacuum. The outcome is the global challenges we face today. Such as climate change, extremism, political instabilities, failed social movements and civilization decay.



Bishnoi's mother feeding kid of doe after her mother death

In this above context, it is important to see the trajectory of the history of the Hindu religion. It is very fragmented, divided yet cast, deep and impactful. From time to time, it has been challenged by the people within its communities. One such example is the religious philosophy propagated by Guru Jambhoji. He challenged the dogmatism of the existing dominant religion and propounded his new commandments. He lived a very austere life to make such a big contribution to humanity. The way other religions are associated with different agendas, it is only in India that a religious philosophy is being conjoined with two very important human agendas. And articulation was done centuries ago but is not being taken seriously even today. He strongly propagated environmental conservation and women's liberation in his twenty-nine principles to live a better, meaningful, purposeful human life. Nowhere in the world has environmental protection been given a religious dimension. This is the reason that human sensitivity is not yet completely devoted to nature in many parts of the world. As a result of this indifference and neglect, the results are very much visible in the environment.

By connecting the agenda of the environment with religion, he brought human sensitivity to it. He made this initiative in 1542. He also gave importance to the significance of rituals in protecting the environment. According to him, Yajna cleans the air in the atmosphere. The Yajna or sacrificial fire, apparently done to worship one or the other deity, also helps in purifying the air and thus keeping the environment healthy.

The history of environmental pollution started with European industrialization. It spread to the whole world and India was no exception to it. Therefore, India because of the absence of knowledge power got affected by a similar outcome as any other part of the world. This is the reason now that Jambhoji's philosophy should be put forth in the international platforms to come up with some new ideas to protect the environment.

THE BISHNOI MODEL

The nature-based “Bishnoi environmental protection model” is unique and is a role model for the present-day world to save the mother Earth from perishing. His 29 commandments include higher moral values inlaying, a nature-based self-contained lifestyle, maintaining purity of natural resources, e.g., Water fuels, compassion and non-violence-based behaviour with the living being and trees. As a result, the recent scientific studies based on satellite imageries have confirmed that Bishnoi habitations have more greeneries than the rest of the habitations. Similarly, it is a well-established fact that wildlife, e.g. blackbucks, chinkaras, birds, peacocks, endangered species find a haven in Bishnoi villages. Bishnoi traditions and practices not only protect animals from animals but also help them to lead a healthy life, by allowing them to graze freely in their surroundings, keeping volunteer's water points and feeding centres during lean periods of the year. These practices include resource shelters (like the one at Jajiwal) where they take care of the injured animal by treatment, feeding and leaving them back in the meantime.

Dairying in villages

Based on Jambhoji's teaching it has been found that in all Bishnoi villages water protection is very significant. Traditionally the leading personalities dug Talabs and Khadins on the periphery of villagers with pious catchment and surrounding protected ORAN (Social Forestry) with local plant species. Nobody is allowed to defecate and urinate into the catchment. Such protection and conserving community rainwater harvesting is old wisdom. Similarly at the individual household level construction of TANKA and their connection with rooftop and developing surrounding catchments are very well-known practices. The TALAB, ORAN and rainwater harvesting and freely moving animals is a wonderful example of an integrated village eco-system.
In the Bishnoi villages, biodegradable vegetables and other agro waste are used for composting and manure. The lifestyle based on Jambhoji's teachings and philosophy can ensure that the modern-day environment reduces pollution levels by adopting a simple nature-based lifestyle, visiting less energy, practicing the traditional wisdom of water conservation and re-use and recycling waste. These practices can save us from the pollution of natural resources, over pollution at concentrated places (big cities) and reduce carbon footprints. The eco-based model propounded by Jambhoji's teachings for the protection of the environment and wild animals needs to be spread across the world.

DESERT ECOLOGY AND AGRONOMY

Thar Desert – one of the most difficult and inhospitable terrains for survival. And yet, the Bishnoi community, guided by the teachings of Jambhoji thrives in this region, providing support and protection to plants and animals. The environmental consciousness is inbuilt in their rituals and has become a part of their culture. Today, when the world is sliding into an irreversible climate change scenario, with billions being pumped to reverse the damages, this part of the world silently started its environment-friendly life almost 500 years back. Largely unnoticed by any major ecological group, their practices form the basis for their survival and reinforce

the notion that traditional wisdom is a deeply scientific approach to sustainable living, which leads to overall prosperity and balanced living.

Sand dunes of region

One incident took place in January 2007, when the local Bishnois of the village Agneyu in Bikaner filed complaints against a film producer when a horse died at the sets. Adding to this, the divisional forest officer of the Abohar Wildlife Sanctuary regularly depends on the local Bishnoi community for night patrolling against the poachers. In Haryana, Bishnois are often first to report poaching incidents.

Gurvindar Bishnoi in Jodhpur has founded an NGO called the community for wildlife and rural development society. His mission is to save and protect the animals that are injured by accidents or by hunters. He also produced a video documentary about Bishnois and Jambhesvara.

There is one Sri Jagatguru Jambheshwar Goshala Sanstha at Mukam. This cow shelter takes care of about 1,335 cows. This institution is inspired by Amar That, an animal shelter institution mentioned in one of the verses by Jambheshvara's disciple Udoji Naina. He said animals should be considered as the kin of human beings and should not be killed in any way.

P. Sivaram, a sociologist at the National Institute of Rural Development, Hyderabad conducted a study at two Bishnoi villages in the Luni block of Jodhpur district in 2003. The respondents mentioned that they were staunch followers of twenty-nine principles due to which their cattle population, green patches and soil fertility have increased. Based on these benefits, the Bishnois were more prosperous than other communities were. He also found several sacred grooves in the villages managed by Bishnois, including some that were claimed to be about 400 years old. Bishnois effectively act as a deterrent against the hunting expeditions by outsiders. The deer and other animals usually roam around Bishnoi houses during the late afternoons and early evenings that are common times for hunting.

Water conservation is the most precious gift of Nature. Bishnois know it as it is recognized by them in their fundamental principles of living and being a Bishnoi. Guru Jambhoji could visualize the reason for the scarcity of water in the desert land of western Rajasthan. All his teachings directly or indirectly lead one to commit oneself to the conservation of water and realize it as the most sacred duty in a Bishnoi's life.

While remaining in the desert, Guruji, though a widely travelled person himself, concluded that the desert land is the best place to live in only if water was utilized properly by its inhabitants. He knew it very well that people would not change their ways unless it was ingrained in their faith to conserve water and work toward the creation of conditions conducive to better rainfall by planting more trees and cutting no green trees. Thus, conservation of water came to be in Bishnoi's DNA over the last 500 years of living a life dedicated to the conservation of water and the environment.

The ritual of touching the water to the ears of every newborn baby was included in the Bishnoi faith to emphasize the social moral and ethical importance of respecting water. On all important occasions of Havan, there is an earthen pitcher full of water which is sanctified by recitation of some Mantras and then the holy water is distributed among the followers as a token of taking a pledge to abide by the principles of **BISHNOISM**. This was his way of giving importance and respect to water which is still being followed by his followers.

While performing the Havan, Kalsh Puja (water worship) is performed in which some of the shlokas are exclusively made in respect of water which the shlokas say is the most important of the five basic elements of life on Earth.

Guruji has mentioned various forms and ways related to water such as river, sea, oceans, rain, clouds, ponds, thunderbolt, pond, Amrit, boat, pitcher, irrigation, tirath, fish, crocodile, tortoise and fisherman. He initiated the construction of many ponds and inaugurated barriers for the collection of running water and planted trees. In villages, his followers construct ponds for animal use and household use separately and construct underground water tanks in their houses for human use to store rainwater in low-lying areas where the soil is less porous and absorptive. The way of living is also such that less water is consumed in daily chores. They do not use Indigo for whitening in clothes as the blue was made of Indigo plants and too much water was wasted in applying and removing the blue. The indigo plant needed land to plant and grow and the fertile land was certainly converted barren where no vegetation would grow, and the underground water would also get affected. They recycle the water for many uses. They started drip irrigation systems and other modern water conservation methods in recent times to cope up with the food grain requirements.

BEAT PLASTIC POLLUTION AND LIFESTYLE

In recent decades, scientific advances, as well as growing environmental problems such as global warming, are helping us to understand the countless ways in which natural systems support our prosperity and well-being. The world's oceans, forests and soils act as vast stores for greenhouse gases such as carbon dioxide and methane, farmers and fisher-folk harness nature on land and underwater to provide us with food; Scientists develop medicines using genetic material drawn from the millions of species that make up Earth's astounding biological diversity. Billions of rural people/farmers around the world spend every working day connected to nature. Appreciate full well their form of fertile soil. They are among the first to suffer when ecosystems are threatened, whether by pollution, climate change, or over-exploitation. Nature's gifts are often hard to value in monetary terms. Like clean air, pure water they are often taken for granted, at least until they become scarce.

Billions of rural people/farmers around the world spend every working day connected to nature. They are among the first to suffer when ecosystems are threatened, whether by pollution, climate change, or over-exploitation. Nature's gifts are often hard to value in monetary terms. Like clean air, pure water they are often taken for granted, at least until they become scarce.

Beat Plastic Pollution, the theme for World Environment Day 2018, is a call to action for all of us to come together to combat one of the great environmental challenges of our time. Chosen by this year's host, India, the theme of World Environment Day 2018 invites us all to consider how we can make changes in our everyday lives to reduce the heavy burden of plastic pollution on our natural places, our wildlife and our health. Nearly one-third of the plastic packaging we use escapes collection systems, clogging our city streets and polluting

our natural environment. Every year, up to 13 million tons of plastic leak into our oceans, where it smothers coral reefs and threatens vulnerable marine wildlife. These can end up circling the Earth four times in a single year and it can take up to 1,000 years before it fully disintegrates. During the national conference, awareness is being created to meet the national theme of Beat Plastic Pollution.

Nature's gifts are often hard to value in monetary terms. Like clean air, pure water they are often taken for granted, at least until they become scarce. Environmental challenges are multifarious in the Rajasthan desert. The Bishnoi community as a custodian of the desert environment is continuing to contribute and serve in its management by giving protection to flora and fauna.

The solution to many climate problems lies in decoding and integrating Vedic Knowledge like traditional water practices with the present lifestyle. In-universe, the divinity of water directly governs the quality and harmony of life. The water scarcity crisis cannot be solved only by drilling water wells, installing desalination plants and constructing water storage reservoirs.

An integrated approach consisting of all water sectors, water supply and sanitation demands, agriculture, energy development and environmental management must be acted upon to alleviate water shortages. Traditional water harvesting structures, water conservation and drinking water practices followed by desert populations including Bishnoi families have survived desert flora and fauna in extreme summer seasons and drought years.

By practicing the principles Stated by Guruji, yoga-naturopathy and adopting the natural art of living with organic food free from pesticides and chemical fertilizers one can not only connect the people with the environment but also achieve stress-free life, peace and harmony. A balanced person with holistic health and Indian ethos is bound to be virtuous, imaginative, productive and an asset to society.

CONCLUSION

THE NECESSITY FOR THE REMEDIATIONS

India's economic growth over the past few years has raised the prospect of eliminating extensive poverty within a generation. But this growth has been clouded by a degrading physical environment and the growing scarcity of natural resources that are essential for sustaining further growth and eliminating poverty. It is no coincidence that the poorest areas of the country are also the most environmentally stressed regions, with eroded soils, polluted waterways and degraded forests.

Simultaneously, rapid growth has unleashed greater public awareness and an unprecedented demand for the sound management of natural resources including water, forests and biodiversity. Environmental sustainability is rapidly emerging as the next major development and policy challenge for the country and will be central to the 12th five-year plan which is currently under preparation.

In rural areas poverty has become intertwined with resource degradation – poor soils, depleted aquifers and degraded forests. To subsist, the poor are compelled to mine and overuse these limited resources, creating a downward spiral of impoverishment and environmental degradation. There is growing pressure to better protect India's pockets of mega biodiversity which are increasingly recognized as being of immense significance for global biodiversity yet are increasingly threatened. Greater investment in the protection of these natural assets would yield a double dividend of poverty alleviation and the improved sustainability of growth.

The health impacts from pollution are comparable to those caused by malnutrition and have a significant impact on productivity, health and quality of life. Environmental health challenges are largely caused by poverty-related risks associated with poor access to basic services, such as safe drinking water and sanitation and poor indoor air quality.

Sundarbans Sustainable Socio-Economic Development-the objective of the Non-Lending Technical Assistance is to assess measures that would build the resilience of the socio-economic and biophysical system

and achieve long-term sustainable development. Historic sea level rise from deltaic subsidence, salinity intrusion, flooding, and nutrient loss in local soils have all conspired over the past century to render it one of the most hazardous areas in the Indian subcontinent.

Jambheswar panorma at village Pipassr

Overall, in this article, we see an overlap of religious, personal and ecological attitudes in the Bishnoi examples and that the term "dharma" is used interchangeably to refer to one's religions, duty and socio-political order of the universe both by the founder and followers of the Bishnoi community.
Most Bishnoi community people are barely aware of the western scientific discourse about "global warming" or "biodiversity". Still, they serve as one of the most powerful examples of environmentalism that is rooted in their dharmic tradition. Unlike other religious movements, the dharma of Bishnoi is not just limited to their religious rituals or scriptures, but it includes natural resources beyond their religious sites as is evident from the examples of their sacrifices done in the farmlands of their villages.

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DEVELOPMENT OF THE NEW APPROACHES FOR THE MOLECULAR CHARACTERIZATION OF OM WITHIN A PEAT BOG

Sara MOGHNIE[1,2]*, Jalal HALWANI[1], Khaled YOUNES[2], Laurent GRASSET[3]

[1]Water & Environment Science Lab, Lebanese University, Tripoli, Lebanon
[2]Department of Chemistry, American University of the Middle East, Kuwait
[3]IC2MP, Poitier University, France

Abstract: *Peatlands are terrestrial ecosystems with an elevated level of waterlogging. They are characterized by a high level of organic matter (OM) and are a significant source of carbon dioxide (CO_2) and methane (CH_4) under anoxic conditions. The main components of organic macromolecules in peatland are mainly lignin and polysaccharides. As greater concentrations of lignin are found to be strongly related to the high CO_2 and CH_4 concentrations under anoxic conditions in the surface peat, the need to study the degradation of lignin under anoxic and oxic conditions has emerged.*
In this study, we evaluated the lignin degradation in soils using cupric oxide (II) under alkaline conditions. The development of various characteristic indicators for lignin degradation state based on the relative distribution of lignin phenols was measured using Gas chromatography following the degradation. To achieve this aim, we applied PCA for the molecular fingerprint of 11 major phenolic sub-units produced by alkaline oxidation of the lignin in the investigated peat sample called "Sagnes".
Principal Component Analysis (PCA) has been applied for the molecular fingerprint composed of the phenolic sub-units, yielded by CuO-NaOH oxidation. This approach aims to remove bias between intercorrelated proxies and potentially revealing patterns that were hidden from the conventional 2D statistical perspective. In this study, we aimed to seek the efficiency of PCA for the estimation of lignin degradation along a peat core. In this ecosystem, two main phases of OM exist, preservation or degradation. PCA was applied for the mass fraction and allowed for a separation to be made between the ecological layers and their interfaces. The different results were confirmed by a high correlation.

Keywords*:* New approaches, molecular characterization, organic matter, *principal component analysis*

INTRODUCTION

Peatlands are terrestrial ecosystems with an elevated level of waterlogging. They are characterized by a high level of organic matter (OM) and are a significant source of carbon dioxide (CO_2) and methane (CH_4) under anoxic conditions. The main components of organic macromolecules in peatland are mainly lignin and polysaccharides. As greater concentrations of lignin are found to be strongly related to the high CO_2 and CH_4 concentrations under anoxic conditions in the surface peat, the need to study the degradation of lignin under anoxic and oxic conditions has emerged.
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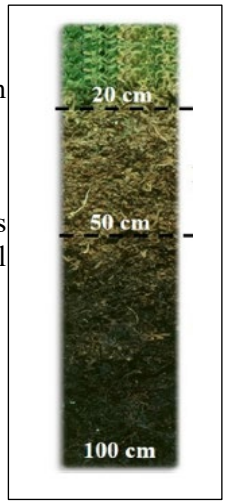
METHODS



Sampling and Settings for the Peatland Site

The investigated peatland is called the “*Sagnes*,” located in the village of Fanay in the Limousin Governorate, France. Depth records were combined into nine samples

Bulk Analysis and CuO-NaOH Phenolic Sub-Units

Elemental analysis was performed on the dried peat samples to seek in the atomic components compositions of C, N, H, O, and S, using Gas Chromatography (GC) coupled with a Total Conductivity Detector (TCD)
The reaction took place in a sealed reactor at 170 °C, and for 2 h.
The investigated 11 phenolic sub-units have been released by alkaline oxidation using cupric oxide.

RESULTS

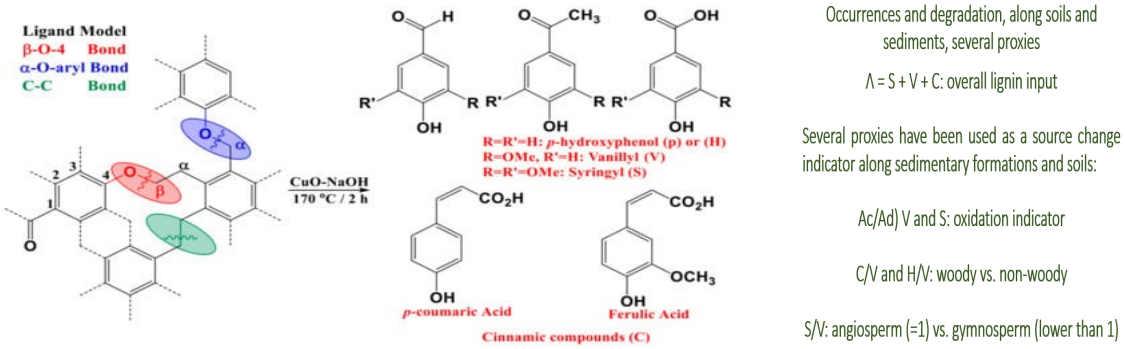
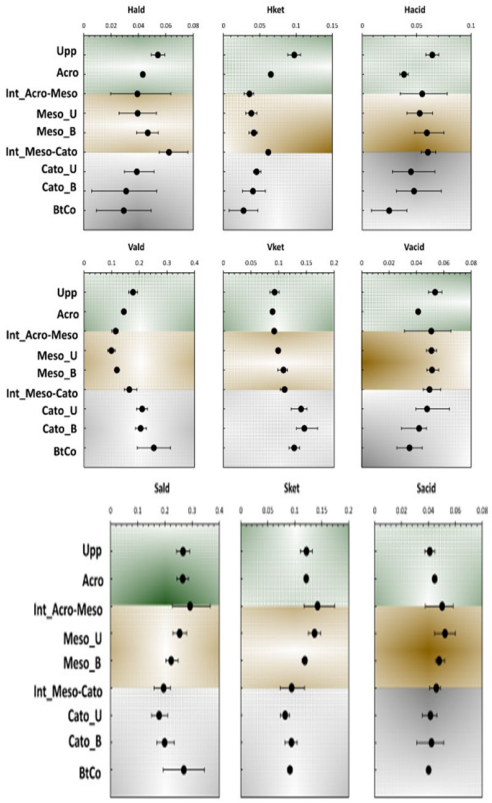
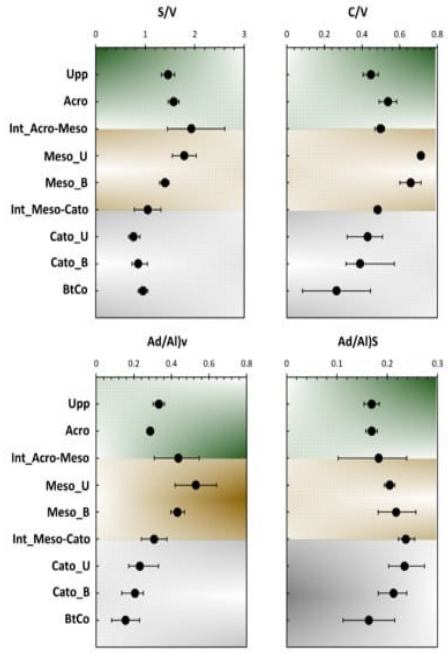


Figure 1 Depth record of the mass fractions for the phenolic subunits



- Decreasing profile → high occurrence in the preserved part of lignin from the first stages of the peatland deposition → " Holocene Climatic Optimum"
- H_{ald} and H_{acid} → fluctuation → provenance from multiple sources and/or a higher degree of oxidation of these moieties
- H_{ket} → stable decreasing profile → high variation for the acid and aldehyde structures originates from microbial reworking.
- V- and S-compound → higher consistency → higher reliance of relative ratios to be used for the characterization of diagenetic events along the investigated ecosystem.

Figure 2. Degradation, Change of Vegetation, and Diagenetic Parameters of Lignin

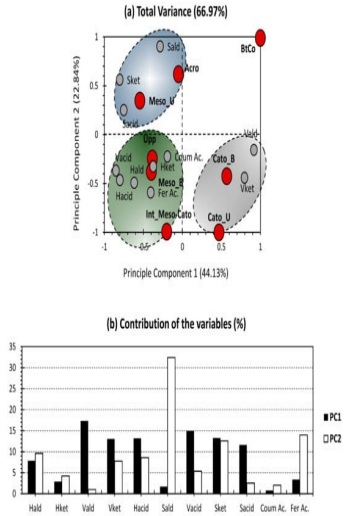


- During lignin degradation, S and C units degrade preferentially when compared to the V units
- Resulting in a decrease of the S-to-V and C-to-V ratio values, except at the first degradation stage.
- S/V and C/V ratios are increasing the acrotelm, due to the input of the fresh nondegraded OM from the uppermost vegetation.
- The decrease of these ratios can be seen along the mesotelm and the catotelm.
- S/V and C/V demonstrate that vascular plant sources at the **catotelm were mostly angiosperm tissues**

Figure 3 Application of PCA to Phenolic Mass Fractions

For the sake of removing bias between intercorrelated proxies and potentially revealing patterns that were hidden from the conventional 2D statistical perspective.

Population: depth peat samples and Variables :11 phenolic subunits



- ❑ The first two PCs accounted for 66.97% of the total variance
- ❑ PC1 exhibited nearly equally distributed contributions for Vald, Vket, Hacid, Vacid, Sket, and Sacid, ranging from 13% to 17%.
- ❑ For PC2, it showed the highest contribution along Sald, accounting for 32%
- ❑ Most of the contributors of PC1 are acidic and ketone moieties → more oxidized state for depth samples positively influenced and a less oxidized one for samples negatively influenced by this PC.

CONCLUSIONS

- In this study, we aimed to seek the efficiency of PCA for the estimation of lignin degradation along a peat core.
- In this ecosystem, two main phases of OM exist, preservation or degradation.
- PCA was applied for the mass fraction and allowed for a separation to be made between the ecological layers and their interfaces.
- The different results were confirmed by a high correlation

MONITORING BIOFILM PARAMETERS ON MBBR TECHNOLOGIES WITH LIGHT MICROSCOPE AND IMAGE PROCESSING

Tamás KLOKNICER

Óbuda University, Inno-Water Zrt, Budapest, tkloknicer@gmail.com, +36306383651

***Abstract**: In the modern world, energetically optimized, decentralized, and environmentally friendly solutions are needed more and more. The trend of urbanization leads to ever growing suburban towns and stagnating or decreasing cities, due to the spreading practice of home office and the need of home-grown foods. These areas around big cities present great opportunities for industrial companies and storages to settle, as more space costs less money, however well-educated workforce is available. This means that the small wastewater treatment plants of suburban towns can't handle the increasing amount of wastewater in terms of hydraulic capacity and organic matter. In the R&D project MICROBI we developed a special MBBR material, which has relatively high surface area compared to other materials. In MBBR technologies it is hard to monitor the growth of the biofilm in terms of mass, surface area used by bacteria, and thickness of biofilm, which are important parameters that determine the efficiency and capacity of the carrier material. To measure these parameters TTC paint was applied to the biofilm samples, then I took light microscope pictures, calibrated the photos' pixels to mm, and with Image Pro processing program I separated the biofilm from unsettled material parts. With this new combination of methods, I can improve the monitoring of these systems and provide useful data for the challenges of modelling MBBR systems. With this data it is possible to determine more accurate kinetics for this special biofilm material, which makes this new technology even more useful, and applicable in the wastewater cleaning process. In the future this knowledge can be a part of a small (50-100 m3/day), autonomous wastewater cleaning technology that can provide smart, local solution for biological wastewater treatment.*

***Keywords**: Biotechnology, MBBR, Wastewater, biofilm monitoring,*

INTRODUCTION

In MBBR systems it is difficult to measure the biofilm thickness, which is essential to understand better the kinetics of this water cleaning method. Traditional carrier size ranges from 2,2 mm to 50 mm in length and 9-64 mm in width [Aygun and Berktay (2008), Das and Naga (2011), Kermani et al. (2008), FLOCOR (2013), BIOSPHERE-BR (2013), Fxsino (2013), Barwal and Chaudhary (2014)]. They are usually made of HDPE, PE, and PP [Barwal and Chaudhary, 2014]. Our special carrier differs in size and material from these, so it is crucial to determine its exact size range, and the ability to carry biofilm microorganisms on its surface. The aim of this study is to determine the diameter, area utilization (settle rate) by microorganisms and the difference in growth rate in four types of new carriers.

To measure the biofilm thickness on carriers Hoang et al. (2014) used Variable pressure electron scanning microscope (VPSEM) without pre-treatment and Atlas image processing software (Tescan USA Inc.,

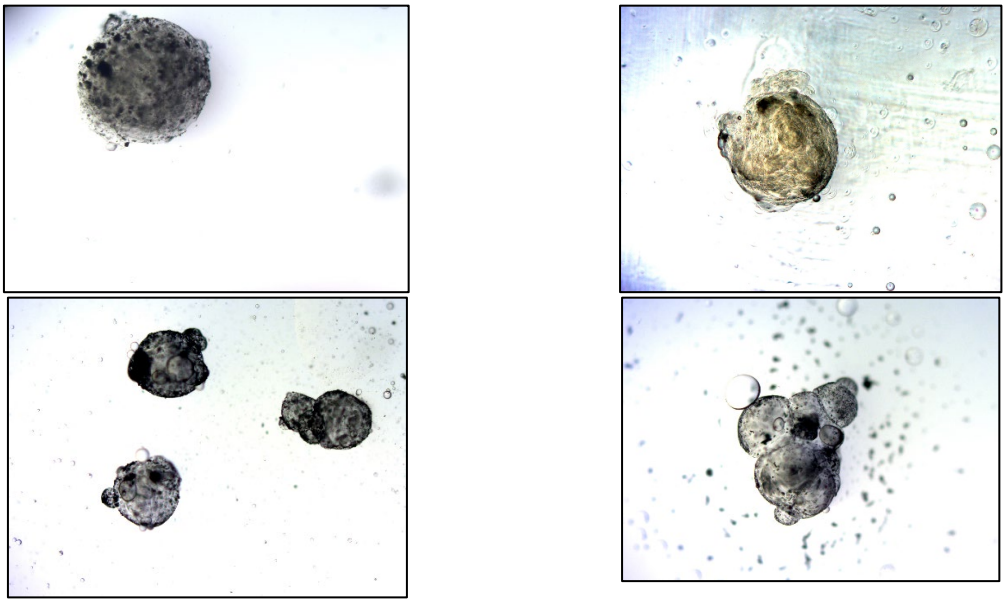
Cranberry, PA) to analyse the pictures. Arabgol et al. (2022) also used VPSEM but used Fiji (Schindelin et al., 2012) software, which is developed for biological microscope image processing. Bjornberg et al. (2009) also used microscopy to determine the biofilm thickness. In their study Spot Advanced software developed by Diagnostic Instruments Incorporated (Sterling Heights, MI) was used to take pictures, and ImageJ, a software program developed by the National Institute of Health (Bethesda, MD) used for processing the images and separating the biomass, background and carrier area.

Tetrazolium salts are widely used colouring materials in biochemical applications for more than fifty years now. One of its compounds, the trifenil tetrazolium chlorid has been first synthetised more than a century ago (Berridge et al., 2005). Szilágyi (2008) used TTC paint to colour the mitochondrial dehydrogenase enzymes in rat brain samples and used UTHSCA ImageTool software to analyze the parts of the brain cells. Hegyi (2014) also showed that TTC paint can detect living microorganisms and their biological activity.

Studies by Barwal (2014) showed that in MBBR systems only around 70 percent of the carriers' surface area is utilized by microorganisms, due to the geometry of the carriers. The studies also showed that a biofilm thickness less than 100 µm is required for full substrate penetration through the biofilm. Torresi (2016) suggests that a biofilm thickness over 200 µm does not significantly increase the functionality of nitrification activity. In studies of Bjornberg et al. (2009) there is a carrier surface area utilization rate on the outer parts of 30 to 50 percent, and a 100 percent in the inner areas.

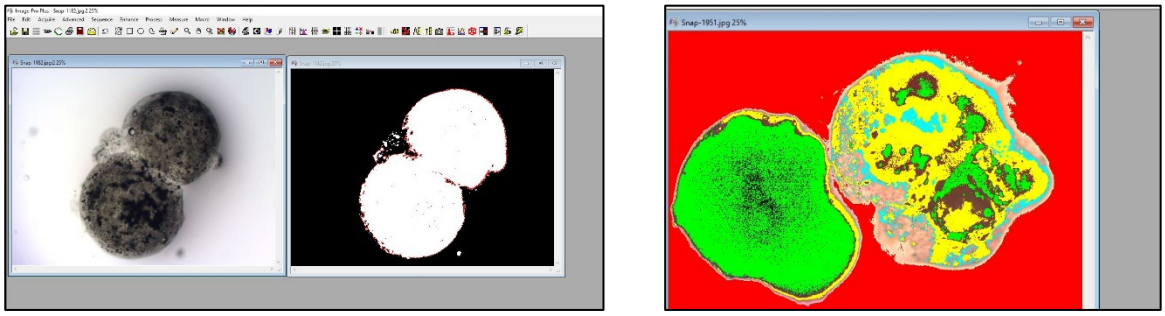
MATERIAL AND METHOD

The experiments have taken place at laboratory scale on four identical SBR (sequence batch reactor) glass reactors between 27.05.2023. and 14.07.2023. Each of the reactors contained 10 percent of the total volume carriers such as the original carrier, carrier with activated carbon adsorbent and two new carriers which were produced by cold polymerization with different types of oils (***Picture 1***). The two new types have iron adsorbent inside them.



Picture 1. – Different types of carriers used in experiment, Top left has added activated carbon, top right is the original, bottom left is made with rapeseed oil and bottom right is made with sunflower oil

The four reactors were fed with treated wastewater, to which we added substrates such as KH_2PO_4, NH_4Cl, Na-acetate, $NaHCO_3$, and calcium carbonate for puffer capacity. I set up the influent water to be optimal for autotrophic organisms so the experiments would last until nitrate appeared in the effluent. The cycle of the reactors was 6 hours of aerated cycle, 10 minutes of deposition, two minutes of water outtake by peristaltic pumps and two minutes of water intake also by peristaltic pumps. I took water samples directly from the effluent three times a week and took one sample from each barrel of influent water. Microscopic analyses were taken simultaneously with water chemical measurements. In the water phase I measured the following parameters: Nitrate-nitrogen, Nitrite-nitrogen, Ammonium-nitrogen, Phosphate-phosphorous, and Chemical oxygen demand. I also measured in the reactors the following parameters: pH values, Oxygen demand and temperature values. From the biomass I sampled the fully aerated reactors and measured the organic, inorganic and dry matter. I took samples from the original, undried sample and TTC painted it for light microscope measurements.
In measuring chemical parameters, I used the following standards: MSZ ISO 6060 (COD), MSZ 1484/13-09 (nitrate-nitrogen nitrite-nitrogen), MSZ ISO 7150-1:1992 (Ammonium-nitrogen), MSZ 448/18-77. For the local parameters (pH, Oxygen demand and temperature) I used Hach HQ40 portable multimeter.
For the microscope measurement I used a Zeiss Lab A1 light microscope with 5X zoom and dark contrast. For microscope camera I used Zeiss AxioCam ERc 5s. For the pictures I used Zen Blue (3.1 version) software. I took 50 pictures of each sample, at each sampling time during the experiment period. Pictures were taken to Image Pro software where I first separated the whole carrier from the background and measured their diameter (mean., max., min.), and the polygons area. The next step is to separate the TTC coloured biomass area from the background and the unsettled parts of the carrier. Pictures taken through the process can be seen in ***Picture 2***.



Picture 2. – Separating background from carrier (left) and separating biomass from unsettled parts (right)

For the data analysis I used Microsoft Excels Pivot function to handle the amount of data I had. For statistical analysis I used Past program.

RESULTS AND DISCSSION

First, I analysed the influent's chemical and local parameters to determine if the difference between the reactor results is caused by external parameters. In ***Figure 1.*** I show the pH, OD, and temperature values for each reactor over the experiment period.

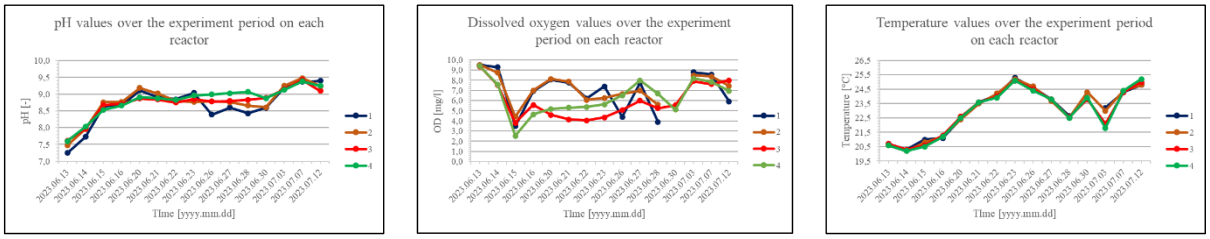


Figure 1. – Results of local parameters measured in the reactors (left pH values, middle: Oxygen demand values and right: temperature values)

As shown in ***Figure 1.*** no major difference occurred in the reactors' parameters. There was a slight difference in oxygen values, but almost all the time it was above 4,0 mg/l, so it was way above the WWTP average. In the third sample date it was around 2,0 mg/l due to a malfunction of aeration system, but I managed to repair it. You can see a slight increase in pH, that is due to the nitrification process. Temperature also increased similarly in every reactor, which was caused by the summer weather, that can affect even the air-conditioned laboratories.

As it is shown in ***Figure 2***., the concentrations were identical to each reactor. However, we started to increase the phosphate-phosphorous concentrations due to the phosphate absorbing abilities of new cold polymerized reactors. The nitrite-nitrogen and nitrate nitrogen amount in the influent were insignificant due to the lack of microbial activities.

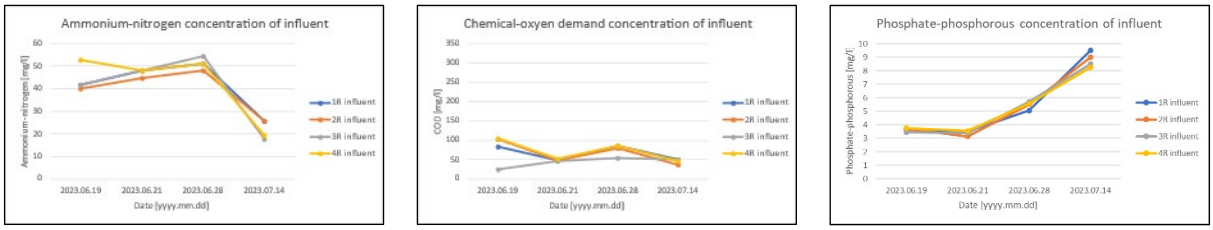


Figure 2. – Results of chemical parameter measurements (left: Ammonium-nitrogen, middle: Chemical oxygen demand and right: Phosphate phosphorous)

I measured the chemical parameters to check the effluents of the reactors, that shows how the biomass is growing in each reactor. The results are shown in ***Figure 3***. In ***Figure 3.*** the first diagram shows how the ammonium-nitrogen decreases in reactors, as the biomass increases, and the first step of nitrification starts in each reactor. The slowest nitrifying reactor is the fourth. In the second diagram we can observe that nitrate began to appear in each reactor, first with the original carriers, while the fourth reactor was the slowest in this regard too. COD values should not decrease significantly as the biofilm is autotrophic. In the second reactor I measured a constant decrease during the experiment, but COD values never measured under 40 mg/l. Autotrophic cultures may need some organic matter, that can cause the decrease of chemical oxygen demand. Phosphate-phosphorous values decreased to zero in third and fourth reactors. It's probably because of the phosphorous adsorbent ability of the new carriers, not the phosphate accumulation of microorganisms. As the experiment progressed, the phosphate begun to appear in those reactors, as the carriers begun to „fill" with phosphorous. These values led me to the conclusion that the third and fourth reactor had a phosphate limited culture, which explains the difference in microscope measurements. The organic matter is higher in the third and fourth reactor, due to the different, filamentous organisms.

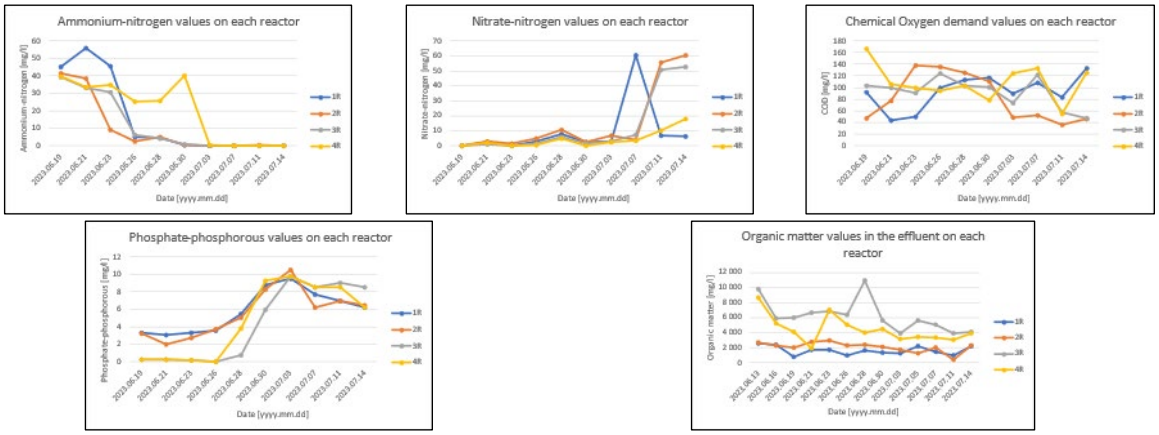


Figure 3. – Chemical parameters in effluent such as ammonium-nitrogen (top left), nitrate nitrogen (top middle), chemical oxygen demand (top right), phosphate-phosphorous (bottom left) and organic matter (bottom right)

After I examined the chemical and local parameters of each reactor, the next step was to deal with the microscopic data. For the third and fourth reactor I have 5 measured dates, and for the first two reactors I measured the carriers under microscope 12 times - control samples included. That means around 1700 pictures in total.

In ***Figure 3.***, the diagrams show the growth rate of each reactor during the experiment period. It is calculated by subtracting the carriers' unsettled areas from the total area, divided by the full surface area. It is calculated for each picture, each carrier, then the average of each day can be seen in the graphs. The ***Figure 4.*** shows when the average settled area (%) reached the maximum of its capacity.

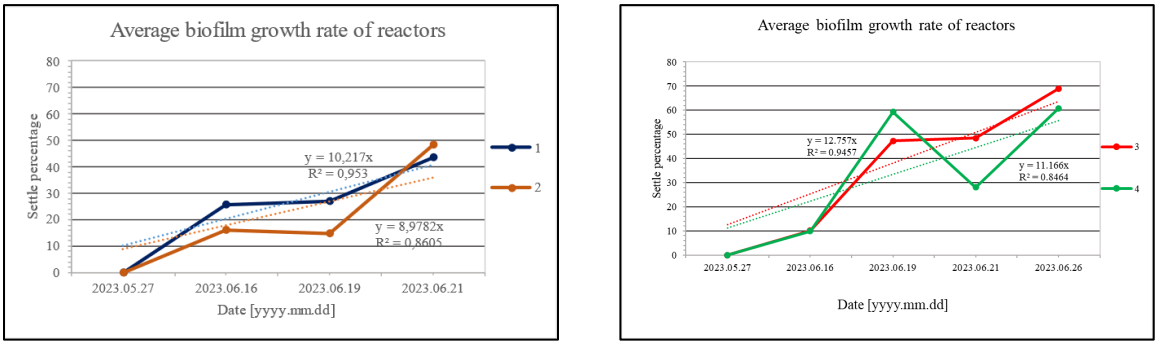
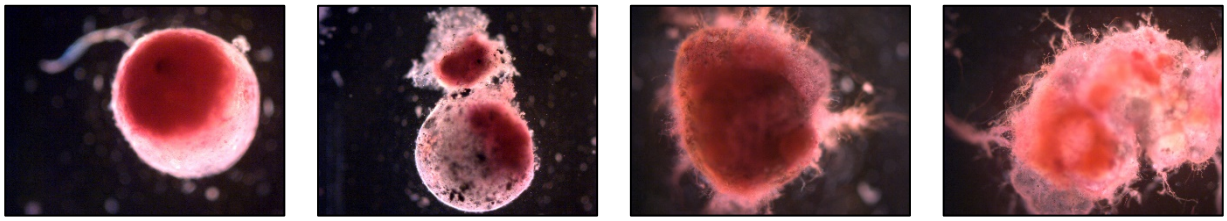


Figure 4. - Growth rate of each carrier types with autotrophic microorganisms

In the left you can observe the first and second reactors, where the carriers made by warm polymerization can be seen. The carrier without adsorbent reached 45,30% settle rate in the initial phase, while the second batch, that contained activated carbon adsorbent had 48,35% of all surfaces utilized. They reached this rate on the third sampling date (control time excluded), which is a faster rate than in the two other reactors, where phosphate was not available for the microorganisms. These reactors however reached a higher (69% in reactor 3, 60,82 in reactor 4) settle rate than the original carriers. This may be caused by the fact that on these carriers morphologically different organisms appeared. These values were smaller than the results of Barwal (2014), and in the range of Bjornberg et al. (2009)'s studies of the outer areas of carrier's surface, however literature data are about carriers marginally different in size and geometry.

In ***Picture 3.*** a picture of settled TCC coloured carriers in each of the four reactors is shown. The third and fourth reactor has filamentous organisms on the carriers' surface, which creates more surface area than on the two original carriers.



Picture 3. - The fully settled carriers of each reactor (first left reactor – 1, second left reactor - 2, first right reactor - 3, second right reactor - 4)

I measured the diameter (mean) values of each carrier at each measuring time and used Past software histograms to show how the carriers' diameter changes over time. Any change to the control samples can be via the growth of the biofilm, as it increases the diameter with its biofilm thickness. In the histogram analysis I used 6 bins each time (that means the number of columns) and set the axis to the same values. The first reactors data is shown in ***Figure 5***.

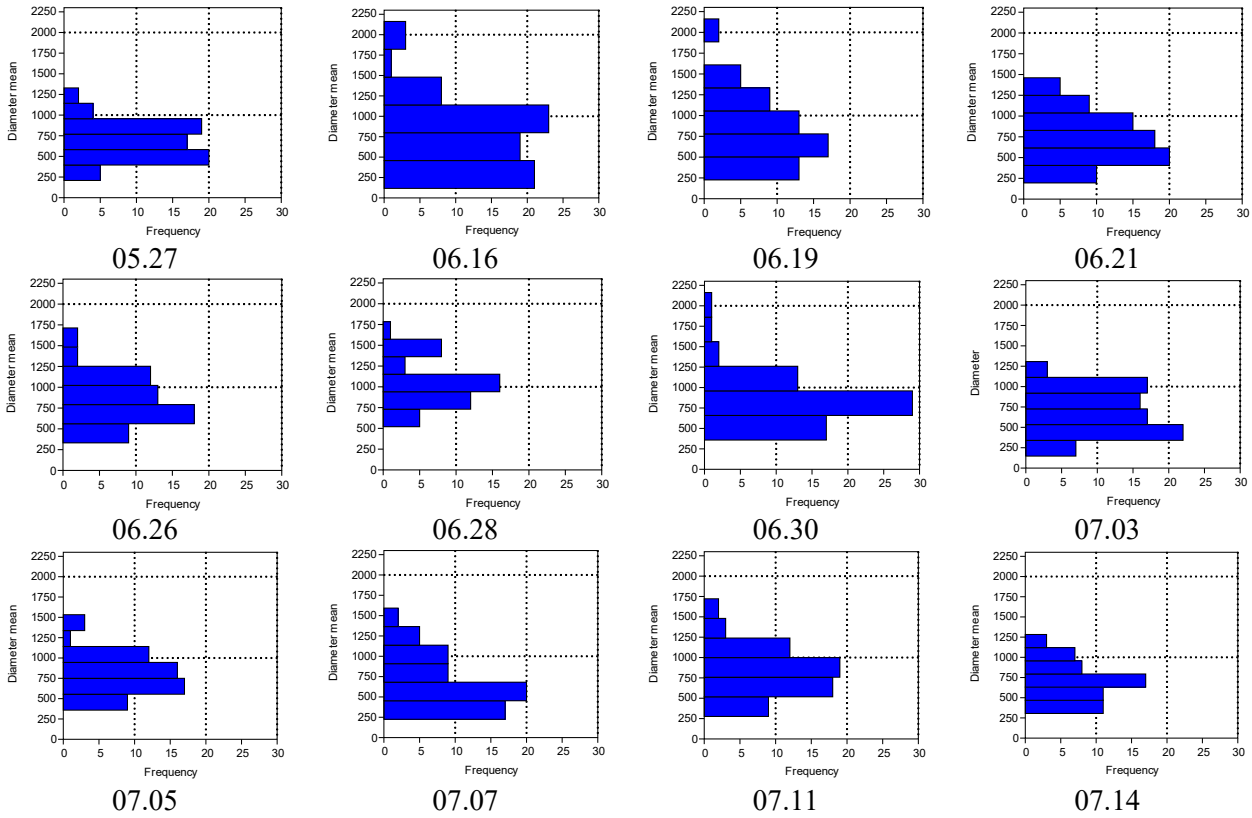


Figure 5. - The changes of carriers' diameter over time in reactor 1

In ***Figure 5***. the first chart shows the control sample diameter mean values distribution. The following charts show that higher diameter (above 125 0µm) values begin to appear, and the majority of carrier diameter moves

from 250-750 µm to 500-1250 µm. However, at 07.03. date there is a decrease, and after that it starts to grow again. Overall, the diagrams show a periodical growing-decreasing cycle of the biofilm.
In ***Figure 6.*** the diameter dispersion in each sample can be seen. In the first histogram you can see the control of the second type carrier. This type has slightly larger carriers than the first reactor, that has no absorbent in the carriers. The diameter size quickly rises, where the most common size is around 1000 µm until 06.26 sample. There is a decrease in diameter then, most carriers are around 750 µm, but there's still a significant number of carriers larger than 1250µm.

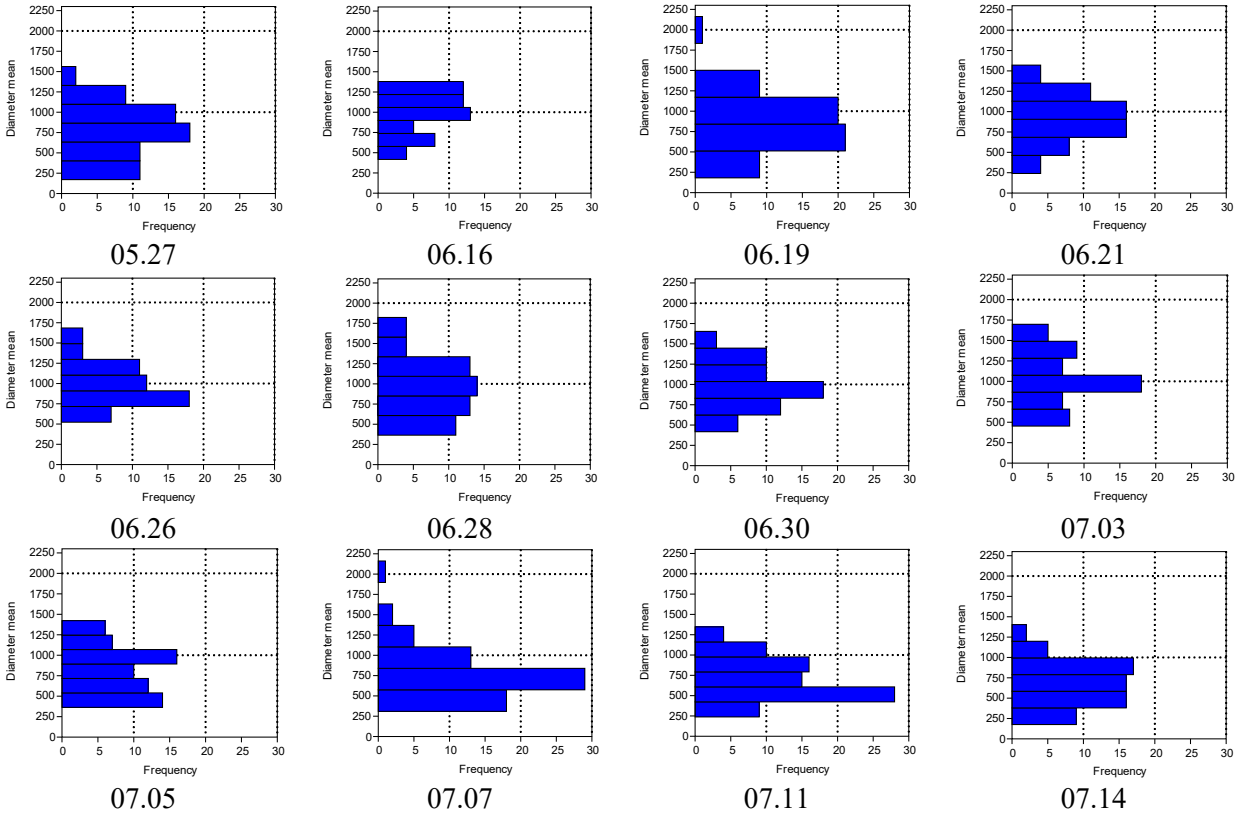


Figure 6. - The changes of carriers' diameter over time in reactor 2

After this there is a slow increase again, and at the last sample (07.14) most carriers are in the range of 1000µm. A similar trend is shown here, as in the first reactor.

In the next ***Figure 7***. we can see the diameter dispersion changes of reactor 3. The original carrier size (control, 05.27) significantly smaller than the traditional carriers. This is caused by the new synthesis method. Diameter mean range for most of the carriers are 300-600µm. The change in diameter however shows faster increase than the previous ones. In the first non-control sample the biggest bin has smaller share (33% vs. 12%) than the control, and the maximum is around 900µm.

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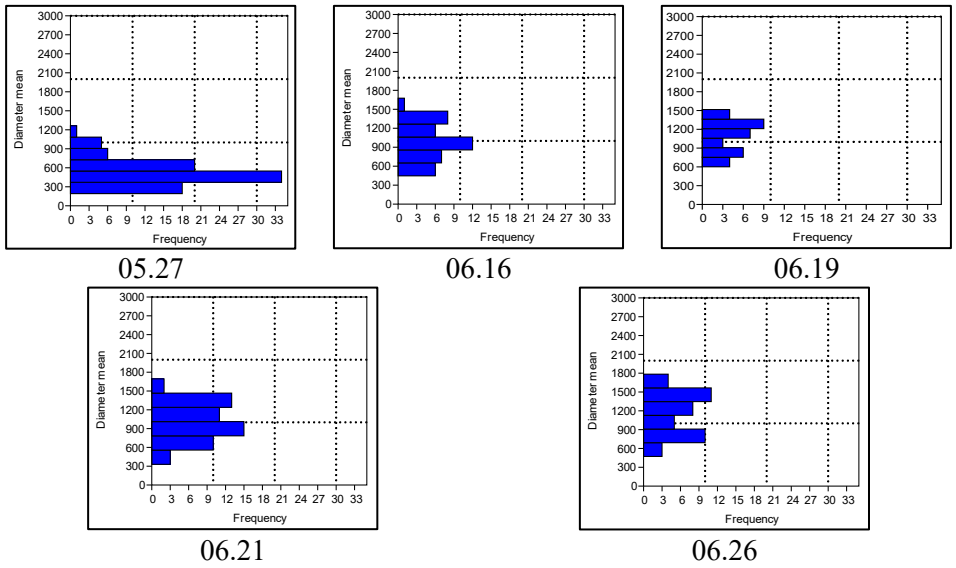

Figure 7. - The changes of carriers' diameter over time in reactor 3

The other samples are like this, with a decent increase in the 1500µm bin. In this reactor a slight increasing trend is visible. In ***Figure 8***. we can see the fourth reactors particle size changes over the experiment period. It shows that the control sizes are small, with most density in the 300-600µm range. Even at the first sampling time it changes dramatically, as seen at reactor 3. Fourth reactor grows biomass slower than reactor 3, as can be seen in every other parameter. Despite this, a growing trend, similar to reactor 3 can be observed.

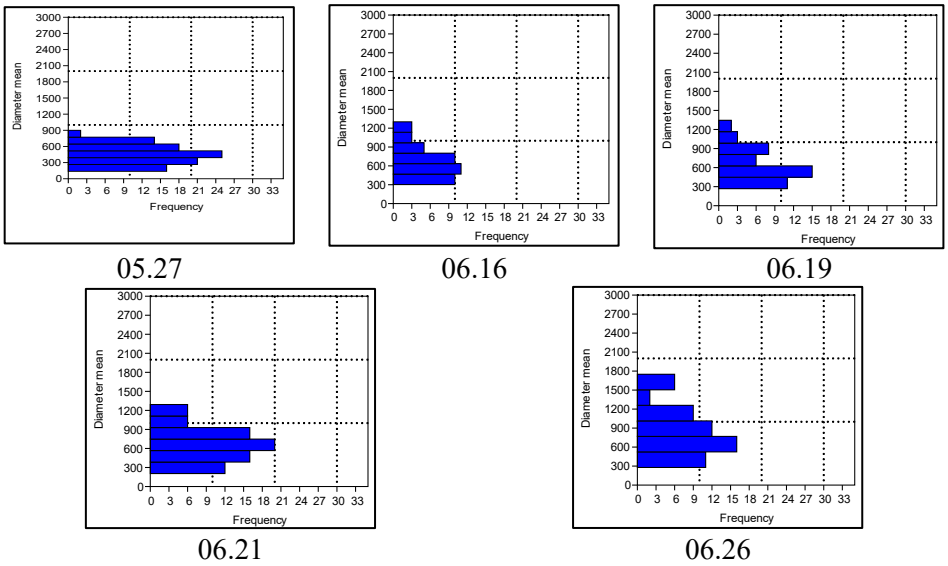

Figure 8. - The changes of carrier's diameter over time in reactor 4

In ***Figure 9.*** the average carrier thickness over the measuring period is shown. In the first chart it is clearly visible that as the biomass grows, then departs from the carrier, it changes its overall diameter. The values are slightly higher than the control, it suggests that a thin biofilm grows on the carriers. In the next chart we can also see a similar trend, but at the end of the experiment it goes a little lower than the original control values.

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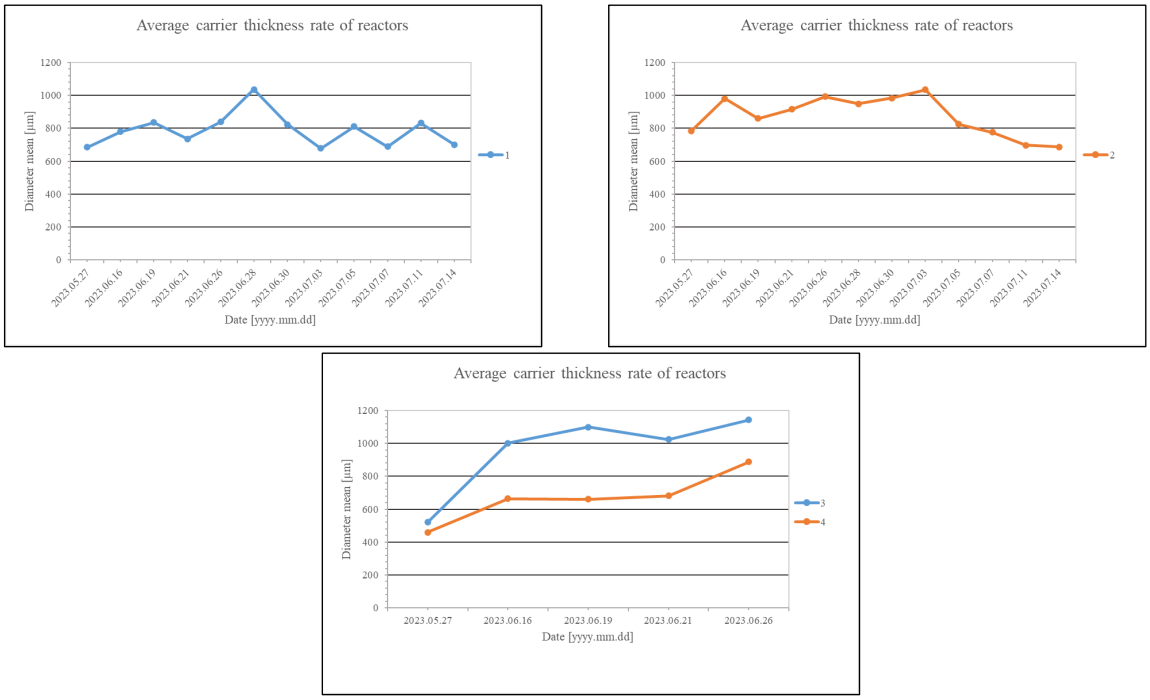

Figure 9. - Average carrier thickness in reactor 1 (top left), reactor 2 (top right), and reactor 3 and 4 (bottom)

The biofilm thickness is relatively small compared to the biomass's diameter, and in these calculations the carriers that has almost no biofilm on their surface are also included. In the reactor 3 and 4 there is a constant increase throughout the experiment period, however on those carriers, a different, phosphate limited, filamentous biomass grew, that shows less removal capacity but uses more surface area.

CONCLUSION & FURTHER PLANS

In this study I presented that TTC colouring with image processing and light microscopy is a suitable method for measuring and monitoring biofilm growth in terms of determining the carriers surface area, and also in monitoring the carrier's changing diameter, which is caused by the growing biomass. The results clearly show the methods ability to monitor the biofilm growing and detaching cycle, as can be seen in reactor 1 and 2. An increasing tendency can also be monitored, as in reactor 3 and 4. Further studies and calculations can be made based on the material shown in this article. To combine the settle rate with the calculations of overall diameter in further studies it is possible to determine the thickness of the biomass on these small carriers. Dividing the diameter calculations based on the settle rate make it possible to only measure those carriers that have actual biofilm on their surface. By isolating the carriers that have no biofilm on them, we can confirm if the new carrier materials' diameter changes over time.

The acquired data shows that this new type of carriers' surface is settleable for autotrophic microorganisms at a high rate. The second carrier was the most effective, and the fourth was the slowest. The original carriers have similar capabilities in terms of waste removal. They can settle quickly and remove ammonium from the influent water. These carriers don't reach the settling rate of the literatures values, however it's worth mentioning that these new carriers are about a hundred times smaller, even with slightly lower settle rate, their

biofilm concentration is even bigger than MBBR systems with traditional carriers. In this study only autotrophic microorganisms were used, for that is the most critical part of wastewater cleaning process. Another interesting result is that the third and fourth type of carrier were able to absorb a relatively high amount of phosphorous, which in this experiment caused a less effective microorganism culture on the reactors. In further studies it is important to determine their exact phosphate adsorbing capacity and after they overflow with phosphorous, how effectively organisms can grow on their surface. However, it's worth noting that even with phosphorous limited conditions, the biofilm on the carriers' surface were able to remove ammonium from the influent. This different filamentous biofilm has higher thickness and quicker growth rate than the original carrier's biomass.

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Workshop Special Session

ENVIRONMENTAL HEALTH AND CLIMATIC CHANGE

(How humanity can solve climate change, alleviate poverty, and save biodiversity)

Hosam E.A.F. BAYOUMI HAMUDA

Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary

bayoumi.hosam@uni-obuda.hu, WhatsApp/viber/messenger: +36303900813

Climate change is happening due to natural factors and human activities. It expressively alters biodiversity, agricultural production, and food security. Mainly, narrowly adapted and endemic species are under extinction. Accordingly, concerns over species extinction are warranted as it provides food for all life forms and primary health care for more than 60–80% of humans globally. Nevertheless, the impact of climate change on biodiversity and food security has been recognized, little is explored compared to the magnitude of the problem globally.

When an environmental variation occurs on a timescale shorter than the life of the plant any response could be in terms of a plastic phenotype. However, phenotypic plasticity could buffer species against the long-term effects of climate change.

Furthermore, climate change affects food security particularly in communities and locations that depend on rain-fed agriculture. When an environmental variation occurs on a timescale shorter than the life of the plant any response could be in terms of a plastic phenotype. However, phenotypic plasticity could buffer species against the long-term effects of climate change.

Furthermore, climate change affects food security particularly in communities and locations that depend on rain-fed agriculture.

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Accordingly, agricultural yields in Africa alone could be decline by more than 30% in 2050. Solving food shortages through bringing extra land into agriculture and exploiting new fish stocks is a costly solution, when protecting biodiversity is given priority.

Mitigating food waste, compensating food-insecure people conserving biodiversity, effective use of genetic resources, and traditional ecological knowledge could decrease further biodiversity loss, and meet food security under climate change scenarios.

HIGHLIGHTS

- Climate change impacts on soil and its biodiversity are underestimated. A healthy environment and soil biodiversity are milestones for food production.
- The synergy of the soil-plant-animal nexus may support combating climate change.
- Integrated agricultural production systems can reduce the effects of climate change.
- Agricultural zoning is a promising tool for minimising climate change effects.
- Soil represents a crucial component of the climatic system.
- The soil is the "unconsolidated mineral or organic material on the immediate surface of the Earth".
- The term biological diversity or biodiversity is defined as the "changeability between existing creatures from all bases counting, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological multiplexes of which they are part; this comprises variety in species, between species, and of ecosystems'' Biodiversity, agricultural production, and food security are predicted to alter expressively in response to a changing future climate globally. So, the movement of plants to higher elevations and latitudes from the climate to which they are adapted is among the predicted consequences of climatic change.

- Twentieth century experienced the strongest warming trend of the last millennium with average temperatures rising by about 0.6 C. However, future temperature rises are likely to exceed this with a predicted rise of between 0.1 and 2°C per decade
- Climate is defined as the average weather conditions, characterized by long-term statistics for the meteorological elements in each area. Also, the term climate is defined as "the average weather condition, characterized by long-term statistics (typically three decades) (mean values, variances, and probabilities of extreme values) for the meteorological elements in a given area". While climate change is described as the change in the climate of an area because of anthropogenic and natural disorders such as the depletion of the ozone layer, and greenhouse effects.
- Factors such as changes in solar emission, long-term changes in the earth's orbital elements (eccentricity, obliquity of the ecliptic, the procession of the equinoxes), natural processes, and human forcing on a planet.
- Though climatic change is due to alteration in external forcing (natural factors or human activities), future projections consider the influence of only anthropogenic increases in greenhouse gases and other human-related factors.
- Climatic change affects species, and ecosystem composition and function both directly (increases in temperature, and changes in precipitation; water temperature and sea level) and indirectly (changes the intensity and frequency of wildfires)
- Worldwide has to emphasise that SDG #13 (Climate action) and its relationship with other SDGs (e.g., #2: Zero Hunger, and #15: Life on Land), it has, actually, a global change approach, in the sense that

global change refers to the changes of the Earth system, treated in its entirety with interacting physicochemical and biological components as well as the impact human societies have on the components and vice-versa

- Focusing on the three research questions:
  1. How does climate change affect soil biodiversity?
  2. How does land use change affect soil biodiversity?
  3. What are the main current climate change adaptation and mitigation activities?

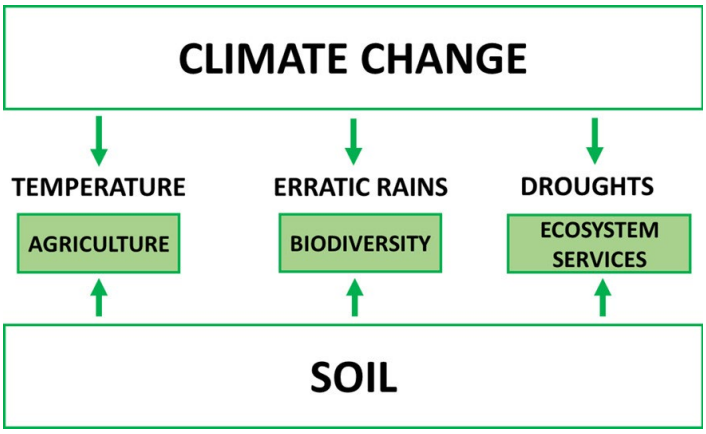
- Land (soil) plays a critical function in the climate system.
- The various types of land use, especially agriculture and forestry, account for nearly a quarter of the greenhouse gas emissions.
- The world's soil is under pressure from many factors, including climate change and land use change.
- Increases in temperature, prolonged drought and floods put pressure on the soil.

- Soil biodiversity and sustainable soil management are preconditions for attaining SDGs, further highlighted by soil being mentioned in 5 of the 17 SDGs. However, despite its essential value to life on earth, soil biodiversity is overlooked mainly in global public policy dialogue.
- Soil biodiversity is gaining prominence as beneficial to human health because it can subdue disease-causing soil organisms and supply clean air, water and food. However, harmful land-use activities and climate change affect life forms underneath the surface soil worldwide.
- Soil biodiversity denotes the complexity of life below the soil surface, e.g., bacteria, fungi, protozoa, insects, worms, and other invertebrates and vertebrates, which dynamic interaction with fauna and flora creates a web of biological activity.
- Soil biodiversity enhances the topsoil vegetation by decomposing plant residues and reinforcing soil resilience. In addition, the rich diversity of organisms promotes soil health and fertility; the soil system likely contains more than 25 % of overall biodiversity.
- Besides, the complex interactions between the subsoil and topsoil systems facilitate life on earth through the following ecosystem services.
- For instance, soil biodiversity is critical for food production, maintaining a healthy environment, nutrient cycling, and mitigating climate change.
- Nevertheless, this vital ecosystem, one of the earth's main biodiversity reservoirs, is subjected to immense pressures due to poor land-use practices, erosion and compaction, and climate-induced factors.
- Moreover, soils are considered non-renewable resources as their degradation/loss is hardly recovered within a human life period. The United Nations designated the year 2015 as the International Year of Soils. The first-ever Status of the World's Soils Report was published towards the end of 2015, followed by the first-ever Global Soil Biodiversity publication in 2016. The insights gained about the species, their mutual relations, and their impact on processes existing within the soil's food web in natural systems provide vital knowledge for effectively managing the land, especially regarding agriculture.
- Strong connections exist between above-surface and below-surface diversity, even at diverse temporal scales for organisms. Moreover, changes that impact above-surface diversity and functioning also reflect in the below-surface ecosystems. How climate change and land use change may negatively

influence soil biodiversity and related services. It also outlines some of the actions needed to increase the resilience of soil biodiversity in the context of a changing climate.

- Some key findings are:
  1. Well-managed soils are critical for resilient production systems.
  2. Integrated agricultural production systems have gained prominence as climate-resilient production systems.
  3. Agricultural zoning may be a valuable tool in integrated systems to minimise the effects of climate change.

- However, it is vital to continuously monitor environmental variations so producers can be more prepared for climate change and extreme events. Finally, adequate water management is essential for soil functioning under climate change aggravating water scarcity. An intersectoral approach between critical sectors facilitates comprehensive water management.



CONCLUSIONS

- The current unsustainable use of the land, aggravated and worsened due to climate change and extreme weather, may negatively influence the biodiversity of soils.
- Therefore, well-managed soils that retain carbon, reduce CO_2 emissions and promote nutrient cycling are critical for resilient production systems.
- Consequently, integrated systems of agricultural production have gained prominence among the systems that promote the improvement of the soil's chemical, physical, and biological characteristics, while they may make agriculture viable.
- These systems explore the synergistic effects of interactions in the soil-plant-animal-atmosphere compartments of areas that integrate agricultural and livestock activities and whether these activities may occur in parallel in the same area.
- Therefore, in this context, it is necessary to consider the best ways to integrate the activities in each place of production (crop, livestock, forest, river and others) considering climatic specificities, the

potential and the agricultural needs of the territory, as well as the accessibility of methods that seek to interfere less in the soil so that the impacts of climate change on soils and land use can be minimised.

- In this context, agricultural zoning may be a valuable tool in integrated systems to minimise the effects of climate change.
- Agricultural zoning indicates the planting season for each crop throughout the agricultural year based on parameters such as rainfall, soil type, photoperiod, and temperature, allowing for the most appropriate development of each crop phase (germination, vegetative growth, flowering, physiological maturity, and harvest).
- However, it is vital to continuously and closely monitor environmental variations so that producers can be more prepared for climate change, especially the influences of extreme events such as drought, excessive rain, sandstorms, hurricanes and cyclones.
- When the producer has this information, it becomes possible to plan the related activities better and sustainably explore each region's available resources.
- There are other measures which, if duly implemented, could prevent soil erosion. For instance, specific sustainable management practices are integral to retaining nutrients and thus enhancing soil fertility and health.
- Furthermore, as climate change aggravates water scarcity, adequate water management is essential for the functioning of the soil.
- This may include newly introduced measures, such as mixing clay with sandy soils, which tend to retain more water. In addition, an intersectoral approach between critical sectors must be adopted for comprehensive water management.
- Most importantly, crop residues reduce soil erosion if left on the surface, so a greater advantage of them may be taken. Moreover, soil tillage should be minimised, avoiding excess herbicides, considering advancing climate change since this process is accompanied by a reduction in organic matter and increased erosion.
- Finally, crop rotation is vital in ensuring soil health because farming with cover crops retains the soil's essential nutrients and carbon. As far as climate change mitigation and soil health improvements are concerned, other sustainable practices may include comprehensive nutrient management and mulch cum manuring. In this context, conservation agriculture and water-saving technologies are also essential. Moreover, intercropping and/or fallow biochar application may be additional practices for supporting proper soil functioning. The fact that soils are widely exposed to global change, and climate change in particular, and bearing in mind that billions of people around the world rely on agriculture for their food supplies, suggests that measures aimed at soil conservation need to be regarded as a priority. Therefore, more research investments are needed, both in respect of soil conservation and protection and in optimising agriculture practices so that their impacts on soils may be minimised.

ICEEE-Cooperation

Our planet requires an array of scientific innovations, and it's time to looked beyond the traditional problems and solve them. This is the critical and exciting time to be alive. The decisions and the actions we take in the next years will define the future for next generations to come. These solutions can be done from practical and not only excellent from theoretical point of view.

From our vision, the main task of the members of our International Council of Environmental Engineering Education board (ICEEE) and their voice, passion, and cooperation are critical to our success.

Please join us to create the future for the new generations free from environmental problems like climatic changes, pollutions, spread of epidemic diseases, reduction in the natural resources, etc., due to the continuous increasing in the global population and depending on the 17 points of sustainable development from United Nations.

With your support, ICEEE can try and continue to solve problems from around the world and to find solutions, catalyse global impact, and create the future we envision.

Prof. Dr. Hosam Bayoumi Hamuda
President of ICEEE
Obuda University
Budapest - Hungary
E-mail: bayoumi.hosam@uni-obuda.hu
WhatsApp/viber/messenger: +36303900813

Invitation for the VIIIth International Symposium-2024

The next scientific
MEETING WILL BE ON
the VIII. International Symposium-2024
which will be during the 9th and 10th of May 2024
Budapest, Hungary
The title of the Symposium is Environment Safety and Security of Biosphere.

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