ÓBUDA UNIVERSITY
REJTŐ SÁNDOR FACULTY OF LIGHT INDUSTRY AND ENVIRONMENTAL ENGINEERING

ICEEE

Indexed International Annual 11th ICEEE-2020 Conference
Sustainable Environmental Protection & Waste Management Responsibility
November 19 – 20, 2020
RKK – Óbuda University
Budapest, HUNGARY

Proceedings Book
11th ICEEE-2020
International Annual Conference

"Sustainable Environmental Protection & Waste Management Responsibility"

November 19, 2020 – November 20, 2020

Óbuda University
Budapest, Hungary

11th ICEEE–2020 International Annual Conference on "Sustainable Environmental Protection & Waste Management Responsibility"

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

Online
November 19th – 20 th, 2020
RKK – Óbuda University
Budapest, Hungary

Content

INTRODUCTION

Why Environmental Engineering and Natural Sciences are vital for our future and why Environmental Protection & Waste Management!

The purpose of the Conference is to analyese the issuses of the global environmental protection and waste management. The authors try to ansewr the questions connectiong to the above mentioned phenpmenon on the basis of their experiences of selected global countries.

Our planet has a natural environment, known as ‘Ecosystem’ which includes lifes of all macrobiotas such as humans, plant and animal as well as microbiotas such as microorganisms, and non-living components such as atmosphere, hydrosphere and lithoshoere 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.

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

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.

Sanitation is a large part of our civil evolution; without it, we would yield more often to water-borne disease and illness - raising our mortality rates and lowering our quality of life. Therefore, we've always needed to find bigger and better ways of taking away our sewage for example, cleaning our water and harnessing natural or artificial water supplies for our health and environment.

Since the industrial revolution in the 19th century we have needed to prevent businesses and individuals from polluting the environment with harmful substances. 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.

Couple this with environmental awareness in the general population and the growing understanding of the impacts of environmental change meant that environmental engineering was born in this era. Since then, environmental legislation has sought to define environmental standards on clean water, air quality, solid waste disposal and pollution management — at state and national level, and to define international standards. We are using an ever-increasing number of chemicals with toxic waste and the remit of the environmental engineer is to keep the environment safe for humans and for other forms of life.

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.

Since 2005, several global processes have called for an integrated approach to climate change adaptation (CCA) and disaster risk reduction (DRR). Calls to pursue this integration were intensified, with the adoption of three main and interrelated agendas, namely the 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction (2015-2030) and the Paris Agreement on Climate Change. While the CCA and DRR communities follow separate paths, bridging the gap between them entails both opportunities and challenges. Similarities between the two communities need to be exploited and differences investigated in order to achieve synergies in dealing with all aspects of weather-related hazards and disasters, assessment tools, institutional arrangements and means of implementation to achieve synergy between the two agendas.

Today, people around the world can connect together 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 during the period from 2010 to 2020.

The aim of the 11th ICEEE-2020 Conference was 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 world. It allowed the participants to have different issues addressed on *Sustainable Environmental Protection and Waste Management Responsibility* by recognized global experts who are up-to-date with the latest developments in this field. This scientific meeting offers a great opportunity for students, researchers, industrialists and academic professionals to share latest research results in Environmental Protection and Waste Management, network with their peers from around the globe and foster new connections that strengthen research and development activities in field of environmental quality. 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 research papers presented in this Proceedings Book volume cover the latest developments and findings in the fields of environmental health, safety, energy, waste management, reclamation and rehabilitation and environmental protection.

Authors from over 10 countries with backgrounds in energy, (bio)chemistry, (bio)engineering, (bio)technology and waste management, human and environmental health 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 protection 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 *Sustainable Environmental Protection & Waste Management Responsibility* (11th ICEEE-2020), held now in Budapest, Hungary during November 19-20, 2020. It providing a unique overview of new directions and opportunities for sustainable and resilient design approaches to protect the environment, it discusses diverse topics related to environmental protection and management of waste, through the eco-friendly re-use and processing of waste materials, the management and disposal of residual wastes, to water treatments and technologies. It also encompasses strategies for reducing waste through better design, improved recovery, re-use, more efficient resource management and the performance of materials recovered from wastes. The contributions were selected by means of a rigorous peer-review process and highlight many exciting ideas that will spur novel research directions and foster multidisciplinary collaboration among different waste management specialists.

Budapest, November, 2020

Editor

BIBLIOGRAPHIC INFORMATION

Editor and affiliation	Prof. Dr. Hosam E.A.F. Bayoumi Hamuda President of ICEEE Institute of Environmental Engineering & Natural Sciences Óbuda University
Organizations	International Council of Environmental Engineering Education (ICEEE)
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International Council of Environmental Engineering Education (ICEEE) Organoization, Scope and Opportunities

ICEEE is a non-profit organization that promotes the Engineering, innovation and Technology, related latest developments and issues to be discussed and experimented through interactions amongst the researchers and academician across the World at a common platform.

ICEEE is leading event in the Environmental Engineering Education sector, sharing the latest research results, developments and innovative environmental protection and applications from industry and the policy context. It is clear that, for the mitigation of climate change, urbanization and with rapid industrialization all over the world, pollution is on the increase, we need a transformation of the education, health, economy and environment, not a marginal change.

During the closing celemony of the Conference, it was decided that **Dr. Lyudmila SYMOCHKO** from Uzhgorod National University, Ukraine is now the **General Seceretory of the ICEEE**. The decision was build on her scientific activities and development as well as her activities and the cooperation with the presidency of the ICEEE.

Budapest, 20th of November, 2020

Prof. Dr. Hosam Bayoumi Hamuda
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Sustainable Environmental Protection &
Waste Management Responsibility
November 19 – 20, 2020
RKK – Óbuda University
Budapest, HUNGARY

ORGANIZATION

11th ICEEE-2020 International Annual Conference on
"Sustainable Environmental Protection &
Waste Management Responsibility"

Organised by:

International Council of Environmental Engineering Education (ICEEE)

Supporting Organisations

Óbuda University
Institute of Environmental Engineering & Natural Sciences (KTI)
Rejtő Sándor Faculty of Light Industry & Environmental Engineering (RKK)

The Conference is carrying out under the auspices of:

Prof. Dr. Levente KOVÁCS
Rector, Óbuda University

Presidency of the Conference:

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

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

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

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ACKNOWLEDGMENT

Dear Guests and Colleagues

Thank you very much for your attendance in the 11th ICEEE-2020 International Annual Conference dealing with the Sustainable Environmental Protection & Waste Management Responsibility which was in Budapest during November 19-20, 2020 online in Budapest at Óbuda University, Hungary.

11th ICEEE - 2020 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 11th ICEEE-2020 Conference deals with „Environmental Protection and Waste Management due to the Climatic Change". Climate change is projected to harm human health through adverse changes in security of the life-style.

The 11th ICEEE-2020 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.

In response, 195 nations as part of the United Nations Framework Convention on Climate Change adopted the Paris Agreement, which aims to limit the global temperature increase below 2°C above pre-industrial levels. On another level, for most decision makers there is little guidance on how to best address the linkages between environmental quality and climate change and waste management as a way to protect the environment within the policy process to understand how the emissions of air pollutants and greenhouse gases and other wastes will impact on the quality of the environment, climate, human health, ecosystems, agriculture, etc.

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 2019, which brought together the world's professions and practitioners from different fields of applied sciences and environmental engineering, the International Council of Environmental Engineering Education (ICEEE) with the cooperation with the Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering (RKK), Institute of Environmental Engineering and Natural Sciences had the great pleasure to welcome all of you as a speaker and contributor for our conference **the *11th ICEEE-2020*** International Annual Conference on "*Sustainable Environmental Protection & Waste Management Responsibility*" which is going online here in Budapest today November 19th to 20th 2020 in Hungary.

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

This conference will provides 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 quaéity of global effort towards environmental health systems.

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

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

Organizing Committee
of the Conference

IMPRESSUM

For the Programme, Abstracts and the Proceedings Book of the papers of the 11th ICEEE-2020 International Annual Conference titled: "*Sustainable Environmental Protection & Waste Management Responsibility*

– The official language is English.
– The Programme and Abstracts 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 11th ICEEE-2020 International Annual Conference are published in the Conference Proceedings Book with the ISBN 978-963-449-203-0.
– The Proceedings form with ISBN 978-963-449-203-0 in CD-ROM format and online (electronic) in the website of ICEEE: www.iceee.hu
– The selected high quality manuscripts will be also published in the online journal.
– The scientific information and quality of the manuscript is due to the corresponding author of the paper.
– Individual authors at their manuscripts shell be responsible for any possible errors
– The Publisher of the Programme, Abstracts and the Proceedings Book of the International Annual Conference is the ICEEE, Institute of Environmental Engineering and Natural Sciences, Sándor Rejtő Faculty of Light Industry and Environmental Engineering and Natural Sciences, Óbuda University, Budapest, Hungary.
– Publication year of the Proceedings is 2020.
– Important Website: www.iceee.hu
– The Conference is organised in the framework of the Hungarian Scientific Season (Hungarian Scientific Festival).
– The publication policy of the ICEEE offer you a chance to publish your full paper in **Euro-Mediterranean Journal for Environmental Integration** which is related to Springer publishing house (https://www.springer.com/journal/41207) which is an indexed journal.
– You can submit your paper (with mam. 30%) to this journal and they well have a direct connection with you. But you have to mention your wish to us.

November, 2020.

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AWARDS OF CONFERENCE

The awards of the 11th ICEEE-2020 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

Each and 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 – 40%
- 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 was 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
- Significance of the paper to the field
- Theoretical contribution
- The ability of practical implementation
- Use of appropriate methodological rigor
- Originality

AWARDS CEREMONY

Congratulations to all our 11th ICEEE-2020 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

This awards were provided for the most outstanding presentation of the entire conference. The two winners were:

1. ***Lyudmyla SYMOCHKO*** *(Uzhhord National University, Faculty of Biology, Uzhhorod, Ukraine)* ***in the presentation:***

   SOIL MICROBIAL DIVERSITY AND FOOD SECURITY

2. ***Edmond HOXHA*** *(Faculty of Geology and Mining, Department of Mineral resource Engineering, Polytechnic University of Tirana, Albania)* ***in the presentation:***

   USING DRONES ON 3D MODELLING AND IDENTIFYING ENVIRONMENTAL DAMAGES IN OPEN CAST MINING

2. THE BEST STUDENT PRESENTATION AWARD

The best student presentation award was given to the most outstanding presentation presented by a participant who has registered under the Ph.D. student. The winner Ph.D. student was:

1. ***Thamer Adnan ABDULLAH*** *(University of Pannonia, Faculty of Engineering, Laboratory for Surface and Nanostructures (LASUNA), Veszprém, Hungary)* ***in the presentation:***

   PREPARATION AND CHARACTERIZATION OF CERIUM DIOXIDES NANOPARTICLES FOR REMOVAL OF METHYLENE BLUE FROM WATER

3. SESSION'S BEST PRESENTATION AWARDS

These awards were provided to the presentations that have been selected to be the best in the particular sessions. They were:

1. ***Israa Qusay FALIH*** *(Department of Chemistry, College of Science, University of Misan, Maysan, Iraq, [2]National Diabetic Center, University of Almustansiria, Baghdad, Iraq)* ***in the presentation:***

   Study the effect of vitamin D3 in type 2 diabetic Iraqi patients with chronic kidney diseases

2. ***Krisztina DEMÉNY** (Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary)* ***in the presentation:***

   ANALYSING LAND USE CHANGE IN THE GÖDÖLLŐ HILLS DURING 1990'S

4. THE BEST POSTER PRESENTATION AWARD

The best poster presentation was selected among all the researchers in the poster session. The winner was:

1. ***Salma LATIQUE** (Department of Biology, Biotechnology and Plant Protection Laboratory, Faculty of Sciences, Ibn Tofail University, Kenitra, Morocco)* ***in the presentation:***

   ROLE OF ULVA RIGIDA EXTRACT IN ALLEVIATION OF SALINITY STRESS ON WHEAT PLANTS

Budapest, 20th of November, 2020

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

MAIN THEMES

- Agricultural, Biological & Environmental Pollution
- Alternative Renewable Fuels
- Biosecurity Strategy for Agricultural & Food Industry
- Climate Change Impacts & GHG Performance
- Energy
- Environmental Contamination & Toxicology
- Environmental Monitoring, Modelling & Assessment
- Environmental Awareness & Engagement: Education, Promotion & Inclusion
- From Waste to Energy
- Industrial, Nuclear & Radio Engineering
- Landscape & Environmental Protection
- Light Industry & Waste Recycling
- Materials Technology & Engineering
- Monitoring & Evaluation in the Waste Management
- Municipal & Industrial Solid Waste Management
- Pure and Applied Sciences: Chemistry, Mathematics, Physics
- Water Treatment & Desalination

CONFERENCE PROGRAMME

First Day:
19th of November 2020 (Thursday)

10:00 – 10:30. **Opening Ceremony**

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

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

Prof. Dr. Levente KOVÁCS
Rector, Óbuda University

Mr. Pal KOVACS
Prime Minister's Office – State Secretary
Honour guest of the Conference

10:30 – 12:30 **Plenary Session**

Chair of the Session: László KOLTAI

10:30. – 11:00 ***Pal Kovacs*** *(Prime Minister's Office – State Secretary)*

THE ROLE OF NUCLEAR IN DECARBONISATION

11:00 – 11:30 ***Sadhan Kumar Ghosh*** *(Jadavpur University, India; President, International Society of Waste Management, Air and Water)*

CIRCULAR ECONOMY - THE WAY FORWARD TO SUSTAINABLE DEVELOPMENT

11:30 – 12:00 ***Nabil Khelifi*** *(Springer Nature; Senior Editor, Manager of Springer MENA program Springer, a part of Heidelberg, Germany)*

SPRINGER AUTHOR ACADEMY: A STEP-BY-STEP GUIDE ON WRITING AND PUBLISHING YOUR JOURNAL MANUSCRIPT

12:00 – 13:00 BREAK

13:00 – 14:40 **Keynote Session-1**

Chair of the Session: Rita BODÁNÉ-KENDROVICS

13:00 – 13:25
Lyudmyla SYMOCHKO[1,2], Hosam E.A.F. BAYOUMI HAMUDA[3], Vitaliy SYMOCHKO[1], Olena Demyanyuk[2] *([1]Uzhhord National University, Faculty of Biology, Uzhhorod, Ukraine, [2]Institute of Agroecology and Environmental Management, Kyiv, Ukraine, [3]Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary)*

SOIL MICROBIAL DIVERSITY AND FOOD SECURITY

13:25 – 13:50
***Jozsef STEIER** (SUNWO Plc, Hungary)*

TO SAVE THE GLOBE: THE CHANGE IN CO2 PARADIGM IS A MUST!

13:50 – 14:15
***Bogdana VUJIC, Una MARCETA,Visnja MIHAJLOVIC, Jasmina PEKEZ, Ljiljana RADOVANOVI, Ivan PALINKAS** (University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Serbia)*

CLIMATE CHANGE CONCERN AND COMMUNICATION PATTERNS WITHIN YOUNG PEOPLE AND THEIR PARENTS

14:15 – 14:30 BREAK

14:30 – 15:45 **Keynote Session-2**

Chair of the Session: **Edit CSANÁK**

14:30 – 14:55
***Israa Qusay FALIH[1], Noor Thair TAHIR[2], Hiba S. AHMED[3]** ([1]Department of Chemistry, College of Science, University of Misan, Maysan, Iraq, [2]National Diabetic Center, University of Almustansiria, Baghdad, Iraq, [3]Department of Microbiology, College of Science, Al-Karkh University of Science, Baghdad, Iraq)*

STUDY THE EFFECT OF VITAMIN D3 IN TYPE 2 DIABETIC IRAQI PATIENTS WITH CHRONIC KIDNEY DISEASES

14:55 – 15:20
B.S. PANWAR[1], REETIKA[2], Mantavya BISHNOI[3], Hosam E.A.F.BAYOUMI HAMUDA[4]
([1]Department of Soil Science, CCS Haryana Agricultural University, Hisar, India, [2]Ph. D. Scholar, Department of Horticulture, CCS Haryana Agricultural University, Hisar, India, [3]Ph. D. Scholar, Department of Food and Nutrition, CCS Haryana Agricultural University, Hisar, India, [4]Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary)

THE ROLE OF PHYTOREMEDIATION IN THE SOIL

15:20 – 15:45
***Hosam E.A.F. BAYOUMI HAMUDA, Krisztina DEMÉNY** (Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary)*

ENVIRONMENTAL PROBLEMS AND PROTECTION UNDER CURRENT SITUATIONS OF 2020

15:45 – 16:00 BREAK

16:00 – 17:00 **Technical Session – 1**

Chair of the Session: **Hosam BAYOUMI HAMUDA**

16:00 – 16:15
***Klaudia TÓTH** (National University of Public Service, Budapest, Hungary)*

CLIMATE CHANGE RELATED VULNERABILITY IN THE LAKE CHAD BASIN

16:15 – 16:30

Zoltán JUVANCZ[1], László TOLNER[2] *([1]Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Science, Budapest, [2]Szent István University Institute of Environmental Science, Gödöllő, Hungary)*

CAN THE ENERGY MANAGEMENT AND THE WASTE MANAGEMENT BE HARMONIZED?

16:30 – 16:45

Ildikó JÁRDII[1], László KOVÁCS[2], Zsuzsa LISZTES-SZABÓ[3], Gergely PÁPAY[1], Stilling FERENC[1], Attila FŰRÉSZ[1], Norbert PÉTER[1], Zalán ZACHER[1], Dénes SALÁTA[4], Károly PENKSZA[1] *([1]Szent István University, Faculty of Agricultural and Environmental Sciences, Institute of Crop Production Sciences, Gödöllő, Hungary, [2] Szent István University, Faculty of Agricultural and Environmental Sciences, Institute of Biological Sciences, Gödöllő, Hungary, [3]Isotope Climatology and Environmental Research Centre, Institute for Nuclear Research, Debrecen, Hungary, [4]Szent István University, Faculty of Agricultural and Environmental Sciences, Gödöllő, Hungary)*

POSSIBILITIES OF SPECIATION FOLLOWING ANTHROPOGENOUS ENVIRONMENTAL CHANGES IN THE CENTRAL SANDY AREA OF THE CARPATHIAN BASIN THROUGH THE EXAMPLE OF FESTUCA TAXA

16:45 – 17:00

Ágnes BÁLINT[1,2], Henrik FÜZES[1] *([1]Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, [2]Hydro-Bio-Mechanical Systems Research Center, Óbuda University, Budapest, Hungary)*

INVESTIGATION OF THE EFFECT OF PHENOL POLLUTION ON DIFFERENT PLANTS IN POT EXPERIMENTS

17:00 – 17:15 BREAK

17:15– 18:15 **Technical Session – 2**

Chair of the Session: **Ágnes Bálint**

17:15– 17:30

Ali Dawood SALMAN[1,3], Tatjána JUZSAKOVA[1], Ákos RÉDEY[1], Moayyed G. JALHOOM[2], Thamer Adnan ABDULLAH[1] , Endre DOMOKOS[1] *([1]Research Group for Surfaces and Nanostructures, University of Pannonia, Veszprém, Hungary, [2]Department of Production Engineering and Minerals, University of Technology Baghdad-Iraq, [3]Department of Chemical and Petroleum Refining Engineering /College of Oil and Gas Engineering Basra University, Iraq)*

RECOVERY OF SCANDIUM (III) BY LIQUID-LIQUID EXTRACTION OF MACROCYCLIC COMPOUNDS FROM NITRATE SOLUTIONS

17:30 – 17:45

Andrew RAVLIKOVSKY[1], Lyudmyla SYMOCHKO[2] *([1]Faculty of Biology, Uzhhorod National University, Uzhhorod, Nature Green Ukraine LLC, Transcarpathian region, Ukraine; [2]Faculty of Biology, Uzhhorod National University, Uzhhorod, Ukraine; Institute of Agroecology and Environmental Management, Kyiv, Ukraine)*

SPENT MUSHROOM SUBSTRATE AS BIOFERTILIZER IN AGROECOSYSTEMS OF BLUEBERRY

17:45 – 18:00

Zoltán JUVANCZ, Krisztina DEMÉNY *(Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Science, Budapest, Hungary)*

ANTHROPOGENIC EFFECTS AT ALSÓ-HEGY IN AGGTELEK NATIONAL PARK

18:00 – 18:15

Thamer Adnan ABDULLAH[1,2], Tatjana JUZSAKOVA[1], Rashed Taleb RASHEED[2], Ali Dawood SALMAN[1], Endre DOMOKOS[1] *([1]University of Pannonia, Faculty of Engineering, Laboratory for Surface and Nanostructures (LASUNA), Veszprém, Hungary, [2]Chemistry Branch, Applied Sciences Department, University of Technology, Baghdad, Serbia)*

PREPARATION AND CHARACTERIZATION OF CERIUM DIOXIDES NANOPARTICLES FOR REMOVAL OF METHYLENE BLUE FROM WATER

18:15 – 18:30

Katalin FŐGLEIN, Ádám SZABÓ, Noémi GÁSPÁR-ZSOVÁN, Tibor TELEKESI *(KTI Institute for Trapnsport Sciences, Non-Profit LTD. Research Centre For Sustainable Transport, Department for Air Quality and Propulsion Systems, Budapest, Hungary)*

IMPACT OF COVID-19 EPIDEMIOLOGICAL MEASURES, FOCUSING ON REDUCTION AND CONSEQUENCES OF ROAD TRANSPORT EMISSIONS

Second Day:
20th of November 2020 (Friday)

09:00– 10:00 **Technical Session – 3**

Chair of the Session: **Krisztina DEMÉNY**

09:00– 09:15

Edmond HOXHA; Jeton PEKMEZI *(Faculty of Geology and Mining, Department of Mineral resource Engineering, Polytechnic University of Tirana, Albania)*

USING DRONES ON 3D MODELLING AND IDENTIFYING ENVIRONMENTAL DAMAGES IN OPEN CAST MINING

09:15– 09:30

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

IN VITRO STUDIES ON SIDE-EFFECT OF SOME INSECTICIDES ON THE GROWTH OF N_2-FIXING ROOT-NODULE BACTERIA

09:30– 09:45

Ágnes BÁLINT[1,2], Csaba MÉSZÁROS[3] *(Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary, [2]Hydro-Bio-Mechanical Systems Research Center, Óbuda University, Budapest, Hungary, [3]Department of Physics and Process Control, Institute for Environmental Engineering Systems, Faculty of Mechanical Engineering, Szent István University, Hungary)*

MODELLING OF THE SIMULTANEOUS CONVECTION-DIFFUSION PROCESS THROUGH POROUS MEDIA WITH PERCOLATIVE-FRACTAL CHARACTER AT PRESENCE OF ANOMALOUS DIFFUSION

09:45– 10:00

Olga HAFIIAK[1], Lyudmyla SYMOCHKO[1,2] *([1]Uzhhord National University, Faculty of Biology, Uzhhorod, Ukraine, [2]Institute of Agroecology and Environmental Management, Kyiv, Ukraine*

SOIL MICROBIOME IN TRANSFORMED ECOSYSTEMS

10:00– 10:15

Salma LATIQUE[1], Reda BEN MRID[2,3], Imad KABACH[2], ABDELAZIZYASRI[3], Mohamed NHIRI[2], Mimoun EL KAOUA[4], Allal DOUIRA[1], Karima SELMAOUI[1] *([1]Department of Biology, Biotechnology and Plant Protection Laboratory, Faculty of Sciences, Ibn Tofail University, Kenitra, Morocco, [2]Laboratory of Biochemistry and Molecular Genetics, Faculty of Sciences and Techniques of Tangier, Morocco, [3]AgroBioSciences Research Division, Mohammed VI Polytechnic University, Benguerir, Morocco, [4]Department of Biology, Laboratory of Biotechnology and molecular bioengineering, Faculty of Sciences and Technology FSTG, Cadi Ayyad University, Gueliz-Marrakech, Morocco)*

SEAWEED EXTRACT TREATMENT ENHANCES VEGETATIVE GROWTH AND ANTIOXIDANT PARAMETERS IN SALT STRESSED TRITICUM DURUM L.

10:15 – 10:30 BREAK

10:30– 11:15 **Poster Session**

Chair of the Session: **Zoltán JUVANCZ**

10:30 – 10:40

O. KICHIGINA[1], N. PALAPA[2], O. USTYMENKO[3] *([1]Independent Seed Ecology Laboratory, Institute of Agroecology and Environmental Management of NAAS, Kyiv, Ukraine; [2]Rural Development Sector, Institute of Agroecology and Environmental Management of NAAS, Kyiv, Ukraine, [3]Department of Medicinal Plant Technology, Experimental Station of Medicinal Plants of the Institute of Agroecology and Environmental Management of NAAS, Kyiv, Ukraine)*

NITROGEN-FIXING POTENTIAL OF MEADOW CLOVER VARIETIES IN ENSURING SOIL QUALITY IMPROVEMENT (Poster)

10:40 – 10: 50

Ildikó JÁRDII, Gergely PÁPAY, Eszter S.-FALUSI, Dénes SALÁTA, Károly PENKSZA *(Szent István University, Faculty of Agricultural and Environmental Sciences, Institute of Crop Production Sciences, Gödöllő, Hungary)*

INVESTIGATION GRAZING IN THE MIDDLE IPOLY (Poster)

10:50 – 11:00

Salma LATIQUE[1], Reda BEN MRID[2,3], Imad KABACH[2], Abdelaziz YASRI[3], Mohamed NHIRI[2], Mimoun EL KAOUA[4], Allal DOUIRA[1], Karima SELMAOUI[1] *([1]Department of Biology, Biotechnology and Plant Protection Laboratory, Faculty of Sciences, Ibn Tofail University, Kenitra, Morocco, [2]Laboratory of Biochemistry and Molecular Genetics, Faculty of Sciences and Techniques of Tangier, Morocco, [3]AgroBioSciences Research Division, Mohammed VI Polytechnic University, Benguerir, Morocco, [4]Department of Biology, Laboratory of Biotechnology and molecular bioengineering, Faculty of Sciences and Technology FSTG, Cadi Ayyad University, Gueliz-Marrakech, Morocco)*

ROLE OF ULVA RIGIDA EXTRACT IN ALLEVIATION OF SALINITY STRESS ON WHEAT PLANTS (Poster)

11:00 – 11:10

Dominika FALVAI, Szilárd CZÓBEL *(Szent Istvan University, Department of Nature Conservation and Landscape Ecology, Hungary)*

POSSIBILITIES OF INSTRUMENTAL MEASUREMENT RELATED TO THE TREE HEALTH (Poster)

11:10 – 11:20

Bernadett KÓSA[1], Györgyi GELYBÓ[2], Tamás ÁRENDÁS[3], Nándor FODOR[3], Hosam E.A.F. BAYOUMI HAMUDA[1] *(Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary, [2]Department of Soil Physics and Water Management, Institute for Soil Science and Agricultural Chemistry, Centre for Agricultural Research, Budapest, Hungary, [3]Crop Production Department, Agricultural Institute, Centre for Agricultural Research, Brunszvik, Martonvásár, Hungary)*

LEAF SCALE PHOTOSYNTHESIS MEASUREMENTS IN MAIZE FIELD UNDER DIFFERENT FERTILIZER TREATMENT (Poster)

11:20 – 11:30 BREAK

11:30– 12:30 **Technical Session – 4**

Chair of the Session: **Lóránt SZABÓ**

11:30 – 11:45

Gyöngyi FARKAS-KARAY[1], Dávid FARKAS[1], Emőke IMRE[2], Ágnes BÁLINT[2,3], Adildorj KHALIUNAA[3], Boldbaatar TSENDSUREN[3], Dang Thi Quynh HUONG[3], Lamas Lopez Lizeth GUADALUPE[3] *([1]Department of Hydraulic and Water Resources Engineering, Budapest University of Technology and Economics, Budapest, Hungary, [2]Hydro-Bio-Mechanical Systems Research Center, Óbuda University, Budapest, Hungary; [3]Institute of Environmental Engineering and Natural Sciences, Óbuda University, Budapest, Hungary)*

LABORATORY TEST FOR SAND BOIL FORMATION NEAR A FLOOD PROTECTION DIKE

11:45 – 12:00

Fatemeh ZAREI[1], Leila NATEGHI[2], Hosam E.A.F. BAYOUMI HAMUDA[3], Maryam ZAREI[4] *(1Halal Research Center Islamic Republic of Tehran, Iran, [2]Department of Food Science and Technology, Faculty of Agriculture, Varamin-Pishva Branch, Islamic Azad University, Varamin, Iran, Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary, [4]Community Nutrition Department, Ministry of health and medical education, Tehran, Iran)*

EXTRACTION AND IDENTIFICATION OF PROBIOTIC BACTERIA WITH POTENTIAL OF GABA PRODUCTION FROM TRADITIONAL WEST AZARBAIJAN DAIRY OF IRAN

12:00 – 12:15

Emőke IMRE[1], Zsombor ILLÉS[2], Ágnes BÁLINT[3], Adildorj KHALIUNAA[3], Boldbaatar TSENDSUREN[3], Dang Thi Quynh HUONG[3], Lamas Lopez Lizeth GUADALUPE[3] *([1]Institute of Power Engineering and HBM Systems Research Center, Óbuda University, Budapest, Hungary, [2]Department of Engineering Geology and Geotechnics, Budapest University of Technology and Economics, Budapest, Hungary, [3]Institute of Environmental Engineering and Natural Sciences and HBM Systems Research Center, Óbuda University, Budapest, Hungary)*

THE SATURATED HYDRAULIC CONDUCTIVITY OF 2-FRACTION GRANULAR SOILS AND THE INTERNAL STABILITY

12:15 – 12:30

Hosam E.A.F. BAYOUMI HAMUDA[1], Lyudmyla SYMOCHKO[2] *(Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary, [2]Uzhhorod National University, Uzhhorod, Ukraine)*

APPLICATIONS of COMPOST AND WASTEWATER SLUDGE CHANGES THE BIOLOGICAL ACTIVITIES IN BROWN FOREST SOIL

12:30 – 13:30 BREAK

13:30– 15:00 **Technical Session – 5**

Chair of the Session: Emőke IMRE

13:30 – 13:45
Ágnes RŐCZEY, Hosam E.A.F. BAYOUMI HAMUDA *(Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary)*

ECOTOXIGOLOGICAL IMPACT OF SOME FUNGICIDES USED IN AGRICULTURE ON SOIL USEFUL MICROBIOTA AND ENZYMATIC ACTIVITIES IN VITRO

13:45 – 14:00
Katalin HRUSTINSZKI, Hosam E.A.F. BAYOUMI HAMUDA*(Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary)*

EFFECTS OF SEWAGE SLUDGE APPLICATION ON THE SOME BIOLOGICAL ACTIVITIES IN THE RHIZOSPHERES OF COMMON BEAN AND CORN

1400 – 14:15
Krisztina DEMÉNY *(Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary)*

ANALYSING LAND USE CHANGE IN THE GÖDÖLLŐ HILLS DURING 1990'S

14:15 – 14:30
Lóránt SZABÓ *(Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary)*

WORKING METHOD OF A HEAT PUMP

14:30 – 14:45
Rita BODÁNÉ-KENDROVICS *(Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary)*

PRACTICE-ORIENTED ENVIRONMENTAL ENGINEERING EDUCATION AT THE ÓBUDA UNIVERSITY

14:45 – 15::00
Ruslan MARIYCHUK (*Faculty of Humanities and Natural Sciences, University of Prešov, Prešov, Slovakia)*

GREEN SYNTHESIS OF METAL NANOPARTICLES WITH RESPONSE IN INFRARED SPECTRAL REGION FOR MEDICINAL APPLICATIONS

15:00 – 15:15
Csaba ÁGOSTON *(KVI-PLUSZ Environmental Testing Office Ltd. Budapest, Hungary)*

EFFECT OF THE GREEN WASTE COMBUSTION ON THE AMBIENT AIR'S QUALITY

15:15 – 15:30
András SZEDER *(Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary)*

ENVIRONMENTAL PROBLEMS OF AIRCRAFT MAINTENANCE AND RENOVATION AT THE LISZT FERENC REPAIR BASE – SUMMARY

15:30 – 15:45
Imre L. BICZÓ *(Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary)*

BIOPOLYMERS COULD BE THE SOLUTION FOR PLASTIC WASTE MANAGEMENT?

15:45 – 16:00
Linh Thùy NGUYỄN, Katalin FŐGLEIN, Tibor TELEKESI, Zoltán BORSI *(KTI Institute for Trapnsport Sciences, Non-Profit LTD., Research Centre for Sustainable Transport, Department for Air Quality and Propulsion Systems, Budapest, Hungary)*

PERSPECTIVES FOR USING CLEAN AND ENERGY EFFICIENT ROAD VEHICLES

16:00- 16:15
Huyen Minh NGUYEN, Zoltán BORSI, Tibor TELEKESI, Katalin FŐGLEIN *(KTI Institute for Trapnsport Sciences, Non-Profit LTD., Research Centre for Sustainable Transport, Department for Air Quality and Propulsion Systems, Budapest, Hungary)*

RANKING LIST AND ROADSIDE ENVIRONMENTAL TRAFFIC INSPECTIONS FOR TRANSPORT GREENERING IN HUNGARY

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16:30 **Closing Ceremony**

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ABSTRACTS OF THE ACCEPTED PAPERS

Theme: "Sustainable Environmental Protection & Waste Management Responsibility"
November 19 – 20, 2020 RKK – Óbuda University, Budapest, Hungary
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THE ROLE OF NUCLEAR IN DECARBONISATION

Pal KOVACS

Prime Minister's Office – State Secretary, Budapest, Hungary

***Abstract**: Nuclear plays a crucial role in the Hungarian electricity system. More than half of the domestic electricity generation came from nuclear in the first half of 2020. Besides this, the Hungarian nuclear power plant generates 36% of the domestic electricity consumption, renewable energy (mainly PV) generates another 11%, and Hungary has an electricity import share of approximately 30%. The electricity consumption in Hungary has a growing tendency, between 2013-2019, the annual average growth rate was 1.,3%. The peak load also increases, the records were broken several times last year. The current maximum peak load (7105 MW) was reached on 5th of December 2019. Until 2033 about 2500 MW capacity from the current power plant fleet will go offline, but the electricity demand will grow by approx. 1000MW. To meet electricity demand in a low carbon way, nuclear power will be inevitable for the electricity system. When looking at European examples we see that low-carbon electricity generation is reached in countries with high nuclear and/or hydro share in the electricity-generation mix. The Hungarian example shows that with nuclear power generation more CO_2 emission can be avoided, than the amount absorbed by forests. Half of the EU Member States rely on nuclear energy. Currently 9 EU Member States are building or planning to build new nuclear units. Hungary is one of them. Paks II. is a capacity replacement project, the two new nuclear units (2x 1200MWe) will on the long run replace the aging units currently in operation. Paks II. is Hungary's biggest project with a capital expenditure of 12,5 bn euro. It includes an outstanding technical solution as the Russian primary circuit is paired with a Western European turbine-generator set from GE-Alstom and an also Western European I & C system from the Siemens-Framatome consortium. In the summer of 2019 construction works of the project started on the construction and erection base (so called CEB). This area contains about 80 buildings, such as complex for assembly works, concrete batching facilities, office buildings. Until the end of September 2020 the Paks II. Project has already obtained 478 licenses, among them major ones like the environmental license and the site license (both effective). With the submission of the Implementation License Application (ILA) to the Hungarian Atomic Energy Authority on 30th June 2020 the most important licensing procedure started. The main tasks of the next months are to continue with the construction of the CEB buildings and to carry out soil improvement works and to construct the slurry wall.*

Keywoeds: *Hungarian electricity system, low-carbon electricity generation, construction and erection base*

Biography:

Pál Kovács:
He is theHungarian state secretary responsible for the maintenance of the capacity of the Paks NPP, Hungary

CIRCULAR ECONOMY - THE WAY FORWARD TO SUSTAINABLE DEVELOPMENT

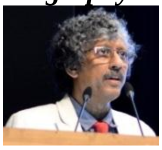
Sadhan KUMAR GHOSH

Professor, Department of Mechanical Engineering, and Chief Coordinator, Centre for Sustainable Development and Resource Efficiency Management, Jadavpur University;
President, International Society of Waste Management, Air and Water (ISWMAW)
sadhankghosh@gmail.com;Mobile: 9830044464

Abstract: Concept of recirculation of resources has been discussed in the Stockholm Conference. Based on that concept, recently the policy makers, researchers, major global companies and implementers are attracted and increased their attention towards transition from the existing linear economy model to a circular one. After years of growing income inequality, concerns about technology-driven displacement of jobs, and rising societal discord globally, the combined health and economic shocks of 2020 have put economies into freefall, disrupted labour markets and fully revealed the inadequacies of our social contracts. A new circular economy model is needed to build truly sustainable businesses –that is recognized by the business leaders gathering at the World Economic Forum. Without urgent action, global waste will increase by 70% on current levels by 2050, according to the World Bank's "What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050" report. The global annual waste generation is expected to jump to 3.4 billion tons over the next 30 years, up from 2.01 billion tons in 2016. In 2016, the world generated 242 million tons of plastic waste or 12% of all solid waste. Out of over 300 million tons of plastics produced every year, nearly 8 million tons are dumped into the oceans as plastic waste globally, and this will be doubled by 2025 at current rates of consumption and production, if no action is taken up to curb it. The 3R and circular economy are the way of rethinking our approach to waste. The portion of the write-up is excerpts from the book, CircularEconomy: Global Perspective, S. K. Ghosh, 2020, Springer Nature, gives a glimpses of the circular economy and its need.

Keywords: *Circular Economy, Consumption rate, Materials Extraction, Plastics waste, Solid Waste, 3R*

Biography:



Completed his PhD from Jadavpur University, India and published nearly 300 papers in reputed journals, proceeding & books. He is in editorial board of repute journals and Associate Editor of Journal of Waste Management and Materials Cycle and Editor-in-chief of IconSWM Publications having collaboration with 40 countries. He is a renowned personality in the field on Waste Management, Circular Economy, Green Manufacturing, Supply Chain Management, Sustainable Development, Co-processing of Hazardous & MSW in cement kiln, Plastics Waste & E-waste management & recycling, management system standards (ISO) and TQM having three patents approved. He is consultant & international expert of UNCRD)/DESA, Asian Productivity Organization, Japan, China Productivity Council, SACEP Sri Lanka, IGES Japan etc. He was convener of ISO TC 61 WG2, member in the Indian mirror committee of ISO TC 207 & ISO TC 275. He worked in various expert committee of the government. He is available at: sadhankghosh9@gmail.com & www.sadhankghosh.com.

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SPRINGER AUTHOR ACADEMY: A STEP-BY-STEP GUIDE ON WRITING AND PUBLISHING YOUR JOURNAL MANUSCRIPT

Nabil KHELIFI

Senior Editor, Manager of Springer MENA program
Springer, a part of Springer Nature
Heidelberg, Germany

***Abstract**: Scientific publication must be seen as an important, if not the most important, part of the research process. It is a central piece of the process that makes science advance. The rapid progress in the trends of scientific publication is enhanced by the availability of many tools that did not exist before.*
However, writing research papers for scientific journals is still not easy and is very competitive. It requires substantial effort which can be maximized by following a few simple guidelines when creating the product for submission. By following guidelines and avoiding common errors, the process can be streamlined and success realized.
Here, we share advice on how to effectively write and structure your paper. After producing data and generating ideas from your research, how do you write a clear and concise paper that attracts the attention of journal editors and readers? How should you prepare a cover letter to make a first good impression about your research paper? How should you respond to reviewer reports?
During this presentation, we'll provide a step-by-step guide to getting you started right away at preparing a successful publication following this plan:
1. What should be the motivation that can inspire you to accomplish a successful publication?
2. What to do before you start writing and how to efficiently prepare the needed literature
3. Which kind of writing style you should learn/use
4. How to logically link your ideas throughout the manuscript
5. Which structure you should follow when preparing your manuscript
6. How to present figures and tables
7. How to shape appealing title and abstract after you finish writing
8. Which journal you should chose and how you select the most appropriate journal
9. How to prepare a cover letter to attract the attention of editors
10. How to answer reviewers' comments

Biography:

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Senior Editor, Springer, MENA region
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Special Advisor, IC-SEWEN19
Springer, part of Springer Nature
Heidelberg, Germany

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SOIL MICROBIAL DIVERSITY AND FOOD SECURITY

Lyudmyla SYMOCHKO[1,2], Hosam E.A.F. BAYOUMI HAMUDA[3], Vitaliy SYMOCHKO[1], Olena DEMYANYUK[2]*

[1] Uzhhord National University, Faculty of Biology, Uzhhorod, Ukraine*
[2]Institute of Agroecology and Environmental Management, Kyiv, Ukraine
[3]Obuda University, Faculty of Light Industry and Environmental Engineering, Budapest, Hungary
**Corresponding author E-mail:* lyudmilassem@gmail.com

Abstract *Agricultural intensification affects soil biodiversity and such changes may impact on current and future food security. The World Health Organization has identified antibiotic resistance as a serious threat to human health and biosecurity across the world. The soil microorganisms play an important role in the development and spread of antibiotic resistance in humans. The aim of this study was to determine soil microbial diversity and the antibiotic resistance of soil bacteria in different agroecosystems. 244 dominating bacteria were isolated, among them 53 antibiotic-resistant bacteria. All isolates were multi-drug resistant, of which greater than 62.3% were resistant to 9 antibiotics. A study of soil samples from agroecosystems of Capsicum annuum, Vitis vinifera, Rubus idaeus L., Petroselinum crispum showed that the microbial community characterized by a high content of antibiotic-resistant microorganisms. From the soil were isolated antibiotic resistant anaerobic and aerobic microorganisms: Clostridium perfringens, Clostridium oedematiens, Clostridium difficile, Enterobacter cloacae, Enterococcus faecalis, Hafnia alvei, Bacillus megaterium, Bacillus mycoides, and Pseudomonas aeruginosa. Modern agroecosystems are the source of spread of pathogenic and opportunistic microorganisms with multiple antibiotic resistances and endangering human health.*

Keywords: *agroecosystem, antibiotic resistance, biodiversity, food security, microorganisms, soil.*

Biography:

Lyudmyla Symochko got her Master's degree in Ecology and Environment Protection in 2000 and Doctor's degree (Ph.D.) by Specialty - 03.00.16 Ecology in 2005. She is Associate Professor since 2008. Professional Career: Prof. Assoc., Dr., a lecturer at the Faculty of Biology, Uzhhorod National University, Ukraine. Symochko Lyudmyla – a specialist in environmental microbiology and ecology. Since 2008 she has focused on autecology and synecology researches of soil and water microbiota. She explores the soil resistome and the role of natural and transformed ecosystems as a reservoir of antibiotic-resistant microorganisms. She is developing new and improving existing methods of bioindication and bioremediation. She is working with microbiological monitoring in different types of ecosystems. Detects antibiotic-resistant opportunistic pathogens in the environment and provide they risk assessment to human health. She is author of over 150 scientific publications, including 5 books.

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TO SAVE THE GLOBE: THE CHANGE IN CO_2 PARADIGM IS A MUST!

Jozsef STEIER

SUNWO Plc, Budapest, Hungary

***Abstract**: With the famous Kyoto Protocol (1997) the carbon-dioxide (CO2) has been declared guilty. So far series of conferences cibled its reduction while by today even a carbon free vision got a serious political consent. In the meanwhile, climate change has been accelerating and escalating contradicting to those overall CO_2 reduction efforts. Increase of global warming with forest fires extension and ice melting are showing also an escalation. While the world air traffic has collapsed (due the COVID-19), atmospheric CO_2 level seems to be stabilizing at 400 PPM. We can simply declare that CO_2 theory does not work while we are running out of time! Let's turn the whole theory upside down. Take the CO_2 as a fertilizer (as it has always been) and start to create large green surfaces – carbon climate farms - with C4 species, agroforestry and geo-engineering while stopping the desertification or even turning it into profit center. Green Sahara and other large green projects completed with CO_2 fertilization could convert large amount of CO_2 into value with which progressive climate mitigation could start. Hungary inaugurated its first carbon climate farm in Nagyberény in 2019 while Morocco labelled our CO_2 open field fertilization pilot project as an important innovation at COP22 in 2016. We have tools for new efficient solutions, so let's convert CO_2 into green value.*

***Keywords:** carbon-dioxide*

***Biography**:*

Prof. Dr. Jozsef STEIER

Co-President of the Energy and Environment Protection Cabinet of the Budapest Chamber of Commerce and Industry (BKIK)

Ex-Chairman of the Scientific Energy Management Association Esztergom(ETE-Esztergom) and member of the ETE-Energy Strategy Committee

Energy and renewable expert of the International Energy and Environmental Protection Association (IEEPA)

Chairman and managing director of SUNWO Zrt. (Strategic Energy Technology Developing and Supply Co.)

Honorary Consul of the Republic of Guinea

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CLIMATE CHANGE CONCERN AND COMMUNICATION PATTERNS WITHIN YOUNG PEOPLE AND THEIR PARENTS

Bogdana VUJIC, Una MARCETA,Visnja MIHAJLOVIC, Jasmina PEKEZ, Ljiljana RADOVANOVI, Ivan PALINKAS

University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Serbia

Abstract: *Environmental education is a crucial starting point for environmentally friendly behaviour and raising awareness. Opposite of adults, children in the pre-adolescent and adolescent period are capable of accepting specific models of environmental behaviour. Adopting environmentally friendly lifestyle is a safe pathway to sustainable development. Since the children still do not have any perception of climate change (CC), a proper education could yield in intergenerational knowledge transfer and rising awareness on CC among elders. This research was conducted in several phases: Phase I- a preliminary survey that was provided among elementary school children (7-14y) and their parents with the primary goal to examine their perception on persona knowledge, awareness, concerns and communication patterns on C. Phase II included educational workshops on CC and the renewable sources of energy, and Phase III was a final survey that has the main goal to examine the effects of previous activities. The result indicated that both children and parents have a high-level perception of personal knowledge. Also, children think that their parent also has a high level of expertise on CC while the perceptions on peer's knowledge are quite the opposite. Answers that indicate mutual communication among children and parents showed different results. From the children's point of view, the lack of communication is revealed, while parents perceive that communication is good. Finally, after the workshops and education, the final survey indicated that communication among children and parents had been improved, but communication among peers seems to deteriorate:*

Keywords: *Environmental perception, Intergenerational knowledge transfer, Communication, Environmental education*

Biography

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STUDY THE EFFECT OF VITAMIN D3 IN TYPE 2 DIABETIC IRAQI PATIENTS WITH CHRONIC KIDNEY DISEASES

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Abstract: *Low vitamin D levels are associated with mortality in hemodialysis (HD) patients; however, the serum vitamin D thresholds are unclear. This study aimed to identify the vitamin D level below which mortality increases in HD patients. This study was designed to evaluate the vitamin D3 levels in Iraqi patients with chronic kidney disease and type 2 diabetes for both genders. Sixty Iraqi patients with chronic kidney disease and type 2 diabetes depended the hemodialysis duration less than 1 year; their age ranged between (33-60) years and compared with 30 healthy subjects as control group; their age ranged between (30-55) years, who were attending Al-Yarmok Teaching Hospital through September 2019 to March 2020. Anthropometric and biochemical parameters were measured for patients and controls. The baseline characteristics of study population are shown in Table 1. There were significant increases ($p < 0.05$) in glycemic test, urea, total cholesterol, triacylglycerol, low density lipoprotein cholesterol. While, there were significant decreases ($p < 0.05$) in high density lipoprotein cholesterol, glomerular filtration rate, and vitamin D3 in patients group as compared to the controls. Moreover, there were elevations in age and body mass index in patients group as compared to the controls. There were significant increases ($p < 0.05$) in fasting serum glucose, serum total cholesterol, triacylglycerol, and low-density lipoprotein cholesterol. While, there were significant decreases in high density lipoprotein cholesterol, glomerular filtration rate, and vitamin D3 in female patients as compared to the males. Moreover, there were elevations in body mass index, urea, and creatinine in female patients as compared to the males. Hypovitaminosis D was seen in Chronic Kidney disease (CKD) patients in this study, which encourage further work to assess whether the reference vitamin D level currently used in the general population is applicable to HD patients.*

Keywords: *Chronic kidney disease, Diabetes mellitus, Hemodialysis, Vitamin D3, Lipid profile, Renal function test*

Biography:

Israa Qusay Falih has completed her PhD at the age of 32 years from University of Basrah in Biochemistry. She is a university professor at University of Misan. She has published more than 7 papers in reputed journals.

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THE ROLE OF PHYTOREMEDIATION IN THE SOIL

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[2]Ph. D. Scholar, Department of Horticulture, CCS Haryana Agricultural University, Hisar, India,
[3]Ph. D. Scholar, Department of Food and Nutrition, CCS Haryana Agricultural University, Hisar, India,
[4]Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary

Abstract: *Pollution of our environment with heavy metals as a result of industrialization and use of agrochemicals to boost agricultural production is continuing unabated and is affecting animal and human health. As system of intensive agriculture is developing near the cities and making use of high doses of fertilizers and sewage sludge, Government and Public Opinion in world has started questioning the possible impact of these agro-chemicals and agricultural practices on the three components of our "Biotope": Soil, air and water (Environment). Soils generally contain low levels of toxic heavy metals viz., cadmium (Cd), Mercury (Hg), Lead (Pb) and Nickel(Ni) but considerable amounts of the elements can be introduced into soils via anthropogenic pathways such as dumping industrial effluent and agricultural application of sewage sludge, use of inorganic and organic agro-chemicals, application of commercial fertilizers. In addition to above mentioned key sources of heavy metals contamination in soil, the products used in our modern society are also too toxic to be disposed off without particular treatment. Not only the industries generate such kind of poisonous and hazardous waste but also many household products fall under this category. If not disposed away correctly, some cleaners, solvents, pesticides, paints in the form of sewage water can contaminate the agricultural soil in the vicinity of cities, leak into the underground water or contaminate the irrigation sources resulting in tremendous risks for the safety and health of human. In the respect of our environment, the basic recommendations of (reduce, recycle, reuse) should prevail as a prevention, instead of curing. As good as it can be applied, this principle cannot totally avoid generation of hazardous waste and therefore, long term solution must be developed. For sustainable clean ups of environment from these hazardous wastes and heavy metals, techniques and strategies includes phytoremediation. It is a three step process involving high uptake of heavy metals by roots, transportation to shoot and sequestration (distribution) of metal within the shoot. Hyper accumulator plant species exhibit the shoot/root ratio of metal content greater than 1, which reflect that specific internal system pumps metals from plant roots to shoot tissue (Brown et al., 1995).*

Keywords: *chelating agents, heavy metals, hyperaccumulattor, microbes, phytoremediation*

Biography:

Professor Dr. B. S. Panwar has completed his in-service PhD at the age of 40 years from CCS Haryana Agricultural University Hisar, India. He was the coordinator of Indo-Hungarian joint project entitled "Phytoremediation of potentially toxic heavy metals contaminated soils by agricultural crop genotypes" funded by DST New Delhi and HAS Budapest from the year2005 to 2008 and "Fate of heavy metals in crop, soil and water ecosystem" funded by INSA and HAS from the year 1997 to 2001. He was visiting professor of ETHZ Zurich, Switzerland, PSTU Mariuopole Ukraine and MSU Moscow, Russia. He has published more than 100 papers in reputed journals and has been serving as an editorial board member of repute research journals.

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ENVIRONMENTAL PROBLEMS AND PROTECTION UNDER CURRENT SITUATIONS OF 2020

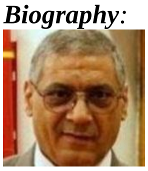
Hosam E.A.F. BAYOUMI HAMUDA*, Krisztina DEMÉNY

*Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary. *Corresponding author*

***Abstract**: What is the current situation of the global environment? Major current environmental issues may include climate change, pollution, and environmental degradation, loss of biodiversity and resource depletion. The World Health Organization has declared coronavirus disease 2019 (COVID-19) is the first pandemic caused by coronavirus named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). SARS-CoV-2 is the most pressing global health issue due to the ongoing pandemic. The conservation movement lobbies for protection of endangered species and protection of any ecologically valuable natural areas, genetically modified foods and global warming. The great fallacy of the environmental debate over the past 30 years has been the hope that an ecological turnaround can essentially be implemented with some* technological innovation programme within the existing economic order**.** *The planet Earth will not continue to offer its harvest, except with faithful stewardship. We cannot say we love the land and then take steps to destroy it for use by future generations. Environmental issues are defined as problems with the planet s systems (air, water, soil, etc.) that have developed as a result of human interference or mistreatment of the planet. Our planet is poised on the brink of a severe environmental crisis. The hard fact is that environmental pressures have increased, and some urgently need to be brought under control. Current environmental problems make us vulnerable to disasters and tragedies, now and in the future. Key environmental policies for a more environmentally friendly future are thus needed. Again, easy regulatory solutions for this simply do not exist. It is quite simply a fact that the current ways of life and economic activity have a comprehensive and deep impact on various ecosystems. Future generations and other living organisms face drastic and irreversible disadvantages. It is extremely likely that human activities, especially emissions of greenhouse gases, are the dominant cause of the observed warming since the mid-20th century.*

***Keywords**: Life and economic activity, current environmental issues, Current environmental problems, key environmental policies, environmental and human health and quality*

***Biography**:*



Prof. Dr. habil. Hosam Bayoumi Hamuda is working at Óbuda University. He is Environmental Microbiologist and Soil Biotechnologist dealing with the interactions between the microbiomes and the environment for increasing soil quality and saving the soil from pollutants as well as how benefits to use the wastewater sludge in the agriculture. His investigations are on the role of waste management, on soil quality, fertility, the crop production and environmental impacts related to the application of organic wastes to soil to assess: Soil quality, microbial inoculants; nitrification inhibitors and crop quality; Monitorization of organic matter; measurements of rhizosphere and soil microbial biomass and enzymatic activities in wastewater sludge amended soils; root systems and microbial composition in the polluted environment and roles of engineered metal oxide nanoparticles in biosphere.. Also he is interested in the role of environmental quality and relation between gut microbiomes on human health.

***Research Interest**: Waste management; Soil: Biotechnology; Protection; Sustainable; Biodiversity Plant Growth-Promoting Rhizomicrobiota (PGPR); Colonization of PGPR; Microbial inoculants in rhizosphere; Econanotoxicology; environmental quality and relation between gut microbiomes on human health.*

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NITROGEN-FIXING POTENTIAL OF MEADOW CLOVER VARIETIES IN ENSURING SOIL QUALITY IMPROVEMENT (Poster)

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[1]Independent Seed Ecology Laboratory, Institute of Agroecology and Environmental Management of NAAS, Kyiv, Ukraine;
[2]Rural Development Sector, Institute of Agroecology and Environmental Management of NAAS, Kyiv, Ukraine,
[3]Department of Medicinal Plant Technology, Experimental Station of Medicinal Plants of the Institute of Agroecology and Environmental Management of NAAS, Kyiv, Ukraine

Abstract: *Intensive use of arable land during the last century has led to a total decline in soil fertility, both in Ukraine and on the planet as a whole. Biological nitrogen is a powerful factor in improving soil fertility.* ***Motivation/Background:*** *That is why we aim to define the meadow clover varieties with a high and stable level of symbiotic nitrogen fixation.* ***Method:*** *Nitrogenase activity was determined by the acetylene reduction method using a «Chrom 5» gas chromatograph with a flame ionization detector. The number of bubbles on the roots of plants was carried out by visual direct counting. The study was conducted in the second decade of June.* ***Results:*** *During 2017-2019, we evaluated the intensity of the nitrogen fixation process of 20 varieties of meadow clover in symbiosis with the Rhizobium leguminosarum bv.trifolii 329b strain. The research was conducted with varieties recommended for cultivation in soils with the following values of Selyaninov Hydrothermal Coefficient (HTC) – 1,0–1,3 and 1,3–2,0. A positive correlation between nitrogenase activity and the number of bubbles per plant was observed (from 0,30 to 0,47). The following varieties were indicated: «Anitra», «Marusia», «Myronivska 5», «Milvus», «Nosivska 5», «Sparta». The nitrogenase activity rates of which, respectively, were: 3,1; 3,4; 3,8; 3,5; 3,2; 3,4 µmol C_2H_4/plant/hour, the number of bubbles per plant were 35, 28, 38, 30, 32, 35 unit/plant.* ***Conclusions:*** *Increasing the proportion of meadow crops in these varieties will improve soil fertility and reduce the use of mineral nitrogen fertilizers, which will contribute to improving the ecological situation in the agroecosystems.*

Keywords: *biological nitrogen, meadow clover varieties, nitrogen-fixing potential, soil fertility.*

Biography

At the age of 40 at the Institute of Agroecology and Environmental Management of NAAS, she defended her PhD dissertation entitled «Ecological features of species of the Trifolium L. genus in agroecosystems of Polissya» and received the degree of Candidate of Agricultural Sciences in specialty 03.00.16 – ecology. Today she is a Senior Research Fellow at the Independent Seed Ecology Laboratory at the Institute of Agroecology and Environmental Management of NAAS. Also, she performs the duties of the Secretary of the Scientific and Methodological Centre «Agroecology», where she takes part in the formation of applied and fundamental research and provides office management. She has about 50 scientific publications in professional journals. Her research interests include study in the field of soil microbiology; research of biodiversity of agroecosystems; seed ecology, in particular, research on the impact of ecological factors on sowing qualities of crop seeds.

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INVESTIGATION GRAZING IN THE MIDDLE IPOLY (Poster)

Ildikó JÁRDI, Gergely PÁPAY, Eszter S.-FALUSI, Dénes SALÁTA, Károly PENKSZA

Szent István University, Faculty of Agricultural and Environmental Sciences, Institute of Crop Production Sciences, Gödöllő, Hungary

Abstract *The vegetation of two different characters of cattle pastures in the middle Ipoly Valley was examined in this research. One of them was wet vegetation beef cattle pasture while the other area was a dry vegetation cattle pasture. The wet pasture was mowed before 2000. Here one sours sandy vegetation and a lower-lying, characterless, Elymus repens dominated grassland area, with fresh and dry patches were examined. There were also two types of vegetation analysed on the dry cattle pasture. One of them was a drier steppe under less pressure grazing, and the other one was a heavily used, degraded steppe which has been used serving as a resting place. There was a significant amount of species adapted to disturbance in each plot, but their proportions were different. The lowest rate was observed in the quadrats of pastures of the dry area cattle under smaller grazing pressure. On the basis of the recordings, on the wet area pasture the sour sandy lawn was more sensitive, where the grazing pressure should be monitored in order to preserve the characteristics of the vegetation. On the new area of wet pasture grazing after mowing favoured the appearance of species characteristic of natural vegetation. Among the examined areas, the dry cattle pasture under grazing pressure was found as be the most favourable in maintaining the natural vegetation. Note: The research was supported by the FEKUTSTRAT 2018 project and the OTKA K125423 application.*

Keywords: *grassland management, nature conservation*

Biography:

Ildikó T.-Járdi has working on her PhD thesis from Szent István University from School of Environmental Science, Gödöllő, Hungary. She has published more than 10 papers in journals. She is working on currently involved in the managament and conservation of domestic grasslands.

ROLE OF ULVA RIGIDA EXTRACT IN ALLEVIATION OF SALINITY STRESS ON WHEAT PLANTS (Poster)

Salma LATIQUE[1], Reda BEN MRID[2,3], Imad KABACH[2], Abdelaziz YASRI[3], Mohamed NHIRI[2], Mimoun EL KAOUA[4], Allal DOUIRA[1], Karima SELMAOUI[1]

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[2]Laboratory of Biochemistry and Molecular Genetics, Faculty of Sciences and Techniques of Tangier, Morocco,
[3]AgroBioSciences Research Division, Mohammed VI Polytechnic University, Benguerir, Morocco,
[4]Department of Biology, Laboratory of Biotechnology and molecular bioengineering, Faculty of Sciences and Technology FSTG, Cadi Ayyad University, Gueliz-Marrakech, Morocco

***Abstract**: Salt stress is a major adverse factor that can lower seed germination and seedlings growth, leading to reduced plant growth and ultimately lower crop productivity in arid and semi-arid regions of the world. In order to improve crop tolerance to this abiotic stress, many research studies have the importance of seaweed extract (SWE) in alleviating stress damage to plants. Seaweed extracts are used as nutrient supplements or biofertilizers in agriculture to increase plant growth and yield. In this study, we examined the effect of liquid seaweed extracts made from Ulva rigida on the growth of durum wheat (Durum triticum L) (cv Karim) under salt stress in laboratory and greenhouse conditions using foliar applications. We assessed SWE at different concentrations (0, 12.5, 25 and 50 %) on growth parameters (shoot length and shoot fresh weight) of wheat plants. Our results indicate that plants treated with SWE of Ulva rigida at lower concentrations (12.5 %) and under moderate salt stress showed enhanced growth (better response in shoot lenght and consequently greater fresh weight). Furthermore, Ulva rigida treatments increase activities of antioxidant enzyme systems to improve the growth of wheat plants under salt stress. This study provides important information on the identification and utilization of Moroccan seaweed resources as a source of liquid extracts as biostimulants in agriculture.*

***Keywords:** Antioxidant enzyme, foliar application, growth, wheat plant, salt stress, Ulva rigida*

Biography:

Researcher in Marine Biotechnology specially on plant Physiology and Seaweed Valorization; Ph D Student from Ibn Tofail University, Engineer in Industry and Safety Food since 2010; Engineer in Biotechnology Applied to Plant Improvement since 2008 from the Faculty of Sciences and Techniques at Cadi Ayyad University.

My Research focus on the importance of seaweed liquid extracts from Macroalgae in improving the agronomic performance of crops especially Bean and wheat plants cultivated on soil or in hydroponic systems and under abiotic stress.

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POSSIBILITIES OF INSTRUMENTAL MEASUREMENT RELATED TO THE TREE HEALTH (Poster)

Dominika FALVAI, Szilárd CZÓBEL

Szent István University, Department of Nature Conservation and Landscape Ecology, Hungary

Abstract: *The stability of urban trees is a key factor that affects everyone. Sick and unstable urban trees pose a great risk to anyone. Three instruments capable of determining and evaluating the health and stability of trees are presented. One of the measuring instruments called ArborSonic FAKOPP 3D acoustic tomography, which is able to detect the size and location of decayed or hollow regions in the trunk non-destructively. Measurement working fast it can be completed in 5-10 minutes and creates a 3D model of the trunk with multiple layers of measurement. Customizable wind load modeling is included in the software. The next instruments called ArbiElectro impedance Tomogtaph. It works based on electric resistivity measurements. Fungi attacks even in very early stages may be determined. Not only should the trees be focused on the visible parts. A measuring device capable of examining underground areas (roots) will be presented. It called Dyna Tree Root and Trunk Testing System. With the help of instrumental measurements, the health status of trees can be determined, which is a very important factor in the urban environment. In recent years we have encountered many accidents caused by the fall of rotten trees in bad health status, for example in car parks, playgrounds and parks. In addition to these, it is important to be able to decide on construction sites which tree to cut down, as it is in poor health (decayed and with hollow parts) and which is better to keep, which are healthier specimens. This helps to preserve the diversity of the areas*

Keywords: *health of trees, ArborSonic FAKOPP 3D acoustic tomography, ArborElectro Impedance Tomograph, DynaRoot Root Testing System, instrumental measurement.*

Biography

My nam is Dominika Falvai and I will finish my PhD. in 2021.
I am doing my studies, researches at the St. Istvan University Department of Nature Conservation and Landscape Ecology.
I have many journals in Hungarian and in English languages.
I am interested in climate change, smart solutions, renewable energy and everything related to a sustainable future.

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LEAF SCALE PHOTOSYNTHESIS MEASUREMENTS IN MAIZE FIELD UNDER DIFFERENT FERTILIZER TREATMENT (Poster)

Bernadett KÓSA[1], Györgyi GELYBÓ[2], Tamás ÁRENDÁS[3], Nándor FODOR[3], Hosam E.A.F. BAYOUMI HAMUDA[1]

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[2]Department of Soil Physics and Water Management, Institute for Soil Science and Agricultural Chemistry, Centre for Agricultural Research, Budapest, Hungary,
[3]Crop Production Department, Agricultural Institute, Centre for Agricultural Research, Brunszvik, Martonvásár, Hungary

Abstract *Carbon dioxide (CO_2) fluxes between the surface and the atmosphere have large biological contribution. Photosynthesis is one of the largest of these fluxes. Components of the carbon balance are in close relationship with plant production, and eventually yield in agricultural vegetation. We examined photosynthesis of maize in the 2019 vegetation period in this study. The study site is a sowing time−fertilizer−maize variety field experiment near Martonvásár. This is a small plot experiment, where a treatment replicate consists only of two rows of maize i.e. a total of about 60-70 individual plants. Ecosystem scale micrometeorological measurements are not applicable in this type of setup and the only destructive examinations can be done upon harvest to avoid disturbance of the experiment in the vegetation season. We used non-destructive leaf scale photosynthesis measurement method (CIRAS-3, PPSystems, and Amesbury, MA, USA) regularly to explore temporal variations of assimilated CO_2 during the vegetation period. The sampling was designed to include several plants and leaves to optimize number of replicates. We selected five plants per row in five replicates (leaves). The methodology was applicable for determination of maize photosynthesis in the experiment. Light response and temperature response of photosynthesis agreed with our knowledge. We found that net photosynthesis rate of maize leaves have a well-defined profile in the vertical canopy as light and leaf age changes, which highlights the importance of repeated measurements in the canopy when planning regular observations.*

Keywords: *CO_2, fertilizer experiment, leaf scale assimilation, maize, net photosynthesis*

Biography:

Bernadett Kósa earned her BSc at Óbuda Universty in 2020. She participated in the Scientific Students' Associations Conference in 2018 and 2019. Earned the New National Excellence Program scholarship in 2018. She published her first paper in 2019. Her research interest include ecological farming, CO_2 cycling, biogas producing.

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CLIMATE CHANGE RELATED VULNERABILITY IN THE LAKE CHAD BASIN

Klaudia TÓTH

National University of Public Service, Budapest, Hungary

***Abstract**: The environmental, social, economic, political, and military aspects of the Lake Chad Basin have been well researched. However, the connection points and correlations between the sectoral elements are much less. Using regional security complex theory developed by Barry Buzan and Ole Wæver of the Copenhagen School, the research discusses how events and processes in the region interact. Data from primary and secondary sources show that the Lake Chad Basin – stretching through Nigeria, Niger, Chad and Cameroon – is one of the most fragile crisis zones of the Sahel. Over the past decades, climate change, resource depletion, demographic pressure, the shrinking process of Lake Chad, inadequate farming techniques, weak statehood, the political mismanagement of certain issues, the presence of radical Islamist groups have all left their mark on the region's development opportunities. Transforming weather patterns, poverty, desertification, declining arable land and migration caused by violent conflicts are all urging issues that the states will have to address in the future. Due to the geographical proximity of the four states, regional interdependence, cultural and economic convergence, Nigeria, Niger, Chad and Cameroon share each other's destinies, which is why it is vital to create a stable, predictable environment for local communities. The fragility of the Lake Chad Basin may also have an indirect impact on Europe, as more and more people may consider emigrating to the European continent due to the prolongation of unfavourable environmental, political, social, economic and military aspects.*

***Keywords:** climate change, demographic pressure, Lake Chad, migration, resource depletion, security*

Biography:

Klaudia Tóth has completed her BA studies at the National University of Public Service, Hungary. Now she is completing International Public Service Relations MA at the same university. She is a researcher at the Migration Research Institute, Hungary. She has won several national and institutional competitions and she has been awarded in recognition of her research work. Her main interest focuses on the security status of the Sahel region. Mainly to analyse the connection between climate change and migration and to better understand the impacts of climate change regarding social, economic, environmental, political, military issues in the Sahel. Her research activity is supported by the ÚNKP-19-2-II-NKE-86 New National Excellence Program of the Ministry for Innovation and Technology.

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CAN THE ENERGY MANAGEMENT AND THE WASTE MANAGEMENT BE HARMONIZED?

***Zoltán JUVANCZ*[1]*, László TOLNER*[2]**

[1]Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Science, Budapest,

[2]Szent István University Institute of Environmental Science, Gödöllő, Hungary

Abstract: *One of the biggest tasks of environmental science is creating more economic and environmentally friendly energy sources. Secondly, the enormously increasing amounts of waste material are also a huge challenge for environmental protection. The two previously mentioned problems can be treated in a harmonized way. The uneven energy consumption requires peaks in the use of energy. The energy consumption is higher in winter than summer in northern part of Europe. Such a seasonal deviation of energy consumption can be compensated with waste burning in winter during the cold weather. The significant portions of municipal wastes are burnable and hardly biological degradable (e.g. polyurethane, PET, PVC, PE, etc.). Moreover several types of them cannot be recirculated. Those materials can be used for energy production. The invention of our proposal, that these waste materials have to be collected and stored during the less energy consuming period, and burn them when the energy requirements are high. The selected burnable waste can be collected during the whole year period, and stored in compressed forms. The abandoned open cast mines are appropriate for such depots. In this way, consumption of fossil fuel will be reduced significantly and the waste stream decreased.*

Key words*: energy management, waste management, harmonization, energy saving*

Biography:

I have got my M.Sc. diploma at ELTE as chemistry researcher in 1975. I defended my D.Sc. title in 2003 at Hungarian Academy of Sciences. I have published more than 190 papers and lectures with more than 100 IF, and gaining almost 1400 citations. My research fields are chromatography on open tubular columns (GC, SFC, CE), and various topics of environmental protections. I visited various laboratories in USA, Germany, Sweden, and Switzerland. My best results dealt with chiral separations. I took part in the introductions more than 15 chiral selective agents. The endocrine disruptive chemicals and pharmaceutical pollutions are my research topics in environmental science. I am also interested in the educational part of environmental protections.

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POSSIBILITIES OF SPECIATION FOLLOWING ANTHROPOGENOUS ENVIRONMENTAL CHANGES IN THE CENTRAL SANDY AREA OF THE CARPATHIAN BASIN THROUGH THE EXAMPLE OF FESTUCA TAXA

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Abstract *Our goal is to check and revise the dominant Festuca species of vegetation types formed under extraordinary conditions through morphotaxonomic and ploidy analyses. To accomplish this, we had to add examinations of dominant species in grasslands further from the Danube in the Carpathian Basin and East Central Europe. Individuals of examined taxa were analysed using 26 parameters of the inflorescences. Ploidy was analysed using low cytometry. After deforestation and shrubcutting, bare soil patches of areas exposed to anthropogenous effects had provided an opportunity new vegetation to form. As a result of this work, new species Festuca pseudovaginata had been discovered here, which is endemic in the Carpathian Basin. Survey continues in order to clear other hardly identificable taxa. The results have confirmed the presence of the species, but we also have new occurences discovered. We verified F. vaginata and F. pseudovaginata from open sandy areas. In closing grasslands F. javorkae and F. wagneri appears. In Slovakia we found F. wagneri and F. pseudovaginata as new species in the country's flora. We could add new appearance data of F. javorkae, and describe F. brevipila as a new taxon of the Hungarian flora. Furthermore, a possibly new species also appeared during our research, on which we found distinctive morphological features, but to describe it as new species it needs further ITS analyses.*

Keywords: *Festuca vaginata, Festuca psammophila series, sandy vegetation*

Biography:

Ildikó T.-Járdi has working on her PhD thesis from Szent István University from School of Environmental Science, Gödöllő, Hungary. She has published more than 10 papers in journals. She is working on currently involved in the managament and conservation of domestic grasslands.

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INVESTIGATION OF THE EFFECT OF PHENOL POLLUTION ON DIFFERENT PLANTS IN POT EXPERIMENTS

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Abstract *Soil contamination with organic pollutants is one of the most serious environmental problems that can cause serious threat to people and the environment. Phenolic compounds represent a large group of molecules and have many functions regarding the aspects of development and the behaviour of the plant. Pot experiments are inexpensive in comparison to field experiments with variety of experimental treatments without contamination of the site. It is easier to observe the possible changes, because the contaminants and the material absorption are more pronounced, because the soil and root are tight and the root cannot grow out of the polluted zone. After a 14-day test period, the physical parameters were measured, but no significant differences were found between the treatments. It has changed the vitamin C content, which is very important in the oxidative stress of plants, as it is a basic material for the plant life. For vitamin C, we have also experienced the phenomenon of hormesis. It is extremely interesting how the plant tries to respond to a certain stress effect by changing the content of vitamin C. As a result of phenol contamination, we have been able to increase vitamin C in some concentrations and decrease mostly at higher concentrations, and vice versa. The amount of vitamin C in plants was measured by HPLC. Phenol as a stress factor, increased the content of vitamin C in certain concentrations in plants. By selecting a suitable non-toxic stress factor, vitamin C content can be increased in different plants.*

Keywords: *Phenol; vitamin C; antioxidant; hormesis; pot experiment; HPLC*

Biography

Name: *Dr. Ágnes Dr. habil. Mészáros-Bálint (Ágnes Bálint is the author name)*
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Scientific degree: *PhD; habilitation, Szent István University, Gödöllő, Hungary*
Institution: *Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering*
Department: *Institute of Environmental Engineering and Natural Sciences*
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Position: *Associate Professor*
Specialty:

- *Inorganic chemistry, environmental analytics, colloid chemistry*
- *Development and application of chromatographic methods for soil/plant, polymer, amino acids and food analysis*
- *Nitrogen transformation in soil/plant/atmosphere system, application of stable isotope tracers, as fertilizer*
- *Experimental and theoretical modelling of transport processes*

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RECOVERY OF SCANDIUM (III) BY LIQUID-LIQUID EXTRACTION OF MACROCYCLIC COMPOUNDS FROM NITRATE SOLUTIONS

Ali Dawood SALMAN[1,3], Tatjána JUZSAKOVA[1], Ákos RÉDEY[1], Moayyed G. JALHOOM[2], Thamer Adnan ABDULLAH[1] , Endre DOMOKOS[1]

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[2]Department of Production Engineering and Minerals, University of Technology Baghdad-Iraq,
[3]Department of Chemical and Petroleum Refining Engineering /College of Oil and Gas Engineering Basra University, Iraq

Abstract: *This study aims to investigate the impact of the supramolecular macrocyclic compounds, dicyclohexyl-18-crown-6 (DC18C6) and 1,4,7,10,13-Pentaoxacyclopentadecane, (15C5) as novel extractants for scandium extraction systems based on molecular recognition technology (MRT). Moreover, the authors set the objectives to design high-technology process using these extractants and to develop a scandium recovery method from the aqueous model solution prior to employing it in industrial applications e.g. for scandium recovery from red mud leachate. One of the main problems of scandium recovery from their ores is its selective separation from rare-earth elements (REEs) and iron, which of physicochemical properties are quite similar. The crown ethers and the related macrocyclic ligands are known to recognize fairly strictly the size of the guest cation accommodated in their cavity. During the preliminary experiments of scandium extraction, different concentrations of DC18C6 and 15C5 were used with different scandium model solutions. The complexation reaction between Sc (III) model solutions and macrocyclic ligands was confirmed by UV and ICP-OES techniques. The result showed that 15C5 has exhibited high selectivity for Sc (III), which could be of potential value in the separation and purification of Sc (III) in REEs processing industry. The main results showed the maximum extraction efficiency (99 %) has been achieved by 15C5 ligand depending on pH value of the solution. In case of using DC18C6 the maximum efficiency has reached up to 25.81%. Moreover, the complexed metal ions can be efficiently recovered/stripped out by HCl and* HNO_3

Keywords: *Scandium, Macrocyclic, Crown ethers, Dicyclohexyl, Red mud.*

Acknowledgment: *The authors would like to thank the Hungarian GINOP-2.2.1-15-2017-00106 project: Complex utilization of red mud and recovery of rare earth metals from red mud, and to Environmental Research Centre, University of Technology, Baghdad-Iraq, for their contribution to testing and measurements.*

Biography*:*

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

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SPENT MUSHROOM SUBSTRATE AS BIOFERTILIZER IN AGROECOSYSTEMS OF BLUEBERRY

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Abstract: *Blueberries (Vaccinium spp.) are one of the most commercially significant berry crops. Of all the fruit crops, blueberries are perhaps the most amenable to organic production: pest problems are fewer than with most other fruits, and they preferentially use ammonium nitrogen which is a direct breakdown product of organic nitrogen sources. Spent mushroom substrate (SMS) is a by-product of mushroom growing. It is often classified as waste despite that it is high in organic matter and mineral micronutrient and can be reused as a bioadditive or fertilizer. Spent mushroom substrate from Lentinula edodes was tested as a fertilizer in comparison with peat. Determination of the chemical composition, number of microorganisms and the content of total microbial biomass, direction of microbiological processes in soil fertilized by SMS and peat were conducted. The initial data for the analysis, calculations and mathematical analysis were the results of the first year studies of the multi-year experiment. The actual content of elements showed that SMS contains a high content of all nutrients except N ammonium. The salt content is within acceptable limits. High content of N nitrate indicates a possible risk of excessive vegetation. Analysis of the cationic-anionic composition of the aqueous extract from SMS showed, that the content of all salts is within the permissible norm, except for a slight excess of the norm by Na^+. Toxic water-soluble salts do not exceed acceptable value. Microbiological studies of the structure of soil microbial communities showed positive effects of SMS on microbial activity. Basing on these results assumptions can be made that spent mushroom substrate from Lentinula edodes has all possibilities to be used as a biofertilizer in agricultural sector.*

Keywords: *spent mushroom substrate, fertilizer, blueberry, chemical composition, soil microorganisms, microbial biomass.*

Biography:

Andrew Ravlikovsky has started his PhD at the age of 25 years at Uzhhorod National University, faculty of Biology in 2019. He is the technologist specialized on exotic mushrooms cultivation at Nature Green Ukraine LLC.

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ANTHROPOGENIC EFFECTS AT ALSÓ-HEGY IN AGGTELEK NATIONAL PARK

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Abstract: *Alsó-hegy is part of Aggteleki Nemzeti Park. It is a mostly untouched landscape, but it has some anthropogenic effects too. The vineyard activity left eroded slopes with scattered forests behind. The pastures transformed the original forests to meadows. However, these territories are regenerating to forestlands with juniper grove. A non-native pine forest was planted on the plateau and invasive acacia groves are frequent at the foot of Alsó-hegy. There are several ruins of lime kilns, where the bare limestone peeps into the surface. The pit of an abandoned marble mine shows the traces of human activity. A small hunter house is the only man made structure on the plateau. The speleological activity can also be recognized in Alsó-hegy. The narrow entrances of pits have been widened, to allow descending the cave researchers to the bottom of caves. The entrances of the big horizontal caves (Meteor, 404 Víznyelő) are closed with iron doors, to prevent the illegal visits. However, these human activities influence the natural landscape to a minor extent only. The main research point is to survey which type of anthropogenic effects changed the landscape and how they transformed it.*

***Keyword**:Alsó-hegy, anthropogenic effects, natural*

Biography:

I have got my M.Sc. diploma at ELTE as chemistry researcher in 1975. I defended my D.Sc. title in 2003 at Hungarian Academy of Sciences. I have published more than 190 papers and lectures with more than 100 IF, and gaining almost 1400 citations. My research fields are chromatography on open tubular columns (GC, SFC, CE), and various topics of environmental protections. I visited various laboratories in USA, Germany, Sweden, and Switzerland. My best results dealt with chiral separations. I took part in the introductions more than 15 chiral selective agents. The endocrine disruptive chemicals and pharmaceutical pollutions are my research topics in environmental science. I am also interested in the educational part of environmental protections.

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PREPARATION AND CHARACTERIZATION OF CERIUM DIOXIDES NANOPARTICLES FOR REMOVAL OF METHYLENE BLUE FROM WATER

Thamer Adnan ABDULLAH[1,2,] Tatjana JUZSAKOVA[1], Rashed Taleb RASHEED[2], Ali Dawood SALMAN[1], Endre DOMOKOS[1]

[1]University of Pannonia, Faculty of Engineering, Laboratory for Surface and Nanostructures (LASUNA), Veszprém, Hungary,
[2]Chemistry Branch, Applied Sciences Department, University of Technology, Baghdad, Serbia

Abstract: *Dyestuff discharges into water from the different industries such as leather, dyes manufacturing and organic materials have negative effect to the human health and his environment. Researchers generally use various other techniques to remove dyes from water such as chemical oxidation, membrane separation, coagulation /flocculation, and ion exchange. One of the best and cost effective techniques is adsorption. In this article, cerium dioxide (CeO_2) was used as a nanoadsorbent material to remove methylene blue (MB) from water. The nanoparticles of CeO_2 were prepared using ceric sulfate tetrahydrate ($Ce(SO_4)_2.4H_2O$), urea (NH_2CONH_2) and cetyl trimethylammonium bromide (CTAB) as surfactant. CeO_2 nanoparticles were annealed at 500°C. Nanoparticles of CeO_2 were characterized using different techniques. The two famous techniques, namely, X-ray diffraction (XRD) and scanning electron microscopic (SEM) were used to study the surface chemistry of the nanoparticles. Atomic force microscopic (AFM), thermal gravimetric (TG) methods recognized the decomposition steps and nanosize of the prepared nanoadsorbent. Fourier transform spectrometry (FTIR) was used to investigate the structure of the nanomaterials. CeO_2 nanoadsorbents were used for MB removal from water. The adsorption procedures for MB removal from water using CeO_2 have been done using the following conditions: shaking rate 250–350 rpm, reaction time is from 0 to 70 min, and MB concentration 2 mg/L, at room temperature. UV/Visible spectrophotometer was used to study the removal efficiency of MB from water. CeO_2 annealed at 500°C exhibited the highest removal efficiency, 89% after contact time of 50 minutes as compared to the fresh CeO_2.*

Keywords *Methylene blue, adsorption, dyes removal, cerium dioxide, nanoparticles*

Acknowledgement: *This work was supported by GINOP-2.3.2-15-2016-00016 project: Excellence of strategic R+D workshops: Development of modular, mobile water treatment systems and waste water treatment technologies based on University of Pannonia to enhance growing dynamic export of Hungary.*

Biography:

Thamer Adnan Abdullah completed his Master of Chemical Engineering from Guru Gobined Singh Indraprastha University New Delhi., since 2008 he is working as assistant lecturer in the University of Technology, Baghdad, in Applied Science Department, Chemistry Branch Group. Currently he is doing his PhD and he is researcher in Laboratory for Surfaces and Nanostructures (LASUNA), Faculty of Engineering, University of Pannonia, Veszprem, Hungary. He has several articles published in sciencediret reputed journals and has participated in many international conferences in the field of environmental chemistry and nanoresearch.

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IMPACT OF COVID-19 EPIDEMIOLOGICAL MEASURES, FOCUSING ON REDUCTION AND CONSEQUENCES OF ROAD TRANSPORT EMISSIONS

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KTI Institute for Trapnsport Sciences, Non-Profit LTD., Research Centre for Sustainable Transport, Department for Air Quality and Propulsion Systems, Budapest, Hungary

Abstract: *Road transport is partly responsible for urban air pollution, which endangers the health of many people. Pollutants emitted by vehicles, according to WHO (World Health Organization) estimates, claimed the early deaths of 4.2 million people worldwide in 2016. The Member States of the European Union also try to control the emissions of harmful substances in various ways, hence transport greening plays a key role in Hungary's short- and long-term goals.*

However, on March 4, 2020, the coronavirus appeared in Hungary as well. In order to prevent a large-scale outbreak of the epidemic, schools were closed and stricter access restrictions were introduced in several stages, forcing companies and institutions to allow their employees to work from home. Factories and service industry have been forced to shut down, in part or in full, leading to a reduction in the number of road users, with a significant impact on human health, the economy and wildlife.

As a result of the reduction of pollutant emissions, the air became clearer. However, due to the topographic conditions of our country, this process could only take place to a small extent and slowly until mid-April. At the end of April, windy, rainy weather removed pollutants from the atmosphere to an increased extent. The sky over Hungary became clear and blue. Greening traffic would help maintain this status quo.

Keywords*: Covid-19, epidemiological measures, reduction and consequences, road transport emissions*

USING DRONES ON 3D MODELLING AND IDENTIFYING ENVIRONMENTAL DAMAGES IN OPEN CAST MINING

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Faculty of Geology and Mining, Department of Mineral resource Engineering, Polytechnic University of Tirana, Albania

Abstract: *The Drone technology recently has many applications. One of its very popular applications is in geology and mine field. This paper presents a case study on 3D modelling of the open cast mine in Progër - Bilisht, Albania using Drone technology. This open cast mine is located on the south east of Albania, close to Korça city. The main mineral is limestone. The altitude is varied from 951m to 895m. The destination of this mineral is the construction industry, cement and lime production. The yearly production capacity is around 30,000 m^3 per year. The paper gives a brief explanation of the methods and materials used to create a 3D model in mining. The method used to make a 3D model and indentify the environmental damages in open cast mine is using Drone technology. Final result of the Data processing is 3D Model of Progër – Bilisht open cast mine which can be rotated, and zoomed in any direction giving the possibility to check details of the opencast mine, to measure distances, angles, surface and volumes. Furthermore the paper gives conclusions and recommendations. One of the most important conclusions is that using Drones is very easy, and cost less way to collect data, which can elaborate with different software to build 3D models. From the other side the environmental damages must be considered through reforestation of the area.*

Keyword: *Open cast mine; 3D modelling; Drones*

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IN VITRO STUDIES ON SIDE-EFFECT OF SOME INSECTICIDES ON THE GROWTH OF N2-FIXING ROOT-NODULE BACTERIA

Mungunzaya GANBAT, Hosam E.A.F. BAYOUMI HAMUDA*

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Abstract: *The biological N_2-fixation is the main source of N input in agricultural soil. However, several environmental conditions are limiting factors to the growth and activity of the N_2-fixing root nodule rhizobia. One of the most important and potentially limiting factors to biological N_2 fixation is the use of pesticides including the insecticides. The objective of the study is to investigate the adverse effect of insecticides on N_2-fixing rhizobia. Experiments were conducted to study the impact of seven insecticides on the growth of seven strains of N_2-fixing root-nodule rhizobia in vitro by measuring optical density. The rhizobial strains were grown in yeast extract mannitol broth medium treated each with different concentrations of each insecticide and incubated for 48 hours in microfermentor at 28°C. The results illustrated that insecticides react differently with the strains depending on their toxicity and concentration. The result provides partial explanation of the compatibility of Rhizobium strains and insecticides under laboratory conditions. For further task, it is required to investigate the adverse effects of these insecticides on nodulation and N_2-fixation capacity of specific host plants with their rhizobia in pot and field experiments as well as other vital microbial processes in a wide range of soils.*

Keywords: *Insecticides, N_2-fixation, root-nodule bacteria, rhizobium, relative growth*

Biography:

Prof. Dr. habil. Hosam Bayoumi Hamuda is working at Óbuda University. He is Environmental Microbiologist and Soil Biotechnologist dealing with the interactions between the microbiomes and the environment for increasing soil quality and saving the soil from pollutants as well as how benefits to use the wastewater sludge in the agriculture. His investigations are on the role of waste management, on soil quality, fertility, the crop production and environmental impacts related to the application of organic wastes to soil to assess: Soil quality, microbial inoculants; nitrification inhibitors and crop quality; Monitorization of organic matter; measurements of rhizosphere and soil microbial biomass and enzymatic activities in wastewater sludge amended soils; root systems and microbial composition in the polluted environment and roles of engineered metal oxide nanoparticles in biosphere.. Also he is interested in the role of environmental quality and relation between gut microbiomes on human health.

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MODELLING OF THE SIMULTANEOUS CONVECTION-DIFFUSION PROCESS THROUGH POROUS MEDIA WITH PERCOLATIVE-FRACTAL CHARACTER AT PRESENCE OF ANOMALOUS DIFFUSION

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Abstract *Soil contamination with organic pollutants is one of the most serious environmental problems that can cause very serious threats to population and the environment. Therefore, the both experimental-, and modelling type investigation of such very complex-type transport processes are, and will be of crucial importance in the future, too. In agreement with the recent most advanced simulation methods, in the present work all results are realized on the base of the extended irreversible thermodynamics. A novel-type analytical solution is proposed for simultaneous convection-diffusion processes taking place through porous media. It is shown that the Riccati-type ordinary differential equation, frequently applied at modelling of the simultaneous convection-diffusion type processes, may be interpreted in a more general manner, as it has been done. The new modelling results are compared to the earlier analytical solutions and their relevance for accurate future modelling of such types of drying processes is also discussed. The completely novel-type solution of the problem indicated is realized in Lagrangian representation of continuum mechanics by extensive use of the MAPLE symbolic computer algebra system.*

Keywords: *Non-equilibrium thermodynamics; convection flow; anomalous diffusion; computational fluid dynamics*

Biography

Name: *Dr. Ágnes Dr. habil. Mészáros-Bálint (Ágnes Bálint is the author name)*
Highest educational degree: *MSc, Chemistry and Physics; Bsc, Software Information Technologist, Roland Eötvös University, Budapest, Hungary*
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Specialty:
- *Inorganic chemistry, environmental analytics, colloid chemistry*
- *Development and application of chromatographic methods for soil/plant, polymer, amino acids and food analysis*
- *Nitrogen transformation in soil/plant/atmosphere system, application of stable isotope tracers, as fertilizer*
- *Experimental and theoretical modelling of transport processes*

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SOIL MICROBIOME IN TRANSFORMED ECOSYSTEMS

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[2]Institute of Agroecology and Environmental Management, Kyiv, Ukraine

Abstract*: The number and area of unauthorized landfills are increasing systematically and impact on forest ecosystems and their components. Pollution negatively affects soil microbiota. Landfills become a habitat for many pathogenic microorganisms, including antibiotic resistant bacteria. The structure of the soil, its physiological and biochemical properties change significantly, there are also qualitative and quantitative changes in the soil microbiota. Soil samples for analysis were taken from different unauthorized landfills. In the most contaminated areas, soil characterized a high number of pedotrophs 27.34 million CFU/g.d.s., which develop intensively on depleted soils, due to their trophic specificity; oligotrophs 16.43 million. CFU/g.d.s., which is an indicatorof reducing the content in the soil of nutrients, micromycetes 7.68 thousand CFU/g.d.s., this is due to the localization in the soil of plant residues, namelyfiber, in smaller quantities there is the presence of diazotrophs 33.60%, streptomycetes 2.34 million CFU/g.d.s involved in the decomposition of plant and animal residues in the soil and ammonifiers 10.09 million CFU/g.d.s. Comparative analysis shows that in more contaminated areas the number of nitrogen fixers, ammonifiers, streptomycetes, and bacteria that use mineral nitrogen decreases, respectively the number of oligotrophs, pedotrophs and myxomycetes that suppress them increases. This is the reason for the violation of the biodynamic balance of the processes of synthesis and destruction of organic matter and the availability of nutrients to plants. As a result, we observe the transformation of flora in the studied areas or lack of vegetation.*

Keywords: *ecosystem, soil, microbiota, biocenosis, transformation.*

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SEAWEED EXTRACT TREATMENT ENHANCES VEGETATIVE GROWTH AND ANTIOXIDANT PARAMETERS IN SALT STRESSED TRITICUM DURUM L.

Salma LATIQUE[1], Reda BEN MRID[2,3], Imad KABACH[2], ABDELAZIZYASRI[3], Mohamed NHIRI[2], Mimoun EL KAOUA[4], Allal DOUIRA[1], Karima SELMAOUI[1]

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[4]Department of Biology, Laboratory of Biotechnology and molecular bioengineering, Faculty of Sciences and Technology FSTG, Cadi Ayyad University, Gueliz-Marrakech, Morocco

***Abstract**: Nowadays, food security depends on the increased production of cereals such as wheat (Triticum durum L.) which is one of the main sources of calories and protein. However, crop production is severely affected by adverse environmental stresses such as salt stress (Rahaie and al., 2013). To limit the negative effet of salinity on plant growth, many methods have been used. A lot of research studies have shown the importance of liquid extracts obtained from seaweeds as foliar sprays for several crops to improve growth under adverse factors (Metha and al., 1967, Latique and al., 2014). The present study reports the result of wheat plants (Triticum durum L.) irrigated with either 2 or 4 g/l of saline solution (SS) by sodium chloride (NaCl) were treated with aqueous extracts of green macroalgae Ulva rigida (URE) in order to increase wheat salt tolerance. Seaweed treated plants showed higher ability to tolerate salt stress (2 or 4 g/l of NaCl) by significant (P>0.5%) increasing of photosynthetic pigments (Chlorophyll: Chlorophyll total, chlorophyll a and b types) contents. The increase of these contents was associated with increasing activities of antioxidant enzyme systems superoxide dismutase (SOD); phosphoenolpyruvate carboxylase (PEPC); glutathione reductase (GR); Glutamate dehydrogenase (GDH); glutathione peroxidase (GPx); glutathione-S-transferase (GST); Isocitrate dehydrogenase (ICDH). However, wheat plant exposed to salt stress showed significant changes in all growth parameter and antioxidant enzyme activities compared with that in plants irrigated with regular water. This study indicates that the algae extracts could be used as a promising plant growth enhancer for treating wheat plants irrigated with saline solution.*

***Keywords:** Antioxidant enzyme, food security, wheat plant, salt stress, seaweed extract, Ulva rigida*

Biography:

Researcher in Marine Biotechnology specially on plant Physiology and Seaweed Valorization; Ph D Student from Ibn Tofail University, Engineer in Industry and Safety Food since 2010; Engineer in Biotechnology Applied to Plant Improvement since 2008 from the Faculty of Sciences and Techniques at Cadi Ayyad University.

My Research focus on the importance of seaweed liquid extracts from Macroalgae in improving the agronomic performance of crops especially Bean and wheat plants cultivated on soil or in hydroponic systems and under abiotic stress.

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LABORATORY TEST FOR SAND BOIL FORMATION NEAR A FLOOD PROTECTION DIKE

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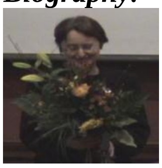
Abstract *The sand boil is the first stage of a piping failure of river dikes which may form in either free granular soil surface or in areas covered with a less permeable layer that is not thick enough to maintain a balance with water pressure if the water's exit speed exceeds a given value. The aim of the research is to see whether a laboratory model is capable to the examination of this phenomenon. The reason for it is the sand boil is starting at a hydraulic gradient much less than the critical value and it may be assumed that the equilibrium condition of individual grains forces may explain this. The model test is made using a simplified Hungarian river dike section where a fine sand layer is placed between the impermeable cover layer and the permeable subsoil. It can be clearly observed that while the flood occurs upstream, the stability of the fine sand grains at the downstream side is not ensured after the cover layer is cracking. The sand boil phenomena also appeared. This proved that a laboratory sandbox model is applicable to modeling and examining sand boiling with controlled circumstances.*

Keywords: *flood protection dike, sand boil, piping, sandbox model, hydraulic gradient* **Biography***:*

Biography:



Name: *Dr. habil. Emőke Imre*
Scientific degree: *habilitation in 2015 at BUTE, Hungary, Budapest*
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Phone: *+36202892656;* ***E-mail:*** *imre.emoke@kvk.uni-obuda.hu*
Position: *Head of Hydro-Bio-Mechanical Systems Research Center, Associate Professor*
Specialty and publications: *dikes, coupled consolidation models, applied math, inverse problem solution and reliability testing, unsaturated soils, municipal landfill waste and energy utilisation of the landfill gas, grading entropy of granular matters, entropy-based grading rules, filtration, internal erosion, segregation, in situ -situ testing (e.g. CPT dissipation tests, evaluation methods and software preparation), laboratory experiments (oedometric relaxation and compression test, water retention curve measurements, evaluation method and software).*

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EXTRACTION AND IDENTIFICATION OF PROBIOTIC BACTERIA WITH POTENTIAL OF GABA PRODUCTION FROM TRADITIONAL WEST AZARBAIJAN DAIRY OF IRAN

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[3]Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary,
[4]Community Nutrition Department, Ministry of health and medical education, Tehran, Iran)

***Abstract**: Lactic acid bacteria play a critical role in fermentation courses. One of the metabolites produced by this bacterial strain is Gamma Amino Butyric Acid (GABA). The objective of this research was extraction and identification of probiotic bacteria with potential of GABA production from traditional West Azarbaijan dairy of Iran and optimization of GABA production conditions in culture. In this study, 30 bacterial samples from indigenous dairy products (yogurt, dough, cheese and butter) were isolated from West Azarbaijan of Iran. Initial diagnostic tests including gram stain, oxidase and catalase tests were performed to detect Lactic Acid Bacteria (LAB). Results showed that only 6 strains were gram-positive, negative catalase and negative oxidase, and were known as LAB. Then, investigation of probiotic properties including acid resistance, bile, gastric juice, and hemolysis inactivity and L-arginine hydrolysis were evaluated. Two LAB samples with strong probiotic properties were selected, followed by identification of the primers with 16SrDNA by sequencing and drawing phylogeny tree. The results showed that L. lactis subspecies Lactis, L. delbrucius subspecies Bulgaricus strains isolated from cheese and butter had the highest probiotic properties. In the second part, the concentration of GABA production by probiotic bacteria was evaluated by HPLC in media of MRS Broth. Based on HPLC results, L. delbrucius subspecies Bulgaricus, grown in MRS broth had shown the highest concentration of GABA production with 377.54 ppm.*

***Keywords:** Gamma aminobutyric acid (GABA), HPLC, L. delbrucius subspecies Bulgaricus, Probiotic, PCR*

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THE SATURATED HYDRAULIC CONDUCTIVITY OF 2-FRACTION GRANULAR SOILS AND THE INTERNAL STABILITY

Emőke IMRE[1], Zsombor ILLÉS[2], Ágnes BÁLINT[3], Adildorj KHALIUNAA[3], Boldbaatar TSENDSUREN[3], Dang Thi Quynh HUONG[3], Lamas Lopez Lizeth GUADALUPE[3]

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[2]Department of Engineering Geology and Geotechnics, Budapest University of Technology and Economics, Budapest, Hungary,
[3]Institute of Environmental Engineering and Natural Sciences and HBM Systems Research Center, Óbuda University, Budapest, Hungary

Abstract *The four grading entropy coordinates can be used for soil classification on the basis of grain size and the grading curve shape (similarly e.g., to the diameter values). The grading entropy coordinates give information on several basic Physics features of soil like dry density, internal stability and degree of degradation for natural soils. Therefore, assumingly, using them, good permeability k regression relations can be elaborated. In this work some laboratory permeability tests are made for saturated permeability on fractally distributed sand mixtures (which are mean grading curves with predetermined composition). After the first stage of the measurement it is found that the regression with both the well-established (d10, void ratio e and Kozeny term e3/(1+ e)) and the new (grading entropy type) variables of the grading curves are good. The correlation is improved if the entropy variables are included and combined with the well accepted variables. However, the results indicate that the preciseness is better if only the data of non-segregating, internally stable mixtures are used, indicating the importance of selecting non-segregating mixtures in laboratory tests.*

Keywords: *granular matter, saturated water permeability, grading curve, grading entropy, segregation.*

Biography*:*

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Phone: *+36202892656;* ***E-mail:*** *imre.emoke@kvk.uni-obuda.hu*
Position: *Associate Professor, head of research center*
Specialty and publications: *dikes, coupled consolidation models, applied math, inverse problem solution and reliability testing, unsaturated soils, municipal landfill waste and energy utilisation of the landfill gas, grading entropy of granular matters, entropy-based grading rules, filtration, internal erosion, segregation, in situ -situ testing (e.g. CPT dissipation tests, evaluation methods and software preparation), laboratory experiments (oedometric relaxation and compression test, water retention curve measurements, evaluation method and software)*

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APPLICATIONS of COMPOST AND WASTEWATER SLUDGE CHANGES THE BIOLOGICAL ACTIVITIES IN BROWN FOREST SOIL

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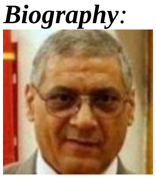
**Corresponding author*

Abstract: *The use of agrochemical such as chemical fertilizers and pesticides has caused tremendous harm to the eco-environment. Organic matter (OM) addition to soil often leads to a rapid increase in the activities of various enzymes and reactivation of biogeochemical cycles in soil. One of the major concerns today in all over the world is the pollution and contamination of the soil. In fact hydrolytic enzymes are sensitive indicators of management induced changes in soil properties due to their strong relationship with soil organic matter (OM) content and quality. An experiment was conducted to study the impacts of combined fertilizer on soil properties in comparison with adding organic as solid waste compost (SWC) of plant origin or municipal wastewater sludge (MWWS) to sandy loam brown forest soil. Soil amendments were: control, 15 or 30 kg/ha dry organic fertilizer. Microbial compositions were determined by culture enrichment technique. Enzyme (β-glucosidase, cellulase, urease, and aryl-sulphatase) activities were estimated. Fluorescein diactate activity as well as physico-chemical properties as well as some microbial parameters were determined after 63 day of incubation under laboratory conditions. The results demonstrated that the SWC and MWWS significantly improved soil physico-chemical properties such as soil pH, moisture content, total C and N contents as well as biological properties. Accordingly, overall enzyme activities were substantially promoted in presence of both amendments and the higher increases were measured at 30% of SWC. Lower beneficial effects occurred at the combination of SWC and MWWS together at 30% possibly because of the increased the presence of trace elements through MWWS application. As a general response, SWC supplied at 30% seems to be a useful strategy to enhance biological activities of soil. Finally, soil biologic activities can be used as an index of soil fertility and organic fertilizer stimulates the natural soil microbiotas and reactivates the biogeochemical cycles.*

Keywords*: biological activities, solid waste compost, municipal solid wastewater sludge, soil.*

Biography*:*



Prof. Dr. habil. Hosam Bayoumi Hamuda is working at Óbuda University. He is Environmental Microbiologist and Soil Biotechnologist dealing with the interactions between the microbiomes and the environment for increasing soil quality and saving the soil from pollutants as well as how benefits to use the wastewater sludge in the agriculture. His investigations are on the role of waste management, on soil quality, fertility, the crop production and environmental impacts related to the application of organic wastes to soil to assess: Soil quality, microbial inoculants; nitrification inhibitors and crop quality; Monitorization of organic matter; measurements of rhizosphere and soil microbial biomass and enzymatic activities in wastewater sludge amended soils; root systems and microbial composition in the polluted environment and roles of engineered metal oxide nanoparticles in biosphere.. Also he is interested in the role of environmental quality and relation between gut microbiomes on human health.

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ECOTOXIGOLOGICAL IMPACT OF SOME FUNGICIDES USED IN AGRICULTURE ON SOIL USEFUL MICROBIOTA AND ENZYMATIC ACTIVITIES IN VITRO

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**Corresponding author*

Abstract*: In the 21st century, pesticide research has focused on the effects and risks of the effects on the human body and the environment, as well as the environmental behaviour of pesticides. These researches can contribute to the reduction of pesticide pollution, which includes and studies in detail the basic processes related to environmental factors, as well as the development of the method of application and treatment of the pesticide. One of the main directions of research is to determine the availability of pesticides in soils; investigation of transformation mechanisms in soil, water and air; exploring the interaction between microorganisms and pesticides. The effect of different pesticides on soil microbial content and enzymatic activity should be investigated, taking into account aspects of sustainable agriculture and environmental protection. During the experiment, brown forest soil was treated with two fungicides (Folpet and Thiuram) at four different concentrations (control, 1 / 2X, X, 2X) which were analysed after 2 weeks. I evaluated the ecotoxicological effects of fungicides applied to brown forest soil on the amount of aerobic heterotrophic bacteria and filamentous fungi, the amount of cellulose-degrading bacteria, phosphate solubility, enzyme activity and soil respiration. The use of other soil types and other pesticides is important for further research, it is recommended to set up further experiments to get an even more complete and comprehensive picture of the soil biological effects of pesticides as soil contaminants.*

Keywords: *the environmental behaviour of pesticides, microbial content, enzymatic activity, concentrations, eco toxic effect*

Biography*:*

Prof. Dr. habil. Hosam Bayoumi Hamuda is working at Óbuda University. He is Environmental Microbiologist and Soil Biotechnologist dealing with the interactions between the microbiomes and the environment for increasing soil quality and saving the soil from pollutants as well as how benefits to use the wastewater sludge in the agriculture. His investigations are on the role of waste management, on soil quality, fertility, the crop production and environmental impacts related to the application of organic wastes to soil to assess: Soil quality, microbial inoculants; nitrification inhibitors and crop quality; Monitorization of organic matter; measurements of rhizosphere and soil microbial biomass and enzymatic activities in wastewater sludge amended soils; root systems and microbial composition in the polluted environment and roles of engineered metal oxide nanoparticles in biosphere.. Also he is interested in the role of environmental quality and relation between gut microbiomes on human health.

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EFFECTS OF SEWAGE SLUDGE APPLICATION ON THE SOME BIOLOGICAL ACTIVITIES IN THE RHIZOSPHERES OF COMMON BEAN AND CORN

Katalin HRUSTINSZKI, Hosam E.A.F. BAYOUMI HAMUDA*

Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary
**Corresponding author*

***Abstract**: Significant population growth has generated several problems over the last half century. Due to the increased land use, the amount of fertile land is constantly decreasing. Minerals released from the soil by crop production and extraction needs to be replenished, as its self-sustaining mechanism cannot reverse such damage. The utilization of sewage sludge is playing an increasingly important role in the field of environmental protection due to the expanding sewerage network. The further storage, treatment and disposal of sewage sludge generated as a by-product during wastewater treatment are a significant problem for wastewater treatment plants, mainly due to the increasing volume. However, its special feature is that, despite being a waste, it is an important source of nutrients that, when returned to the soil, improves its quality. The aobjective of the study was to measure the effect of sewage sludge on soil biochemical properties and its remedial effect. In the course of the research, soil mixtures treated with different proportions of sewage sludge were examined, with different application rates. The study was rhizosphere enzyme activity of two plant species (common bean, maize), urease, ß-glucosasease, dehydrogenase, and phosphatase based on the content of sewage sludge. Based on the results of the study, it can be concluded that the application of organic waste improves the quality of the soil in all cases, however, after 15% treatment, a significant change can be observed; there was a spectacular increase in soil enzymatic activity. Finally, the study covers the situation of domestic agriculture and the legal framework of sewage sludge disposal.*

***Keywords** Sewages sludge, enzymatic activity, Risk assessment, soil, plant rhizosphere*

***Biography**:*

Prof. Dr. habil. Hosam Bayoumi Hamuda is working at Óbuda University. He is Environmental Microbiologist and Soil Biotechnologist dealing with the interactions between the microbiomes and the environment for increasing soil quality and saving the soil from pollutants as well as how benefits to use the wastewater sludge in the agriculture. His investigations are on the role of waste management, on soil quality, fertility, the crop production and environmental impacts related to the application of organic wastes to soil to assess: Soil quality, microbial inoculants; nitrification inhibitors and crop quality; Monitorization of organic matter; measurements of rhizosphere and soil microbial biomass and enzymatic activities in wastewater sludge amended soils; root systems and microbial composition in the polluted environment and roles of engineered metal oxide nanoparticles in biosphere.. Also he is interested in the role of environmental quality and relation between gut microbiomes on human health.

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ANALYSING LAND USE CHANGE IN THE GÖDÖLLŐ HILLS DURING 1990'S

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Abstract: *In Hungary, economic and social transformation after the political changeover played a major role in the evolution of the rapidly changing structure of the landscape. In order to reconstruct the earlier conditions, we need to familiarise ourselves with the history of the landscape. As the quality of the landscape has been deteriorating at a growing pace, we also need to examine the main parameters of the landscape components. Moreover, we need to devote special attention to the areas most sensitive from the perspective of nature conservation (e.g. the situation of wetlands and forest lands) to be able to monitor their alteration and mitigate the anthropogenic impact if possible. The main objective of this research work was focused on surveying land use change during 1990's.*

Keywords: *land use, land use change, Hungary, landscape*

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WORKING METHOD OF A HEAT PUMP

Lóránt SZABÓ

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Abstract *The operating principle of the air-source heat pump is based on the physical property that the boiling point of a fluid increases with pressure. A heat pump has four main components: evaporator, compressor, condenser and expansion device. The examined heat pump is used for making domestic hot water and air condition. Decreasing energy resources of the Earth and enhanced energy consumption are typical of our life. However, one of the basic conditions to survive is that the amount of the energy used every day should be reduced. The energy used to air-condition a room and the possible use of secondary energies generated by the air-conditioning is studied in the research. The heat energy distracted by a heat pump out of the room is not let outside as heat loss, but it is used for making domestic hot water. The efficiency of the heat pump is examined with varied air parameters inside. About 0.3 kW electric power taken by heat pump from national electricity network. Heat pump can be separated from united electrical network by solar energy system; this article shows solution for this method too.*

Keywords *Air-conditioning, coefficient of performance (COP), domestic hot water supply, effectiveness, heat pump.*

Biography :

In 2014, he completed his PhD at the age of 52 years from Nyugat-magyarországi University. He has published more than 20 papers in different journals. His research fields are air-jet looms, acoustics, renewable energies.

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PRACTICE-ORIENTED ENVIRONMENTAL ENGINEERING EDUCATION AT THE ÓBUDA UNIVERSITY

Rita BODÁNÉ-KENDROVICS

Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary

Abstract: *The new strategy of higher education - Graduation in Higher Education, Guidelines for the Development of Performance-Based Higher Education - expects a higher proportion of practice-oriented education in engineering education, as it provides the basis for the development of professional competencies. This includes in particular the co-emergence of knowledge, skills, attitudes and the ability to take responsibility. The competency development of students majoring in environmental engineering s need to be supported by field work and practical activities based on examples taken from the real life problems and the solutions. Practice-oriented education promotes the development of internal, self-regulatory motivation, which is necessary for the further acquisition of knowledge in an individual way, for the development of ability of lifelong learning. By providing an opportunity to expand the teaching-learning space and considering fieldwork as an integral part of the training, project education creates the conditions for competence-based training, contributes to the development of responsible, environmentally conscious behaviour towards the environment, as well as the system approach that is essential for engineering activities.*

Keywords: *project education, environmental attitude, field work, systems approach*

Biography:

Her degrees: M.Sc. thesis in Technical University of Budapest in mechanical engineering (1991), Ph.D. in environmental sciences (2012), Municipal water and wastewater management (2017) and Environmental protection (1998) special engineering course. She works at Óbuda University in Rejtő Sándor Light Industry and Environmental Engineering Faculty as associate professor. She is acting as vice dean of the Faculty and director of the Environmental Engineering and Nature Sciences Institute. Subjects she taught: Water quality protection, Wastewater treatment technologies, Technical drawing. Her education skills cover the theoretical lectures, laboratory practices and field work. She is an expert in water quality protection, water and wastewater treatment technologies, and project education. She is member of Hungarian Water and Wastewater Association and Hungarian Hydrological Society, Water Supply and Sewerage Committee of the Hungarian Academy of Sciences. Research experience in environmental education, water quality protection, university lectures, more than 60 scientific publications.

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GREEN SYNTHESIS OF METAL NANOPARTICLES WITH RESPONSE IN INFRARED SPECTRAL REGION FOR MEDICINAL APPLICATIONS

Ruslan MARIYCHUK

Faculty of Humanities and Natural Sciences, University of Prešov, Prešov, Slovakia

Abstract: *With the development of nanotechnologies, a growing number of scientists going to apply the green chemistry approach to the synthesis of nanoparticles and nanomaterials. The synthesis and application of nanomaterials have become a key technology in many fields – optics, electronics, sensorics, drug delivery systems etc. Introducing of green chemistry principles deliver important benefits such as the sustainability, cost-effectivity, low time consuming, and biocompatibility of new nanomaterials. Application of nanomaterials in medicine request not only control over the size of nanoparticles but also their morphology (shape). Recent successes in the development of chemical methods for the synthesis of metal nanoparticles have delivered a wide range of preparation tools. However, the effective control of morphology involves the utilization of toxic reducing agents (sodium borohydride, methoxy polyethylene glycol, potassium tartrate, and hydrazine), and stabilizers (sodium dodecyl benzyl sulphate, and polyvinyl-pyrrolidone). These factors limit the applications of the nanoparticles in medicine. Therefore, extensive studies are directed on the development of green methods of nanoparticles synthesis. Many modern techniques are usually involved in the characterization of nanoparticles: ultraviolet, visible and infrared spectroscopy, surface and transmission electron microscopy, atomic force microscopy, energy-dispersive X-ray spectroscopy, dynamic light scattering. The present report will be focused on the analysis of recent successes in green synthesis of gold and silver nanoparticles with controlled size and shape [1-2]. Formation of irregularly shaped (nanotriangles, nanoprisms and others) gold nanoparticles shows that extracts of selected plants (juniper, goldenrod, spearmint, lemon balm etc.) can be successfully used for preparation of plasmonic materials. The perspectives of utilization of such nanoparticles in medicine will be discussed.*

1. Mariychuk R., Fejer J., Porubska J., Grishchenko L.M., Lisnyak V. Appl. Nanosci. 2020. 10(8), P.2835-2841.
2. Mariychuk R., Grulova D., Grishchenko L.M., Linnik R.P., Lisnyak V.V. Appl. Nanosci. https://doi.org/10.1007/s13204-020-01406-x

Keywords: *nanomaterials, nanoparticles, phytosynthesis, plasmonic materials, spectroscopy*

Biography:

Dr. Ruslan Mariychuk has completed his PhD at the age of 27 years from Taras Shevchenko National University of Kyiv, Ukraine and Postdoctoral Studies from Departments of Inorganic chemistry, Regensburg University and Bayreuth University, Germany. He is the Head of Department of Ecology at the Faculty of Humanities and Natural Sciences, University of Prešov, Slovakia. He has published more than 35 papers in reputed journals and has been serving as an editorial board member of repute. Research interes: green technologies, green chemistry and nanomaterials.

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EFFECT OF THE GREEN WASTE COMBUSTION ON THE AMBIENT AIR'S QUALITY

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Abstract: *The contamination of the ambient air poses a risk and the quality of life also worsens due to the not adequate air: respiratory and also cardiovascular diseases can form. Industry, traffic and domestic heating are the main factors of the air contaminations. There are several parts of Hungary where industrial emissions do not exist although other activities influence the concentration of the pollutant materials in the air. In Hungary the combustion of green waste is permitted in the case if the national regulations are followed. This study focused on the quality of the ambient air during these alternatives: samplings carried out at first in a one-week then in a three-week period. During the investigations the permission of the green waste combustion was only one day therefore the effect of the burning on the ambient air's quality was detected efficiently. Based on our results the quantity of the flying ash (PM10) increased significantly.*

Keywords: *ambient air's quality, PM10, local air quality, green waste*

ENVIRONMENTAL PROBLEMS OF AIRCRAFT MAINTENANCE AND RENOVATION AT THE LISZT FERENC REPAIR BASE – SUMMARY

András SZEDER

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***Abstract**: During my research I tried to draw attention to the environmental risks arising during the activities of the airplane repair base at Liszt Ferenc Airport. Since its foundation, 58 Boeing and 42 Airbus aircraft have rolled out of the Liszt Ferenc repair base in a brand new, refurbished condition. It is worth mentioning here that in a hangar they usually deal with the repair of two machines at the same time. It is planned that over time, wide-body aircraft will also be repaired in Hungary. In my research I describe the environmental problems caused by transport, including aviation. I describe the emissions to the environment during the maintenance and renovation of aircrafts at the repaiar base. Within this topic, I would like to discuss in more detail the problems of waste generation, waste management, wastewater discharge, noise pollution and air pollution in the light of the technological processes of maintenance, repairs and renovations. In addition to the effects on the environment, special attention must be paid to the effects that adversely affect the health of the workers on the Repair Base. In the course of my work, I focus on one of the most critical technologies of major repairs, paint removal in connection with the renovation of machine bodies, and air pollution during the painting process. I examined the extent of personal exposure of workers and the qualitative and quantitative characteristics of air pollution, taking into account the presence of toxic substances that are extremely harmful to health and the environment. My aim is to highlight the critical points associated with environmentally harmful emissions in order to protect the environment and the health of workers, and to draw attention, where necessary, to the need to take appropriate measures. It would be useful to extend the scope of separate collection not only to paper and wood waste, but also to other recyclable waste materials. The waste on the base is transported, disposed of and recycled by specialized companies contracted for this purpose only.*

***Keywords:** environmental problems, aircraft maintenance and renovation, Liszt Ferenc repair base*

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BIOPOLYMERS COULD BE THE SOLUTION FOR PLASTIC WASTE MANAGEMENT?

Imre L. BICZÓ

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Abstract:
Not recieved

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PERSPECTIVES FOR USING CLEAN AND ENERGY EFFICIENT ROAD VEHICLES

Linh Thùy NGUYỄN, Katalin FŐGLEIN, Tibor TELEKESI, Zoltán BORSI

KTI Institute for Trapnsport Sciences, Non-Profit LTD., Research Centre for Sustainable Transport, Department for Air Quality and Propulsion Systems, Budapest, Hungary

Abstract: *The development of the economy promotes the growth of the travel market, creating challenges and opportunities for the development of the transportation system. Increased income and personal demands are also conditions for people to buy and use vehicles. Habits and needs are one of the main leading causes of environmental pollution, especially air pollution. This article focuses on the pollution caused by vehicles. The process of checking the quality of a car before it is put into production is very complicated, combining many inspection steps. This article is about the PEMS method that meets Euro 6 standards, should be widely applied in the future not only for passenger cars but also for heavy vehicles and others. According to the measurements, Volkswagen Golf met the Euro 6b limits for the NEDC and PEMS test in lighter conditions. Detected values were well below the limit value. Skoda Octavia is well below the limit value for carbon monoxide in the RDE-PEMS test; however, NOx emissions were 2-3 times higher than in the NEDC test. Emissions of vehicles in the laboratory test are different from the actual environment, so the use of PEMS for vehicle testing is necessary.*

Keywords: *Perspectives, using clean energy, energy efficient, road vehicles, quality of a car*

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RANKING LIST AND ROADSIDE ENVIRONMENTAL TRAFFIC INSPECTIONS FOR TRANSPORT GREENERING IN HUNGARY

Huyen Minh NGUYEN, Zoltán BORSI, Tibor TELEKESI, Katalin FŐGLEIN

KTI Institute for Trapnsport Sciences, Non-Profit LTD., Research Centre for Sustainable Transport, Department for Air Quality and Propulsion Systems, Budapest, Hungary

***Abstract**: Air pollution is one of the most significant environmental concerns. It can cause adverse health effects like cancer, cardiovascular diseases and high levels of mortality. High population size is a key contributory factor to air pollution in industrial and metropolitan areas. This article focuses on pollution caused by vehicles, presents extensions to the current methods and future methodologies that are used to the decarbonisation of transport and to estimate the association between air pollution exposure and the risks to human health. This paper is centered around two specific topics, all of which focus on greenering transport. First is about air quality problems in Hungary caused by transport and the possible environmental projects ranked by KTI expert group for decision makers to choose the appropriate one for solve current problems; the second is a practical one, presents a special Hungarian project for greenering transport: a roadside inspection survey of the actual vehicles' technical condition and its emission in traffic, to explore the causes of high emissions, to look for ways to reduce emissions; to make feasibility studies for options of greenering and to plan action projects based on these feasibility studies.*

***Keywords**: Ranking list, roadside environmental traffic inspections, transport greenering, Hungary*

DEMONSTRATION AND MANUSCRIPTS OF THE ACCEPTED PAPERS

DEMONSTRATION AND MANUSCRIPTS OF THE PLENARY LECTURE

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THE ROLE OF NUCLEAR IN DECARBONISATION

Pal KOVACS

Prime Minister's Office – State Secretary, Budapest, Hungary

***Abstract**: Nuclear plays a crucial role in the Hungarian electricity system. More than half of the domestic electricity generation came from nuclear in the first half of 2020. Besides this, the Hungarian nuclear power plant generates 36% of the domestic electricity consumption, renewable energy (mainly PV) generates another 11%, and Hungary has an electricity import share of approximately 30%. The electricity consumption in Hungary has a growing tendency, between 2013-2019, the annual average growth rate was 1,3%. The peak load also increases, the records were broken several times last year. The current maximum peak load (7105 MW) was reached on 5th of December 2019. Until 2033 about 2500 MW capacity from the current power plant fleet will go offline, but the electricity demand will grow by approx. 1000MW. To meet electricity demand in a low carbon way, nuclear power will be inevitable for the electricity system. When looking at European examples we see that low-carbon electricity generation is reached in countries with high nuclear and/or hydro share in the electricity-generation mix. The Hungarian example shows that with nuclear power generation more CO_2 emission can be avoided, than the amount absorbed by forests. Half of the EU Member States rely on nuclear energy. Currently 9 EU Member States are building or planning to build new nuclear units. Hungary is one of them. Paks II. is a capacity replacement project, the two new nuclear units (2x 1200MWe) will on the long run replace the aging units currently in operation. Paks II. is Hungary's biggest project with a capital expenditure of 12,5 bn euro. It includes an outstanding technical solution as the Russian primary circuit is paired with a Western European turbine-generator set from GE-Alstom and an also Western European I&C system from the Siemens-Framatome consortium. In the summer of 2019 construction works of the project started on the construction and erection base (so called CEB). This area contains about 80 buildings, such as complex for assembly works, concrete batching facilities, office buildings. Until the end of September 2020 the Paks II. Project has already obtained 478 licenses, among them major ones like the environmental license and the site license (both effective). With the submission of the Implementation License Application (ILA) to the Hungarian Atomic Energy Authority on 30th June 2020 the most important licensing procedure started. The main tasks of the next months are to continue with the construction of the CEB buildings and to carry out soil improvement works and to construct the slurry wall.*

Nuclear plays a crucial role in the Hungarian electricity system

More than half of the domestic electricity generation came from nuclear in the first half of 2020. Besides this, the Hungarian nuclear power plant generates 36% of the domestic electricity consumption, renewable energy (mainly PV) generates another 11%, and Hungary has an electricity import share of approximately 30%. (Figure 1)

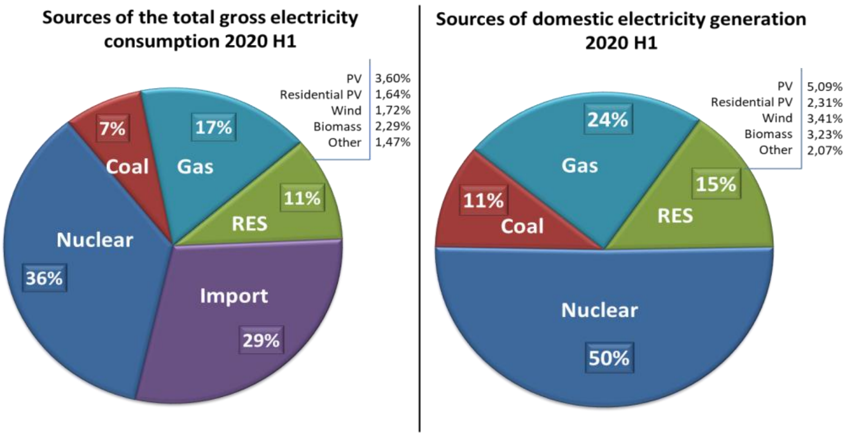
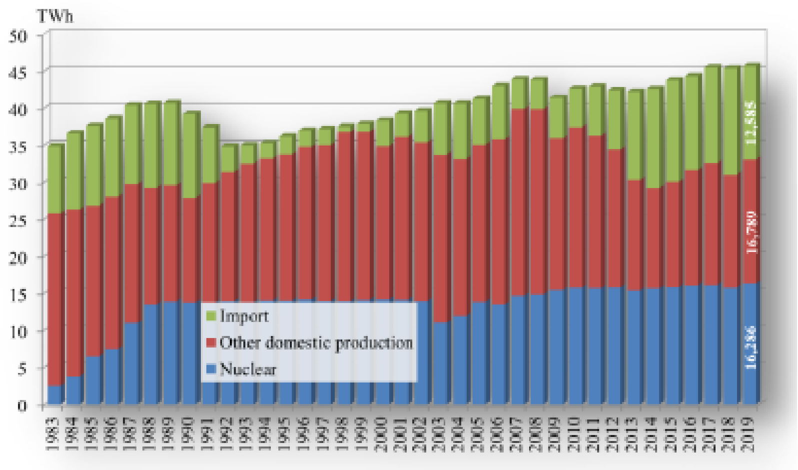


Figure (1) Nuclear plays a crucial role in the Hungarian electricity system
Source: MAVIR database 2020

The electricity consumption in Hungary has a growing tendency

- The total gross consumption of electricity (Figure 2) continues to grow and is reaching new records every year.
- Between 2013 and 2019, the annual average growth rate was 1.3%.
- The main reasons for the increasing demand for electricity were GDP growth and continuing electrification.



Source: MVM Paks Nuclear Power Plant Ltd
Figure (2) The electricity consumption in Hungary has a growing tendency

Development of gross peak load

The peak load also increases, the records were broken several times (Figure 3):

- 2019.12.05. – 7105 MW
- 2019.12.04. – 7099 MW
- 2019.01.23. – 6926 MW
- 2019.01.08. – 6884 MW
- 2018.12.19. – 6869 MW

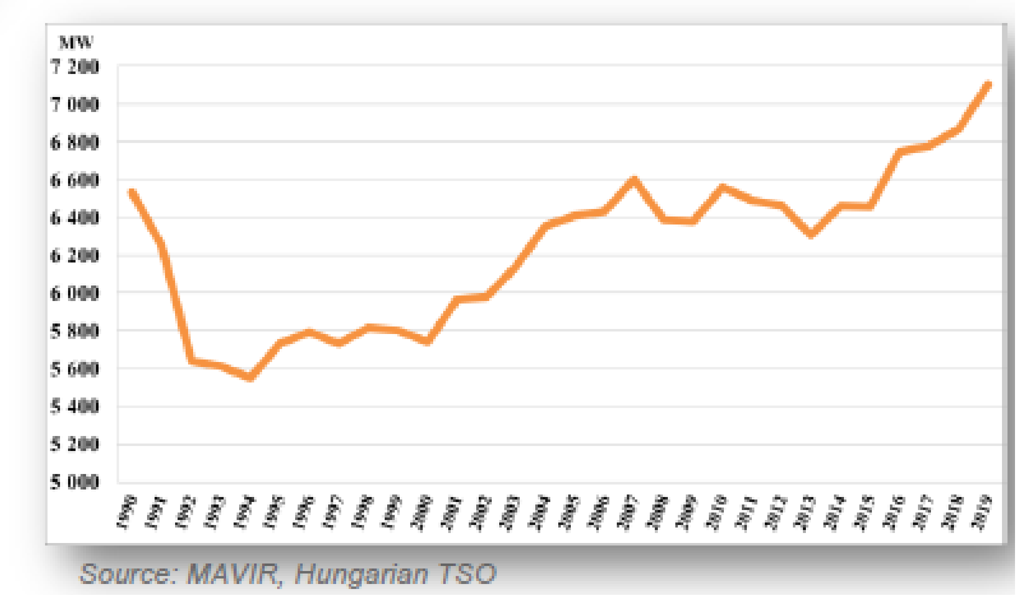


Figure (3) Development of gross peak load

The electricity consumption in Hungary has a growing tendency, between 2013 and 2019; the annual average growth rate was 1.3%. **The peak load also increases, the records were broken several times last year.** The current maximum peak load (7105 MW) was reached on 5th of December 2019. Until 2033 about 2500 MW capacity from the current power plant fleet will go offline, but the electricity demand will grow by approx. 1000MW. **To meet electricity demand in a low carbon way, nuclear power will be inevitable for the electricity system.**

Electricity import share in 2019 was 27.56% on average (Figure 4)

- The yearly import share in electricity consumption in 2019 was 27.56%.
- There were periods, when it was above 50%.
- Hungary has one of the largest electricity import-share in Europe.
- The cross-border electricity transmission capacity exceeds the required level by far.

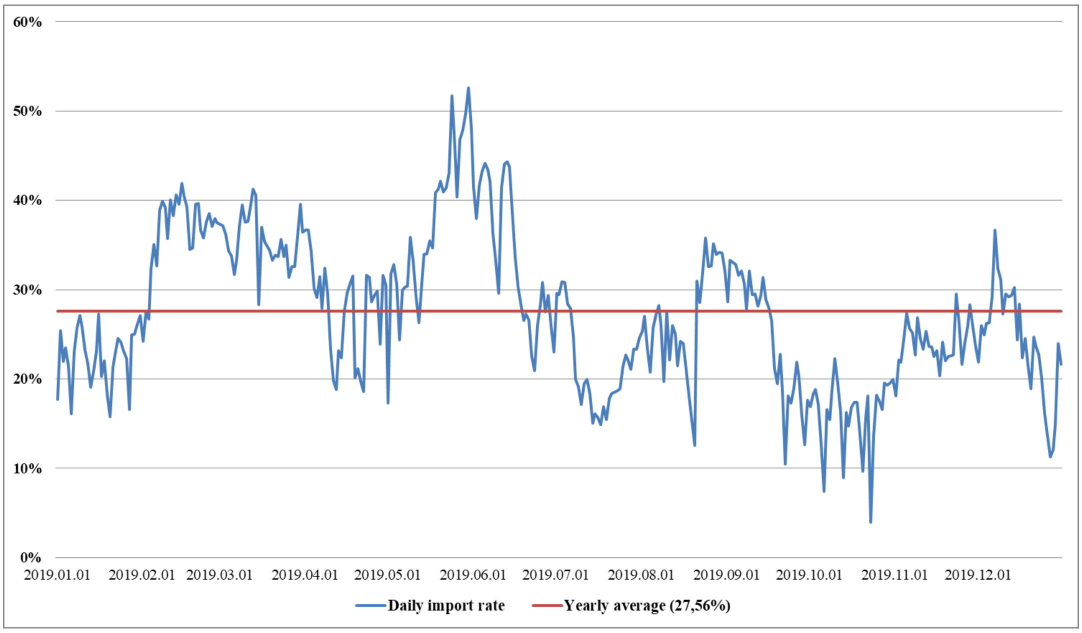
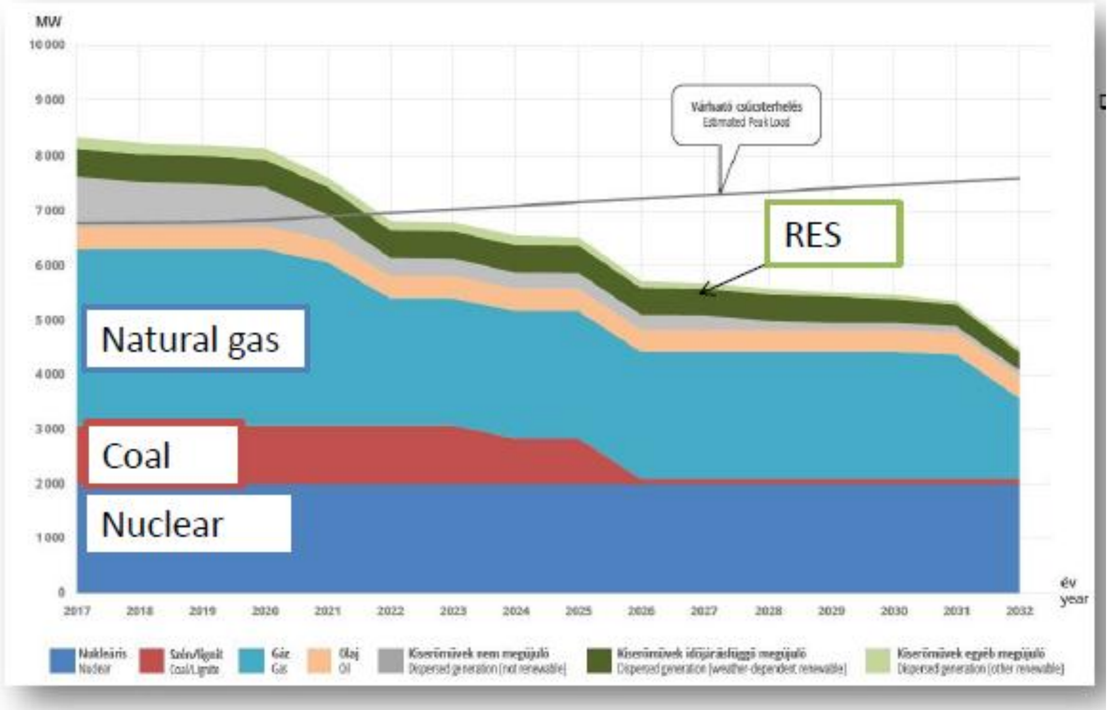


Figure (4) Share of electricity import in electricity consumption in 2019 (daily data)

Future of the current power plant capacities

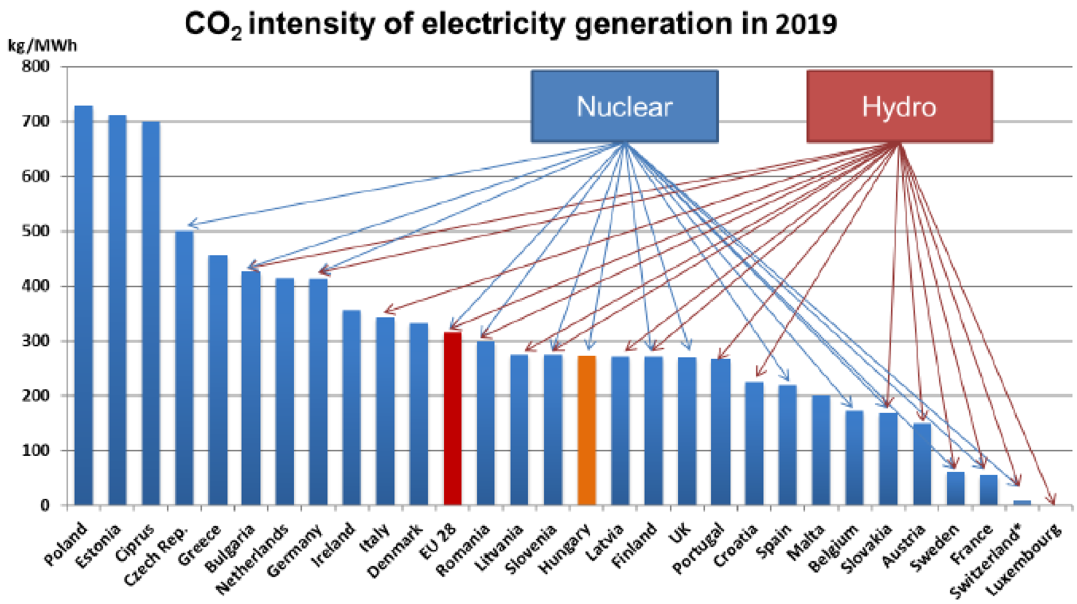
Figure (5)



MAVIR (2018): A magyar VER adatai 2017, p. 19.

Figure (5) Nuclear power will be inevitable for a low carbon emission electricity system

Low-carbon electricity generation in Europe is reached in countries with high nuclear and/or hydro share in the mix



Source: ENTSO-E and Agora Energiewende
**Switzerland's data are from 2018*

Figure (6) Main objective: decarbonisation

Means to achieve: nuclear, renewables and energy efficiency

Installed electricity generation capacities in Hungary and their envisaged future

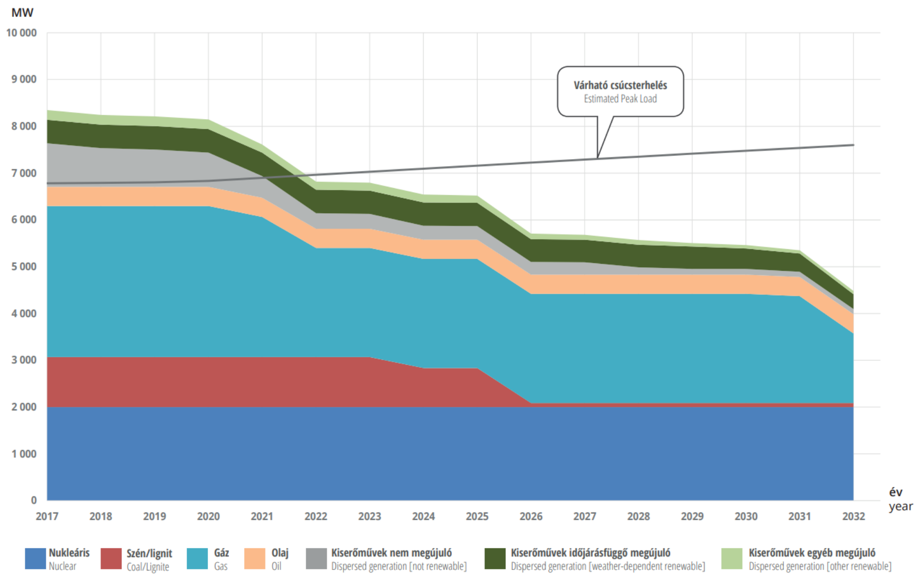


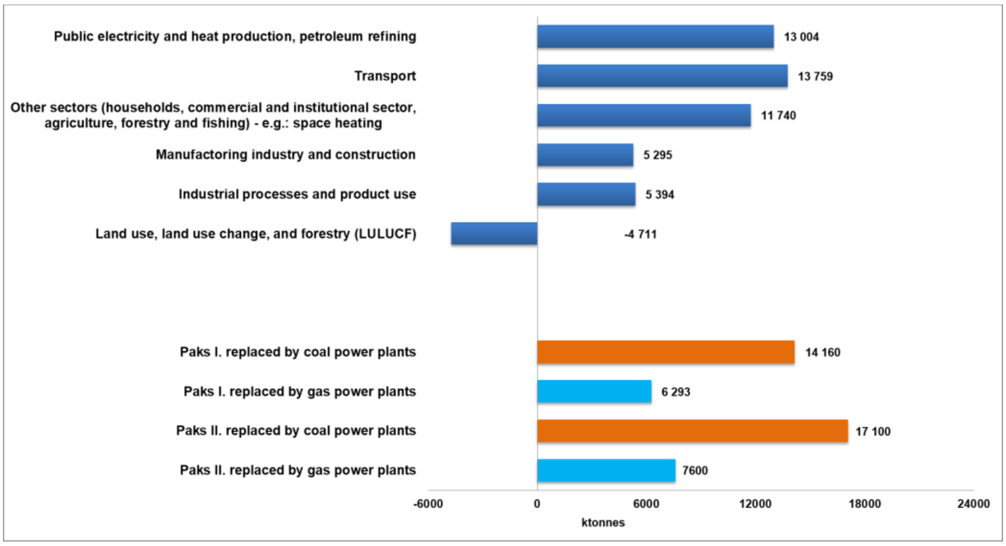
Figure (7) Data of the Hungarian electricity system Source: MAVIR, 2018: Data of the Hungarian electricity system

When looking at European examples we see that **countries reach low-carbon intensity of the electricity generation with high nuclear and/or hydro share in the electricity-generation mix.** The Hungarian example shows that with nuclear power generation **more CO_2 emission can be avoided, than the amount absorbed by the Hungarian forests** (covering more than 20% of the territory of the country)**.**

Until 2033:

- ~2500 MW capacity will go offline
- Demand up by ~1000MW
- ~5000 MW would be missing between peak load and available capacity

With nuclear power, Hungary avoids more CO_2 emissions yearly, than the amount absorbed by forests



Source: Hungarian Meteorological Service: National Inventory Riport 1985-2018

Figure (8) Total CO_2 emission of Hungary by sectors, 2018

Without nuclear power in Hungary CO_2 emissions of the domestic power plants fleet could be two times higher.

Half of the EU Member States rely on nuclear energy. Currently 9 EU Member States are building or planning to build new nuclear units. Hungary is one of them. **Paks II. is the capacity replacement project, the two new nuclear units (2x 1200MWe) will on the long run replace the aging nuclear units currently in operation.** Paks II. is the Hungary's biggest project with a capital expenditure of 12,5 bn euro. **It includes an outstanding technical solution as the Russian primary circuit will be paired with a Western European turbine-generator set from GE-Alstom and an also Western European I&C system from the Siemens-Framatome consortium.** In the summer of 2019 construction works of the project started on the construction and erection base (so called CEB). This area contains about 80 buildings, such as complex for assembly works, concrete batching facilities, office buildings.
Until the end of September 2020, the Paks II Project has already obtained 478 licenses, among them major ones like the environmental license and the site license (both effective). With the submission of the Implementation License Application (ILA) to the Hungarian Atomic Energy Authority (HAEA) on 30th June 2020 the most important licensing procedure started. Meanwhile, on 20th of November 2020 the Hungarian Energy and Public Utility Regulatory Authority issued the Implementation License (a license that differs from the one to be issued by the HAEA). The main tasks of the next months are to continue with the construction of the CEB buildings, with the detailed design and to carry out soil improvement works and to construct the slurry wall.

Nuclear in Europe

Figure (9) Location – Paks I. site

Half of EU Member States rely on nuclear energy

Member States building / considering new units: France, Slovakia, Finland, Hungary, Czech Republic, Bulgaria, Poland, Slovenia, Romania (UK, Turkey, Belarus)

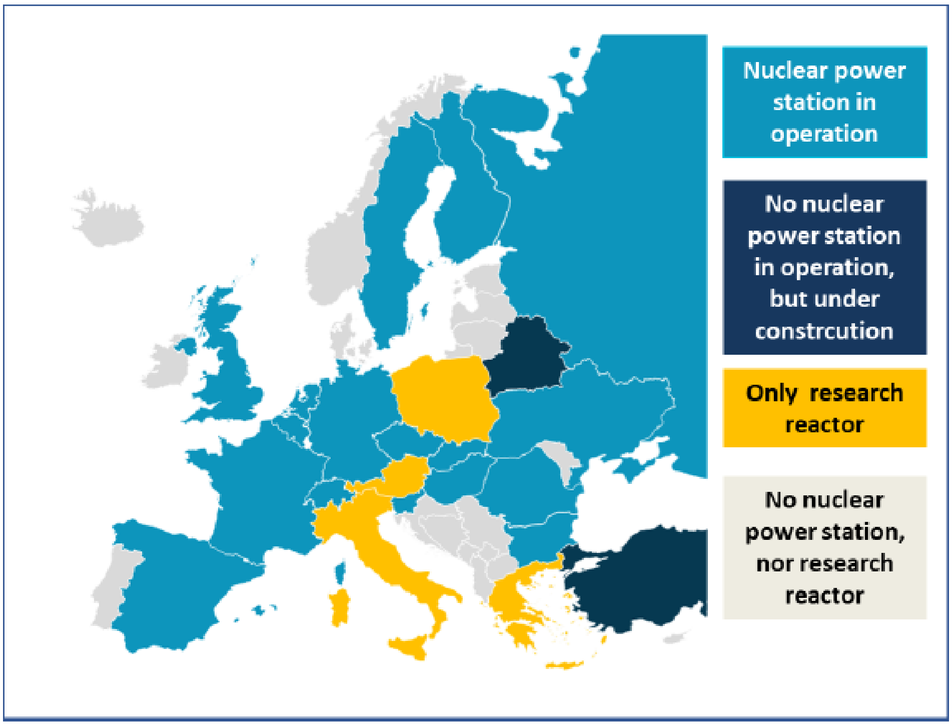


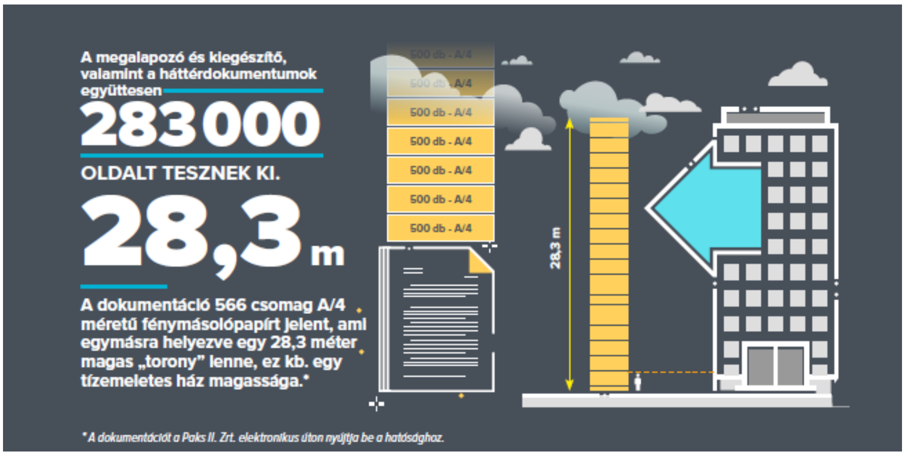
Figure (10) EU Member and nuclear energy

Paks II., a capacity replacement project

Paks II. – Hungary's biggest project, also unique in Europe

- Two new nuclear units, 2x VVER-1200
- 12.5 bn EUR investment
- Separate minister responsible for the project
- Advanced safety systems
- Load-following capability
- High annual load factor

Implementation License Application (ILA) – submitted on 30/6/20



- Submitted to the Hungarian Atomic Energy Authority on **30 June 2020**
- ILA: 283 000 pages
- Until 30th September 2020, the Paks II. has already obtained 478 permits

Key characteristics of the III+ Gen VVER-1200 power unit

Reactor type	Pressurized water reactor
Thermal output	ca. 3220 MW
Electrical output	ca. 1200 MW*
Fuel	U-235, max. enrichment 4.95%
Number of primary loops	4
Number of steam-generators	4
Coolant temperature at reactor outlet	328.9°C
Coolant temperature at reactor inlet	298.2°C
Primary pressure	16.2 Mpa
Secondary pressure	7 Mpa
Safety systems	active and passive safety systems
Designed lifetime	min. 60 years
Availability factor	>90%
Plant efficiency	37%
House load consumption	7.1%
Time required for maintenance (for a 7-year cycle)	4 x 16 days; 2 x 24 days; 1 x 30 days
Demand for operating personnel (in terms of electrical output)	0.42 person/MWe

*Based on the turbogenerator system planned for use, the rated electrical output of new Paks units will be 1262 MW

Source: Implementation Licensing of the new nuclear power unit, comprehensible summary

An outstanding technical solution

- Russian primary circuit is paired with a Western European turbine-generator set and I & C system
- a turbine-generator set from GE-Alstom
- main and upper-level I & C from Siemens-Framatome

www.ge.com

framatome

PRESS RELEASE

Oct. 23, 2019

RASU JSC and Framatome-Siemens consortium sign contract to supply automated process control systems for Hungarian Paks-2 Nuclear Power Plant

MOSCOW, Oct. 23, 2019 – Rusatom Automated Control Systems JSC (RASU JSC), a subsidiary of Rosatom State Corporation, and the Franco-German consortium Framatome-Siemens signed an agreement to manufacture, deliver and commission automated process control systems for the Paks Nuclear Power Plant Units 5 and 6, located in central Hungary. This award was based on the results of a competitive call for bids.

The document was signed by CEO of RASU JSC Andrei Butko, Managing Director of Framatome GmbH Carsten Haferkamp, Vice President Sales Nuclear I&C of Siemens AG Jens König, and Commercial Sales Director Nuclear I&C of Siemens AG Jens Bostelmann.

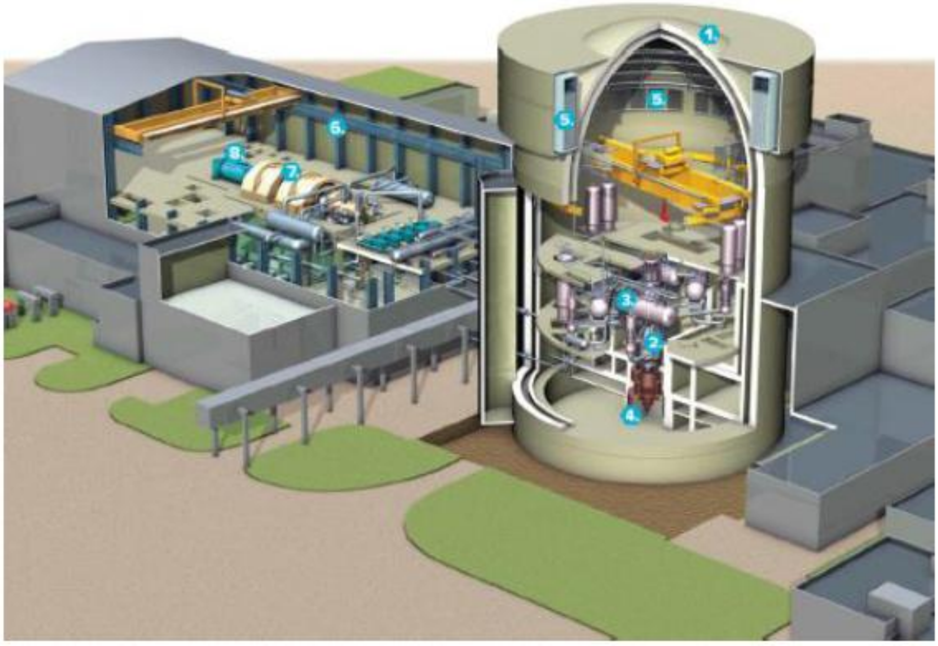
According to the signed agreement, the Framatome-Siemens consortium will manufacture and supply the equipment for automated process control systems, as well as conduct its certification and qualifications, including compliance with information security requirements.

"Framatome is proud to provide automated process control systems for Paks-2 in conjunction with our partner, Siemens," said Frédéric Lelièvre, senior executive vice president in charge of Sales, Regional Platforms and the Instrumentation and Control (I&C) Business Unit at Framatome. "Our high-performing people have been commissioning automation systems at nuclear power plants in Russia for many years. With Paks-2, we are delighted to use our expertise in I&C for VVER reactors in Europe, and add to a long list of successful projects with Rosatom."

www.framatome.com

Schematic design of VVER-1200

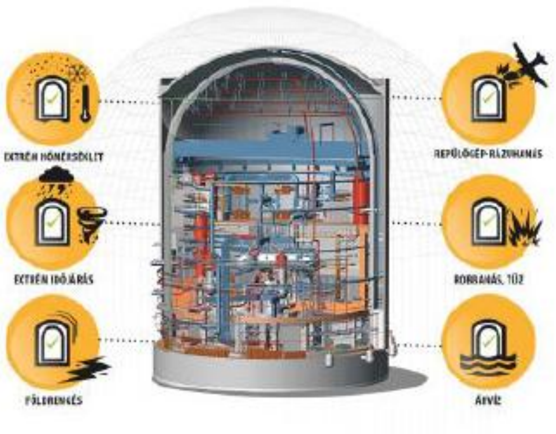
1. Containment
2. Reactor pressure vessel
3. Steam generator
4. Core catcher
5. Passive heat removal system of the containment
6. Turbine building
7. Turbine
8. Generator



Source: Paks II. Ltd.

Safety systems – 1

Double-walled, full hermetic containment

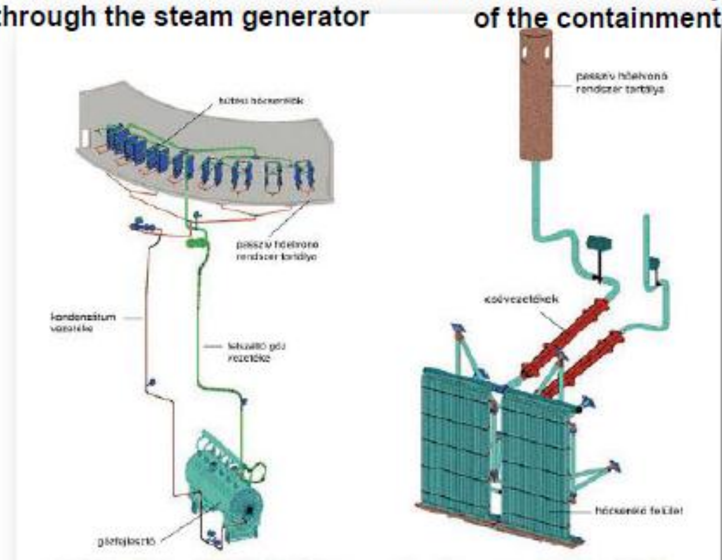


Kettősfalú konténment

Inner containment: retaining radioactivity
Outer containment: protection against external hazards

Passive heat removal system through the steam generator

Passive heat removal system of the containment



A gőzfejlesztő passzív hőelvonó rendszere

A konténment passzív hőelvonó rendszere

Residual heat dissipation

Controls the temperature and pressure increase in case of accident

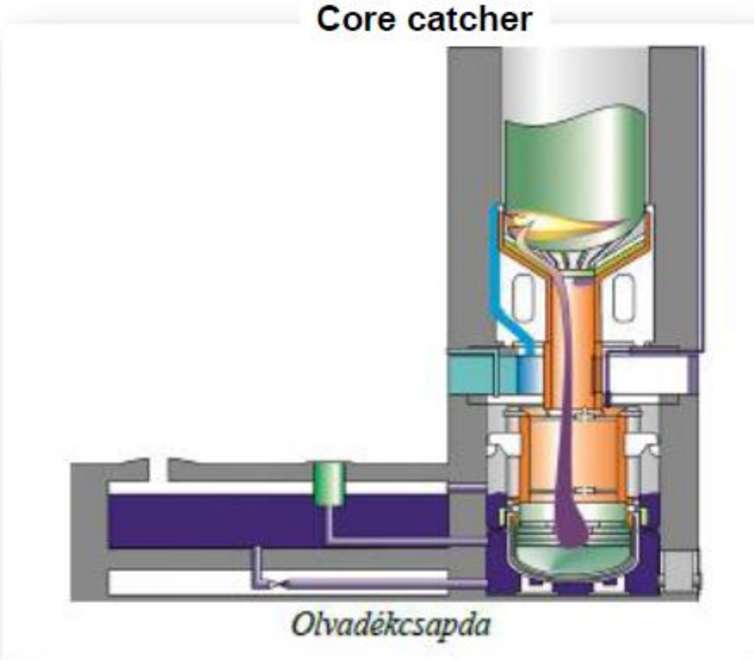
Source: Paks II. Ltd.

Safety systems – 2

Hydrogen combiner

In case of an accident they keep hydrogen concentration low

Core catcher



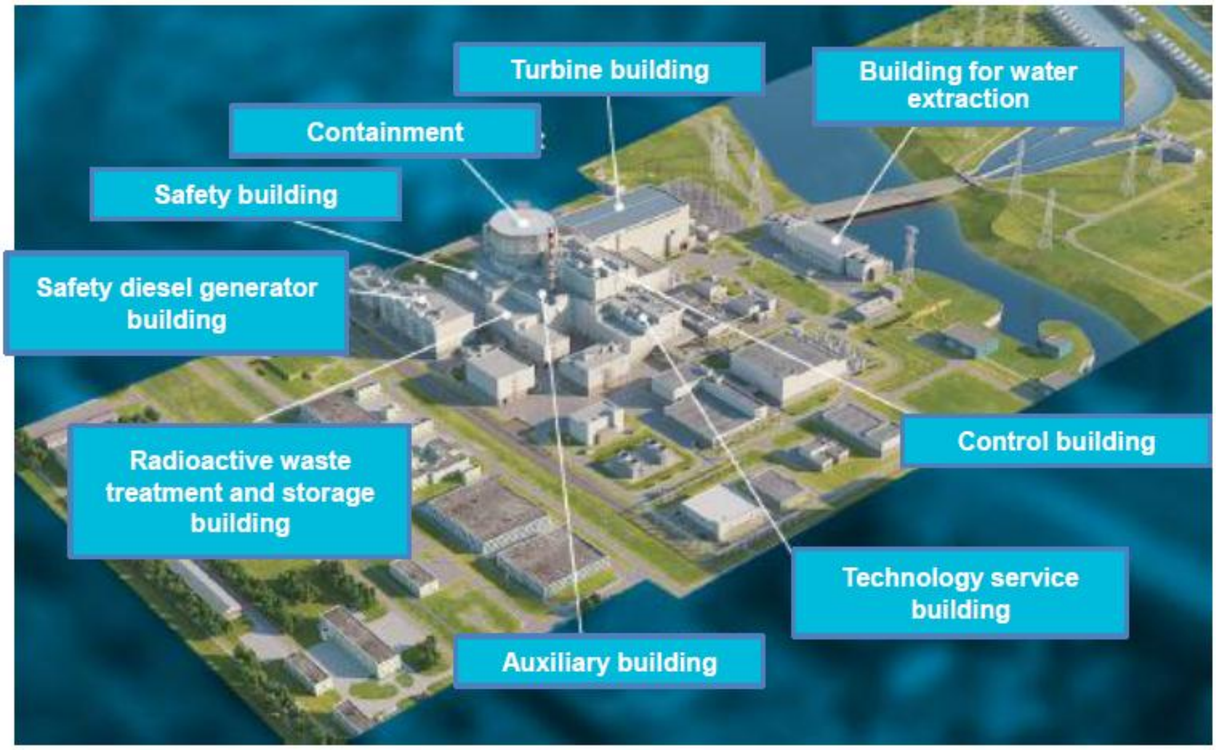
In case of a severe accident it protects the base plate from the molten core

Source: Paks II. Ltd.

Site, CEB and visualization of the new and old units

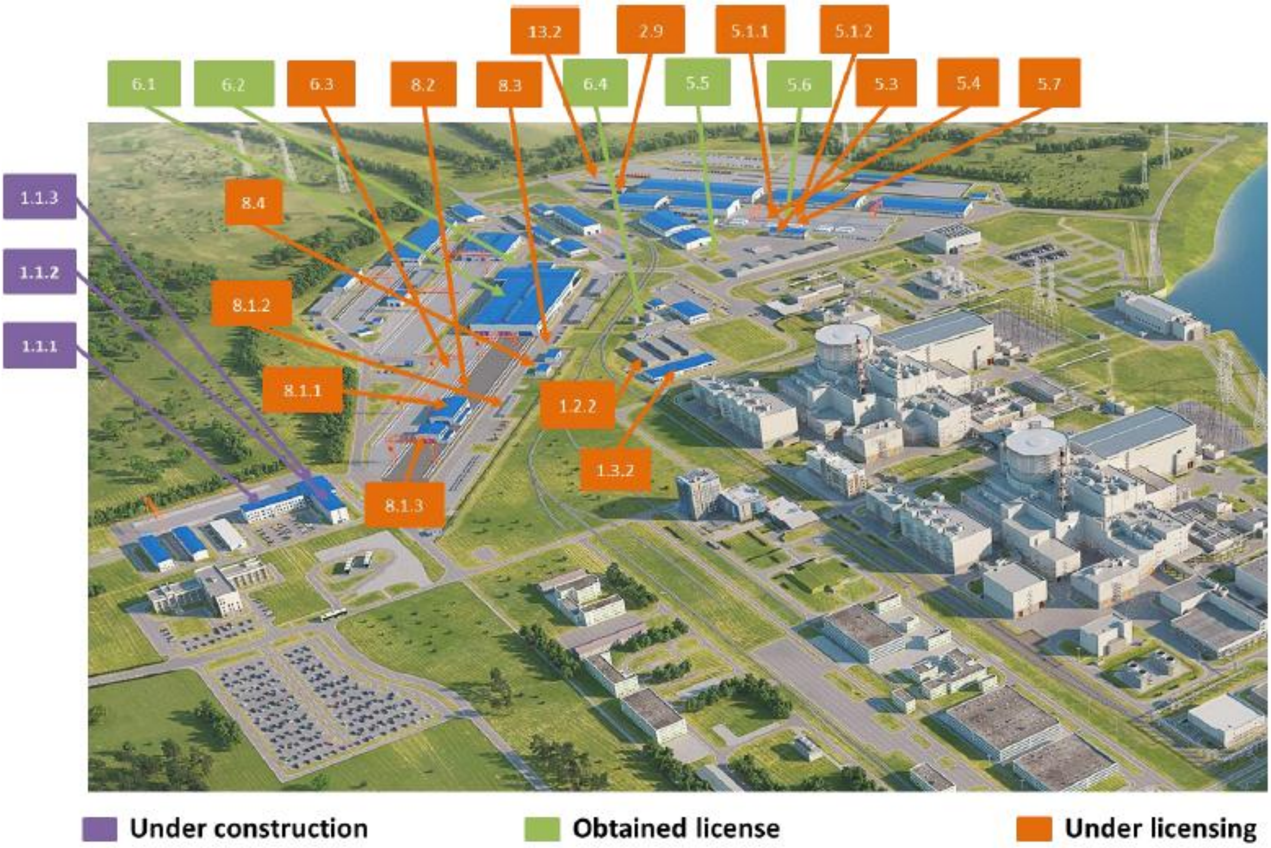
Source: Paks II. Ltd

VVER-1200 unit – main buildings



Source: Paks II. Ltd.

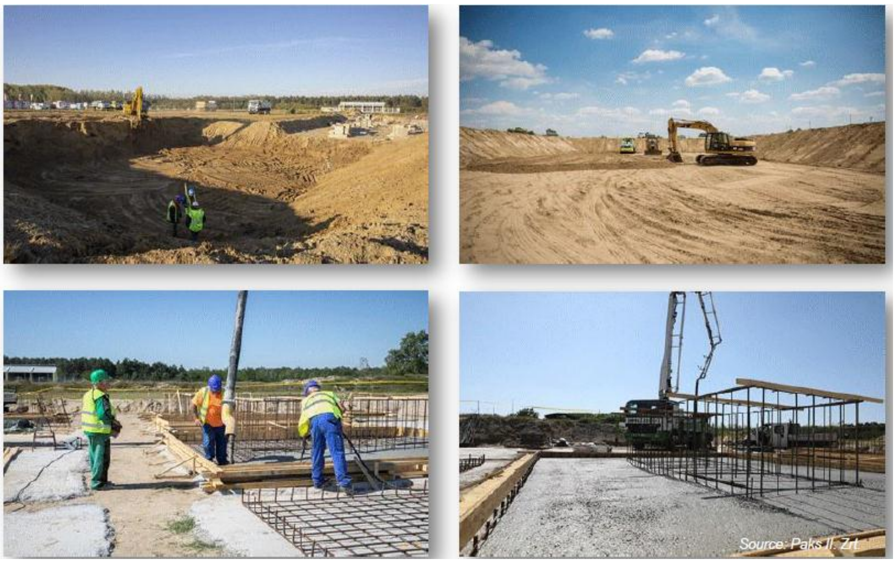
Construction and erection base (CEB) buildings status



Building construction starting date: 20th of June 2019

Building construction works

Source: Paks II. Zrt.



Most recent pictures - 1

Visualisation of the concrete testing laboratory

Visualisation of the metal structure and storage workshop

Figure (11) Buildings 6.1, 6.2, 5.5 and 5.6

Figure (12) Buildings 8.1.1, 8.1.2 and 8.1.3

Visualisation of the solvents and paints storage 			Visualisation of the material storage

Figure (13) Buildings 8.3 and 8.4

Theme: *"Sustainable Environmental Protection & Waste Management Responsibility"*
November 19 – 20, 2020 RKK – Óbuda University, Budapest, Hungary
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CIRCULAR ECONOMY - THE WAY FORWARD TO SUSTAINABLE DEVELOPMENT

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President, International Society of Waste Management, Air and Water (ISWMAW)
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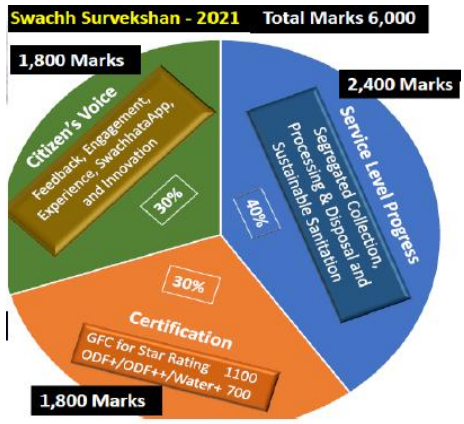
***Abstract**: Concept of recirculation of resources has been discussed in the Stockholm Conference. Based on that concept, recently the policy makers, researchers, major global companies and implementers are attracted and increased their attention towards transition from the existing linear economy model to a circular one. After years of growing income inequality, concerns about technology-driven displacement of jobs, and rising societal discord globally, the combined health and economic shocks of 2020 have put economies into freefall, disrupted labour markets and fully revealed the inadequacies of our social contracts. A new circular economy model is needed to build truly sustainable businesses –that is recognized by the business leaders gathering at the World Economic Forum. Without urgent action, global waste will increase by 70% on current levels by 2050, according to the World Bank's "What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050" report. The global annual waste generation is expected to jump to 3.4 billion tons over the next 30 years, up from 2.01 billion tons in 2016. In 2016, the world generated 242 million tons of plastic waste or 12% of all solid waste. Out of over 300 million tons of plastics produced every year, nearly 8 million tons are dumped into the oceans as plastic waste globally, and this will be doubled by 2025 at current rates of consumption and production, if no action is taken up to curb it. The 3R and circular economy are the way of rethinking our approach to waste. The portion of the write-up is excerpts from the book, CircularEconomy: Global Perspective, S. K. Ghosh, 2020, Springer Nature, gives a glimpse of the circular economy and its need.*

***Keywords**: Circular Economy, Consumption rate, Materials Extraction, Plastics waste, Solid Waste, 3R*

Contents



Status of waste management in a few countires

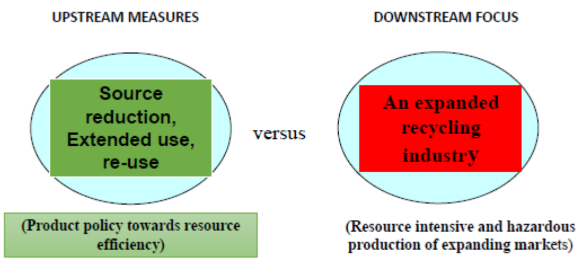
Country	MSW mil ton/Yr	kg/day Per capita	Collection efficiency	% recycled	% Composted	% Energy Recovery	% other treatment	% Landfill
Bangladesh	8.64	0.43	Urban:70% Rural: 35%	15%in Dhaka	3 %	NA	NA	82%
Bhutan	44,800	0.53	Urban:70% Rural: 25%	10 % in Urban	1 %	NA	NA	97%
Brazil	79.9	0.972	90.8 %	31.9%	10%	0.1%	4%	59%
Egypt	30	0.8	60 %	11.5%	NA	NA	NA	88%
India	62	0.5	Urban:95% Rural:55%	28 %	12 %	3 %	5 %	57%
Italy	29,5	1.5	100%	26%	18%	19%	11%	26%
Lebanon	2.55	1.0	90%	8%	15%	-	10%	70%
Portugal	4.52	1.26	100%	10%	25%	20%		34%
Nigeria	32.59	0.49	30%	??	??	???	??	??
S. Africa	59	0.7	74%	11%		unknown	2	90%
S. Korea	17.86	0.95	97.5%	36%	23%	25.3%	0%	15.7%; 3% by'20
Sri Lanka	2.74	0.4 –1.0	Western Province:59%;Others:8%	15%	5%			80%
USA 19/11/2020	254	2.0	100%	25.3%	9.7%	11.7%	-	53.8%

11th ICEEE Conference: CE-Way forward to Sustainable Development_Prof. Sadhan K. Ghosh_CSEAS_Hungary_19.11.2020

LOST OPPORTUNITY

The study, published in Science Advances, found that of the 8.3 billion tons of total plastic ever produced: Only 9 percent has been recycled. 90 % of the material recycled was only reused once. About 12 % was incinerated; 79 % ended up in landfills. 30 % is currently still in use. Packaging only remains in use max. for about a year. Plastics in construction and machinery remain in use for the longest period of time. If current production trends hold, total production will be 12 billion tons by 2050. The US lags far behind Europe, India and China in recycling. 2014 recovery rates: Europe (30 %), India (22%), China (25 %), and the US (9 %).

A prevalent policy dilemma - what should be the priority for government authorities?



Many government policies and programs tend to focus on conventional waste management solutions such as sanitary land filling or incineration – mainly downstream disposal, which is expensive, while failing to pursue upstream measures to reduce the actual waste load.

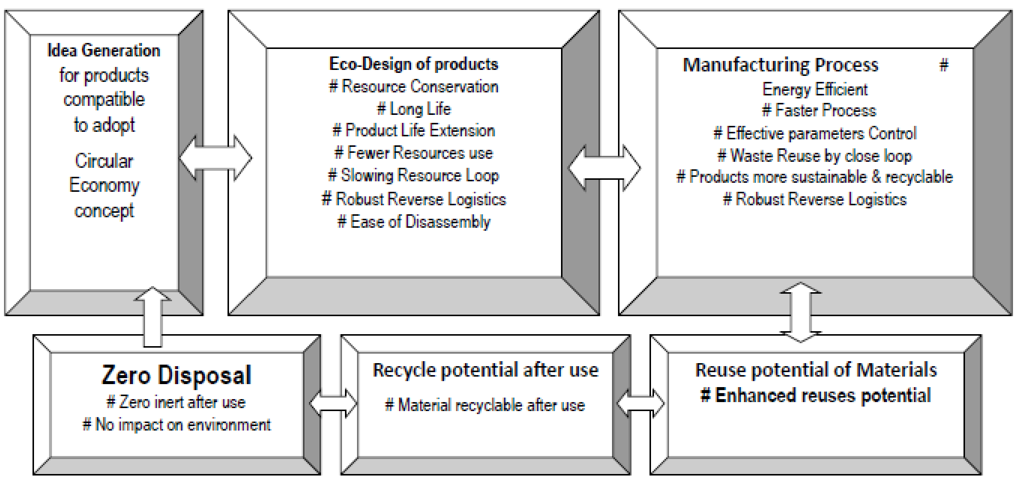
CE in post covid-19 Era

CE Definition: "CE is a systems-level approach to economic development and a paradigm shift from the traditional concept of linear economy model of extract-produce-consume-dispose-deplete (epcd2) to an elevated echelon of achieving zero waste by resource conservation through changed concept of design of production processes and materials selection for higher lifecycle, conservation of all kinds of resources, material and/or energy recovery all through the processes, and at the end of the life cycle for a specific use of the product will be still fit to be utilized as the input materials to a new production process in the value chain with a close loop materials cycles that improves resource efficiency, resource productivity, benefit businesses and the society, creates employment opportunities and provides environmental sustainability" (Source: Ghosh et al., 2020).

3R's Principles: Reduction, Reuse and Recycle

- Selection of lighter materials with extended life,
- Reduction in consumption of energy in the processes,
- Reduction in generation of wastes in the processes,
- Reduction in manual intervention,
- Reduction in the flow or steps in the manufacturing processes,
- Reduction in packaging,
- Reduction in cycle time,
- Reduction of resource consumption by reusing, and many more

Generic Business Framework for Design with intent for Circular Economy



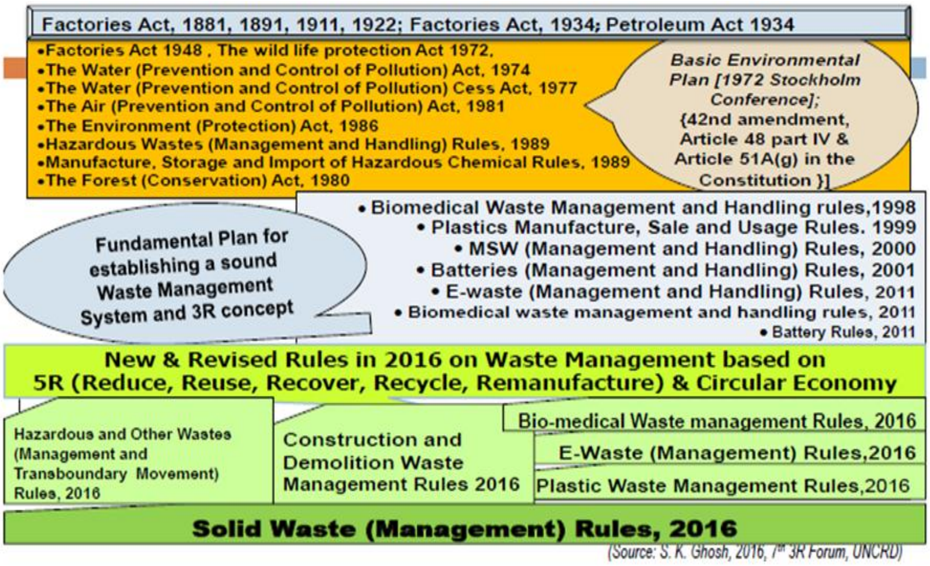
Swachh Bharat Mission & Swachh Survekshan in India Demostrating 3R & Circular Economy

How India is carrying out Circulation of Resources and Involving the Citizen

1. Swach Bharat Mission
2. Draft National Resource Efficiency Policy (Nrep)

Evolution of environmental legislation in India and its approach

Legal System for establishing "Sound Waste Management" in India

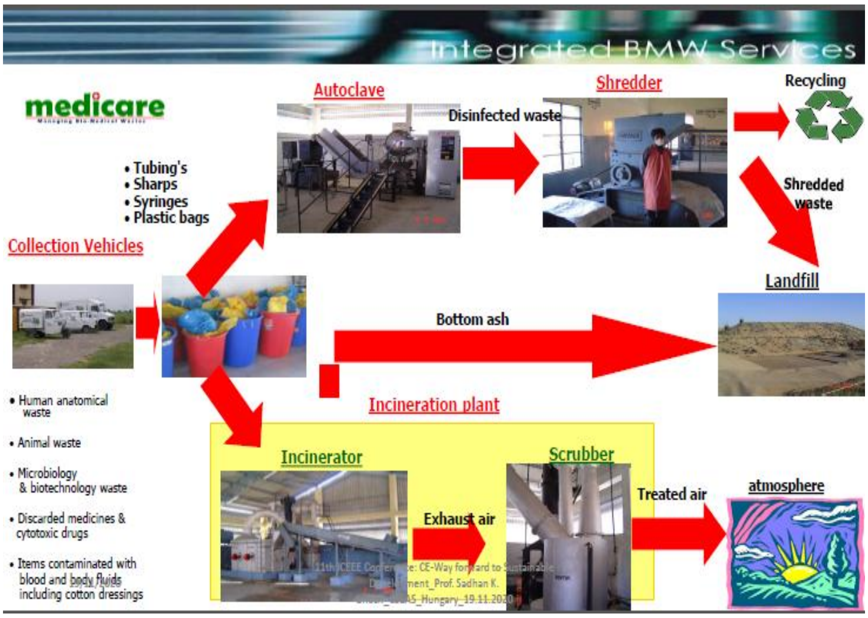


SW, Masks and gloves Disposal

ULBs: daily collection of segregated general SW from quarantine centers, home-care and hospitals in securely tied bags (without opening to ensure waste collector safety and to avoid pilferage).

- Liquid disinfectant (1% sodium hypochlorite solution) may be sprayed over bags containing general wastes prior to collection or disposal. General SW may be disposed as per SWM Rules, 2016, in landfills, waste to energy plants, as is available infrastructure.
- Identify dedicated area on landfill and the bags should be spread and covered daily with layer of soil or stabilized waste after sprinkled with lime/bleaching powder. Access to landfills sites should be restricted;
- Masks and gloves used by persons other than COVID-19 patients should be kept in paper bag for a

minimum of 72 hours prior to disposal of the same as general SW after cutting the same to prevent reuse.



Water-energy-environment nexus

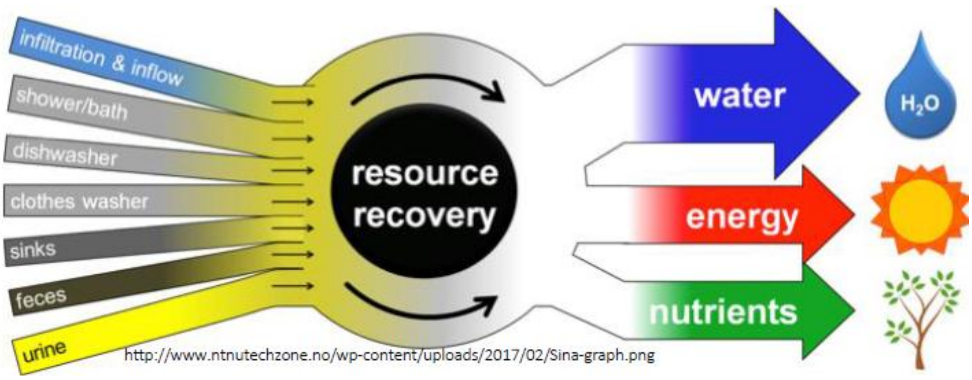
Energy & Resource recovery: A promising solution for wastewater treatment systems

- Achieving water, energy, and environment security pre-requisite for human welfare
- One third of countries (Northern Africa, Western, Central and Southern Asia) face medium to high levels of water stress (UN's SDGs report, 2019)
- Wastewater could contribute to address SDG

- Wastewater discharged to water bodies without any treatment (~ 90%)
- UN's Water Development Report, 2017; United Nations SDGs report, 2019 highlighted the importance of recovery of energy, nutrients and other recoverable by-products
- Paris Climate Agreement: energy recovery in wastewater treatment plants (WWTPs) has been given a renewed sense of urgency
- Implementation of principles of 3R & Circular Economy

Recovery from wastewater

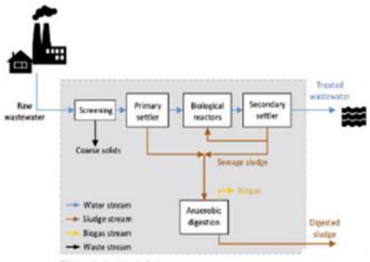
- Common recovery options: internal water reuse from treated effluent and sludge reuse for agricultural application



- Organic substances – source of chemical energy for useful energy (electricity and heat) via direct anaerobic treatment, anaerobic digestion of excess sludge and combined heat and power (CHP)
- Recovered Energy - offset energy need of plant (energy is consumed during sewage collection, transportation, effluent treatment, sludge treatment and disposal)

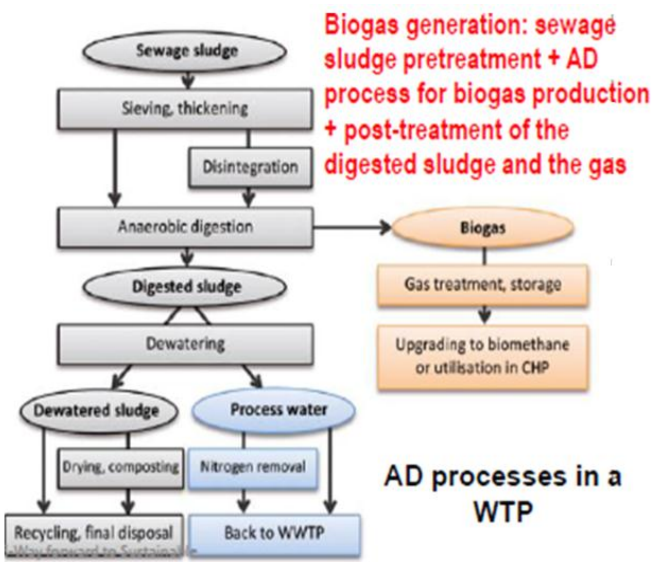
Anaerobic digestion: Energy recovery Processes

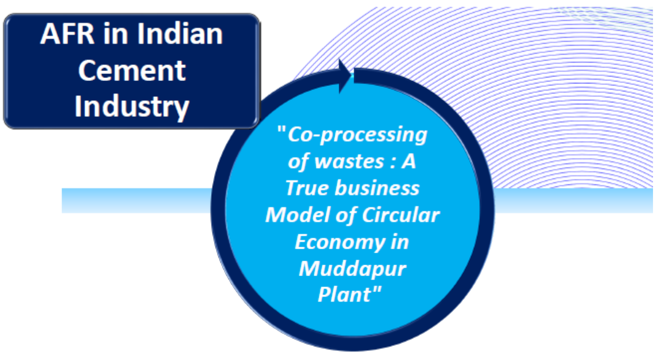
- AD - a widely used biological method - convert organic wastes into methane - leads to the stabilization & waste reduction
- Robust & efficient treatment of municipal wastewater & part of the process to treat biodegradable waste & sewage sludge



Biogas production; bio-solid incineration

- Provides electricity; Reduce the organic & inorganic loads of wastewater



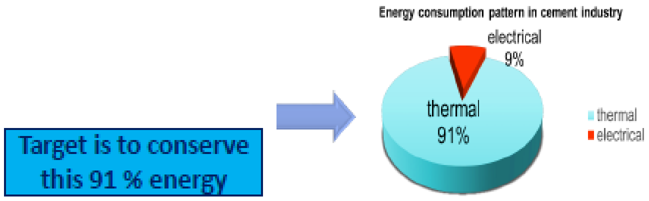


Energy consumption - Indian cement industry

Cement production in India is about 545 MioTPA

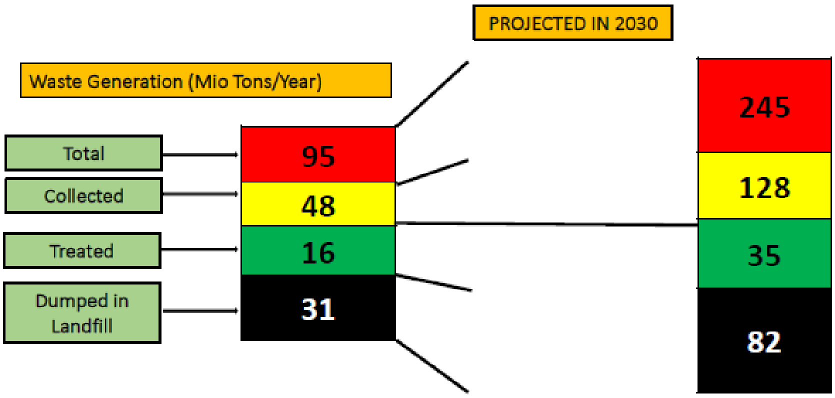
- India is 2nd largest cement producer after China
- Estimated coal required - 40 MioTPA

India has the potential to use the entire hazardous/Non-hazardous waste generated, if suitable for co-processing.



- Energy cost is 50-70% comprising of both thermal and electrical energy of total cost of production.
- The energy distribution is given as:
- The conservation of energy and use of cheaper renewable alternate fuel have assumed greater importance for improving productivity and reducing thermal energy consumption

Total Waste & potential in INDIA



Waste Management hierarchy

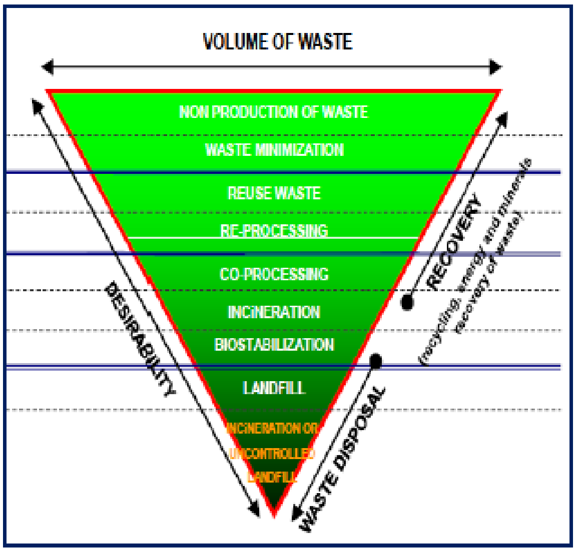
1. Reduce
2. Reuse
❖ *When prevention/reuse not feasible*

3. Recycle-Re-processing
➢ Recycling of end of life cementitious product

❖ *When Re-processing is not feasible*

4. Resources Co-processing in existing EII's
➢ Process specific guidelines
➢ Pre-processing is key
❖ *When Co-processing is not applicable*

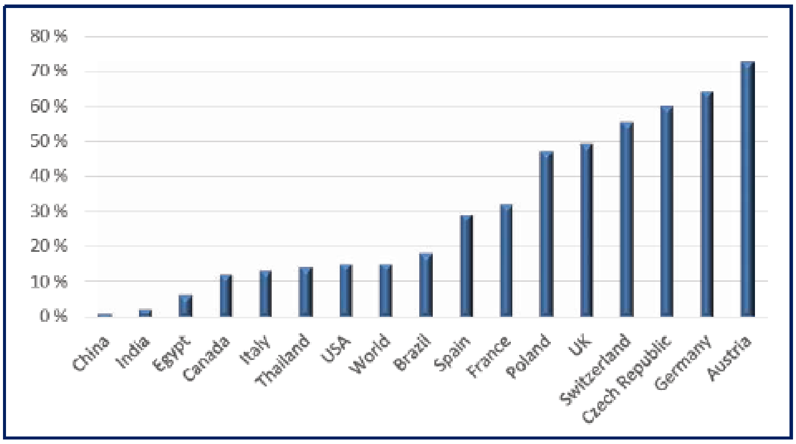
5. Waste disposal activities
➢ For organic : Incineration
  - Waste to energy programs
  - Energy efficiency is key
➢ For Minerals: Land filling



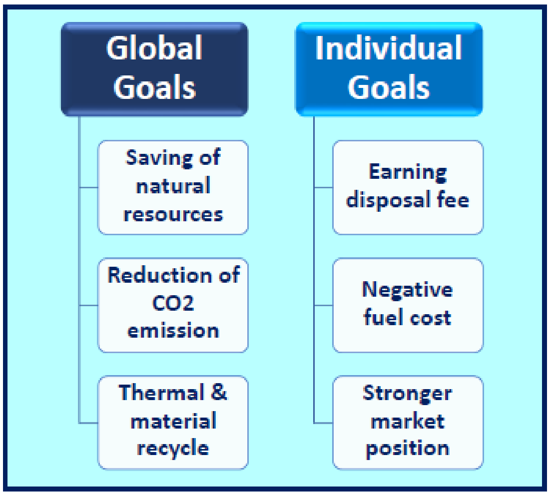
Alternative Fuel - Fact & Figures

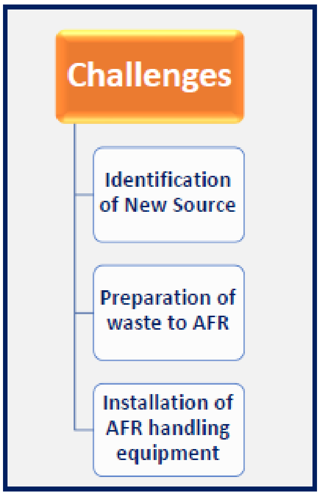
Recent database analysis shows that the green house gases emission reduction potential through waste utilization in cement industry is extremely higher.

Average utilisation of alternative fuels in selected countries

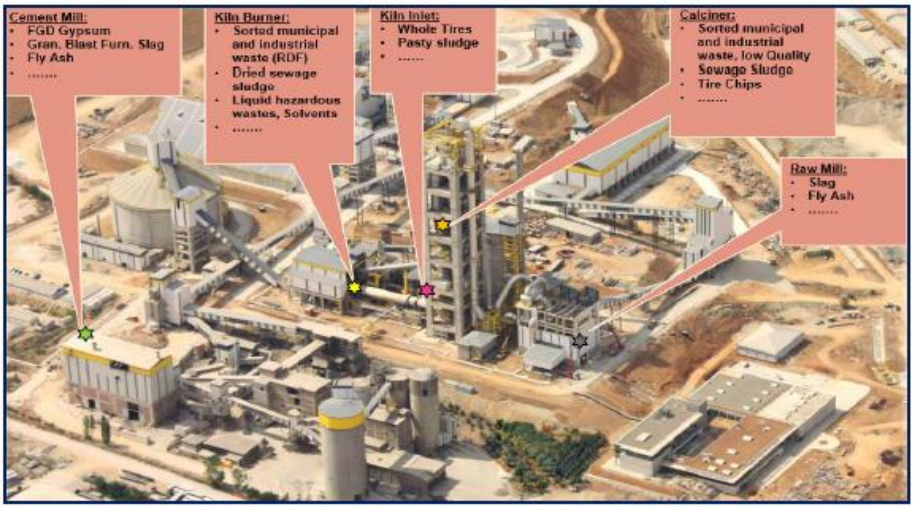


Goals & Challenges

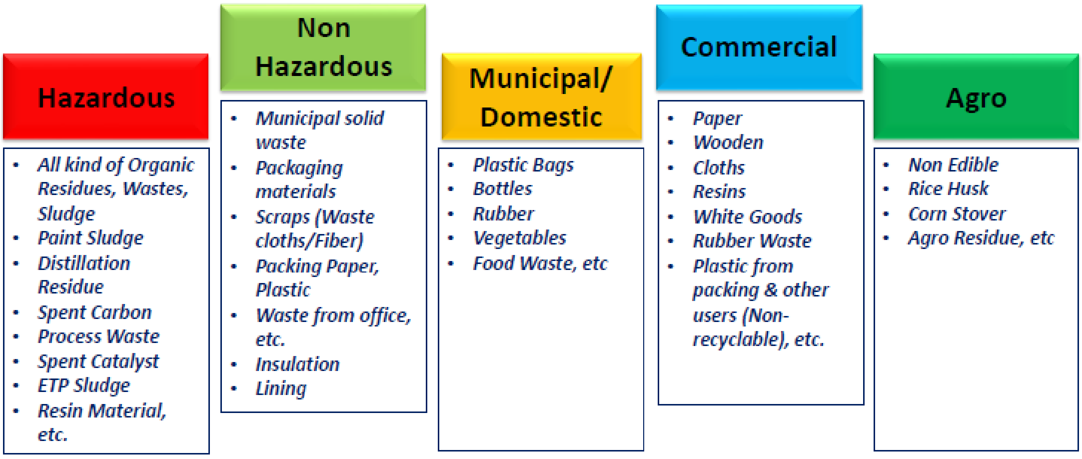




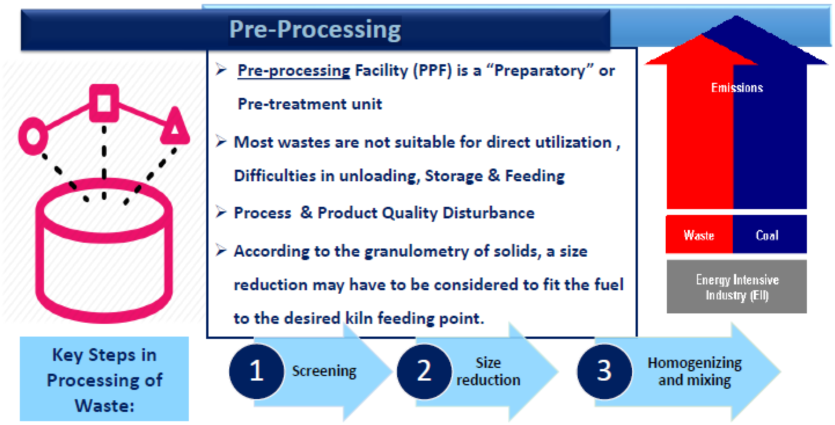
AFR-Feeding Points in Cement Plant



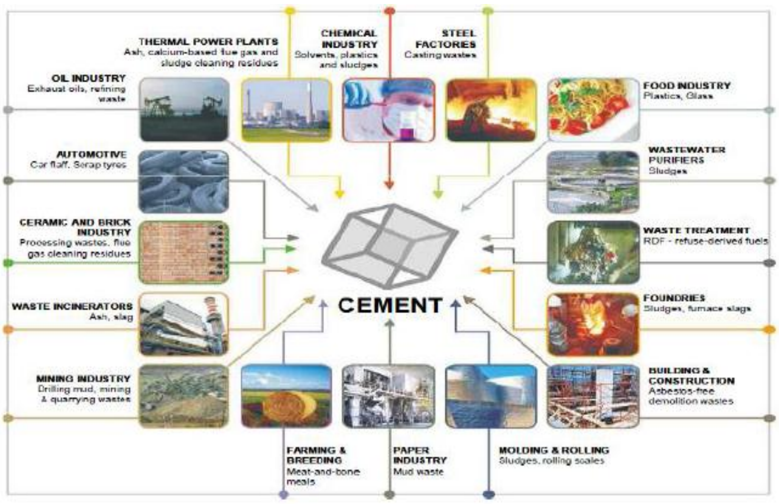
Types of Waste



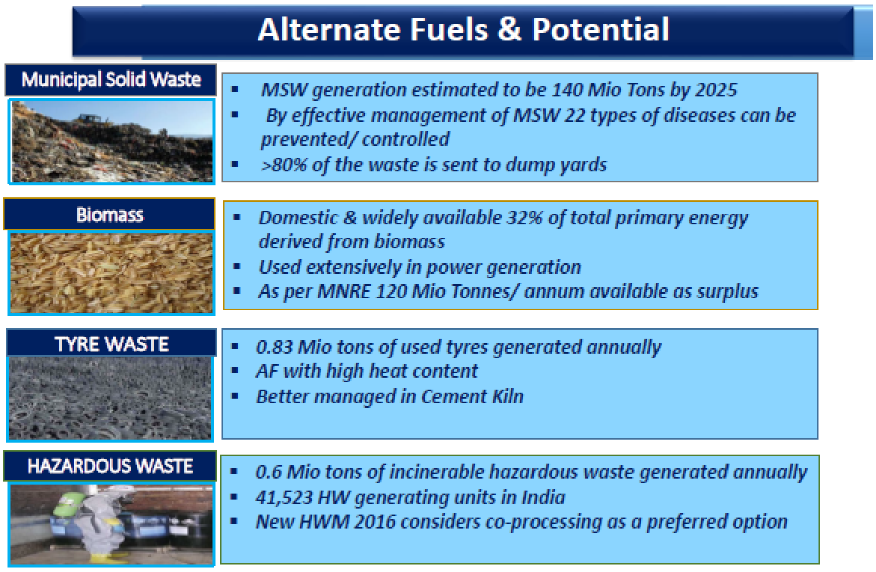
Pre-Processing



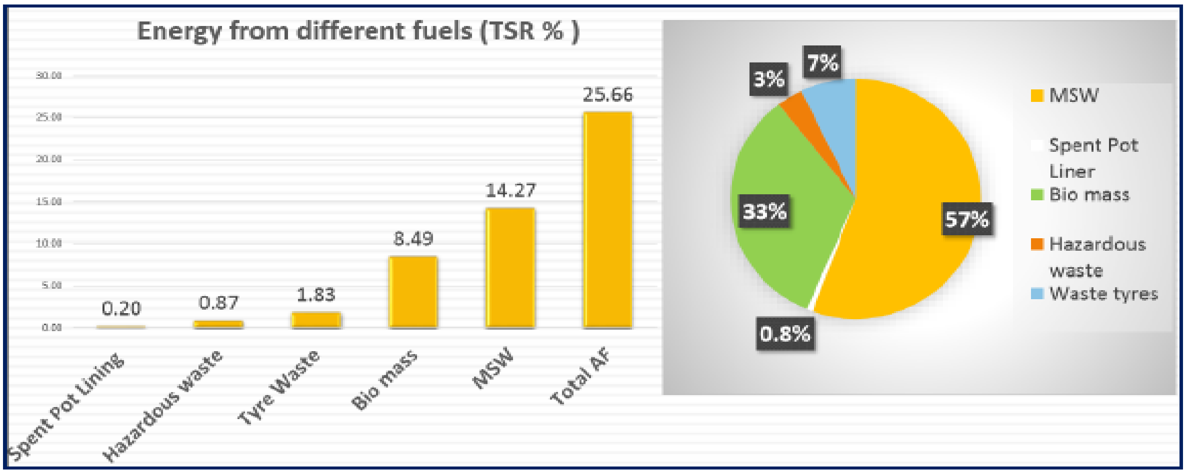
Sources of Alternate Raw material



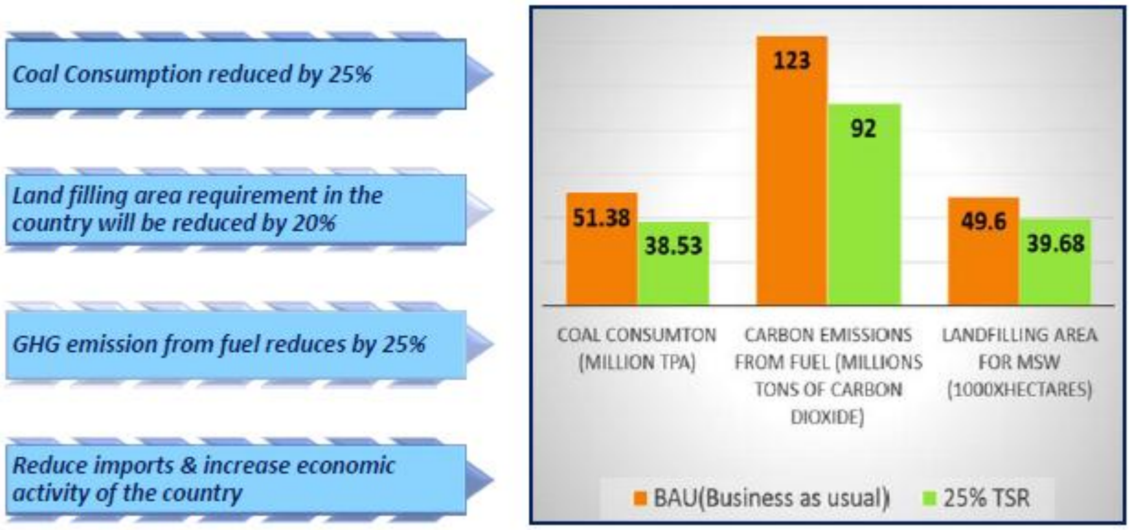
Alternate Fuels & Potential



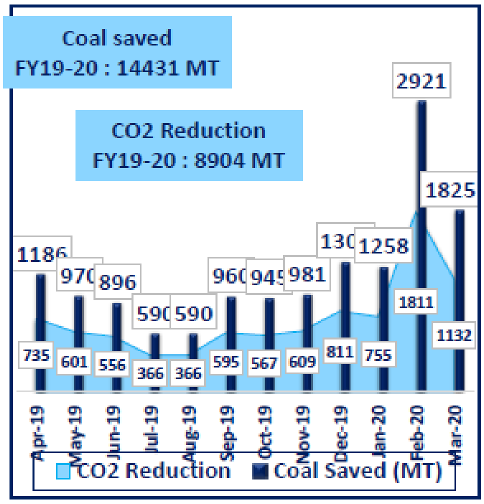
Energy From AFR Projected 25% TSR @ 2025



Anticipated Benefits By 25% TSR @ 2025



AFR Coal Savings & CO2 Reduction

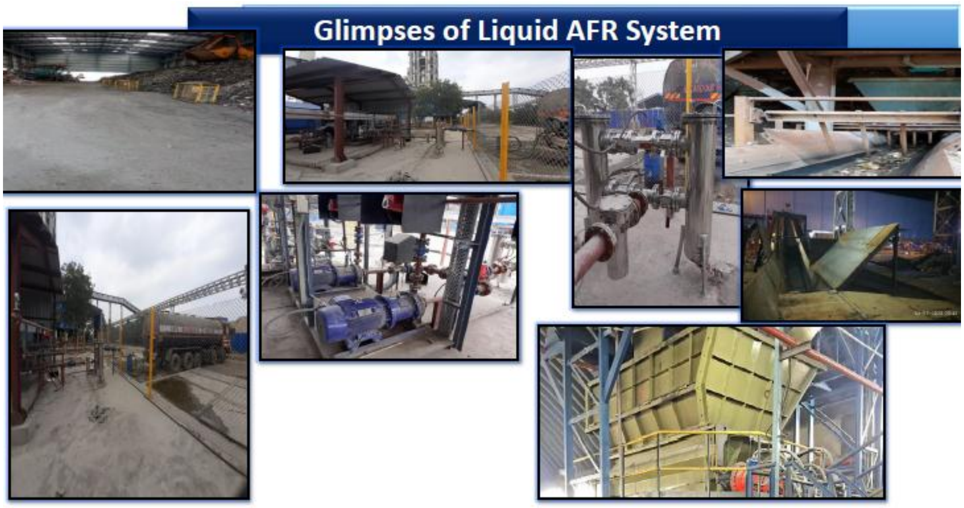


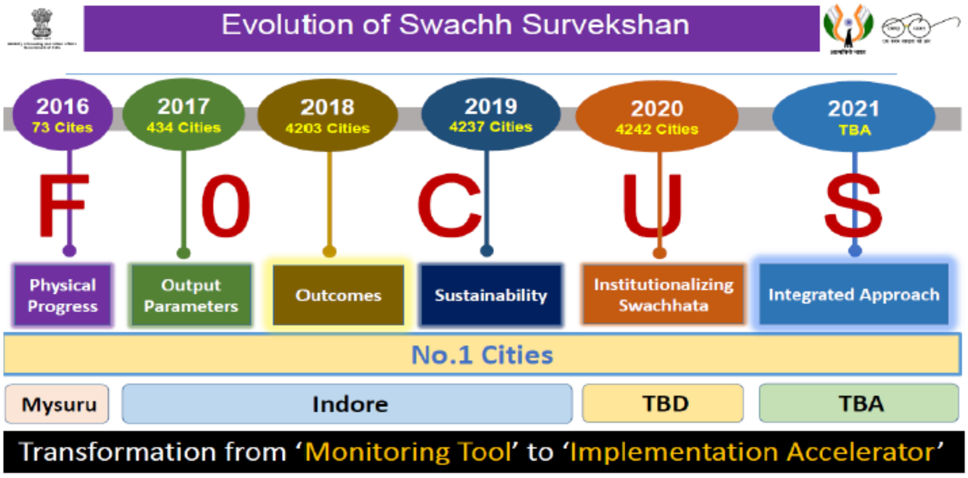
- Conventional fuel reduction by Volume (20-25 %) and TSR (10-15 %)
- PAT target to reduce 5% MTOE will be helpful by using AFR
- Reduction of global emission
- High temperature around 1400 Deg C & long Calciner residence time around 5-6 Seconds
- Double valorization: organic and minerals totally destroyed
- High efficiency and total recovery
- No adverse effect in cement product quality

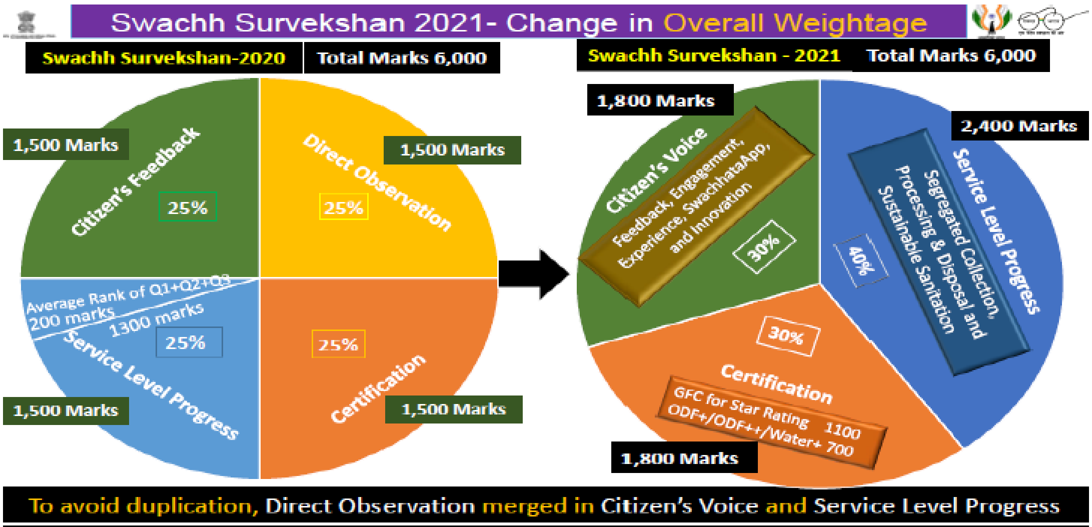
Challenges of AFR

- Problem in burning and operational stability, reduction in thermal efficiency (If feed size is > 50 mm)
- Handling as well as additional heat is required for drying, reducing thermal efficiency (If Moisture content is > 15 %)
- Not suitable for direct feeding, required additional cost for conditioning, causes increase in specific power (Low Calorific value < 2500 Kcal/Kg)
- Effect of minor component on clinker quality (Proper selection of AFR/RDF)

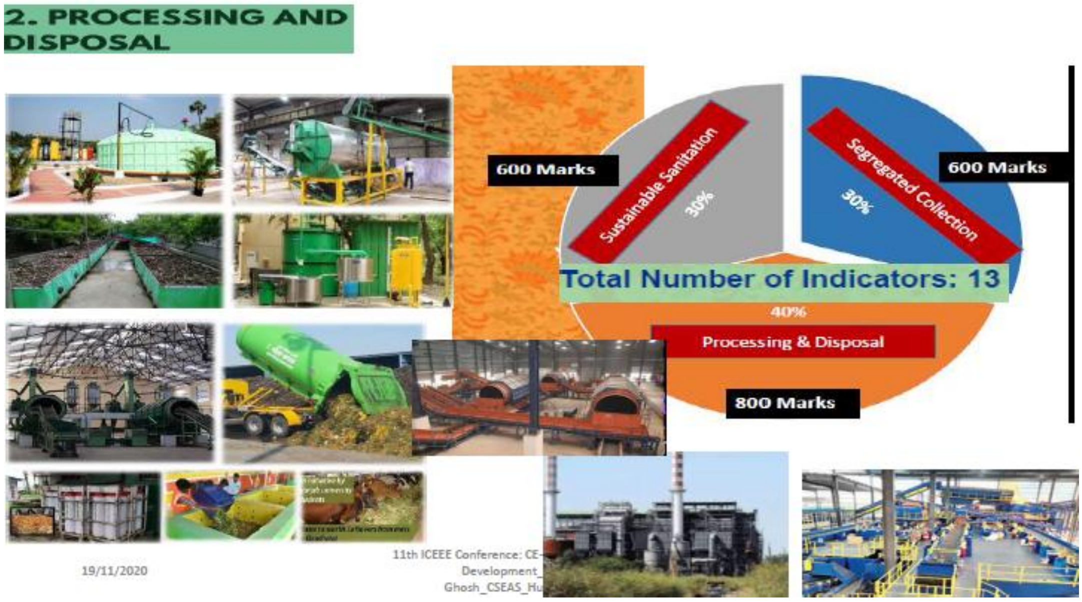
Glimpses of Liquid AFR System




Evolution of Swachh Survekshan
2016
73 Cites
2017
434 Cities
2018
4203 Cities
2019
4237 Cities
2020
4242 Cities
2021
TBA
F O C U S
Physical Progress
Output Parameters
Outcomes
Sustainability
Institutionalizing Swachhata
Integrated Approach
No.1 Cities
Mysuru
Indore
TBD
TBA
Transformation from 'Monitoring Tool' to 'Implementation Accelerator'

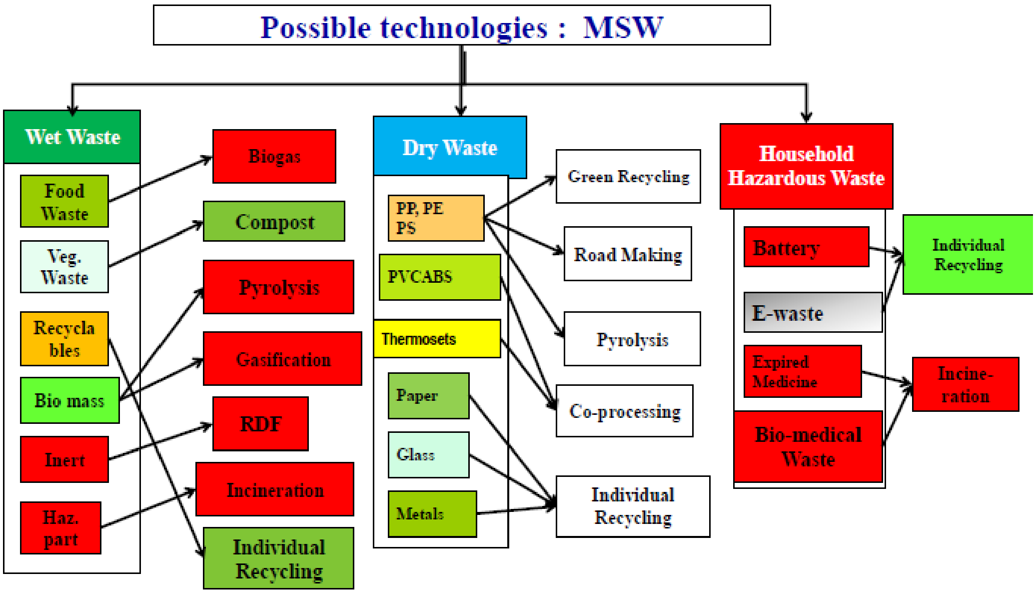

Swachh Survekshan 2021- Change in Overall Weightage
Swachh Survekshan-2020
Total Marks 6,000
Swachh Survekshan - 2021
Total Marks 6,000
1,500 Marks
Citizen's Feedback
25%
Direct Observation
1,500 Marks
25%
Average Rank of Q1+Q2+Q3
200 marks
1300 marks
25%
Service Level Progress
1,500 Marks
25%
Certification
1,500 Marks
1,800 Marks
Citizen's Voice
Feedback, Engagement, Experience, SwachhataApp, and Innovation
30%
2,400 Marks
Service Level Progress
Segregated Collection, Processing & Disposal and Sustainable Sanitation
40%
30%
Certification
GFC for Star Rating 1100
ODF+/ODF++/Water+ 700
1,800 Marks
To avoid duplication, Direct Observation merged in Citizen's Voice and Service Level Progress


SS-2021
New Performance Category
'Prerak DAUUR Samman'
Service Level Progress
2,000 Marks
for each Indicator
1. SEGREGATED COLLECTION
Total :
2000 Marks
Total Number of Indicators: 7
600 Marks
Sustainable Sanitation
30%
600 Marks
Segregated Collection
30%
40%
Processing & Disposal
800 Marks
Banned
Artefacts from Waste
19/11/2020


2. PROCESSING AND DISPOSAL
600 Marks
Sustainable Sanitation
30%
Segregated Collection
30%
600 Marks
Total Number of Indicators: 13
40%
Processing & Disposal
800 Marks
19/11/2020
11th ICEEE Conference: CE-
Development_
Ghosh_CSEAS_Hu


REVENUE
EXPENSES
Segregated as per value
CDW Recycling
Landfill & Remediation
Processing
19/11/2020
11th ICEEE


SUSTAINABLE
3. SANITATION
Sewage Treatment Plant
600 Marks
Sustainable Sanitation
30%
Segregated Collection
30%
600 Marks
Total Number of Indicators: 5
40%
Processing & Disposal
800 Marks
FSTP/
STP
Sewerage/Septic Tank
19/11/2020
Development_Prof. Sadhan K.
Ghosh_CSEAS_Hungary_19.11.2020



CONCLUSION

- Resource consumption must be reduced in all the countries
- Comply with the requirements of SDG 2030,
- Resource Efficiency need to be enhanced in all the countries by implementing 3Rs(Reduce, Reuse and Recycle) and Circular Economy

Theme: "Sustainable Environmental Protection & Waste Management Responsibility"
November 19 – 20, 2020 RKK – Óbuda University, Budapest, Hungary
ISBN: 978-963-449-203-0 www.iceee.hu

SPRINGER AUTHOR ACADEMY: A STEP-BY-STEP GUIDE ON WRITING AND PUBLISHING YOUR JOURNAL MANUSCRIPT

Nabil KHELIFI

Senior Editor, Manager of Springer MENA program
Springer, a part of Springer Nature
Heidelberg, Germany

***Abstract**: Scientific publication must be seen as an important, if not the most important, part of the research process. It is a central piece of the process that makes science advance. The rapid progress in the trends of scientific publication is enhanced by the availability of many tools that did not exist before.*
However, writing research papers for scientific journals is still not easy and is very competitive. It requires substantial effort which can be maximized by following a few simple guidelines when creating the product for submission. By following guidelines and avoiding common errors, the process can be streamlined and success realized.
Here, we share advice on how to effectively write and structure your paper. After producing data and generating ideas from your research, how do you write a clear and concise paper that attracts the attention of journal editors and readers? How should you prepare a cover letter to make a first good impression about your research paper? How should you respond to reviewer reports?
During this presentation, we'll provide a step-by-step guide to getting you started right away at preparing a successful publication following this plan:
1. What should be the motivation that can inspire you to accomplish a successful publication?
2. What to do before you start writing and how to efficiently prepare the needed literature
3. Which kind of writing style you should learn/use
4. How to logically link your ideas throughout the manuscript
5. Which structure you should follow when preparing your manuscript
6. How to present figures and tables
7. How to shape appealing title and abstract after you finish writing
8. Which journal you should chose and how you select the most appropriate journal
9. How to prepare a cover letter to attract the attention of editors
10. How to answer reviewers' comments

Full manuscript not recieved

MANUSCRIPTS AND DEMONSTRATION OF THE KEYNOTE LECTURES

Theme: "Sustainable Environmental Protection & Waste Management Responsibility"
November 19 – 20, 2020 RKK – Óbuda University, Budapest, Hungary
ISBN: 978-963-449-203-0 www.iceee.hu

SOIL MICROBIAL DIVERSITY AND FOOD SECURITY

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2 Institute of Agroecology and Environmental Management, Kyiv, Ukraine
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**Corresponding author E-mail: lyudmilassem@gmail.com*

***Abstract**: Agricultural intensification affects soil biodiversity and such changes may impact on current and future food security. The World Health Organization has identified antibiotic resistance as a serious threat to human health and biosecurity across the world. The soil microorganisms play an important role in the development and spread of antibiotic resistance in humans. The aim of this study was to determine soil microbial diversity and the antibiotic resistance of soil bacteria in different agroecosystems. 244 dominating bacteria were isolated, among them 53 antibiotic-resistant bacteria. All isolates were multi-drug resistant, of which greater than 62.3% were resistant to 9 antibiotics. A study of soil samples from agroecosystems of Capsicum annuum, Vitis vinifera, Rubus idaeus L., Petroselinum crispum showed that the microbial community characterized by a high content of antibiotic-resistant microorganisms. From the soil were isolated antibiotic resistant anaerobic and aerobic microorganisms: Clostridium perfringens, Clostridium oedematiens, Clostridium difficile, Enterobacter cloacae, Enterococcus faecalis, Hafnia alvei, Bacillus megaterium, Bacillus mycoides, and Pseudomonas aeruginosa. Modern agroecosystems are the source of spread of pathogenic and opportunistic microorganisms with multiple antibiotic resistances and endangering human health.*

***Keywords:** agroecosystem, antibiotic resistance, biodiversity, food security, microorganisms, soil.*

INTRODUCTION

The effects of soil biota and plant-soil biota interactions on plant productivity and food security is an active field of research [1,2]. Soil biodiversity can be defined as variation in soil life, from genes to communities, and the variation in soil habitats, from micro-aggregates to entire landscapes [3-5]. Biodiversity of soils varies depending on factors such as soil temperature, acidity, moisture, nutrient and organic matter contents. Inevitably, soil is a hot spot for antibiotics to affect indigenous microbes since it receives a large portion of excreted antibiotics through application of manure and sewage sludge as fertilizers [6-8]. The higher density of microbes in the soil environment encourages genetic exchanges, which could enhance the development of microbial resistance in the presence of antibiotics. Environmental contamination by antibiotic compounds is inextricably linked to development of antimicrobial resistance in non-target species of bacteria. Whether the bacteria perform critical ecosystem services, pose a health threat as pathogens or have incompletely understood functions in nature, development of antimicrobial resistance as a result of human activities is problematic. Susceptibility characteristics of microbes can be altered by incorporation of genetic information encoding for resistance or by mutation in their DNA. Antibiotic resistance genes are recognized as important environmental contaminants [9].

More and more evidence is being collected to support the idea that the environment acts both as a reservoir for antibiotic resistance and a means by which this resistance can be broadly disseminated. Antibiotics used in therapeutic doses on farms for pigs and cows, together with their feces, are subsequently exported to fields with agricultural plants. Even in small doses, they can cause a toxic effect and form antibiotic resistance of microorganisms [10]

Manure is often contaminated with veterinary antibiotics which enter the soil together with antibiotic resistant bacteria. However, little information is available regarding the main responders of bacterial communities in soil affected by repeated inputs of antibiotics via manure. Estimation of food security in different type of agroecosystems and screening of antibiotic-resistant bacteria-causative agents of human diseases is one of the important aspects in modern agroecology and environmental micobiology.

MATERIALS AND METHODS

Materials of research were soil samples, which had been collected by envelope method from agroecosystems: with cultivated of Capsicum annuum, Vitis vinifera, Rubus idaeus L., Petroselinum crispum, (organic fertilizer has been used continuously for the last 3 years). Microbiological studies of soil were carried out at the Scientific Research and Educational Center of Molecular Microbiology and the Immunology of Mucous Membranes, Uzhhorod National University and at the Laboratory of Microbial Ecology, Institute of Agroecology and Environmental Management, following the standard protocols [11]. Microbiological study of soil was performed in sterile conditions. The method of serial dilution was used to obtain the suspension where microorganisms titre were 10-3 CFU/ml. **-** 10-5 CFU/ml. 100 μl of the soil suspension was evenly distributed on the surface of the medium with a sterile spatula. For the study we used the following media: Endos agar, Meat peptone agar, Strepto agar and Entero agar, Agar-Agar, Eshbi agar, Soil agar, Chapek agar**,** Starch agar in 4 repetitions. Petri dishes with study material were incubated in the thermostat at 37ºC for 48 hours in aerobic conditions. The chromogenic selected media Uri-Select 4 (Producer: Bio-Rad, France) was used for isolation of microorganisms in aerobic conditions.

All isolated microorganisms were identified by applying of appropriate biochemical test-systems LACHEMA according to the instructions. Antibiotic resistance of the identified microorganisms was analysed by Kirby-Bauer method with the aim to find antibiotic resistant strains of pathogenic microorganisms. A total of 244 isolates from soil of medicinal plants were examined for resistance to 12 antibiotics of the main pharmacological groups: TE30 Tetracycline; VA30 Vancomycin; L10 Lincomycin; CXM30 Cefuroxime; AMP10 Ampicillin; CIP5 Ciprofloxacin; GEN10 Gentamicin; DO30 Doxycycline; AK30 Amikacin; AMX10 Amoxicillin; E15 Erythromycin; OL15 Oleandomycin. Anaerobic microbiota were additionally tested to Metronidazole MT5; Rifampicin RIF5; Clindamycin CD2. Results were expressed as means (±) standard deviation (SD) and (SSD_{05}) smallest significant differences of experiments conducted in quadruplication. Data were evaluated using the software Statistica 10.0.

RESULTS AND DISCUSSION

Environment surrounding is a huge bacterial reservoir, and antibiotic resistance can be passed between bacteria in the environment, including in the soil. Microbiological soil control is necessary for assessing and predicting the possibility of spreading antibiotic-resistant microorganisms. Soil microbial communities are heterogeneous entities with distinct components that are each capable of responding differently to environmental characteristics. Microbial composition was shown seasonal dynamics and differences in the structure of microbial communities, depending on the time of fertilization. Table 1 show the results of soil studies, where was observed the post-effect of organic fertilizer application. The soil of the agroecosystems was characterized by a high content of ammonifiers and nitrogen-fixing microbiota. The process of nitrogen fixation was most active in the agroecosystem where *Capsicum annuum* was grown. The number of micromycetes, oligotrophes and pedotrophes was variabeled in different agroecosystems. In the agroecosystem, where *Rubus idaeus* L. was cultivated, the maximum content of oligotrophs and pedotrophs was observed. Their number was respectively 3,46 CFU/ per 1 g/d.s. and 2,52 CFU/ per 1 g/d.s. Long-term application of organic fertilizers contributed to the preservation of positive dynamics in the structure of microbial communities. This is confirmed by a high content of organotrophes in the soil under all plants and a relatively low level of oligotrophyty of the soil through out the entire vegetative period.

Table (1) Functional biodiversity of soil microorganisms in agroecosystems

№	Agroecosystem	CFU-colony forming units/ per 1 gram of dry soil					%
		I	II	III	IX	X	XI
		$*10^3$	$*10^6$	$*10^6$	$*10^6$	$*10^6$	-
1	Capsicum annuum	16,22	6,17	1,67	1,68	5,33	77,3
2	Vitis vinifera	28,56	4,30	2,33	2,88	3,11	50,2
3	Rubus idaeus	25,42	3,42	3,46	2,52	2,86	41,6
4	Petroselinum crispum	13,19	7,70	1,72	1,34	4,15	64,2
-	SSD_{05}	0,22	0,31	0,27	0,19	0,54	1,27

** I Micromycetes; II Ammonifiers; III Oligotrophes; IX Pedotrophes; X Bacteria using mineral forms of nitrogen; XI Nitrogen fixing bacteria.*

One of the important indicators of the ecological and sanitary state of the soil and the whole ecosystem is the presence of conditionally pathogenic and pathogenic microorganisms. Particularly dangerous are the antibiotic-resistant microorganisms, which, together with the bioproduction, can enter to he human and animal organisms from the modern agroecosystems. The structure of microbial communities of the soil is interrelated with the presence of antibiotic-resistant pathogenic microorganisms. In the soil of agroecosystems where the number of pedotrophes and oligotrophes was higher, a greater number of antibiotic-resistant microorganisms were isolated. From the agroecosystem of raspberry (*Rubus idaeus* L.) were isolated following antibiotic resistance anaerobic microorganisms: *Clostridium perfringens* (resistant to erythromycin, clindamycin, tetracycline, rifampicin, amoxicillin, moderately sensitive to metronidazole and vancomycin sensitive), *Clostridium oedematiens* (moderately susceptible to amoxicillin and vancomycin), *Clostridium difficile* (sensitive to metronidazole). Nevertheless, the enrichments of *Clostridium* in soil which was continually treated with manure containing can be dangerous for public health. The enrichment of these bacteria, which are phylogenetically closely related to human pathogens, may improve the chance of transferring antibiotic resistance genes to human pathogens, since horizontal gene transfer is more prevalent between closely related organisms than between those distantly related Soil particles carrying viable bacteria can be transported over long distances and might contribute to the spreading of antibiotic resistant bacteria over wide geographic ranges [6].
A significant number of aerobic microorganisms with multiple antibiotic resistances were isolated from the agroecosystem of raspberry: *Enterobacter cloacae, Enterococcus faecalis, Hafnia alvei, Bacillus megaterium*, *Bacillus mycoides*, and *Pseudomonas aeruginosa*.
From the agroecosystem of parsley were isolated mostly bacteria of the genus *Bacillus*. All of them are antibiotic resistant and are the causative agents of foodborne infections. The soil microbiome plays an important role in the development and spread of antibiotic resistance in humans. The risk to antibiotic resistance exposure via produce consumption should best be managed by ensuring that practices designed to protect bioproduction from contamination with pathogenic microorganisms are also protective with respect to exposure to antibiotic-resistant bacteria selected for in the digestive tract of animals or humans.

CONCLUSION

Soil microbiome of plants: *Capsicum annuum, Vitis vinifera, Rubus idaeus* L., *Petroselinum crispum* characterized by high functional biodiversity. The taxonomic structure of microbial community has been determined by biochemical markers and showed significant difference between plant species. The screening of conditionally pathogenic and pathogenic microorganisms of soil microbiome has proved that modern agroecosystems are the source of the spread of pathogenic and opportunistic antibiotic resistant microorganisms. In total from communities of dominanting bacteria were isolated 23% of microorganisms characterized by high level of antibiotic resistance. All of them are pathogenic or conditionally pathogenic for human and can cause food borne diseases.

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TO SAVE THE GLOBE – THE CHANGE IN CO_2 PARADIGM IS A MUST!

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***Abstract**: With the famous Kyoto Protocol (1997) the carbon-dioxide (CO2) has been declared guilty. So far series of conferences cibled its reduction while by today even a carbon free vision got a serious political consent. In the meanwhile, climate change has been accelerating and escalating contradicting to those overall CO_2 reduction efforts. Increase of global warming with forest fires extension and ice melting are showing also an escalation. While the world air traffic has collapsed (due the COVID-19), atmospheric CO_2 level seems to be stabilizing at 400 PPM. We can simply declare that CO_2 theory does not work while we are running out of time! Let's turn the whole theory upside down. Take the CO_2 as a fertilizer (as it has always been) and start to create large green surfaces – carbon climate farms - with C4 species, agroforestry and geo-engineering while stopping the desertification or even turning it into profit center. Green Sahara and other large green projects completed with CO_2 fertilization could convert large amount of CO_2 into value with which progressive climate mitigation could start. Hungary inaugurated its first carbon climate farm in Nagyberény in 2019 while Morocco labelled our CO_2 open field fertilization pilot project as an important innovation at COP22 in 2016. We have tools for new efficient solutions, so let's convert CO_2 into green value.*

***Keywords:** carbon-dioxide, ecology, history*

SUNWO Zrt

Strategic Energy Technology Development and Supplying Co

- Strategic deployment of energy technologies → leader in green technologis. Activity focused on innovation, renewable energies, carbon-climate plantation and progressive climate mitigation
- Extended international relationships
- **Organizer of International Energy and Innovation Forums (17-27th), Sahara Scientists Summits (1-3rd)**

Cooperation with EU sponsored Climate-KIC program in biogas and CO2 recovery(2013)

↓

International engagement in Morocco (2015-2020)

Really the CO_2 is responsible for global warming?

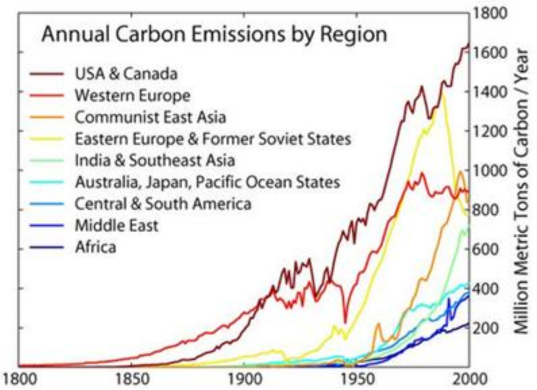
Facts

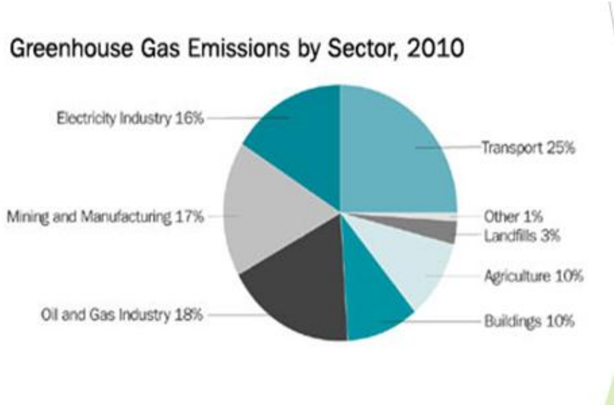
- Globe has always been having fluctuating climate and (relative) high CO_2 level
- Vegetation with intense photosynthesis capacity(C4) and extended green surface has been compensating temperature increase and decreased CO_2 level
- Srinkening CO_2 level(degradation of flora, majority of C3) with human activity (deforestation) development togather have neutralised the Earth self defence capacity

Trends

- CO_2 current level is low even for C3 type species while climate change is continuing to fluctuate
- Deforestation and deserticication have even been accelerated, surface reflection has been growing
- C4 species could not efficiently contribute to climate change mitigation unless CO_2 fertilisation will be introduced

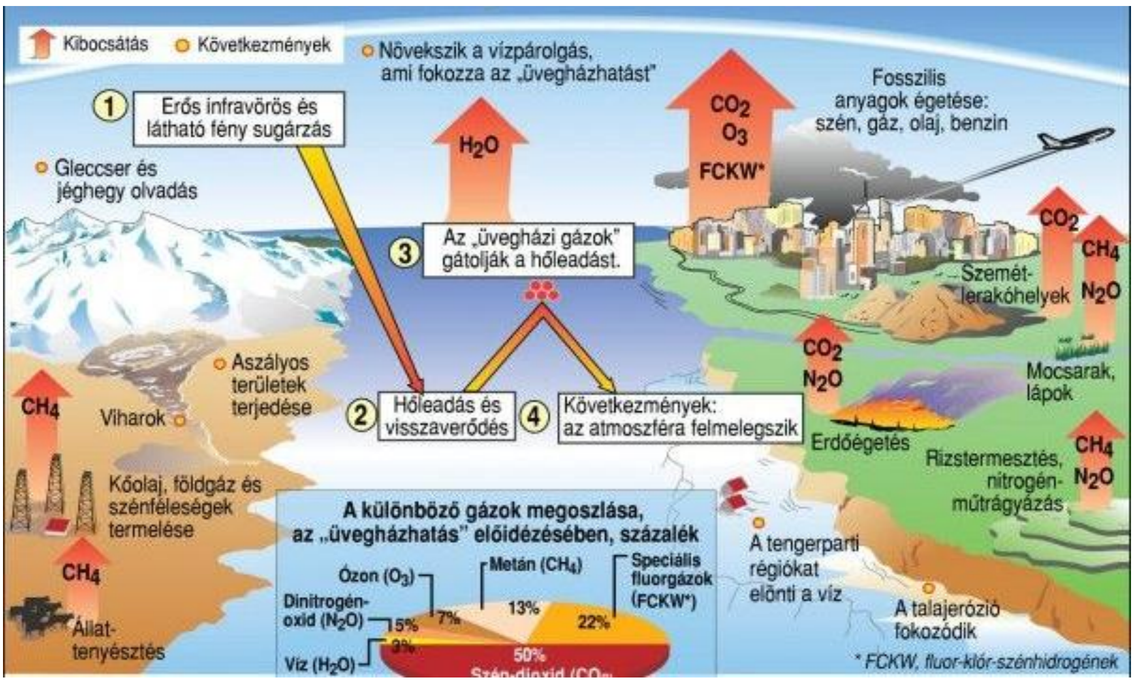
Increase in carbon dioxide emissions and structure





- In 2014 the carbon dioxide emissions growth per annum exceeded 3.2% and in total was 31.6 billion tons.By 2030 (at constant structure), an other increase of 40% expected from the transport

Greenhouse effect, for which the CO_2 is the main guilty

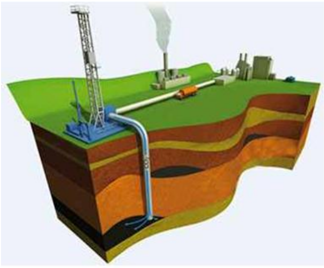


CO_2 History

- The amount of carbon dioxide is extremely and continuously varied in the athmosphere throughout the Earth's history
- We have had – not even once -higher than 1800 ppm level
- At the beginning of the industrial revolution it was as low as 280 ppm
- Today, it is reported to be in the range of 380-410 ppm

To measure the CO_2 concentration we are using an internationally accepted ppm units. The ppm is parts per million

Solution I.

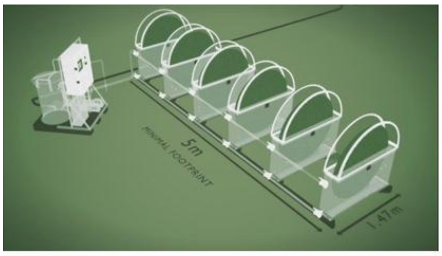


Storing CO_2 (CCS Carbon Capture and Storage)

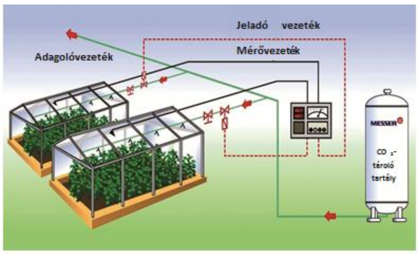
Sequestration of CO_2 through photosynthesis

CO_2 storage (CCS) could overbridge seasonal and geographical differencies and boost carbon-climate farming all over the World

Solution II.



ALGADISK



CO_2 fertilization

Brilliant solutions to increase the added value, but not enough to absorb large amounts of carbon dioxide gas

Solution III.

CO_2 fertilisation on corn plantation

Symbiotic (coffee and tree) plantation

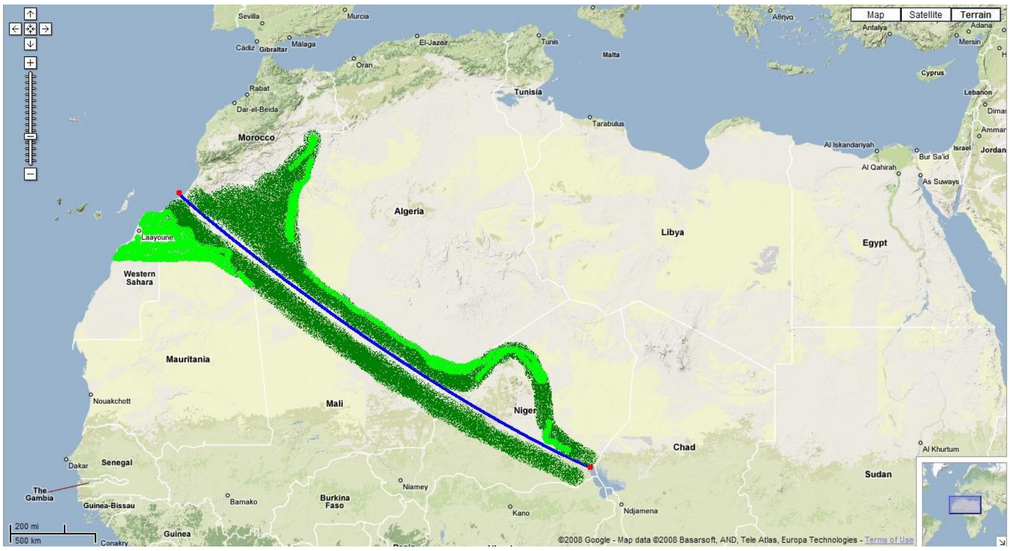
In a plantation or even in a symbiotic cultivation the level of **CO_2 assimilation can be increased to 3-5**

times and reach about 30 -200 tons / ha / year .Currently, the average CO_2 assimilation in Hungary is about 13.6 tons/ha/year.

CO_2 fertilization technology ave been modelized in Morocco (2016)

- The bottled commercial CO_2 was mixed with air and used in a 1600 ppm dilution
- The CO_2 trough a flexible pipeline was delivered to the plantation where the CO_2-air mix was injected in the crowns of the trees.
- The management of the process was controlled remotely by a software which allows to maintain an optimum condition (in accordance with the curve of CO_2 assimilation of the specific plant) continuously monitoring the humidity, temperature and light, measuring the intensity of illumination.
- With this method it was possible to increase the large scale absorption of CO_2 by 4-5 times(almost up to the maximum of C4 plants), while the cell mass (and yield of course) was increased by approximately 30%
- **Above solution was labeled as an important innovation of COP22 (2016) Marrakech-Morocco**!

CO_2 irrigation can be a tool to the Green Sahara project and key to the progressive climate mitigation



CO_2 irrigation can be a tool to the Green Sahara project and key to the progressive climate mitigation

- From 9 million km^2 of the Sahara Desert about one third can be rehabilitated by a symbiotic plantations, which use a C4 photosynthetic hibrid (Paulownia Smaragdfa) Thus we can transform about 4 billion tons of CO_2, while improving the supply of food and feedstock in the world
- Promoting eco-forests (C4 type trees for rehabilitation the rain forest) and the cultivation of trees in the unused, degraded areas is estimated to lead to the seizure of other 4 billion tons of CO_2, obtaining also as important materials as oxygen and wood besides other externalias.
- If the **world on the 161 million hectares - which are used to grow corn -** is to perform CO_2 irrigation technology ,too we could consume additional 1.61 billion tonnes of CO_2
- **Just from above solutions 10 billion tons a year of CO_2 can be converted into value trough a Progressive Climate Mitigation concept.**

Ecological paradigma shift?

- The reduction in CO_2 emissions by 2030, and carbon dioxide planned fertilisation together provide a new solution for humanity, which puts the emphasis on the CO_2 processing instead of placing additional restrictions on national economies;
- The resulting amount of biomass would increase further the biogas and bio-to-liquid (BTL) technologies, further reducing the global amount of CO_2 produced by fossil fuels;
- The evolving CO_2 pipeline systems generate extraordinary investment opportunities (strenghteening the green economy) in agriculture while geo-engineering works also offer new investment occasions worldwide;
- Carbon irrigation and related technologies are opening new dimension of industrial agriculture or in agro-forestry, where the carbon dioxide can become a useful raw material.
- To provide a finance for a 10 ha pilot scale project with CO_2 fertilisation system and its innovative technologies in Agadir, Morocco
- Expected budget: → 300.000 €
    - Duration 3 to 4 years
    - Engineers to be recruited 10 persons
    - Patenting and know-how control important!
    - International extension (Green Sahara or GGW support): from the beginning

→ Project will prove progressive climate mitigation as a workable solution with CO_2 fertilisation

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CLIMATE CHANGE CONCERN AND COMMUNICATION PATTERNS WITHIN YOUNG PEOPLE AND THEIR PARENTS

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**Corresponding author*

Abstract: *Environmental education is a crucial starting point for environmentally friendly behaviour and raising awareness. Opposite of adults, children in the pre-adolescent and adolescent period are capable of accepting specific models of environmental behaviour. Adopting environmentally friendly lifestyle is a safe pathway to sustainable development. Since the children still do not have any perception of climate change (CC), a proper education could yield in intergenerational knowledge transfer and rising awareness on CC among elders. This research was conducted in several phases: Phase I- a preliminary survey that was provided among elementary school children (7-14y) and their parents with the primary goal to examine their perception on persona knowledge, awareness, concerns and communication patterns on C. Phase II included educational workshops on CC and the renewable sources of energy, and Phase III was a final survey that has the main goal to examine the effects of previous activities. The result indicated that both children and parents have a high-level perception of personal knowledge. Also, children think that their parent also has a high level of expertise on CC while the perceptions on peers knowledge are quite the opposite. Answers that indicate mutual communication among children and parents showed different results. From the children's point of view, the lack of communication is revealed, while parents perceive that communication is good. Finally, after the workshops and education, the final survey indicated that communication among children and parents had been improved, but communication among peers seems to deteriorate:*

Keywords: *Environmental perception, Intergenerational knowledge transfer, Communication, Environmental education*

INTRODUCTION

The development of industry and the growth of the population, climate change becomes more evident and intense, so the combat against climate change today is one of the priorities in political agenda of the international community, which is reflected in many international conventions and agreements [1], [2], [3].
The decisions of individuals in terms of changing life habits can have the effect of mitigating the impact of climate change, but solving this problem on a global level requires global action. Political ideologies of individuals and worldviews may have a negative impact on solving this problem because they lead people to ignore risks, so it is very important to direct climate change communication efforts towards integrating scientific knowledge into political ideologies and worldviews [4].
One way to encourage climate change mitigation actions is effective communication of climate change science. This way, it influences the building/making positive attitudes of the public regarding the legitimacy of the science of climate change, the ability of individuals to contribute to solving problems, as well as the

adverse effects of not taking actions aimed at adaptation and mitigation actions [5].
When one talks about environmental education to shape attitudes and eventually change behaviour, children are often the target group. The main reason is that attitudes about environmental problems begin to develop at an early age, and already formed attitudes are difficult to change. Studies have shown that environmental attitude and behaviour of children increases until the age of about 10-12 years when it begins to decline until young adulthood, i.e. in the period between 13 and 18 years it rises again [6], [7].
Despite the widespread belief that parents are the ones who transfer knowledge to children and shape their attitudes, it has been shown that there is a two-way influence among parents and children and that communication between children and adults can play a significant role in evolving understanding of climate changes. Children may be able to overcome anti-reflexive tendencies of adults through intergenerational learning in the context of climate change. However, the impact of children on parents is not yet well-evaluated, and it is not known to what extent children influence their parent's consciousness and behavior through things they learn in school and take home [5], [8], [9].
In this paper the results obtained within the project "Development and application of the model for raising intergeneration awareness on environmental behavior, environmental protection and climate change in the Autonomous Province of Vojvodina" that is financially supported by Provincial Secretariat for science and technological development (No.142-451-2524/2019-02.).
The project was provided during the period of July 2019-avgust 2020 in several and had several phases that included preliminary survey that had a goal to take a insight in general situation on awareness and knowledge on climate changes among pupils and their parents, creative workshops and final survey to evaluate the effects of education. In this paper only a part of the research will be presented that refers on adolescent perception and their peer communication as well as the communication with adults (mostly parent) on climate change issues.

MATERIALS AND METHODS

To reach defined goals of the Project, research was provided in different parts of Vojvodina province among elementary school pupils (7-14y and their parents).
Research was provided in several phases. Phase I includes preliminary activity: consultation with teachers, preparation of workshops and definition a preliminary survey that has a goal to insight into the basic perception and knowledge on CC among participant. Phase II included workshops that has a goal to educate pupils on CC courses and consequences and the importance of using the renewable energy as CC mitigation process.
The survey contained two groups of questions: general and specific questions. General group covered questions on age, gender [10], education [11], questions with attention to analyze conceptual approaches to the problem of climate change [12]. Also, this group included questions regarding personal views on climate change, their religious commitment as well as nationality.
Comparative view of the questions in preliminary and final survey is presented in Table 1. Most of the questions have a choice of the answers that was suitable for age structure: Some of the questions are formulated as a dummy variable (for gender) or an interval level variable (for age). Some question included a statement, with which participants could agree, disagree, or neither on a 5-point scale (i.e. Strongly Agree, Agree, Neither Agree nor Disagree, Disagree, Strongly Disagree), and some of the questions implied the option for participants to formulate their answer.
The questions that included free/opinion answers were revised and systematized into groups that included the most frequently represented answers.

Table (1) The group of questions that refers to personal knowledge and concern on CC

Younger pupils I-IV grade (7-10y)	Older pupils V-VIII grade (11-14y)	Parents
Do you know that ice is melting on the North Pole?	Where have you heard about CC?	
Do you know why ice is melting?	I know a lot of about CC.	
Do you know whose responsibility is that?	I think that CC will cause a lot of problems in future.	
Are you concerning because ice is melting?	I am concerned about CC issue.	

Table (2) The group of question that refers topeer communication and parents' communication

<table>
<tr><th>Participants</th><th>I survey</th><th>II survey</th></tr>
<tr><td rowspan="3">Younger pupils
I-IV grade
(7-10y)</td><td colspan="2">Have you heard your parents talk about climate change?</td></tr>
<tr><td rowspan="2">With whom do you talk about CC?</td><td>To whom you talked most about what have you learned on workshops about climate changes and renewable energy sources?</td></tr>
<tr><td>What did you learn your parents/grandparents about CC?</td></tr>
<tr><td rowspan="5">Older pupils
V-VIII grade
(11-14y)</td><td colspan="2">My parents know a lot about CC.</td></tr>
<tr><td>Our family talk very often about CC.</td><td>Our family now talk more often about CC.</td></tr>
<tr><td>With whom do you talk about CC?</td><td>To whom you talked most about what have you learned on workshops about climate changes and renewable energy sources?</td></tr>
<tr><td colspan="2">Most of my friend know a lot about CC.</td></tr>
<tr><td colspan="2">I talk with my friends about CC.</td></tr>
<tr><td rowspan="4">Parents</td><td>Our family talk very often about CC.</td><td>Our family now talk more often about CC.</td></tr>
<tr><td>My child is interested in discussion on CC.</td><td>My child is now more interested in discussion on CC.</td></tr>
<tr><td></td><td>Workshops have improved my child's knowledge on CC.</td></tr>
<tr><td></td><td>After workshops my child have improved my knowledge and awareness on CC.</td></tr>
</table>

RESULTS AND DISCUSSION

Participant's profile

In the preliminary survey participated with 300 pupils (age 7-15) and 294 parents. Majority of parents (74%) were in age range from 25-31. Great share (58%) of parents has academic degree (B.Sc, M. Sc and Ph. D degree) mostly in engineering and pedagogy.
Final survey was provided online because of lockdown due the Covid-10 pandemic, resulted in lower share of participants in the final survey: 159 pupils and 144 parents.

PRELIMINARY SURVEY RESULTS

Personal perception on knowledge and awareness on CC issue

As a first step, in preliminary survey, personal perception on CC was exanimated (Table 1). For younger pupils, a simple question was asked: "Do you know that Ice is melting on the North Pole?" We concluded that younger pupils are aware of ice melting because the majority (65%) answered that they know about this issue. Older pupils (11-14y) were asked same question: "Have you heard about CC?" Half (50%) of older pupils answered that the CC is one of the topics that they learn in school, and 29% stated that the media (tv, internet and radio) was the main source of this information about CC. Opposite, 56% parents stated that they are informed on CC by media, and 22% stated that they learned about CC in school.
Since the pupils, nevertheless their age, are informed and know something about CC, next step was to examine their personal perception of knowledge about CC issue. Young pupils were asked "Do you know why ice is melting?" According to their answers we concluded that they are not sure about the causes of this phenomenon because only 12% of answers indicated knowledge ("Because of global worming" and "Because of climate changes"). The rest of the pupil did not give the satisfying answers that indicate their knowledge. Additionally, more that 51% young pupils know that the human's activity made this change.
Personal perception of knowledge about CC issue among older pupils and parents was exanimated with the direct statement "I know a lot of about CC". Answers indicated that 49% of older pupil positively answered (I agree 43% and I totally agree 6%). Still, share of pupils that negatively answered (I do not agree 17%, I do not agree at all 2%) and those who does not have any opinion on this topic (29%) is not negligible. So, the personal perception is polarized between the pupils whose personal perception on CC knowledge high and those who are not. Parents are confident in their knowledge on climate change. More than 82% of parents stated that their knowledge on CC is particularly good.
When we speak about concern on CC issue, younger pupils showed significant concern. More than 77% of them answered that they concerned about ice melting. Personal concern on CC, among older pupils and parents was examined through two questions: "I am concerned about CC issue"and I think that CC will cause a lot of problems in future" (Table 1). Results of answers (Figure 1) showed that 45% percent pupils showed

their concern on CC (I agree 30% and I totally agree 15%). Still, 27% answered that they do not agree with the statement “I am worried about CC issue “, and 28% of pupils stated that they do not have opinion. Answers on statements „I think that CC will cause a lot of problems in future” indicated similar results. Most of the older pupils (58%) are aware of the CC seriousness, but 20% of them stated that they do not find that CC will cause a lot of problems in future, and 23% of them do not have opinion. To examine parents concern on CC, the same two questions were asked. Results indicated that parents more concerned on cc issue then children (Figure 1).

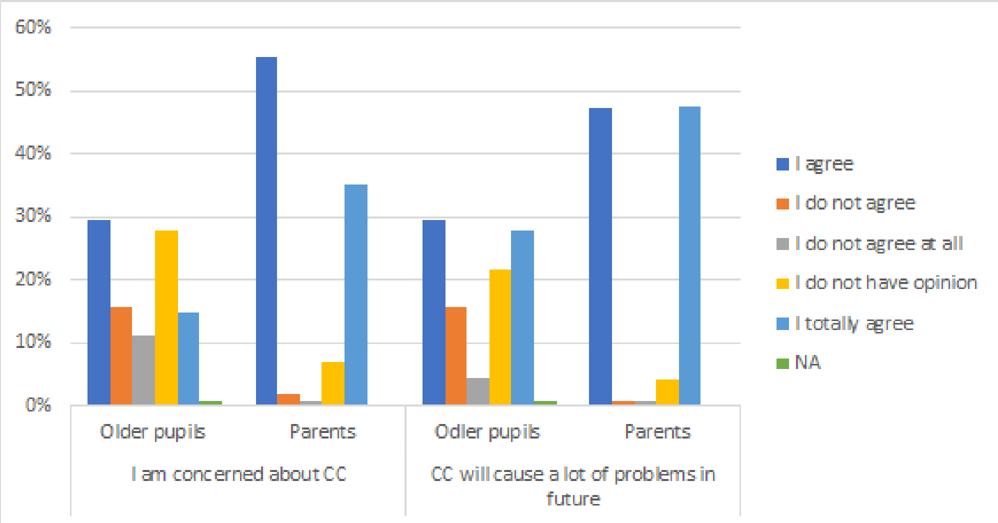

Figure (1) Answers: “I am concerned about CC”and “CC will cause a lot of problems in future” (Pupils (10-14y) and parents)

After the preliminary survey, a set of educational workshops on CC and renewable energy sources, were provided among all the pupils. Furthermore, after the education an online survey was provided to examine the communication improvement between parents and children.

Mutual communication on CC among parents/pupils and among peers was also examined. Questions that were asked in preliminary and final survey are presented in Table 2. In comparison to the preliminary survey, in final survey some of the questions were modified and some of them remained the same (Table 2).

Younger pupils were asked: “With whom do you talk about CC?” Literally, lack of communication was indicated. Share of 54% young pupils stated that they do not talk at all with parents/grandparent about CC. Still, 23% pupils stated that they have communication and most of them (22%) with their mothers (Figure 2).

Older pupils were asked how often they talk on CC issue with their parents/grandparents. Answers indicated that, although older pupils have higher level of knowledge, they do not talk on this topic very often with their parents and grandparents. Similarly, like at young pupils, among older pupils the communication is more frequent with mothers (36%), with fathers (25%) (see Figure 2).

Results of final survey showed a positive trend and improved communication among parents and children. We recorded higher percentage of positive answers about communication. Also, a significant reduction of answers “we do not talk about CC at all” (see Figure 2).

Another proof of improved communication was reflected trought the answers of younger pupils that were asked: „What did you learn your parents/grandparents about CC? All the pupils respond to this question giving us the conclusion that they have informed their parent obout workshops topics.

Pupils’ perception on parents’ knowledge on CC issue was examined (Table 2). According to their answers, 49% pupils think that their parents have a lot of knowledge on CC issue (I Agree 34% and I totally agree 15%), 21% have an opposite opinion (I do not agree 13% and I do not agree at all 9%), and 29% of them do not have an opinion at all. In Final survey we discovered that percent of positive answers increased giving that 72% pupils agreed with this statement (Figure 3).

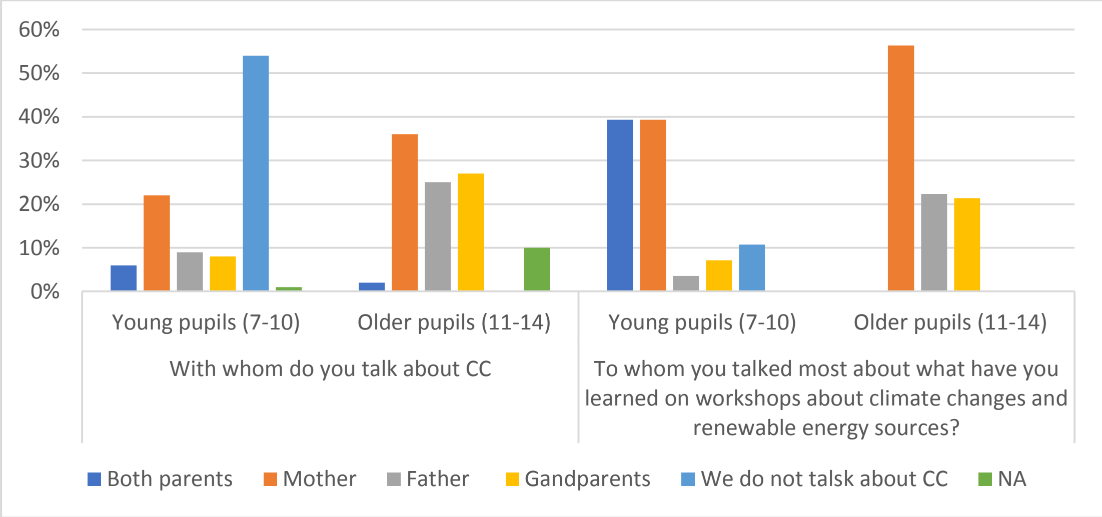

Figure (2) Answers: "With whom do you talk about CC?" and "To whom you talked most about what have you learned on workshops about climate changes and renewable energy sources?" (Pupils (7-14y))

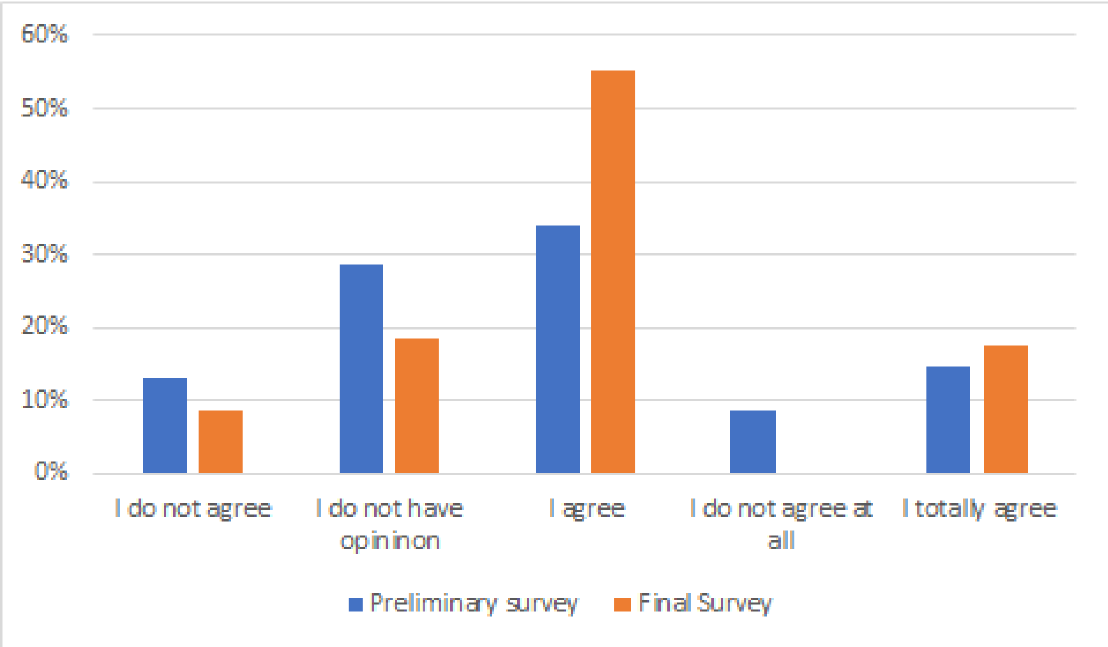

Figure (3) Answers:" My parents know a lot about CC" (Pupils 10-14y)

The presence of communication was also exanimated among parents, who were asked several questions (Table 2).

Opposite of pupils, results showed that parents think that they often talk with their kids on CC issue. Namely, statement "We talk about CC very often in our family" indicated that parents positively answered 69% (I agree 62%, and I totally agree 7%), and 20% answered that they do not agree with this statement in preliminary survey. Parents were also asked about how they agree with the statement "My child is very interested in CC issue". Most of the parents (65%) positively answered. Only 10% answered that they do not agree with above statement (Figure 4). In final survey, we asked parents on their perception of workshops effects on mutual communication.

Results showed that parents do not think that provided educational workshop have improved their communication. This is quite expected because the parents expressed high level communication in preliminary survey (Figure 4).

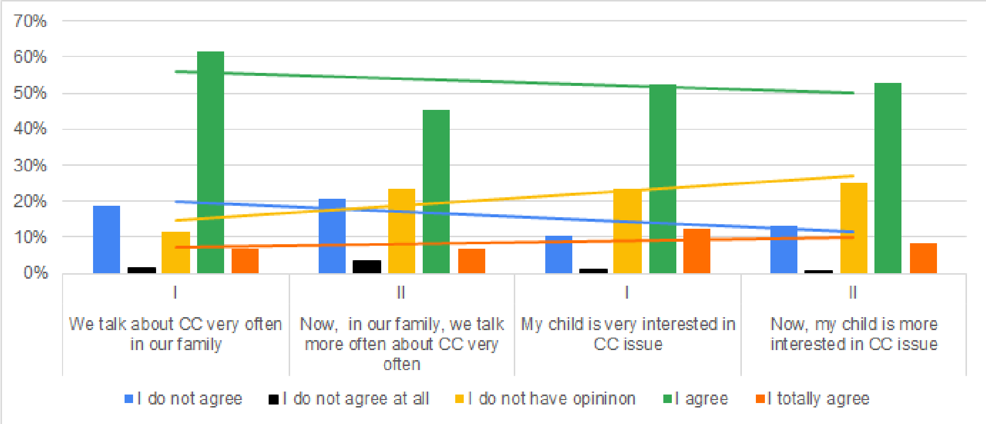

Figure (4) Answers: "We talk about CC very often in our family" and "My child is interested in CC issue" (Parents)

Finally, when they were asked about the workshop's effects on children's knowledge, parents responded positively. More than 80% answers were positive to improved knowledge both in parents and children that is a proof that they had conversation about CC (Figure 5).

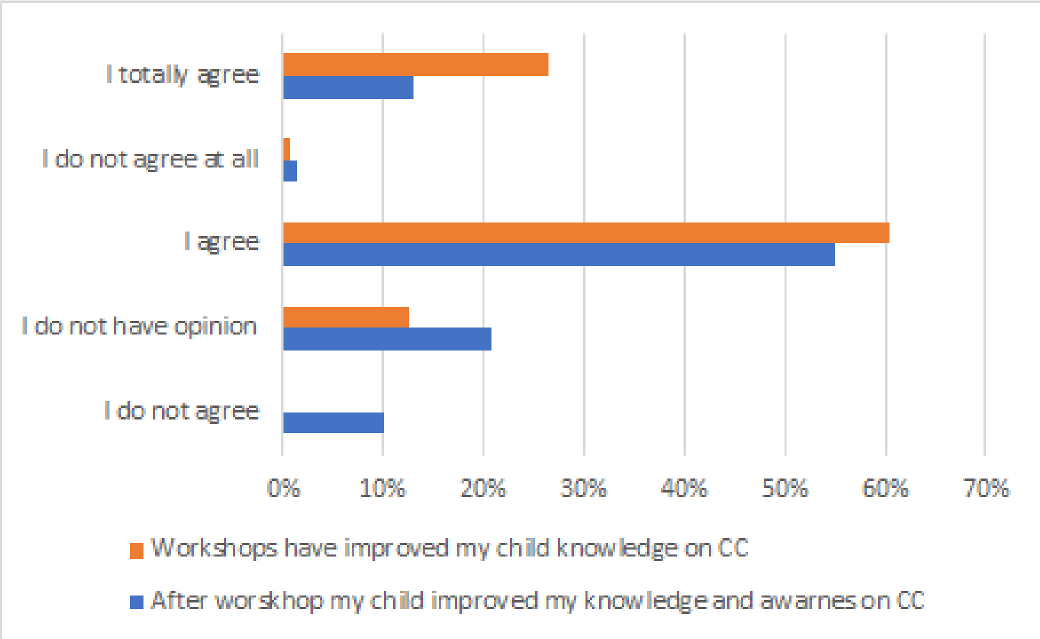

Figure (5) Answers: „After workshop my child improved my knowledge and awareness on CC" and „Workshops have improved my child knowledge on CC" (Parents)

Additionally, older pupils were asked about perception of knowledge on CC of their peers, as well as their mutual communication about this topic.

In preliminary survey it is identified that 35% of older pupils do not agree that their friends know a lot of CC issue. Only 27% think that their peers have certain knowledge, and great share of pupils (31%) do not have opinion at all about peer's knowledge. After the education, final survey showed some improvement. Namely, the percent of negative answers were much lower (18%), and percent of those who thinks that their friend know about CC was slightly higher (30%) (see Figure 6).

Lack of communication among older pupils was identified, as well. Share 61% (I do not agree 35% and I do not agree at all 24%) pupils did not agree with the statement: "I talk with my friends about CC". Only 17% answered positively on this statement. Great share of pupils does not have opinion at all. In final survey we identified that peer's communication was much worst in comparison to the situation before workshops because 68% pupils answered negatively to this statement (Figure 6).

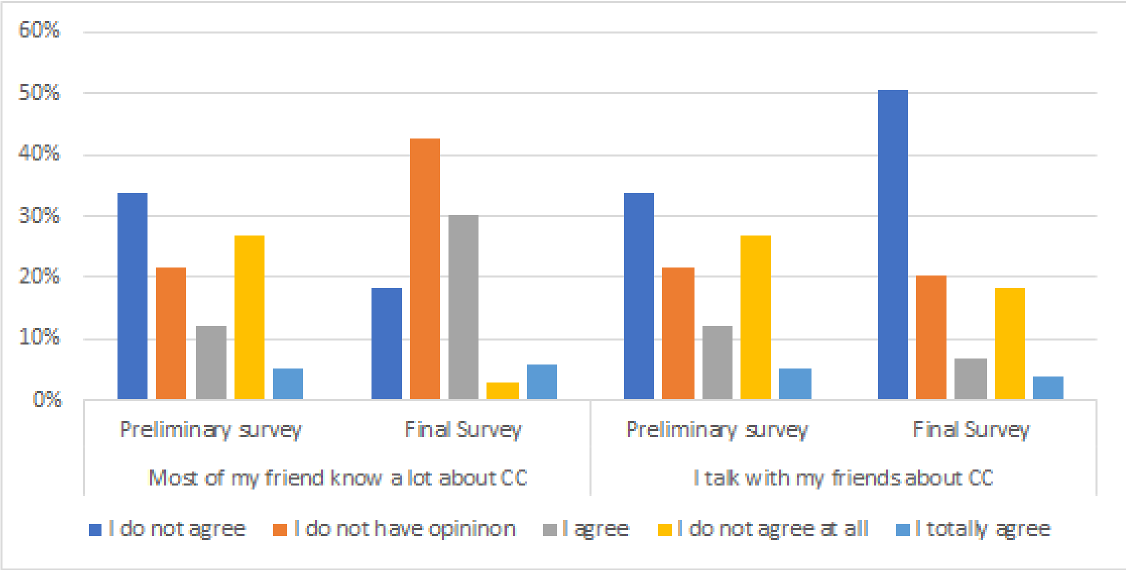

Figure (6) Answers: "Most of my friend have knowledge on CC" and I talk with my friends about CC" (Pupils (11-14y))

CONCLUSION

Development of the model and curriculum of intergenerational knowledge transfer in the Project, showed that there is a great potential to improve knowledge and awareness on climate change. In order to do so, it is necessary to make an impact on three generations at the same time. Therefore, in the long run, it is necessary to promote continuing education on climate change, beyond planned curricula, which include practical examples, work and solving specific problems, which encourages their active involvement and thinking. This approach enables raising awareness and levels of knowledge in a completely different, faster and more efficient way, beyond our education system requirements.

Acknowledgement

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STUDY THE EFFECT OF VITAMIN D3 IN TYPE 2 DIABETIC IRAQI PATIENTS WITH CHRONIC KIDNEY DISEASES

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Abstract: *Low vitamin D levels are associated with mortality in hemodialysis (HD) patients; however, the serum vitamin D thresholds are unclear. This study aimed to identify the vitamin D level below which mortality increases in HD patients. This study was designed to evaluate the vitamin D3 levels in Iraqi patients with chronic kidney disease and type 2 diabetes for both genders. Sixty Iraqi patients with chronic kidney disease and type 2 diabetes depended the hemodialysis duration less than 1 year; their age ranged between (33-60) years and compared with 30 healthy subjects as control group; their age ranged between (30-55) years, who were attending Al-Yarmok Teaching Hospital through September 2019 to March 2020. Anthropometric and biochemical parameters were measured for patients and controls. The baseline characteristics of study population are shown in Table 1. There were significant increases ($p < 0.05$) in glycemic test, urea, total cholesterol, triacylglycerol, low density lipoprotein cholesterol. While, there were significant decreases ($p < 0.05$) in high density lipoprotein cholesterol, glomerular filtration rate, and vitamin D3 in patients group as compared to the controls. Moreover, there were elevations in age and body mass index in patients group as compared to the controls. There were significant increases ($p < 0.05$) in fasting serum glucose, serum total cholesterol, triacylglycerol, and low-density lipoprotein cholesterol. While, there were significant decreases in high density lipoprotein cholesterol, glomerular filtration rate, and vitamin D3 in female patients as compared to the males. Moreover, there were elevations in body mass index, urea, and creatinine in female patients as compared to the males. Hypovitaminosis D was seen in Chronic Kidney disease (CKD) patients in this study, which encourage further work to assess whether the reference vitamin D level currently used in the general population is applicable to HD patients.*

Keywords: *Chronic kidney disease, Diabetes mellitus, Hemodialysis, Vitamin D3, Lipid profile, Renal function test*

INTRODUCTION

Diabetes mellitus (DM) is metabolic disease that has serious impact on human health. Diabetes mellitus complications include cardiovascular diseases, retinopathy and diabetic nephropathy (DN), which is the most common and serious complication of DM [1]. It has become the leading cause of chronic kidney failure, starting with norm-, micro-, and macroalbumin¬uria and ultimately leading to end stage renal disease (ESRD) [2].
The glomerular filtration rate (GFR) test is a skillful way to measure your level of kidney function and determine your stage of kidney disease. When the GFR level is less than 60 ml/min/1.73 m^2 for ≥ 3 months is referring to renal disease or in another term called Chronic Kidney disease (CKD). Other cardinal signs that imply abnormalities of blood or urine test or imaging studies have a strong link with (CKD) [3], even low

levels of vitamin D have main associated with (CKD) [4]. Vitamin D plays an important role in the regulation of approximately 3% of the human genome, as it is involved in this regulation through its cellular bile receptor and its distinct hormonal system. It also works to enhance the absorption of calcium and phosphate from the small intestine and raise their concentration in the teeth and bones. New research topics confirm the association of a range of diseases and symptoms with vitamin D deficiency, such as kidney disease, autoimmune diseases, tuberculosis, cardiovascular disease, diabetes, cancer and, of course, fractures [5]. In CKD, the mineral metabolism is progressively altered. Serum calcium (Ca^{+2}) and phosphorus remain normal until estimated glomerular filtration rate (eGFR) declines below 40 ml/min. There is a body of opinion that supports the higher mortality rate in CKD due to altered mineral metabolism [6].

MATERIALS AND METHODS

Sixty Iraqi patient with CKD and type 2 DM depended the hemodialysis duration less than 1 year encompassed 30 males and 30 females; age ranged between (33-60) years and compared with30 healthy subjects as control group (12 males and 18 females); age ranged between (30-55) years, who were attending Al-Yarmok Teaching Hospital through September 2019 to March 2020. Anthropometric and biochemical parameters were measured for patients and controls.

2.1. Laboratory measurements

Venous blood was sampled from patients following the admission day after 10-12 hours fasting. Fasting serum glucose (FSG), serum lipid profile encompassing: [total cholesterol (TC), triacylglycerol (TAG), high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), and very lowdensity lipoprotein (VLDL)], serum urea, creatininie, and were determined using standard biochemical techniques by automated Kenza TX 240 instrumental. Serum urea, and creatinine were evaluated using auto-analyzer (Hitachi, China). Glomerular filtration rate (GFR) was determination on equation depended on sex patients. Furthermore, vitamin D3 was measured by (Minividas, Biomerux kit, France).

2.2. Inclusion criteria

Criteria of CKD cases undergoing HD: Adequate hemodialysis for 2 hours/ 2 times weekly during 1st year.

2.3. Exclusion criteria

Patients with ischemic heart disease (IHD), hypothyroidism, nephrotic syndrome, hypertension, familial hypercholesterolemia, hepatic diseases, and recurrent myocardial infarction were excluded from the study.

2.4. Statistical analysis

Study analysis of Results are expressed as mean ± SD. Student-t test was used to compare the significance of the difference in the mean values of any two groups. The *p* value of less than 0.05 was considered significant.

RESULTS AND DISCUSSION

Approximately 10% in people deaths with type 2 DM are attributable to kidney failure. It is well-established that most diabetic patients develop diabetic kidney disease resulting in persistent albuminuria, a reduced eGFR, or both. The rates of diabetes complications such as CVD significantly decreased in the past two decades, it has not translated nearly as well as kidney complications [9]. The baseline characteristics of study population are shown in Table 1. There were significant increases ($p < 0.05$) in FSG, HbA1c, urea, TC, TAG, LDL-C, SBP, and DBP. While, there were significant decreases ($p < 0.05$) in HDL-C, GFR, and vitamin D3 in patients group as compared to the controls. Moreover, the patients in this study had lower BMI as compared to the controls. Also, (Jitraknatee et al., 2000) manifested their patients were underweighted which is in agreement with our data [10].

The current study showed that CKD patients had hypercholesterolemia and hypertriglyceridemia [11]. Numerous studies demonstrated that the main deviation of lipid in patients with CRF is the dramatic increase in the level of triglycerides [12, 13]. The enzyme (LPL) lipoprotein lipase plays the most prominent role in the decomposition of the TAG coming from the diet, and then the creation of a new TAG in the liver resulting from the breakdown of adipose tissue and muscles. Hence when LPL activity decreases it causes TAG level to rise. Many enzymes and receptors involved in lipoprotein metabolism are disorganized and dysfunctional, especially lipoproteins HLD and TAG, when chronic renal failure occurs. Chronic kidney patients undergoing hemodialysis should have their LCAT, apoA-1, and hepatic lipase regulated in parallel with the regulation of cholesterol-converting protein (CETP) as the largely responsible for reducing HDL-C and increasing HDL and TAG. [14]. Excessive elevation of TG, LDL, VLDL, IDL and chylomicron residues in blood plasma is caused by disruption of skeletal muscle, LDL adipose tissue enzymes, hepatic lipase, and VLDL receptors. Our data observed increasing levels in VLDL and decreasing levels in HDL-C for CRF patients with hemodialysis as (HD) against controls; these outputs are conformed to results of another pre-research [15]**.**

Table 1: The baseline characteristics of study population

Parameters	Means ± SD		*p* value
	CKD Patients (n=60)	**Controls (n=30)**	
Gender (Male/Female)	(30/30)	(12/18)	-
Age (Years)	54.4±6.21	48.20±5.17	0.81
BMI (Kg/m^2)	21.52±3.74	24.13±2.51	0.63
FSG (mg/dl)	228.6±9.31	92.1±4.55	0.001
HbA1c (%)	10.71±2.11	4.84±0.83	0.04
Urea (mg/dl)	62.7±8.21	28.56±2.52	0.001
Creatinine (mg/dl)	2.17±0.98	0.78±0.24	0.05
TC (mg/dl)	236.11±11.90	159.1±7.50	0.001
TAG (mg/dl)	223.2±3.71	120.22±12.20	0.001
HDL-C (mg/dl)	35.31±3.71	52.52±3.64	0.03
LDL-C (mg/dl)	148.21±12.31	84.63±9.14	0.001
GFR (ml/min)	35.22±4.01	95.13±5.01	0.001
SBP (mmHg)	165±3.41	120.0±1.23	0.01
DBP (mmHg)	105.0±2.51	71.40±1.56	0.01
Vitamin D3 (ng/ml)	12.98±1.81	33.6±3.51	0.01

There were significant increases ($p < 0.05$) in FSG, serum TC, TAG, and LDL-C. While, there were significant decreases in HDL-C, GFR, and vitamin D3 in female patients as compared to the males. Moreover, there was elevation in BMI, urea, creatinine, SBP, and DBP in female patients as compared to the males (Table 2). There was significant increase in the levels of serum urea observed in CRF group. On balance, unhealthy foods full of fats and proteins, especially red meat, lead to a deterioration of the kidneys' condition and cause the accumulation of urea in the blood serum [16]. Raise values of urea in the blood performs to serious complications in the body unless it is removed quickly by the kidneys [17]. Thru hemodialysis, the amount of excess urea is removed from the patient's blood a little to prevent its accumulation. Eating a balanced amount of protein consumed is also a critical step to confine excessive urea production [18]. Waste removal during hemodialysis also depends on the appropriate timing of dialysis, patient education, hemodialysis machine and appropriate dietary habits of patients [19]. The process of diagnosing and monitoring kidney failure can be done by measuring urea and creatinine levels they are important vital sign [20].

The urea molecule which is a bad sub-product of protein metabolism is accumulated in the blood of patients with renal failure causing hematuria [21] [22]. The high level of creatinine in the blood is considered an indication of the occurrence of kidney diseases and thus the difficulty of getting rid of this molecule that is generated as an unwanted product during the metabolic processes of the muscles.

Serum creatinine level was significantly higher than normal range (up to 1.4 mg/dl) in CKD patients undergoing dialysis. Increasing level of creatinine in serum may cause itching and damage to nerve endings [23]. Moreover, CKD patients are at a higher risk of hospitalization and CVD and the risk increases with a decline in GFR [24].

The reasons that may lead to a reduction in the levels of 25 (OH) D in patients with chronic renal failure have been mentioned previously. It is possible to raise the levels of the active vitamin D by eating foods rich in vitamin D and nutritional supplements containing vitamin D [25], despite these conflicting results of research on the extent to which patients with chronic kidney failure benefit from taking these supplements as well as the extent of their impact on deaths [26].

Table (2) Comparison of biochemical characteristic between male and female patients

Parameters	CKD Patients (Means ± SD)		*p* value
	Male (n= 30)	**Female (n= 30)**	
Age (Years)	56.23±2.68	52.27±2.82	0.623
BMI (Kg/m^2)	22.80±2.64	23.45±1.22	0.412
FSG (mg/dl)	278.0±15.61	290.0±17.80	0.05
HbA1c (%)	8.79±2.40	9.31±1.99	0.302
Urea (mg/dl)	63.93±8.81	68.91±7.14	0.05
Creatinine (mg/dl)	2.08±0.23	2.24±0.69	0.158
TC (mg/dl)	252.90±10.05	286.28±8.40	0.01
TG (mg/dl)	208.11±11.32	263.66±10.12	0.01
HDL-C (mg/dl)	43.90±5.06	30.12±4.04	0.01
LDL-C (mg/dl)	138.86±12.40	168.31±14.60	0.01
GFR (ml/min)	43.31±4.81	30.31±3.45	0.01
SBP (mmHg)	168.12±3.11	175.10±2.15	0.146
DBP (mmHg)	91.20±1.23	105.60±2.12	0.178
Vitamin D3 (ng/ml)	18.28±4.50	10.80±1.48	0.01

Additionally, Correlation coefficients between serum vitamin D3 and other parameters in patients' group are shown in Table 3. There were significant positive correlations between seum vitamin D3 and BMI, HDL-C, and GFR in CKD patients. While, there were significant negative correlations between serum vitamin D3 and FSG, TC, TAG, and LDL-C in CKD patients. Vitamin D deficiency may be due to a decrease in the concentration of the enzyme hydroxylase in the kidneys, or due to a decrease in the rate of skin formation of a substance such as cholecalciferol as a result of a lack of physical activities such as walking and morning sports and lack of exposure to beneficial sunlight. In addition, the decrease in calcidiol in chronic kidney disease indicates a decrease in the revivify of vitamin D form they have. The inverse correlation between 25(OH)-VD levels and parathyroid hormone (PTH) has been demonstrated across virtually all stages of CKD [27, 28].

Table (3) Correlation coefficient between serum vitamin D3 and other parameters in patients' group

Parameters	Vitamin D3 (ng/ml)	
	r	***p***
Age (Years)	0.178	0.08
BMI (Kg/m^2)	0.629	0.01
FSG (mg/dl)	-0.367	0.04
HbA1c (%)	-0.337	0.05
Urea (mg/dl)	-0.340	0.05
Creatinine (mg/dl)	-0.254	0.05
TC (mg/dl)	-0.278	0.03
TAG (mg/dl)	-0.461	0.01
HDL-C (mg/dl)	0.263	0.04
LDL-C (mg/dl)	-0.548	0.01
GFR (ml/min)	0.278	0.03

Adults suffer from soft and lax bones in the event of a lack of vitamin D stores in the body, while this decrease causes rickets in children. Different subgroups such as race, geographic latitude, sun exposure, skin pigmentation rate, and dietary vitamin D intake are a classification that is adopted for the normal population when they develop a vitamin D deficiency, but the classification range is wider in chronic kidney patients who need dialysis [29]. The evidence of calcidiol hormone turbulence or low is indicated if its rate in the blood less than (25-25) nmol/liter [30]. Recent investigations have evidenced the insufficiency and deficiency of 25 (OH) D in patients with stage 5 CKD. While, other conditions such as gender, a high BMI level, and a low rate of sun exposure can exacerbate serum levels of 25 (OH) D as well [31]. Moreover, there were multiple researches used as a guide for distinguishing the decline of both 25(OH)D and 1,25(OH)2D in hemodialysis patients. This lack in both forms of vitamin D is an unrelated reason to death in these patients along with other factors such as residual kidney function which is known as mortality predictor in dialysis patients [20, 21].

CONCLUSIONS AND RECOMMENDATIONS

Our study was marked a steady relationship between serum urea and creatinine levels among CRF patients presenting information on renal function among these populations. Kidney function is evaluated by measuring certain components in the blood plasma, such as the level of urea and creatinine. Dialysis is the best way to get rid of unwanted waste in patients with chronic kidney failure. Spreading health awareness to reduce the spread of obesity and diabetes by advising individuals to eat healthy, fat-free meals or reduce red meat and to provide modern techniques for early detection of diabetes complications that usually end in kidney failure would reduce this problem globally.
Hypovitaminosis D was seen in CKD patients in this study, which assess whether in more activities to the reference level of vitamin D the same for all people in HD patients. A study that includes the administration of various concentrations of vitamin D is needed to estimate its role in the rate of death.

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THE ROLE OF PHYTOREMEDIATION IN THE SOIL

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Abstract: *Pollution of our environment with heavy metals as a result of industrialization and use of agrochemicals to boost agricultural production is continuing unabated and is affecting animal and human health. As system of intensive agriculture is developing near the cities and making use of high doses of fertilizers and sewage sludge, Government and Public Opinion in world has started questioning the possible impact of these agro-chemicals and agricultural practices on the three components of our "Biotope": Soil, air and water (Environment). Soils generally contain low levels of toxic heavy metals viz., cadmium (Cd), Mercury (Hg), Lead (Pb) and Nickel(Ni) but considerable amounts of the elements can be introduced into soils via anthropogenic pathways such as dumping industrial effluent and agricultural application of sewage sludge, use of inorganic and organic agro-chemicals, application of commercial fertilizers. In addition to above mentioned key sources of heavy metals contamination in soil, the products used in our modern society are also too toxic to be disposed off without particular treatment. Not only the industries generate such kind of poisonous and hazardous waste but also many household products fall under this category. If not disposed away correctly, some cleaners, solvents, pesticides, paints in the form of sewage water can contaminate the agricultural soil in the vicinity of cities, leak into the underground water or contaminate the irrigation sources resulting in tremendous risks for the safety and health of human. In the respect of our environment, the basic recommendations of (reduce, recycle, reuse) should prevail as a prevention, instead of curing. As good as it can be applied, this principle cannot totally avoid generation of hazardous waste and therefore, long term solution must be developed. For sustainable clean ups of environment from these hazardous wastes and heavy metals, techniques and strategies includes phytoremediation. It is a three step process involving high uptake of heavy metals by roots, transportation to shoot and sequestration (distribution) of metal within the shoot. Hyper accumulator plant species exhibit the shoot/root ratio of metal content greater than 1, which reflect that specific internal system pumps metals from plant roots to shoot tissue (8).The chelator-assisted phytoremediation studies has been carried out on the phytoremediation of Cd, Ni, Pb and Hg polluted soils by Brassica species under screen house condition in spiked soils in the Department of Soil Science, CCS Haryana Agricultural University Hisar-India.*

Keywords: *chelating agents, heavy metals, hyperaccumulattor,microbes, phytoremediation*

INTRODUCTION

The use of specially selected and genetically engineered metal accumulating plants for environmental clean-up is an emerging frontline technology called "Phytoremediation" which describes a system wherein plants in association with soil organisms can remove or transform contaminants into harmless and often valuable

forms. [9]. Heavy metal pollution of soils in all over the world is an alarming and catastrophic situation requiring urgent rejuvenation and decontamination. This has forced the researchers to think of using plants for cleaning of their own support system.
Local metal enrichments are either natural or result from human activities, such as smelting, mining, processing, agricultural and waste disposal technologies. The release of metals by industrial activities at some extent has been limited in Europe. As Indian and Middle East countries scenario is concerned, due to rapid industrial development and urbanization during the last two decades, disposal of industrial effluents, electronic waste has become a serious problem because they contain a large amount of heavy metals (Cd, Ni, Pb, Cr and Se). In addition to this, hospital disposal, city waste and lack of facilities of sewer water treatment (except in few metropolitan cities where treatment facilities are available) adds a large amount of heavy metals to soil. Farmers grow vegetables in sewer water irrigated areas in lure of saving some fertilizer, as sewer water and effluents are rich in nitrates and phosphates. Also for saving transportation costs, farmers grow vegetables in areas around the big cities, which are highly polluted by city waste, sewer water, electronic waste and hospital disposal. Use of agrochemicals viz. pesticides, herbicides and insecticides which contain heavy metals (Hg, As and Pb) at large scale make the situation more dangerous. Above mentioned points clearly indicate that vegetable growing areas are highly contaminated in India and in other Middle East countries also. Vegetables bring heavy metals directly in food chain and cause serious health hazards to human beings. So it is a matter of serious concern that there is a very emphatic need to remediate these vegetable growing areas with phytoremediation technique.

In view of this, the research project was planned with the following objectives:

1. Relative efficiency of Brassica species, and Maize to accumulate heavy metals (Cd, Hg, Pb and Ni) with and without application of chelating agents (EDTA, NTA) in soil.
2. To investigate the accumulation factor (AF) for different heavy metals in some hyper accumulator plant genotypes.
3. To investigate the heavy metals content and speciation of Cd, Hg, Pb and Ni in sewage sludge applied soils and decontamination with introducing hyper accumulator crops in local crop-rotation.
4. The heavy metal tolerant bacteria shall be identified, characterized and utilized for biosorption of heavy metals in the industrial effluents and waste water.

MATERIALS AND METHODS

This study included green house/field trials as well as laboratory experiments. The physico-chemical characteristics of soils were determined using standard procedures and heavy metals have been determined by ICP.

1. Homogenous (metal spiked) soils for different heavy metals (Cd, Hg, Pb and Ni) prepared in bulk and different hyper accumulator test crops species tested for accumulation of metals.
2. Similarly sewage sludge soils from areas in vicinity of urban areas which used for intensive cultivation had been collected and repetition of above mentioned hyper accumulator for decontamination.
3. Effect of different chelating agents/rhizotrons to boost phytoremediation observed and soil application in solution form pre and post germination of crop were performed.
4. Isolation and characterization of heavy metal tolerant bacteria and their utilization in bioremediation of soil and waste water.

Screen house experiments: The screen house experiment consists of the following organic amendments and microbial biomix treatment combinations.

A. Metal-enriched soil as such (Cd_{50})
B. Metal-enriched soil + FYM @ 2% (Cd_{50}+ FYM)
C. Metal-enriched soil + Vermi Compost @ 2% (Cd_{50} +VC)
D. Metal-enriched soil + Microbes *(Azotobacter spp-Mac-27*)
E. Metal-enriched soil + Microbes *(Pseudomonas spp-P-36*)
F. Specific metal enrichment in incubation tests A-E are: i) Cd_{50} ii) Ni_{200} and iii) Pb_{400}

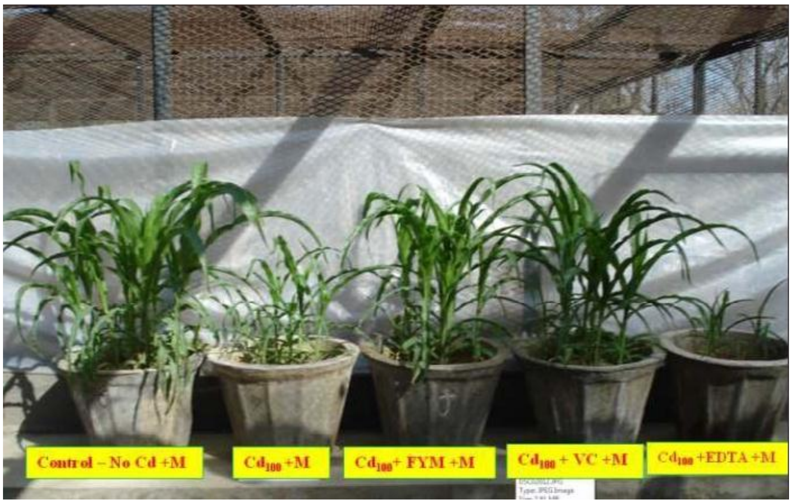
Test crops

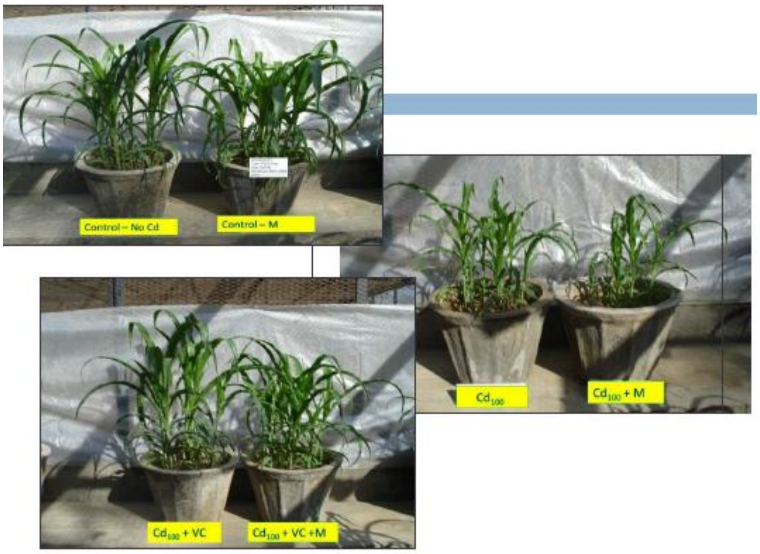
1. Indian mustard *(Brassica juncea* L*),*
2. Sunflower *(Helianthus annuus* L.*),*
3. Maize (*Zeya mays*)

Plant samples were digested in cc.HNO_3 + cc.H_2O_2 and the heavy metal contents measured by ICP-AES techniques.

RESULT AND DISCUSSION

Reports of infamous itai-itai and minamata diseases from Japan due to excessive dietary intake of cadmium and mercury by human beings [2] are the specimens of heavy metals pollution. Health hazards associated with lethal intake of Cd included renal (kidney) damage, anemia, hypertension, and liver damage [15]. Mercury levels in human beings have been directly related to in gestation of fish reared on Hg-polluted aquaculture, although agricultural use of mercurial fungicides can also cause entry of Hg into human system through crop plants [2]. Principal anthropogenic sources of Pb and As are use of leaded gasoline and spraying of arsenic pesticides. Encephalopathy (damage to brain), neurophysical deficit in children and metabolic disorder are caused by the lead intake by human and animals.*Thlaspi* have been grown in soils contaminated by smelter fumes.





These contaminated soils are virtually barren. Accumulating more than 30,000 mg/kg (about 3%) zinc in their tissues, the *Thlaspi* plants grown on this site, could be harvested to remove large quantities of the metals from the soil. This and another phytoremediation technologies for metals (e.g. the bio-reduction of Cr and Se ions) hold promise for cleaning up or making them less harmless the badly contaminated soils.

The survey of literature suggests that some crop plants like Indian mustard and maize possess the ability to hyperaccumulate the toxic heavy metals [(6]; [18]; [13]. Micro-organisms produce a wide range of different chelating agents like siderophores which make metals more available for plant uptake and therefore may be useful for remediation application [7]; [11]. Plant growth can also be promoted by microorganisms that produce growth factors, protect plants from the toxic metals or make soil micronutrients and metals bioavailable to plants [23].
Use of synthetic chelating agents (like EDTA, NTA etc.) is known to promote metal extractability, increased availability to plants and transformation to other forms/complexes [12]; [10]; [17]. The C-EDTA-4 with a release period of 80 days proved to be the best in decreasing Pb and EDTA concentrations in soil solution and increasing Pb accumulation in sorghum shoots compared to the direct application of EDTA. [22].

HYPERACCUMULATOR

Phytoremediation is a new technique employed for the remediation of contaminated soils. *Brassica juncea* (Indian mustard) accumulates high amounts of Pb, Cd, Cu, Ni and Zn in shoots. Metal uptake and accumulation in shoots of *B. juncea* is shown to be enhanced by application of chelators [1]; [16]; [21]. Phytoextraction by using hyper accumulator plants may provide an effective and in situ way of removing heavy metals from contaminated soils by metal accumulating plants, are used to transport and concentrate metals from the soils into the harvestable parts of roots and above ground shoot. *Brassicaceae* and *Compositae* families are capable of having high levels of heavy metals in their above-ground plant organs. In many soils affected by mining, smelting, industrial processes and application of sewage sludge contaminated with single metal is most uncommon but with several metals usually occurring at high content. Nickel is often found in high content in polluted soils with Cd and Zn, and the sensitivity of highly Ni/Cd/Zn tolerant hyper accumulators has not been documented. The efficiency of metal uptake by hyper accumulating species is poorly defined in the situation where several metals are present at high concentrations. The term hyper accumulator has come to mean a plant capable of taking up concentrations of heavy metals approximately 100 times greater than normal plant species [3]. It has been suggested that highly specialized plants that have evolved the ability to accumulate and tolerate very high concentrations of metals from soils may provide the basis for remediation of heavy metals. Hyper accumulator species have been found that contain > 10^3 mg Zn kg^{-1} and >100 mg Cd kg^{-1} shoot biomass [4]. Before, phytoremediation can be effectively exploited on contaminated soils, better agronomical practices for metal uptake by hyper accumulator species is necessary.
The use of plant roots to remove heavy metals from water is also an emerging environmental clean-up technology. Roots of many hydroponically grown terrestrial plants, e.g., Indian mustard, sunflower and various grasses, effectively removed the toxic metals such as Pb^{2+}, $Cd^{2+}$and $Ni^{2+}$from aqueous solutions. Roots of *B. juncea* concentrate these metals 131-563 times (on a dry weight basis) above initial solution concentration of Pb/Cd. The uptake was based on tissue absorption and on root-mediated Pb/Cd precipitation in the form of insoluble inorganic compounds, mainly leads phosphate/Cd phosphate.
Heavy metals uptake in Indian mustard is proportional to the amount of metals contained in a measurable fraction of the soil solution and plant capable to tolerate higher levels of heavy metals in soils and in shoot tissue also. The shoot/root ratios for Cd, Ni, Pb and Hg are much higher for these *Brassica* species. A greater portion of total metal in the plant is therefore, sequestered in harvestable tissues, [17].
Threshold for cadmium hyper accumulator has been set at 100 μ g g^{-1} D.M. [4]. The hyper accumulator plant (*T. caerrulscens*) could take up 0.16 kg ha^{-1} Cd and 0.25 kg ha^{-1} Ni in a single harvest of crop. The *T. caerulescens* cultivation in contaminated soil, assuming a constant rate of Cd uptake with 0.40 mg Cd kg^{-1}D.M. removed in 5 weeks, all the cadmium content in soil would be removed after 15 years and the *C. halleri* accumulated 60 g Cd ha^{-1}in a single harvest of crop. Development of phytoremediation must be a process of matching the plants to the particular situation. High biomass crops such as *Brassica* species may be useful, especially with addition of metal chelating or acidifying compounds which would boost the metal concentrations in the crops by desorbing the metals from the soil and overcoming any limitation to their transport to the site of uptake in the roots and translocation to the shoots. In India considerable effort is being devoted to identifying indigenous plant species that can be used to remediate pollutants such as pharmaceutical wastes, arsenic, fly ash, and metals. It is fairly low in cost, does not require extensive equipment, and is appropriate not only for India, Iran, Pakistan, Bangladesh, and other Asian nations, but

also for advanced nations [14].

FERTILIZER IMPACT

The spontaneous, increase of heavy metals in the agricultural soils with the use of commercial fertilizers is also another problem for farmers, The phosphogypsum (industrial byproduct) is contaminated with 3.4 to 14.0 mg Cd kg^{-1} and gypsum (natural) from 0.12 to 5.0.

Agricultural lime (industrial byproduct) 14.0 mg Cd kg^{-1} Zinc sulphate 24.9 mg Cd kg^{-1}) and copper sulphate 17.2 mg Cd kg^{-1}fertilizer. The rock phosphate (Parent material for P fertilizer) having Cd, Hg, Ni and Pb 90, 2.1, 51 and 51 mg kg^{-1}D.M., respectively. A source of rock phosphate also contaminated with heavy metals. USSR (Kola) having 1.0 mg Cd kg^{-1}P and 0.20 mg Cd kg^{-1}D.W.,

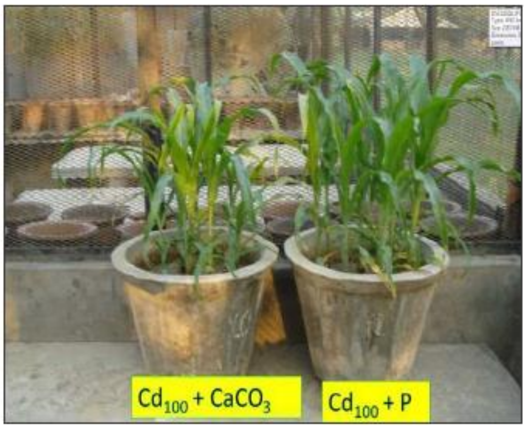


Plate: Comparative toxicity of Cd, Ni and Pb in Indian Mustard (Panwar and Grewal, 2013)

Naura rock phosphate 611 mg Cd kg^{-1}P and 100 mg Cd $kg^{-1}$and China (Yunan) rock phosphate 35.0 mg Cd kg^{-1}P and 5.0 mg Cd kg^{-1}D.W. High Cd contents was found in fertilized soils (0.01-0.73 mg Cd kg^{-1}soil) as compared to unfertilized soils (0.01-0.29 mg Cd kg^{-1}soils. In India (1998-99), the consumption of P fertilizer was 95.3 lakh tones (58.1 DAP and 37.2 SSP) whereas, production of P_2O_5 was 3170 thousand tones).

Soil fertility status for phosphorus in all over India (17 districts is high P, 184 districts medium and 170 districts low in P) hence, major parts of agricultural soils fall in the medium to low category which need P fertilization for production of high yields.

EFFECT OF CHEMICALS

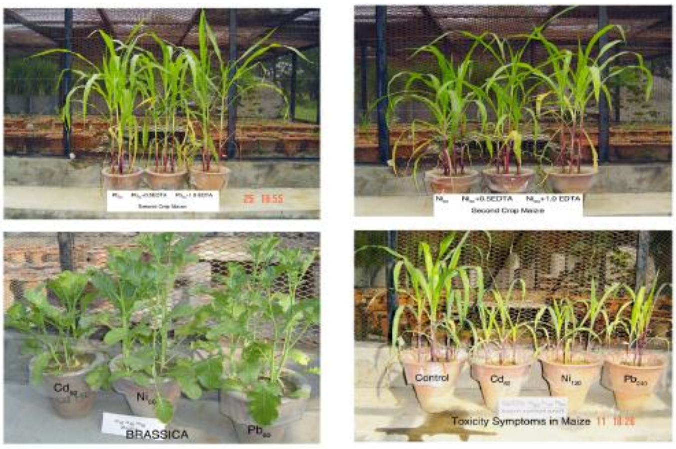
Organic Chelates, Microbes and Bacteria

Huang *et al*. [10] indicated that EDTA was the best chelating agent for mobilizing Pb from the soil particles. Gradual acidification to release more metals from the soil matrix, the EDTA (Ethylene diamine tetracetic acid) is one of the most promising chelator. The ability of this chelant to bind the metals ions in extremely stable complexes can be utilized not only for desorption of adsorbed ions, but for the dissolution of insoluble metal compounds as well.

Panwar *et al* [19] reported that with maize (*Zea mays)* grown on artificially spiked soil (100 μ g Cd g^{-1}) with EDTA (2 mmol kg^{-1} in 5 split doses), FYM, Vermicompost (VC) and Microbial inoculants (*Azotobacter* and *Pseudomonas*). The growth of maize was better in farm yard manure (FYM) or vermicompost (VC) amended soil as compared to no-Cd- 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 maize either alone or in combination with bioinoculants. The application of EDTA caused a significant decrease in biomass of crop plants. Application of bioinoculants increased the dry matter yield of both root and shoot but not significantly because bioinoculants show greater sensitivity towards cadmium.

Cadmium concentration was observed maximum under EDTA with bioinoculants treatments, however Cd uptake was maximum in Vermicompost with inoculates treatments. The Cd concentration in shoot over Cd_{100} treatment increased in Cd_{EDTA} followed by Cd_{VC} and Cd_{FYM} in the absence of microbial inoculates. The corresponding trend in the presence of microbial inoculates were as same, respectively. Similar trend was also observed in root as in order Cd_{EDTA+M}> Cd_{VC+M}>$_{CdFYM+M}$> Cd_{100+M}.



Effect of chelating agent (EDTA) on crops

The remarkable root and shoot Cd content increase was observed with microbial inoculates in Cd_{EDTA+M} treatment over Cd_{EDTA} treatment. The FYM, Vermicompost and EDTA also increased Cd uptake significantly with and without microbial inoculates in root shoot biomass.

The results indicated that Vermicompost in combination with bioinoculants is better and proven implication for the phytoremediation of Cd by maize crops from Cd-polluted soil being higher uptake value in shoot in Cd_{VC+M} followed with Cd_{EDTA+M}, Cd_{FYM+M} and Cd_{100+M} treatment combinations. Recently, the native flora and microbes from various research laboratories, the algae, cyanobacteria, vascular plants, and aquatic macrophytes have been used extensively in poly houses and field conditions [l4].

Bhupender and Sharma [5] conducted a study for identifying heavy metal tolerant bacteria in soil samples obtained from three different sites in and around Solan city of Himachal Pradesh. The samples included industrial effluents from manufacturing unit of batteries and invertors at Oachhghat, metal dumping site at Chambaghat (Salogra) and domestic waste contaminated site at Solan city.

From each of the three sites 8, 8 and 6 soil samples respectively, the sites of the collection in each category were located 5-10 meters apart.

The serial tenfold dilutions of the soil samples upto 10^{-6} were prepared. The highest addition of the sample dilution (10^{-6}) was inoculated into nutrient agar for isolation of bacteria. Colonies with different morphological features from the mixed cultures were subcultured in order to obtain pure colonies. These colonies were then grown on nutrient agar containing different molarities of salts of heavy metals (Zn, Cd, Pb and Co). The highest concentration at which the growth was observed is as follows: Zn-8mM, Cd-4mM, Pb-6mMand Co-4mM.

The bacteria having multiple tolerances were identified as *Comamonas, Pseudomonas, Staphylococcus nepalensis, Bacillus licheniformis, B. cereus, B. subtilis and Micrococcus spp.* on the basis of colony morphology, microscopic examination and biochemical tests. One sample each of *Comamona testesteroni, Staphylococcus sonerensis and Bacillus licheniformis* were identified on the basis of partial nucleotide sequencing of amplicons of 16S rRNA.

The tolerant isolates were further subjected to *in vitro* antibiotic cultural sensitivity assay and were found resistant to multiple antibiotics. The antibiotic resistance may be correlated to heavy metal tolerance. The bacteria might be of human origin.

However further studies are required to establish these facts. The study is of significance in that such bacteria can be utilized for phyto-bioremediation of heavy metals in the environment.

Hyperaccumulator Crop Species:

1. Indian mustard
2. Maize
3. Indian cotton
4. Castor
5. Sunflower
6. Indian mustard

Trees	Perennial grass	Crops
Pine	*Arrhenathermelatius*	Indian mustard
Oak	Salix clones	Maize
Hybrid Poplar		Indian cotton
NM$_6$ (Nigra x maximo-wiczil		Castor
		Sunflower

Induced heavy metals with synthetic, organic complexing agents, microbial and bacterial activity:

1. EDTA, NTA, FYM, Compost, Vermicompost
2. EDDHA (Fe-chelator)
3. Rhizotrons
4. Azotobacter
5. Bacteria/Microbes

REMEDIATION TIME SPANE:

AF = Plant accumulation (mg kg^{-1} D.M.)

Metal content (mg kg^{-1} soil)

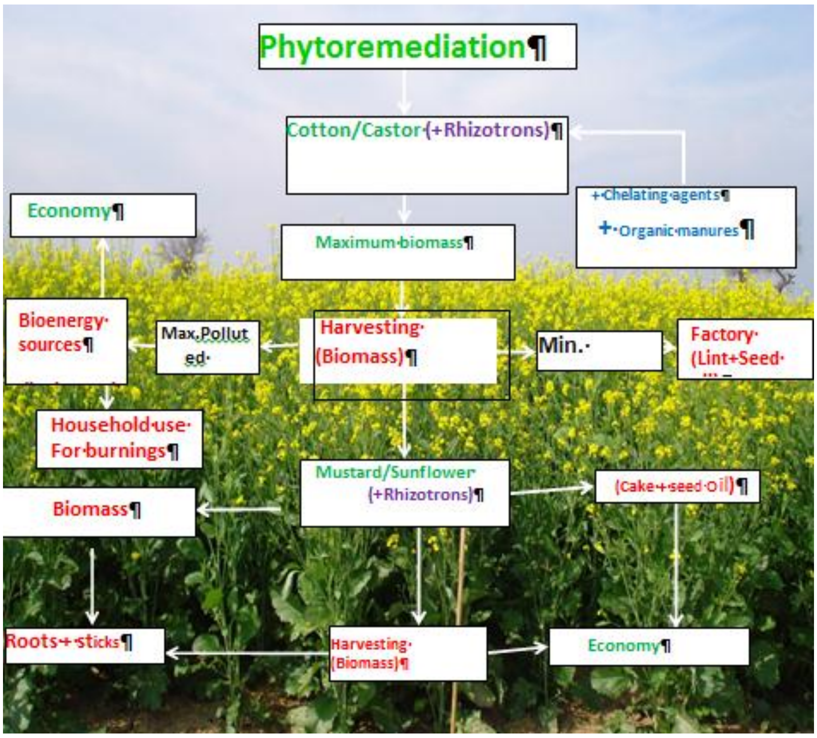
RF= Plant canopy,ha^{-1} x CH

Metal quantity,ha^{-1}

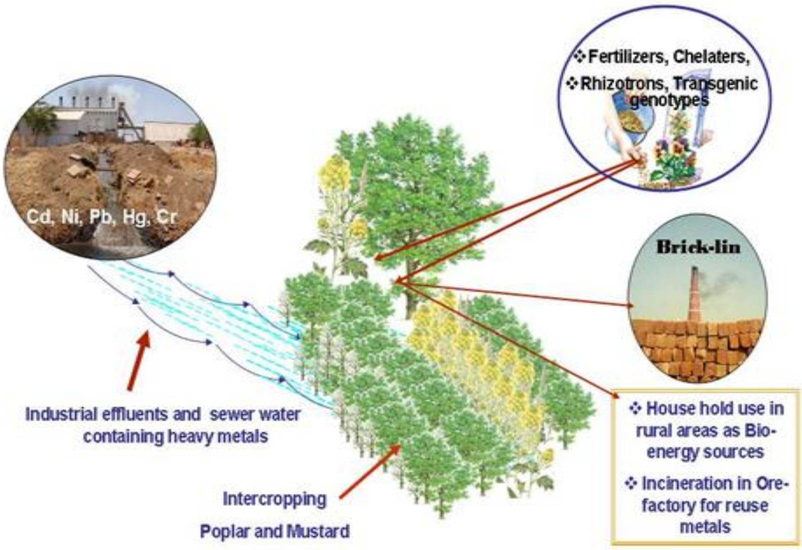
Abbreviation: AF = Accumulation factor, RF = Remediation factor, CH = Crop harvest

CONCLUSION

i. Brassica species and maize had been proved as hyperaccumulators in Indian ecosystem
ii. Organic and synthetic chelating agents increased uptake of metals and biomass of crops



Proposed cropping model for moderately heavy metal contaminated soils



Schematic diagram of phytoremediation

Panwar(2010) CCS HAU, Hisar, India

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ENVIRONMENTAL PROBLEMS AND PROTECTION UNDER CURRENT SITUATIONS OF 2020

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Abstract*: What is the current situation of the global environment? Major current environmental issues may include climate change, pollution, and environmental degradation, loss of biodiversity and resource depletion. The World Health Organization has declared coronavirus disease 2019 (COVID-19) is the first pandemic caused by coronavirus named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). SARS-CoV-2 is the most pressing global health issue due to the ongoing pandemic. The conservation movement lobbies for protection of endangered species and protection of any ecologically valuable natural areas, genetically modified foods and global warming. More than 200 natural disasters were occurred across world in 1st half of 2020. The great fallacy of the environmental debate over the past 30 years has been the hope that an ecological turnaround can essentially be implemented with some technological innovation programme within the existing economic order***.** The planet Earth will not continue to offer its harvest, except with faithful stewardship. We cannot say we love the land and then take steps to destroy it for use by future generations. Environmental issues are defined as problems with the planet s systems (air, water, soil, etc.) that have developed as a result of human interference or mistreatment of the planet. Our planet is poised on the brink of a severe environmental crisis. The hard fact is that environmental pressures have increased, and some urgently need to be brought under control. Current environmental problems make us vulnerable to disasters and tragedies, now and in the future. Key environmental policies for a more environmentally friendly future are thus needed. Again, easy regulatory solutions for this simply do not exist. It is quite simply a fact that the current ways of life and economic activity have a comprehensive and deep impact on various ecosystems. Future generations and other living organisms face drastic and irreversible disadvantages. It is extremely likely that human activities, especially emissions of greenhouse gases, are the dominant cause of the observed warming since the mid-20th century.*

Keywords*: Life and economic activity, current environmental issues, Current environmental problems, key environmental policies, environmental and human health and quality*

LNTRODUCTION

Environmental Problems

The global environment is constantly changing. There is no denying that fact. With a massive influx of natural disasters, warming and cooling periods, different types of weather patterns and much more, people need to be aware of what types of environmental problems our planet is facing. Global warming has become an undisputed fact about our current livelihoods; our planet is warming up and we are definitely part of the problem. However, this isn't the only environmental problem that we should be concerned about. All across the world, people are facing a wealth of new and challenging environmental problems every day. Some of them are small and only affect a few ecosystems, but others are drastically changing the landscape of what we already know. We'll take a look at some of them — from water shortages and loss of biodiversity to waste management — and discuss the challenges we have ahead of us. This global plan of action adopted in 2015 puts forward specific measures to achieve a world that is fairer, more prosperous and more respectful of the environment within ten years. The impact that human activities have on the environment around us is undeniable and more studies are being conducted each year to show the extent of the issue. Climate change and the many factors that contribute to emissions could lead to catastrophic issues in the future. More needs to be done to remedy the major environmental issues that affect us today. If this doesn't happen, the possibility exists that great swathes of the planet will become uninhabitable in the future. The good news is that many of these issues can be controlled. By making adjustments, humanity can have a direct and positive impact on the environment.

Environmental Policy

To date, environmental and sustainability policy has far from succeeded in achieving a sufficiently strong reduction in ecological burdens. Since public and common goods such as clean air, biodiversity, cohesion, or justice have no price, they can be destroyed for free and the resulting costs are charged to the general public.

Developing the right policies demands some knowledge of the kinds of pressures globe is facing, what is driving these pressures, and how they are likely to evolve. Building a sound view of how the environment look in 2020 is therefore a crucial exercise. It means analyzing recent trends, taking stock of the present state of the environment, and making projections for developments in the most environmentally sensitive issues, as well as for the underlying social and economic forces that drive them.

Take the case of chemicals. Yet manufactured chemicals are still widespread in the environment, and are difficult to tackle because of releases through diffuse uses, like driving cars and farming. Groundwater pollution harbours a similar problem, for unlike the more manageable surface water and point source problems (such as rivers and industrial factories), its causes are also diffuse, primarily from agricultural run-off. Likewise, while some air pollution emissions have been reduced (Pb, SO_2, and CO_2), others, such as volatile organic compounds and NO_x emissions which contribute to photochemical smog, are on the increase. Again, easy regulatory solutions for this simply do not exist. The destruction of tropical forests, encroaching deserts, dry wastelands, millions of more species lost, weather patterns playing havoc, cities choking, watercourses trickling, and vast dead oceans heaving with oil and other undigestable left behind by the human race. This is an exaggerated and harrowing view of the future and, thankfully, no such scenario for the world's environment is in prospect, at least not between now and 2025. But is a spoiled planet Earth really as improbable as all that?

Global use of materials is accelerating. It has more than tripled since 1970. Moreover, the global economy is only 9% circula. Just 9% of the 92.8 billion tonnes of material that enter the economy are re-used annually.

Greenhouse gas (GHG) emissions tell a similar story. While the output of GHG emissions relative to GDP has fallen for the Organisation for Economic Co-operation and Development (OECD) countries in recent years, total absolute emissions have risen. Under current policies, OECD countries could increase GHG emissions by a further 30% to 2010, far from the overall Kyoto Protocol target of a 5% reduction from 1990 levels to 2008-2012. This is true of transportation, where motor vehicle kilometres travelled in the OECD are expected to increase by at least 65% between 1990 and 2020 and passenger air kilometres are expected almost to quadruple. Similarly, levels of OECD municipal waste generation in 2020 are expected to continue following Gross Domestic Product (GDP) growth, approximately doubling from the 1980 levels.

The OECD Environmental Outlook to 2030 is based on projections of economic and environmental trends to 2030. The key environmental challenges for the future are presented according to a "traffic light" system (Table 1). The Outlook also presents simulations of policy actions to address the key challenges, including their potential environmental, economic and social impacts. [41]

Separating growth and the environment

In general, environmental degradation has kept pace with economic growth. But the use of energy and other resources, like raw agricultural materials, water and metals, now appears to be on the decline in relation to GDP [12] in many OECD countries. This fall in intensity points to a potential decoupling between the respective directions the economy and the environment are taking, with an easing in the rhythm of environmental degradation in relation to economic growth. In some cases, these reductions in resource intensity have been large enough to lead to absolute, rather than just relative, environmental improvements, by offsetting the overall effects of total economic and population growth. However, despite such eco-efficiency improvements, overall environmental degradation has persisted in most cases.

Table (1) The OECD Environmental Outlook to 2030 [41]

	[Green Light]	[Yellow Light]	[Red Light]
Climate change		• Declining GHG emissions per unit of GDP	• Global GHG emissions • Increasing evidence of an already changing climate
Biodiversity & renewable natural resources	• Forested area in OECD countries	• Forest management • • Protected areas	• Ecosystem quality • Species loss • Invasive alien species • Tropical forests • Illegal logging • Ecosystem fragmentation
Water	• Point-source water pollution in OECD countries (industry, municipalities)	• Surface water quality and wastewater treatment	• Water scarcity • Groundwater quality • Agricultural water use & pollution
Air quality	• OECD country SO2 & NOx emissions	• PM & ground-level ozone • Road transport emissions	• Urban air quality
Waste & hazardous chemicals	• Waste management in OECD countries • OECD country emissions of CFCs	• Municipal waste generation • Developing country emissions of CFCs	• Hazardous waste management and transportation • Waste management in developing countries • Chemicals in the environment and in products

Source: KEY:
Green light = environmental issues which are being well managed, or for which there have been significant improvements in management in recent years but for which countries should remain vigilant.
Yellow light = environmental issues which remain a challenge but for which management is improving, or for which current state is uncertain, or which have been well managed in the past but are less so now.
Red light = environmental issues which are not well managed, are in a bad or worsening state, and which require urgent attention. All trends are global, unless otherwise specified.

The Environmental Problems of 2020

Overpopulation

The population of the planet is reaching unsustainable levels as it faces a shortage of resources like water, fuel and food. Population explosion in less developed and developing countries is straining the already scarce resources. Intensive agriculture practiced to produce food damages the environment through the use of chemical fertilizer, pesticides and insecticides. Overpopulation is also one of the crucial current environmental problems**.** Overpopulation may seem to impact the environment by straining resources, but this is complicated by consumption patterns, government policy, availability of technologies, and regions where the population rise occurs. However, in 2019, the UN revised its world population report of previous projections of 11.2 billion people by 2100. The new data shows a downward turn in birth rates with populations actually shrinking. Many of the issues listed here result from the massive population growth that Earth has experienced in the last century. The planet's population grows by 1.13%/year, which works out to 80 million people. This results in a number of issues, such as a lack of fresh water, habitat loss for wild animals, overuse of natural resources and even species extinction. The latter is particularly damaging, as the planet is now losing 30,000 species per year.

Gender inequality

Although gender inequality is not a direct environmental problem, solving problems like inadequate access to birth control, health services, and education has a positive impact on the economy and environment. Education lays a foundation for vibrant lives for girls and women, their families, and their communities. It is one of the most powerful levers available for avoiding emissions by curbing population growth. Women with more years of education have fewer and healthier children, and actively manage their reproductive health. Gender inequality is indirectly linked to environmental problems.

Poverty line

Poverty is indirectly linked to environmental problems. When you solve issues related to poverty you also solve environmental problems such as deforestation, population growth, gender inequality, and climate change. The world has been making steady progress toward ending extreme poverty for years according to the UN. The COVID-19 crisis has reversed some of the progress. But before the virus, life was better for many people around the world than ever before in history. Now, we need to deal with the crisis and get back to making progress.

Public Health

As infectious diseases and viruses, including the coronavirus, continue to increase in frequency, scientists have predicted that fighting high-impact epidemics will become commonplace. Cross-species transmission, or spillover, is the most significant cause of disease emergence in humans, and other species. This mostly occurs when animals are intensively farmed in close proximity with other animals or even with trees and agricultural produce. The current environmental problems pose a lot of risk to the health of humans and animals. Dirty water is the biggest health risk in the world and poses a threat to the quality of life and public health. Runoff to rivers carries with it toxins, chemicals and disease-carrying organisms. Pollutants cause respiratory diseases like Asthma and cardiac-vascular problems. High temperatures encourage the spread of infectious diseases like Dengue. The World Health Organization (WHO) defines health inequities as "avoidable inequalities in health between groups of people within countries and between countries"[1] The Corona virus disease 2019 (COVID-19) pandemic has played an important role in uncovering and amplifying numerous health inequalities that already existed within societies and between different population groups. COVID-19 was declared a pandemic by the WHO on March 11, 2020 (Table 2).

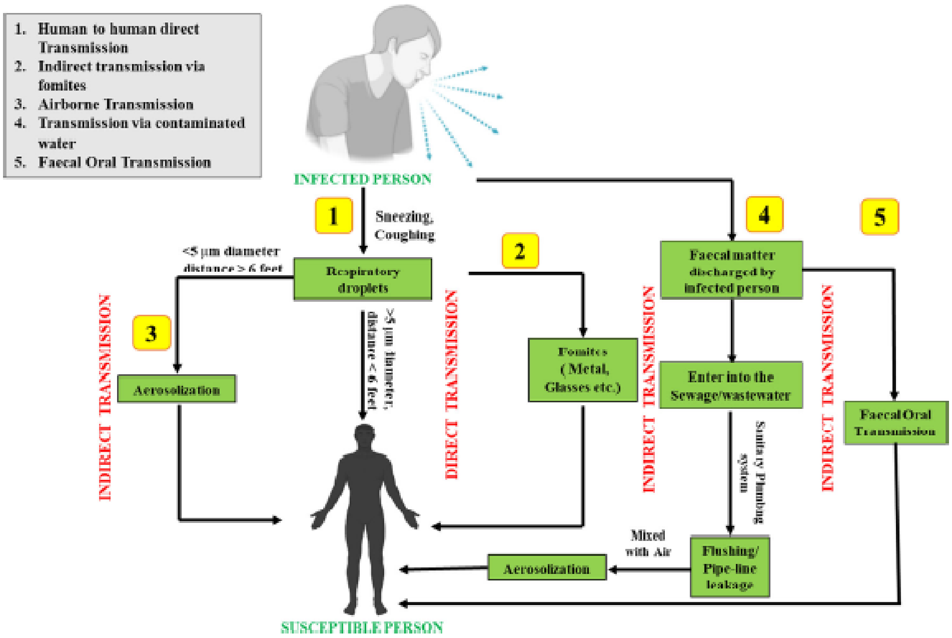
Table (2) The related events of novel coronavirus annocuned by WHO.

Time	Event
2020.01.12	2019 novel coronavirus (2019-nCoV)
2020.02.11	Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)
2020.02.12	Coronavirus disease 2019 (COVID-19)
2020.03.11	A pandemic

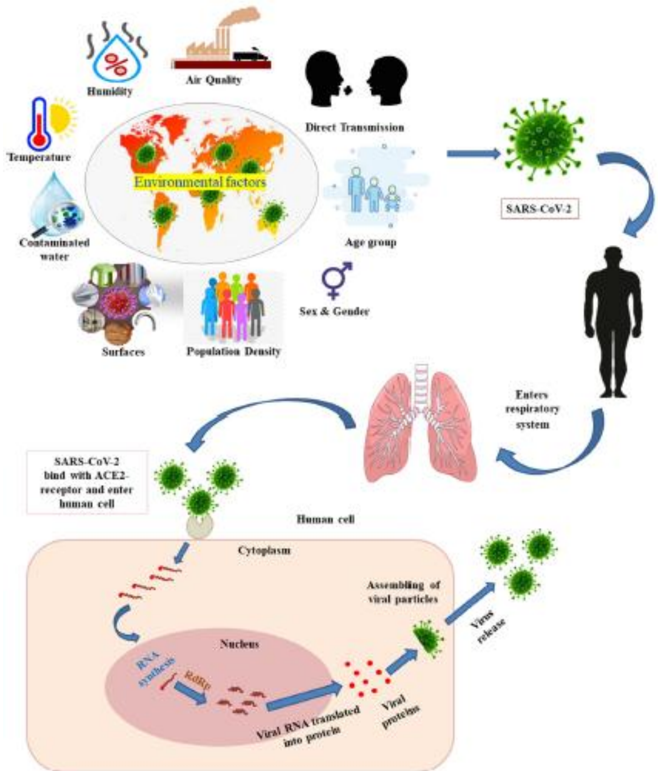
This has led to disastrous and unjust consequences in mortality rates amongst black and minority ethnic groups, vulnerable groups of society such as refugees, asylum seekers and individuals from socioeconomically deprived backgrounds.[2],[3] Inequalities in health during COVID-19 are exacerbated by interweaving risk factors and comorbidities which unfavorably magnify the disease burden and therefore this has been described as a co-occurring, synergistic pandemic for the more underprivileged communities.[3] The emergence and rapid global spread of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pose an unprecedented medical and socioeconomic crisis, in which at the end of 2019, a new severe respiratory infection caused by a novel pneumonia (COVID-19), caused by a novel coronavirus (SARS-CoV-2) and resulted in a high mortality rate in Wuhan City, Hubei Province, China.

Today, entire neighborhoods are caring for each other. COVID-19 is pandemic disease. Coronaviruses are enveloped, non-segmented, positive-sense, and single stranded RNA viruses that cause mild or severe diseases in some birds and mammals, including humans. Their genome size is about 30 kilobases which consist of non-structural open reading frames near the 5′-end and at least four structural proteins near the 3′-end, including membrane, envelope, spike, and nucleocapsid proteins. The coronavirus name derives from their solar corona appearance, which is formed due to the club-shaped spikes that project from the surface of the virus. Seven coronaviruses have been discovered in humans that can cause mild to lethal respiratory tract infections. HCoV-229E, HCoVOC43, HCoV-NL63, and HCoV-HKU1 are the low-risk members of this family and the reason for some common colds. Besides, SARS-CoV, MERS-CoV, and newly identified SARS-CoV-2, which is also known as 2019-nCoV, are the more dangerous viruses. Due to the rapid spread of this novel coronavirus and its related disease, COVID-19, a reliable, simple, fast, and low-cost detection method is necessary for patient diagnosis and tracking worldwide [4],[5],[6]. The increasing COVID-19 widespread has created the necessity to assess the diagnostic accuracy of newly introduced (RT-PCR based) assays for SARS-CoV-2 RNA detection in respiratory tract samples. The laboratory detection techniques include RT-PCR, RT-LAMP, electrochemical and optical biosensors for RNA detection, and whole virus or viral proteins detection assays. Looking deeper at that response can shed light on commonalities between the

AIDS/HIV and COVID-19 crises, but it points to a much deeper tradition of the capacity of humans to care for one another, independent of the state (especially when its response has been negligent). Healthcare professions are at high risk of occupational exposure to the new pandemic human coronavirus due to the directional airflow and strong environmental hygiene procedures. However, we detected viral RNA on the surface of some objects. The risk of infection was eliminated by the use of disposable footwear covers and the application of more effective environmental and personal hygiene measures. In addition, monitoring the environmental contamination of wards and disinfecting contaminated surfaces and places should be regularly performed to prevent the infection of environment including the humans. The major pathway of COVID-19 transmission and infection, which includes various ways (see the diagram betow).



Different transmission pathways COVID-19 in the environment



Influence of Environmental factors on THE infection OF COVID-19

Direct transmission refers to the transfer of viruses from an infected person to another person without any intermediate object, whereas indirect transmission is the transfer through contact with a contaminated intermediate object. Another major pathway/mode is airborne transmission, which encompasses droplet spray transmission and aerosol transmission. In droplet spray transmission, the virus is transferred via air droplets produced at the time of breathing/sneezing/coughing/talking, followed by its deposition on the mucous membrane. The present concern regarding the transmission of SARS-CoV-2 is not limited to direct contact with infected people or indirect contact with infected surfaces, but recent studies suggested transmission via droplets spray and aerosols. Major environmental factors regarding the influence of varied abiotic and biotic factors on COVID-19 transmission, persistence, and infectivity and discuss the existing knowledge gaps. Abiotic factors include: climatic, air quality, water and wastewater, solid surfaces and frozen food and cold chain transportation. Biotic factors such as age factor, sex and gender, blood type, population density and behavioural variables.

Climate Change

Climate change is yet another environmental problem that has surfaced in the last couple of decades. It occurs due to the rise in global warming, which happens due to the increase in temperature of the atmosphere by burning fossil fuels and the release of harmful gases by industries. Climate change has various harmful effects but not limited to the melting of polar ice, change in seasons, occurrence of new diseases, frequent occurrence of floods and change in overall weather scenario. Climate change is one of the most threatening consequences of the pursuit of everlasting economic growth. Despite all the promises made in Paris in 2015, the 5 largest producers even emit 28% more fossil fuels. An average increase in global warming of 5 degrees worldwide, as predicted by the end of the century, means massive changes. 5 degrees in the other direction *as a comparison*, *it* was the last ice age. About 2/3 of Switzerland were covered by ice at that time. That's the measure of change when we talk about 5 degrees. Climate change happens when GHGs are released and trapped in the atmosphere, causing the GH effect. The GH effect creates a layer around the earth's atmosphere that traps heat from the sun, making our atmosphere warmer, similar to a greenhouse. The following GHGs contribute to climate change.

- **Carbon dioxide (CO_2):** CO_2 enters the atmosphere when fossil fuels like coal, oil, and natural gas are burned. CO_2 is also released when trees and other plants are burned or cut down and through manufacturing cement. CO_2 made up 81% of man-made greenhouse gas emissions from the United States (US) in 2018 according to the Environmental Protection Agency (EPA).
- **Methane (CH_4):** CH_4 is released from fossil fuels (natural gas), agriculture (cow farts and manure), and landfills. CH_4 made up 10% of GHGs in the US in 2018.
- **Nitrous oxide (N_2O):** N_2O is emitted from agriculture, fossil fuels, industry, and waste-water treatment. N_2O made up 7% of GHG emissions in 2018.
- **Fluorinated gases:** Fluorinated gases are hydrofluorocarbons (used in refrigerators and air conditioners), perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride. They are man-made gases commonly used in refrigerants used for cooling air conditioners and refrigerators. These gases have a high Global Warming Potential and makeup 3% of GHGs emitted in the US according to the USEPA.

The global GHG emissions trend has increased since the beginning of the 21st century in comparison to the 3 previous decades, mainly due to the increase in CO_2 emissions from China and the other emerging economies. As a result, the atmospheric concentrations of GHGs substantially increased enhancing the natural GH effect, which may negatively affect the life on the Earth. These issues are internationally addressed in the framework of UNs Framework Convention on Climate Change (UNFCCC); countries are developing national emissions inventories and propose/implement actions to mitigate GHG emissions. CO_2 emissions, which are the main responsible for global warming are still increasing at world level despite climate change mitigation agreements. EDGAR [7] provides an independent estimate of GHGs for each world country, based on a robust and consistent methodology stemming from the latest Intergovernmental Panel on Climate Change (IPCC) guidelines and most recent activity data. Following the latest update released in September 2020, (Figure 1) emission data are now available for fossil CO_2 for each country for the time period 1970-2019. Climate change is a major factor in disease emergence. The survival, reproduction, abundance and distribution of pathogens, vectors and hosts can be influenced by climatic parameters affected by climate change, the United Nation Environment Program (UNEP) and the International Livestock Research Institute (ILRI) report released on July 6, 2020. Climate change can particularly affect diseases transmitted by insects, ticks and other arthropod vectors, according to the report preventing the Next Pandemic: Zoonotic disease and how to break the chain of transmission. Warmer temperatures can increase the vector population size and distribution, along with the season duration when infectious vector species are present in the environment. It was mentioned that climate change can increase or decrease the incidence of the insect-transmitted Chagas disease, sand-fly transmitted leishmaniasis and other vector-borne and zoonotic diseases, generally with greater illness occurring at higher degrees of warming.

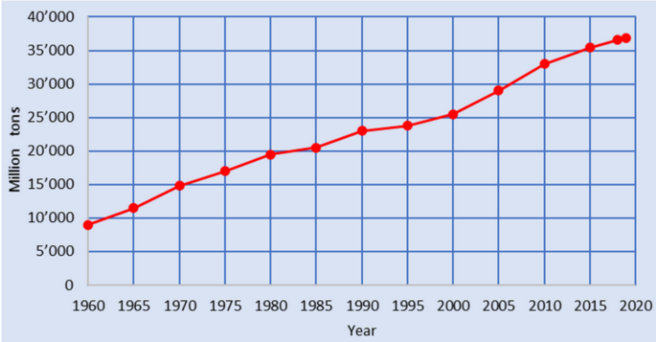


Figure (1) Worldwide CO_2 emissions 1960-2019

The climate crisis is accelerating at an unprecedented rate, and world is not ready for it. While the crisis has many factors that play a role in its exacerbation, there are some that warrant more attention than others. Here are some of the biggest environmental problems of lifetime of world population. The populations of rich countries and, more generally, the rich worldwide, bear an overwhelming responsibility for any future climate change. The goal of halving global emissions by 2030 represents the absolute minimum worldwide must achieve if the worldwide populations are to have at least a 50% chance of safeguarding humanity from the worst impacts. United Nations (UNs) is not fit to deal with the climate crisis: it was assembled to prevent another world war and is not fit for purpose. Anyway, members of the UNs are not mandated to comply with any suggestions or recommendations made by the organisation. For example, the Paris Agreement, an agreement within the UNFCCC, mentioned that countries need to reduce GHG emissions significantly so that global temperature rise is below 2 degrees Celsius by 2100, and ideally less than 1.5 degrees. Further, the issue of equity remains a contentious issue whereby developing countries are allowed to emit more in order to develop to the point where they can develop technologies to emit less, and it allows some countries, such as China, to exploit this. China is the single largest emitter of C. This is, largely due to goods produced in China but consumed elsewhere in the world. It was found that the attribute of the emissions to where the consumption takes place, North Americans consume 22.5 tons of CO_2/year/person, Western Europeans 13.1, Chinese 6, and South Asia just 2.2 [8]. Overall, 10% of the world's population (the highest polluters) contribute roughly 50% of CO_2 emissions, while the 50% who pollute the least contribute just over 10% (Figure 2). However, developed nations typically have high CO_2 emissions/capita, while some developing countries lead in the growth rate of CO_2 emissions. These uneven contributions to the climate crisis are at the core of the challenges the world community faces in finding effective and equitable solutions to global warming [9].

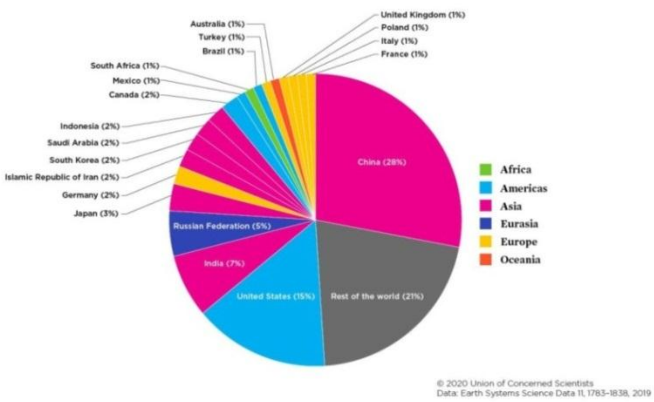


Figure (2) Worldwide CO_2 emissions

Global Warming

Scientists agree that global warming is caused mainly by human activity. Specifically, the evidence shows that certain heat-trapping gases, such as CO_2, are warming the world [10],[11],[14]. As scientific models and methods grow more sophisticated, and the confidence in human-caused climate change grows higher. Climate changes like global warming are the result of human practices like the emission of GHGs. Global warming leads to rising temperatures of the oceans and the earth' surface causing natural disasters that include flooding, melting of polar ice caps, rise in sea levels and also unnatural patterns of precipitation such as flash floods, hurricanes, wildfires, drought, excessive snow or desertification. At time of publication, CO_2 parts per million (PPM) is at 410 and the global temperature rise is 0.89°C. Increased GHGs emissions have caused temperatures to rise, which are causing catastrophic events all over the world just this year has seen Australia experience one of the most devastating bushfire seasons ever recorded, locusts swarming across parts of Africa, the Middle East and Asia, decimating crops, scientists warning that the planet has crossed a series of tipping points that could have catastrophic consequences, microplastic being found in Antarctic ice for the first time, a heatwave in Antarctica that saw temperatures rise above 20 degrees for the first time, warnings of advancing permafrost melt in Arctic regions, the Greenland ice sheet melting at an unprecedented rate, news of the accelerating sixth mass extinction, increasing deforestation in the Amazon rainforest, warnings of air pollution exacerbating the spread of COVID-19, China experiencing its worst floods in decades, methane levels rising to their highest on record, Canada's last intact ice shelf collapsing, a national park in the US recording the highest temperature ever recorded on Earth, 13% of deaths in the EU being linked to various forms of pollution, a report saying that population sizes of wildlife have experienced an average decline of 68% since 1970 and record-breaking wildfires in California that have blocked out the sun– and these are just a fraction of the events. The climate crisis is causing tropical storms and other weather events such as hurricanes, heat waves and flooding to be more intense and frequent than seen before. However, a study has found that even if all GHG emissions were halted in 2020, global warming would only be halted by around 2033. It is absolutely imperative that we reduce GHG emissions; thankfully, this year is set to see the highest uptake of renewable energy projects around the world (Figure 3) [15].

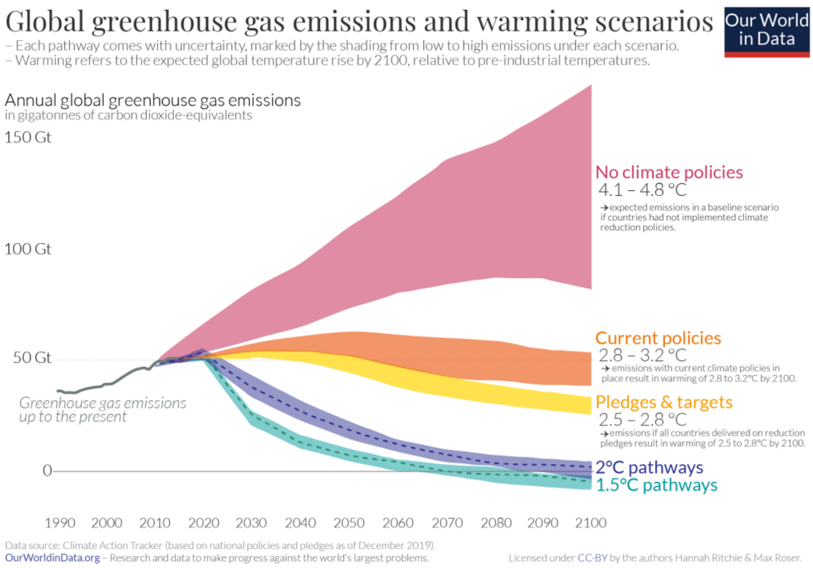


Figure (3) Global Greenhouse gas emissions and warming

Acid Rain

Acid rain occurs due to the presence of certain pollutants in the atmosphere. Acid rain can be caused due to combustion of fossil fuels or erupting volcanoes or rotting vegetation which releases SO_2 and N_2O into the atmosphere. Acid rain is a known environmental problem that can have a serious effect on human health, wildlife and aquatic species. Acid rain comes as a result of air pollution, mostly through chemicals released into the environment when fuel is burned. Its effects are most clearly seen in aquatic ecosystems, where increasing acidity in the water can lead to animal deaths. It also causes various issues for trees. Though it doesn't kill trees directly, acid rain does weaken them by damaging leaves, poisoning the trees and limiting their available nutrients [16].

Ozone Layer Depletion

The record-breaking 2020 Antarctic ozone hole finally closed at the end of December after an exceptional season due to naturally occurring meteorological conditions and the continued presence of ozone depleting substances in the atmosphere [17]. The ozone layer is an invisible layer of protection around the planet that protects us from the sun's harmful rays. The depletion of the crucial ozone layer of the atmosphere is attributed to pollution caused by chlorine and bromide found in chloro-fluoro carbons (CFCs). Once these toxic gases reach the upper atmosphere, they create a hole in the ozone layer, the biggest of which is above the Antarctic. CFCs are banned in many industries and consumer products. The ozone layer is valuable because it prevents harmful UV radiation from reaching the earth. This is one of the most important current environmental problems. The 2020 Antarctic ozone hole grew rapidly from mid-August and peaked at around 24.8 million square kilometres on 20 September 2020, spreading over most of the Antarctic continent.

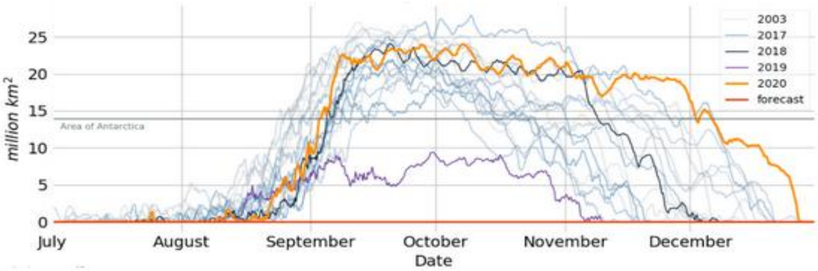


Figure (4) 2020 Southern hemisphere ozone hole areas

Ozone depletion is caused by the release of chemicals, primarily chlorine and bromide, into the atmosphere. A single atom of either has the potential to destroy thousands of ozone molecules before leaving the stratosphere. Ozone depletion results in more UVB radiation reaching the Earth's surface. UVB has been linked to skin cancer and eye disease, plus it affects plant life and has been linked to a reduction of plankton in marine environments. "The last two ozone hole seasons demonstrate the year-to-year variability of the ozone hole and improve our understanding of the factors responsible for its formation, extent and severity," said Oksana Tarasova, head of WMO Atmospheric Environment Research Division, which oversees WMO Global Atmosphere Watch network of monitoring stations. "We need continued international action to enforce the Montreal Protocol on ozone depleting chemicals. [17]

Melting Ice Caps

The issue of the melting of polar ice caps is a contentious one. Although NASA studies have shown that the amount of ice in Antarctica is increasing, however, this increase is only one-third of what is being lost in the Arctic. There is enough evidence that shows sea levels are rising, and the melting of Arctic ice caps is a major contributor. Over time, the melting of polar ice caps could lead to extensive flooding, contamination of drinking water and major changes in ecosystems. The climate crisis is warming the Arctic more than twice as fast as anywhere else on the planet. Seas are now raising an average of 3.2 mm/year globally, and are predicted to climb to a total of 0.2 to 2 m by 2100. In the Arctic, the Greenland Ice Sheet poses the greatest risk for sea levels because melting land ice is the main cause of rising sea levels.

Representing arguably the biggest of the environmental problems, this is made all the more concerning considering that last year's summer triggered the loss of 60 billion tons of ice from Greenland, enough to

raise global sea levels by 2.2 mm in just two months. According to satellite data, the Greenland ice sheet lost a record amount of ice in 2019: an average of a million tons/minute throughout the year, one of the biggest environmental problems that have cascading effects. If the entire Greenland ice sheet melts, sea level would rise by six metres. Meanwhile, the Antarctic continent contributes about 1 mm/year to sea level rise, which is a third of the annual global increase. Additionally, the last fully intact ice shelf in Canada in the Arctic recently collapsed, having lost about 80 km^2, or 40%, of its area over a two-day period in late July, according to the Canadian Ice Service. This indicator tracks the extent, age, and melt season of sea ice in the Arctic Ocean (Figure 5).
The sea level rise will have a devastating impact on those living in coastal regions: according to research and advocacy group Climate Central, sea level rise this century could flood coastal areas that are now home to 340 million to 480 million people. Climate Change Indicators:

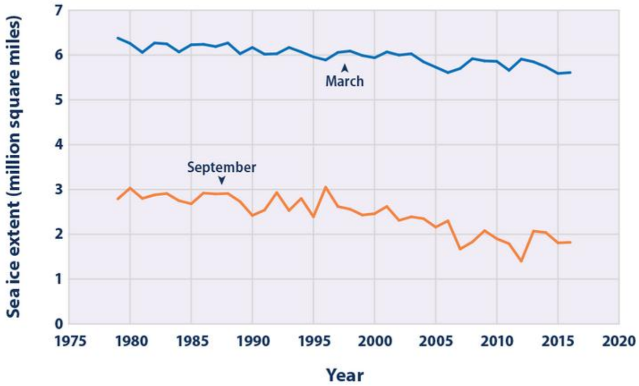


Figure (5) March and September Monthly Average Arctic Sea Ice Extent (18)

Ocean acidification

It is a direct impact of excessive production of CO_2. 25% of total atmospheric CO_2 is produced by humans. The ocean acidity has increased by the last 250 years, but by 2100, it may shoot up by 150%. The main impact is on shellfish and plankton in the same way as human osteoporosis. Ocean acidification is one of the main problems associated with climate change. It doesn't get as much attention as other environmental problems, but it can have a major impact on ocean ecosystems. The ocean absorbs about 30% of the CO_2. As levels of atmospheric CO_2 increase from human activity such as burning fossil fuels (e.g., car emissions) and changing land use (e.g., deforestation), the amount of CO_2 absorbed by the ocean also increases. When CO_2 is absorbed by seawater, a series of chemical reactions occur resulting in the increased concentration of H^+ ions. This process has far reaching implications for the ocean and the creatures that live there (Figure 6).

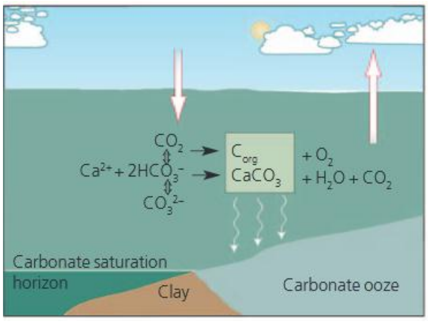


Figure (6) Diagram of the carbonate buffer and biologicalpump in the surface oceans [19]

After absorption of CO_2 intothe oceans it is converted by the carbonate buffer. Calcification in the oceans also releases CO_2, some ofwhich is returned to the atmosphere. The biological pump converts CO_2 from the atmosphere into organic carbon and $CaCO_3$ and transfers it to the deep ocean waters and sediments. The vertical scale is compressed: the process depicted by the equations and the 'box' occur within the surface oceans. This is far above the carbonate saturation horizon, which for the calcite form, occurs at depths in therange of about 1.5 to 5 km and for the aragonite form, atdepths in the range of about 0.5 to 2.5km.
Ocean acidification is the term used to describe the continued lowering of the pH levels of the Earth's oceans

as a result of CO_2 emissions. It is estimated that ocean acidity will increase by 150% by 2100 if efforts aren't made to halt it. This increase in acidification can have dire effect on calcifying species, such as shellfish. This causes issues throughout the food chain and may lead to reductions in aquatic life that would otherwise not be affected by acidification.

Agriculture

One of the great challenges facing humanity is the increase in food production to meet the ever-growing human population. Studies have shown that the global food system is responsible for up to 1/3 of all human-caused GHG emissions, of which 30% comes from livestock and fisheries. Crop production releases GHGs such as NO through the use of fertilisers. 60% of the world's agricultural area is dedicated to cattle ranching, although it only makes up 24% of global meat consumption. Agriculture not only covers a vast amount of land, but it also consumes a vast amount of freshwater, another one of the biggest environmental problems on this list. While arable lands and grazing pastures cover 1/3 of Earth's land surfaces, they consume 3-quarters of the world's limited freshwater resources. Scientists and environmentalists have continuously warned that world population need to rethink for the current food system; switching to a more plant-based diet would dramatically reduce the C footprint of the conventional agriculture industry.

Deforestation

Logging and clear-cutting destroy wildlife habitats and are among the leading causes of species extinction. Moreover this also contributes to global warming as trees trap GHG emissions, and in their absence these emissions increase, according to National Geographic. Worldwide forests are natural sinks of CO_2 and produce fresh O_2, as well as helps in regulating temperature and rainfall. At present, forests cover 30% of the land, but every year tree cover is lost, amounting to the country of Panama due to the growing population [13] demand for more food, shelter and cloth. Deforestation simply means clearing of green cover and make that land available for residential, industrial or commercial purposes.Deforestation is linked to many environmental problems and the biggest problem is agriculture. Agri-businesses should meet their commitments to deforestation-free commodity chains and companies that have not made zero deforestation commitments should do so. Commodity investors should adopt business models that are environmentally and socially responsible. These actions will, in many cases, require a revision of current policies and financial incentives. The demands of an increasing population have resulted in increasing levels of deforestation. Current estimates state that the planet is losing 80,000 acres of tropical forests per day. This results in loss of habitat for many species, placing many at risk and leading to large-scale extinction. Furthermore, deforestation is estimated to produce 15% of the world's greenhouse gas emissions.

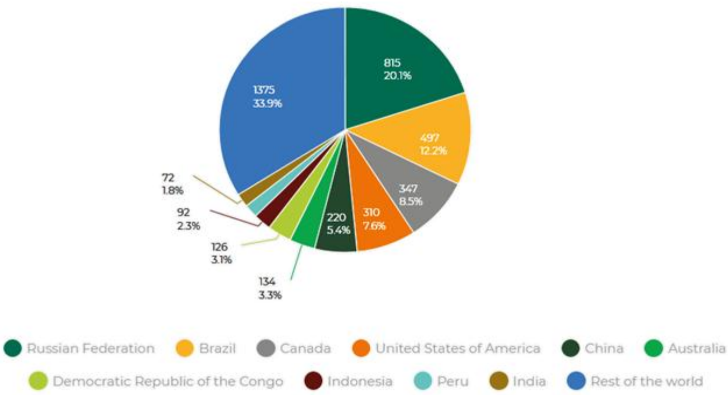


Figure (7) Global distribution of forests showing the ten countries with the largest forest area, 2020 (million hectares and % of world's forest) [20]

Every minute, forests the size of 20 football fields are cut down. By the year 2030, the planet Earth might have only 10% of its forests; if deforestation isn't stopped, they could all be gone in less than 100 years. Agriculture is the leading cause of deforestation, another one of the biggest environmental problems appearing on this list. Land is cleared to raise livestock or to plant other crops that are sold, such as sugar cane and palm oil. Besides for carbon sequestration, forests help to prevent soil erosion, because the tree roots bind the soil and prevent it from washing away, which also prevents landslides. The three countries experiencing the highest levels of deforestation are Brazil, the Democratic Republic of Congo and Indonesia.

Loss of Tropical Rainforests

Nearly 40% of Americans are worried about distant problems like loss of tropical forests. Rain forests cover only 2% of land but support 50% of its species according to Mongabay. Yet among tropical forests the area of rainforests cleared is the maximum, and most of it is export driven. Every year an area of rainforest the size of New Jersey is cut down and destroyed" notes Mongabay. In 2019, summer fires that ravaged the Brazilian Amazon and set the world ablaze with outcries [21].

Food and Water Insecurity

Improvements in health over the past century have been underpinned by positive advances in the management of vital resources such as water and food. Water supply and quality, and food security and safety are intertwined. Freshwater resources and especially high quality freshwater resources are becoming increasingly scarce, driven by factors including population growth, urbanisation and probably global climate change. The availability of freshwater resources adequate in both quantity and quality is vital to food security and production. Water, like food, is a vehicle for the transmission of many agents of disease and continues to cause significant outbreaks of disease in developed and developing countries world-wide.
Water can also contaminate food. Helminths, protozoa and viruses also may be spread from contaminated water to food. Contaminated irrigation water has been associated with hepatitis A. People can be exposed to infectious agents or toxic chemicals through:
– the ingestion of contaminated water incorporated into foods;
– the ingestion of foods irrigated with or harvested from contaminated water; and
– the ingestion of foods that have come into contact with contaminated water during processing.
There are many competing demands for fresh water and their number is increasing. They include food production and processing; domestic supplies; industry; tourism and leisure; energy production; navigation; and the need to maintain ecosystem integrity. Different uses may be polluting and/or make quantity/quality demands on resources.
Rising temperatures and unsustainable farming practices has resulted in the increasing threat of water and food insecurity. Globally, more than 68 billion tonnes of top-soil is eroded every year at a rate 100 times faster than it can naturally be replenished. Laden with biocides and fertiliser, the soil ends up in waterways where it contaminates drinking water and protected areas downstream. Furthermore, exposed and lifeless soil is more vulnerable to wind and water erosion due to lack of root and mycelium systems that hold it together. A key contributor to soil erosion is over-tilling: although it increases productivity in the short-term by mixing in surface nutrients (e.g. fertiliser), tilling is physically destructive to the soil's structure and in the long-term leads to soil compaction, loss of fertility and surface crust formation that worsens topsoil erosion.
With the global population expected to reach 9 billion people by mid-century, the Food and Agriculture Organization of the United Nations (FAO) projects that global food demand may increase by 70% by 2050. Around the world, more than 820 million people do not get enough to eat. In terms of water security, only 3% of the world's water is fresh water, and two-thirds of that is tucked away in frozen glaciers or otherwise unavailable for our use. As a result, some 1.1 billion people worldwide lack access to water, and a total of 2.7 billion find water scarce for at least one month of the year. By 2025, 2/3 of the world's population may face water shortages. While these are some of the biggest environmental problems plaguing our planet, there are many more that have not been mentioned, including overfishing, urban sprawl, toxic superfund sites and land use changes. While there are many facets that need to be considered in formulating a response to the crisis, they must be coordinated, practical and far-reaching enough to make enough of a difference. [22]
The COVID-19 pandemic is a global health crisis that is already having devastating impacts on the world economy – both directly and through necessary measures to contain the spread of the disease. These impacts are also being felt by the food and agriculture sector. While the supply of food has held up well to date, in many countries, the measures put in place to contain the spread of the virus are starting to disrupt the supply of agro-food products to markets and consumers, both within and across borders. The sector is also experiencing a substantial shift in the composition and – for some commodities – the level of demand.
How damaging these impacts turn out to be for food security, nutrition and the livelihoods of farmers, fishers and others working along the food supply chain will depend in large part on policy responses over the short, medium and long term. In the short term, governments must manage multiple demands – responding to the health crisis, managing the consequences of the shock to the economy, and ensuring the smooth functioning

of the food system. While the pandemic poses some serious challenges for the food system in the short term, it is also an opportunity to accelerate transformations in the food and agriculture sector to build its resilience in the face of a range of challenges, including climate change.

Biodiversity Loss

Biodiversity encompasses every living organism on the Earth. The various concerns for pollution, endangered species and the increase in species extinction and different types of pollution, make biodiversity the number one environmental concerns. Based on the increased rate of species extinction, some scientists have stated the earth is in the throes of the 6th extension, the 5th having been when the dinosaurs disappeared. A survey conducted by National Geographic Society and Ipsos of 12,000 people around the world revealed the majority believe half of the Earth should be dedicated to the protection of the land and sea. Human activity is leading to the extinction of species and habitats and loss of biodiversity. Ecosystems, which took millions of years to perfect, are in danger when any species population is decimating. Balance of natural processes like pollination is crucial to the survival of the ecosystem, and human activity threatens the same. Another example is the destruction of coral reefs in the various oceans, which support the rich marine life. The large and rapidly progressing decline in global biodiversity, e.g. in agriculture is a serious risk to the food security of future humans. Land use change linked to massive expansion of globalized, highly commercialized industrial agriculture is the main overarching driver of declining agrobiodiversity. Globally, the FAO estimates that 75% of crop diversity was lost in the 20th century. Historically about 7,000 plant species were cultivated for food; today only about 80 plant species make major contributions to food supplies at the global level. In fact, half of all plant-based calories come from only 3 species: rice, maize, and wheat. And 93% of global meat supplies come from just 4 animal species: pigs, poultry, cattle, and buffalo. Looking ahead, restoring agrobiodiversity (the richness of what we cultivate, breed, consume, and conserve in the wild) is crucial to ensure resilient food systems against the backdrop of climate change. The past 50 years have seen a rapid growth of human consumption, population, global trade and urbanisation, resulting in humanity using more of the Earth's resources than it can replenish naturally. A recent World Wildlife Fund (WWF) report found that the population sizes of mammals, fish, birds, reptiles and amphibians have experienced a decline of an average of 68% between 1970 and 2016. The biodiversity loss is due to land-use change, particularly the conversion of habitats, like forests, grasslands and mangroves, into agricultural systems. Animals such as pangolins, sharks and seahorses are significantly affected by the illegal wildlife trade, and pangolins are critically endangered because of it. More broadly, a recent analysis has found that the 6th mass extinction of wildlife on Earth is accelerating. More than 500 species of land animals are on the brink of extinction and are likely to be lost within 20 years; the same number was lost over the whole of the last century. The scientists say that without the human destruction of nature, this rate of loss would have taken thousands of years. [23]

Pollution

Pollution is among the many environmental challenges the world is facing today. It is a major concern in much of the developing countries as the impact of pollution is more severe with levels that often cause poor health, deaths, and disabilities for many people, which consequently leads to higher mortality rates. However, in many developing countries, the environmental cost of pollution is unavoidable as the industrial sector is a crucial sector that generates the primary engine of economic growth and development. There are 7 key types of pollution: air, water, soil, noise, radioactive, light and thermal and these are primary causes that affect our environment in many ways. All these types of pollution are interlinked and influence each other. Pollution of air, water and soil requires millions of years to recoup. Industry and motor vehicle exhaust are the number one pollutants. Heavy metals, nitrates and plastic are toxins responsible for pollution. While water pollution is caused by oil spill, acid rain, urban runoff, air pollution is caused by various gases and toxins released by industries and factories and combustion of fossil fuels; soil pollution is majorly caused by industrial waste that deprives soil from essential nutrients. Light pollution and noise pollution can affect the quality of residential life, human health and behavior. More than 100 million human beings are affected by noise pollution as well as the effect light pollution has on plants and animals by upsetting their natural biological clocks, affecting migratory birds, insects and even aquatic life.

Air Pollution

Air pollution is an important issue within the topic of sustainable development because air pollution

seriously threatens economic development, ecological civilization, and human well-being.
Air pollution coming from a variety of sources has a range of chemical compositions and toxicity that can harm human health when exposed to it. Various pollutants were used in the literature, along with particulate matter (PM), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and carbon dioxide (CO_2), among others, to evaluate environmental pollution.
Socioeconomic development and the increase in human activities are the causes of air pollution, which have led to an increasingly tense relationship between humans and nature. Air pollution occurs in the natural world. It is caused by the artificial input of some harmful substances into the environment, and this deterioration makes the natural world unable to purify itself and thus harms the environment. This kind of harm affects the survival and reproduction of organisms and the productivity and life of humans.
Theoretically, a sizeable number of epidemiological studies have established a positive association between air pollutant exposure and mortality incidence rate. According to a 2019 WHO report 9 out of 10 people are breathing air that has high levels of pollutants. WHO reports 4.2 million people die annually from outdoor air pollution. For those living in urban areas, 80% are in regions where air pollution levels exceed the WHO limits. The State of Global Air reports air pollution is number 5 worldwide for the leading mortality risk factor. The largest worldwide risk factor is fine particle air pollution. Phys.org reported a 2019 study conducted by the International Council on Clean Transportation (ICCT) found diesel vehicles cause 47% of exhaust emissions death. Exhaust emissions deaths from diesel emissions in Italy, Germany, France, and India were 66%. Research from the World Health Organization (WHO) shows that an estimated 4.2 to 7 million people die from air pollution worldwide every year and that nine out of 10 people breathe air that contains high levels of pollutants. In Africa, 258 000 people died as a result of outdoor air pollution in 2017, up from 164 000 in 1990, according to United Nations Children's Fund (UNICEF).



This comes mostly from industrial sources and motor vehicles, as well as emissions from burning biomass and poor air quality due to dust storms. In Europe, a recent report from the EU’s environment agency showed that air pollution contributed to 400 000 annual deaths in the EU in 2012 (the last year for which data was available). In the wake of the COVID-19 pandemic, attention has been put on the role that air pollution has in transporting the virus molecules. Preliminary studies have identified a positive correlation between COVID-19-related mortalities and air pollution and there is also a plausible association of airborne particles assisting the viral spread. This could have contributed to the high death toll in China, where air quality is notoriously poor, although more definitive studies must be conducted before such a conclusion can be drawn. [24]

Biological Pollutants

The EPA says that "biological contaminants are, or are produced by, living things." These include bacteria, viruses, molds, mildew, dander, dust, mites, and pollen, as indoor pollutants. They are found in places where there is food and moisture available. They can cause allergic reactions or infectious diseases, to which children and elderly people are more susceptible. [25] Microbial contamination and damaging effects due to environmental factors (temperature, humidity) of old books is an extremely important issue in the heritage preserving field, being a great threat to this unique cultural and literary treasure.

Traffic Cause for Concern

WHO mentined that:

- Approximately 1.35 million people die each year as a result of road traffic crashes.
- The2030 Agenda for Sustainable Development has set an ambitious target of halving the global number of deaths and injuries from road traffic crashes by 2020.

- Road traffic crashes cost most countries 3% of their gross domestic product.
- More than half of all road traffic deaths are among vulnerable road users: pedestrians, cyclists, and motorcyclists.
- 93% of the world's fatalities on the roads occur in low- and middle-income countries, even though these countries have approximately 60% of the world's vehicles.
- Road traffic injuries are the leading cause of death for children and young adults aged 5-29 years.

Traffic is a major cause of concern. Throughout the world the numbers of cars are increasing, as are harmful emissions. New generation cars, however, such as hybrid and electric cars are an environmentally friendly option. These cars offer good performance along with limited harmful emissions meaning that they are kind to the environment. [26]

Water Pollution

Water is the driving force of all life. Between the start of April and the end of August the Environment Agency (The Guardian) attended just 292 water pollution incidents, down from 1,726 during the same period in 2019, according to data obtained by the Guardian using freedom of information legislation. While the number of water pollution incidents attended by the Environment Agency declined by 83%, the number of reports of pollution incidents remained high. The agency was given 9,144 reports of pollution incidents during the time period. This is just 3% less than the 9,424 it received during the same period in 2019. [27]
Many water sources like streams, rivers and oceans are getting polluted. Related issues include acid rain, nutrient pollution, ocean dumping, urban runoff, oil spills, ocean acidification, and wastewater. Rivers in Asia, Africa and South American are polluted. [28] Globally, "certain food-borne disease outbreaks" are linked to water pollution (Figure 8). Clean drinking water is becoming a rare commodity. Water is becoming an economic and political issue as the human population fights for this resource. One of the options suggested is using the process of desalinization. Industrial development is filling our rivers, seas and oceans with toxic pollutants, which are a major threat to human health. Fresh water is crucial to life on Earth, yet more sources are being polluted through human activities each year. On a global scale, 2 million tons of sewage, agricultural and industrial waste enters the world’s water every day.

Figure (8) Water quality testing on coastal waters and lakes

Water pollution can have harmful effects outside of contamination of the water we drink. It also disrupts marine life, sometimes altering reproductive cycles and increasing mortality rates. Contamination of fresh water used for household needs, including pollution of rivers, lakes and reservoirs, ranks top on the list of environmental concerns for 61% of global population. The EPA has set standards to ensure quality of drinking water to protect public health by limiting levels of various contaminants like microorganisms, disinfectants and their byproducts, inorganic compounds, organic compounds and radionuclides.

Plastic Pollution

Plastic pollution is a major environmental problem. The global campaign to gain control of plastic waste is one of the fastest-growing environmental causes ever mounted. Yet it hasn't been enough to make a dent in the growing tonnage of discarded plastic that ends up in the seas. [29] Plastic comes from fossil fuels, which we need to phase out, so using less plastic is important. But ultimately solving the problem of plastic pollution may come down to improving waste management technology and creating a more circular economy for plastics. In 1950, the world produced more than 2 million tons of plastic per year. By 2015, this annual production swelled to 419 million tons. Eight million metric tons of plastic waste enter the oceans every year. This equates to one garbage truck's worth of plastic being dumped into our oceans every minute. The total weight is the equivalent of 90 aircraft carriers.

On top of that, models project that by 2050; there will be more plastic by weight than fish in the oceans. [30] [31] A report by science journal, Nature, determined that currently, roughly 11 million tons of plastic make its way into the oceans every year, harming wildlife habitats and the animals that live in them. The research found that if no action is taken, this will grow to 29 million metric tons/year by 2040. If worldwide include microplastics into this, the cumulative amount of plastic in the ocean could reach 600 million tons by 2040.



National Geographic found that 91% of all plastic that has ever been made is not recycled, representing not only one of the biggest environmental problems of our lifetime, but another massive market failure. Considering that plastic takes 400 years to decompose, it will be many generations until it ceases to exist.

Chemical Toxins

Toxic chemicals are used in industry, agriculture, laboratories, hospitals, waste management systems and even residential homes, and include chlorofluorocarbons, heavy metals, pesticides, herbicides, toxic waste, PCB, DDT, bioaccumulation, endocrine disruptors, asbestos. These can also arise from poorly implemented hazardous waste management. These can be solid, liquid or gaseous and can pollute air, water and soil. When they enter the food-chain, they pose a health risk especially for children and elderly people according to National Geographic.

Aquatic ecosystems are affected by man-made pressures, often causing combined impacts. The analysis of the impacts of chemical pollution is however commonly separate from that of other pressures and their impacts. This evolved from differences in the data available for applied ecology vis-à-vis applied ecotoxicology, which are field gradients and laboratory toxicity tests, respectively. With this study, we demonstrate that the current approach of chemical impact assessment, consisting of comparing measured concentrations to protective environmental quality standards for individual chemicals, is not optimal. [33]

Human activities are a driving force influencing the environment and human health. A variety of pressures may affect surface water quality and quantity, with impacts on aquatic life, ecosystem services and human health. Chemical pollution is an increasingly important pressure. In response, various regulations have been defined to prevent, assess and manage water quality. There is an increasing awareness that all pressures and impacts need to be considered at the systems-level. For example, chemical safety needs to look at the whole 'chemical economy', the multiple pressures on aquatic systems are assessed and managed starting from river basins and hydrological connections as the organizing principle, and pressure impacts on biodiversity are evaluated in the context of large-scale land use patterns.

The aquatic ecosystem can be contaminated by the transfer of metals from both natural and anthropogenic sources. Over long periods, these metals accumulate and are absorbed, increasing the concentration and toxicity in the food chain, and presenting a serious health hazard. Heavy metals are natural constituents in marine environments; they are freely soluble materials and may thus be taken up by all aquatic animals, especially by edible finfish and shellfish. The dissolved form of metals in water and sediment and decomposed foods can be transferred to bottom-dwelling aquatic animals. Trace metal pollution contained in marine source food is gradually becoming a global crisis, as seawater is exposed to the continuous discharge of pollutants in bays and coastal areas. Therefore, an increasing human health risk associated with the ingestion of marine source foods polluted by toxic heavy metals has been identified over the past few decades. A number of studies have investigated adverse affects on human health originating from trace levels of heavy metals in marine source foods present in different trophic levels of the food pathway. In addition, marine shellfish including mussels, oysters and clams also have been widely used to monitor bioaccumulation of heavy metals due to their ability to transport metals without harming themselves. Therefore, marine shellfish are considered a good bioindicator for metallic hazards in marine environments.

Oil spills

In 2010, the Deepwater Horizon oil rig sank in the Gulf of Mexico, making it one of the most environmentally damaging oil spills in history. The spill covered over 43,300 square miles. It killed and harmed dolphins, sea turtles, fish, and a variety of organisms. Over the past half century, statistics for the frequency of spills greater than 7 tonnes from tankers have shown a marked downward trend, as illustrated in Figure 9. The environmental problems associated with oil have many layers. Not only does an oil spill kill wildlife and fishing industries, but oil is also a fossil fuel that contributes to climate change. Although oil is a necessary source of energy in every developed and developing country today, it comes with dire environmental problems. The number of large spills (>700 tonnes) has decreased significantly over the last few decades. The yearly average recorded in the 2010s was 1.8 spills, which is less than a tenth of the average recorded in the 1970's. No large spills were recorded in 2020.

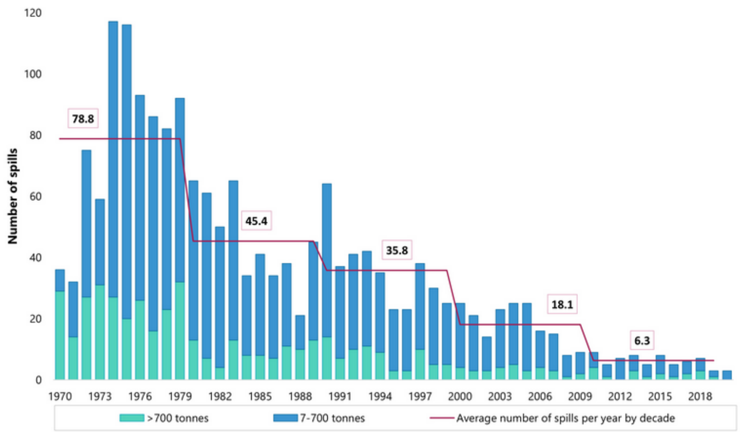


Figure (9) Number of spills (>7 tonnes) from 1970 to 2020 [34]

Similarly, there has been a significant decrease in the quantity of oil spilled through the decades. In the 2010s approximately 164,000 tonnes of oil were lost from tanker spills of 7 tonnes and above, a 95% reduction since the 1970's. [34]

Nuclear issues

Climate change is widely recognized as a major threat to humanity and much of the natural world. According to the IPCC, limiting global warming to 1.5°C above pre-industrial levels in an effort to avert the worst effects of climate change would require energy production and use to be fully decarbonized by 2050. Rapid reductions in GHG emissions would need to start immediately. Nuclear power is a large-scale, concentrated energy source that provides round-the-clock electricity. Yet it is flexible enough to contribute effectively to low carbon energy systems with large shares of variable renewable sources like wind and solar. Its GHG emissions per kilowatt-hour are 40 times less than those of an efficient gas-fired power plant.
Climate Change and Nuclear Power provides an overview of the most important linkages between climate change and nuclear energy's role in mitigating it. Building on statistics and scenarios from organizations including the International Energy Agency (IEA) and the IPCC, this publication summarizes the role of the energy sector in climate change and the possible contribution of nuclear energy in reducing future GHG emissions. Selected issues pertaining to the challenges and development of nuclear energy (waste management, investment costs, technology development, etc.) are also presented. [35] Concern the over

impacts of the world population reliance on nuclear power such as nuclear fallout, nuclear meltdown, and production of long lasting radioactive waste trouble many peoples. Greenpeace considers nuclear energy slow and expensive, concluding that the risks far outweigh its benefits. Nuclear has a strong track record of CO_2 emission avoidance. Annual CO_2 emissions of the global electricity sector would have been around 2 gigatonnes higher over the past decade if electricity from nuclear power plants had instead been supplied using the average global fossil fuel generation mix. [35]

Over the years, many views and concerns have been expressed in the media, by the public and other interested groups in relation to the nuclear industry and in particular its waste. Questions have been raised about whether nuclear power should continue when the issue of how to deal with its waste has apparently not yet been satisfactorily resolved. Questions have been raised about whether nuclear power should continue when the issue of how to deal with its waste has apparently not yet been satisfactorily resolved. Some of the more commonly expressed views and concerns include: [36]

- The nuclear industry still has no solution to the 'waste problem'.
- The transport of this waste poses an unacceptable risk to people and the environment.
- Plutonium is the most dangerous material in the world.
- Nuclear waste is hazardous for tens of thousands of years. This clearly is unprecedented and poses a huge threat to our future generations.
- Even if put into a geological repository, the waste might emerge and threaten future generations.
- Nobody knows the true costs of waste management. The costs are so high that nuclear power can never be economic.
- The waste should be disposed of into space.
- Nuclear waste should be transmuted into harmless materials.
- There is a potential terrorist threat to the large volumes of radioactive waste currently being stored and the risk that this waste could leak or be dispersed as a result of terrorist action.
- Man-made radiation differs from natural radiation.

Soil Degradation

Changes that result in replacing natural vegetation with urban sprawl and farms leads to habitat destruction, fragmentation, lack of free space for people and more C emissions, according to the US Global Change Research Program. Soil loss due to water runoff could increase greatly around the world over the next 50 years due to climate change and intensive land cultivation. This was the conclusion of an international team of researchers led by the University of Basel, which published the results from its model calculation in the scientific journal PNAS. Contemporary societies live on a cultivated planet where agriculture covers ~38% of the land surface. Humans strongly depend on the capacity of soils to sustain agricultural production and livestock, which contributes more than 95% of global food production. The underlying agricultural systems are at the same time major drivers of soil and environmental degradation and a substantial source of major biogenic greenhouse gas emissions. Globally, food security depends on the factor whether or not soils are in good condition to produce crops. According to UN estimates, about 12 million hectares of farmland a year get seriously degraded. Soils get damaged due to many reasons include erosion, overgrazing, overexposure to pollutants, monoculture planting, soil compaction, land-use conversion and many more. Nowadays, a wide range of techniques of soil conservation and restoration exist, from no-till agriculture to crop rotation to water-retention through terrace-building. Soil degradation affects 1.5 billion people around the world according to the UN. It is brought about by farming, grazing, clearing of forests, and logging. Soil erosion is a major global soil degradation threat to land, freshwater, and oceans. Wind and water are the major drivers, withwater erosion over land being the focus of this work; excludinggullying and river bank erosion. Improving knowledge of theprobable future rates of soil erosion, accelerated by human activity. [37] The major anthropogenic drivers of erosion are land use and potentially climate change through a more intense hydrological cycle. Depending on the scenario, the simulations predict that by 2070 soil erosion will increase significantly, by 30% to 66%, compared to 2015 figures. If agricultural practices do not change and measures are not taken to stop global warming, the study predicts that more than 28 billion additional metric tons of soil will be lost annually. This is around two-thirds more than the 43 billion tons estimated for 2015. [37]

Soil contamination

Land and soil pollution is also a global problem. Air and water can transport pollutants, including nitrogen compounds and tiny plastic fragments, across the globe and deposit them on land surfaces. Pollutants are found even on the highest peaks and the most remote beaches. Pollutants released from industry, transport and other economic activities can also travel long distances and reach soils, where they become diluted and are temporarily stored. Soil, a component of land, is considered polluted when contaminants adversely affect human health or the environment. The large variation of contaminants, soils, and climatic and land use conditions makes it costly to monitor and assess the full extent of land and soil pollution. What we know is mostly based on field samples scattered across countries. For example, soil erosion, soil salinization, and soil contamination by waste, pesticides, heavy metals, fertilizers, and persistent organic pollutants. Soil is necessary for supporting life and economy. Many existing and upcoming policy initiatives under the European Green Deal (the circular economy, the farm to fork strategy, the biodiversity strategy, the chemicals strategy, the new soil strategy and the zero pollution action plan) provide a European framework and support national authorities and land users to protect land and soils from pollution. Additional support to local authorities and a more coherent EU policy framework on soil would further reinforce these efforts. After all, pollution is only one of the many threats that soils and land face.[38]

The Nitrogen Cycle

The release of reactive nitrogen (N) into the environment is having severe and ongoing ecosystem, economic and human health impacts. Nitrogen is a crucial component of all life. Problems occur when the N_2-cycle is not balanced. Nitrogen exists in many different forms in the environment. It transforms and moves between the atmosphere, biosphere, and hydrosphere. Detrimental effects to the environment have also resulted in various human health issues. A process through which it is converted or fixed to a more usable form is called fixation. The fixation happens biologically and through lightning, or it can be done industrially. People have learned to convert N_2 gas to ammonia (NH_3^-) and fertilizers that are N-rich to supplement the amount of N fixed naturally. It is estimated that agriculture may be responsible for about 50% of the N_2-fixation on earth through the cultivation of N_2-fixing crops and the production of human-made fertilizers. When N is used more than plant demand, it can leach from soils into waterways and contributes to eutrophication. Excess levels of N in water can hamper marine ecosystems, through overstimulation of plant and algae growth. This blocks the light from getting into deeper waters, thus damaging the rest of the marine population. The problem can also occur during nitrification and denitrification. N_2O can be formed when the chemical process is not completed. N_2O is a potent GHG contributing to global warming.

Overfishing

Fish production is a helping hand as a source of cheap, valuable, and easily digestible protein. In 2015, fish accounted for about 17% of the total world’s consumption of animal protein, and this percent continuous to grow up. Actually, catching fish either from natural freshwater or marine resources does not meet the tremendous and continuous increase in human population that is why there is a necessity to focus on fish cultures and to do the best effort to achieve the self-sufficiency of fish productivity. Good nutrition, control of fish pathogens, and maintaining good water quality are the most important ways to sustain aquaculture development and achieve high fish production.

Overfishing occur when more fish are caught then are able to reproduce to repopulate. Because fishing has long been an industry used by humans, Overfishing affects natural ecosystems severely and leads to an imbalance of ocean life. Around 63% of global fish stocks are estimated to be overfished. Overfishing caused fishing fleets to migrate to new waters that would further deplete the fish stocks. Moreover, it has negative effects on coastal communities that rely on fishing to support their living. Many forms of fishing like blast fishing, cyanide fishing, bottom trawling, whaling, and over-fishing have had an adverse effect on aquatic life. Some of the causes of overfishing include:

- Difficulties in regulating fishing areas due to lack of resources and tracking activity.
- Most areas in the world have a total lack of oversight related to their fishing industry, which means the practices and activities of fishing fleets are not or barely monitored.
- In international waters, there are little to no rules regarding fishing practices, which means fishing fleets can bypass areas that do have regulations.
- Lack of knowledge regarding fish populations and quotas in a universal standard.
- Problems with customs and importation where the provenance of fish is not questioned, leading to surreptitious practices such as calling one kind of fish something else.
- Unreported fishing, which is nearly impossible to track.
- Many countries have subsidies for fishermen which keeps their number higher than it needs to be (it is

estimated that there are 2 ½ times more fleets than needed).

- Fishing areas are largely unprotected – only a little over 1.5% of oceans have been declared protective areas, and most of these are still open to fishermen. This means that areas can be harmed or depleted. [40]

According to Mother Nature Network (MNN), there has been a decrease in populations of 36% of species, from sardines to baleen whales, due to over-harvesting. Overfishing leads to a misbalance of ocean life, severely affecting natural ecosystems in the process. Furthermore, it also has negative effects on coastal communities that rely on fishing to support their economies.

Natural Resource Depletion

Another crucial current environmental problem is the depletion of natural resources. Humans, use so many natural resources that it would need almost 1.5 Earths to cover all our needs. This will further increase in the future due to massive industrialization in Asian countries like India and China. Increased use of natural resources leads to a number of other environmental issues, such as industrialization, population growth and air pollution. Most resources are extracted from developing nations, where working conditions are often poor and environmental deterioration is remarkable. The worldwide transformation from a predominantly agricultural society to an industrial regime has rapidly increased our use of resources, such as fossil fuels, metals and timber, especially in the second half of the 20th century. [42] Over time, natural resource depletion will lead to an energy crisis. The chemicals emitted from many natural resources contribute to climate change. Fossil fuel consumption results in the emission of greenhouse gases, which is primarily responsible for global warming and climate change. Globally, people are making efforts to shift to renewable sources of energy like solar, wind, biogas and geothermal energy. As such, the cost of installing the infrastructure and maintaining these sources has plummeted in recent years. Finite natural resources are being over-exploited. Phys.org and Global Agriculture reported in July 2019 of Earth Overshoot Day. The world had used up all the natural resources for the year. This type of unsustainable use poses the danger that the world can run out of necessary materials and affect the economy and human's well-being.

Over-consumption affects the Eartht. Natural resources are finite and are being destroyed by current consumption patterns. In 2019, the PNAS (Proceedings of the National Academy of Sciences) published a paper depicting how commodity production of agricultural crops creates biodiversity losses of significant proportions.

Wasted natural resources

267.8 million tons of municipal solid waste went to landfills instead of being recycled, upcycled, composted, or used for something else in 2017, according to the EPA. There are a lot of wasted natural resources that originally came from nature, in one form or another. In a circular economy, these natural resources would not be wasted. Instead, they could be upcycled, recycled, or used to regenerate other materials.

Landfills: An Unsustainable Form of Waste Management

The huge production of waste due to our hyperconsumption is a major threat to the environment. As per the study, the average person produces 4.3 pounds of waste/day, and the US alone accounting for 220 million tons a year. Since modern technology allows us to access digital environments, many things that you need can be fulfilled in the cloud. This hyperconsumption results in non-biodegradable trash in the form of plastic packaging, toxic e-waste, and harmful chemicals that leach into our waterways. When this waste ends up in landfills, it generates enormous amounts of methane, which ranks as one of the worst greenhouse gases because of its high potential for global warming. It creates severe explosion hazards.

Waste and Waste Production

The average person produces 4.3 pounds of waste/day, with the US alone accounting for 220 million tons/year. Much of this waste ends up in landfills, which generate enormous amounts of methane. Not only does this create explosion hazards, but methane also ranks as one of the worst of the greenhouse gases because of its high global warming potential. Waste generation and management create a slew of environmental issues, such as litter, landfills, incineration, marine debris, e-waste, and contamination of water and soil caused by improper disposal and leaching toxins, according to Encyclopedia.com.

The coronavirus disease 2019 (COVID-19) pandemic has led to an abrupt collapse of waste management

chains. Safely managing medical and domestic waste is crucial to successfully containing the disease [43]. Mismanagement can also lead to increased environmental pollution. All countries facing excess waste should evaluate their management systems to incorporate disaster preparedness and resilience.
Wuhan, the COVID-19 epicenter of China, experienced a massive increase of medical waste from between 40 and 50 tons/day before the outbreak to about 247 tons on 1 March [44]. Cities such as Manila, Kuala Lumpur, Hanoi, and Bangkok experienced similar increases, producing 154 to 280 tons more medical waste per day than before the pandemic [45]. Meanwhile, the widespread lockdown has caused a substantial increase in domestic waste in the United Kingdom [46]. These large amounts of waste require collection and recycling, both of which are compromised as a result of manpower shortages and efforts to enforce infection control measures [47] [48]. Disrupted services have led to waste mismanagement increases of 300% in some rural UK communities [49]. With fewer options available, traditional waste management practices such as landfills and incineration are replacing more sustainable measures such as recycling, with adverse effects on the environment [50]. The U.K. Environment Agency further threatens the environment by allowing temporary storage of waste and incineration ash at sites that have not been granted a permit, as is usually required [51] [52]. The design and analysis of sustainable waste management chains, including logistics, recycling, and treatment technologies and policies, should be prioritized [53]. To reduce the socioeconomic and environmental impacts of waste management, the whole system must be considered, including waste generation, collection, transport, recycling and treatment, recovered resource use, and disposal of remains. Protecting waste management chains will help achieve sustainable cities and communities as outlined in the UN Sustainable Development Goals [54]. The overconsumption of resources and the creation of plastics are creating a global crisis of waste disposal. Developed countries are notorious for producing an excessive amount of waste or garbage and dumping their waste in the oceans and less developed countries. Nuclear waste disposal has tremendous health hazards associated with it. Plastic, fast food, packaging and cheap electronic wastes threaten the well being of humans. Waste disposal is, therefore, one of the urgent current environmental problems.

Food Waste

Food waste is a global problem and a modern problem. It occurs at all stages of the food supply chain, from production to post consumer disposal as garbage. While there are a range of factors that contribute to food waste in the production and retail stage of the supply chain, the solution to those problems are being addressed through the collaborative actions and decisions of businesses and government.
Food waste is a big environmental problem. There's a lot of media coverage about how diet is related to the environment. But the majority of that coverage has to do with how individuals should eat, not how agriculture and waste management services should improve. This loss is detrimental to both people going hungry and the environment, considering all of the manufacturing and shipping emissions from products that go uneaten. A third of the food intended for human consumption (around 1.3 billion tons) is wasted or lost. Up to 40% of food is wasted from farm to fork to landfill according to the National Resource Defense Fund. This is enough to feed 3 billion people; this is according to a report by the FAO.
Food waste and loss accounts for 4.4 gigatons of greenhouse gas emissions annually; if it was a country, food waste would be the third highest emitter of GHGs, behind China and the US. Food waste and loss occurs at different stages in developing and developed countries; in developing countries, 40% of food waste occurs at the post-harvest and processing levels, while in developed countries, 40% of food waste occurs at the retail and consumer levels. Many companies are starting initiatives to reduce their food waste by avoiding situations where it arises. For example, Marriott hotels are taking steps like not refilling buffet trays as frequently and using more sustainable practices in preparing meals. Overall, the hotel chain hopes to decrease their food waste by 50% by 2025. Some technologies, such as dehydrators and digesters, are becoming popular methods to manage waste. These systems process food in different ways to reduce the volume that ends up in a landfill. They can also decrease the environmental impact by speeding up decomposition. Food loss and waste must be reduced for greater food security and environmental sustainability. The United States is the global leader in food waste, with Americans discarding nearly 40 million tons of food every year. That’s 80 billion pounds of food and equates to more than $161 billion, approximately 219 pounds of waste/ person and 30-40% of the US food supply. Most of this food is sent to landfills; food is the single largest component taking up space inside US landfills. In fact, it makes up 22% of municipal solid waste. [55] The value of this wasted amount of food is about 680 billion dollars. A waste in food means a waste of the public and private economy, and not making the best use of food losses to feed the

poor means waste in social and human relations that contributes to increasing poverty and hunger. The Middle East is limited in production for its food needs, and it can provide 50% of its food to its people, and the rest will import it. According to statistics, the Middle East and the Arab countries in North Africa are expected to reach about 92.4 billion dollars in 2020. [56] [57]

Urban Sprawl

Urban sprawl refers to the migration of population from high-density urban areas to low-density rural areas, which results in the spreading of the city over more and more rural land. Urban sprawl results in land degradation, increased traffic, environmental issues and health issues. The ever-growing demand for land displaces the natural environment consisting of flora and fauna, instead of being replaced. [58]

Genetic Engineering

Genetic modification of food using biotechnology is called genetic engineering. Genetic modification of food results in increased toxins and diseases as genes from an allergic plant can transfer to the target plant. Genetically modified crops can cause serious environmental problems as an engineered gene may prove toxic to wildlife. Another drawback is that increased use of toxins to make insect resistant plants can cause resultant organisms to become resistant to antibiotics. The need for change in our daily lives and the movements of our government is growing.

Since so many different factors come into play, such as voting, governmental issues, the desire to stick to a routine, many people don't consider that what they do will affect future generations. If humans continue moving forward in such a harmful way towards the future, then there will be no future to consider. Although it's a fact that humans cannot physically stop ozone layer from thinning, there are still so many things we can do to try and put a dent in what we already know. By raising awareness in your local community and within your families about these issues, you can help contribute to a more environmentally conscious and friendly place for you and your future generations to live.

For generations, the field of biology has been largely defined by its discoveries. Now, because many crucial aspects of biology have begun the transition from an empirical science to an engineering discipline, the pendulum is shifting from "What can we discover?" to "What can we solve? (Figure 11) [59]". Nowhere is this perhaps more evident than in the global scientific community's collective response to combat a global pandemic—pushing us even further into one of the most prolific periods in the world of bio in both scientific and commercial development we have ever seen.

As our engineering toolkit in bio expands to be more powerful than ever before, and the infrastructure to deliver, produce, and scale these solutions comes increasingly online, a whole new world of problems in biology begin to feel approachable. Here are the 16 biggest and potentially most rewarding challenges we see coming in the world of bio.

The same way sequencing DNA led us to a new universe of drug development, the next generation of platforms and screening techniques for additional biological dimensions will allow us to drug entirely new targets of disease. Just a 5-10% efficiency on cost or time—a Moore's Law for clinical trials—would mean that in 7 years, it might cost half as much to run a new therapeutic through clinical trials, and an order of magnitude more diseases cured. We are finally entering an era in which the engineering principles of abstraction, modularity, and hierarchy can be applied towards the design of biology itself. [59]

Genetic Modification of Crops

Environmental issues caused by man-made chemicals are becoming clearer. For example, there has been a 90% reduction in the Monarch butterfly population in the US that can be linked to weed killers that contain glyphosate. There is also some speculation that genetically-modified plants may leak chemical compounds into soil through their roots, possibly affecting communities of microorganisms. People are concerned about genetically modified foods (GMOs) and genetic pollution. The US Center for Food Safety reports, genetically engineered foods are prominent in the food supply chain. The percentages of GE foods include 92% corn, 94% of cotton, 94% of soybeans and 72% of all processed foods. However, creating genetically modified organisms does not proceed without conflicts. One part of the equation concerns objections made by disputants of GMOs to the manipulation of life, as opposed to defenders who argue that it is essentially an extension of traditional plant cultivation and animal breeding techniques. There are conflicts regarding the risks to the environment and human health from using GMOs. Concerns about the risks to the environment and human health from GM products have been the subject of much debate, which has led to the development of regulatory frameworks for the evaluation of GM crops. However, the absence of a globally accepted framework has the effect of slowing down technological development with negative consequences for areas of the world that could benefit from new technologies. [60] Possible risks of using genetically modified products: 1) Environmental Hazards and 2) Risks to Human Health. Basic concepts related to genetically modified products: 1) The Notion of Substantial Equivalence; 2) The Precautionary Principle; 3) The Safeguard Clause; 4) The Cartagena Protocol; 5) Labeling of Genetically Modified Products; 6) Ethical Concerns; 7) Ethics and the Environment; 8) Ethics and Animal Rights and 9) Patenting Living (Genetically Modified) Organisms. [60]

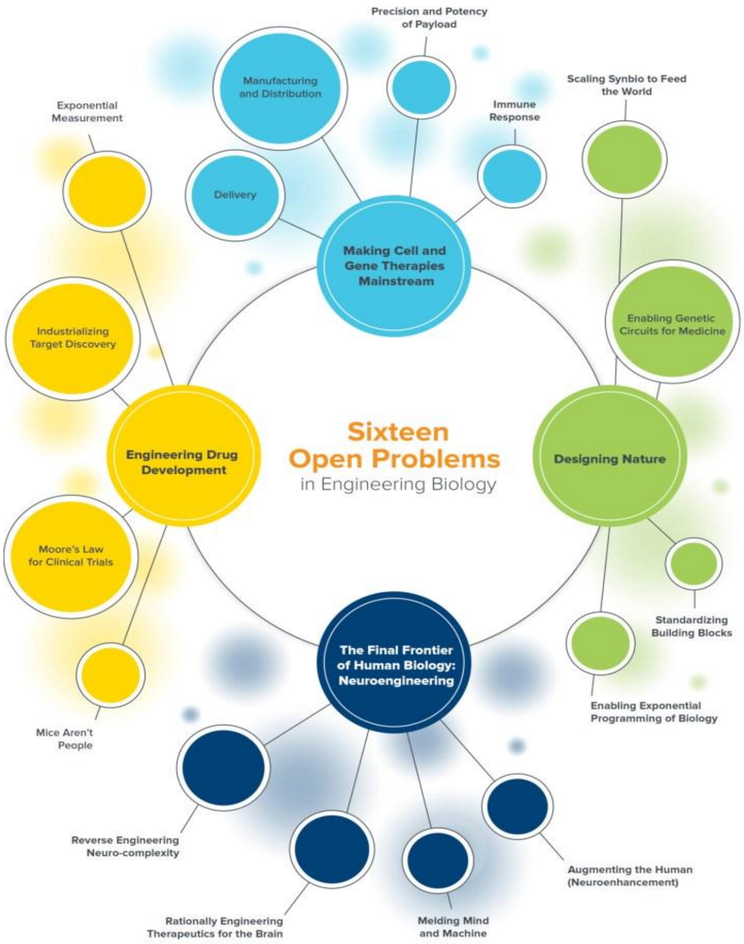


Figure (11) Sixteen open problem in engineering biology [59]

Carbon Footprint

A carbon footprint is the amount of C emissions each individual living organism creates (Figure 12). [61] Individuals can reduce this footprint and their effect on the environment, through use of renewable energy sources (e.g., solar power, geothermal heat pumps), recycling, and sustainable living.

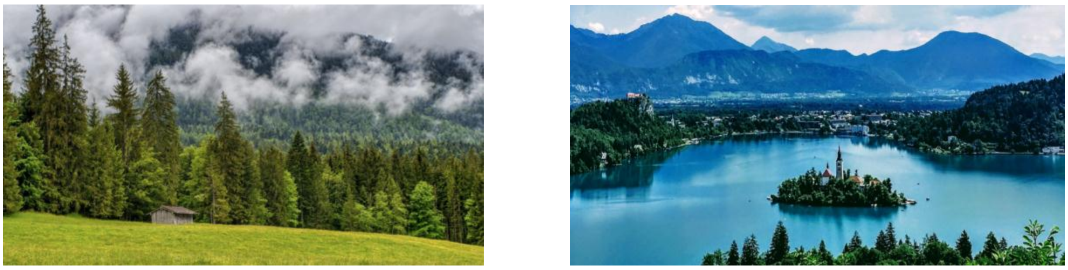


Figure (12) Amount of C emission [61] [64]

Today, the term “C footprint” is often used as shorthand for the amount of C (usually in tonnes) being emitted by an individual activity or organization. The C footprint is an important component of the Ecological Footprint, since it is one competing demand for biologically productive space. Carbon emissions from burning fossil fuel accumulate in the atmosphere if there is not enough biocapacity dedicated to absorb these emissions. Therefore, when the C footprint is reported within the context of the total Ecological Footprint, the tonnes of CO_2 emissions are expressed as the amount of productive land area required to sequester those CO_2 emissions. This tells us how much biocapacity is necessary to neutralize the emissions from burning fossil fuels. The C Footprint is a descriptive, widely-used term for the GHG emission balance of an entire organization, or alternatively, of a single product or service. It includes emissions of CO_2 and other GHG (measured in CO_2 equivalents/CO_2-eq). In the case of an organization like a company or public institution, the C Footprint includes all emissions that are directly or indirectly caused by the activities of the organization over a certain time, usually a year. The C Footprint of a product or service, in turn, includes all emissions occurring over its lifecycle. Researchers say global C emissions (Figure 13) dropped by an estimated 2.4 billion metric tons in 2020 by 7% due to the coronavirus-induced lockdowns. They have warned that the emissions may rebound once the pandemic ends. Researchers say the emissions are down mainly because more people stayed home and traveled less by car or plane this year. [62]

The Ecological Footprint framework addresses climate change in a comprehensive way beyond measuring carbon emissions. It shows how C emissions compare and compete with other human demands on our Earth planet, such as food, fibers, timber, and land for dwellings and roads (Figure 14). [63]

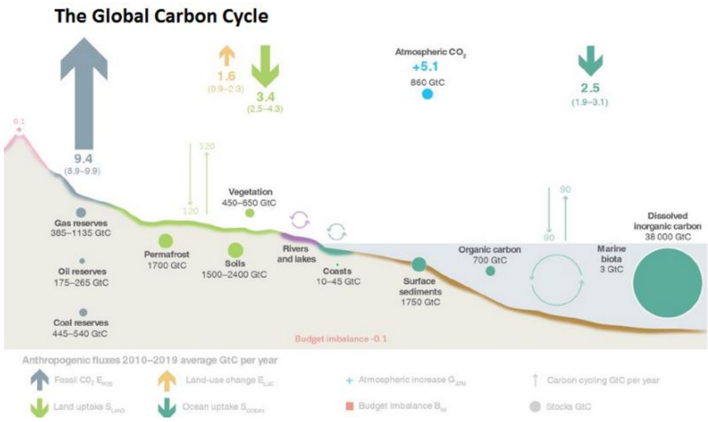


Figure (13) Human and natural sources and sinks of CO_2, updated to 2020 [62]

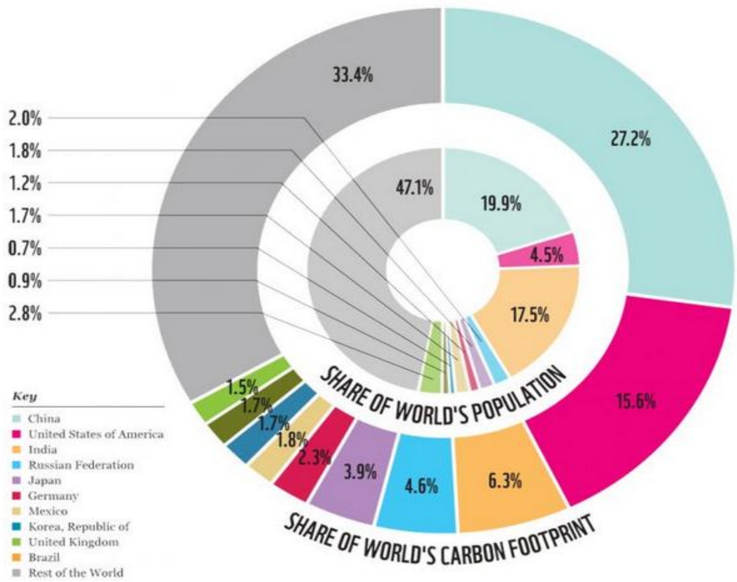


Figure (14) The combination of all forces (consumption, deforestation, agriculture and food, emissions) underscores more than ever the value of a comprehensive measure like the Ecological Footprint that takes into account all competing demands on the biosphere, including CO_2 emissions and the capacity of our forests and oceans to absorb C. [63]

Dams and their impact on the environment

WWF reports there are 48,000 dams in the world, built to provide water for drinking and irrigation, and energy. However, they lead to habitat destruction, species loss, and displacing millions of people.

Five ways mega-dams harm the environment: Dams are often touted as environmentally friendly. Although they do represent a renewable source of energy, a closer look reveals that they are far from green. DW lays out the biggest environmental problems of mega-dams [65]:

- Dams alter ecosystems
- Dams reduce biodiversity and cause extinction
- Dams contribute to climate change
- Dams reduce water quality
- Dams waste water

Sustainable communities

Development of sustainable communities depends on reducing reliance on fossil fuels, supporting local farmers and merchants, encouraging green practices and building, consideration of native wildlife, adoption of mass transportation and cleaner methods of commuting. Sustainable development is necessary to ensure human needs like housing are met, to protect resources and biodiversity, to control climate change, and for a stable economy. The environment and the climate need to be fully protected. This can only be achieved if we open ourselves to a sustainable life. The concept of "sustainable communities" is a broad one, and several definitions can be found. In this review, we focus on the definition proposed by the World Bank's Social, Urban, Rural, and Resilience Global Practice, which includes the following four key dimensions: First, sustainable communities are environmentally sustainable in terms of cleanliness and efficiency. Second, sustainable communities are resilient to social, economic, and natural shocks. Third, sustainable communities are inclusive communities. Finally, sustainable communities are competitive communities that can stay productive and generate jobs for members of the community. The steadily growing consumption is the engine that drives the steady growth of our economy. This in turn results in major environmental impacts worldwide and the climate change and is increasingly endangering our natural basis of life and living together on earth. The five global risks of the coming years that are highest in terms of their likelihood are all environmental:

- Extreme weather events with great damage to property, infrastructure and human life.
- Governments and businesses fail to mitigate and adapt to climate change.
- Man-made environmental damages and disasters.
- Great loss of biodiversity and collapse of ecosystems with irreversible consequences for the environment, which leads to a severe depletion of resources for humanity and industry.
- Major natural disasters such as earthquakes, tsunamis, volcanic eruptions and geomagnetic storms.

Natural disasters

Since the 20th century, substantial population growth and the continuous increase in living standards have encouraged the large-scale manufacture of pharmaceuticals, medicines, chemicals, dyes, pigments, organic pesticides, fertilizers and other synthetic ingredients. Hence, the amount of these artificial ingredients has gradually increased in aquatic environments. Out of the various kinds of organic pollutants detected in aquatic environments, the amount of pesticides and their derivatives is considerable. Pesticides are a kind of chemical substances that have been generally used to safeguard produces frommicrobial, fungal, or pest attacks. The use of pesticides has certainly helped to raise agronomic growth and yield. These pesticide residues move into water in various pathways and contaminate surface water.

Earthquakes, volcanoes, tsunamis, floods, tornadoes, hurricanes, avalanches, landslides and forest fires are natural disasters that threaten people and the environment. As the Unified Computing System (UCS) report on global warming points out that, there has been an increase in extreme weather events like snow fall, storms and floods in US linked to climate change. Statista reports that besides the US, China and the Philippines are the worst affected, with total fatalities amounting to several hundred thousands.

A record-breaking Atlantic hurricane season, flash floods, earthquakes, volcanic eruptions and wildfires plagued already reeling communities from Australia to Turkey this year, as thousands of people lost their lives. According to the UNs Office for Disaster Risk Reductions, there has been a rise in climate-related disasters during the past 20 years. Between 1980 and 1999, there were 3,656 climate-related events, as opposed to 6,681 between 2000 and 2019. Those differences are reflected in the number of floods, which has more than doubled in the past 20 years, while the incidence of storms increased from around 1,457 to around 2,034. [66] At least 207 natural disasters were recorded globally in the first six months of 2020 — this is above the 21st century average (2000-2019) of 185 disasters. The number of events exceeded average in all regions except the Americas. There was an increase of at least 27 per cent in natural disasters recorded during the same time in 2019. Between January and June 2019, at least 163 natural disasters were recorded. These disasters cost the world $75 billion, according to the Aon catastrophe report, titled *Global Catastrophe Recap: First Half of 2020*, released on July 23, 2020. This is close to the average loss of $78 billion during 1980-2019. These numbers are preliminary and will change as losses continue to develop, according to the report. At least $71 billion, over 95% of the loss, was due to the weather-related disasters. In fact, around 92% of these disasters between January and June were weather-related. The economic loss is due to tropical cyclone increased by 270% above the average of 2000-2019.

Drought

Vegetation can geavily influence the underground water distribution. The team of researchers investigated how the process of evaporation and groundwater recharge differed under various kinds of soils and land uses. They examined the storage, distribution and quality of water within the landscape. Brandenburg has the lowest rainfall in the region. The annual rainfall there is 560 liters per square metre. In 2018, there was about 390 litres of water per square meter, which is 40% less precipitation than normal. Under the grassland, the water continuously recharged the groundwater. The soil could store more water. As the plants only took water from the upper soil, this led to “older” soil water. Even under normal climatic conditions, about 90% of the precipitation is said to be released back into the atmosphere; it does not flow into rivers or groundwater. The researchers have been working together with the forestry as well as the agricultural sectors to bring their research results into practice. Accordingly, groundwater levels continued to in 2020. The vegetation has still not been able to recover due to the low rainfall in the winter months. Unfortunately, people are far from ‘normal’ conditions. To improve the resistance of Brandenburg’s ecosystems to droughts and other climate changes, measures must be implemented that promote groundwater recharge and create soils that can store more water. Our results underline the central role of vegetation in the development of such strategies. [67]

Nanotechnology and future effects of nanopollution/Nanotoxicology

Nanotechnology has become one of the most important interdisciplinary sciences, and it integrates physics, chemistry, engineering and biology. It gains global public interest due to its rapidly evolving and expanding in many applications in engineering, electronics, agriculture, medicine, food industry, and environment.

According to the nano-size of nano-materials, nanoparticles have new unique physicochemical properties, overcome high pressure and temperature, and participate in many applications. Nanoparticles could pollute soil and groundwater, and eventually get into the food chain, where they can be a health risk. However, the health risks they pose are unknown since research in this area has been deemed irresponsible and therefore unfeasible. The impact of nanotechnology extends from its medical, ethical, mental, legal and environmental applications, to fields such as engineering, biology, chemistry, computing, materials science, and communications. Major benefits of nanotechnology include improved manufacturing methods, water purification systems, energy systems, physical enhancement, nano medicine, better food production methods, nutrition and large-scale infrastructure auto-fabrication. Nanotechnology's reduced size may allow for automation of tasks which were previously inaccessible due to physical restrictions, which in turn may reduce labor, land, or maintenance requirements placed on humans. Potential risks include environmental, health, and safety issues; transitional effects such as displacement of traditional industries as the products of nanotechnology become dominant, which are of concern to privacy rights advocates. These may be particularly important if potential negative effects of nano particles are overlooked.

Nanotoxicology deals with structure-activity relationships: it seeks to pin-point the specific properties that drive biological effects. Research in Nanotoxicology offers an opportunity to explore the interactions between engineered or incidental materials and biological systems at the nanoscale. [68] This has important ramifications for nanomedicine: understanding interactions at the nano-bio interface is a prerequisite for the safe and efficacious deployment of nanomaterials in patients. [69]. Toxicology deals with the cellular and molecular mechanisms that are triggered or perturbed by a toxicant. Cell death research is intimately and obviously linked to toxicology. Nanotoxicology is a relatively new discipline that embraces new developments in toxicology including the application of systems biology approaches with which to model and predict perturbations inflicted by nanomaterials in a living system. [70] Nanotoxicology can be viewed as a lesson in interdisciplinarity, and a comprehensive understanding of nano-bio interactions can only be obtained through a combination of different perspectives found in chemistry, physics, molecular biology, immunology, pharmacology, computational sciences, and so forth. Continuous communication across scientific disciplines is, therefore, critically important. The future of nanotoxicology may provide a useful template. The health impacts of nanotechnology are the possible effects that the use of nanotechnological materials and devices will have on human health. As nanotechnology is an emerging field, there is great debate regarding to what extent nanotechnology will benefit or pose risks for human health. Nanotechnology's health impacts can be split into two aspects: the potential for nanotechnological innovations to have medical applications to cure disease, and the potential health hazards posed by exposure to nanomaterials. [71]

The nanotechnology revolution is extended to include fish cultures, to participate in their growth, and to overcome their challenges. [72] Applications of nanotechnology in fish cultures include direct and indirect applications. Direct applications of nanotechnology are dealing mainly with fish: growth, reproduction, and health. Indirect applications of nanotechnology in fish cultures are concerned mainly with water quality: sterilization of ponds, reducing the rate of water exchange, reducing nitrogenous compounds concentration, water treatment, and remediation of either chemical or biological contaminants. [73]

Despite the abovementioned advantages of nanotechnology applications in fish cultures, some challenges raise several questions about their complete safety on fish health, human health, and the surrounding environment. Toxicity of nanoparticles especially metal nanoparticles can affect various fish physiological functions, antioxidant and enzyme activities, reproductive hormones, survivability of early developmental stages, and histopathological pictures. [74] Moreover, the environmental transformation of nanoparticles that is affected by many physical, chemical, or biological factors produces secondary pollutants in the environment that affect the untargeted living organisms, affect the biodiversity, and bioaccumulate within the food chain to finally affect human health. [75]

Based on what mentioned above, there are many implications of nanotechnology applications in fish farms, and they need more efforts and studies to increase the knowledge about the possible toxicity on fish and untargeted organisms. Further studies about the lowest effective dose, duration, lethal and sublethal concentrations, bioaccumulation, residues concentration, and environmental fate are required. Moreover, legislation and rules of nanomaterials synthesis and field applications should be triggered to ensure environmental safety.

Medical applications: Nanomedicine is the medical application of nanotechnology. The approaches to nanomedicine range from the medical use of nanomaterials, to nanoelectronic biosensors, and even possible future applications of molecular nanotechnology. Nanomedicine seeks to deliver a valuable set of research tools and clinically helpful devices in the near future. The National Nanotechnology Initiative expects new commercial applications in the pharmaceutical industry that may include advanced drug delivery systems, new therapies, and in vivo imaging. Neuro-electronic interfaces and other nanoelectronics-based sensors are another active goal of research. Further down the line, the speculative field of molecular nanotechnology believes that cell repair machines could revolutionize medicine and the medical field. [71]

Health hazards: Nanotoxicology is the field which studies potential health risks of nanomaterials. The extremely small size of nanomaterials means that they are much more readily taken up by the human body than larger sized particles. How these nanoparticles behave inside the organism is one of the significant issues that need to be resolved. The behavior of nanoparticles is a function of their size, shape and surface reactivity with the surrounding tissue. Apart from what happens if non-degradable or slowly degradable nanoparticles accumulate in organs, another concern is their potential interaction with biological processes inside the body: because of their large surface, nanoparticles on exposure to tissue and fluids will immediately adsorb onto their surface some of the macromolecules they encounter. The large number of variables influencing toxicity means that it is difficult to generalise about health risks associated with exposure to nano materials each new nanomaterial must be assessed individually and all material properties must be taken into account. Health and environmental issues combine in the workplace of companies engaged in producing or using nanomaterials and in the laboratories engaged in nanoscience and nanotechnology research. It is safe to say that current workplace exposure standards for dusts cannot be applied directly to nanoparticle dusts. [71] The extremely small size of nanomaterials also means that they are much more readily taken up by the human body than larger sized particles. How these nanoparticles behave inside the body is one of the issues that need to be resolved. The behavior of nanoparticles is a function of their size, shape and surface reactivity with the surrounding tissue. They could cause overload on phagocytes, cells that ingest and destroy foreign matter, thereby triggering stress reactions that lead to inflammation and weaken the body's defense against other pathogens. Apart from what happens if non-degradable or slowly degradable nanoparticles accumulate in organs, another concern is their potential interaction with biological processes inside the body: because of their large surface, nanoparticles on exposure to tissue and fluids will immediately adsorb onto their surface some of the macromolecules they encounter. This may, for instance, affect the regulatory mechanisms of enzymes and other proteins. [71]

Environmental Impact: The environmental impact of nanotechnology is the possible effects that the use of nanotechnological materials and devices will have on the environment. As nanotechnology is an emerging field, there is debate regarding to what extent industrial and commercial use of nanomaterials will affect organisms and ecosystems. Nanotechnology's environmental impact can be split into two aspects: the potential for nanotechnological innovations to help improve the environment, and the possibly novel type of pollution that nanotechnological materials might cause if released into the environment. [71]

Environmental applications: Green nanotechnology refers to the use of nanotechnology to enhance the environmental sustainability of processes producing negative externalities. It also refers to the use of the products of nanotechnology to enhance sustainability. It includes making green nano-products and using nano-products in support of sustainability. Green nanotechnology has been described as the development of clean technologies, to minimize potential environmental and human health risks associated with the manufacture and use of nanotechnology products, and to encourage replacement of existing products with new nano-products that are more environmentally friendly throughout their lifecycle. Green nanotechnology has two goals: producing nanomaterials and products without harming the environment or human health, and producing nano-products that provide solutions to environmental problems. It uses existing principles of green chemistry and green engineering to make nanomaterials and nano-products without toxic ingredients, at low temperatures using less energy and renewable inputs wherever possible, and using lifecycle thinking in all design and engineering stages. [71]

Pollution: Nanopollution is a generic name for all waste generated by nanodevices or during the nanomaterials manufacturing process. Nanowaste is mainly the group of particles that are released into the environment, or the particles that are thrown away when still on their products. [71]

Social impact: Beyond the toxicity risks to human health and the environment which are associated with first-generation nano materials, nanotechnology has broader societal impact and poses broader social challenges. Social scientists have suggested that nanotechnology's social issues should be understood and assessed not simply as downstream risks or impacts. Rather, the challenges should be factored into upstream research and decision-making in order to ensure technology development that meets social objectives. [71]

Many social scientists and organizations in civil society suggest that technology assessment and governance should also involve public participation Over 800 nano-related patents were granted in 2003, with numbers increasing to nearly 19,000 internationally by 2012. Corporations are already taking out broad-ranging patents on nanoscale discoveries and inventions. For example, two corporations, NEC and IBM, hold the basic patents on carbon nanotubes, one of the current cornerstones of nanotechnology. Carbon nanotubes have a wide range of uses, and look set to become crucial to several industries from electronics and computers, to strengthened materials to drug delivery and diagnostics. Carbon nanotubes are poised to become a major traded commodity with the potential to replace major conventional raw materials. [71]

Nanotechnologies may provide new solutions for the millions of people in developing countries who lack access to basic services, such as safe water, reliable energy, health care, and education. The 2004 UN Task Force on Science, Technology and Innovation noted that some of the advantages of nanotechnology include production using little labor, land, or maintenance, high productivity, low cost, and modest requirements for materials and energy. However, concerns are frequently raised that the claimed benefits of nanotechnology will not be evenly distributed, and that any benefits associated with nanotechnology will only reach affluent nations. [71] Longer-term concerns center on the impact that new technologies will have for society at large, and whether these could possibly lead to either a post-scarcity economy, or alternatively exacerbate the wealth gap between developed and developing nations. The effects of nanotechnology on the society as a whole, on human health and the environment, on trade, on security, on food systems and even on the definition of "human", have not been characterized or politicized. [71]

Risks and Opportunities for Mining: Global Outlook 2020

Mining has negatively impacted natural forests and wildlife, hurt living environment for people, leads to leaching of toxic pollutants and heavy metals that pollute water, land, and air, points out Patagonia Alliance, and therefore recommends responsible mining practices. Acid mine drainage also threaten water resources The mining industry is facing new challenges. In the past, mining companies simply had to plan their production on the basis of "highest volumes at the lowest production cost" to keep stakeholders happy. Today, mining companies have to address an increasing list of demands from a wide range of stakeholders to be not only profitable and productive but also responsible and sustainable. Environmental, Social and governance matters are key considerations in this age of stakeholder capitalism. The global mining & metals sector spent 2019 balancing two competing forces. Concerns surrounding the macro picture grew, as a Chinese slowdown that started in 2018 was exacerbated by global trade tensions and slowing manufacturing across Europe and the US. However, this was partially offset by increasingly tight supplies of metals amid dwindling stockpiles, demonstrating that the underlying fundamentals of the industry remained strong (Figure 15). [76]

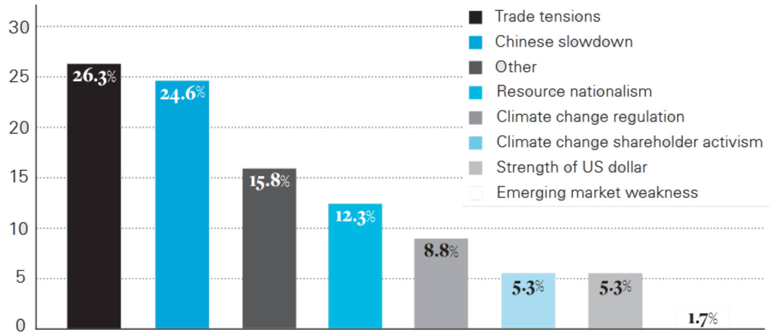


Figure (15) Key risk for mining & metals in 2020 [76]

Ecosystem destruction

One-fifth of the world's countries are at risk of their ecosystems collapsing because of the destruction of wildlife and their habitats. Natural "services" such as food, clean water and air, and flood protection have already been damaged by human activity. More than half of global GDP depends on high-functioning biodiversity. Shrinking habitats such as aquaculture, estuaries, shellfish protection, landscaping, and wetlands are responsible for species loss, and can be protected through ecological restoration. Though global initiatives, like the Convention on Biological Diversity that was signed by 150 countries in 1992, increasingly protect ecosystems a scientific review in 2016 found nearly half of habitats are still severely threatened. Cellulose, one of the main components of wood, is proving to be remarkably useful when broken into nano-sized bits. As inventors find new uses for the versatile material, demand is growing a hefty 18%/year. Use of nanocellulose for packaging and construction can help remove CO_2, a primary contributor to climate change, from the atmosphere, and reduce demand for environment-harming plastics. But it could also increase pressure to turn diverse forests into biodiversity-bereft plantations and otherwise disrupt habitat. Habitat loss poses the greatest threat to species. The world's forests, swamps, plains, lakes, and other habitats continue to disappear as they are harvested for human consumption and cleared to make way for agriculture, housing, roads, pipelines and the other hallmarks of industrial development. Without a strong plan to create terrestrial and marine protected areas important ecological habitats will continue to be lost.

Energy conservation

Use of renewable energy for home and business can affect energy efficiency, and avoiding fossil fuel use to mitigate climate change and protect the environment. The European Union committed itself in 2009 to the reduction of its GHG emissions by between 80 and 95% by 2050. The European Climate Foundation (ECF) has commissioned a series of reports from various sector experts to quantify that goal, assess how it can be achieved and what its impacts might be. Energy Savings 2020 is the latest report in the series. The role of this report is to assess the impact of current EU energy and climate policies and to make recommendations on the design of an overarching energy saving policy framework to achieve Europe's 20% energy savings target by 2020 as a vital step to meet its 2050 GHG commitment. [77]

Intensive farming

Monoculture, irrigation, and excessive use of chemical fertilizers and pesticides can leads to loss of soil fertility and increase in carbon emissions according to the Union of Concerned Scientists. Similarly cattle rearing in industrial farming rely on antibiotics that pose a health risk for people. Moreover, as WWF points out in many parts of the world, cattle rearing cause overgrazing, forest destruction and degradation, and methane emissions. Agricultural products, food and culinary traditions are a major part of the European Union's (EU's) regional and cultural identity. This is, at least in part, due to a diverse range of natural environments, climates and farming practices that feed through into a wide array of agricultural products. A growing share of consumers gives importance to the provenance of their food, for example choosing regional products or traditional specialities. This may be contrasted with the growing share of consumers who choose to shop in discount retailers that have radically changed the market for groceries in several EU Member States. Around two fifths of the EU's land is farmed: this underlines the important impact that farming can have on natural environments, natural resources, wildlife as well as soil and water quality. Farmers are increasingly being asked to manage the countryside for the benefit of everyone; delivering a public good, so that the whole of society can benefit from a countryside that is carefully managed and well looked after. There are a range of environmental issues that affect farmers in the EU, among which: the impact of climate change on agriculture and of agriculture on climate change; water pollution and scarcity; soil erosion and compaction; the impact of agriculture on air quality; preserving landscapes and biodiversity. [78]

CONCLUSION

Nowadays, the rapid economic development brings great damage to the environment and seriously restricts the sustainable development. Therefore, the worldwide intervention in pollution control and environmental protection is particularly important

Depending on the great challenges facing humanity is the increase in food production and environmental protection as well as the waste management to meet the ever-growing human population, economists and environmentalists have urged policymakers for years to increase the price of activities that emit GHGs (one of our biggest environmental problems), the lack of which constitutes the largest market failure, for example through C taxes, which will stimulate innovations in low-carbon technologies. Research on the relationship between environmental regulation and technological innovation should be the focus of scholarly attention in future as the main task for environmental and global protection.

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MANUSCRIPTS AND DEMONESTRATIONS OF THE POSTERS

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NITROGEN-FIXING POTENTIAL OF MEADOW CLOVER VARIETIES IN ENSURING SOIL QUALITY IMPROVEMENT (Poster)

O. Kichigina1, N. Palapa2, O. Ustymenko3

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Abstract: *Intensive use of arable land during the last century has led to a total decline in soil fertility, both in Ukraine and on the planet as a whole. Biological nitrogen is a powerful factor in improving soil fertility.* ***Motivation/Background:*** *That is why we aim to define the meadow clover varieties with a high and stable level of symbiotic nitrogen fixation.* ***Method:*** *Nitrogenase activity was determined by the acetylene reduction method using a «Chrom 5» gas chromatograph with a flame ionization detector. The number of bubbles on the roots of plants was carried out by visual direct counting. The study was conducted in the second decade of June.* ***Results:*** *During 2017-2019, we evaluated the intensity of the nitrogen fixation process of 20 varieties of meadow clover in symbiosis with the Rhizobium leguminosarum bv.trifolii 329b strain. The research was conducted with varieties recommended for cultivation in soils with the following values of Selyaninov Hydrothermal Coefficient (HTC) – 1,0–1,3 and 1,3–2,0. A positive correlation between nitrogenase activity and the number of bubbles per plant was observed (from 0,30 to 0,47). The following varieties were indicated: «Anitra», «Marusia», «Myronivska 5», «Milvus», «Nosivska 5», «Sparta». The nitrogenase activity rates of which, respectively, were: 3,1; 3,4; 3,8; 3,5; 3,2; 3,4 µmol C_2H_4/plant/hour, the number of bubbles per plant were 35, 28, 38, 30, 32, 35 unit/plant.* ***Conclusions:*** *Increasing the proportion of meadow crops in these varieties will improve soil fertility and reduce the use of mineral nitrogen fertilizers, which will contribute to improving the ecological situation in the agroecosystems.*

Keywords: *biological nitrogen, meadow clover varieties, nitrogen-fixing potential, soil fertility.*

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INVESTIGATION GRAZING IN THE MIDDLE IPOLY (Poster)

Ildikó Járdi, Gergely Pápay, Eszter S.-Falusi, Dénes Saláta, Károly Penksza

Szent István University, Faculty of Agricultural and Environmental Sciences, Institute of Crop Production Sciences, Gödöllő, Hungary

Abstract *The vegetation of two different characters of cattle pastures in the middle Ipoly Valley was examined in this research. One of them was wet vegetation beef cattle pasture while the other area was a dry vegetation cattle pasture. The wet pasture was mowed before 2000. Here one sours sandy vegetation and a lower-lying, characterless, Elymus repens dominated grassland area, with fresh and dry patches were examined. There were also two types of vegetation analysed on the dry cattle pasture. One of them was a drier steppe under less pressure grazing, and the other one was a heavily used, degraded steppe which has been used serving as a resting place. There was a significant amount of species adapted to disturbance in each plot, but their proportions were different. The lowest rate was observed in the quadrats of pastures of the dry area cattle under smaller grazing pressure. On the basis of the recordings, on the wet area pasture the sour sandy lawn was more sensitive, where the grazing pressure should be monitored in order to preserve the characteristics of the vegetation. On the new area of wet pasture grazing after mowing favoured the appearance of species characteristic of natural vegetation. Among the examined areas, the dry cattle pasture under grazing pressure was found as be the most favourable in maintaining the natural vegetation. Note: The research was supported by the FEKUTSTRAT 2018 project and the OTKA K125423 application.*

Keywords: *grassland management, nature conservation*

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ROLE OF ULVA RIGIDA EXTRACT IN ALLEVIATION OF SALINITY STRESS ON WHEAT PLANTS

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***Abstract**: Salt stress is a major adverse factor that can lower seed germination and seedlings growth, leading to reduced plant growth and ultimately lower crop productivity in arid and semi-arid regions of the world. In order to improve crop tolerance to this abiotic stress, many research studies have the importance of seaweed extract (SWE) in alleviating stress damage to plants. Seaweed extracts are used as nutrient supplements or biofertilizers in agriculture to increase plant growth and yield. In this study, we examined the effect of liquid seaweed extracts made from Ulva rigida on the growth of durum wheat (Durum triticum L) (cv Karim) under salt stress in laboratory and greenhouse conditions using foliar applications. We assessed SWE at different concentrations (0, 12.5, 25 and 50 %) on growth parameters (shoot length and shoot fresh weight) of wheat plants. Our results indicate that plants treated with SWE of Ulva rigida at lower concentrations (12.5 %) and under moderate salt stress showed enhanced growth (better response in shoot lenght and consequently greater fresh weight). Furthermore, Ulva rigida treatments increase activities of antioxidant enzyme systems to improve the growth of wheat plants under salt stress. This study provides important information on the identification and utilization of Moroccan seaweed resources as a source of liquid extracts as biostimulants in agriculture.*

Keywords: Antioxidant enzyme, foliar application, growth, wheat plant, salt stress, Ulva rigida

INTRODUCTION

Nowadays, it is estimated that these restriction cause more than 50% of yield loss in agriculture (Acquaah 2007). Salt stress has severely affected the agricultural productivity; it is estimated that about 20% of the irrigated land is influenced by salinity in arid and semi-arid lands of the world (Yeo 1999). Salinity is a major limiting factor in agriculture production affecting different plant growth stages. In recent years, seaweed liquid extract has newly gained importance as a foliar spray for several crops, including cereals, vegetables and spices (Pramanick, 2014). Furthermore, many studies concerning plant growth stimulating

effects of marine algae are carried out (Kavipriya, 2011).
Seaweed extracts are known to contain a large range of bioactive compounds like antioxidants, plant growth hormones, osmoprotectants, mineral nutrients (Pacholczak, 2016a; Nabti, 2017). However, as is mentioned by many authors, plant growth promotion by seaweed extracts is usually observed (Latique, 2013; Latique, 2014), but the mechanisms of stimulation of plant growth aren't entirely known in many cases (Nabti, 2017).
The main objective of present study is to determine the proximate composition of the green algae *Ulva rigida* collected from the coastal area of Akhfenir and to evaluate their potential as natural fertilizer in wheat plants.

RESULTS AND DISCUSSION

To evaluate how the *Ulva rigida* extract (URE) affects wheat L. plants, some growth parameters as length and fresh weights were determined (Table 1).

Table (1) Biomass accumulation of wheat shoots growing at increased levels of *Ulva rigida* extracts.

	0%	12.5%	25%	50%
SL (cm)	32±0.612^{a}	33.8±1.483^{ab}	35.84±1.236^{bc}	36.6±2.191^{c}
FW (mg)	357.4±25.706^{a}	393.8±65.933^{a}	454.2±44.612^{b}	416.6±57.557^{a}

Results are means ± S.D (n = 3),
Different letters show statistically significant differences for $P < 0.05$.

The table 1 shows the effect of URE on the growth parameters of wheat shoots. From these results, we can observe that URE contributes in a beneficial way to the growth of the wheat shoots. In fact, the length of the aerial part of the treated plants were significantly greater compared to the control plants.

The highest values of shoot length were obtained for the plants treated with 25% and 50% of URE. For the fresh weight, the seaweed extract exerted a positive effect; however, the differences between the treated plants and the control were significative only for the concentration of 25%.
The effect of the seaweed extracts, *Ulva rigida*, was also evaluated on the antioxidant system through the determination of enzyme activities such as SOD, GST and GR.

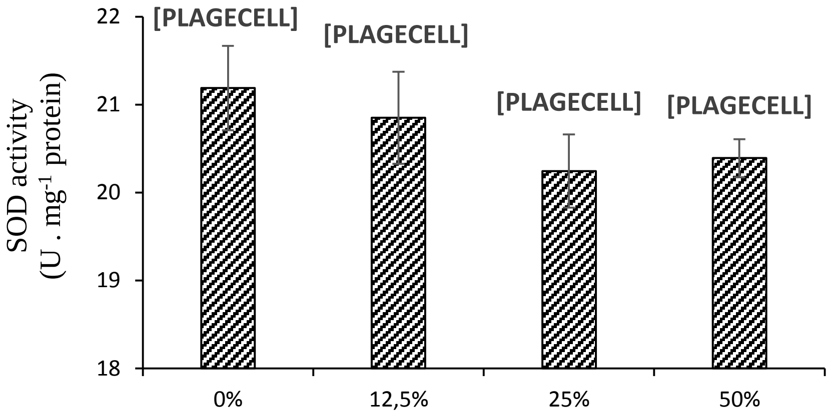

Figure (1) Effect of seaweed extract on leaves superoxide dismutase (SOD) activity of wheat plant.

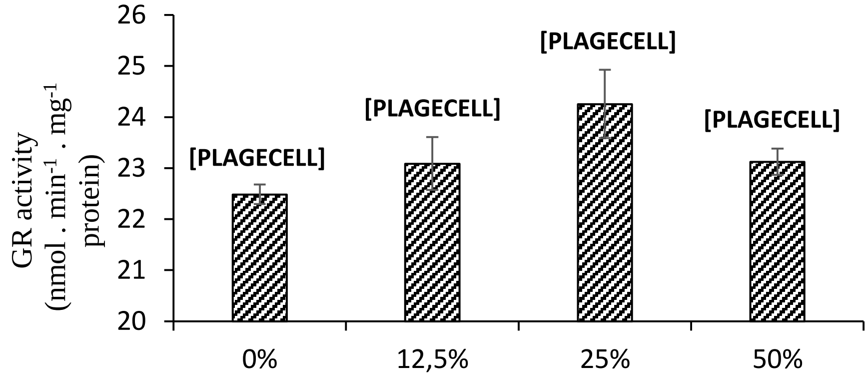

Figure (2) Effect of seaweed extract on leaves glutathione reductase (GR) activity of wheat plant.

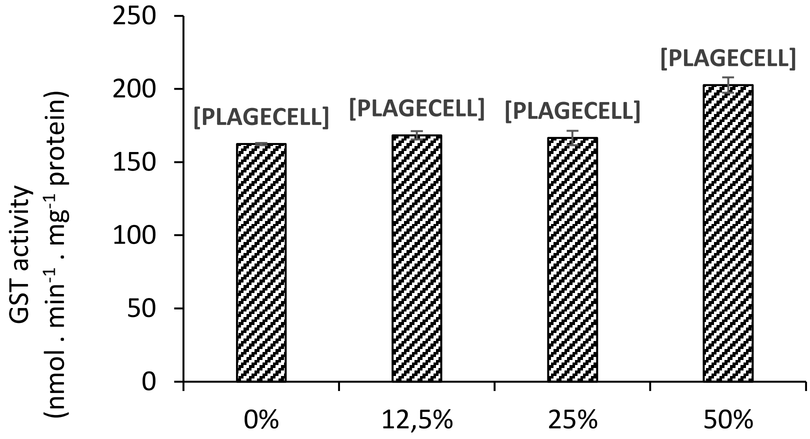

Figure (3) Effect of seaweed extract on leaves glutathione S-transferase (GST) activity of wheat plant.

Results are means ± S.D. Different letters show statistically significant differences for P< 0.05 level. In the present study, we did not observe any significance differences between the control plants and those treated with 12.5% of the seaweed extract. However, we surprisingly noticed a decrease in the SOD activity after treatment with 25% and 50% of the seaweed extract (Figure 1). Our data reveals that in leaves of wheat, the GR activity was enhanced at the concentration of 25% of URE and reaches 24.3 nmol. min^{-1}. mg^{-1} protein compared to the control with 22.5 nmol. min^{-1}. mg^{-1} protein (Figure 2). Our results indicated that GST activity increased only at the concentration of 50% of URE (Figure 3).

CONCLUSION

In the present study, we observed that the application of SWE improved notably shoot length plants in all salt treatments. This extract reduced the salt effect and enhanced the antioxidant potential of plants by activation of antioxidant enzymatic system. Extract of green SWE showed better result when they were applied at concentrations lower than 50%. This SWE can be used to improve plant growth under stress conditions. In addition, application of SWE contributes to protection of plants against peroxidation imposed by salt stress.

Consequently, the present findings encourage the application of such seaweed as natural fertilizer in agricultural sector.

As perspective It would be beneficial to carry out more research including study of antioxidant and substances active in seaweeds extract that stimulate the enzymatic system and lead to salt stress tolerance in wheat plants.This extract enhanced the antioxidant potential of plants by activation of antioxidant enzymatic system of SOD, GR, and GST which can contributes to plants protection against oxidative stress imposed by environmental stress.

Consequently, the present findings encourage the application of Moroccan green seaweed (*Ulva rigida*) as natural fertilizer in agricultural sector.

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POSSIBILITIES OF INSTRUMENTAL MEASUREMENT RELATED TO THE TREE HEALTH

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Abstract: *The stability of urban trees is a key factor that affects everyone. Sick and unstable urban trees pose a great risk to anyone. Three instruments capable of determining and evaluating the health and stability of trees are presented. One of the measuring instruments called ArborSonic FAKOPP 3D acoustic tomography, which is able to detect the size and location of decayed or hollow regions in the trunk non-destructively. Measurement working fast it can be completed in 5-10 minutes and creates a 3D model of the trunk with multiple layers of measurement. Customizable wind load modeling is included in the software. Another instruments called ArborElectro Impedance Tomogtaph. It works based on electric resistivity measurements, thus fungi attacks even in very early stages may be determined. Not every measuring device focuse on the visible parts of trees. A special measuring device capable of examining underground areas (roots) will be presented. It called Dyna Tree Root and Trunk Testing System. With the help of instrumental measurements, the health status of trees can be determined, which is a very important factor in the urban environment. In recent years we have encountered many accidents caused by the fall of rotten trees in bad health status, for example in car parks, playgrounds and parks. In addition to these, it is important to be able to decide on construction sites which tree to cut down, as it is in poor health (decayed and with hollow parts) and which is better to keep, which are healthier specimens. This helps to preserve the tree diversity of urban areas.*

Keywords: *health of trees, ArborSonic FAKOPP 3D acoustic tomography, ArborElectro Impedance Tomograph, DynaRoot Root Testing System, instrumental measurement.*

INTRODUCTION

Monitoring less healthy trees are very important, especially in urban environments. As there are fewer trees in cities, they should be prevented from being cut down unnecessarily. Sick and unstable urban trees pose a great risk to anyone. Three instruments capable of determining and evaluating the health and stability of trees are presented. The first instrument is ArborSonic 3D is a minimally invasive evaluation tool for trees. It works based on sound velocity measurements between several sensors around the trunk. s a non-destructive acoustic tomograph that can determine the size and location of decayed or hollow parts of the trunk and calculate the ratio of whole trunk and healthy wood [1]. Because sound velocity drops in decayed areas, internal holes can be detected and the stability of the tree can be estimated [2]. Examined the health of trees on 200-year-old *Quercus rubra* specimens using a Fakopp instrument and visual inspection. After felling the trees, it was confirmed that both methods were capable of identifying health problems, but the instrument was able to determine the extent and location of the deterioration with Fakopp examined sessile oak stands of different age groups, of which the 80-year-old proved to be the healthiest, while the 20-year-old showed the

worst values by [3].
The next instrument called ArboElectro impedance Tomogtaph. It works based on electric resistivity measurements. Fungi attack even in very early stages may be determined. Not only should the trees be focused on visible parts. A measuring device capable of examining underground areas (roots) will be presented. It called Dyna Tree Root and Trunk Testing System.
With the help of instrumental measurements, the health status of trees can be determined, which is a very important factor in the urban environment. In recent years, many accidents have been caused by fallen trees which were in bad health condition. With the measuring instruments mentioned above, we can find out which trees are worth (and safe to keep) and which trees that are need to be cut down due to their poor health and plant new healthy trees in their place.

MATERIALS AND METHODS

The steps for measuring the ArborSonic 3D are as follows. Drive the transducers through the bark using a rubber hammer with even spacing around the trunk. Measure the distances between the transducers with a caliper and enter the measured data to the computer. Tap each transducer with a steel hammer to generate sound waves. ArborSonic 3D measures the travel times with microsecond precision to each transducer and transmits the data to the computer. The software calculates and displays the internal sound-velocity distribution of the tree. The Measured time is precision± 2 microseconds. Sensor low noise is SD02 piezo sensor. Number of sensors variable from 8 up to 32 pieces. The instrumental'sPower consumption 240 mW and Power supplyStandard (rechargeable) 9V block battery. Continuous operation time with one battery is approximately 2 hours. Total weight is approximately 6 kg (without PC, including case, hammers and 10 sensors). PC connection RS232 over cable or Bluetooth. Data transmission time per sensor tapBelow one sec. Total measurement time of one tree 20 minutes one section, including assembly, geometry registration, tapping and disassembly, using 10 sensors. Operating temperature range 0-40°C [http 1]

The next measuring tool called Arbor Electro Impedance Tomography. First step to use the instrumental, place the resistivity meter onto the tree.
Measure the circumference and decide the proper shape (circular, elliptic or irregular). Place the electrodes onto the tree at the proper positions or measure their positions. Enter the data to the computer. Start the measurement on the computer. During the measurement do not touch the tree. Do not measure other conditions parallel to the resistivity measurement. Choose triangulation parameters and run the iterations. The program will calculate the resistivity map of the selected cross section. Excitation voltage is 5-50V and adjustable in 5V steps. The Current measurement range is 0-20mA; 0-400μA; 0-40μA. The length of one basic measurement is 640ms. Power supply built in 5V/5000mAh Li-ion Power Bank. Continuous operation time on average diameter trees Approximately 2 hours. Total weight without PC, including case and hammers approximately is 6 kg. PC connection LEMO-USB is cable or Bluetooth. Total measurement time of one tree one section, including assembly, geometry registration, measurement 45 minutes. Operating temperature is ranged betveen 0 and 40 °C [http 2].

Often tree problems that are visible in the leafy crowns of trees are caused by problems below ground in the tree’s root zone. Curing these problems may be as simple as surgically removing a root that is strangling other roots, or may require complex therapy such as aerating the soil, loosening the soil, or adding special fungi to the roots to increase their absorption of water and nutrients [http 3].

The third measuring tool called Dyna Root Root Testing System.
The DynaRoot system should be used on days with at least 25 km/h (15 mph) wind gust velocities. Setting up the measurement involves the following steps. Assemble the anemometer tower in the vicinity of the tree(s) to be assessed. Attach the anemometer on the top, and erect the tower.
Wind velocity readings are sent to, and data is collected at the instrument box located at the bottom of the tower. Start recording data by pressing the start button located in the instrument box. Mount the inclinometer on the root collar of the tree to be assessed. Start recording data by pressing the start button located on the side of the instrument box. Repeat the previous 2 steps if you have more inclinometers and want to assess multiple trees. Record data are for at least 3 hours. After the recordings are finished, transfer the acquired data to a PC by removing the internal SD card or by switching the instruments to Wi-Fi mode. Load the data

into the DynaRoot evaluation software and calculate the safety factor. Useful data are from the anemometer. Sampling rate is 1 Hz. The Measurement range 0-150 km/h. Accuracy 0.2 km/h. Maximal SD card size 8GB and the anemometer instrumental is Wheatherproof (IP65). Dual axis inclinometer Measurement range ±2° and the resolution 0.001°. The Sampling rate is 10 Hz. Maximal SD card size is 8GB. Operating voltage and currents is 12 V, 20 mA [http 4].

RESULTS AND DISCUSSION

The ArborSonic 3D is a minimally invasive evaluation tool for trees. It works based on sound velocity measurements between several sensors around the trunk. Because sound velocity drops in decayed areas, internal holes can be detected and the stability of the tree can be estimated. Measurements taken at various heights can be assembled into a 3D model. Through three-dimensional measurements we can see the inside of the trees.
Green indicates a completely healthy tree, red indicates rotten trees, and blue indicates hollow areas (Figure 1).

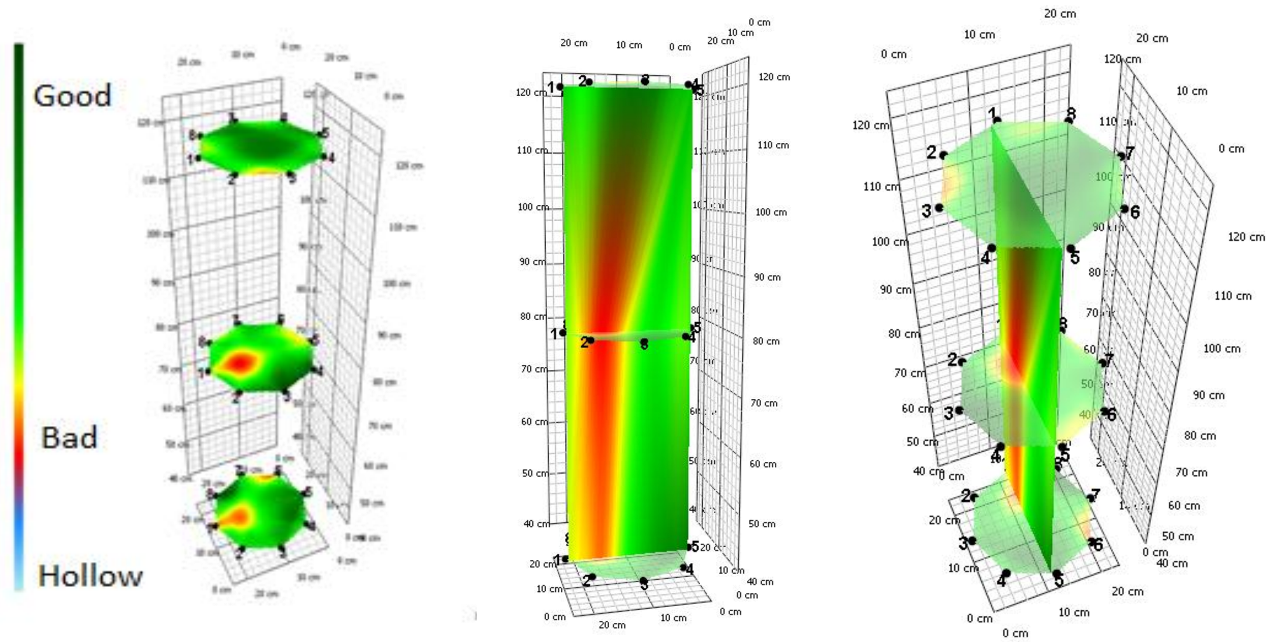

Figure (1) The figure shows a 3 dimensional image of a tree.
Three measurements were made on it, thus showing three cross-sectional images.

The next instrument called ArboElectro impedance Tomogtaph. It works based on electric resistivity measurements. Fungi attack even in very early stages may be determined (Figures 2 & 4).

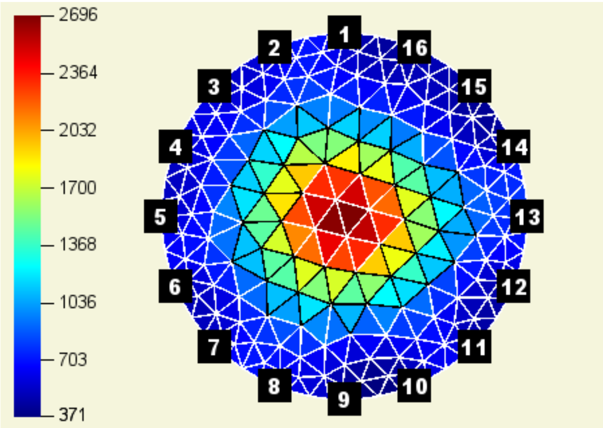

Figure (2) We can see a cross-sectional view of a completely healthy, fungus-free tree.

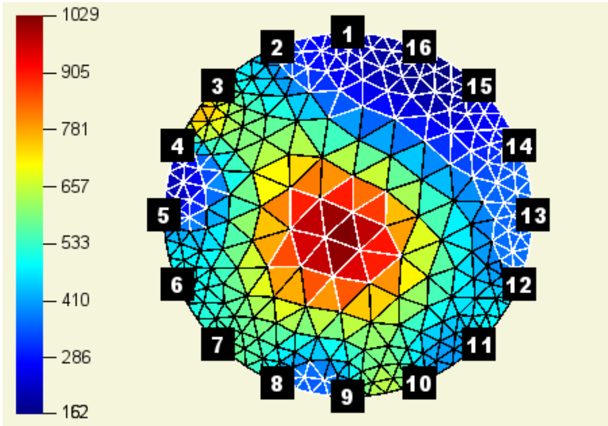

Figure (3) Here is a cross-sectional view of a tree under attack by fungus.

Not only should the trees be focused on visible parts. A measuring device capable of examining underground areas will be presented. It called Dyna Tree Root and Trunk Testing System. Examining the roots is very important, so it is worthwhile for diseased trees to examine their roots. An instrument for measuring the wind velocity is at or near the tree to be evaluated. The closer to the better, but, depending on wind velocity DynaRoot may provide reliable data even with measurements taken several kilometres/miles away. The anemometer provides wind velocity data of sufficient frequency; ideally the anemometer should be clear of buildings or other objects that may obstruct the wind, at a height of at least 10m. Dual axis inclinometer (Figure 4). An instrument affixed to the root collar that measures the inclination of the trunk in two perpendicular directions. The instrument provides very accurate inclination data with sufficient frequency.

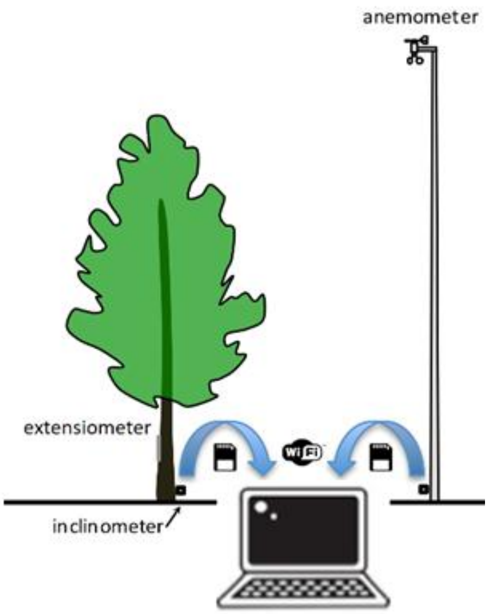

Figure (4): A PC software for evaluating wind velocity and inclination.

The data, recorded over a period of several hours, are transferred from the anemometer and inclinometer on memory cards or wirelessly via Wi-Fi. The software breaks the data down into shorter intervals, and calculates statistical parameters for each interval that are used for the tree stability evaluation (source: http4).

CONCLUSIONS AND RECOMMENDATIONS

Using these tools, the health status of trees can be monitored.
Thanks to the monitoring, we will be aware of the health status of the trees in the given area. These instruments are very useful in the long run. If we detect a disease in a tree in time, we can still treat it. By treating certain diseased trees in a timely manner, we can save them from decay and fungal attacks. This helps to preserve the diversity of the areas!

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LEAF SCALE PHOTOSYNTHESIS MEASUREMENTS IN MAIZE FIELD UNDER DIFFERENT FERTILIZATION ADDITION

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***Abstract**: Carbon dioxide (CO_2) fluxes between the surface and the atmosphere have large biological contribution. Photosynthesis is one of the largest of these fluxes. Components of the carbon balance are in close relationship with plant production, and eventually yield in agricultural vegetation. We examined photosynthesis of maize in the 2019 vegetation period in this study. The study site is a sowing time−fertilizer−maize variety field experiment near Martonvásár. This is a small plot experiment, where a treatment replicate consists only of two rows of maize i.e. a total of about 60-70 individual plants. Ecosystem scale micrometeorological measurements are not applicable in this type of setup and the only destructive examinations can be done upon harvest to avoid disturbance of the experiment in the vegetation season. We used non-destructive leaf scale photosynthesis measurement method (CIRAS-3, PPSystems, and Amesbury, MA, USA) regularly to explore temporal variations of assimilated CO_2 during the vegetation period. The sampling was designed to include several plants and leaves to optimize number of replicates. We selected five plants per row in five replicates (leaves). The methodology was applicable for determination of maize photosynthesis in the experiment. Light response and temperature response of photosynthesis agreed with our knowledge. We found that net photosynthesis rate of maize leaves have a well-defined profile in the vertical canopy as light and leaf age changes, which highlights the importance of repeated measurements in the canopy when planning regular observations.*

***Keywords**: Leaf scale, photosynthesis measurements, maize field, fertilization addition*

SITE DESCRIPTION, METHOD

Experiment of continous maize sowing date was done in four replicates with combination of four sowing dates. We focused on one variety (Mv Tarján), which is a very popular choice of Hungarian farmers. The last sowing date (beginning of May) combined with two constracting fertilizer treatments was selected, 60 kgN/ha and 180 kgN/ha. Measurements were carried out on the same five leaves, each examined plants, taken from bottom to top (Fig. 1). Timing of measurements was 8-11 AM in every occasion. A total of five measurement days was sucessful in the 2019 vegetation period.

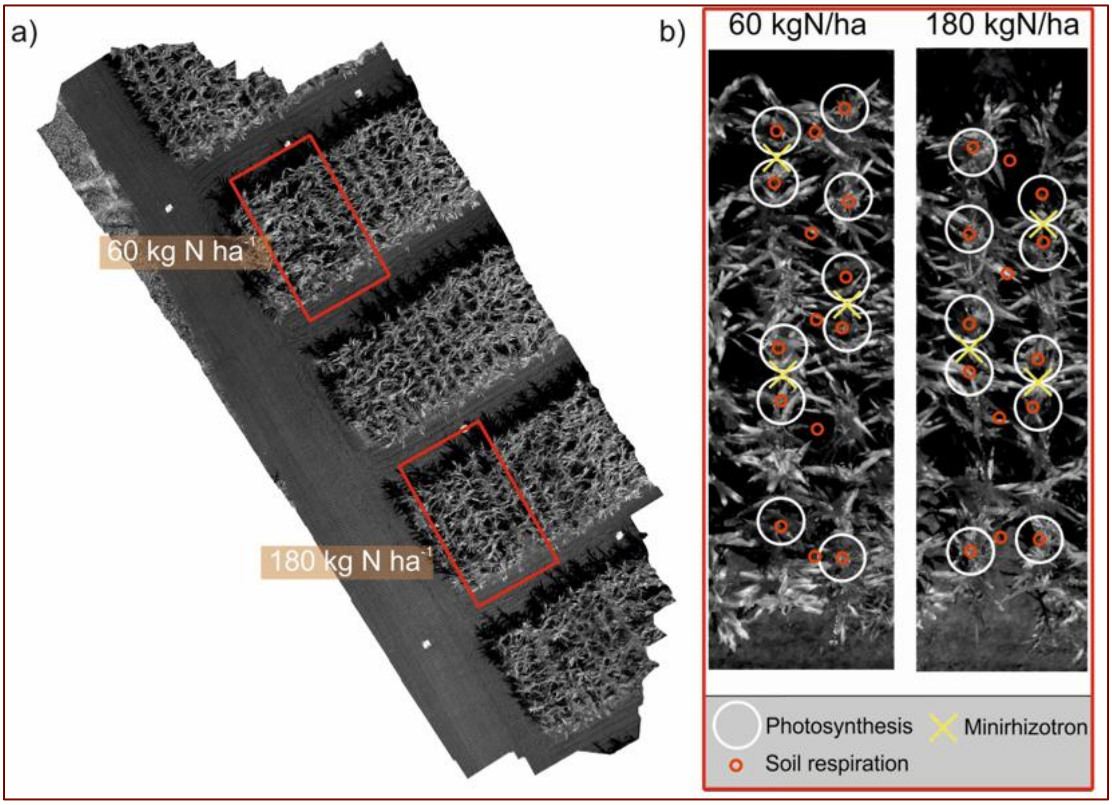
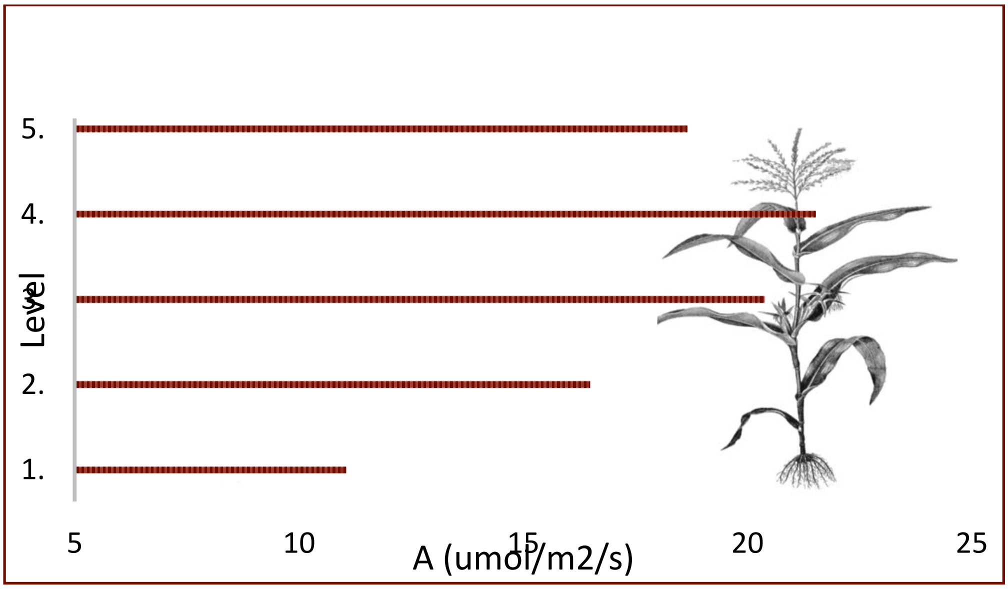


Figure (1) a.) ortophotograph of the experiment; b) Aerial photograph of he study indicating the photosynthesis (white circles) and other measurements as soil respirations (red circles) and installed minihizotron tubes (yellow X)

RESULTS

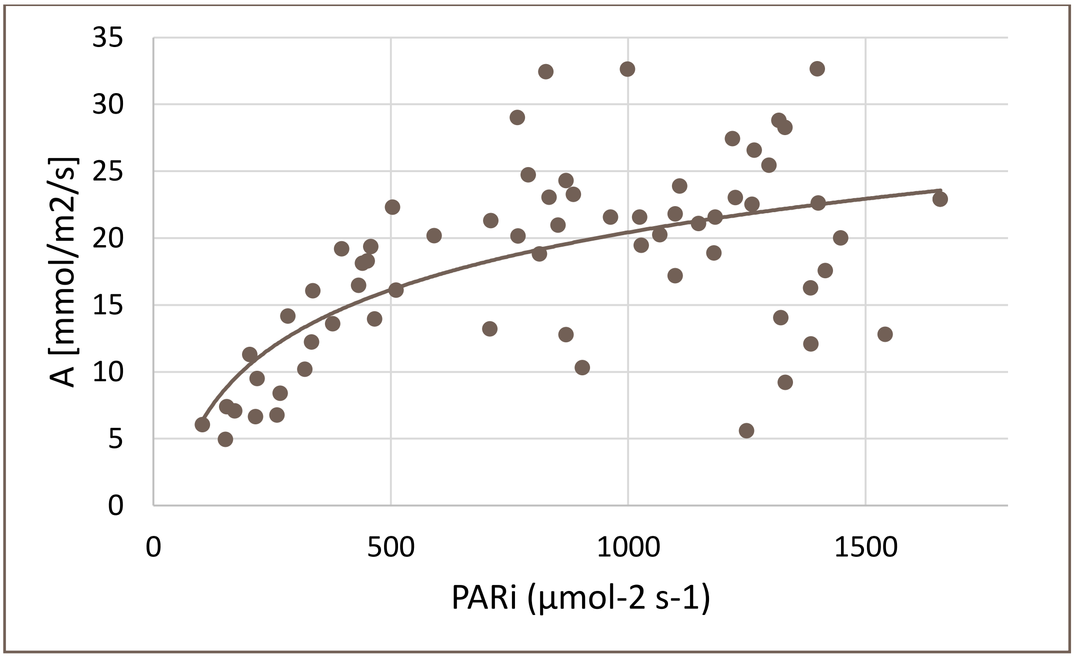
Results showed that generally lower leaves gave lower assimilation rates, but the value had a drop at the top layer as shown on Fig. 2. This finding was consistent in both treatments, every single plant.



CO_2 assimilation in different levels, both treatements

Figure (2) Measured average CO_2 assimilations depending on the level of leaves from bottom to top

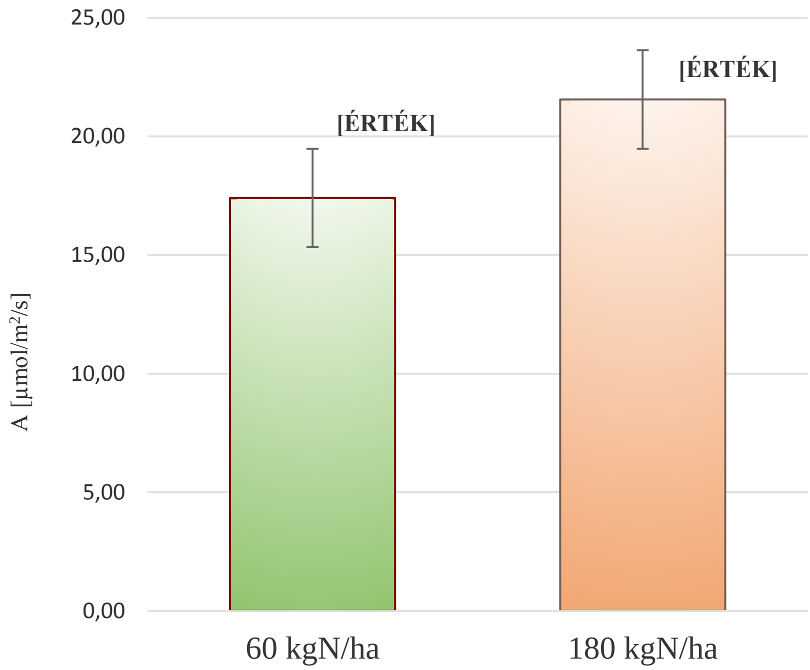
Light response curves (LRCs) provide indications of light saturated photosynthetic rate, quantum efficiency, and maximum photosynthetic capacity with examination of photosynthetic changes (A) as a function of incident photosynthetically active radiation (PARi)



Light response curve

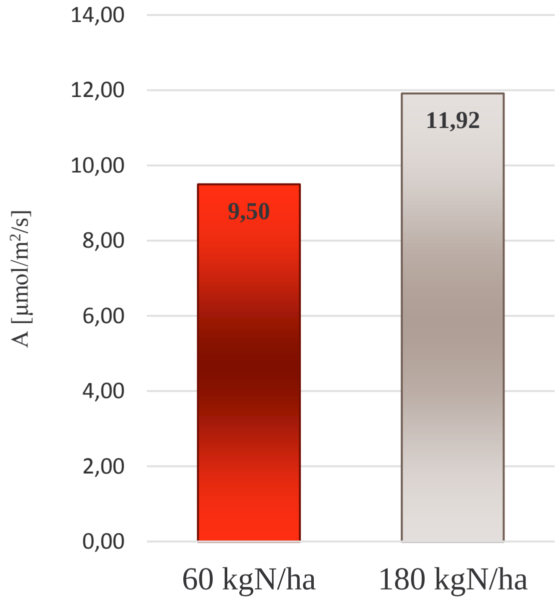
Figure (3) Relationship between net CO_2 assimilation and photosynthetically active radiation.

Comparing assimilation rates of the plants of both treatments separately showed us, addition of higher amount of Nitrogen can increase the photosynthetic production (Fig. 4). However, data dispersion was high in virtue of abiotic factors on measurement days (Fig. 5)



Average CO_2 assimilation levels in different treatments

Figure (4) Moderate assimilation levels in both treatments



Data dispersion of CO_2-assimilation

Figure (5) Data dispersion of CO_2 assimilation in both treatments

CONCLUSIONS

In the next step, simple photosynthesis models will be applied on the data to mathematically examine differences between the treatments. Photosynthesis data will be compared to other parameters measured simultaneously (soil respiration, soil water content, soil temperature, plant height).

Acnkowledgements

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MANUSCRIPTS AND DEMONSTRATION OF THE LECTURES

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CLIMATE CHANGE RELATED VULNERABILITY IN THE LAKE CHAD BASIN

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***Abstract**: The environmental, social, economic, political, and military aspects of the Lake Chad Basin have been well researched. However, the connection points and correlations between the sectoral elements are much less. Using regional security complex theory developed by Barry Buzan and Ole Wæver of the Copenhagen School, the research discusses how events and processes in the region interact. Data from primary and secondary sources show that the Lake Chad Basin – stretching through Nigeria, Niger, Chad and Cameroon – is one of the most fragile crisis zones of the Sahel. Over the past decades, climate change, resource depletion, demographic pressure, the shrinking process of Lake Chad, inadequate farming techniques, weak statehood, the political mismanagement of certain issues, the presence of radical Islamist groups have all left their mark on the region's development opportunities. Transforming weather patterns, poverty, desertification, declining arable land and migration caused by violent conflicts are all urging issues that the states will have to address in the future. Due to the geographical proximity of the four states, regional interdependence, cultural and economic convergence, Nigeria, Niger, Chad and Cameroon share each other's destinies, which is why it is vital to create a stable, predictable environment for local communities. The fragility of the Lake Chad Basin may also have an indirect impact on Europe, as more and more people may consider immigrating to the European continent due to the prolongation of unfavourable environmental, political, social, economic and military aspects.*

***Keywords:** climate change, demographic pressure, Lake Chad, migration, resource depletion, security*

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CAN THE ENERGY MANAGEMENT AND THE WASTE MANAGEMENT BE HARMONIZED?

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Abstract: *One of the biggest tasks of the environmental science is creating more economic and environmentally friendly energy sources. The enormously increasing amounts of waste material are also a huge challenge for the environmental protection. These previously mentioned problems can be treated in a harmonized way. The uneven energy consumption requires peaks in the production of energy. The energy consumption is higher in winter than in summer in northern part of Europe. Such a seasonal deviation of energy consumption can be compensated with the waste burning in winter during the cold weather. The significant portions of municipal wastes are burnable and hardly biological degradable (e.g. polyurethane, PET, PVC, PE, etc.). Moreover several types of them cannot be recirculated. The plastic materials can be used for energy production. The invention of our proposal is the plastic waste materials have to be collected and stored during the less energy consuming period, and burn them when the energy requirements are high. The selected burnable waste can be collected during the whole year period, and stored in compressed forms. The abandoned open cast mines are appropriate for such depots. In this way the consumption of fossil fuel will significantly be reduced and the waste stream decreased. Several alternative ways are also shown for the use of plastic waste.*

Keywords*: Energy management, harmonization, plastic materials, waste management*

INTRODUCTION

The recent time is being called polymer age since the middle of 20th century [1]. Nowadays the production of plastics is more than double by volume than the production of crude steel production worldwide. The global plastics production reached almost 360 million tonnes in 2018, and Europe took 61.8 million tonnes share of it [2]. 40% of world productions were used as packing materials. The success of polymer originates from various sources. They are rather cheap and versatile materials. They can be produced and formed among mild conditions. They contain only traces of poisonous materials (plasticisers, stating materials etc.). Practically the modern life cannot be imagined without plastic materials.
On the other hand, such an enormous volume products result in very big amounts of wastes. Overwhelming part of the productions becomes waste [3]. Recently one of the most important goals of the environmental protection is to reduce the amount of plastic waste pollution. Only 29.1 million tonnes of plastic were collected selectively from the 61.8 million tonnes plastic productions in Europe [2]. It seems more than the half of the used plastic volumes were not collected selectively or were not collected at all. The part of the thrown away plastics gathers in ocean surface. The Great Pacific Garbage Patch is the largest accumulation

of plastic waste, having 2.41 million tonnes plastic garbage in 1.6 million square kilometres [4].
It is necessary to reduce the plastic flood to prevent the environment. One way is to reduce the production volumes of plastics. The less prodigal packaging material usages are one of the main goals of environmental protection. The other important goal is increasing the recycling and reusing rates of the used plastics. The energy recovery is a meaningful part of the reuse techniques [5, 6], but there are several other ways of utilization of the used plastic materials.
The subject of this paper is important not only from the point of environmental science, but it is also useful in education aspects too [6].

General characterisation and description of polymer materials

Plastics are a wide range of synthetic or semi-synthetic organic compounds. They build up chemically connected monomers reaching several thousand molecular weights. Generally the plastic molecules are indigestible and non-poisonous. Their toxic effects come from their additives (e.g. ftalates) or the remaining traces of monomers and oligomers (e.g. styrene, bisphenol-A, vinyl chloride). Some type of the plastics are biodegradable, but the majority of them none or hardly biodegradable materials. The environmental difficulties come from these non-degradable features. Very huge amount of the plastics are produced yearly (Figure 1), which generate enormous volume waste [7].

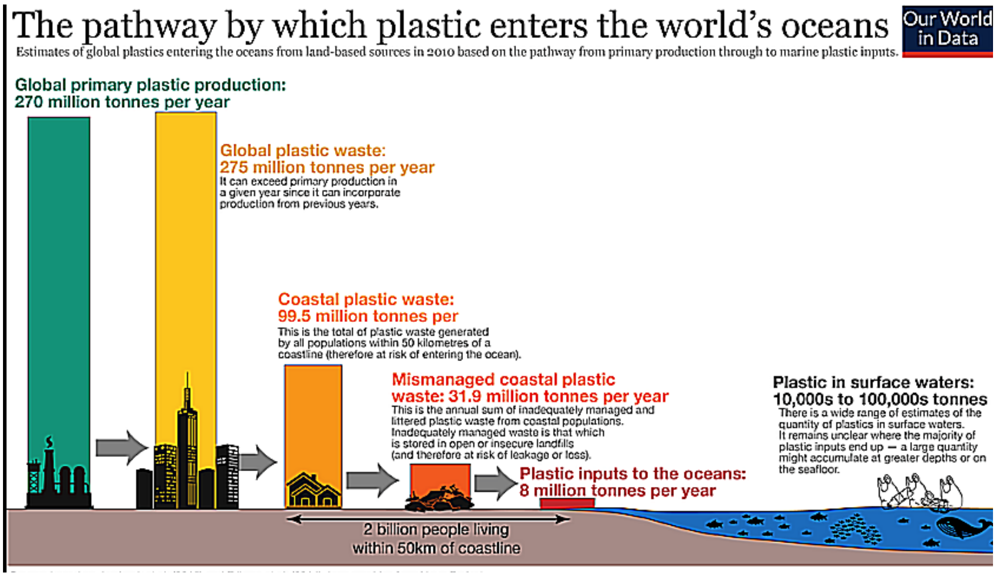

Figure (1) The way of the plastic flood from the production to ocean [7]

The treatment of plastic waste is unsolved recently, but is necessary to overcome this trouble urgently. First of all the selective collection of the plastic wastes have to be solved with high efficiency. Unfortunately, less than the half of the plastic waste is collected separately todays. For example, 275 million metric tons of plastic wastes were produced by coastal countries, and 4.8 -12.7 million metric tons were discarded into the oceans in 2010 [8]. The European plastics manufacturers are committed to reach 60% rates of reusing and recycling for plastic packaging by 2030, 100% rate by 2040 [8].

The fate of the selectively collected plastic materials

There are three ways of the fates of plastic materials: recycling, energy recovery and landfill [2]. The recycling can be the usage in original forms as the bottle redemption and refilling. The another way of recycling to create new products from the plastic, making textile from the grinded PET bottles or use them as raw materials of art objects.
The Figure (2) shows the ratio of different fates of plastic in function of time in the period 2006-2018 in Europe. The amounts of collected waste have increased with 19% from 24.5 million tons to 29.1 million tons, more steeply than production amount of plastic materials. The ratio of energy recovery and recycling increased steeply, and the ratio of land fill decreased greatly. Even the absolute amount of landfills also has decreased.

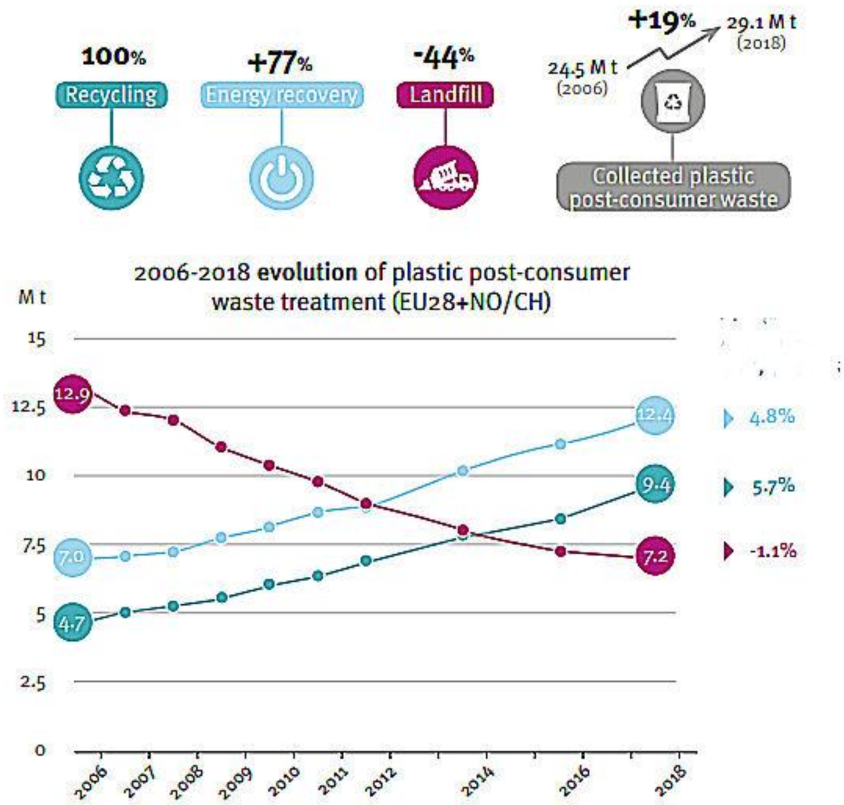

Figure (2) The tendency of the fate of plastic waste between 2006 and 2018 in Europe

These tendencies are promising, but the landfills still share 18% of the plastic wastes [2].

Energy recovery

The energy recovery seems more easily manageable than recycling. The energy recovery needs less organization and investment than the recycling. Moreover, the energy recovery need not fight with the well-developed Chinese competition.

The energy contents of the plastics are rather high according to Figure (3). [9] The hydrogen has higher energy contents (140MJ/kg) by weight than plastics (40-60 MJ/kg), but the energy content by volume of plastics are much higher than hydrogen. Moreover, the plastics are much more advantageous from the point of view of the safety than hydrogen. Several researches try to solve the energy production of future using solar energy.

These plans produce hydrogen with the electrolysis of water, and the gained hydrogen is transformed with further reactions to hydrocarbons. The Fischer-Tropsch reactions result in hydrocarbon from the reaction of hydrogen and carbon dioxide [10]. The long time storage of the pressurized hydrocarbon can be solved using the natural cavern (e.g. depleted natural gas fields). However, plastics can store more effectively the energy than the pressurized hydrocarbons, and the storage and treat of the plastic are simpler and safer in solid state.

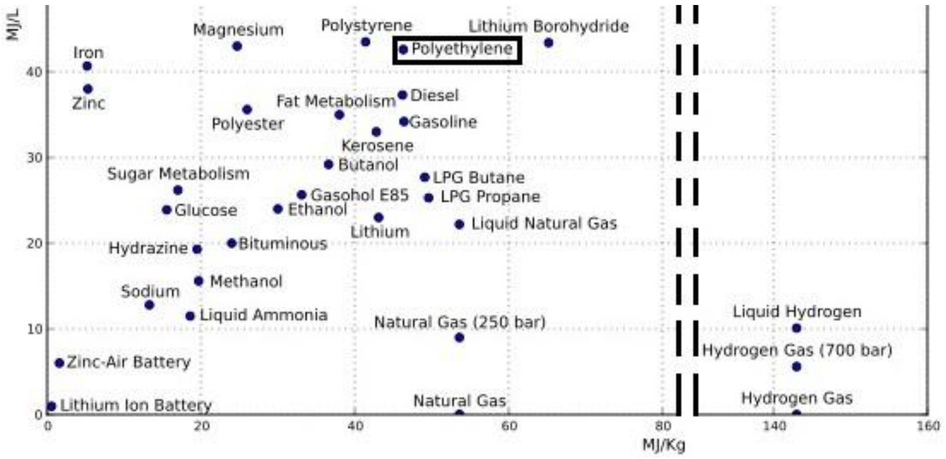

Figure (3) The energy densities of different materials (exception of oxidizing chemical agents) [9]

The collected plastic materials can be used as fuel materials in the peak seasons of energy consumptions. Seasonal deviation of energy consumption can be easily compensated by plastic wastes. The summer collected plastic waste can be burnt in winter. The compressed plastic waste bales can be stored in abandoned quarry until their burn. The materials of Great Pacific Garbage Patch can be expected potential raw materials of electricity productions. Such of plastic wastes burnings require precautions. The burning PVC can produce extremely toxic dioxins [11]. Of course, such toxic effect can be eliminated with plasma torch in the chimney. A well designed garbage incineration is good not only for environment, but it can be an artistic object too (Figure 4).

Figure (4) Garbage incineration in Vienna, designed by Hundertwasser

The plastics themselves do not destroy the environment. The environmental troubles are caused by the humans with their unsparing and careless attitudes. The use of decreased amount of packing plastic materials can significantly reduce the plastic waste flood. The non-produced plastics do not become plastic wastes. The selective waste collections and separations of the plastics from other waste materials are another significant ability to make a better waste management and shrinking the plastic gush.
To improve the plastic waste managements need several changes in the human attitudes, legislative issues and better taxation and subsidization systems. The environmentally friendly education can help a lot. To ban of the plastic straw does not decrease significantly the volume of the plastic waste, but such actions draw the attentions of the children for the less prodigal use of plastics?

The high product fees and redemption fees push the producers for reusing the plastic products instead of purchasing, use and throw away practice. The redemption of bottles is a typical example for such a practice. The free of charge selective waste collections have to introduce everywhere. The expanses of selective waste collection must be included the prices of the products. In this way, the people feel, the selective waste collections are free-of charge. Of course, the non-selective municipal waste practice must be fine.
The investments of selective waste managements (e.g. selection conveyor belt, flotation basin and gridding mills) require financial supports or tax reduction, from national as well European sources.

CONCLUSION

The plastic materials are indispensables in our recent life. The waste stream of plastic can be reduced in several ways. The plastic waste can be used very effectively as secondary energy source. However, there is a need for a significant improvement in attitudes from education to legislation in the waste management.

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POSSIBILITIES OF SPECIATION FOLLOWING ANTHROPOGENOUS ENVIRONMENTAL CHANGES IN THE CENTRAL SANDY AREA OF THE CARPATHIAN BASIN THROUGH THE EXAMPLE OF FESTUCA TAXA

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Abstract: *Our goal is to check and revise the dominant Festuca species of vegetation types formed under extraordinary conditions through morphotaxonomic and ploidy analyses. To accomplish this, we had to add examinations of dominant species in grasslands further from the Danube in the Carpathian Basin and East Central Europe. Individuals of examined taxa were analysed using 26 parameters of the inflorescences. Ploidy was analyzed using low cytometry. After deforestation and shrub cutting, bare soil patches of areas exposed to anthropogenous effects had provided an opportunity new vegetation to form. As a result of this work, new species Festuca pseudovaginata had been discovered here, which is endemic in the Carpathian Basin. Survey continues in order to clear other hardly identifiable taxa. The results have confirmed the presence of the species, but we also have new occurences discovered. We verified F. vaginata and F. pseudovaginata from open sandy areas. In closing grasslands F. javorkae and F. wagneri appears. In Slovakia we found F. wagneri and F. pseudovaginata as new species in the country’s flora. We could add new appearance data of F. javorkae, and describe F. brevipila as a new taxon of the Hungarian flora. Furthermore, a possibly new species also appeared during our research, on which we found distinctive morphological features, but to describe it as new species it needs further ITS analyses.*

Keywords: *Festuca vaginata, Festuca psammophila series, sandy vegetation*

INTRODUCTION

Those taxa of *Festuca* species in the Carpathian Basin which have bowed base and stem leaves are identified and mentioned by various authors as belonging to the aggregation of *Festuca ovina* [1-9]. These taxa can be identified easily based on their characteristic tissue structure and molecular genetic analyses [10-16]. Pawlus [17] separated a new series within the *Festuca* genus. This is the *psammophila* series, which includes *F. polesica* Zapal, *F. vaginata* W. K., *F. psammophila* Host. *F. pallens*. Subsequently, Šmarda et al. [17] added *F. pseudovaginata* Penksza and *F. glaucina* Stohr. to it. The species which were determinate in the original natural vegetation Borhidi et a. [18] were expected to appear on the new bare soil patches. So we wanted to answer the question: on new surfaces formed by human interventions, is there a possibility to form new vegetation units and species, or will the natural vegetation and its main species appear?

MATERIALS AND METHODS

The *Festuca* individuals collected in the Carpathian Basin were put through morphological and ploidy examination. Meanwhile, we made coenological records in every type of sandy grasslands along the Danube from Austria to Romania. Furthermore, we set up a collection of living plants, which ensures individuals growing in the same conditions to molecular surveys. We also modelled the appearance, composition and dominant species of new vegetation on bare soil surfaces. The area has been being managed since 2006. The study area lies on the Pest plain near the left bank of the Danube. For data analysis and presenting the results, PAST (Paleontological Statistics Version 3.06) Hammer [19] and Hammer et al. [20] statistical software was used.

RESULTS AND DISCUSSION

Based on our results, we confirmed the appearance of *Festuca vaginata, F. psudovaginata, F. javorkae, F. wagneri* in the natural grasslands, and discovered new occurrences of *F. brevibila* and *F. javorkae* in the area. In Slovakia, *F. wagneri* appeared as a new species of the flora of the country. *Festuca pseudovaginata* habits only the Pannon region, we found endemic and natural stands of it, but on secondary habitats it was confirmed as a completely new species. Furthermore, taxa of disturbed vegetations are being examined. These habitats are potential hotspots of speciation.

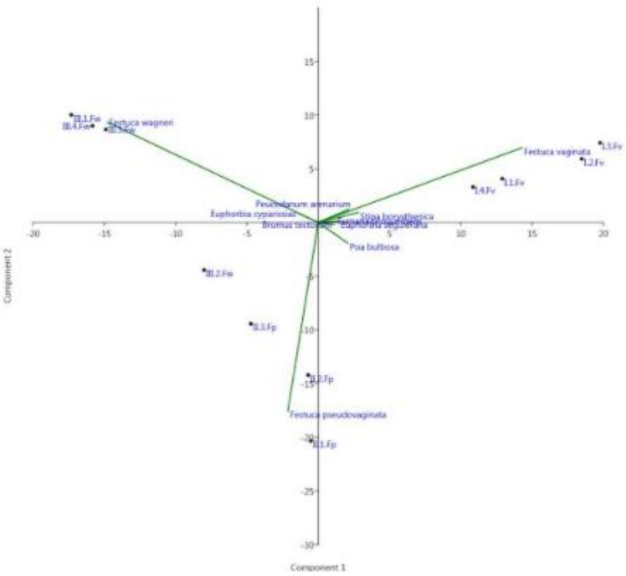

*Figure (1) PCA analysis of the vegetation types in the central sandy part of the Carpathian Basin (Festuca vaginata vegetation types: **I.1.Fv**: Little Hungarian Plain, **I.2.Fv:** northern part of Kiskunság, **I.3.Fv:** southern part of Kiskunság, **I.4.Fv** southernmost part. Festuca pseudovaginata **II.1.Fp:** degradated type dominated by weeds, **II.2.Fp:** **erdős terület, II.3.Fp:** természetes gyepet. Festuca wagneri **III.1.Fw:** Csallóköz, **III.2.Fw:** Northern part of Kiskunság, **III.3.Fw:** Southern part of Kiskunság, **III.4.Fw:** in the southernmost part)*

CONCLUSIONS AND RECOMMENDATIONS

In earlier literature, *Festuca vaginata* was treated as the only dominant grass taxon of the open calcareous sandy grasslands. This was debated by Pócs [21] when finding *F. wagneri* in Hungary for the first time, however, he treated it as a forest-steppe species. There was no consensus on the coenological affiliation of F. *wagneri,* although its taxonomy was clarified by Penksza and Engloner [22] when describing it as a separate species. Since older specimens lose their epidermal hairs and their sclerenchyma becomes annular, a greenish grass taxon was identified as *F. wagneri* in samples of *F. vaginata* grasslands, until Penksza [23] described it as a new species named *F. pseudovaginata*, which also forms an association new to science. Later it was confirmed that the soil parameters of this association differ greatly from the others Bajor et al. [24], i.e., Ca and Mg content. However, in the present survey soil profile was made for the first time, and its analysis confirmed what enironmental backdrop *F. pseudovaginata* indicates. This species has evolved on forest soils. The soil profile showed 1,5 m deep forest soil, and the amount of organic matter was higher.
On bare soil surfaces of areas exposed to anthropogenous effects, two species of the genus *Festuca* have become dominant. One of them, *Festuca pseudovaginata* was described as a new species Szabó et al. [25], and is endemic in the Carpathian Basin Penksza et al. [16] (Figure 1). Examinations are being continued in order to clear hardly identificable taxa. Our survey has confirmed the occurrence of the species so far, and we discovered new occurences too.

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INVESTIGATION OF THE EFFECT OF PHENOL POLLUTION ON DIFFERENT PLANTS IN POT EXPERIMENTS

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Abstract: *Soil contamination with organic pollutants is one of the most serious environmental problems that can cause serious threat to people and the environment. Phenolic compounds represent a large group of molecules and have many functions regarding the aspects of development and the behaviour of the plant. Pot experiments are inexpensive in comparison to field experiments with variety of experimental treatments without contamination of the site. It is easier to observe the possible changes because the contaminants and the material absorption are more pronounced, because the soil and root are tight, and the root cannot grow out of the polluted zone. After a 14-day test period, the physical parameters were measured, but no significant differences were found between the treatments. It has changed the vitamin C content, which is very important in the oxidative stress of plants, as it is a basic material for the plant life. For vitamin C, we have also experienced the phenomenon of hormesis. It is extremely interesting how the plant tries to respond to a certain stress effect by changing the content of vitamin C. As a result of phenol contamination, we have been able to increase vitamin C in some concentrations and decrease mostly at higher concentrations, and vice versa. The amount of vitamin C in plants was measured by HPLC. Phenol as a stress factor, increased the content of vitamin C in certain concentrations in plants. By selecting a suitable non-toxic stress factor, vitamin C content can be increased in different plants.*

Keywords: *Phenol; vitamin C; antioxidant; hormesis; pot experiment; HPLC*

INTRODUCTION

Soil pollution with organic pollutants is one of the most common environmental problems, posing a serious threat to people and the environment. Innovative solutions for the remediation of soils contaminated with organic matter deserve special attention [1]. Contaminants are taken up by the roots of plants from the soil or their leaves from the air and, if they enter the tissue, can cause serious damages [2].
Phenol and its derivatives form a large family. These include indicator molecules, pigments and flavouring substances that attract or repel or protect plants from viruses, bacteria, fungi and insects [3]. To assess human risks, it is extremely important to understand the uptake and accumulation of organic contaminants in plants. However, scientists have also observed the decomposition of these accumulated substances in plants [4]. Phenolic compounds act as stressors on plants, thus also influencing the number of antioxidants [5].
Hormesis is a dose-response phenomenon characterized by low-dose stimulation and high-dose inhibition. Hormesis usually occurs in plant species [6], [7]. The most common form of dose-response curve is the low-dose stimulating and high-dose inhibitory effect; the inverted U-shaped curve ("A") [6]. The other common

form depicts the low-dose decrease and the high-dose enhancing effect, the U-shaped curve (“B”) [6].
In the present paper was studied the effect of phenolic pollution in the soil on various plants. Pot experiments were performed on soil samples with phenol contamination and control samples. Soil contamination was artificial and was investigated for its effects on various plants (*Lepidium sativum*, *Sinapis alba*, *Triticum aestivum*). After planting and test period, Vitamin C content in different parts of plants (root, stem, leaf) were examined. Vitamin C concentration was determined by HPLC. The results were evaluated using Microsoft Office Excel.

MATERIALS AND METHODS

Soil sampling

Soil samples were taken from the area of Óbuda University (H-1034 Budapest, Doberdó u. 6.). Soil type was Soil Ramann's brown forest soil. Soil characteristics were measured in the Soil Research Institute [8]. After soil sampling, the soil was air-dried (for approximately 72 hours). The soil was then sieved through a 2 mm diameter sieve. It was further dried at room temperature for 72 hours.

Pot experiment with artificially polluted soil (phenol)

0, 50, 100, and 150% of the soil phenol contamination limit (according to 6/2009. (IV. 14.) KvVM-EüM-FVM decree: 1 mg phenol / kg) was chosen for the pollution of the soil used [9]. The pot experiment was performed in 3 replicates. Number of seeds planted per pot was 100.
After planting, 50 ml of distilled water was sprinkled daily for a test period of 14 days.

Sample preparation for chromatographic analyses

One g plant sample was use for vitamin C determination. The plants had to be prepared very fast since vitamin C is very sensible for heat, UV light and oxygen. For the determination of vitamin C the frequently used method Furusawa [8] was applied and plant sample preparation was performed according to Lásztity and Törley [9].

Chromatographic analysis of vitamin C content

The measurement was done by HPLC (type: YL9300 HPLC System built-in Vacuum Degasser Quartenary Pump, UV/VIS Detector and 7725i injector). The measurement was carried out by HPLC-UV was at 254 nm. Vitamin C was separated on a C18 Kinetex column (5μ C18 100 A 150 x 4.6 mm and Security Guard Cartridges C18 4x3.0 mm ID). The flow rate was 1 cm3 min-1; solvent was 2% acetic acid (isocratic system). The chromatographic data processing software was YL-Clarity data system.

Plants used in the pot experiment

The following plants were used for planting: mustard, wheat (BiOrganik Online Kft.) and garden cress (Rédei Kertimag - Vetőmagkereskedelmi Zrt.).

RESULTS AND DISCUSSION

The following questions were looking for the answer: did phenol influence biochemical processes within the plant (e.g., antioxidant balance). Is phenol left in the soil? What effect did it have on the vitamin C content measured in the plant parts?

Garden cress

In the case of root: The phenomenon of hormesis [6] can be observed. Based on the dose-response curve, there was an increasing in the phenol concentration at low concentrations that inhibit root growth to the minimum of the function (0.5 mg / kg phenol in soil) and then the vitamin C content increases. At the same time, phenol at a certain concentration, reaches a maximum from which vitamin C is already reduced and a toxic effect prevails in the plant.

Stem: The phenomenon of hormesis can be observed; however, here the curve is blunter. Based on the dose-response curve [6], there was an increasing the phenol concentration at low concentrations with an inhibitory effect on stem growth to the minimum of the function (0.5 mg / kg phenol in soil) and then increasing the vitamin C content. At the same time, phenol at a certain concentration, reaches a maximum, from which the vitamin C content is already reduced, and a toxic effect prevails in the plant.

Leaf: The phenomenon of hormesis can be observed. The changes in the vitamin C content of the leaf can be plotted on the "A" curve (Figure 1) of the hormesis phenomenon [6]. Based on the dose-response curve [6], increasing the phenol concentration stimulates the vitamin C content of the leaf up to the maximum of the function (0.5 mg / kg phenol in soil), and then the vitamin C content decreases.

Mustard

Root: The vitamin C content of mustard roots decreased with increasing phenol concentration. A linear relationship can be established.

Stem: The vitamin C content of mustard stems decreased with increasing phenol concentration. A linear relationship can be established.

Leaf: Hormesis [6] is observed in the vitamin C content of the mustard leaves as the phenol concentration increases. The changes in the vitamin C content of the leaf can be plotted on the "B" curve of the hormesis phenomenon [6]. However, a blunt curve is obtained. Based on the dose-response curve, by increasing the phenol concentration, at low concentrations, it inhibits leaf growth to the minimum of the function (0.5 mg / kg phenol in soil), and then the vitamin C content increases. At the same time, phenol reaches a maximum at a certain concentration, from which the vitamin C content is already reduced, and a toxic effect prevails in the plant.

Wheat

According to the results, the vitamin C content of the plant increases if the stress affecting the plant is marginal (1.5 mg kg-1 phenol in soil), however the growth was not intensified. This response of immune reaction confirms that hormesis is measurable and that it might be generalized. This concentration dependent biochemical change is rarely studied in detail [6], in spite of the fact that over the past decade the concept of hormesis has been accepted and widely investigated [7].

Root: Hormesis is observed in the vitamin C content of wheat root with increasing phenol concentration. Changes in the vitamin C content of the root can be plotted on the "B" curve of the hormesis phenomenon [6]. Based on the dose-response curve, by increasing the phenol concentration, at low concentrations, it inhibits root growth to the minimum of the function (0.5 mg / kg) and then increases the vitamin C content (1 mg / kg phenol). The maximum of hormesis can be observed here, because after that the vitamin C content decreases. It can be concluded that the phenol concentration of 1.5 mg / kg phenol in soil no longer has a stimulating effect on wheat roots.

Stem: Hormesis is observed in the vitamin C content of wheat stems with increasing phenol concentration. Changes in the vitamin C content of the stem can be plotted on the "B" curve of the hormesis phenomenon [6]. However, the dose-response curve is quite blunt.
Based on the dose-response curve, by increasing the phenol concentration, at low concentrations, phenol has an inhibitory effect on root growth, to a minimum of function (0.5 mg / kg phenol in soil), and then the vitamin C content increases. However, we do not know the maximum of the function here. A phenol concentration of 1.5 mg / kg phenol in soil has a stimulating effect on vitamin C content.

Leaf: Hormesis is observed in the vitamin C content of wheat leaf with increasing phenol concentration. Changes in the vitamin C content of the leaf can be plotted on the "B" curve of the hormone phenomenon [6]. However, the dose-response curve is quite blunt. Based on the dose-response curve, by increasing the phenol concentration, at low concentrations [10], [11] it has an inhibitory effect on root growth to the minimum of the function (0.5 mg / kg phenol), and then the vitamin C content increases. However, we do not know the maximum of the function here. A phenol concentration of 1.5 mg / kg phenol in soil also has a stimulating effect on vitamin C content.

CONCLUSIONS AND RECOMMENDATIONS

For selected plants, we would suggest that cress and wheat are excellent for determining phenolic contamination; we would not recommend mustard and beans. Initially, we also applied the measurements to beans, but it developed at a slower rate than germination, or not at all. The phenol contamination causes oxidative stress on plants, which increases hydrogen peroxide production. Its proportion and amount are proportional to the concentration of vitamin C in the plant. We would recommend measuring hydrogen peroxide simultaneously with the measurement of vitamin C concentration measured with an HPLC device. Regarding plants, phenol can cause hormesis in plants.

Then, we have measured the inhibition of growth of certain plant parts by phenol on plants. Pot experiments are inexpensive in comparison to field experiments with variety of experimental treatments without contamination of the site.

Phenol has changed the vitamin C content, which is very important in the oxidative stress of plants, as it is a basic material for the plant life. Without vitamin C, the excess of hydrogen peroxide in the plant would kill it. For vitamin C, we have also experienced the phenomenon of hormesis.

No measurable amount of phenol was found in the soil. According to the literature, the phenol has a half-life in soil less than 5 days. The amount of vitamin C in plant samples and residual amount of phenol were measured by HPLC.

Our experimental plants are fit for human consumption and their consumption are widespread in the world also. Phenol as a stress factor increased the content of vitamin C in certain concentrations in plants. In today's world, you can hear more and more that the fruit and vegetables available in the store contain far fewer C-vitamins than before. By selecting a suitable non-toxic stress factor, vitamin C content can be increased in different plants.

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RECOVERY OF SCANDIUM (III) BY LIQUID-LIQUID EXTRACTION OF MACROCYCLIC COMPOUNDS FROM NITRATE SOLUTIONS

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Abstract: *This study aims to investigate the impact of the supramolecular macrocyclic compounds, dicyclohexyl-18-crown-6 (DC18C6) and 1,4,7,10,13-Pentaoxacyclopentadecane, (15C5) as novel extractants for scandium extraction systems based on molecular recognition technology (MRT). Moreover, the authors set the objectives to design high-technology process using these extractants and to develop a scandium recovery method from the aqueous model solution prior to employing it in industrial applications e.g. for scandium recovery from red mud leachate. One of the main problems of scandium recovery from their ores is its selective separation from rare-earth elements (REEs) and iron, which of physicochemical properties are quite similar. The crown ethers and the related macrocyclic ligands are known to recognize fairly strictly the size of the guest cation accommodated in their cavity. During the preliminary experiments of scandium extraction, different concentrations of DC18C6 and 15C5 were used with different scandium model solutions. The complexation reaction between Sc (III) model solutions and macrocyclic ligands was confirmed by UV and ICP-OES techniques. The result showed that 15C5 has exhibited high selectivity for Sc (III), which could be of potential value in the separation and purification of Sc (III) in REEs processing industry. The main results showed the maximum extraction efficiency (99 %) has been achieved by 15C5 ligand depending on pH value of the solution. In case of using DC18C6 the maximum efficiency has reached up to 25.81%. Moreover, the complexed metal ions can be efficiently recovered/stripped out by HCl and* HNO_3

Keywords: *Scandium, Macrocyclic, Crown ethers, Dicyclohexyl, Red mud.*

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SPENT MUSHROOM SUBSTRATE AS BIOFERTILIZER IN AGROECOSYSTEMS OF BLUEBERRY

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Abstract: *Blueberries (Vaccinium spp.) are one of the most commercially significant berry crops. Of all the fruit crops, blueberries are perhaps the most amenable to organic production: pest problems are fewer than with most other fruits, and they preferentially use ammonium nitrogen which is a direct breakdown product of organic nitrogen sources. Spent mushroom substrate (SMS) is a by-product of mushroom growing. It is often classified as waste despite that it is high in organic matter and mineral micronutrient and can be reused as a bioadditive or fertilizer. Spent mushroom substrate from Lentinula edodes was tested as a fertilizer in comparison with peat. Determination of the chemical composition, number of microorganisms and the content of total microbial biomass, direction of microbiological processes in soil fertilized by SMS and peat were conducted. The initial data for the analysis, calculations and mathematical analysis were the results of the first year studies of the multi-year experiment. The actual content of elements showed that SMS contains a high content of all nutrients except N ammonium. The salt content is within acceptable limits. High content of N nitrate indicates a possible risk of excessive vegetation. Analysis of the cationic-anionic composition of the aqueous extract from SMS showed, that the content of all salts is within the permissible norm, except for a slight excess of the norm by Na+. Toxic water-soluble salts do not exceed acceptable value. Microbiological studies of the structure of soil microbial communities showed positive effects of SMS on microbial activity. Basing on these results assumptions can be made that spent mushroom substrate from Lentinula edodes has all possibilities to be used as a biofertilizer in agricultural sector.*

Keywords: *spent mushroom substrate, fertilizer, blueberry, chemical composition, soil microorganisms, microbial biomass.*

INTRODUCTION

Blueberry: Morphology and cultivation. Blueberry plants (*Vaccinium spp.*) are perennial woody shrubs that mature in 5- to 7 years. Canes emerge from a central crown, and each plant typically produces 15 to 18 upright canes by maturity. Growth habit is usually upright, although some sorts have a spreading form. Blueberry plants are deciduous, reaching full dormancy during the winter months.

Root growth begins in spring when soil temperatures reach 6-7°C, usually the time buds begin to swell. Root growth stops when fruit reach maturity and resumes again after harvest. In fact, during late summer and autumn, after harvest and when soil temperatures drop below 15-16°C again, blueberry roots make most of their growth. Blueberries have extremely fibrous root systems. Moreover, blueberry root systems are shallow. Roots are contained primarily (90 percent) within the dripline. Because they lack root hairs, blueberry roots are sensitive to drought and changes to soil-water conditions.

Blueberry flower buds form in autumn, with 5 to 8 flower buds on each shoot. Each bud has 5 to 10 potential flowers. Flowering can last 1 to 2 weeks, although early flowering sorts usually bloom for a longer period due in part to genetics and to cooler temperatures. Buds on shoot tips open first, and then flowering occurs sequentially down shoots. Buds on thin canes open before those on thick, woody canes.

Blueberries have urn-shaped, inverted flowers that shield them from wind and rain. As a result, self-pollination often cannot occur and pollination by insects is required. lower sweetness readily attracts insects such as bees; bees vibrate/sonicate and loosen pollen, thereby spreading pollen from flower to flower or self-pollinating flowers. Stigmas are only receptive to pollen for 3 to 6 days after bloom.

Pollinated flowers turn red colored, while unpollinated flowers remain white. Each of several ovaries per flower requires pollination; the more that are pollinated, the larger the fruit will develop. Some sorts are self-unfruitful, so cross-pollination increases fruit set for these sorts, also resulting in earlier fruit production and larger berries. Overall, open flowers with exposed stigmas are susceptible to a number of potential problems. They are the least cold hardy flower stage and can be easily damaged during extreme cold weather. Early blooming sorts also risk poor pollination as cool spring weather limits bee activity

Blueberry fruit develop approximately from 2 to 3 months after bloom, dependent upon cultivar, weather conditions, and plant vigor. Overall, thicker canes produce larger berries. Fruit is initially tart, but as fruit-acids are broken down during ripening, tartness is lost. Sugar is manufactured by leaves and transported to berries. Sugar levels increase for several days after fruit turns blue. For the highest quality fruit, berries should be allowed to ripen on plants; fruit flavor and sugar content will not improve after harvest. Green fruit contain approximately 7% sugar while mature fruit contain approximately 15%. Additionally, fruit size increases up to 35% after fruit turns blue culminating in about 85% water. Consequently, drought reduces fruit size, lowers starch content, and ultimately results in lower sugar content (Gautheir Ward N., Kaiser C., eds., 2013).

Blueberry is one of the most commercially significant berry crops. It is mainly cultivated in the United States and Canada, but also in Europe, Australia, Chile and New Zealand.. European cultivation of blueberry began after 1920, in the Netherlands. In the following years, cultivation spread to Poland and Germany, where the first European blueberry breeding products, crosses of North American genotypes, were introduced. However, blueberry cultivation did not expand into southwestern Europe until the 1980s. Today, European blueberry production is mainly concentrated in Germany, Poland, France, the Netherlands, Lithuania, Romania, Italy and Spain. For the last year's production of this crop is increasing in response to increased consumer demand for healthy foods.

Blueberry requires acidic, well-drained soils, with optimum acidity ranging from pH 4.5 to 4.8. As blueberry has a shallow root system (located mainly at depths smaller than 60 cm) the soil should be mulched with a deep layer (at least 10 cm) of organic mulch, such as bark, sawdust or leaves. Mulching increases the amount of organic matter in the soil, keeps moisture in the soil, protects roots from heat and helps to control weeds.

The blueberry root system has a limited water uptake capacity. Therefore, the amount of water applied and irrigation scheduling and distribution have a significant impact on its cultivation. Microjet and drip irrigation systems are currently the most commonly used in blueberry plantings, while sprinkler irrigation is used mainly for frost protection and cooling.

Most blueberry plantings require nitrogen applications each year, while other nutrients are generally applied only as needed. Ammonium sulfate is the preferred nitrogen source for blueberry, especially if the soil pH is relatively high (above 5.0), because it tends to decrease soil pH levels. Nitrogen is usually split in multiple soil applications during the spring, using granular formulation on the surface of the mulch, in order to increase nitrogen efficiency (Daniele Prodorutti et al., 2007).

Of all the fruit crops, blueberries are perhaps the most amenable to organic production. Pest problems are fewer than with most other fruits, and they preferentially use ammonium nitrogen which is a direct breakdown product of organic nitrogen sources. Even with these advantages, more research on growing blueberries organically is needed, especially in the area of pest management, organic bioadditives and fertilizers (Carroll, J., Pritts, M.P., and Heidenreich, C., eds., 2016).

Spent mushroom substrate. From waste to fertilizer. The end result of mushroom cultivation is not only the mushroom itself but also a huge amount of spent mushroom substrate (SMS). Traditionally SMS is discarded as wastes, creating an environmental nuisance, despite the fact that it is high in organic matter and mineral micronutrient. In last 10 years it became an increasing challenge for mushroom production industry and the emergence of a new line of research aimed at identifying the most environmentally and economically sustainable way to reuse it. The first thing that drew attention was the physical properties and nutritional

value of SMS.
In 2007 Fangliang Lia together with Qingbo Kong, Qing Zhang, Huangping Wang, Limin Wang, and Tao Luoc started a 10 year experiment to find out the how SMS affect soil humus composition, microbial biomass and functional diversity in paddy fields. In 2016 they collected soil from 6 treatments. The results showed that application of SMS could significantly increase the contents of (contents of soil organic carbon) SOC, soil total alkali-soluble humic carbon (HEC), humic acid carbon (HAC), especially the treatment of with high quantity of SMS, but not significantly increase the content of fulvic acid carbon (FAC). This indicated that the application of SMS could be considered as a good strategy for improving soil quality by reducing the input of chemical fertilizer. The appropriate application of SMS showed somewhat positive impact on the microbial biomass and microbial functional diversity. Sufficient but not excessive application of SMS was beneficial to the carbon source utilization of rapid growing microorganisms (r-strategy). Basing on these results authors made a conclusion that, application of SMS is an effective measure to improve paddy soil productivity. However, they also mentioned that subsequent studies are needed to further elucidate the changes in soil environment, soil nutrient cycling and soil microbial properties after the application of SMS (Fangliang et al., 2020).

In 2009 E. Medina, C. Paredes, M.D. Pérez-Murcia, M.A. Bustamante and R. Moral shared results of their experiment – spent mushroom substrates as component of growing media for germination and growth of horticultural plants. The results showed that the use of spent mushroom substrates in professional horticulture contributes to their disposal in an environment-friendly way and reduces the need for peat simultaneously (Medina et al., 2009).

In 2010 E. Herrero-Hernández, M.S. Andrades, M.S. Rodríguez-Cruz and M.J. Sánchez-Martín represented results of their studding of effect of spent mushroom substrate applied to vineyard soil on the behavior of copper-based fungicide residues. The results obtained show the influence of the solid organic carbon from the SMS organic residue in the retention of Cu from a Cu-based fungicide immediately after its application to the soil. The decrease in the concentration of the metal in the topsoil of the amended soils with time occurred parallel to the decrease and/or loss of the organic carbon in the soil. This effect, together with the ability of Cu to form soluble complexes with the dissolved organic carbon derived from SMS, facilitates the leaching of Cu and the decrease in total Cu content in the topsoil. In the case of the unamend soil, the decrease in the total content of Cu in the topsoil cannot be linked to the decrease in the OC content, since the degree of mineralization of the OC was low (Herrero-Hernández et al., 2011).

In 2017 Xingyao Meng together with group of scientists were experimenting with growth medium for tomato and pepper seedlings based on Composted biogas residue and spent mushroom substrate. The results showed that it is feasible to use biogas residues and SMS compost as a growth medium to replace peat in growing tomato and pepper seedlings. Compost can provide nutrition for plant growth comparable to that in chemical fertilizers. Though the addition of compost resulted in a slightly higher pH and electrical conductivity than the optimal range, amendment of the growth medium with compost yielded a better or comparable seedling quality (Meng et al., 2017).

In Ukraine mushroom growing, especial exotic mushroom is now on its rise and no researches connected with question of SMS were done (Ravlikovsky, Symochko, 2019). Therefore, it’s needed to be studied in more detail.

MATERIALS AND METHODS

Experimental site and investigation design. The experiment was conducted on blueberry farm «Green FE» where spent mushroom substrate from shiitake was tested as a fertilizer in comparison with peat. Blueberry sorts «Duke» and «Bluecrop» were chosen for test. Determination of the chemical composition, number of microorganisms and the content of total microbial biomass, direction of microbiological processes in soil fertilized by SMS and peat were conducted in the private laboratory «FitoLab» and at the Institute of Agroecology and Environmental Management of National Academy of Agrarian Sciences of Ukraine. Data and requirements of national standards for blueberry cultivation were used as reference values. The initial data for the analysis, calculations and mathematical analysis were the results of the first year studies of the multi-year experiment. We determined the mean values (x) and their standard deviations (SD). The level of significance in the study was $P < 0.05$. Dispersion analysis and the Tukey test were used to compare the averages of the independent samples. The logistic transformation was applied to the data expressed as a percentage.

Description of blueberry sorts. «Duke» - early season sort. Concentrated harvest, suitable for mechanical harvest. Blooms late. Needs very good growing site. Large, firm, mild, sweet fruits, holds up well on bush. Consistently large yields. Moderately resistant to twig blight, susceptible to *Botryosphaeria* stem blight (dieback), moderately susceptible to mummy berry fruit phase.
«Bluecrop» - early and middle season sort. High, adapts to variety of sites. Consistent yields. Long harvest period. Large and very large firm, high quality fruits, resistant to cracking, limited shelf-life. Drought resistant. Very resistant to shoestring virus and moderately resistant to red ringspot virus, mummy berry, and powdery mildew. Very susceptible to anthracnose (Figure 1).




Figure (1) Blueberry sorts «Duke» and «Bluecrop»

Description of substrate preparation, SMS and soil sampling. Substrate for shiitake mushroom consists of next raw components – beech sawdust (aged for 2-3 month before use, moister level – 24-28%, particle size – 2-4 mm), barley, corn, sunflower seeds of fine grinding and wheat bran. All of components are mixed together. During mixing water is added. The optimal humidity of the substrate during and after mixing is between 56-63%. After mixing substrate is packed in special bags with microfilters and sterilized. Temperature during sterilization – 112-121°C, overpressure – 0.5-1 atm. This is needed to kill bacteria and molds before inoculation. After sterilization, substrate is cooled to 18-20°C. After cooling, the substrate is inoculated. The amount of mycelium for inoculation is usually 1-2% of the weight of the substrate. After inoculation, bags are sealed and moved to the incubation chambers where it is kept under controlled climate conditions (temperature – 21-25°C, air humidity – 60-80%, concentration of CO_2 – 2000-10000 ppm (0.2-1%)). During incubation substrate is passing through next stages: mycelium running, mycelium coat and bumps formation, pigmentation phase, coat hardening phase. Depending on type of substrate and conditions in chamber incubation period can vary from 16 to 20 weeks. After pigmentation and coat hardening phase substrate is moved from incubation chambers to fruiting. In first two-three days air temperature in fruiting chamber should be low – 12-14°C, and humidity high – up to 95%. This period is called temperature shock and is needed to stimulate the formation of primordial. Bags are cut off the substrate after first primordial appear. During or shortly after cutting substrate receives a water bath. The temperature in fruiting chamber is rising up to 18-20°C, concentration of CO_2 is kept in rang 1700-2000 ppm (0.17-0.2%). Mushroom is picked in dry conditions. On average, the yield of the first wave is 15-25% of weight of the substrate. Up to 5 waves can be received from one substrate but their yield is much lower – 10-12% (Ravlikovsky, Symochko, 2020). After harvesting SMS is received.
Spent mushroom substrate was crushed to small particles and stored n heaps for 6-8 months. During this period it was periodically mixed. The method and the amount which was used for fertilizing the soil with SMS was the same as it is used for peat (Figure 2).


Figure (2) Fertilized soil with peach (on the left) and SMS (on the right)

The soil sampling was carried out by standard methods (ISO 10381-6: 1993). The soil samples were selected from the 0–20 cm layer of the plants over the period when the system reached its climax - stable, balanced state. All samples were prepared using the unified procedure: they were air dried and grounded to < 3 mm in size; visible plant and mesofauna residues were removed. Experiments were performed in 4-fold repetition.

Chemical composition study. Chemical composition was carried out by standard methods as are used for peat (GOST 27984.6-88; GOST 27984.5-88; GOST 27984.4-88; GOST 27984.10-88; GOST 26483-85; GOST 26423-85; GOST 26715-85; GOST 7079-2009; GOST 7882-2015).

Microbiological study of soil microorganisms. For the microbiological analyses, soil samples were selected from each variant in 4-fold replication and prepared an average sample. Batches of 10 g each were put on sterile mortar and then the microorganisms were separated from the soil particles using the method of D. Zviahyntsev (1991). The quantitative compound of the microorganisms of the main ecological-trophic and taxonomic groups in soil was determined using the methods of inoculating the soil suspension to standard growth medias, which are generally accepted in soil microbiology (Zviahyntsev, 1991): streptomyces and bacteria which use mineral nitrogen (N_{min}) – to starch-and-ammonia agar (SAA), the number of pedotrophs – to soil agar (SA), oligotrophs on purified agar (PA), micromycetes – to Czapek-Dox agar, bacteria which use organic nitrogen (N_{org}) – to meat infusion agar (MIA) After the inoculation to the media, the bacteria were incubated at the temperature of 28ºC during 5–14 days. The colonies which grew in these media were calculated assuming that one colony is formed from one vital cell. The results of assessments of the number of microorganisms grown on the nutrient media were expressed in Colony Forming Units (CFU) per 1 g of dry soil. For this purpose, the moisture of the soil samples was determined for the experiments using the thermostat-gravimetric analysis, and recalculated the obtained number of colonies taking into consideration the coefficient of moisture and solution of the soil suspension. The inoculations were repeated three times, the obtained data were analyzed using mathematical statistics, calculating the confidence interval in the number of microorganisms.

Direction of soil microbiological processes. The direction of microbiological processes in the soil was determined by the appropriate coefficients (Andreyuk & Valagurova, 1992):

- coefficient of mineralization (K_{min}) was calculated by the ratio of the number of microorganisms immobilizing the mineral forms of nitrogen (C_{SAA}) to the number of organotrophs (C_{MIA}) by the formula: $K_{min} = C_{SAA} / C_{MIA}$;
- coefficient of oligotrophity (K_{ol}) was calculated by the ratio of the number of microorganisms, which are able to absorb nutrients from very rarefied solutions to the total number of eutrophic microorganisms by the formula: $K_{ol} = C_{PA} / (C_{SAA} + C_{MIA})$;
- coefficient of pedotrophity (K_{ped}) were calculated as the ratio of the number of pedotrophic microorganisms (C_{SA}) to the number of microorganisms using organic nitrogen (C_{MIA}): $K_{ped} = C_{SA} / C_{MIA}$;
- coefficient of transformation of organic matter (K_{tom}) was calculated by formula: $K_{tom} = (C_{MIA} + C_{SAA}) \times (C_{MIA} / C_{SAA})$.

RESUTS AND DISCUSSION

The actual content of elements showed that SMS has a high content of all nutrients except N ammonium (Table 1). The salt content is within acceptable limits. High content of N nitrate indicates a possible risk of excessive vegetation, the formation of large leaves of dark green color, which can lead to shading and irrational use of water from the soil by the plant.

Table (1) The actual content of elements in terms of the initial humidity of the samples

№	Name of the sample	Ca^{2+} mg/100 g	Mg^{2+} mg/100 g	P_2O_5 mg/100 g	K_2O mg/100 g	N ammonium mg/100 g	N nitrate mg/100 g
1	Soil fertilized by peat	427.6	210.6	78.0	29.09	4.0	1.61
2	Soil fertilized by SMS	455.6	729.6	338.0	340.5	41.0	183.0

Analysis of the cationic-anionic composition of the aqueous extract from SMS showed, that the content of all salts is within the permissible norm, except for a slight excess of the norm by Na^+ (Table 2). Toxic water-soluble salts do not exceed acceptable value.

Table (2) Cationic-anionic composition of the aqueous extract of the samples, mg-eq./100 g

№	Name of the sample	HCO_3^-	Cl^-	Ca^{2+}	Mg^{2+}	Na^+	K^+	SO_4^{2-}	Amount of salts, %	pH
1	Soil fertilized by peat	0.15	0.30	0.29	0.50	0.21	0.10	1.34	0.11	4.31
2	Soil fertilized by SMS	0.01	0.12	2.79	2.64	1.18	4.22	1.31	0.37	4.04
Toxicity threshold for plants		*0.80*	*0.30*	-	-	*1.00*	-	*1.70*	*no salinity*	*Acidic*

For both soil samples the number of microorganisms and the content of total microbial biomass was determined (Table 3). The enrichment of soil by SMS led to the growth of microbial biomass (406.34±38.10). In the soil fertilized by SMS decreased number of oligotrophs more than in 3 times and pedotrophic microorganisms in 2 times in compare with soil fertilized by peat. Fertilization of soil by SMS creates new favorable conditions for soil microorganisms and leads to changes in the structure of their community.

Table (3) The number of soil microorganisms and the content of total microbial biomass

	Soil fertilized by peat	Soil fertilized by SMS
Micromycetes, $\times10^3$ CFU g^{-1}	11.65±0.18	1.48±0.04
Bacteria which use organic nitrogen, $\times10^6$ CFU g^{-1}	47.41±5.82	17.53±0.43
Bacteria which use mineral nitrogen, $\times10^6$ CFU g^{-1}	28.0±0.56	24.7±1.44
Oligotrophs, $\times10^6$ CFU g^{-1}	147.64±32.42	41.21±0.36
Streptomyces, $\times10^6$ CFU g^{-1}	19.52±0.28	9.41±0.07
Pedotrophs, $\times10^6$ CFU g^{-1}	84.25±2.36	43.71±1.81
Total microbial biomass, mcg	357.53±13.48	406.34±38.10

Basing on the number of soil microorganisms coefficients of mineralization, oligotrophity, pedotrophity and transformation of organic matter were calculated (Table 4).

Table (4) Direction of soil microbiological processes

№	Name of the sample	Coefficient of mineralization K_{min}	Coefficient of oligotrophity K_{ol}	Coefficient of pedotrophity K_{ped}	Coefficient of transformation of organic matter K_{tom}
1	Soil fertilized by peat	1.0	1.56	1.78	94.61
2	Soil fertilized by SMS	1.95	1.21	2.49	26.31

For soil fertilized by peat values of the coefficients were next: mineralization – 1.0, oligotrophity – 1.56, pedotrophity – 1.78, transformation of organic matter – 94.61. For soil fertilized by SMS we got next values: coefficient of mineralization – 1.95, coefficient of oligotrophity – 1.21, coefficient of pedotrophity – 2.49 and coefficient of transformation of organic matter – 26.31.

According to the results of microbiological studies of the structure of soil microbial communities we can conclude about the positive effects of SMS on microbial activity. Therefore, it's needed to be studied in more detail impact of agricultural land use on the soil microbiome, the dependence of the number and structural diversity of microbiota on environmental and human factors that determine the stability of agricultural soils (Patyka & Symochko, 2013; Symochko et al, 2015; Symochko & Hamuda, 2015).

CONCLUSION

The actual content of elements showed that SMS contains a high content of all nutrients except N ammonium. The salt content is within acceptable limits. High content of N nitrate indicates a possible risk of excessive vegetation, the formation of large leaves of dark green color, which can lead to shading and

irrational use of water from the soil by the plant. Analysis of the cationic-anionic composition of the aqueous extract from SMS showed, that the content of all salts is within the permissible norm, except for a slight excess of the norm by Na+. Toxic water-soluble salts do not exceed acceptable value. According to the results of microbiological studies of the structure of soil microbial communities we can conclude about the positive effects of SMS on microbial activity. Therefore, it’s needed to be studied in more detail impact of agricultural land use on the soil microbiome, the dependence of the number and structural diversity of microbiota on environmental and human factors that determine the stability of agricultural soils.
Basing on these results assumptions can be made that spent mushroom substrate from *Lentinula edodes* has all possibilities to be used as a biofertilizer in agricultural sector.

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ANTHROPOGENIC EFFECTS ON ALSÓ-HEGY IN AGGTELEK NATIONAL PARK

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Abstract: *Alsó-hegy is part of Aggteleki Nemzeti Park. It is roughly a nature landscape, but it has some anthropogenic effects too. The vineyard activity left eroded slopes with scattered forests behind. The pastures transformed the original forests to meadows. However, these territories are regenerating to forestlands with juniper grove. A non-native pine forest was planted on the plateau and the invasive acacia groves are frequent at the foot of Alsó-hegy. There are several ruins of lime kilns, where the bare limestone peeps into the surface. The pit of an abandoned marble mine shows the traces of human activity. A small hunter house is the only man made structure on the plateau. A demolished village and ruins of a fortress are also located here. There are also many built-up springs for drinking purposes. The speleological activity can also be recognized in Alsó-hegy. The narrow entrances of pits have been widened, to allow the descending of the researchers to the bottoms of the caves. The entrances of the big horizontal caves (Meteor, 404 Víznyelő) are closed with iron doors to prevent the illegal visits. However, these human activities influence the natural landscape only slightly. The main research point is to survey which type of anthropogenic effects has changed the landscape and how they have transformed it. Only the Hungarian part of Alsó-hegy is discussed in this report.*

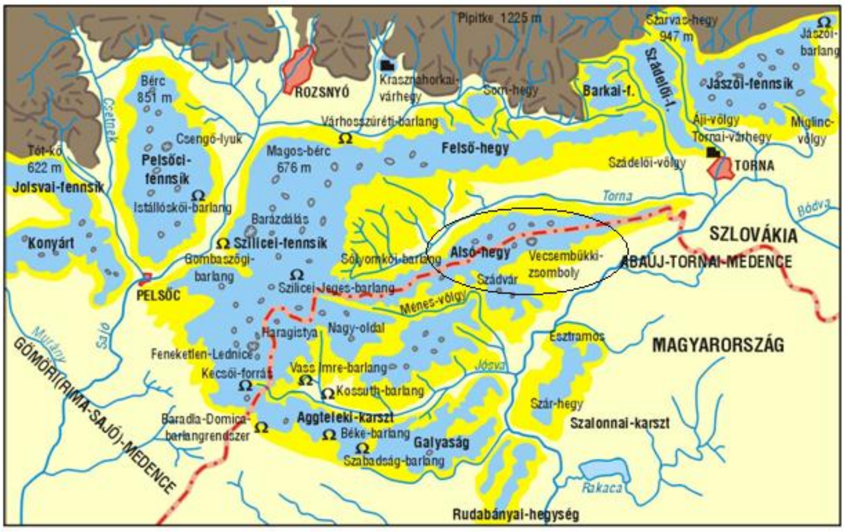
Keywords: *Alsó-hegy, minor anthropogenic effects, natural landscape*

INTRODUCTION

The Alsó-hegy belongs to the karstic region of Northern Hungary, which is a shallow see Wetterstein formation (Limestone) [1]. It is part of Northern Gömör-Tornai karst region (Figure 1.). The recent landscape formations are the results of more than 5 million years processes.

The borders of Alsó-hegy are the followings: south, Bódva river and Ménes creek; north, Torna creek; west, Szilice plateau. Its expansion is 50 km^2 with 400-500 m elevation [2]. This territory abounds vertical caves (spothole, zsomboly), most of them were born in Pliocene age [3]. However, several horizontally caves are also located here.

The flora and fauna of Alsó-hegy have a big diversity [4]. This area belongs to the deciduous forest biome. The climate of this area is temperately cool and humid. The average annual temperature is 8-8.8 °C, with 680mm precipitation (rain and snow). The typical tree species are the hornbeam and oak, but several other species are also present. The meadows among the woods have forest steppe characters [4]. The typical trees of southern slops are oaks and junipers. The most part of the landscape is unsettled.



Figure(1) Map of Gömör-Tornai karst [2] The Alsó-hegy is circled. The red dash and dot line shows the border between Hungary and Slovakia.

The Hungarian part of Alsó-hegy is the part of Aggteleki National Park (ANP, Aggteleki Nemzeti Park)[5, 6]. ANP has become the members of UNESCO Word Heritage network in 1995 [7]. Therefore it is a highly protected area, with overwhelmingly natural characters. On the other hand, several anthropogenic effects can be recognized, in spite of the highly protected status of this area.
This area is excellent from point of view of education of the environmental engineer students. They can realize the long term effects of human activities. They can transform their theoretical knowledge to real situation using project work system [8].

OBSERVED ANTHROPOGENIC EFFECTS

The anthropogenic effects on the surface soil and rocks

The main significant anthropogenic effect is the eroded southern slopes of Alsó-hegy above the Bódva valley. Recently this area is a bushy terrain with dints (devil plowing, ördögszántás) (Figure 2.). This karren field is the consequence of intensive viticulture before the phylloxera epidemic. The grape rows caused intensive erosion of soil. After the phylloxera epidemic the erosion has become more intensive on the abandoned terrain (Figure. 2).
There are some small quarries on Alsó-hegy (e.g. Márványbánya). The mining activities were made mechanically in small scales. They cannot be recognized from bigger distance, their presences do not disturb the original landscape. On the other hand, one up-to date rock mine exists in the Slovakian part of the Alsó-hegy, using explosion for production of stones. This mine causes serious wound in the landscape, similar to the Extramos Mountain in the opposite side of Bódva valley.

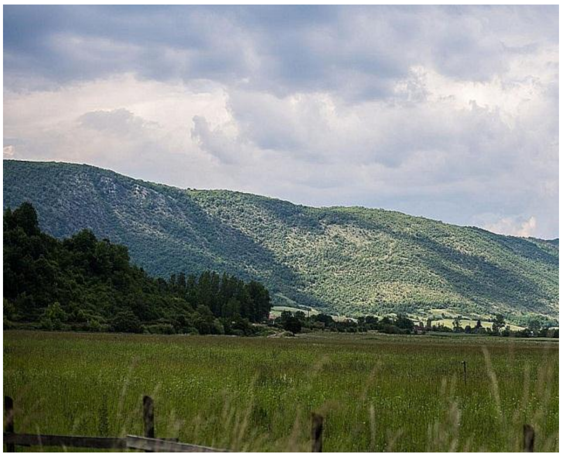


Figure (2) The eroded southern slope of the Alsó-hegy
The eroded surface is consequence of previous viticulture activity.

Anthropogenic effects on vegetation

The viticulture activity on the southern slopes changed the forest to vineyards. After stopping the grape cultivation after the phylloxera epidemic, it has become bushy terrain with some trees, as it was mentioned previously.

There are some meadows in the plateau, (e.g. Szabó-pallag). The forests were cleaned, and the area was used for hay production for animal feeding. Later this activity stopped, and the forest has been started gaining back its territory. Recently there are several juniper groves in these meadows (Figure 3.).

There are also invasive species in Alsó-hegy caused by human interventions. A moderate size pine forest was planted in the plateau (Szabó-pallag). Big territories acacia forests are at the foot of the slopes of Alsó-hegy, mostly in the vicinities of the villages. The reasons were probably the fast wood production for firing purposes of the local inhabitants.

Active loggings functions are also present by forestry enterprises. The Alsó-hegy is a highly protected area; therefore the logging activity is limited. Clear cut or plantations of invasive species are not allowed recently.

Figure (3) Characteristic part of Szabó-pallag meadow.

A five meter wide line clearance was cut along to Hungarian-Slovakian border. There are also row of landmark stones along the clearance.

Appearances of wolves and lynxes are reported showing that, this area is close to natural conditions.

The rough roads, tourist paths and their signals do not disturb significantly the natural habitat.

Anthropogenic effects on water management

All major and permanent springs have been debouched. The smaller ones have only short stainless tubes on their walls, and basins under the tubes, for the drinking purposes on site (Figure 4.).

The bigger springs are connected to the drinking water pipelines of the local villages. For example, the Kastélykerti forrás is the source of the drinking water supply of Tornanádaska. Therefore, the vicinities of these springs are fenced area to keep clean the water of the springs.

Recently, small flood water reservoir has been constructed in front of the Bódvaszilas

Buildings in Alsó-hegy

Only one house is built in the plateau of Alsó-hegy. It is a small hunter lodge. Of course, there are several wooden high-stands for hunting purposes in the whole area.

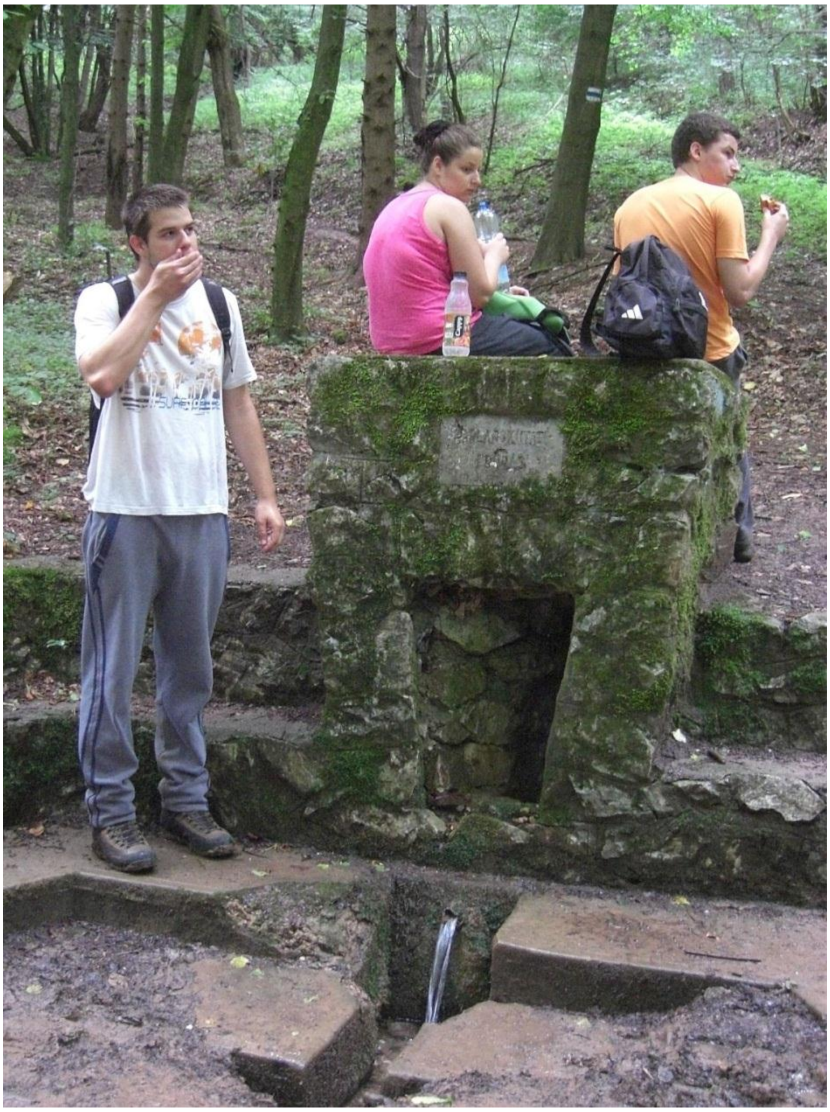


Figure (4) The debouched Barlangkutató forrás spring

The ruin of Szádvár fortress is also part of Alsó-hegy micro region. The fortress were established in 13.th century and finally demolished at the end of 17th century [9]. Recently the “Friends of Szadvár” civil organization protects the ruins and partly rebuilds the walls (Figure 5.).

Figure (5) The ruins of Szadvár fortress

The member of Friends of Szadvár civil organization protect the ruins and partly rebuild the fortress.

A ghost village, Derenk is located at the edge of Alsó-hegy micro region [10]. 400-500 Polish minority groups lived here. However, Miklós Horty, the governor of Hungary displaced the local inhabitants, because he established a bear hunting park nearby. Today, only the school building and a small chapel (Figure 6.) remained intact (rebuilt), but the other buildings are ruins.

Figure (6) Chapel of Derenk in a ghost village

Traces of cave research in Alsó-hegy.

The Alsó-hegy is very rich in caves, mostly in vertical caves. Several of them had not a visible entrance originally. Their entrances were covered by debris or they had very narrow fissure in the surface. In these cases the entrance of the caves were widened with carving. No any hole could be recognized in the surface of the Tektonik cave. The cave could only be recognized by the heavy white frost depositions among the rocks in a cold winter day. The entrance has been widened to a medium-sized man (Figure 7.).

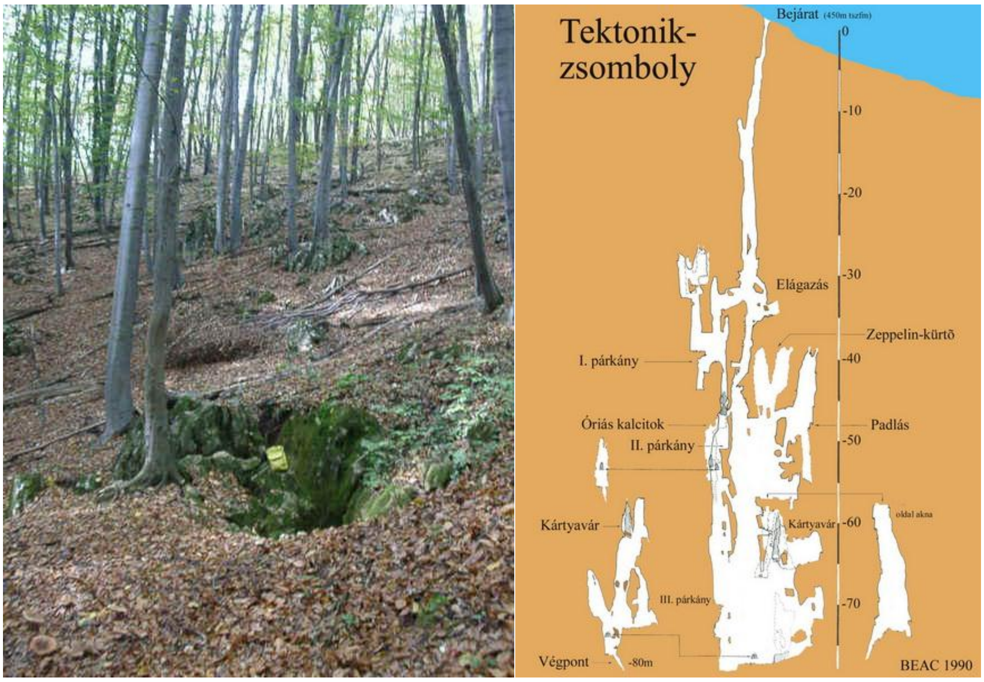


Figure (7) The narrow entrance of Tektonik zsomboly and the map of it [3].

Several times, the cave researchers were pooled-up with rope by man forces from the bottom of first pit. The towing paths can be recognized in some dolines (e.g. Vecsembükki zsomboly).

The entrances of the bigger horizontal caves are locked by strong gates to reserve these caves in their original forms and for safety reasons.
Some tools have been built into the caves (e. g. belays, winch stands, ladders) to make the descending and ascending in these caves easier, but these tools can not be seen from the surface.

CONCLUSIONS

The highly protected Alsó-hegy is close to the natural status. The agriculturally cultivated areas have been partly recovered (Szabó pallag, southern slopes of Alsó-hegy). The invasive vegetation expansions are limited. The ruins of area (Derenk, Szádvár) fit well to the landscape. The debouched springs do not disturb their natural water management conditions in their surroundings. The speleological activities do not disturb the landscape significantly. The Alsó-hegy is appropriate to show its natural habitat and the moderate effects of anthropogenic activities.

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PREPARATION AND CHARACTERIZATION OF CERIUM DIOXIDES NANOPARTICLES FOR REMOVAL OF METHYLENE BLUE FROM WATER

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Abstract: *Dyestuff discharges into water from the different industries such as leather, dyes manufacturing and organic materials have negative effect to the human health and his environment. Researchers generally use various other techniques to remove dyes from water such as chemical oxidation, membrane separation, coagulation /flocculation, and ion exchange. One of the best and cost effective techniques is adsorption. In this article, cerium dioxide (CeO_2) was used as a nanoadsorbent material to remove methylene blue (MB) from water. The nanoparticles of CeO_2 were prepared using ceric sulfate tetrahydrate ($Ce(SO_4)_2.4H_2O$), urea (NH_2CONH_2) and cetyl trimethylammonium bromide (CTAB) as surfactant. CeO_2 nanoparticles were annealed at 500°C. Nanoparticles of CeO_2 were characterized using different techniques. The two famous techniques, namely, X-ray diffraction (XRD) and scanning electron microscopic (SEM) were used to study the surface chemistry of the nanoparticles. Atomic force microscopic (AFM), thermal gravimetric (TG) methods recognized the decomposition steps and nanosize of the prepared nanoadsorbent. Fourier transform spectrometry (FTIR) was used to investigate the structure of the nanomaterials. CeO_2 nanoadsorbents were used for MB removal from water. The adsorption procedures for MB removal from water using CeO_2 have been done using the following conditions: shaking rate 250–350 rpm, reaction time is from 0 to 70 min, and MB concentration 2 mg/L, at room temperature. UV/Visible spectrophotometer was used to study the removal efficiency of MB from water. CeO_2 annealed at 500°C exhibited the highest removal efficiency, 89% after contact time of 50 minutes as compared to the fresh CeO_2.*

Keywords *Methylene blue, adsorption, dyes removal, cerium dioxide, nanoparticles*

Full manuscript not recieved

IMPACT OF COVID-19 EPIDEMIOLOGICAL MEASURES, FOCUSING ON THE REDUCTION AND CONSEQUENCES OF ROAD TRANSPORT EMISSIONS

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Abstract*: Road transport is partly responsible for urban air pollution, which endangers the health of many people. Pollutants emitted by vehicles, according to WHO (World Health Organization) estimates, claimed the early deaths of 4.2 million people worldwide in 2016. The Member States of the European Union also try to control the emissions of harmful substances in various ways, hence transport greening plays a key role in Hungary's short- and long-term goals. However, on March 4, 2020, the coronavirus appeared in Hungary as well. In order to prevent a large-scale outbreak of the epidemic, schools were closed and stricter access restrictions were introduced in several stages, forcing companies and institutions to allow their employees to work from home. Factories and service industry have been forced to shut down, in part or in full, leading to a reduction in the number of road users, with a significant impact on human health, the economy and wildlife. As a result of the reduction of pollutant emissions, the air became clearer. However, due to the topographic conditions of our country, this process could only take place to a small extent and slowly until mid-April. At the end of April, windy, rainy weather removed pollutants from the atmosphere to an increased extent. The sky over Hungary became clear and blue. Greening traffic would help maintain this status quo.*

Keywords*: Covid-19, epidemiological measures, reduction and consequences, road transport emissions*

INTRODUCTION

One of the main sources of air pollution is the emission of transport. At the same time, the freedom to go wherever we want has its price that our health suffers the most. Air pollution is a silent killer. The World Health Organization (WHO), the European Union, and the individual Member States themselves, are working to take measures to reduce emission from transport in several forms.
Earlier this year, however, another opportunity came unexpectedly to reduce transport emission. However, this opportunity did not expect and did not want to, and in fact, it created fear and tension in people. With a Chinese source, a new type of SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus-2) coronavirus has arisen.
Due to the cross-continental pandemic, different countries introduced different levels of authority measures

to prevent the rapid spread of the virus at different times, including keeping mandatory social distance, cities under lockdown with curfew, school closures, and forced home office everywhere it was possible.
The economy suffered severe damage, health institutions became overburdened in several countries due to illness and death, and layoffs and pay cuts occurred due to factory shutdowns. Economic damage is measured in hundreds of billions of dollars worldwide. Factory shutdowns, dusk-to-dawn curfew, home office and other restrictions have been accompanied by a decline in all sub-sectors of transport; air, water, rail or road. The reduction in mobility and emissions associated with the closures also had an impact on air pollution. Concentrations of harmful substances decreased near all sources, up to 30 to 40 percent overall in Europe.

AIR POLLUTION

Traffic air pollution Transport has been a jointly managed policy area in the EU for more than 30 years, and the importance of harmonizing national laws, regulations and administrative provisions and the technological, social and tax environment is constantly growing. [1] Road transport is estimated to account for Particulate Matter (PM) of up to 50% of the emissions in the Organization for Economic Co-operation and Development (OECD) countries, and up to 30% in European cities, mainly due to diesel vehicle traffic.
Air pollution poses different challenges in different regions of Europe: only 36% of the European cities meet the WHO annual target for PM2.5. In 2019, the highest level of PM2.5 among European countries was in Eastern and Southern Europe (14.6 μg/m3 in Hungary), while the cleanest cities and regions are mainly in Northern and Western Europe. [2] Many European cities are focused on preventing high concentrations of NOx and NH3, while others continue to face challenges with unsafe levels of PM10 or PM2.5. [2] In general, air quality in Hungary was basically good on March 13, 2020, a few cities showing higher levels of pollution only. [3]

Adverse effects of air pollution The road transport sub-sector has always had a number of environmental problems, including air pollution, noise, congestion, accidents, etc. Controlling and reduction air pollution is currently not just an urgent issue, but a local priority. The environmental impacts of increased emissions and polluted air from transportation are becoming more severe, endangering human life, and habitats of living things around the Earth. [4] According to WHO data from 2016, about 4.2 million premature deaths have been attributed to environmental (outdoor) air pollution, 91% of which belong to the poor and populous countries of Southeast Asia and the Pacific. According to the Health Effect Institute (HEI, 2018), more than 95% of the world's population breathes polluted air and up to 60% of people live in areas that do not meet even the most basic WHO standards. [5]

Decrease in mobility, outage of traffic At the end of January 2020, the Government of Hungary established the Operational Staff Responsible for the Control of the Coronavirus Epidemic. (III. 11.), according to security reasons, the central state ceremony was no longer held on 15 March and the personal form of education was closed from 16 March. It was recommended to companies and institutions to allow anyone to do the work at home. The country has virtually stalled in terms of mobility. They promoted the use of public transport and bicycles, while the closure was accompanied by a drastic reduction in vehicle traffic. Similar measures have been introduced in other countries of the world, depending on the date of local appearance of the coronavirus. All four sub-sectors of transport (road, water, air and rail) have been affected to some extent by curtailment and mobility restrictions. Planes have been forced to the ground, cars are resting in garages, and supply chains are jammed. The frequency of public transport was reduced primarily due to underutilisation, but was slightly re-condensed due to the possibility of maintaining a mandatory social distance.

Decrease in vehicle use The road traffic stop is also reflected in the change of numbers of active users of the Waze application, the number of vehicles on the roads has decreased. The current data also show lower values on weekdays from mid-March than on weekends before March 13, with less than 7,500 vehicles per day in total. [6]

Increase in the number of cyclists The number of cyclists increased on weekdays. Weekend data are lower than those counted during the week, but higher after March 15th then before. [7] The number of cyclists will continue to grow by designating and making temporary bike lanes safe.

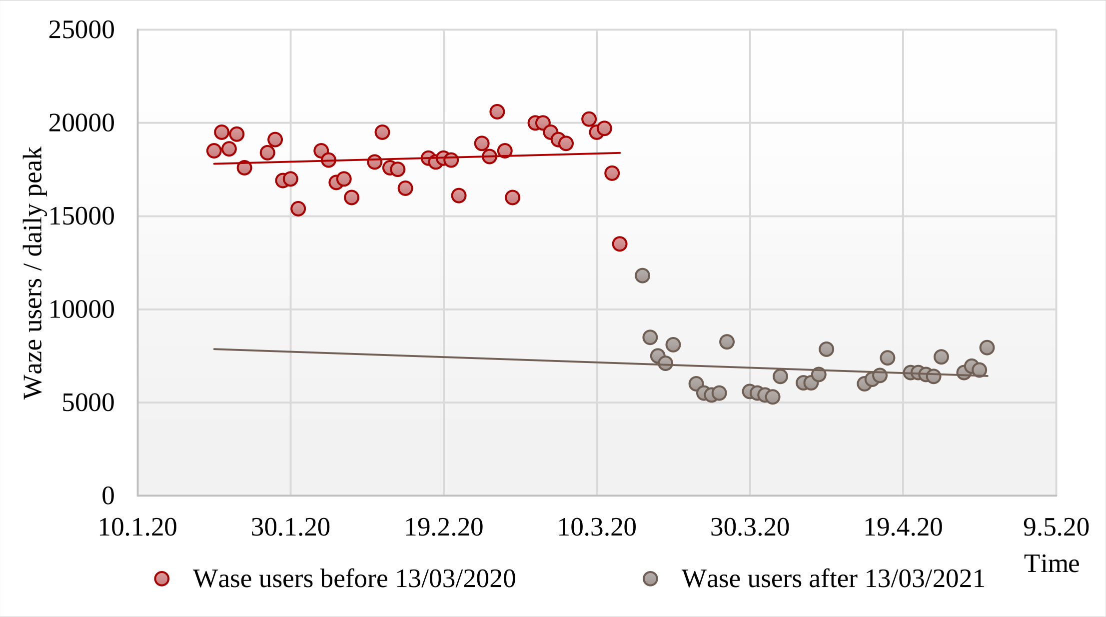

Figure (1) Waze user data, daily peak [6]

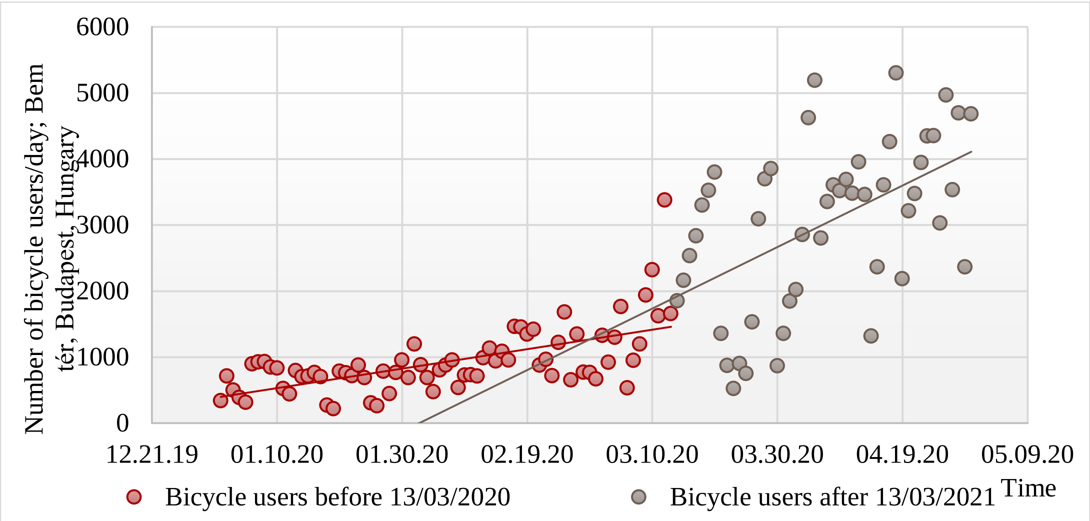

Figure (2) Number of cyclists a day, Bem tér Budapest, Hungary

Changes in the number of public transport users Number of public transport users decreased significantly due to home office and the closure of public educational institutions. More people switched to cars, so the total number of public transport vehicles and their emissions decreased during reviewed period (mid-March to end April) [8].

Narrowing of the used car market In China, after the first two months of 2020, the previous trend changed from one moment to the next. The number of sales decreased significantly due to the decrease in mobility, but those wishing to sell used cars are also waiting, so the market is not saturated. The recession is expected to be 5% for used cars aged 0-6. Experts are calculating with a quick recovery after the current stagnation due to the epidemic.

Changes of car market Previously, experts calculated with a massive expansion of the car market, for example they predicted a 40% increase in the sales of battery electric cars by 2020. But, one of the adverse effects of the coronavirus epidemic is the drastic decline in car sales. The decrease of newly registered passenger cars and light commercial vehicles was low in February, increased already significantly in March, and dropped dramatically in April compared to the same month of the previous year. A similar trend can be observed in European countries as well [9]. Same number of new cars were sold in the UK in April 1946, a total of 4,321 were registered, 97% less than a month earlier. The Dealers and Manufacturers Association estimated that 1.68 million of new passenger cars will be sold by the end of the year, a 27% drop compared to 2019.

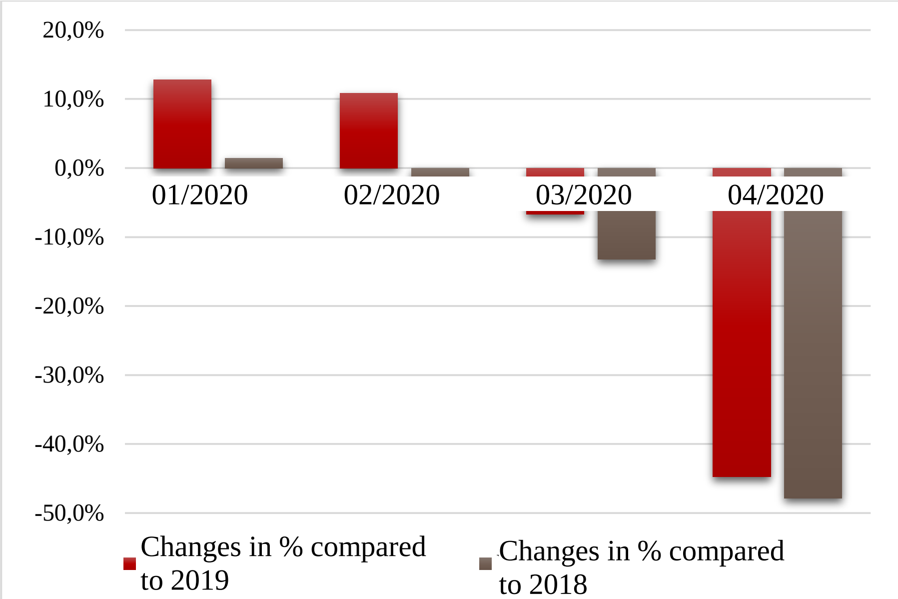

Figure (3) Changes of the car and light commercial vehicle registrations in the Hungarian market in the first four months of the year in 2020 compared to 2019 and 2018 [Datahouse]

CHANGE IN AIR QUALITY

Road traffic stop, like everything, have both advantages and disadvantages. Undoubtedly, the biggest benefit is the reduction in air pollution. Satellite measurement data from the Copernicus program prove that NO_2 emissions have been reduced and the atmosphere has been cleared. However, concentration of pollutants in Hungary is due to not only the level of emissions, but also for topographical reasons. It is landlocked, mountains surrounding the country do not allow the cleansing effect of the weather to prevail, winds blowing at high speeds are rare and amount of rain falling is less and less. In the Carpathian Basin, the air is able to sit down for a long time, allowing the concentration of pollutants to increase above the limit value.

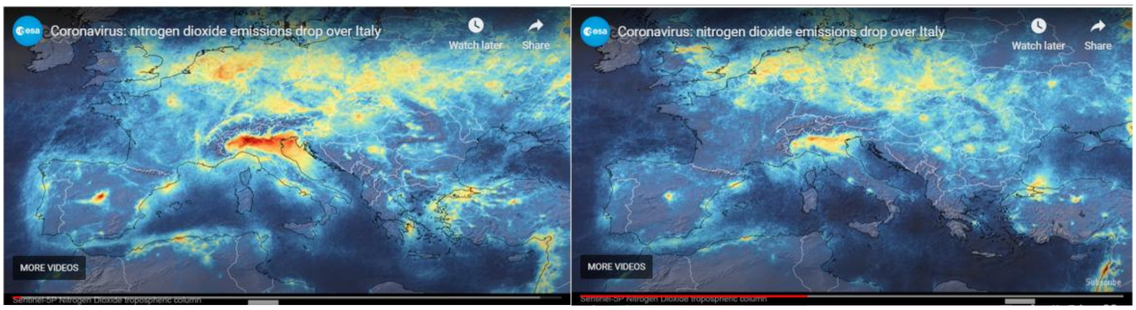

Figure (4) Changes in NO_2 concentrations in the atmosphere over southern Europe between January and March 2020 [10]

The impact of road transport on air quality in Hungary is not entirely clear by direct examination of the concentration in the short term. Concentrations of pollutants also basically change periodically over the course of a year, depending on the weather and the activity of the sources. Due to residential heating as a source of pollution, the amount of PM10, which is so problematic for Hungary, increases in the winter.
Looking at the first months of 2020, atmospheric concentrations of PM10 and CO decreased significantly,

while concentrations of NO_2 changed to a lesser extent. The period from 15 March to 30 April shows the effects of road traffic stoppages. Concentrations of the main pollutants also decreased in the period from 1 January to 15 March 2020, but the rate of reduction became higher after the cessation of road traffic. NO2 has strong correlation with the reduction of transport and it has a low decrease before 15th March and higher drop after lockdown. Heating in wintertime has mainly an effect on other pollutants with decrease in concentration before 15th March as well with the exception of ozone. Any change in its concentration has a strong relationship with sun radiation based on oxidative smog.

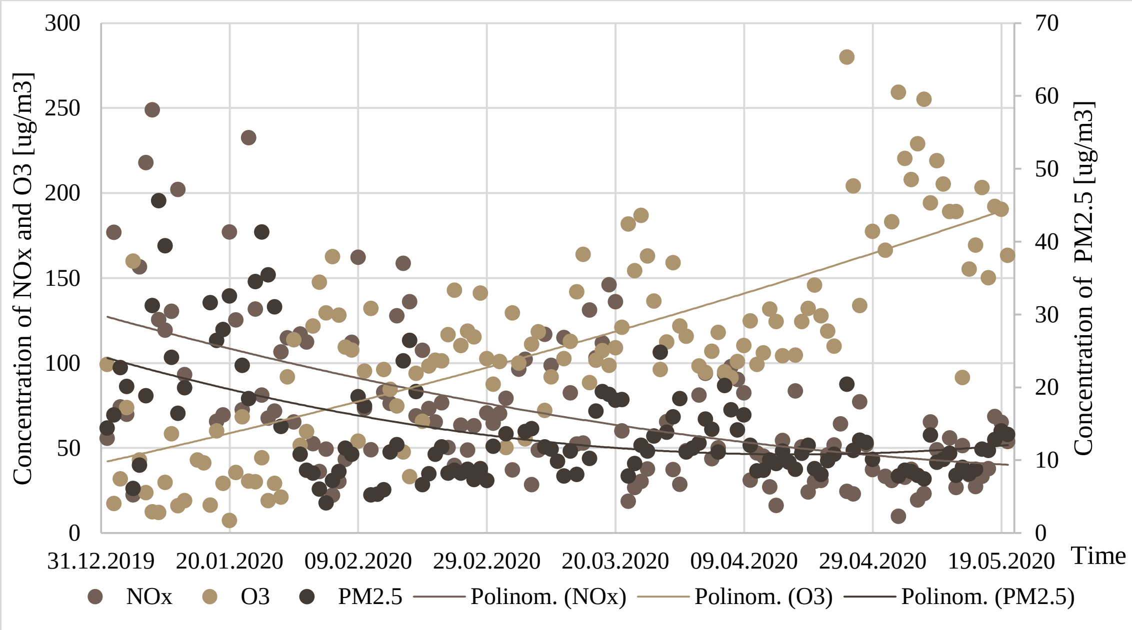

Figure (5) Daily data measured at Széna tér, Budapest measuring station in the period January-May 2020 [11]

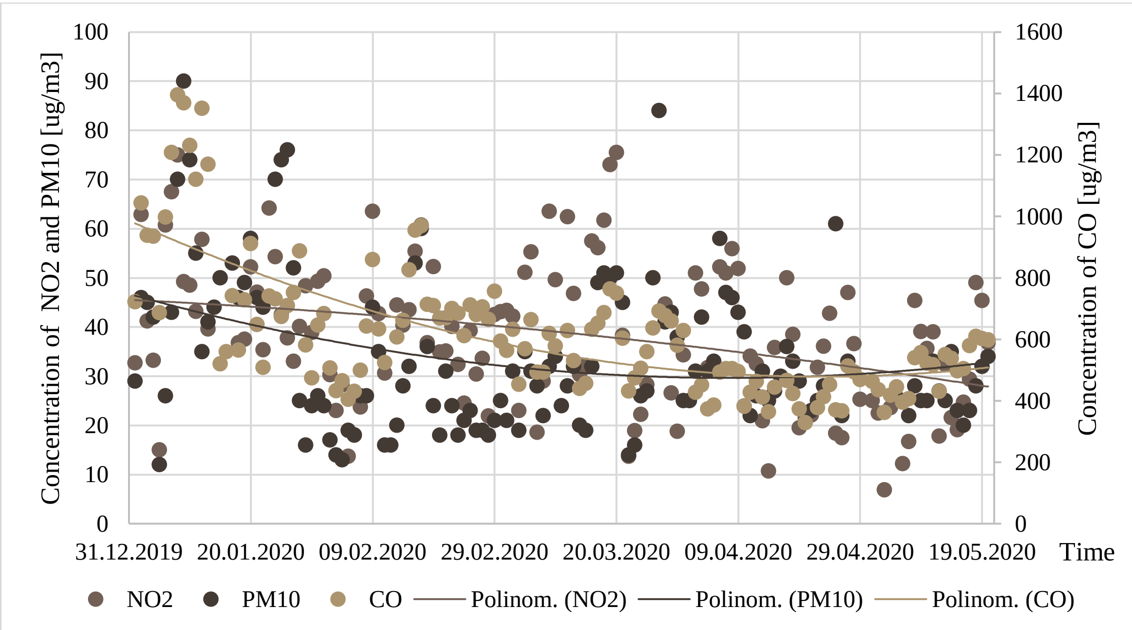

Figure (6) Daily data measured at Széna tér, Budapest measuring station in the period January-May 2020 [11]

Plotting the concentration data as a function of the number of Waze users makes it possible to see the relationship between the number of car users and the level of pollution. The main source of PM10 is residential combustion, depending not so strongly on the number of vehicles, in contrast to the concentration of CO and NOx, which actually increases with increasing number of users.

Above Hungary, air pollution did not decrease significantly in proportion to the decrease in traffic in the

period March-April, which was also confirmed by international measurements [11].
In order for the air-purifying effect of the road traffic shutdown to take effect, windy weather is also necessary, which, however, only reached Hungary on April 25, 2020. Precipitation to help deplete air pollutants only fell in late April 2020. In mid-March, the precipitation came partly in the form of snow, furthermore the less windy, rain-poor spring weather also did not promote the removal of pollutants from the atmosphere of the Carpathian Basin.

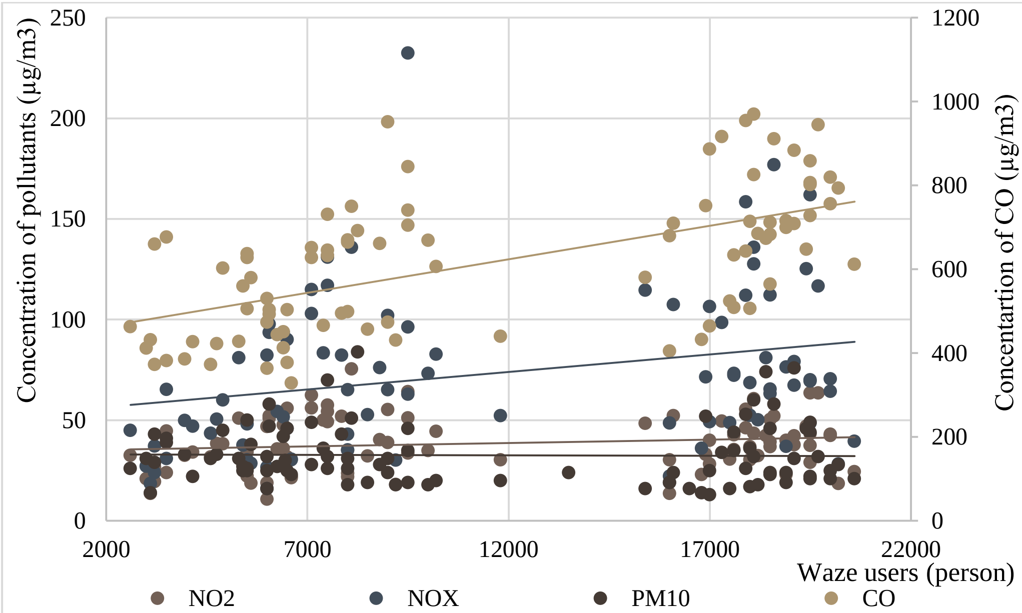

Figure (7) Daily data measured at Széna tér, Budapest measuring station for the period March-April 2020 [4, 12]

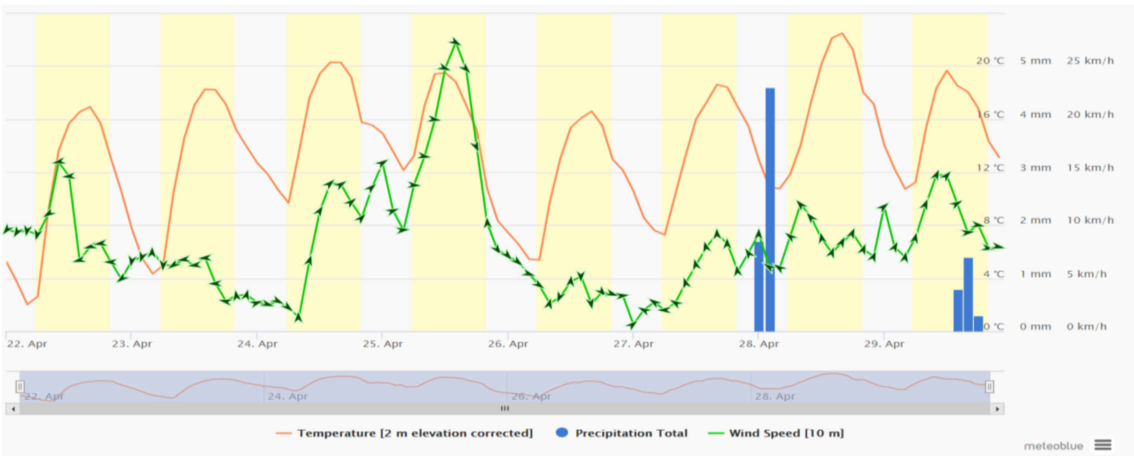

Figure (8) Temperature, precipitation and wind speed data for Budapest [13]

Performance of solar cells depends strongly on the air quality. The next figure shows us the change of the power of solar plants in the relation of the concentration of pollutants; relative humidity, PM2.5 and NOx concentrations affect the most to the power production. CO has no effect. Ozone formation depends on solar radiation, hence the higher the solar radiation, the higher the ozone concentration and the solar cell performance as well. Due to the road traffic stop, the cleaner air promoted the higher electricity production as well.

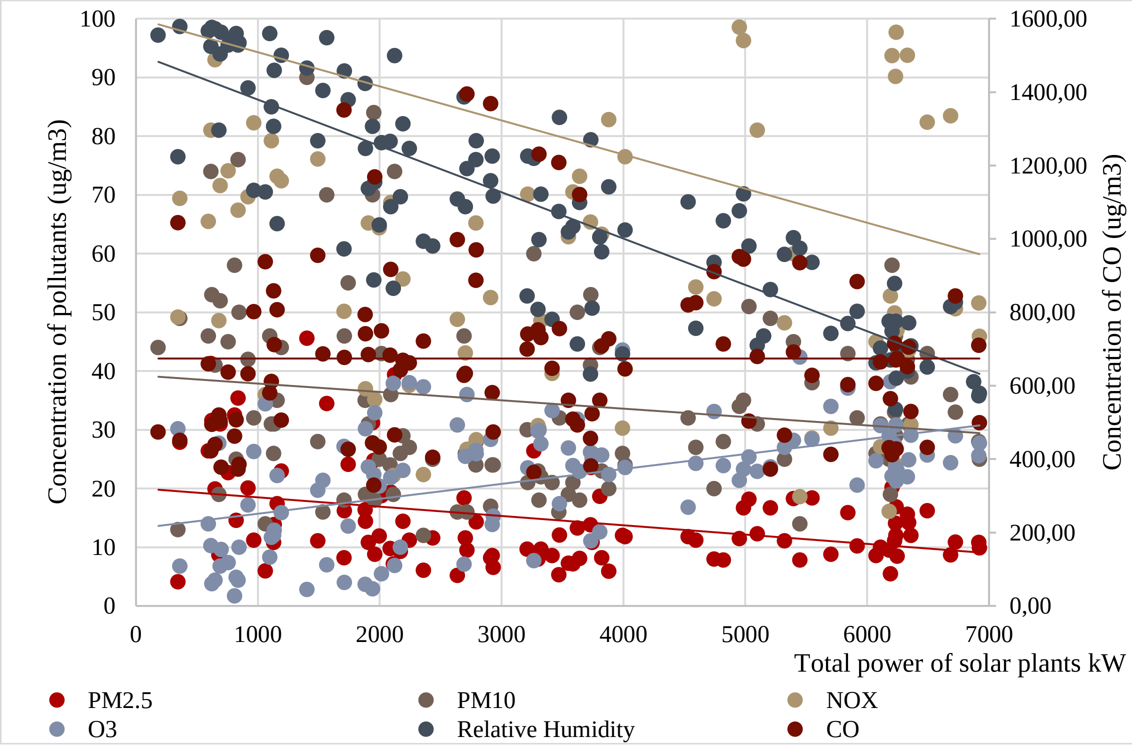

Figure (9) Performance of solar plants in Hungary in the relation of pollutants

SUMMARY

The concentration of air pollutants of Hungary decreased due to the road traffic stop, however, one and a half months after the lockdown, the air in the Carpathian Basin is still not reduced to a greater extent, because the topography of the country allows only a slow cleansing.
From the point of view of the health of the population of Hungary, it would be very important if the achievements in the field of air purification could be maintained even after the start of the economy with financial support invested in transport greening.
Due to the topographic and weather conditions, every investment made in Hungary to reduce emissions and make transport greener pays off twice.

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USING DRONES ON 3D MODELLING AND IDENTIFYING ENVIRONMENTAL DAMAGES IN OPEN CAST MINING

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Abstract: *The Drone technology recently has many applications. One of its very popular applications is in geology and mine field. This paper presents a case study on 3D modelling of the open cast mine in Progër - Bilisht, Albania using Drone technology. This open cast mine is located on the south east of Albania, close to Korça city. The main mineral is limestone. The altitude various from 951m to 895m. The destination of this mineral is the construction industry, cement and lime production. The yearly production capacity is around 30,000 m^3 per year. The paper gives a brief explanation of the methods and materials used to create a 3D model in mining. The method used to make a 3D model and indentify the environmental damages in open cast mine is using Drone technology. Final result of the Data processing is 3D Model of Progër – Bilisht open cast mine which can be rotated, and zoomed in any direction giving the possibility to check details of the opencast mine, to measure distances, angles, surface and volumes. Furthermore the paper gives conclusions and recommendations. One of the most important conclusions is that using Drones is very easy, and cost less way to collect data, which can elaborate with different software to build 3D models. From the other side the environmental damages must be considered through reforestation of the area.*

Keyword: *Open cast mine; 3D modelling; Drones*

INTRODUCTION

Drone technology is using more and more in different fields of the life. In geology and mine drones can be used to search and carry out processes related to exploration, exploitation and other processes. In exploration Drones help to predict the location of mineral deposits, oil and gas production, and so on. Drone technology provides realistic, measurable benefits in mining operations, reducing risk by increasing the speed and range of geo data collection. The history of using Drones in Albania it is not so old. Mostly they are using from amateurs, movie maker, etc. In the last 5 years drones started to be used also for topographic, geology, mine construction, roads and other purposes. On this paper we will discuss about the using Drone technology for 3D modelling of an opencast mining in Bilisht area in Albania.
The opencast mine of Progër - Bilisht is located on the south east of Albania, close to Korça city (Figure 1, 2). The altitude varies from 951m to 895m. The mineral exploited in this mine is the limestone. The destination of this mineral is the construction industry, cement and lime production. The yearly production capacity is around 30,000 m^3 per year. The system used for mineral exploitation is transporting it in a distance around 1km and depositing and processing further there. The exploitation system elements applied in this open cast mine are: height of the ladder h=5-10m; the width of the work area varies from 8-12m and

20-40m; Ladder escarpment angle 60˚-70˚; The width of the final ladder place is 4m.

Figure (1) Satelitte image of Open Cast Mine of Proger, Bilisht, Albania. [Source: Google earth]

Figure (2) View of area of elaboration of the limestone mineral

MATERIALS AND METHODS

3D Modelling of Progër, Bilisht open cast mine is done using the Drone technology. We used this method because using drone definitely increase number and improve the accurate of data in a very short time. Because stockpiles are irregular in shape it is difficult to estimate their volume with great precision using traditional methods such as GNSS surveying, but using Drone the calculation is more accurate. Using drones not only reduce the time and the cost, but from the other side the work of the surveyor's is more safe, without forced them to climb up and down stockpiles, or work in the middle of moving machinery.
Because the flight of drones can be realised, as many times as, we want, we can update our data very easily every week or month. Because the data are updated more frequently is easier to administer the opencast mine in better way. In the transport, and machinery moving, because the visual view is clear is very easily to make better design of roads and machinery moving. As it is known the risk of natural disaster like water flood, disruption, etc are always present in opencast, and worker's safety is high priority. Drones can help to prevent these danger activities through 3D digital modelling produced by drone images. Flying frequently allows us to create a database over time, and monitor the progress every week or month.
One of the most important works in open cast mine is drilling and blasting. Both these processes can be better designed using 3D models of the areas where will be drilled or blasted. Inspection of the special points and area are very easy to be realised by drone. These models help accurately analyze the area to be drilled and calculate the volume to be extracted post blasting. This data allows us to better manage resources such as the number of trucks needed. A comparison against surveys taken before and after the blasting will allow volumes to be calculated more accurately. This improves planning for future blasts, cutting the cost of explosives, time on site and drilling.
Because data are collected very fast, just by connecting in a laptop, and using different software we can

create and generate different maps like: *Orthomosaic maps*, where distance, and surface can be measured; *3D point cloud*, where each point contains geospatial (X, Y, Z); *DTM (Digital terrain model*) where each pixel contains 2.5D information (X, Y, and Z values of the highest altitude). These models allow us to identify stockpiles and pit changes, and to model water flows and wall collapses; *3D Textured mesh* which can be used for inspecting unreachable areas, such as pits and slopes.
Very important aspect is the accurate of the measurements. Because drone capture thousands of data points for one stockpile, the accurate of Drones is higher than surveying with total stations and because of that it generate more accurate calculation of volumes and costs. Collecting data with a drone is up to 30 times faster than with traditional land-based methods, and does not require the presence of a surveyor on site. Over the long term, the costs of surveying and monitoring are substantially reduced.

The materials

Materials used to realize this work were: Topographic and geological map of the region; Satellite imagery; Instruments like Total Station and GPS for control points; Drone DJH Mavic Pro; Some software for data processing as Pix4D Discovery; AgiSOFT Software; 3D Survey Software; and Micromine.

Figure (3) Drone DHJ Mavic Pro [Source: https://www.dji.com/mavic]

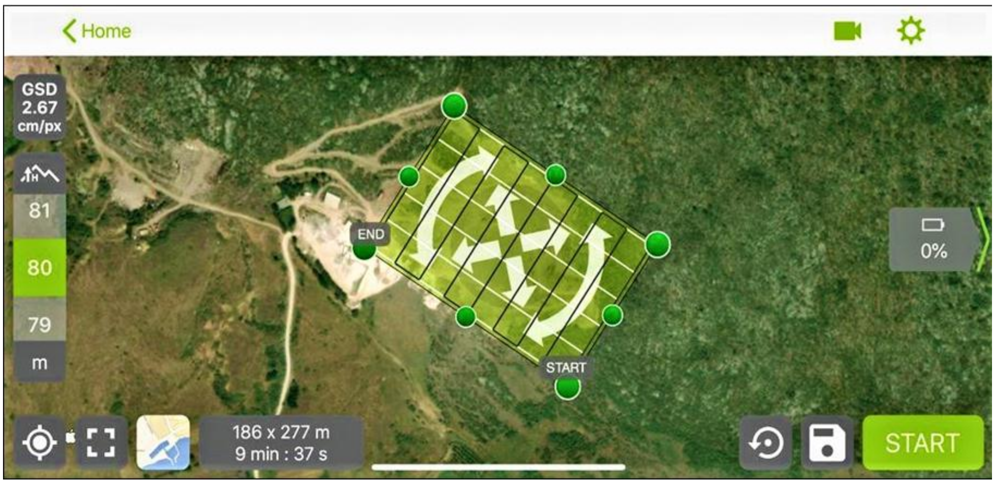

Figure (4) Flight path of the Drone

The methods

The method for building a 3D model of Progër – Bilisht open limestone cast mine was by capturing data in the field and processing them in office, manually and automated. Steps followed from data collecting to 3D model printing were:

[1] Control points defining;
[2] Flight path of the Drone designing base on the Google earth Satellite Imagery, and Maps of the area

(Figure 4);
[3] Data capturing with Drone DHJ Mavic Pro;
[4] Downloading data from Total Station, and Drone in computer;
[5] Data processing through the Pix4D Discovery program (Figure 5, 6).

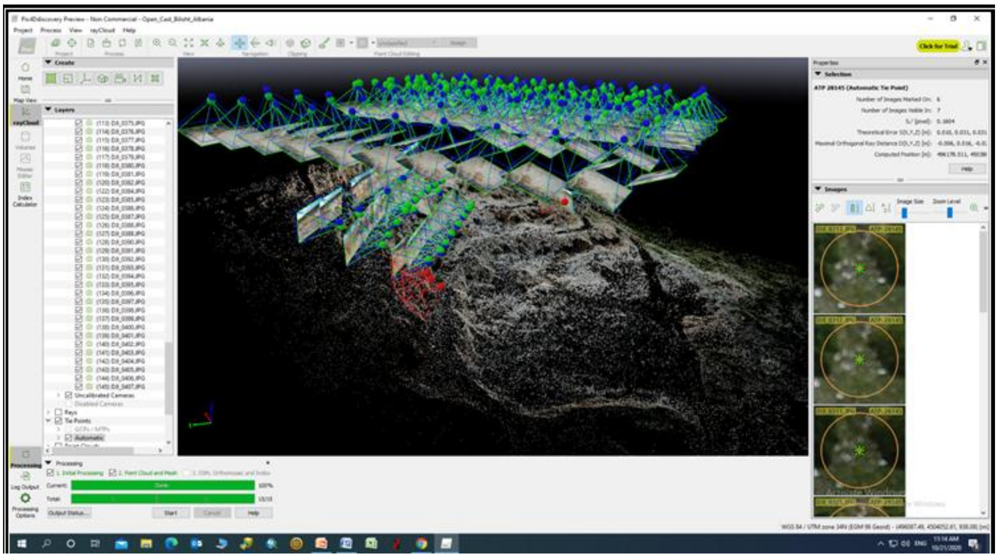

Figure (5) Tie Point view, and camera position

Figure (6) Photo of the opencast limestone mine by Drone

RESULTS AND DISCUSSION

Final result of the Data processing is 3D Model of Progër – Bilisht open cast mine (Figure 7), which can be rotated, and zoomed in any direction giving the possibility to check details of the opencast mine, to measure distances, angles, surface and volumes.
From the other side zooming in very high resolution create the possibility to discover problematic in stairs especially where very danger to inspect there. This model shown clearly all the opencast mine area, stairs, machinery, surrounding environment etc. This model is very good not only for view presentation but also for measurements and calculation taken. Through this model we can calculate volumes of the mineral stocks, height and width of the stairs, blast area, etc.

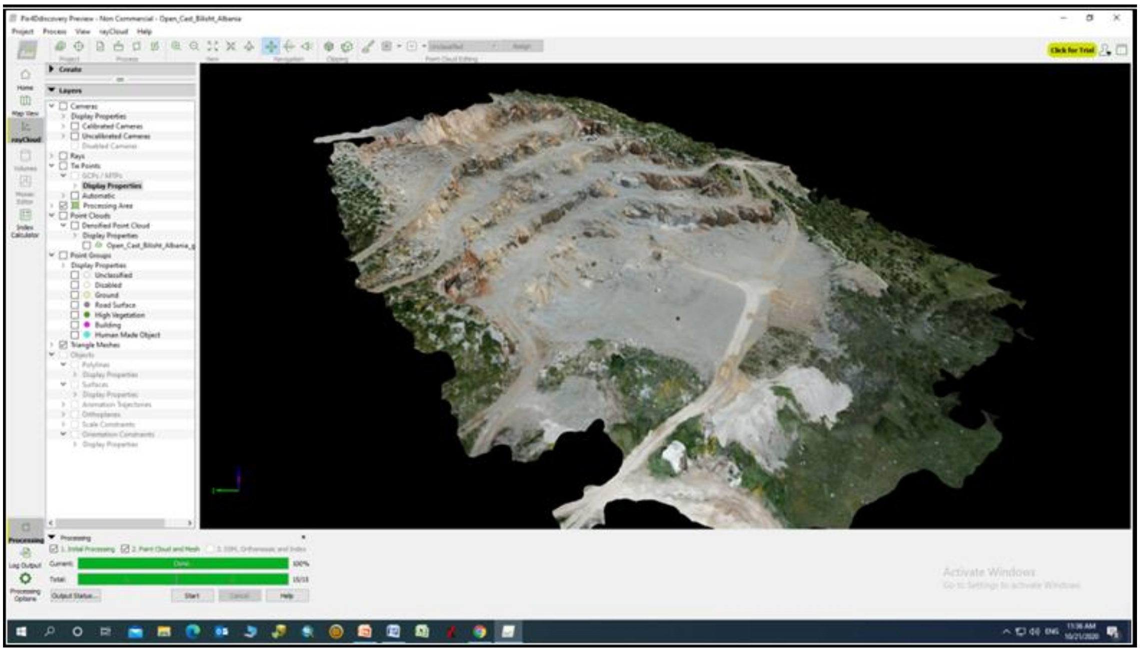

Figure (7) 3D model of the Limestone Opencast of Bilisht, Albania produced by Pix4D program.

As it can be seen through this program we are able to make different measure like distance, surface an volumes, but also we can classify different groups point as: Ground, Road surface, Vegetation, Building, humans, etc, (Figure 8). We can also have different type of view like: Tie Points (Figure 5).

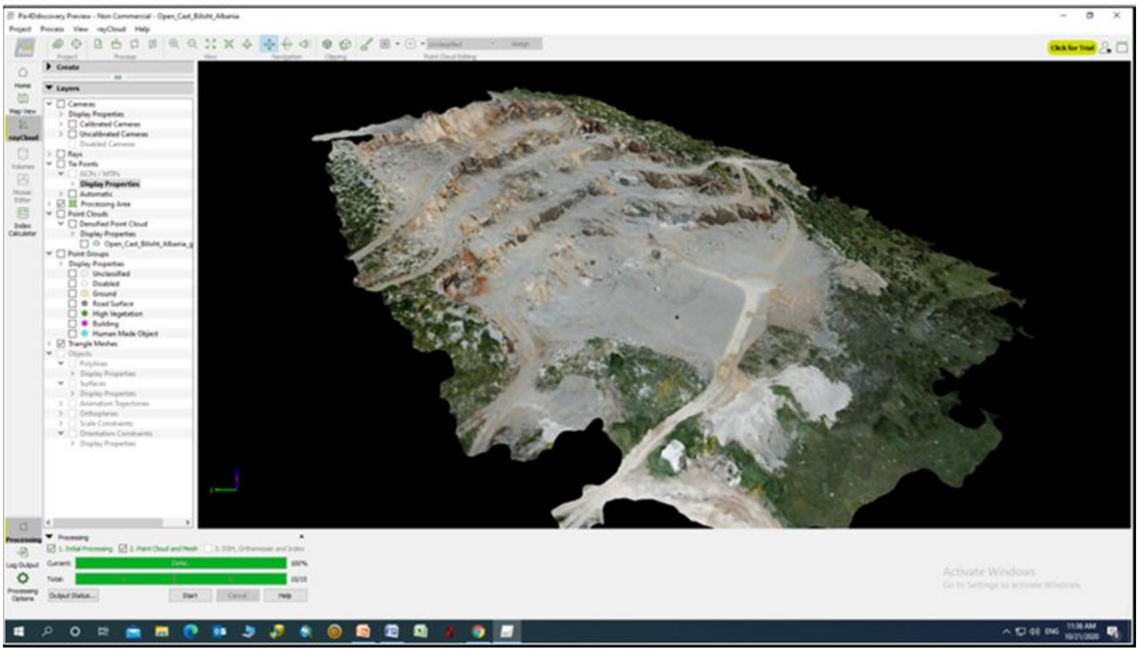

Figure (8) Measurements of distance, surface and volums in PixD4 program

The environmental damages are shown in Figure 9. There are presented two polygons showing the situation in 2006 and in 2020. As it can be seen in 2006 there were only 0.77 Ha damaged by the open cast activity. In 2020 there are 6.27 Ha. The mainly damages are in forestry and air pollution because of the enrichment plant of the mineral there. The calculation of damages are done comparing the satellite image of 2006 and 2020, also the real situation photographed by Drone

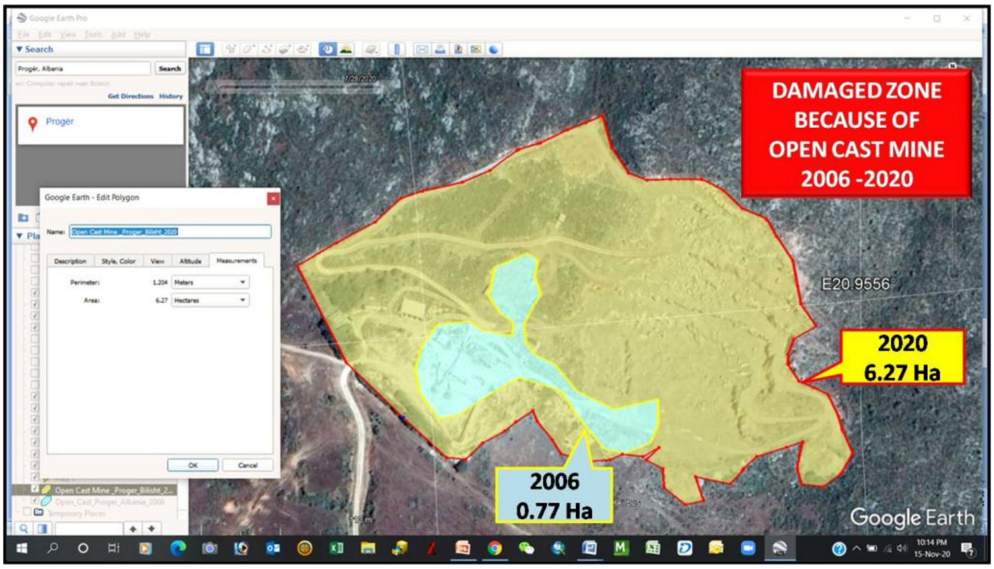

Figure (9) Damaged area because of open cast mine activity

CONCLUSIONS AND RECOMMENDATIONS

- The using of Drones in 3D modelling in geology and mine is still in beginning in Albania, but very fast it will be spread in most of the mine sites;
- Using Drones is very easy, and cost less way to collect data. These data can be elaborated with different software making different analyses and building 3D models. The Drone can offer views of danger areas for the human staff;
- Pix4Ddiscovery program is very easy to use, it offers many possibilities to act and interact in the object making different measurement and design;
- The accuracy achieved by drone is enough good for the purpose of 3D modelling and environmental issues;
- Using Drones in Albania needs a clear legislation, because recently this legislation is missing. It is recommended to start the work for a full legislation according of the European Directive;
- It highly recommended using drones in all opencast mining. Drones can be chosen according of the goals and objectives;
- From the environmental view, it is recommended to make the necessary rehabilitation of the area, planting tree on the open cast steps, also to make necessary protective measures from the the dust produced from the machines.

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IN VITRO STUDIES ON SIDE-EFFECT OF SOME INSECTICIDES ON THE GROWTH OF N_2-FIXING ROOT-NODULE BACTERIA

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Abstract: *Globally, the consumption of nitrogen (N) fertilizer- is significantly increased day after day. The biological N_2-fixation is the main source of N input in agricultural soil. However, international emphasis on environmentally sustainable development with the use of renewable resources is likely to focus attention on the potential role of biological N_2-fixation in supplying N for agriculture. Several environmental conditions are limiting factors to the growth and activity of the N_2-fixing root nodule rhizobia. One of the most important and potentially limiting factors to biological N_2 fixation is the use of pesticides including the insecticides. The objective of the study is to investigate the adverse effect of insecticides on N_2-fixing rhizobia. Experiments were conducted to study the impact of seven insecticides [Anthio 33 EC (Formotion (33%), Sevin 85 WP (Carbaryl (85%), Rogor L-40 (Dimethoate (40%), Thiodan 50 WP (Endosulfan (50%), Phosphotion (Malathion (50%), Lannate 20 L (Methomyl (200 g/l), Pirimor 50 DP (Pirimicarb (50%)] on the growth of seven strains of N_2-fixing root-nodule rhizobia (four strains belonging to Rhizobium leguminosarum, one strain belonging to R. phaseoli, one strain belonging to R. trifolii and one strain belonging to R. loti) in vitro by measuring optical density. The rhizobial strains were grown in yeast extract mannitol broth medium treated each with different concentrations (0, 0.1, 1, 10, and 100 mg/litre of active ingredient) of each insecticide and incubated for 48 hours in microfermentor at 28°C. The results illustrated that Phosphotion and Sevin had an adverse effect on the growth of the investigated rhizobial strains, whereas Thiodan was safe to these rhizobial strains. Whereas the strain Lóbab Z of R. leguminosarum was the most tolerant and R. trifolii Ló133/64 was the most sensitive one among the tested strains. The adverse effects of insecticides on rhizobia were observed at concentrations not normally expected to occur under field conditions. For further task, it is required to investigate the adverse effects of these insecticides on nodulation and N_2-fixation capacity of specific host plants with their rhizobia in pot and field experiments as well as other vital microbial processes in a wide range of soils.*

Keywords: *Insecticides, N_2-fixation, root-nodule bacteria, rhizobium, relative growth*

INTRODUCTION

A tremendous amount of anthropogenic nitrogen (N) fertilizer has been applied to agricultural lands to sustain crop production all over the world. However, inappropriate N management applications have caused numerous ecological and environmental problems. Rather than anthropogenic nitrogen fertilizer, biological nitrogen fixation is more emphasized on supplying N for agriculture.
The main problem of using pesticides including insecticides is that the amount of applied pesticides which

actually reaches the target organism is about 0.1 % and the rest usually ends up contaminating the soil ecosystem. [1] Invention of pesticides and insecticides has also promoted crop production by controlling the pests effectively which has also had negative impacts on environment due to its xenobiotics characteristics. The negative impact of these chemicals on the soil environment and their processes has received more attention and has been described by many researchers. [2] Recent studies show that the applied pesticides may harm the natural microorganisms, disrupt soil ecosystem, and which eventually may affect human health by entering in the food chain.

Soil has its beneficial microorganisms and their associated biotransformations. Soil microorganisms have the ability to perform biochemical transformations of different elements like nitrogen (N), phosphorus (P), sulfur (S), and carbon (C). Pesticides and insecticides may directly or indirectly has an effect on the important biochemical reactions such as mineralization of organic matter, nitrogen fixation, nitrification, denitrification, and ammonification by activating/deactivating specific soil microorganisms and/or enzymes. [3] The fact that information on possible effects of pesticides on all biochemical processes is sparse proves that it deserves more emphasis from the researchers. The legume–rhizobia symbiosis has distinctive role in agriculture and it results in huge quantities of nitrogen fixation throughout the world and any adverse effect on rhizobia results in decreased rates of biological nitrogen fixation. The activity of the N_2-fixing root nodule rhizobia is limited by many factors such as increased use of pesticides and insecticides. [4] Some pesticides can be detrimental to N_2-fixing bacteria. It slows down the nitrogen fixation process in bacteria and reduces the bacterium's respiration rate which later prevents its positive effects. By infecting the roots of legumes, rhizobia bacteria can form nodules where N_2 fixation occurs. [5]

This research focused on finding out how these seven insecticides may have effect on growth of root nodule rhizobia strains namely *R. leguminosarum* strains, *R. phaseoli*, *R. trifolii*, and *R. loti* in a field condition.

MATERIALS AND METHODS

An *in vitro* experiment was carried out to evaluate the response of four *Rhizobium leguminosarum* strains and each strains of *R. phaseoli*, *R.trifolii*, *R.loti* mentioned in Table (1) originated from different soil types to seven insecticides mentioned in Table (2) using microfermentor technique.

The microfermentor technique was carried out as following: Insecticides were applied at four concentrations (0.0, 0.1, 1.0, 10, and 100 mg/l). These range of concentrations was tested in 5 ml yeast extract mannitol (YEM) broth medium inoculated with 125 µl bacterial suspension of cell density (10^6 CFU/ml).

Sterilized, defined yeast mannitol broth medium [6] contains the following ingredients in 1 litre of distilled water: yeast extract 1 g, mannitol 10 g. The growth was measured at 550 nm from a shaken culture using a Sanyo-Gallenkamp SP50 spectrophotometer U.K after 48 hours incubation in rotary shaker (150 rpm) at 28°C.

Table (1) Detailed data on tested Rhizobium strains

<table>
<tr><th>Rhizobium strain</th><th>Laboratory code</th><th>Host plant</th><th>Origin</th></tr>
<tr><td rowspan="4">R.Leguminosarum</td><td>HB-3841^{str+}</td><td rowspan="4">Vicia faba</td><td>Libya</td></tr>
<tr><td>E 1012</td><td>England</td></tr>
<tr><td>Lóbab Z</td><td rowspan="5">Hungary</td></tr>
<tr><td>Bükköny 75/4</td></tr>
<tr><td>R.phaseoli</td><td>Feryol 1/4</td><td>Phaseolus vulgaris</td></tr>
<tr><td>R.trifolii</td><td>Ló 133/64</td><td>Trifolium pratense</td></tr>
<tr><td>R.loti</td><td>Baltacim-3</td><td>Onobrychis viciifolia</td></tr>
</table>

Table (2) Detailed data on inoculated insecticides [7]

Commercial names	Active Ingredients	Active Ingredients	Molecular Formula
Anthio 33 EC	Formothion	33%	$C_6H_{12}NO_4PS_2$
Sevin 85 WP	Carbaryl	85%	$C_{12}H_{11}NO_2$
Rogor L-40	Dimethoate	40%	$C_5H_{12}NO_3PS_2$
Thiodan 50WP	Endosulfan	50%	$C_9H_6Cl_6O_3S$
Phosphotion	Malathion	50%	$C_{10}H_{19}O_6PS_2$
Lannate 20L	Methomyl	200g/L	$C_5H_{10}N_2O_2S$
Pirimor 50DP	Pirimicarb	50%	$C_{11}H_{18}N_4O_2$

RESULTS AND DISCUSSION

The results were presented as relative growth rate of control tubes.The results from this study provide critical baseline information for further examinations to optimize the growth of these root nodule N_2-fixing bacteria. Figure (1) summarizes the average growth of all strains by each insecticide effect, Phosphotion and Sevin 85 WP had an adverse effect on all strains. To contrast, Thiodon 50 WP, Piriimor 50 DP were safer to use.

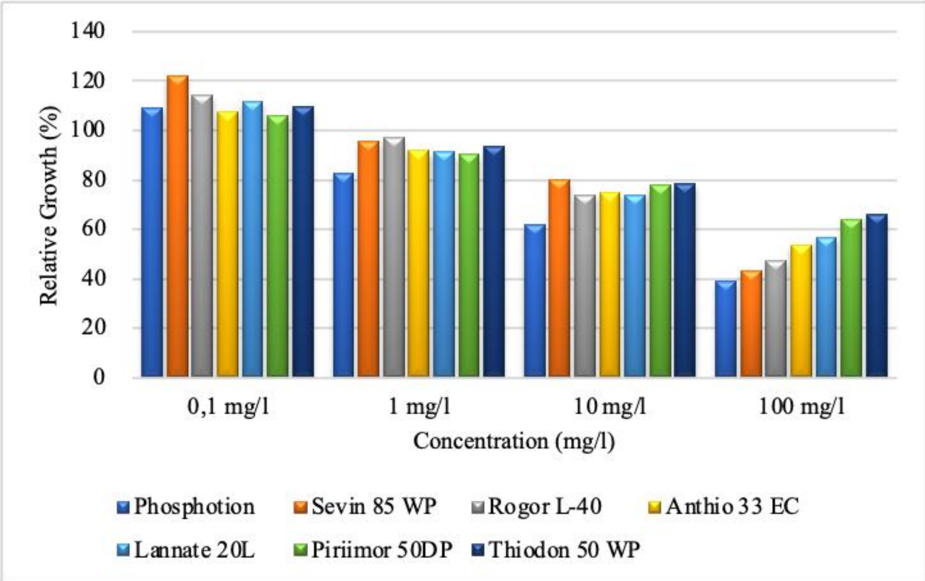

Figure (1) Average relative growth of all strains for each insecticide

Figure (2) shows that Lóbab Z has showed tolerance against Sewin 85 WP insecticide, Ló 133/64 was the sensitive one. Overall, there are huge differences between the growths of each strain at each concentrations, it indicates that sewin 85 WP had *the most* adverse effect on root-nodule bacteria.

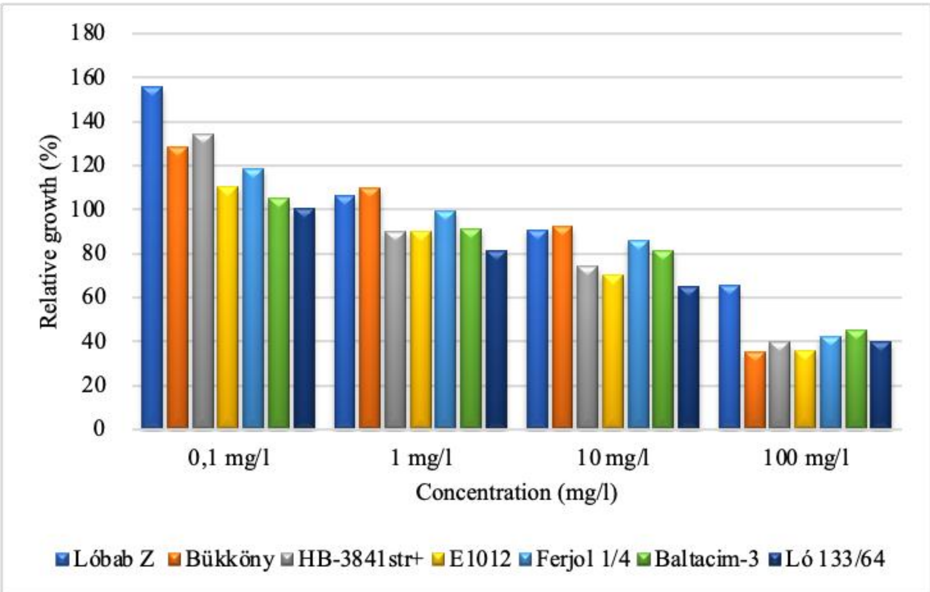

Figure (2) Relative growth of each strain for Sewin 85 WP insecticide

Figure (3) shows the effect of Thiodon 50 WP insecticide on the different strains. Bükköny and Ferjol 1/4 showed bigger growth while this insecticide was harmful for strains Ló 133/64, E1012, Baltacim 3.

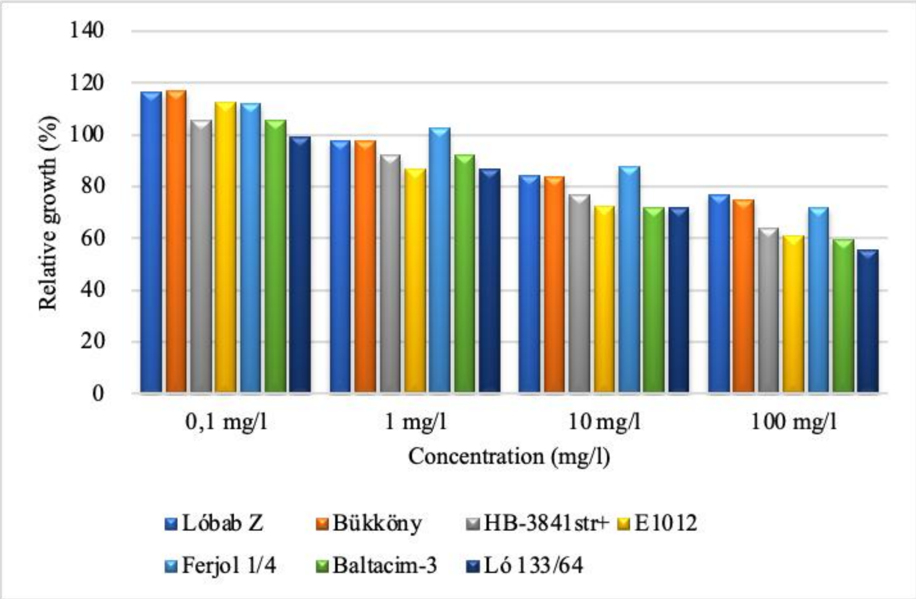

Figure (3)10 Relative growth of each strain for Thiodon 50 WP

Nevertheless, the insecticides used for aphid control may cause adverse effects on non-target organisms. [8] It is concluded that *Rhizobium* strains vary in their sensitivity to the insecticides. The Lóbab Z strain (isolated from Hungarian soil) proved to be broad-tolerant (the most tolerant) to most of the insecticides investigated, Bükköny 75/4 (Hungarian) and HB 3841 (Libyan) strains were the following tolerant strains. Strain E1012 (of English origin) was relative sensitive strain which depended on the toxicity of insecticides. Thus, it can be said that insecticides react differently with the strains depending on their toxicity and concentration. It was found that Thiodon 50 WP, Piriimor 50 DP were the least toxic, compared with Phosphotion, Sevin 85 WP being the most toxic. Rogor L-40, Anthio 33 E, Lannate 20 L have moderately influenced strain survival and reproduction.

These results provided a partial explanation of the compatibility of *Rhizobium* strains and insecticides under laboratory conditions. As mentioned earlier, any adverse effect on legume-rhizobia symbiosis results in reduced rates of biological N_2-fixation which counts and contributes more than artificial nitrogen supply. Therefore, the research with definite results and comparison to show how insecticides and pesticides affect this bacteria and its N_2-fixation process by decreasing the bacterium's respiration rate should be carried out in the future.

There is a significant impact of pesticide contamination in soil ecosystem. The applied insecticides affect the growth, survival, and working capacity of symbiotic rhizobial associationwith roots of legume plants resulting in dwindled atmospheric N_2-fixation [9].

The antagonistic interaction between the applied insecticides and symbiotic N-fixers differ with the specific chemical group of insecticide and the specificN_2-fixer group. However, the field recommended doses of these chemicals had little effect on symbiotic N-fixing bacteria [10]. Consequently, the soil receives the bulk of complex agrochemical compounds, several of which are poisonous to the activity of non-target beneficial soil micro-organisms [11].

More than 95% of the applied herbicides and 98% of insecticides reach non-target soil micro-organisms than their target pest, as they are sprayed proportionately across the entire field, irrespective of the affected areas [12].

The application of insecticides chlorpyrifos, imidacloprid, cypermethrin, endosulfan and carbofuran under field conditions causes considerable variation in soil bacterial populations [13]. Among the applied insecticides, chlorpyrifos has the most destructive effect on soil bacterial diversity. The residues of insecticides, when applied at field-recommended rates, do not cause any harmful influence on the nitrification [9].

However, it is the prolonged use and the amounts of such insecticides that cause concerns. Nevertheless, at higher rates, it inhibits the process of nitrification and microbes involved in it [11].

Some insecticides have a neutral effect on ammonification (e.g., superacids (25 and 500 g/ha) and nuvacron (100 and 600 g/ha) did not affect the ammonification process but is significantly reduced at higher

concentrations of 1000 g/ha and 750 g/ha, respectively under controlled laboratory conditions [14]. Similarly, insecticides belonging to the chemical group of organophosphates (i.e., dimethoate, diazinon, chlorpyrifos, quinalphos, and malathion) inhibit the growth and population of soil bacteria [99].
Hence, it was reviewed that (1) the impact of various agrochemicals on the soil microbial diversity and environment; (2) the importance of smallholder farmers for sustainable crop protection and enhancement solutions, and (3) management strategies that serve the scientific community, policymakers, and land managers in integrating soil enhancement and sustainability practices in smallholder farming households. The current review provides an improved understanding of agricultural soilmanagement for food and nutritional security. [15]

CONCLUSIONS AND RECOMMENDATIONS

This study was designed to evaluate the effects of seven insecticides in vitro on the growth rate of seven rhizobial strains of N_2-fixing root-nodule. The adverse effects of insecticides on rhizobia strains were observed at concentrations not normally expected to occur under field conditions. From this study, it can be concluded that the results obtained under in vitro experiment show the sensitivity of the studied *Rhizobium* strains to chosen insecticides. It is evident that accumulations of high insecticide concentration are more destructive to rhizobia bacteria as compared to less concentration. Scientific studies on strain tolerance of *Rhizobium* and their reproduction is not widespread. Therefore, more investigations should be carried out using different techniques and other species of symbiotic N_2-fixing bacteria. What other factors affect the strain tolerance towards any kind of pesticides and how insecticides specially affect N_2-fixing bacteria should be studied as well in order to understand the relationship between the genes and symbiotic genes.

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MODELLING OF THE SIMULTANEOUS CONVECTION-DIFFUSION PROCESS THROUGH POROUS MEDIA WITH PERCOLATIVE-FRACTAL CHARACTER AT PRESENCE OF ANOMALOUS DIFFUSION

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Abstract: *Soil contamination with organic pollutants is one of the most serious environmental problems that can cause very serious threats to population and the environment. Therefore, the both experimental-, and modelling type investigation of such very complex-type transport processes are, and will be of crucial importance in the future, too. In agreement with the recent most advanced simulation methods, in the present work all results are realized on the base of the extended irreversible thermodynamics. A novel-type analytical solution is proposed for simultaneous convection-diffusion processes taking place through porous media. It is shown that the Riccati-type ordinary differential equation, frequently applied at modelling of the simultaneous convection-diffusion type processes, may be interpreted in a more general manner, as it has been done. The new modelling results are compared to the earlier analytical solutions and their relevance for accurate future modelling of such types of drying processes is also discussed. The completely novel-type solution of the problem indicated is realized in Lagrangian representation of continuum mechanics by extensive use of the MAPLE symbolic computer algebra system.*

Keywords: *Non-equilibrium thermodynamics; convection flow; anomalous diffusion; computational fluid dynamics*

INTRODUCTION

It is known, that in the contemporary theories of coupled transport processes through porous media methods of both non-equilibrium thermodynamics [1] and many ones from the confident, well-established results of the contemporary theories of critical phenomena relevant for percolative systems [2,3,4] should simultaneously be taken into account. Although many of these methods have also been applied in the contemporary modelling and simulation problems, there are further possibilities for their common new applications, to which our work is devoted, too. Particularly, the actual states of the different types of environmental problems require continuous improvement of the relevant complex transport models founded earlier. Besides, the direct determination of the corresponding characteristic material flow patterns is of crucial importance in this sense. Accordingly, in the present study, the newest confident methods of the non-equilibrium thermodynamics will be taken into account, as the most important ones.

METHODS

The basic PDE for modelling of the convection-diffusion problems is [5]:

$$\frac{\partial c}{\partial t}-\nabla\left(D(c)\nabla c\right)+\frac{dK}{dc}\cdot\frac{\partial c}{\partial z}=0, \tag{1}$$

where c(r,t) denotes the concentration distribution function, D(c,T) is the thermodynamically state-dependent diffusion coefficient, K(c) is the concentration-dependent hydraulic conductivity coefficient and z-axis corresponds to the direction of the gravitational acceleration. The general solution of the basic problem for a large class of convection - type transport processes through porous media can be suitably explained by the sums [5]:

$$\begin{gathered} c(\zeta)=a_0+\sum_{i=1}^{q}\left(a_i\cdot\omega^{i}+b_i\cdot\omega^{-i}\right), \\ a_0,a_i,b_i=\text{const.},(1\le i\le q),q\in\square \end{gathered} \tag{2}$$

and it is explained by use of D'Alembert-type independent variables $\zeta := x - v\cdot t$ (with a constant value "v" of the convection flow velocity). The physical meaning of the formula (2) is, that it gives analytical solution of the basic convection-diffusion equation (1) in the form of multiple travelling waves. Furthermore, simultaneous presence of convection and e.g. diffusion may also lead to appearance of wave-type transfer processes e.g. [6], it is also necessary to model drying processes from this point of view, too. Together with convection, the presence of anomalous diffusion [1,2], characteristic for genuine percolative-fractal systems is also taken into account in this study.

RESULTS AND DISCUSSION

The functions of the separate modes entering (2), must obey the Riccati-type ODE:

$$\frac{d\omega}{d\zeta}=\omega^2+k, \tag{3}$$

with "k" as a parameter depending on the actual experimental conditions [8]. The solutions of this basic convection-diffusion problem may be even of solitonic type. In order to realize our modelling work, we specify the eq. (3) as follows:

$$\omega'=\omega^2+k\rightarrow\omega'=\omega^2+\sum_m a_m(p)\zeta^m, \tag{4}$$

i.e. the coefficient *k* has been replaced here by $\sum_m a_m(p)\cdot\zeta^m$, where the series expansion coefficients are also assumed to be of stochastic character, due to the genuine percolative-fractal character of the dried bulk porous material to be observed at mesoscopic level [7]. Then, it is necessary to extend the calculation method applied, in order to open possibility for including further terms beyond the "dominant term" into the general modelling procedure we are developing, i.e. by

$$\frac{d^2\omega}{d\zeta^2}-a_n(p)\cdot\zeta^n\cdot\omega(\zeta)=a_r(p)\cdot\zeta^r. \tag{5}$$

Therefore, we may directly apply the well-known basic general formula for solving the relevant inhomogeneous second-order ODE (6), and by this way we obtained (using [8]):

$$\omega(\zeta)=C_1\sqrt{\zeta}\cdot J_{\frac{1}{n+2}}(\xi)+C_2\sqrt{\zeta}\cdot N_{\frac{1}{n+2}}(\xi)+$$
$$+\zeta^{\frac{1}{2}}\cdot J_{\frac{1}{n+2}}(\xi)\times\int\frac{(-1)\cdot a_r(p)\cdot\zeta^r\cdot N_{\frac{1}{n+2}}(\xi)d\zeta}{J_{\frac{1}{n+2}}(\xi)\left[\zeta^{\frac{1}{2}}N_{\frac{1}{n+2}}(\xi)\right]'-N_{\frac{1}{n+2}}(\xi)\left[\zeta^{\frac{1}{2}}J_{\frac{1}{n+2}}(\xi)\right]'} \tag{6}$$
$$+\zeta^{\frac{1}{2}}\cdot N_{\frac{1}{n+2}}(\xi)\times\int\frac{a_r(p)\cdot\zeta^r\cdot J_{\frac{1}{n+2}}(\xi)d\zeta}{J_{\frac{1}{n+2}}(\xi)\left[\zeta^{\frac{1}{2}}N_{\frac{1}{2}}(\xi)\right]'-N_{\frac{1}{n+2}}(\xi)\left[\zeta^{\frac{1}{2}}J(\xi)\right]'},$$

where a new independent variable defined by $\xi:=\dfrac{2\sqrt{-a_n(p)}}{(n+2)\cdot\zeta^{-\left(\frac{n}{2}+1\right)}}$ has been applied. Then, the whole procedure applied here may be continued by taking into account gradually further terms from (4), having „less-dominant" character compared to the previous ones. In order to present our own new modelling results in this area (based on [8]), which already belong to the Extended Irreversible Thermodynamics (EIT), we will here firstly recall the crucial generalization of the basic linear parabolic-type PDE describing the diffusion processes (and corresponding to the choice q = 2 in the relevant expression given below):

$$\frac{\partial c}{\partial t}=D\cdot\frac{\partial^2}{\partial x^2}c^{q-1}(x,t)\Rightarrow c(x,t)=t^{-\frac{1}{q}}\cdot f\left(\xi=x\cdot t^{-\frac{1}{q}}\right). \tag{7}$$

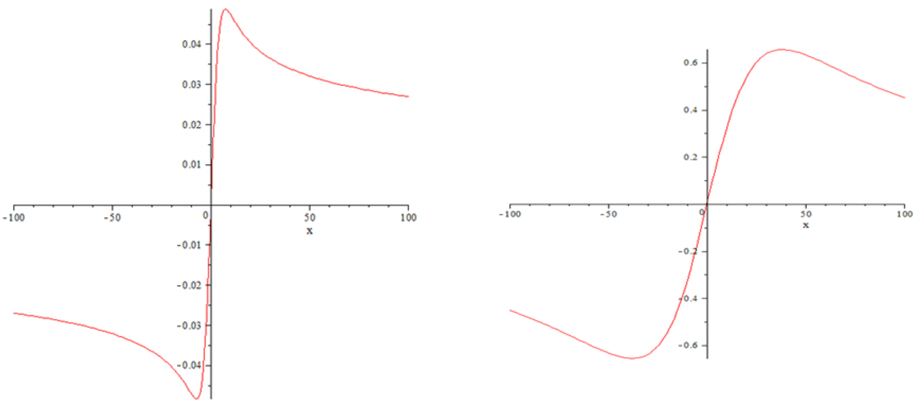
Then, the following two basic types can be recognized distinguished [1]:
Superdiffusion:

$$q > 2\Rightarrow f(\xi)=B\left(A^2-\xi^2\right)^{\frac{1}{q-2}},A=A(q),B=B(q), \tag{8a}$$

and subdiffusion:

$$q < 2\Rightarrow f(\xi)=B\left(A^2+\xi^2\right)^{\frac{1}{2-q}},A=A(q),B=B(q). \tag{8b}$$

In these new distribution function expressions the novel-type functions A = A(q), B = B(q) have also been introduced, in order to give mathematically correct modifications of the initial, classical-type distribution functions applicable in the case of the anomalous diffusion processes, too. Then, the following graphical presentations can be assigned to the e.g. supperdiffusive-type solution (9) for different values of finite-time moments (denoted in (9) by t_f) (Figure. 1(a-b)):



(a) (b)

Figure (2) Curvature characteristics of the superdiffusion solution functions represented for two different time moments t_f (in relative units)

CONCLUSIONS

In the present study a novel-type general method has been described for modelling of the simultaneous convection-diffusion processes taking place in bulk porous media. The relevance of the Riccati-type ordinary differential equation is accepted as a crucial mathematical background necessary for modelling of such types of complex transport processes. According to this novel-type algorithm for accurate modelling of the simultaneous convection-diffusion processes through bulk porous media, the possible problems appearing because of the inclusion of more than the first dominant convective term into the linearized Riccati's ordinary differential equation are also eliminated. Having solved this basic problem, we turned to incorporating of the relatively recently developed method of anomalous diffusion processes of the solution formulae and obtained completely new concentration distribution function expressions, which are of very promising and widespread applicable mathematical tools.

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SOIL MICROBIOME IN TRANSFORMED ECOSYSTEMS

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***Abstract**: The number and area of unauthorized landfills are increasing systematically and impact on forest ecosystems and their components. Pollution negatively affects soil microbiota. Landfills become a habitat for many pathogenic microorganisms, including antibiotic resistant bacteria. The structure of the soil, its physiological and biochemical properties change significantly, there are also qualitative and quantitative changes in the soil microbiota. Soil samples for analysis were taken from different unauthorized landfills. In the most contaminated areas, soil characterized a high number of pedotrophs 27.34 million CFU/g.d.s., which develop intensively on depleted soils, due to their trophic specificity; oligotrophs 16.43 million. CFU/g.d.s., which is an indicatorof reducing the content in the soil of nutrients, micromycetes 7.68 thousand CFU/g.d.s., this is due to the localization in the soil of plant residues, namelyfiber, in smaller quantities there is the presence of diazotrophs 33.60%, streptomycetes 2.34 million CFU/g.d.s involved in the decomposition of plant and animal residues in the soil and ammonifiers 10.09 million CFU/g.d.s. Comparative analysis shows that in more contaminated areas the number of nitrogen fixers, ammonifiers, streptomycetes, and bacteria that use mineral nitrogen decreases, respectively the number of oligotrophs, pedotrophs and myxomycetes that suppress them increases. This is the reason for the violation of the biodynamic balance of the processes of synthesis and destruction of organic matter and the availability of nutrients to plants. As a result, we observe the transformation of flora in the studied areas or lack of vegetation.*

***Keywords:** ecosystem, soil, microbiota, biocenosis, transformation.*

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SEAWEED EXTRACT TREATMENT ENHANCES VEGETATIVE GROWTH AND ANTIOXIDANT PARAMETERS IN SALT STRESSED *TRITICUM DURUM* L.

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***Abstract**: Nowadays, food security depends on the increased production of cereals such as wheat (Triticum durum L.) which is one of the main sources of calories and protein. However, crop production is severely affected by adverse environmental stresses such as salt stress (Rahaie and al., 2013). To limit the negative effet of salinity on plant growth, many methods have been used. A lot of research studies have shown the importance of liquid extracts obtained from seaweeds as foliar sprays for several crops to improve growth under adverse factors (Metha and al., 1967, Latique and al., 2014). The present study reports the result of wheat plants (Triticum durum L.) irrigated with either 2 or 4 g/l of saline solution (SS) by sodium chloride (NaCl) were treated with aqueous extracts of green macroalgae Ulva rigida (URE) in order to increase wheat salt tolerance. Seaweed treated plants showed higher ability to tolerate salt stress (2 or 4 g/l of NaCl) by significant (P>0.5%) increasing of photosynthetic pigments (Chlorophyll: Chlorophyll total, chlorophyll a and b types) contents. The increase of these contents was associated with increasing activities of antioxidant enzyme systems superoxide dismutase (SOD); phosphoenolpyruvate carboxylase (PEPC); glutathione reductase (GR); Glutamate dehydrogenase (GDH); glutathione peroxidase (GPx); glutathione-S-transferase (GST); Isocitrate dehydrogenase (ICDH). However, wheat plant exposed to salt stress showed significant changes in all growth parameter and antioxidant enzyme activities compared with that in plants irrigated with regular water. This study indicates that the algae extracts could be used as a promising plant growth enhancer for treating wheat plants irrigated with saline solution.*

***Keywords:** Antioxidant enzyme, food security, wheat plant, salt stress, seaweed extract, Ulva rigida*

INTRODUCTION

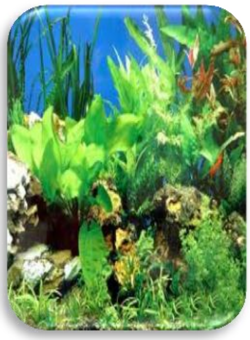
World agriculture is facing a lot of challenges like producing 70% more food for an additional 2.3 billion people by 2050 (FAO 2009).

Salinity is one of the most brutal environmental factors limiting the productivity of crop plants because most of the crop plants are sensitive to salinity caused by high concentrations of salts in the soil.

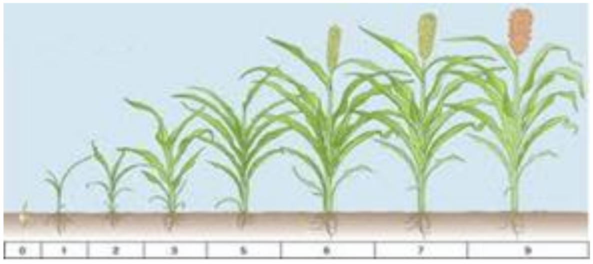
One of the most effective anti-stress compounds is seaweed extract which is a bio-stimulant that has been used as soil conditioner for improving plant growth (Hurtado et al. 2009).

Marine bioactive substances extracted from marine algae are used in agricultural and horticultural crops, and many beneficial effects, in the terms of enhancement of yield and quality have been reported (Blunden, 1991; Crouch and Van Staden, 1994).

Seaweed concentrates are known to cause many beneficial effects on plants as they contain: Growth promoting hormones (IAA and IBA, cytokinins) trace elements (Fe,Cu, Zn,Co,Mo,Mn and Ni), vitamins and amino acids;



Liquid extracts derived from marine algae have been used over the past forty years on a variety of crops to promote plant growth and development;



Interest in these seaweed concentrates (SWC) in agricultural systems has focused on their use as an inexpensive source of naturally occuring plant growth regulators.

tried to characterize Moroccan macroalgae species *Ulva rigida* collected from coastal area of Akhfenir in order to evaluate their potential to

Ulva rigida
Green algae

Triticum durum
Monocotyledone specie

Globally, wheat is within the second rank among the cultivated worldwide cereals crops after maize and rice (FAO.,2018)

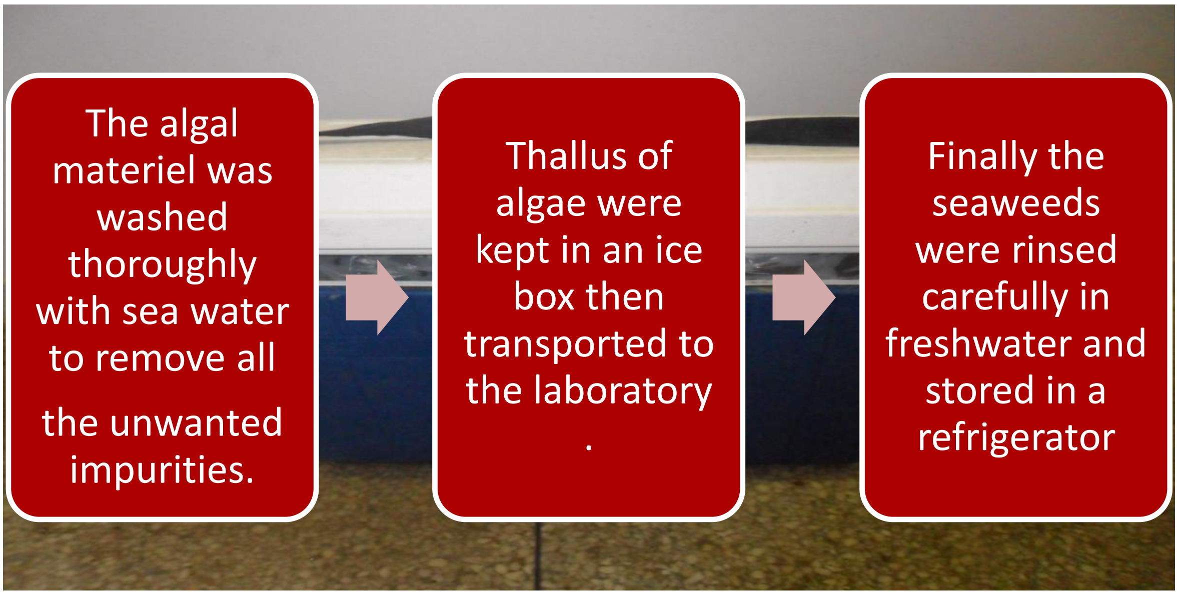
Considering the commercial importance of this plant, the physiological and biochemical effects of foliar seaweed application was analysed and therefore the results obtained on this aspect are presented in this communication.

MATERIELS AND METHODS

Collection of Seaweeds

Seaweeds "Ulva rigida belonging to the classes Chlorophyceae were hand picked from the coastal area of Akhfenir near to Laayoune city, Morocco, in March 2019.

Ulva rigida - Green algae



Preparation of Seaweed Liquid Fertilizers

- One kg of fresh seaweed material was cut into small pieces and boiled separately with a liter of distilled water for an hour and filtered through a double layered muslin cloth to remove debris (Sivasankari and al. 2006)
- The filtrate was taken as 100% concentration of the seaweed liquid extract
- Seaweed liquid extracts were prepared with differents concentrations using distilled water: 12,5%; 25% and 50%

RESULTS AND DISCUSSION

Ulva rigida Mineral elements composition

The mineral elements in the macroalgae are listed in Fig.1.

The means of macro elements showed that *Ulva rigida* is rich in Mg followed by K and Ca but low in Na and Cl.

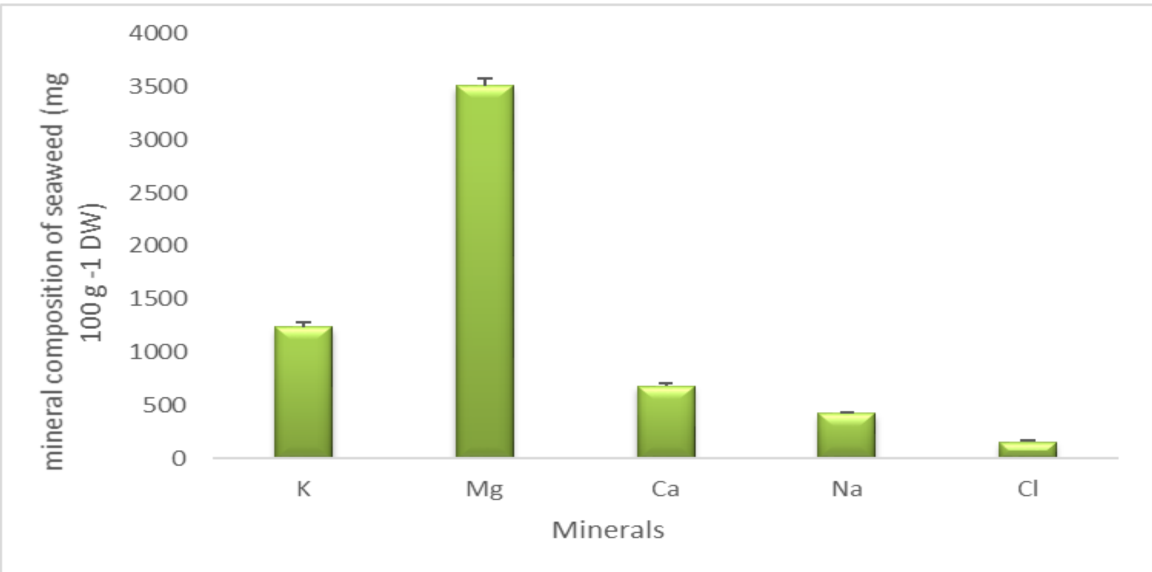


Figure (1) Mineral composition of Ulva rigida

Results are means ± S.D (n = 3) Different letters show statistically significant differences for P< 0.05.

Ulva rigida Amino Acids composition

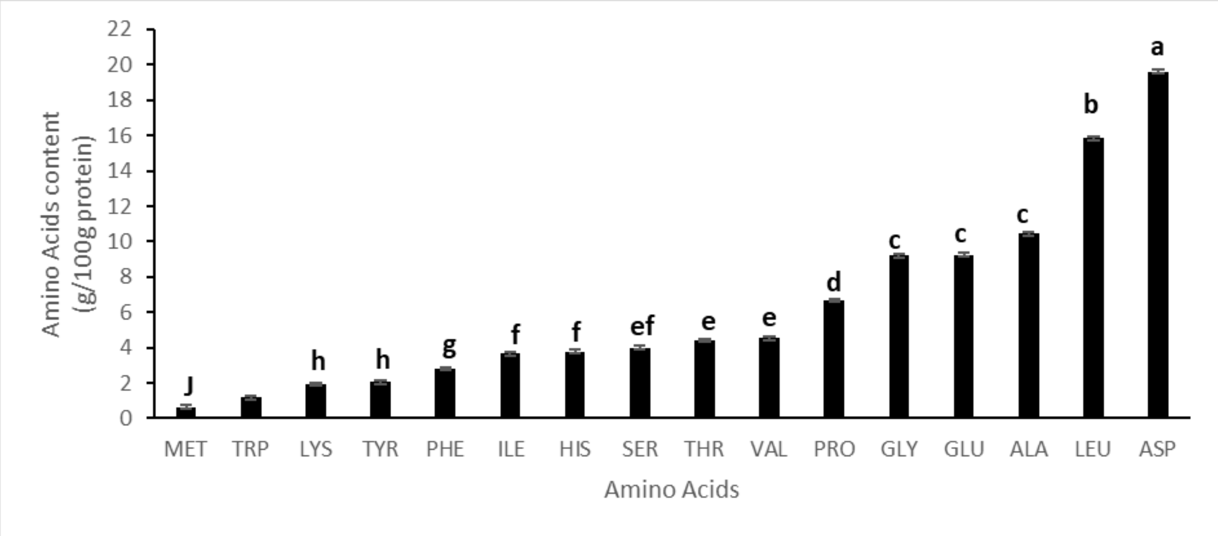


Figure (2) Amino acid content of Ulva rigida from Akhfenir coastal
Results are means ± S.D. Different letters in a single line show statistically significant differences for P< 0.05 level.

Plants Results

Table (1) The effect of Salt stress on shoot length (SL) and fresh weight (FW) of Triticum durum L. sprayed with SWE at P<0.05

	SL (cm)	**FW (g)**
B1 (0 $g.L^{-1}$ of NaCl/ 0 SWE)	$41.3+5.91^{a}$	$2.01+0.45^{a}$
B2 (2 $g.L^{-1}$ of NaCl/ 0 SWE)	$34.1+2.83^{b}$	$1.50+0.25^{ab}$
B3 (4 $g.L^{-1}$ of NaCl/ 0 SWE)	$33.14+1.56^{b}$	$1.05+0.03^{b}$
B4 (0 $g.L^{-1}$ of NaCl/ 12,5% SWE)	$39+5.65^{ab}$	$2.09+0.33^{a}$
B5(2 $g.L^{-1}$ of NaCl/ 12,5% SWE)	$38.9+2.3^{ab}$	$1.96+0.14^{a}$
B6(4 $g.L^{-1}$ of NaCl/ 12,5% SWE)	$38.7+4.08^{ab}$	$1.51+0.27^{ab}$
B7(0 $g.L^{-1}$ of NaCl/ 25% SWE)	$38+1.27^{ab}$	$1.98+0.01^{a}$
B8(2 $g.L^{-1}$ of NaCl/ 25% SWE)	$37.4+1.14^{ab}$	$1.89+0.35^{a}$
B9(4 $g.L^{-1}$ of NaCl/ 25% SWE)	$35.8+1.79^{ab}$	$1.89+0.47^{a}$
B10(0 $g.L^{-1}$ of NaCl/ 50% SWE)	$38.8+0.76^{ab}$	$1.97+0.22^{a}$
B11(2 $g.L^{-1}$ of NaCl/ 50% SWE)	$37.5+4.47^{ab}$	$1.62+0.32^{ab}$
B12(4 $g.L^{-1}$ of NaCl/ 50% SWE)	$37.5+1.87^{ab}$	$1.42+0.16^{ab}$

Results are means ± S.D (n = 3) Different letters show statistically significant differences for P< 0.05.

The foliar spraying effect of *Ulva rigida* liquid seaweed extract showed that 12,50% concentration increased significantly the growth parameters (SL/FW) of plant studied

RESULTS

A pot experiment was conducted at the greenhouse of Faculty of Sciences and Techniques of Tangier

4 weeks **8 weeks**

SaltTreatment **SaltTreatment+ SLE(%)**

Plants Results

The effect of the seaweed extracts, *Ulva rigida*, was also evaluated on the antioxidant system through the determination of enzyme activities such as SOD, GST and GR.

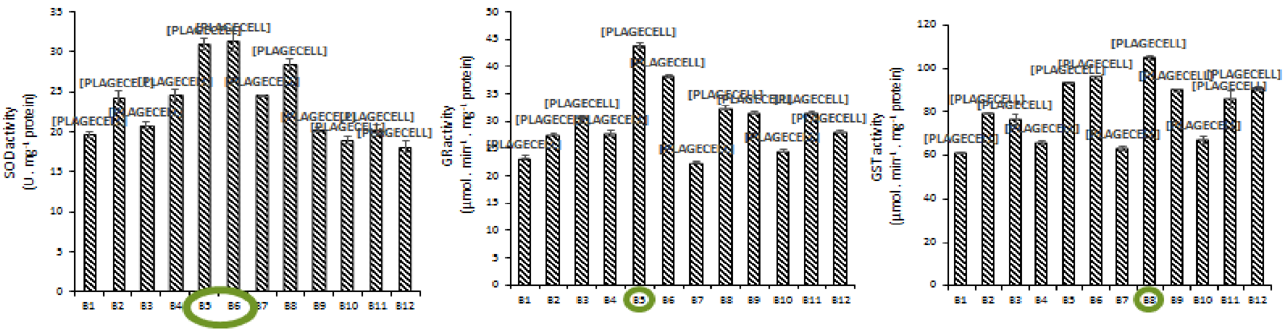


Figure (3) Effect of seaweed extract on leaves SOD, GR, GST activities of wheat plant.
Results are means ± S.D. Different letters in a single line show statistically significant differences for P< 0.05 level.

DISCUSSION

The seewead extract effect can be related to plant growth regulators:
Plant growth regulators alter cell division, root and shoot elongation, initiation of flowering, and other metabolic functions, whereas fertilizers supply minerals needed for the nutrition and normal growth of the plant .
Trace minerals present in seaweed extract may play a role in plant nutrition and physiology, probably as enzyme activators.
The beneficial effect of seaweed extract application is as a result of many components that may work synergistically at different concentrations, although the mode of action still remains unknown (Fornes et al., 2002).

PERSPECTIVES

The present investigations revealed that seaweed species were observed to be a potentiel sources of fertilizers;

The present findings encourage the application of such seaweeds as natural fertilizer in agricultural sector

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LABORATORY TEST FOR SAND BOIL FORMATION NEAR A FLOOD PROTECTION DIKE

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Abstract *The sand boil is the first stage of a piping failure of river dikes which may form in either free granular soil surface or in areas covered with a less permeable layer that is not thick enough to maintain a balance with water pressure if the water's exit speed exceeds a given value. The aim of the research is to see whether a laboratory model is capable to the examination of this phenomenon. The reason for it is the sand boil is starting at a hydraulic gradient much less than the critical value and it may be assumed that the equilibrium condition of individual grains forces may explain this. The model test is made using a simplified Hungarian river dike section where a fine sand layer is placed between the impermeable cover layer and the permeable subsoil. It can be clearly observed that while the flood occurs upstream, the stability of the fine sand grains at the downstream side is not ensured after the cover layer is cracking. The sand boil phenomena also appeared. This proved that a laboratory sandbox model is applicable to modeling and examining sand boiling with controlled circumstances.*

Keywords: *flood protection dike, sand boil, piping, sandbox model, hydraulic gradient*

INTRODUCTION

Hungary has the longest river dike system in Europe. Piping (Lampl, 1959, Nagy, 1993-2014) may form in either free granular soil surface if the exit speed of the upstream groundwater exceeds the critical value or can form in flood areas covered with a more or less clayey and watertight layer which is not thick enough to maintain a balance with water pressure, or if it has holes, cracks, so continuity gaps, caused by worms, plants or other conditions, so there are continuity gaps on which the water can break. Such unique piping can be successfully mitigated by surrounded bags ensuring a smaller hydraulic gradient (Figure 1). Dynamic effects due to triggering lateral spread of the downstream part apart from the upstream part, and the cracking of the cover layer may contribute to the development of pipe once the sand boil appears at the or close to the toe of the dike.

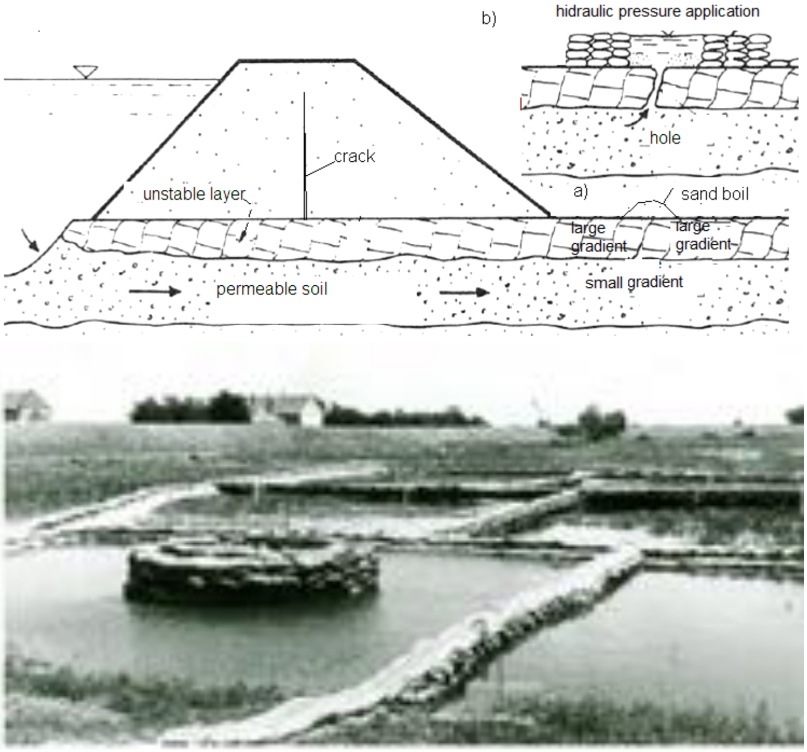

Figure (1) The piping phenomenon during flood at the Hungarian river dike system. (a) The formation of a sand boil due to the crack or a hole in the cover layer, (b) the treatment of the sand boil by decreasing the hydraulic gradient around the boil [after Galli, 1968]. ***Sand boil treatment by decreasing the hydraulic gradient***

However, there is a general experience that the sand boiling due to an upward flow can occur at much lower hydraulic gradients than the well-established theoretical critical hydraulic gradient value. Garai (2016) stated that this discrepancy results from the incomplete equilibrium requirements as follows (Appendix). The sand boiling can be initiated and developed from the removal of single grains at the exit surface. Therefore, the stability of the grain should be ensured. Garai agrees that the grading curve influences the internal stability of the fine sand layer in later stage of piping, also (Imre 1995, Imre et al, 2012, Nagy, 2014).

The key role of the fine grains at the start of the sand boiling is supported by the tests of Lampl (1959, who reports on the experiments carried out to determine how the presence in different % of the silt fraction between 0.01 and 0.1 mm affects the predisposition of soils to piping formation and the percentage of silt content that no longer forms a piping. Lampl found that sands with silt content of around or larger than 7% are generally no longer dangerous for the formation of piping.

However, there is a general experience that hydraulic failure in an upward flow can occur at much lower hydraulic gradients than the well-established theoretical critical hydraulic gradient value. In the following some explanation and experimental result supporting this explanation are presented.

Garai: Assuming that the grains are spherical the relevant equation can be derived from employing Stokes law. Critical diameter, corresponding to grain size destabilized at the critical hydraulic gradient, is introduced (Figure 2). This diameter separates the grains of the soil into two parts. The grains, which size exceeds the critical diameter, lose their stability at the critical hydraulic gradient derived from "global/overall" equilibrium condition (Terzaghi's criterion). Smaller grains loose stability at smaller hydraulic gradients.

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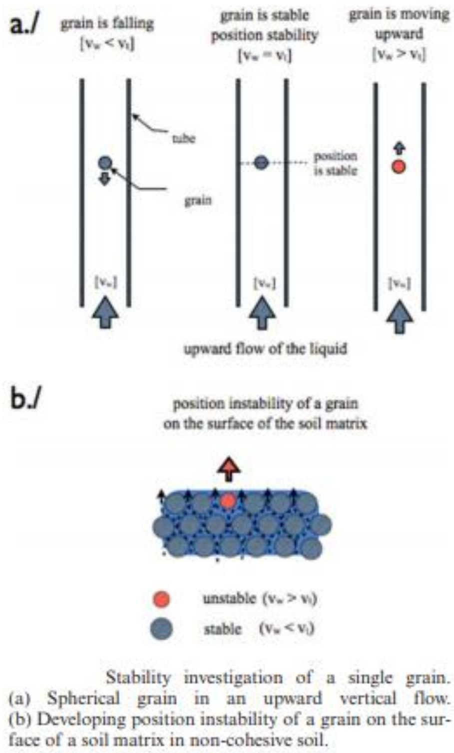


Figure (2) Garai's analyses of single grain

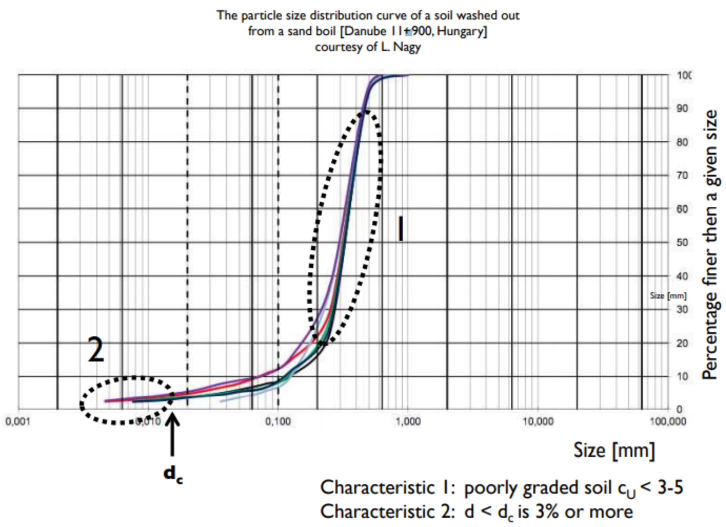
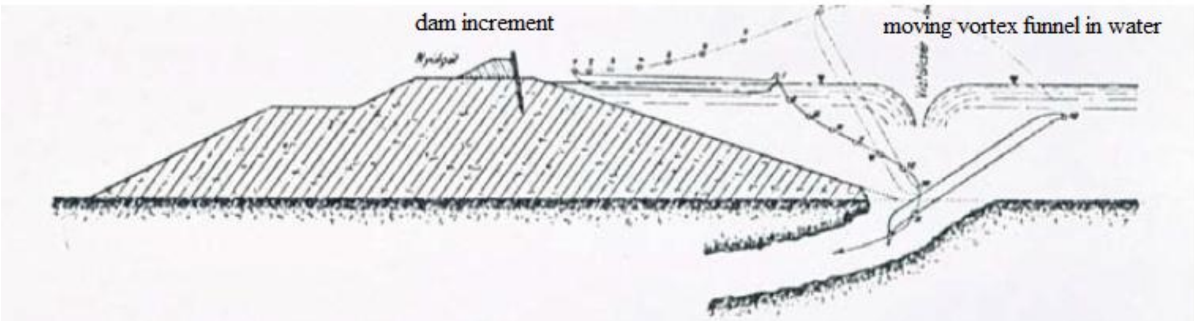


Figure (3) Garai's representation oof critical grain size

REVIEW: CASE STUDY

In 1926, there was a very high and long flood on the estuary section of the Danube Dráva. Therefore, on the downstream side, a dike increment was created (Figure 74).
A few days before the dam breach, a spring was spotted 10-12 meters from the saved side leg of the

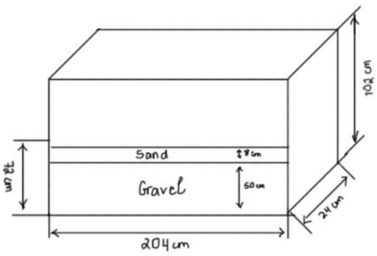
embankment, which also brought sand with it. According to their well-established method, a barrel was put on the spring, and the barrel was surrounded by a ground block, by which time the water rose in it and was at the same height for two days.
On the third day the water in the barrel started to oscillate: landed and rose. The change in the water color in the barrel clearly showed that a cavity had formed in the subsoil, and the cavity is temporarily blocked for the path of the water by earth which is washed out afterwards.
Therefore, he immediately had protective material (sacks, planks, piles, etc.) carried there and at the same time put on standby a boat about 10 meters long and 2 meters wide to be charged and settled it if necessary.
Over the next 24 hours, the rise and drop of the water level continued in the barrel.
During this time, on the downstream side, 2-3 volcanic sand boil happened and these were already stronger than the first. At first, the boat sank nicely, his buttocks with load more than his nose. After a minute or two, the boat was arrived the upstream side, turning his bottom upwards. The dike stood for a few more minutes, after which its crown began to crack. At one time, the embankment breached at a length of 8-10 meters, the water began to protude into the saved area, and the dam burst soon widened to 80-100 meters. The depth of pipe at the site of the rupture was 24 meters below the flood level.
The next day, the spring suddenly erupted in the form of a mud volcano. A water funnel about 30 meters on the upstream side appeared, which was constantly approaching the embankment (Figure). Meanwhile, the water funnel on the upstream side was constantly approaching the embankment. When he approached the embankment at 15-20 meters, the boat suddenly began to tilt, his nose up and made the path dived under water.

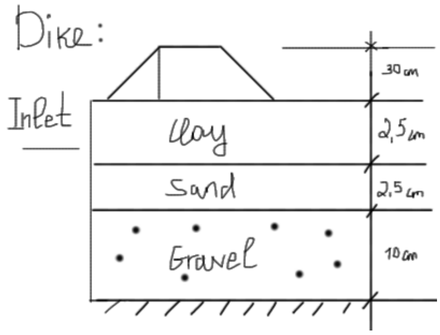


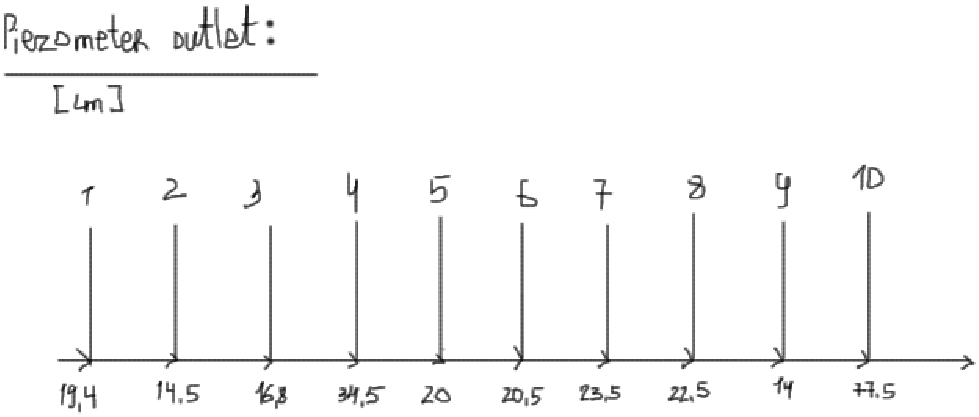
A piping's cavity level to the water side elevated. Tiszasas, no breach.

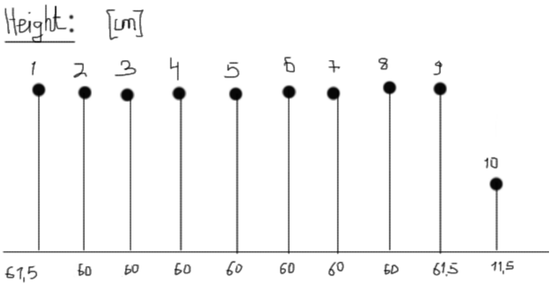
MATERIALS AND METHODS

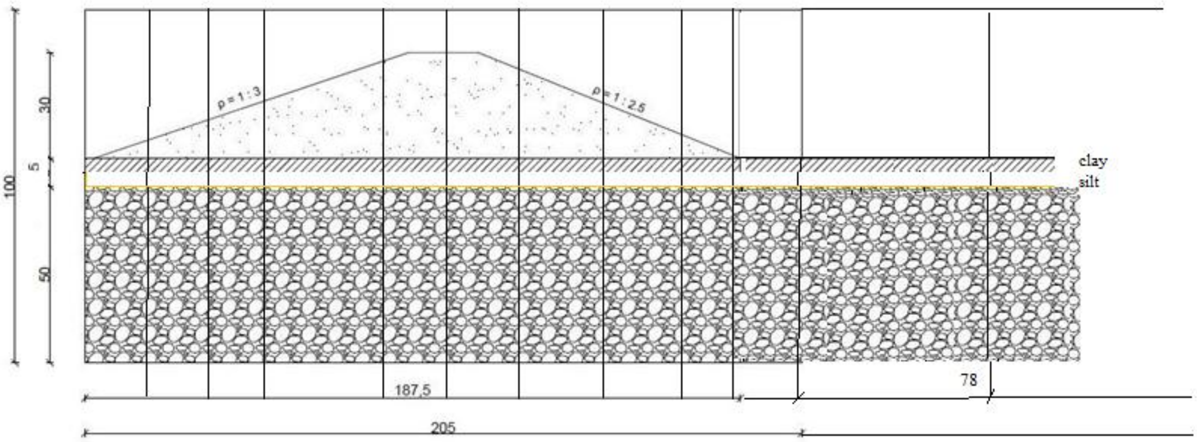
The laboratory experiment was done on dike failure due to the impact of seepage force have been carried out in the water laboratory in a horizontal channel, with transparent plexiglass wall. A sketch of the experimental facility is illustrated below:











Materials used for dike:	**Calculation [cm]**
Gravel	V=W*L*A=24*204*10=48960 cm (~50 liter)
Sand	
Clay	V=W*L*A=24*204*2.5=12240 cm (~13 liter)

Measurement steps of dike experiment

⇒ Prepared sand, gravel and clays to fill the dike.


⇒ Estimated the dike model structure


⇒ Add the materials into the model

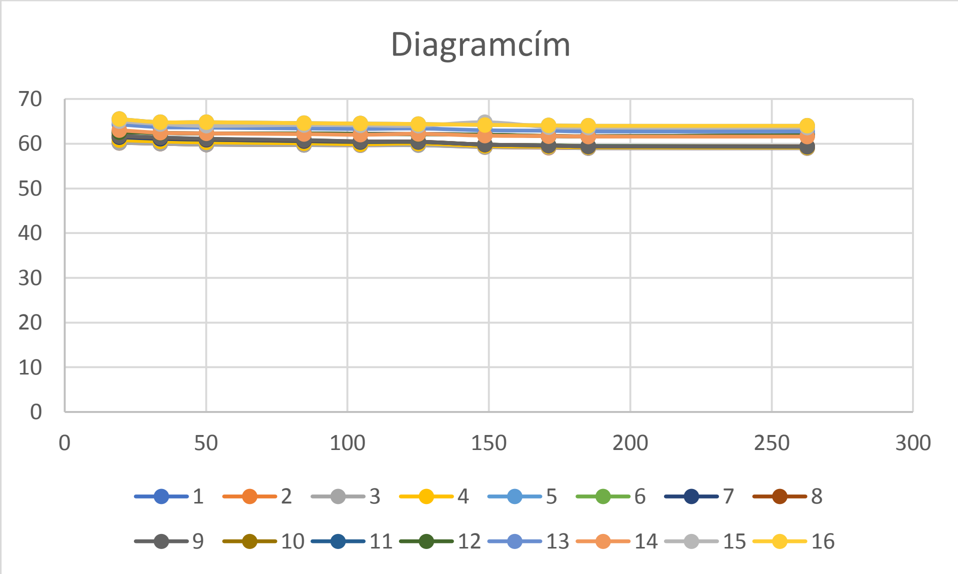

We put cameras on the top and from the front view, in order to record the evolution dike erosion process.

OBSERVATION

⇒ Increase in flood level
⇒ Originally steady-state piezometer level changed immediately
Then changed with time
⇒ Measurement of outflow (discharge) [v]
Outflow level was kept constant during the stage.
⇒ Measurement of piezometer level

Measurement steps for constant head permeability test

	1	2	3	4	5	6	7	8	9	10	mean i [-]
	19.4	33.9	50.2	84.7	104.7	125.2	148.7	171.2	185.2	262.7	
5.1h40	60.25	60	59.8	59.7	59.7	59.8	59.3	59.15	59	59	0.005
5.2h	60.2	60	59.8	59.7	59.65	59.7	59.25	59.1	59	59	0.0048
5.2h15	60.2	60	59.8	59.7	59.65	59.65	59.25	59.15	59	59	0.0048
5.2h45	60.8	60.5	60.3	60.1	59.9	60.05	59.5	59.35	59.2	59.15	0.0066
5.2h45	65.5	64.8	64.8	64.6	64.5	64.4	64.2	64.1	64	64	0.006
5.3h	61.5	61.15	60.9	60.6	60.4	60.4	59.8	59.65	59.5	59.4	0.0084
5.3h	61.45	61.1	60.9	60.6	60.4	60.4	59.8	59.6	59.45	59.4	0.0082
5.3h45	61.7	61.35	61.05	60.75	60.5	60.45	59.8	59.6	59.4	59.35	0.0094
5.4h	61.7	61.4	61.1	60.8	60.5	60.45	59.8	59.6	59.4	59.3	0.0096
6.2h10	62.55	62.4	62.3	62.3	62.2	62.2	62	61.75	61.65	61.9	0.0026
6.2h25	62.6	62.4	62.3	62.3	62.2	62.2	62	61.7	61.65	61.9	0.0028
6.2h40	62.6	62.4	62.3	62.3	62.15	62.1	62	61.7	61.65	61.9	0.0028
6.2h30	64.3	63.7	63.6	63.4	63.3	63.4	63	62.9	62.75	62.75	0.0062
7.2h05	63	62.45	62.3	62.15	62	62.2	61.8	61.7	61.6	61.6	0.0056
7.2h40	65	64.4	64	64.2	64.1	64	64.8	63.7	63.6	63.6	0.0056
7.2h45	65.5	64.8	64.8	64.6	64.5	64.4	64.2	64.1	64	64	0.006



N=2 fractal gradings were tested (Figure 1 and Table 1) with constant head permeability tests. The four fractions (N =1) were: 0.25-0.5 mm, 0.5-1 mm, 1-2 mm 2-4 mm, (uniform distribution was assumed within the limits). The tested optimal 2-fraction soils are shown in Figure 1.

CONCLUSION

A sand boil was cause due to an upward flow can occur at much lower hydraulic gradients than the well-established theoretical critical hydraulic gradient value.

Acknowledgements

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EXTRACTION AND IDENTIFICATION OF PROBIOTIC BACTERIA WITH POTENTIAL OF GABA PRODUCTION FROM TRADITIONAL WEST AZARBAIJAN DAIRY OF IRAN

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Abstract: *Lactic acid bacteria play a critical role in fermentation courses. One of the metabolites produced by this bacterial strain is Gamma Amino Butyric Acid (GABA). The objective of this research was extraction and identification of probiotic bacteria with potential of GABA production from traditional West Azarbaijan dairy of Iran and optimization of GABA production conditions in culture. In this study, 30 bacterial samples from indigenous dairy products (yogurt, dough, cheese and butter) were isolated from West Azarbaijan of Iran. Initial diagnostic tests including gram stain, oxidase and catalase tests were performed to detect Lactic Acid Bacteria (LAB). Results showed that only 6 strains were gram-positive, negative catalase and negative oxidase, and were known as LAB. Then, investigation of probiotic properties including acid resistance, bile, gastric juice, and hemolysis inactivity and L-arginine hydrolysis were evaluated. Two LAB samples with strong probiotic properties were selected, followed by identification of the primers with 16SrDNA by sequencing and drawing phylogeny tree. The results showed that L. lactis subspecies Lactis, L. delbrucius subspecies Bulgaricus strains isolated from cheese and butter had the highest probiotic properties. In the second part, the concentration of GABA production by probiotic bacteria was evaluated by HPLC in media of MRS Broth. Based on HPLC results, L. delbrucius subspecies Bulgaricus, grown in MRS broth had shown the highest concentration of GABA production with 377.54 ppm.*

Keywords: *Gamma aminobutyric acid (GABA), HPLC, L. delbrucius subspecies Bulgaricus, Probiotic, PCR*

INTRODUCTION

Probiotics are viable and non-pathogenic microorganisms found in some foods that have a positive effect on the host's health when taken in sufficient quantities. Ideal probiotics are part of the microflora, are involved in regulating immune responses, are capable of colonizing the human gastrointestinal tract, and inhibit the pathogenic bacteria from attaching to the intestinal mucosa [1]. It also has ideal properties such as resistance to gastric acid, bile salts, digestive enzymes and processing stages, ability to bind to intestinal epithelial cells, non-pathogenic and non-invasive, ability to maintain and maintain genetic stability, ability to cope with pathogens. Improve digestion of proteins and fats, vitamins synthesis, detoxification and protection of toxins [2]. Probiotics maintain and restore intestinal homeostasis, which can lead to several diseases, such as diarrhea, inflammatory bowel disease, irritable bowel syndrome, gastric ulcer, and even cancer [3]. Probiotics can be effective if they are resistant to passage through the stomach and intestine and do not disappear [4].

Many species of lactic acid bacteria (LAB) are generally known to be safe and several species of LAB have been recognized as safe by European food safety authorities [6]. Probiotics must be able to grow in the stomach and intestine and have the ability to attach to the intestinal wall and reside there in order to have beneficial effects on the body. For this purpose, there must be resistance to gastric acid chloride and bile salts present in the small intestine [7]. A minimum level of viable microorganisms is required to see a positive effect on their health; this level is usually between 10^8 and 10^{11} colony forming unit (cfu), depending on the strains used and the health impact required [8]. Therefore, assuming daily consumption of 100 grams of dairy products, they should have 10^6 to 10^9 cfu/g of live bacteria at the time of consumption.

In general, LAB with probiotic properties are mainly used in various fermented foods, particularly dairy products. Based on their ability to synthesize gamma-aminobutyric acid (GABA), screening of LAB could open new prospects to GABA enriched dairy products [9]. GABA is a non-protein amino acid (AA) with the chemical formula of C4H9NO2 and a molecular weight of 103.12 g mol-1. This case is created by the activity of glutamate decarboxylase (GAD) in mitochondria through the irreversible decarboxylation of L-glutamate in the presence of pyridoxal-5'- phosphate coenzyme [10].

The biological roles of GABA include lowering of blood pressure in humans, diuretic effects, sleep regulation, insomnia and depression mitigation, and auto-immune response suppression, treatment of chronic alcohol-related illnesses, reduction of stress and stimulation of immune cells [11]. Hence, much attention is paid to GABA as a useful bioactive agent with potential healing properties in foods and pharmaceuticals [12]. Natural GABA was first recognized in potatoes and found in small quantities in several agricultural products such as barley, corn, cereals, fruits and vegetables including spinach, broccoli, tomatoes, apples and grapes [13]. In developed countries, GABA is used as a health AA. In addition, it is common as an extra supplement in numerous foods and nonprescription drugs used for many symptoms such as sleep disorders and stress. Relatively, studies on use of GABA supplementation in healthy individuals for up to 18 g for 4 days or 120 mg for 12 months have shown positive results [14]. Currently, use of functional foods containing GABA is increasing worldwide due to the important health benefits [15]. To the best of the author's knowledge, extraction and identification of probiotic bacteria with potential of GABA production from traditional West Azarbaijan dairy (Iran).

MATERIALS AND METHODS

Materials

Lactic acid bacteria were isolated from 30 samples of local yogurt, butter, dough and cheese purchased from the local market in West Azarbaijan of Iran. The culture media used were MRS Agar, Blood Agar, L-Arginine Amino Acid, purchased from Merck Co., Germany, as well as degenerate primers R 630, V 616 prepared by Takapoo Bios, Iran. Bile oxalate bile salts, hydrochloric acid, pepsin, trypsin, peptone juice, NaOH reagent were purchased from Merck Co., Germany. MRS broth was purchased from Sigma-Aldrich (USA). Triethylamine, acetonitrile, dihydrogen phosphate, acetonitrile and methanol were purchased from Merck (Germany), and phenyl isothiocyanate, orthophthalic aldehyde (OPA) and GABA standards were supplied by Sigma Aldrich (USA).

Preparation of culture media and probiotic bacterial inoculation

To increase the number of microorganisms and ease of separation, 5 mg of each sample was transferred to MRS Broth medium. Samples were incubated in the incubator at 50 rpm for 1 week at 37°C to grow the isolated bacteria. During 1-week incubation, if needed, discarded culture medium was discarded and fresh media added again.

After the enrichment period, the microorganisms were isolated by centrifugation at 6000 rpm and suspended in 2 mM volume from the same culture medium. Serial dilution was then prepared in buffer solution of PBS phosphate salt solution from the above suspensions and cultured in the same medium. After 48 h incubation, the isolates were cultured on a new plate according to morphological characteristics. To maintain the isolated strains, the isolated microorganisms were cultured in the environment and under appropriate conditions and 25% sterile glycerol was added to them and stored in a freezer at -70°C until tests.

Initial diagnostic tests

In order to identify lactic acid bacteria, initial diagnostic tests (Gram staining, catalase and oxidase) were performed on 30 samples of bacteria isolated from native dairy products (yogurt, butter, cheese and Dough) in West Azarbaijan of Iran [16].

Evaluation of Probiotic Properties

The tolerance of the LAB isolates to both acidic pH value and bile salts, Arginine hydrolysis test, Hemolytic Activity and pepsin and trypsin test was studied using the methodology described [17].

Molecular identification of selected strains

After performing the probiotic properties tests, the bacteria with the highest probiotic properties were selected for identification by 16SrDNA primers.

Inoculation of probiotics in culture media

One colony of each *L. lactis subspecies Lactis, L. delbrucius subspecies Bulgaricus* was added to MRS broth incubated at 37°C for 24-48 h. To calculate number of bacteria inoculated in each milliliter of the suspension, 0.5 of McFarland standard was used. The optical density (OD) was measured at 625 nm with results in a range of 0.08-0.13 [18].

Measurement of GABA using high performance liquid chromatography (HPLC)

Produced GABA in MRS broth was measured using reverse phase liquid chromatography. Derivation was conducted according to an original protocol by [19]. After centrifuging of media at 12000 ×g at 25°C for 10 min, 20 µl of the supernatant were poured into a 2-ml vial and then mixed vigorously with 20 µ1 of borate buffer. Then, 10 µl of OPA were added to the mixture stored at room temperature for 1 min. Then, 5 µl of 5% acetic acid were added to the mixture.
After derivation, 20 µ1 of each sample were injected to a capillary C18 Column, Rstech Hector-M (150 mm × 4.6 mm × 0.5 µm) at 25°C with UV-Vis detector (Younglin Acme 9000m, YL Instruments Co, South Korea) set at λ = 338 nm, 40 mM of sodium dihydrogen phosphate as mobile phase A (pH 7.8) and cetonitrile:methanol:water (10:45:45) as mobile phase B.
A stock solution of GABA (1 mg ml^{-1}) was prepared in water and diluted to 50% v v-1to obtain various concentrations. The analysis was carried out based on the corresponding calibration curves. Concentration of GABA was calculated by the comparison of the peak area with the corresponding GABA standard. The GABA concentration was reported as ppm.

STATISTICAL ANALYSIS

The results of probiotic properties evaluation were analysed by Duncan's multiple range test at 95% confidence level using US version 16 software. Molecular identification results were performed using prism statistical software for selected Bacillus and sequencing for 16SrDNA sequence of Bacillus strains was performed using Blastn bioinformatics software and phylogenetic tree drawing was performed using MEGA version 4 of France was done.
All experiments were carried out in triplicate. The means comparison was carried out using Duncan's one way analysis of variance at a 95% confidence level. To optimize the production of GABA, RSM was used (Minitab Software v.16).

RESULTS AND DISCUSSION

Identification of bacteria isolated from native dairy products in West Azarbaijan of Iran. The results of the initial diagnostic tests (gram stain test, catalase and oxidase) performed to identify lactic acid bacteria on 30 samples isolated from yogurt, buttermilk, butter and cheese are presented in Tables (1a and 1b).
The results showed that only 6 strains isolated from yogurt, buttermilk, Dough and cheese were gram positive, catalase negative and oxidase negative, and were confirmed as lactic acid bacteria and selected for further studies.

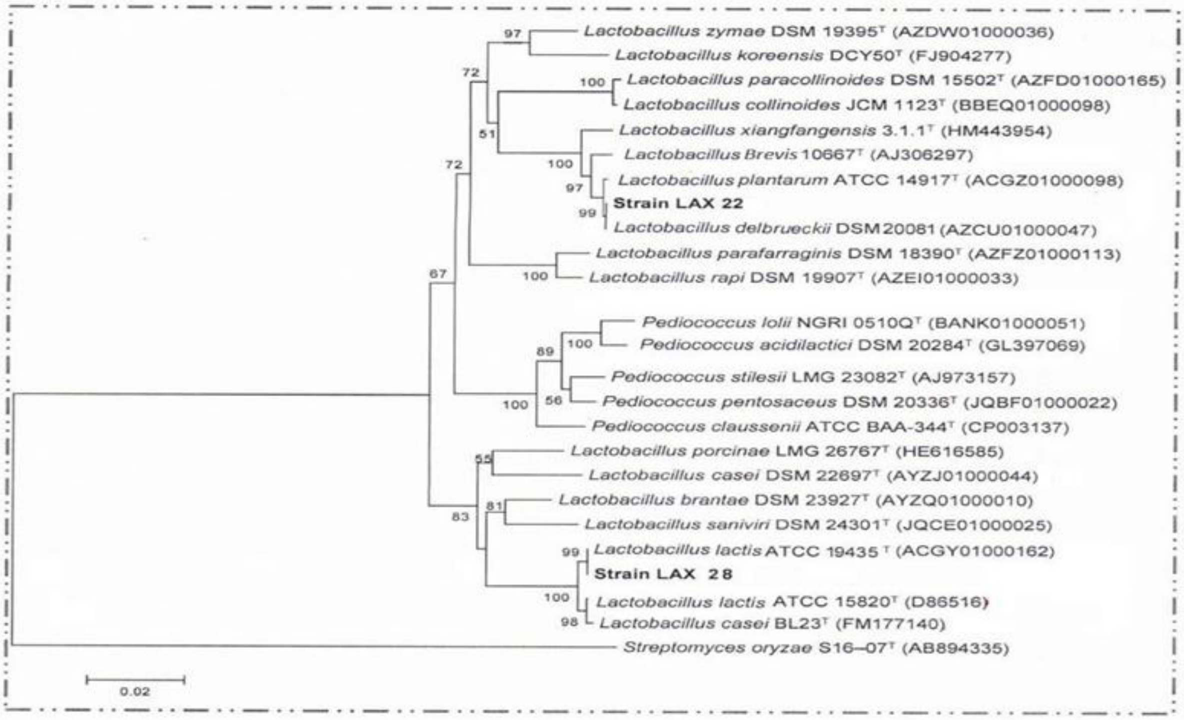
Table (1a):Results of Identification of bacteria isolated from native dairy products in West Azarbaijan of Iran.

Treatment	Code	Source	Oxidase	Gram test	Catalase test
1	LAX-28	Butter	Negative	Positive	Negative
2	LAX-148	Cheese	Negative	Positive	Negative
3	LAX-22	Yogurt	Negative	Positive	Negative
4	LAX-239	Dough	Negative	Positive	Negative
5	LAX-239	Cheese	Negative	Positive	Negative
6	LAX-239	Yogurt	Negative	Positive	Negative

Table (1b):Results of Identification of bacteria isolated from native dairy products in West Azarbaijan of Iran.

Treatment	Code	Bile salts resistance	Acid resistance pH 2.5	Trypsin resistance	Pepsin resistance	Hemolytic activity	L-Arginine
1	LAX-28	0.123±0.011e	7.953±0.56b	7.77±0.13a	7.27±0.14a	Negative	Negative
2	LAX-148	0.337±0.019b	6.263±0.24c	5.393±0.19d	6.25±0.21c	Negative	Negative
3	LAX-22	0.153±0.022d	7.023±0.045a	7.674±0.35b	7.12±0.23ab	Negative	Negative
4	LAX-239	0.207±0.005f	6.313±0.38b	7.305±0.11b	7.02±0.22b	Negative	Negative
5	LAX-239	0.208±0.013 c	6.123±0.16d	5.206±0.23d	6.02±0.13d	Negative	Negative
6	LAX-239	0.408±0.028 a	6.114±0.13d	6.206±0.16c	6.12±0.17cd	Negative	Negative

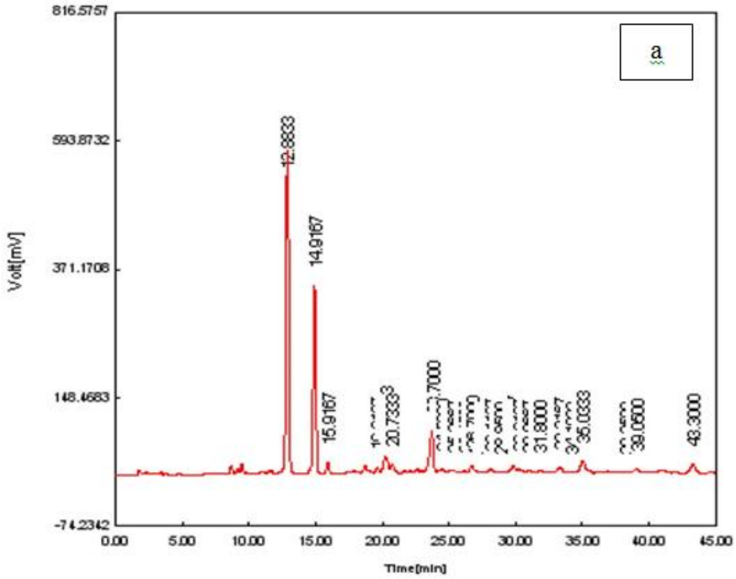
The results of Tables (1a and 1b) showed that only the LAX-28, LAX-22 strains isolated from yogurt and butter, respectively, were gram positive, catalase negative and oxidase negative and were confirmed as lactic acid bacteria and for further studies were chosen.
Probiotics are living microorganisms that, by being in the intestinal environment, can modify the microbial balance to increase their usefulness, and by their activity prevent the activity of non-beneficial and pathogenic microorganisms. All strains that have potential probiotic potential in order to be able to provide positive effects on the host are expected to tolerate gastrointestinal conditions.
The ability to tolerate acid, bile salts, and resistance to gastric juice are considered as good indicators for the survival of the strains in the gastrointestinal tract. These traits are usually evaluated first for selection of probiotic strains under culture conditions.
Although not all real-life conditions in the gut ecosystem can be provided under the conditions of the culture medium, it is still a powerful method for rapid screening of high-potential strains, allowing extensive study and study of a large number of strains. Enables probiotics to discover specific selection of probiotic strains under culture conditions, considering appropriate criteria, could isolate strains with more effective digestive capacity [20].
The molecular identification results of probiotic isolates are shown in Figure (1). All 2 strains were harvested using the 16SrDNA polymerase chain reaction of the D 616, V 616 degenerate primers prepared by Tekapoo Bios, whose sequence is as follows.



Neighbor-joining phylogenetic tree based on 16S rRNA gene sequences was constructed which shown the position of strains LAX 28 LAX22 and other related genera. GenBank accession numbers are given in parentheses. The 16S rRNA gene sequence of the *Streptomyces oryzae* S16–07(T) was used as outgroup. Bootstrap values (%) are based on 1000 replicates, only values above 50 % are given. Bar, 0.02 substitutions per nucleotide position.

Figure (1) Phylogenetic tree plotted in the SrDNA16 gene sequence

According to the BLAST results, all samples were stratified by species similarity between 99-98%. Sequencing of the 16SrDNA region revealed that the selected strains showed the most affinities to the LAX-22, LAX -28 strains, respectively, as *L. lactis subspecies Lactis, L. delbrucius subspecies Bulgaricus strains.* Briefly, GABA was produced under the following conditions of temperature at 30°C for 42 h at pH 4 by *L. lactis subspecies Lactis, L. delbrucius subspecies Bulgaricus strains* in MRS broth (Table 2). Chromatograms are shown in Figures (2a and 2b). Of these bacteria, *L. delbrucius subspecies Bulgaricus* produced the highest GABA content of 377.54 ppm.



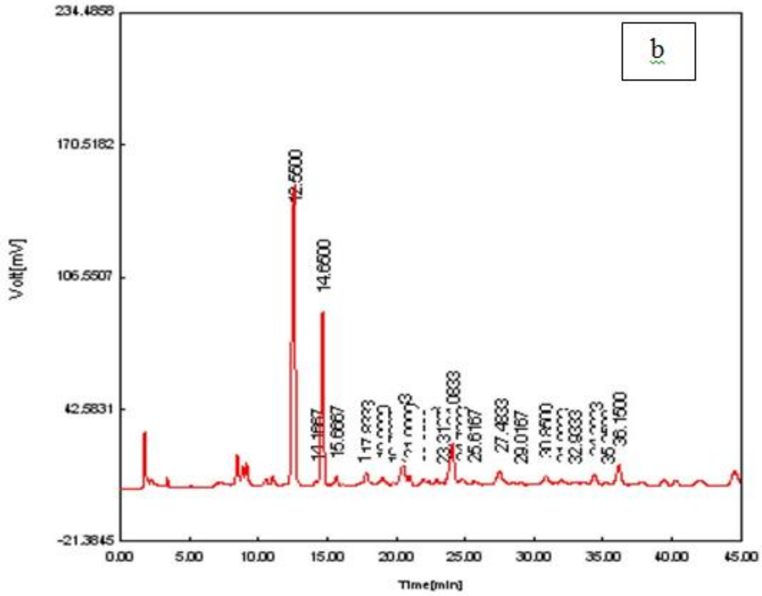


Figure (2) Chromatograms of the gamma-aminobutyric acid (GABA) production by lactic acid bacteria in MRS Broth Figure (2a) L. lactis subspecies Lactis, (Figure b) L. delbrucius subspecies Bulgaricus strains

Table (2) Gamma-amino butyric acid production in MRS broth (ppm)

Media culture	Bacteria	GABA (ppm)
MRS	*L. lactis subspecies Lactis*	301.09 ±10.99^{AB}
	L. delbrucius subspecies Bulgaricus	377.54 ±15.12^{A}

Different letters in each column show significant differences (P≤0.05)

Lactobacillus plantarum NDC75017 is a strain that is screened in traditional fermented dairy products in China. The inducing factors for GABA production included L monosodium glutamate (MSG) at 80 Mm, pyridoxal-5- phosphate as coenzyme of GAD at 18 μM and a culture temperature of 36°C. Under these conditions, activity of GAD in yogurt resulted in the production of 314.56 mg GABA per 100 g of the product [21]. A number of species and subspecies of lactic acid bacteria that produce GABA like: *Lactococcus lactis*, *Lactobacillus paracasea*, *Lactobacillus delbruci*, *Lactobacillus bosneri*, *Lactobacillus plantarum, Lactobacillus holoticus.* Among the lactic acid bacteria, *Lactobacillus* produces more GABA. Among the *Lactobacillus*, *Lactobacillus brevis* produce more GABA. All types of bacteria are separated from traditional foods such as kimchi, cheese, sourdough and paukai and so on. GABA-producing sources are the highest level of glutamate *Lactobacillus buchneri* isolated from kimchi produced GABA at a concentration of 251 mM was reported [22]. The highest content of GABA was found in Pecorino di Filiano (391 mg/kg). Among 22 different varieties of Italian cheeses, the responsible microorganisms for the GABA production were *Lb. paracasei* PF6, PF8 and PF13, *Lb. plantarum* PF14, *Lactobacillus* sp. strain PF7 and *Enterococcus durans* PF15 [23].

CONCLUSION

In summary, the aims of the current study were assessment of potential GABA production by two probiotic bacteria extracted from **Traditional West Azarbaijan Dairy (Iran).** Of the two studied strains, *L. delbrucius subspecies Bulgaricus, grown in MRS broth had shown the highest concentration of GABA production with 377.54 ppm.*

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THE SATURATED HYDRAULIC CONDUCTIVITY OF 2-FRACTION GRANULAR SOILS AND THE INTERNAL STABILITY

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Abstract *The four grading entropy coordinates can be used for soil classification on the basis of grain size and the grading curve shape (similarly e.g., to the diameter values). The grading entropy coordinates give information on several basic Physics features of soil like minimum dry density, internal structure and degree of degradation for natural soils. Therefore, assumingly, using them, good permeability k regression relations can be elaborated. In this work some laboratory tests are made for saturated permeability on fractally distributed sand mixtures (which are mean grading curves with predetermined composition). After the first stage of the measurement it is found that, the results indicate that the preciseness is better if only the data of non-segregating, internally stable mixtures are used, indicating the importance of selecting non-segregating mixtures in laboratory tests.*

Keywords: *granular matter, saturated water permeability, grading curve, grading entropy, segregation.*

INTRODUCTION

The permeability regression with both the well-established (d_{10}, void ratio (e) and Kozeny term e3/(1+ e) [1 to 3]) and the new (grading entropy type) variables of the grading curves are examined in the research, the grading entropy variables are included and combined with the well accepted variables. The entropy coordinates give information on minimum dry density, internal stability and degree of degradation for natural soils. Using together them with usual grading curve parameters to elaborate permeability regression form is physically acceptable since the grading entropy coordinates can be interchanged with mean log diameter, can be amended by d_{10} and relative density information which are missing from the grading entropy coordinates.

In this part of the work, the results of some laboratory permeability tests are presented, which were made at the Laboratory of the Engineering Geology and Geotechnics Department of the Budapest University of Technology and Economics.

For the measurement 3 series of - artificial soil mixtures of natural grains with 2 neighbor fractions were used. The measured data were analyzed in terms of typical k- d_{10} relationship. The main result of the study was that the k- d_{10} relationship had different slope for A<2/3 and A>2/3 within each series. It can be noted that the natural granular soils has generally A>2/3 since only these have stable internal structure. Connecting these data for all series, the result was a nice quasi-linear relationship. Some of the results are presented here.

Grading entropy

The statistical entropy (the entropy of a distribution function) is presented in many textbooks and can be formulated as follows in the discrete case. Let us consider M elements in m equal cells, M_i is the number of the elements in the i-th cell. The statistical entropy S_s is:

$$S_s=Ms \tag{1}$$

where s is the specific entropy, or the entropy of an element given by

$$s=-\sum_{i=1}^{m}\alpha_i \log_b \alpha_i \tag{2}$$

In equation (2), b is the base of the logarithm, and α_i is the relative frequency of the i-th cell, given by

$$\alpha_i=\frac{M_i}{M} \tag{3}$$

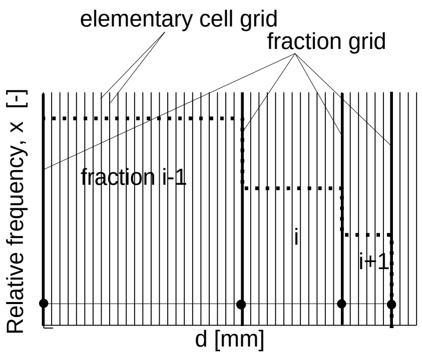


Figure (1) The grading density curve embedded in the elementary cell grid, assuming uniform distribution within the fractions.

For the statistical entropy [4-8] of a finite discrete grain size distribution, a uniform cell system is used. In the case of the empirical grading curve, the base of the logarithm is set to 2 in the statistical entropy formula:

$$s=-\frac{1}{\ln 2}\sum_{i=1}^{m}\alpha_i \ln\alpha_i \tag{4}$$

So, that the maximal value of the specific entropy of a two-cell system could be equal to 1 where the relative frequencies of a two cells are equal.

The empirical grain size distribution curve is considered as a finite discrete distribution. The statistical entropy is computed using two statistical cell systems (Figure 1). The so called fractions which are measured - are defined by successive multiplication with a factor of 2, starting from an arbitrary d_0 as follows (j =1, 2.., Table 1).

$$2^j d_0 \geq d > 2^{j-1} d_0 \tag{5}$$

where fractions are numbered by j (serial number). The elementary cells are with d_0 width assuming that the distribution within a fraction is uniform (Figure 1). The "smallest diameter" d_o may be practically taken as equal to the height of SiO_4 tetrahedron (d_o=2^{-26} m, ~2,68E-8m).

Table (1) Definition and properties of fraction

j	**1**	**23**	**24**
Limits in d_0	1 to 2	2^{22} to 2^{23}	2^{23} to 2^{24}
S_{0j} [-]	1	23	24

The number of the elementary cells C_i in the fraction i is equal to:

$$C_i = \frac{2^i d_0 - 2^{i-1} d_0}{d_0} = 2^{i-1} \tag{6}$$

The relative frequency of any elementary cell in fraction i is equal to:

$$\alpha_i = \frac{x_i}{C_i} \tag{7}$$

where x_i is the relative frequency of fraction i.
The grading entropy S is derived by using secondary cells and inserting the relative frequency of the secondary cell α_i:

$$S = -\frac{1}{\ln 2} \sum_{x_i \neq 0} C_i \frac{x_i}{C_i} \ln \frac{x_i}{C_i}, x_i \geq 0 \tag{8}$$

where C_i is the number of the elementary cells in fraction i, and x_i is the relative frequency of fraction i. The grading entropy S is split into the base entropy S_o and the entropy increment ΔS:

$$S = S_0 + \Delta S \tag{9}$$

The base entropy S_0 and the normalized form A:

$$S_0 = \sum x_i S_{0i} = \sum x_i i \tag{1}$$

$$A = \frac{S_o - S_{o\min}}{S_{o\max} - S_{o\min}} \tag{2}$$

where S_{0k} is the k-th fraction entropy (Table 1), which is defined as follows (Table 1):

$$S_{ok} = \frac{\ln C_k}{\ln 2} \quad S_{ok} = k \tag{12}$$

S_{0max} and S_{0min} are the entropies of largest and smallest fractions, respectively. The entropy increment ΔS and the normalized version B:

$$\Delta S = -\frac{1}{\ln 2} \sum_{x_i \neq 0} x_i \ln x_i. \tag{3}$$

$$B = \frac{\Delta S}{\ln N} \tag{4}$$

where S_{0i} is the grading entropy of the k-th fraction. The grading entropy parameters induces a secondary structure on the space of the grading curves. The A = const. condition defines parallel N-2 dimensional hyper-plane sections of the N-1 dimensional simplex, the A = const., B=const. condition defines N-3 dimensional topological circles).
The relative frequencies of the fractions x_i (i = 1, 2, ..N) for each grading curve fulfil:

$$\sum_{i=1}^{N} x_i = 1, \quad x_i \geq 0, \quad N \geq 1. \tag{5}$$

where N is the number of the fractions between the finest and coarsest non-zero fractions:

$$N = j_{\max} - j_{\min} + 1 \tag{6}$$

The relative frequencies x_i - and the space of grading curves with N fractions - can be identified with the barycentre coordinates in an N-1 dimensional simplex (see Figures 2-3).
Four maps can be defined between a grading curve space (i.e. N-1 dimensional, open simplex) and the two dimensional space of the entropy coordinates: the non-normalized $\Delta \rightarrow [S_0, \Delta S]$; normalized $\Delta \rightarrow [A,B]$; partly normalized $\Delta \rightarrow [A, \Delta S]$ or $\Delta \rightarrow [S_0, B]$. The map is continuous on the open simplex and can continuously be extended to the closed simplex. The diagram is symmetric and compact, having a minimum and a maximum boundary line (see Figures 4-7).
The relative base entropy A indicates the relative distance of the mean diameter from the maximum-minimum $\log_2$ diameter values. If A > 2/3 then enough large grains are present in a mixture to form gradually a skeleton and a stable soil matrix. The coarse particles “float” in the matrix of the fines if A < 2/3.
The internal stability criterion (Figure 8) for elongated grading curves includes a transitional zone, its boundary connects the maximum entropy points with fraction numbers less than N. Considering the fractal gradings, the soil is stable if n < 2, transitional between n at A=2/3 (n is varying in the function of N). The segregation criterion is similarly given in terms of A (Figure 8).

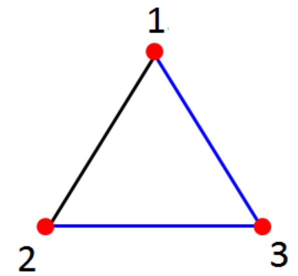


Figure (2) Standard simplex image with dimension 2.

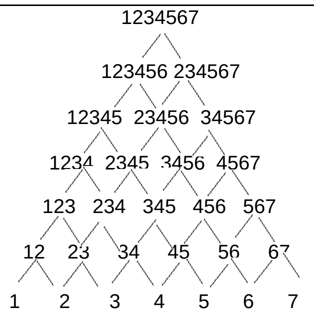


Figure (3) The lattice of the continuous sub- simplexes of the 6-dimensional simplex

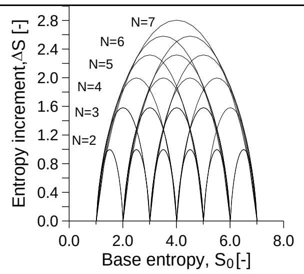


Figure (4) The maximum lines in the non-normalised entropy diagram of a simplex with N=7

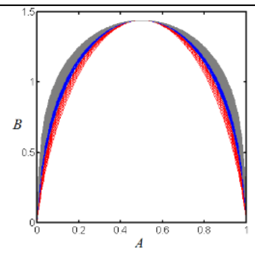


Figure (5) The maximum lines in the normalised entropy diagram of a simplex with N=7

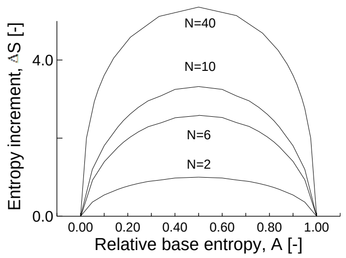


Figure (6) The maximum lines in the partly normalized diagram, using A, a simplex with N=7.

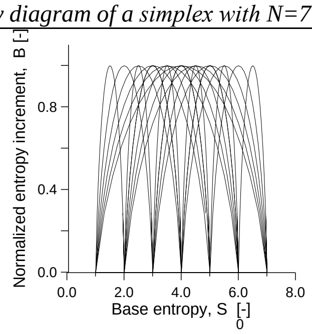
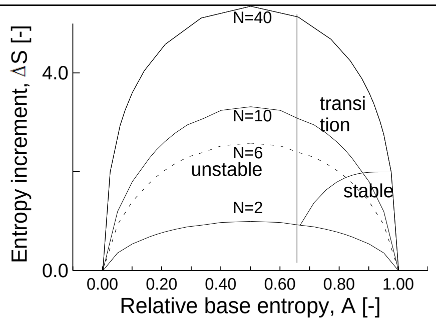
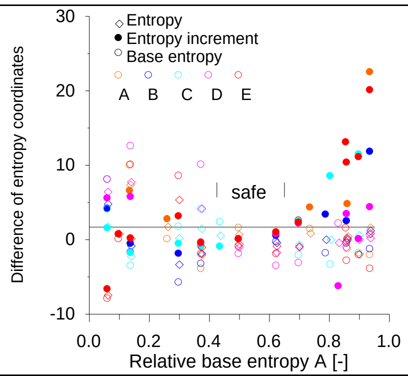


Figure (7) The maximum lines in the partly normalized diagram, using B, a simplex with N=7.



(a)



(b)

Figure (8) (a) Internal stability criterion and (b) segregation criterion of Lőrincz [4]

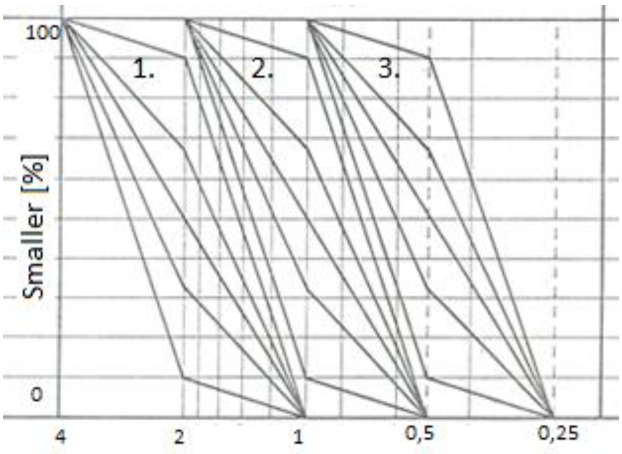


Figure (9) The earlier tested 2-fraction, continuous grading curve series 1, 2 and 3.

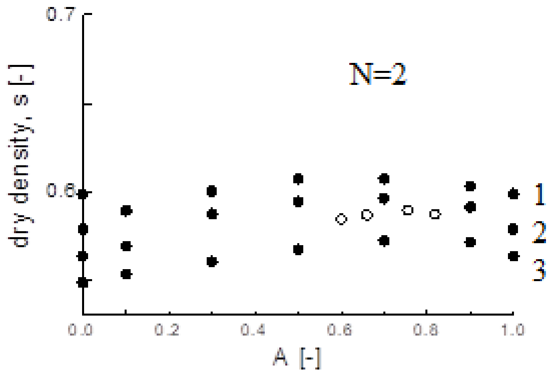


Figure (10) Measured minimum dry density in terms of A (open symbols indicates some repeats in the frame of an ongoing research).

According to some earlier test results, the entropy coordinates give information on minimum dry density, critical state friction angle, internal stability and degree of degradation for natural soils [4-10]. For example, using artificial soil mixtures of natural grains with 2 neighbor fraction grading curves, minimum dry density emax or smin test were made. According to Figures 9 to 10, it was found that the maximum was dependent on A for each soil series in the same way, encountered at around A = 2/3.

MATERIALS AND METHODS

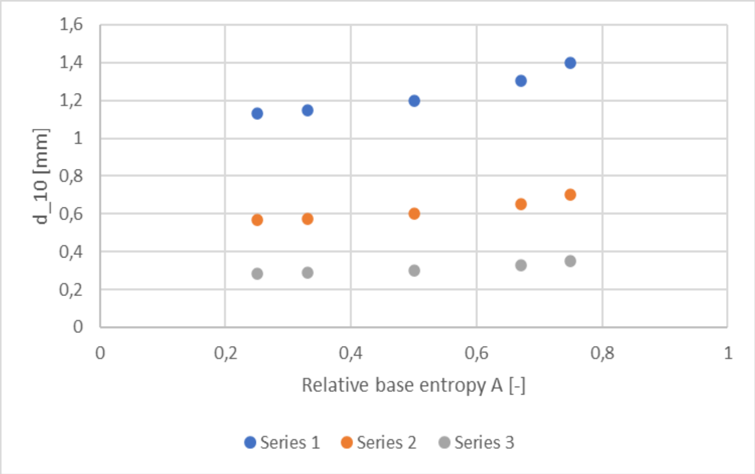
The 3 series of N=2 neighbor fraction mixtures used to measure the saturated water permeability at 5 different A parameter values: 0.25, 0.33, 0.5, ,0.67, 0,75. The four fractions (N =1) were: 0.25-0.5 mm, 0.5-1 mm, 1-2 mm 2-4 mm, (uniform distribution was assumed within the limits). The 2-fraction soil mixtures (Table 2) were tested with constant head permeability tests, and s_{min} test.

RESULTS

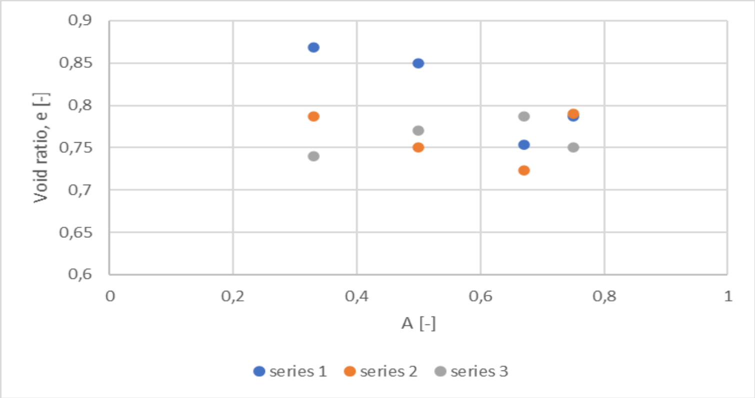
Results are shown in Figures 11 to 14. According to the results, for the tested gradings, the d_{10} has a monotonic increasing relationship with the relative base entropy A - the normalized mean log diameter, as expected. According to Figure 11, the maximum value of s_{min} of optimal series was at around A=2/3, the s_{min} for mixtures increased with mean diameter. Similarly, the k has a monotonic increasing relationship with the relative base entropy A. However, the $d_{10} – k$ relationship is not independent of the value of the relative base entropy A, which is neglected in the well-known relationships ([1] to [3]). The relationship has different slope for A<2/3 and A>2/3 within each series. It can be noted that the natural granular soils has generally A>2/3.

Table (2) The soils tested

Source of soil	No. of k Measurements	No. Grading Curves	Range d_{10} (mm)	Range k_{20oC} (cm/s)	Range C_U	Range C_C	N fraction number
Kvarc-Ásvány Kft. 8256 Ábrahámhegy-Kisörs	15	15	0.28 to 1.4	0.079-1.382	1.6 to 2.2	0.9 to 1.1	2



(a)



(b)

Figure (11) The characteristic d_{10} (a) and void ratio e (b) in terms of A for tested grading curve series 1, 2 and 3. The void ratio e is minimal at A=2/3.

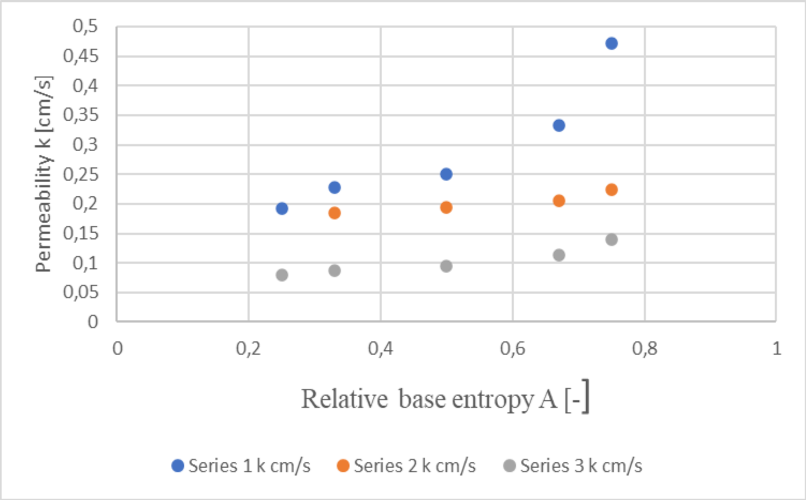


Figure (12) The measured permeability k in terms of A for tested grading curve series 1, 2 and 3.

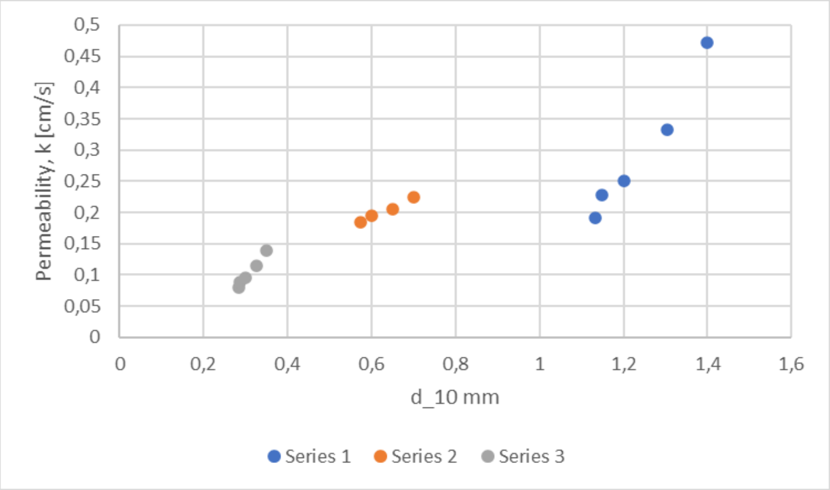


Figure (13) The measured permeability k in terms of d10 for tested grading curve series 1, 2 and 3.

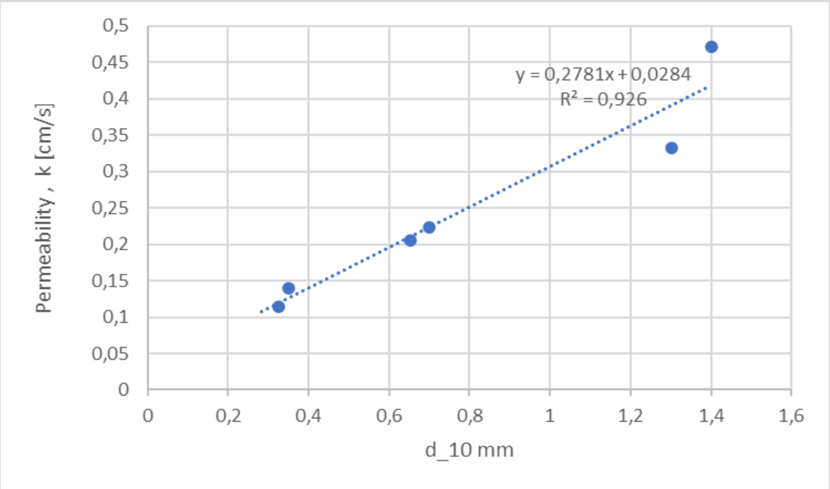


Figure (14) The measured permeability k in terms of d10. for A>2/3.

DISCUSSION AND CONCLUSIONS

The 3 series of N=2 fraction mixtures used to study the relation of saturated water permeability and the grading curves were selected at 5 different A parameter values: 0.25, 0.33, 0.5, 0.67 and 0.75. The result was as follows.

1. The d_{10} – k relationship follows the expectations with the following comment. It is not independent of the value of the relative base entropy *A*. The permeability k versus d10 relation seems to be is different for internally stable soils than for internally unstable soils.
2. The maximum value of s_{min} of optimal series was at around *A*=2/3, the s_{min} for mixtures increased with mean diameter. The tendency was not distinct for A<2/3.

According to the segregation rule (0.4<A<0.8), the first two A values are segregating mixtures. The internal stability is not ensured in the first three A (A<2/3) values. It can be assumed that the segregation during sample preparation causes the difference, the grading curve of the sample is likely not homogeneous is the sample is not internally stable. In other words, this can probably partly be explained by the fact that the internally stable soils are less sensitive to segregation during sample preparation.

The conclusion is as follows. Both the d10 (or A) – k relationship and – s_{min} – A relationship the expectations but is not independent of the value of the relative base entropy *A*, being different for internally stable soils and internally unstable soils. It can be assumed that the segregation during sample preparation causes the difference.

Acknowledgements

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APPLICATIONS of COMPOST AND WASTEWATER SLUDGE CHANGES THE BIOLOGICAL ACTIVITIES IN BROWN FOREST SOIL

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Abstract: *The use of agrochemical such as chemical fertilizers and pesticides has caused tremendous harm to the eco-environment. Organic matter (OM) addition to soil often leads to a rapid increase in the activities of various enzymes and reactivation of biogeochemical cycles in soil. One of the major concerns today in all over the world is the pollution and contamination of the soil. In fact hydrolytic enzymes are sensitive indicators of management induced changes in soil properties due to their strong relationship with soil organic matter (OM) content and quality. An experiment was conducted to study the impacts of combined fertilizer on soil properties in comparison with adding organic as solid waste compost (SWC) of plant origin or municipal wastewater sludge (MWWS) to sandy loam brown forest soil. Soil amendments were: control, 15 or 30 kg/ha dry organic fertilizer. Microbial compositions were determined by culture enrichment technique. Enzyme (β-glucosidase, cellulase, urease, and aryl-sulphatase) activities were estimated. Fluorescein diactate activity as well as physico-chemical properties as well as some microbial parameters were determined after 63 day of incubation under laboratory conditions. The results demonstrated that the SWC and MWWS significantly improved soil physico-chemical properties such as soil pH, moisture content, total C and N contents as well as biological properties. Accordingly, overall enzyme activities were substantially promoted in presence of both amendments and the higher increases were measured at 30% of SWC. Lower beneficial effects occurred at the combination of SWC and MWWS together at 30% possibly because of the increased the presence of trace elements through MWWS application. As a general response, SWC supplied at 30% seems to be a useful strategy to enhance biological activities of soil. Finally, soil biologic activities can be used as an index of soil fertility and organic fertilizer stimulates the natural soil microbiotas and reactivates the biogeochemical cycles.*

***Keywords**: biological activities, solid waste compost, municipal solid wastewater sludge, soil.*

INTRODUCTION

Soil is the major component of agroecosystems specifying the level of their biological productivity and transforming matter and energy fluxes. Current interest in examine the soil quality has been triggered by increasing awareness of soil as a component of the biosphere. Crop responses to wastewater sludge (WWS) application vary by source, application rate, plant species, soil type, climatic conditions, and management

practices [1]. However, soil quality is defined as the capacity of a soil to function within ecosystem boundaries to sustain biological productivity, maintain environmental quality and promote plant and animal health [2]. Several factors make soil quality very difficult to define, because soils are inherently variable [3]. There is growing recognition for the need to develop sensitive indicators of soil quality in promoting appropriate soil management strategies for long-term sustainability of terrestrial ecosystems.
Monitoring is needed to encourage the use of wastewater sludge in agriculture and to regulate its use to prevent harmful effects on soil, crop, animal and man [4]. Therefore, treated wastewater sludge can be defined as biological, chemical or physical treatment of long-term storage or any appropriate process significantly to reduce its fermentability and the health hazards resulting from its use.
Organic fertilizer differs from chemicals in that they feed plants and adding organic matter to the soil. Organic farming technology is necessary to support the developing organic, sustainable and non-pollution agriculture. Excessive amounts of salts have adverse effect on physical and chemical properties and on biologically mediated processes in the soil, such as C and N-mineralization.
Due to climatic changes, global warming is considered to promote the decomposition of soil OM, and thereby to increase the C flux from soil to the atmosphere. Various organic treatments such as solid waste compost (SWC) or municipal wastewater sludge (MWWS) have been investigated for their effectiveness in acidic soil remediation. Meanwhile, the application of WWSs increases soil microbial biomass and some soil enzymatic activities such as urease and β-glucosidase linked to C, N, P and S soil cycles [5, 6].
In fact hydrolytic enzymes are sensitive indicators of management induced changes in soil properties due to their strong relationship with soil OM content and quality [7].
According to Rao and Pathak [8] and Liang et al. [9], the incorporation of organic treatments to soil stimulate dehydrogenase activity because the added material may contain intra- and extracellular enzymes and may also stimulate microbial activity in the soil. These parameters are the most sensitive to the changes which occur in acid-affected soil, and provide rapid and accurate information on changes in soil quality.
A simulated acidified experiment was performed in this study to examine the effects of MWWS and SWC incorporated in acid affected soil on the activity of some soil enzymes related to nutrient cycling such as aryl-sulphatase, phosphatase, dehydrogenase, β-glucosidase, urease and catalase.
Wastewater is a waste product produced at the end of municipal and industrial wastewater treatment processes and is being produced in gradually large volumes global due to increasing population and growing urbanization.
The application of WWS on soils has been widespread in agricultural areas. It depends on soil properties, HM levels and characteristics, plant species and climatic conditions.
Wastewater sludge is usually reflected as waste, the recycling and reuse of valuable nutrients contained in the WWS are currently being measured as important resources for sustainable development [10]. Treated WWS can be reprocessed in numerous ways including its use as fertilizer with important nutrient additions improving plant growth and as a soil conditioner for improving the physical and chemical properties of soils [11-13].
The estimated percentages of WWS applied to agricultural soils have been mentioned as 29% in the USA, 40% in the UK, 60% in France, 30% reuse potential in Russia and 230,000 ton/year in Japan [14-17]. In developing countries, the experience of using WWS application for agricultural purposes is often kept to communal farms. There is a supposed risk to the environment that prevented wastewater sludge from existence application to agricultural soils.
The utilization of WWS in agriculture and forestry is becoming a widespread practice. Municipal WWS are increasingly used as soil organic amendments, especially to agricultural lands with low OM content to maintain or improve soil quality. This practice can, however, increase the concentration of heavy metals and organic toxins in soil. Heavy metals can reduce soil microbial activities including respiration, ammonification, nitrification and enzyme activities.
Oxidative enzymes (especially dehydrogenase) were proposed as a measure of overall microbial activity. Dehydrogenase being an intracellular enzyme related to oxidative phosphorylation process that occurs in all intact, viable microbial cells [6]. Incorporation of both SWC and WWS stimulated dehydrogenase activity because the added material may contain intra- and extracellular enzymes and may also stimulate microbial activity in the soil [9].
In fact, some studies indicated that high doses of some organic materials can introduce into the soil toxic compounds such as heavy metals which could have a negative effect on enzyme activities [18].
The biological activity of soil may serve as an informative indicator of the ecological state of biocenosis. The aim of the present study was to examine the effects of SWC and WWS application on some soil biological

activities such as the microbial content and enzymatic activities as well as soil pH, moisture contents, total organic carbon and total nitrogen content.

MATERIALS AND METHODS

Figures and Tables

In a greenhouse study, the soil samples used in pot experiment were clay loam brown forest collected from farmland surface layer (0–200 mm) of an agricultural area of Gödöllő (Hungary). One sample of WWS was selected depending on its low HMs content originated from Nyíregyháza wastewater treatment plant and the compost sample SWC was originated from garden plant residue. The main physico-chemical parameters of soil and WWS are shown in Table 1.

Table (1) Physico-chemical properties of soils and wastewater sludge samples

Parameters	Soil	Wastewater sludge
	Clay loam brown forest	
$pH_{(H2O)}$	5.12	7.99
Dry matter, %	22.4	74
Organic matter, %	1.27	25.6
Humus content, %	1.24	-
Salt content, %	0.74	-
$CaCO_3$, %	1.01	-
Total N content, mg kg^{-1}	84.11	75.700
NO_3-N, mg kg^{-1}	133.08	-
NH_4-N, mg kg^{-1}	410.69	-
Ca, mg kg^{-1}	856	5707
Mg, mg kg^{-1}	203	2810
Na, mg kg^{-1}	21	1290
AL-P_2O_5, mg/kg	121.31	9700
AL-K_2O, mg/kg	107	3120
Zn, mg kg^{-1}	38.1	453
Cu, mg kg^{-1}	22.9	100
Cd, mg kg^{-1}	0.18	1
Ni, mg kg^{-1}	0.064	15
Pb, mg kg^{-1}	15.1	30

Fresh soil samples were sieved through a 4 mm sieve and mixed with WWS or SWC to form 10 and 30% (soil : Waste; w/w), and then placed into plastic pots with 42 cm in height and 23 cm in diameter. All treatments were designed in triplicates and submitted for statistical analysis. The study was conducted to determine the effect of WWS or SWC or in mixture on the biological activities of the soil after 4 weeks of incubation.

Soil moisture content and pH were measured according to the method of Brzezinska et al. [19] and Pérez de Mora et al. [20], respectively. Total organic carbon (TOC) was analyzed by dichromate (K2Cr2O7) oxidation and titration with ferrous ammonium sulphate according to Walkley and Black [21]. Total nitrogen content in soil was determined by Kjeldahl digestion–distillation procedure [22]. Determinations the enzymatic activities were carried as following: Fluorescein diacetate (FDA) hydrolysing activity of the control and amended soil subsamples were determined by measuring the released fluorescein at 490 nm according to Alef [23].

Dehydrogenase activity was determined by the method of García et al. [24]. Urease activity was determined in 0.1 M phosphate buffer at pH 7; 1 M urea and 0.03 M N α-benzoylargininamide was used as substrate. The activity was determined by the NH4+ released [25].

β-glucosidase activity was determined using p-nitrophenyl-β-D-glucopyranoside (PNG, 0.05 M) as substrate [26]. Similarly, aryl-sulphatase activity was determined as proposed by Tabatabai and Bremmer [27], after the soil incubation with p-nitrophenyl sulphate and measured at 400 nm.

Furthermore, the enumeration of microbial population in soil amended with SWC or WWS was done using

the serial dilution plate method. The total colony forming units (CFU) of bacteria and fungi were recorded on Ken Knight and Munaier's agar [28] and Martin's Rose Bengal agar [29] media, respectively.
Enumeration of cellulose decomposers was determined according to Hendricks et al. [30]. For phosphate solubilized microorganisms, method of Goldstein [31] was applied. The plates were incubated at 28°C and microbial population densities were calculated and expressed as log10 of CFU x 10n g-1 air dried soil, where 10n was dilution factor.

RESULTS AND DISCUSSION

Utilization of WWS in agriculture increases the concentration of HMs in soil and HMs–rich MSS drastically reduced the biologic activity in soil. These critical limits depend on the source, WWS application rate and frequency. Phyto- and rhizo-bioremediation using plants and related microorganisms are the promising approach to clean up the contaminated environment.
Soil pollution by HMs is a serious worldwide problem and can be potentially harmful to human health via the food chain. The results of pot experiment illustrated the followings:
Tables 2a and 2b show that the effect of soil amendment with SWC and WWS on some important terms of soil characteristics from agriculture.
It was found that application of SWC and WWS on soil pH has a positive influence, they significantly increased the pH and the combination of the two organic matters rose up the pH value better than in single application.
Similar results also obtained in term of moisture content and it is economically important to keep the soil more moisted for longer time too. In case of total organic carbon, the data of the experiment showed that the amount of TOC increased more when both organic matters were combined together.
Also, the amount of total nitrogen content increased significantly more than they applied alone. The best combination can be selected is 30% from SWC and 10% from WWS and in this case we reduced the risk of heavy metals effects on soil biodynamic properties.
The major factor affecting the productivity of the biocenoses is the level of the soil N supply, because N is the main element limiting the production of plant and animal food on the Earth.

Table (2a) Effect of compost and sludge treatments on some physico-chemical properties of soil samples

Parameters	Compost (C)		Sludge (S)	
	10	30	10	30
pH	5.78	5.84	5.78	5.97
Moisture, %	10.5	20.7	12.8	22.4
TOC, mg/kg soil	0.89	2.15	0.96	2.42
TNT, mg/kg soil	35.6	57.4	35.1	68.2

Table (2b) Effect of compost and sludge combinations on some physico-chemical properties of soil samples

Parameters	Combination			
	10C+10S	10C+30S	30C+10S	30C+30S
pH	5.89	6.09	5.99	6.25
Moisture, %	14.7	23.5	22.7	25.9
TOC, mg/kg soil	1.28	2.11	1.73	2.65
TNT, mg/kg soil	36.2	62.4	65.8	72.1

Tables 3a and 3b clarify the important of the application of organic matter to the soil which increases the soil fertility and makes nutrients available for plant growth and development. The increasing enzyme activity in soil plays an important role for mineralization of organic matter, and in this case the soil quality will be increased.
Tables 3a and 3b also, illustrate that the investigated enzymes are more active when SWC is in combination with WWS added to the soil.
For more safety, 30% of compost matter in combination with 10% of sludge can prevent any contamination of the soil by heavy metals. All enzymes were more active when the soil was amended with both organic matters together. Soil OM has a great influence on the chemical and physical properties of soil and makes

up, together with the clay, most of the cation exchange capacity and this is the key parameter describing the sorption and desorption of plant nutrients and contaminants from soil.

Table (3a) Effect of compost and sludge treatments on some enzymatic activities in soil samples

Parameters	Compost (C)		Sludge (S)	
	10	30	10	30
FDA	130	204	147	313
Dehydrogenase	139	306	171	326
Urease	1.79	2.91	1.88	3.67
β-glucosidase	130	228	142	304

Table (3b) Effect of compost and sludge combinations on some enzymatic activities in soil samples

Parameters	Combination			
	10C+10S	10C+30S	30C+10S	30C+30S
FDA	143	277	292	337
Dehydrogenase	151	332	351	355
Urease	1.87	3.12	2.71	3.89
β-glucosidase	139	304	325	348

The major input sources of OM to soil are manure, litter-fall and crop residues, but the equilibrium content of soil OM is influenced by climate, land use and management, over time. Organic contaminants in WWS are not expected to pose major health problems to the human population when sludge is re-used for agricultural purposes.

Tables 4a and 4b demonstrate the important of addition of organic matter to the soil as energy source and help the microbial content to be more active and established well in the soil. It was found that the microbial population increased by increasing the rate of application and in combination the population is more and it is important for soil fertility too. Tables 4a and 4b show that the cellulose-decomposers and phosphate-solubiliers are more public in the combination of the two organic matters.

Table (4a) Effect of compost and sludge treatments on some microbial population in soil samples

Parameters	Compost (C)		Sludge (S)	
	10	30	10	30
Aerobic heterotrophic bacteria (10^6)	9.54	28.7	13.5	36.2
Filamentous fungi (10^4)	5.95	23.6	7.65	31.4
Cellulose-decomposers (10^3)	5.5	16.5	7.07	20.3
Phosphate-solubilises (10^2)	4.4	22.1	4.5	26.9

Table (4b) Effect of compost and sludge combinations on some microbial population in soil samples

Parameters	Combination			
	10C+10S	10C+30S	30C+10S	30C+30S
Aerobic heterotrophic bacteria (10^6)	10.8	30.8	35.3	41.3
Filamentous fungi (10^4)	7.21	29.67	29.4	33.4
Cellulose-decomposers (10^3)	6.84	18.71	22.57	26.6
Phosphate-solubilises (10^2)	5.21	24.61	27.3	30.19

It was found that WWS had a positive effect on the enzymatic activities. More studies are needed to deeper our knowledge of the effect of HM contamination on enzymatic activities. However, our results indicated that there are positively related correlation between the investigated enzymes and OM in the applied WWS or SWC or in combination. This indicates that an aggregate of multi-enzymatic activities may be better correlated with soil fertility than a single enzyme. Particularly, the enzymatic activities in soil amended with WWS-LHM content were markedly higher than those in the soil amended with WWS-HHM content.

The soil microbial populations were far higher under WSS application than in case of the control and SWC treatments. Bacteria showed a marked increase in population size with increasing WWS mixing rate levels, other soil microbes; fungi in population size responded similarly to bacteria, although all treatments showed significant difference on population size in comparison between the WWS of LHM and SWC contents compared to control.

Further research is required with plant trials to test the effects of the WWS or SWC applied to different soil environments and measure the soil productivity under these applications as organofertilizer as well as soil conditioner.

However, as it seemed from the result of the experiment, that there is a good potential for using the WWS and SWC as soil improving agents. Considering the nutrient and soil conditioning values of the WWS and reusing them for agriculture is an economical and environmentally sound option and deserves given greater attention.

The results suggest that WWS addition induces a reactivation of soil quality and activity, as indicated by microbial content and enzymatic activities. According to this, our results are in good agreement with the results of Singh and Agrawal [32] who established that the mature municipal solid waste compost might be used as conditioner for clay soil, but not for sandy soil.

Monitoring soil quality by means of bioindicators can be helpful for the management and sustainability of soils that received WWS application. It should be concluded that the accumulative concentration of HMs in WWS amended soil should be calculated after every application of MSS.

CONCLUSION

In conclusion, both SWC and WWS affected soil physical and chemical properties and biological activities. The positive effect of the organic treatments on soil biological quality is due to the stimulation of microbial communities and growth and/or to the addition of microbial cells or enzymes with the amendment. This hypothesis seems to be reliably supported by the increase observed for more than one soil enzyme activity that very likely behaved as valid indicators of soil biological activity. However, a balance between adequate fertilization and the possible environmental risks caused by over fertilization must be considered. Organic matter application increases soil microbial biomass and soil enzymatic activities linked to C, N, and S soil cycles.

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ECOTOXIGOLOGICAL IMPACT OF SOME FUNGICIDES USED IN AGRICULTURE ON SOIL USEFUL MICROBIOTA AND ENZYMATIC ACTIVITIES IN VITRO

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Abstract*: One of the main factors that affect the distribution and activity of microorganisms in the soil is the usage of practices. Nowadays, when the global population is increased and the agricultural land is decreased and also due to the climatic changes, humans increasingly applied the pesticides in agriculture to increase the crop production for humanity and controlling various plant diseases. As a result of these applications, the amount and number of pesticides used is increasing.in which are intensively polluting the agricultural soil environment. The effects of different fungicides on microbial content and enzymatic activity in the soil need to be studied, also taking into account sustainable agriculture and environmental protection aspects. The aim of the study in pot experiment was to evaluate the effects of four concentrations (control, ½X, X and 2X) of two fungicides (folpet, thiuram) on soil microbial populations such as aerobic heterotrophic bacteria, filamentous fungi, cellulose-decomposing microbes, phosphate-solubilizing microbes, soil respiration (CO_2 release) and four soil enzymatic activities of dehydrogenase, urease, phosphatase, β-glucosidase in brown forest soil, using pot experiment. The results indicated that the application of thiuram ha smore ecotoxicological effects on the microbial populations and enzymatic activities than folpet at the concentrations X and 2X. The soil respiration was increased by increasing the concentrations of fungicides. For further research, it is important to use other soil types and other pesticides, it is recommended to set up further experiments to get an even more complete and comprehensive picture of the soil biological affected by pesticides as soil pollutant agents.*

Keywords: Ecotoxigological impact; fungicides; agriculture soil; useful microbiota; enzymatic activities in vitro

INTRODUCTION

Misuse or overuse of pesticides degrades the soil and can damage the community of organisms living in the soil. Some pesticides are more toxic to soil organisms than others. Some pesticides degrade rapidly when applied to the soil, while others may persist for a longer period of time. Both soil and pesticide type can affect pesticide persistence. The contaminating effect of pesticides consists of the effect of plant protection products on non-target species. Pesticides are chemical preparations used to kill fungal or animal pests. More than 98% of sprayed insecticides and 95% of herbicides reach destinations other than their target species because they are sprayed or spread throughout the agricultural area. The runoff releases pesticides into the aquatic environment, while the wind can transport them to other fields, grazing areas, human settlements, and undeveloped areas that may affect other species. Other problems arise due to poor production, transportation and storage practices. Over time, repeated application will increase pest resistance, while its effects on other species may facilitate pest regeneration.

The assessment of the biocidal activity of the active substance of folpet demonstrates that it has a sufficient level of efficacy against the target organism(s) and the evaluation of the summary data provided in support of the efficacy of the accompanying product, establishes that the product may be expected to be efficacious. The behaviour of folpet in the aquatic environment was investigated in two dissimilar water/sediment systems (silty clay and sandy loam) in a study conducted at 20°C according to SETAC 1995/BBA Part IV, 5-1 guidelines. In each test, folpet was rapidly degraded in both the overlying water and the whole system.
Folpet was metabolised to CO_2 as a principal metabolite. Low recoveries were obtained at most sampling intervals, partly due to the loss of CO_2 during sample processing. Folpet is rapidly degraded in a range of aerobic soil types at temperatures of 20 and 25°C under laboratory conditions. The degradation of folpet under aerobic conditions at a lower temperature of 10°C was measured to be 3.8 days in a silt loam soil (corresponding value at 20°C was 0.8 days). The equivalent range of soil degradation rates at the EU average temperature of 12°C can be estimated to be 0.4 to 14.3 days. However, the data suggest that factors other than temperature (e.g. soil pH) have a significant influence on soil degradation. Levels of bound residues initially accumulated to a level of 31.2% AR at day 14, but subsequently declined resulting in substantial mineralisation to CO_2. Overall, folpet is not considered to be persistent in soil. Two studies with inocula from domestic catchment sewage treatment plants have tested the effects of folpet on microbial processes involved in aerobic biological waste-water treatment. The first investigated the effect of folpet on the rate of O_2 uptake (total respiration) by activated sludge and the second specifically addressed effects on nitrifying microorganisms, which are generally the most sensitive group. [1]
Thiram is an organic disulfide that results from the formal oxidative dimerisation of N,N-dimethyldithiocarbamic acid. It is widely used as a fungicidal seed treatment. It has a role as an antibacterial drug, an antiseptic drug and an antifungal agrochemical. In studies with ruminant animals fed corn treated with thiram, rumen microorganisms are degraded thiram to carbon disulfide (CS_2) and probably hydrogen sulfide (H_2S) and dimethylamine. Thiram is moderately toxic by ingestion, but it is highly toxic if inhaled.
Microbial degradation is an important step in the disappearance and, in most cases detoxification of pesticides. Many soil applied pesticides are degraded more rapidly following repeated application at the same site. These types of pesticides, adversely affect fungi and bacteria which may lead to the break down of food chains and consequently the disturbance of the natural balance. Some factors, like temperature and humidity influence pesticides effect on microorganisms. The inhibitory effect of pesticides on the growth of bacteria and actinomycetes was reported to be at high temperatures. Thiram degrades by microbial action or by hydrolysis more rapidly in acidic soils and in soils high in organic matter. In a humus sandy soil, at pH 3.5, Thiram decomposed after 4 to 5 weeks, while at pH 7.0, Thiram decomposed after 14 to 15 weeks. Thiram persisted for over two months in sandy soils, but disappeared within one week from a compost soil. The major metabolites of Thiram in the soil are copper dimethyl-dithiocarbamate, dithiocarbamate, dimethylamine and carbon disulfide. Minor degradative products included nitrite ions (nitrate reduction) and dimethylnitrosamine. It was reported more than 95% conversion of Thiram to metabolites by soil microorganisms after 55 days of incubation. The harmful effects of pesticides are generally studied for many communities and individuals in the ecosystem, but very few studies were devoted for investigating the effects of soil microorganisms on the degradation of pesticides in soil. [2] The objectives of the study was to investigate the ecotoxicological effects of the two fungicides on soil biological activities.

MATERIALS AND METHODS

The long-term, regular use of fungicides has a detrimental effect on the environment, flora and fauna, human health and, last but not least, reduces the sustainability of agricultural production. Nevertheless, there is an increase in the amount of fungicides used in several countries, while biological pest control methods are becoming less common. Table (1) shows some of the properties of the used fungicides. The experimental soil sample was collected from the garden of the Sándor Rejtő Faculty of Light Industry and Environmental Engineering of the University of Óbuda.
The sample used was obtained from the upper 0-25 cm of the soil layer. This soil is a slightly alkaline Ramann's brown forest soil that is not previously cultivated. Table (2) shows some of the physico-chemical properties of the studied soil sample.
After homogenization of soil samples, both fungicides concentrations were pipetted separately onto 200 g of soil surface and then homogenized for 30 min in a rotary mixer where soil samples treated with different concentrations (1/2 X, X and 2 X) of fungicide (Table 3) were added to each plastic pot. Untreated soil

served as a control. The pols were kept in a controlled environment, in the laboratory (LABOR 8, Institute of Environmental Engineering and Natural Sciences), at 25±3°C. 45% of the soil moisture remained.
The size of the microbial population was determined by the plate method. I used a spectrophotometer to determine the enzyme activity.

Table (1) Some properties of the pesticides used.

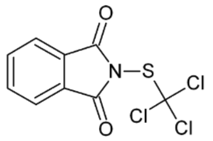
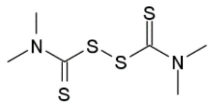
Active substance	Folpet	Thiuram
Active substance group	phthalimide	Thiocarbamates
Active substance	N-(trichloromethylthio)-phthalimide	bis-(dimethylthiocarbamate)-disulfide
Field application rate	>940 g/kg	3 kg/ha
Chemical structure		

Table (2) Some physicochemical characteristics of the soil

Tested parameters	Units	Values
pH_{KCL}		7.13
EC	µS/cm	483
$CaCO_3$	m/m %	32.34
H	m/m %	3.34
Total N content	mg/kg	1930
NH_4-N	mg/kg	18.76
NO_3-N	mg/kg	13.69
AL - P_2O_5	mg/kg	51.7
AL - K_2O	mg/kg	169
AL-Na	mg/kg	37.2
KCl-Mg	mg/kg	146
KCl-S	mg/kg	14.1

Table (3) Rate of field application of selected fungicides

Fungicides	Experimental field application rate		
	½X	X	2X
Thiuram	1,5 kg/ha	3 kg/ha	6 kg/ha
Folpet	250 g/kg	500 g/kg	1000 g/kg

The study was performed on soil microbial populations such as aerobic heterotrophic bacteria, filamentous fungi, cellulose-decomposing microbes, phosphate-solubilizing microbes, soil respiration (CO_2 reéease) and determination of soil enzymatic potencial activities such as dehydrogenase, urease, phosphatase, β-glucosidase.
Soil respiration was determined [3] by trapping the evolved CO_2 in NaOH and back titrated with HCl. Furthermore, the total mesophilic aerobic heterotrophic bacterial and fungal populations were counted according to Szegi [4]. Cellulose decomposers were detected according to Hendricks et al. [5] and phosphate solubilizers were determined according to Goldstein [6].
Enzymatic activities were determined for following: Dehydrogenase activity was measured by the method of García et al. [7]. Urease activity was determined according to the method of Nannipieri et al. [8]. Phosphatase activity was measured according to Tabatabai and Bremmer [9] and β-glucosidase activity according to Masciandaro et al. [10]
Experimental statistical analysis was compiled in a randomized block design in three parallel studies with three replicates. The mean and correlation were calculated as well as the regressiones between the treatments

RESULTS AND DISCUSSION

Pesticides are used worldwide for agricultural purposes to increase yields and mitigate losses. They can destroy pests and insects. They can eradicate undesirable herbs and grasses between crop plants or in other areas. They have increased our reliance on them because they can improve agricultural production. Despite their beneficial effects, these pesticides also have enormous impacts on the soil, water, and other natural resources, leading to many environmental and animal health issues. [11].

The following Figures (from 1 to 9.) show the effect of the two fungicides on soil respiration, microbial populations and the potential activitities of some enzymes in the treated brown forest soil. Here, it is clear significant difference between the effect of 2X dose of fungicides and the control. The double dose significantly increased CO_2 emissions, resulting in toxic effects and the partial biodecomposition of both fungicides. Figure (1) shows the effect of the two fungicides on CO_2 emissions from brown forest soils

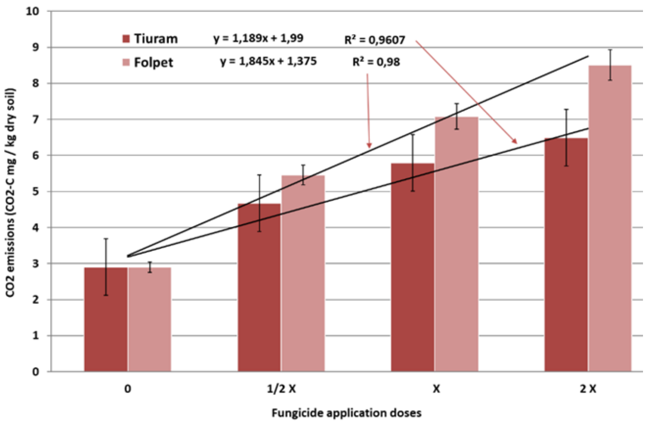


Figure (1)

Effect of fungicides on CO_2 emissions from brown forest soils

The applications of differenet doses such as control, ½X and X dose were not significant between the two fungicides regarding to the emissions of CO_2. However, in each case, the use of the double dose significantly reduced the number of bacteria as shown in Figure (2).

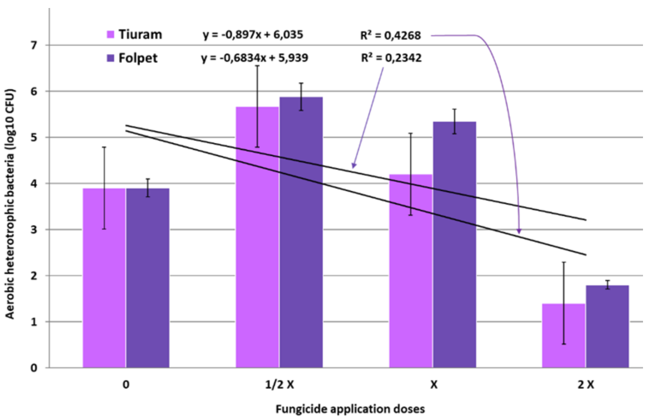


Figure (2)

Effect of fungicide on heterotroph aerobic bacteria in brown forest soil

A significant difference can be observed for Folpet, yet Thiuram can be said that it has a stronger ecotoxicőlogical effect of the fungicide on aerobic mesophil heterotrophic bacterial count. The use of double doses for both fungicides also has an ecotoxicological effect (Figure 2). Similar observations were recognized with the enumeration of filamentous fungi as in Figure (3).

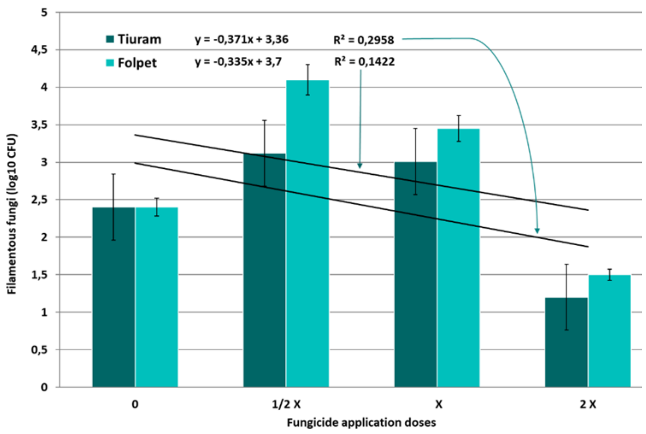


Figure (3)
Effects of fungicides on filamentous fungi in brown forest soil

Figure (4) illustrates that fungicides applied to the brown forest soil samples at doses ½X and X had a stimulating effect on cellulose-decomposing microbes, while 2X significantly reduced the number of microbes. Thus, it can be said that cellulose breakers also have an ecotoxicological effect with the use of all pesticides, as a significant difference is observed at double doses.

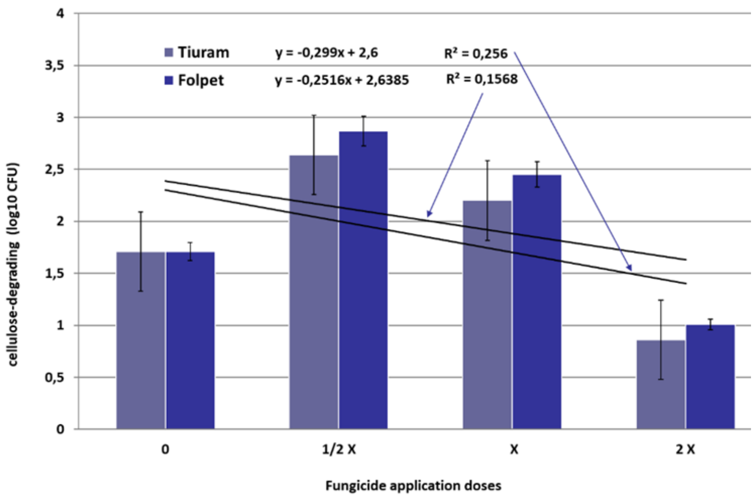


Figure (4)
Effect of fungicide on cellulose decomposers in brown forest soil

Figure (5) demonstrates the relationship between the applications of the fungicides on the phosphate solubilizers in the brown forest soil. I was found that as the Figure shows that the two fungicides had a similar effect compared with the microbial counts. Compared to the control soil sample, the phosphate solubilizers was increased in 2 cases (½X and X), and the double dose of each fungicide indicates a toxic effect.

Organic matter increase soil fertility in several ways and compost as an important source of organic matter has primary impacts on important soil properties. Based on the high nutrient mineralization potential and humus formation capacity, Fungicides application can distrib the nutrient supply and organic matter content of soils. Organic matter plays also an important role in decreasing heavy metal availability. These results have the main roles of soil biotas which have the ability to convert the organic matter to inorganic and in this case increase the soil fertility of the soil.

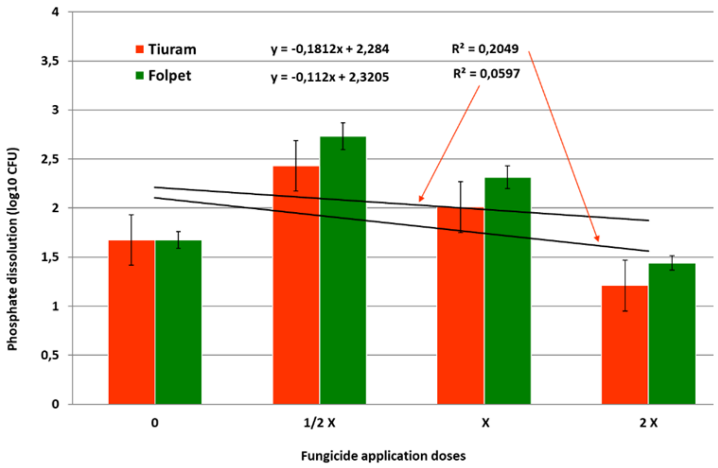


Figure (5)
Effect of fungicide on phosphate dissolution in brown forest soil

In the case of dehydrogenase activity as shown in Figure (6), the amount of potencial activity of the enzyme in the soil showed a significant increase in both fungicides under normal (X) and half dose (½X). However, the effect of the double dose was not significant for any of the two fungicides for this parameter, but the enzyme activity in the soil decreased to a certain level.

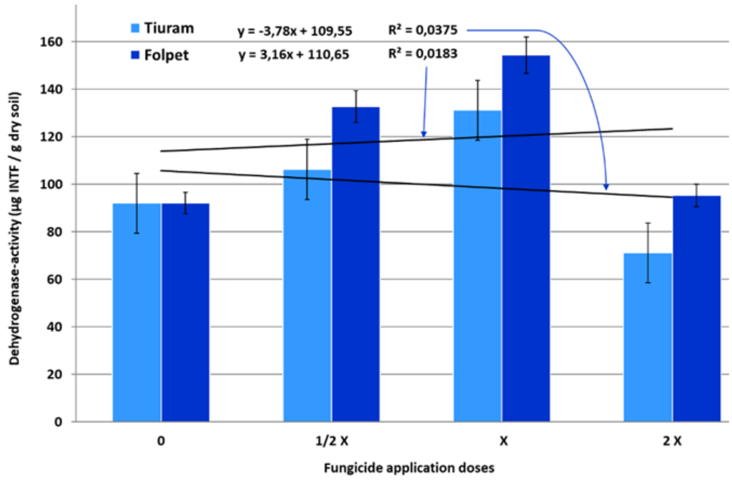


Figure (6)
Effect of fungicide on dehydrogenase activity in brown forest soil

Considering the control sample, the increase can be said to be significant for the half-dose (½X) and the normal applied dose (X) when examining urease as in Figure (7). At 2X doses of fungicides, the potencial activities were not significantly between them. But the effect of the application of the 2X dose of each fungicide to the brown forest soil is highly reduced the potencial enzyme activity compared to the control soil and other soil amended with low and normal applied doses.

Consequently, the soil receives the bulk of complex agrochemical compounds such as fungicides, several of which are poisonous to the activity of non-target beneficial soil microorganisms. Microorganisms in the soil are exclusively important because they impact soil structure, functions, and fertility. These organisms are primarily decomposers of organic matter, but also perform many other functions such as provide nitrogen, phosphorus, potassium, etc., through fixation and mineralization.

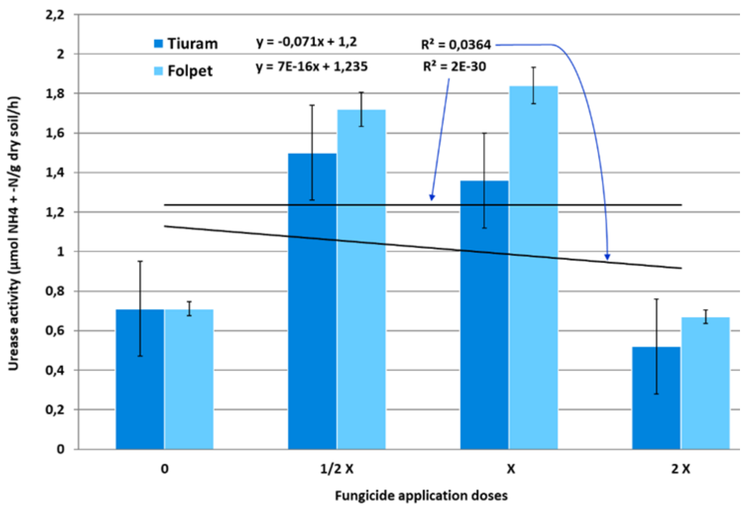


Figure (7)
Effect of fungicide on urease activity in brown forest soil

The nature of phosphatase potencial activity can be observed in Figure (8). There is a significant difference between the two and fungicides at the normal and double doses, but this is not significant compared to the control. Nevertheless, due to decreased enzyme activity, the use of 2X can be said to be toxic.

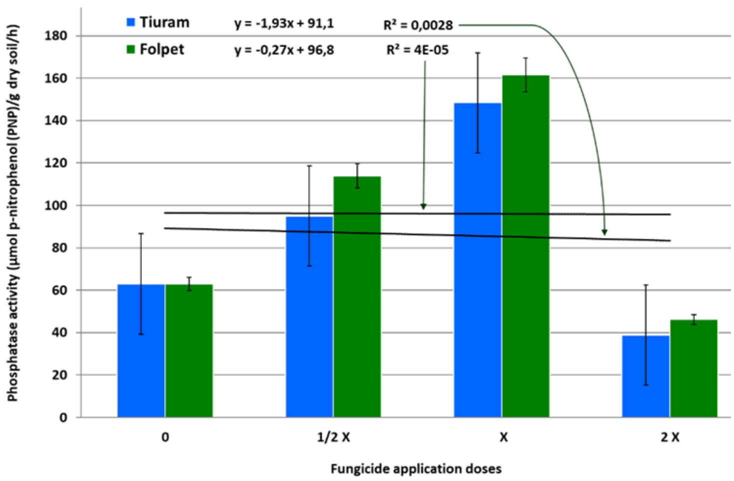


Figure (8)
Effect of fungicide on phosphatase activity in brown forest soil

In the following Figure (9), it can be observed that β-glucosidase potencial activity is much higher at normal applied doses of fungicides administered to the brown forest soil than the half applied doses. Thus, it can be said to be significant compared to the control soil sample. Double dosing also reduced soil activity in this enzyme activity, but was significant only in the case of Folpet.

There are no adequate test methods to evaluate the soil microbiological and biochemical effects of fungicides. This is due on the one hand to the diversity of fungicides and soil types and on the other hand to the relatively short history of fungicides. The results for urease and β-glucosidase show the process of carbon and nitrogen cycles. The test procedures presented above were not originally developed in this area, but are widely used to evaluate the microbiological and biochemical effects of fungicides on soil.

The use of other soil types and other fungicides is important for further research, it is recommended to set up further experiments to get an even more complete and comprehensive picture of the soil biological effects of fungicides as soil contaminants. It is suggested that further investigation of the mechanism of action of various fungicides on non-target microorganisms at the level of molecular genetics.

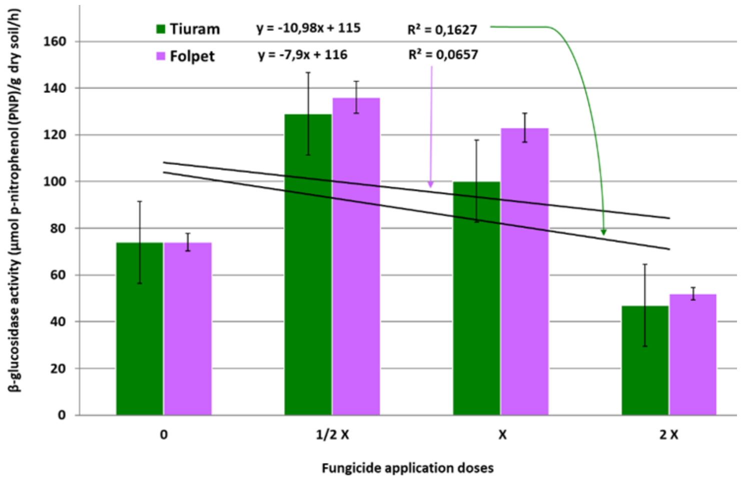


Figure (9)
Effect of fungicide on β-glucosidase activity in brown forest soil

Most copper based fungicides have a deleterious effect on the population of N-fixing bacteria. Fungicidal residues, for example, apron, arrest, captan, tend to remain in soil reacting with living organisms and affecting the N-fixation in legume-Rhizobium association [12]. Both mancozeb and chlorothalonil can decrease the process of nitrification and denitrification at an incubation period of 48 h [13]. The negative impact of the long-term application of organomercurial Verdean on cellulolytic fungal species has also been reported [14]. Several studies have reported the harmful effects on soil microbial growth, survival, and activity [15]. Fungicide bavistin has an inhibitory effect on several soil microbial populations, but the impact is non-significant [16]. Several biochemical processes in soil are closely linked with enzymatic activities which are adversely affected by residues and toxic elements left after application of fungicides [17]. Fungicides benomyl, mancozeb, and tridemorph inhibit the soil enzymatic activity of dehydrogenase, urease, and phosphatase [18]. Activities of phosphomonoesterase and urease enzymes are also inhibited in soils treated with captan, trifloxystrobin, and thiram fungicides [19],[20]. Yet, captan and thiram are classified as soil and seed protectant fungicides, respectively. However, the fungicide ridomil has a non-significant impact on the activity of a phosphatase enzyme [21]. These enzymes may be protected from degradation by adsorption on clays or humic substances in soil [22],[23]. The smaller the size of the clay particle, the greater is the protection against the added fungicides [24]. The synthesis of amino acids of certain bacteria is repressed by some glucopyranosyl antibiotic fungicides [25],[26]. The use of Cuin combination with mefenoxam can disturb soil microbial diversity as determined by structural and metabolic profiling. The population of ammonium oxidizing bacteria is decreased by the application of mefenoxam and mefenoxamp Cu fungicides after 60 days of application [27].

CONCLUSION

There are no adequate test methods to evaluate the soil microbiological and biochemical effects of fungicides. This is due to the diversity of fungicides and soil types on the one hand, and the relatively short history of fungicides on the other. The results for urease and β-glucosidase show the process of carbon and nitrogen cycles. The test procedures presented above were not originally developed for this field, but are widely used to evaluate the microbiological and biochemical effects of fungicides on soil.
In general, the concentrations of the two pesticides I studied (Folpet and Thiuram) had an increasing or decreasing effect on both soil respiration and soil microbiological populations and enzyme activities for all treated soil samples. The pesticides to be used in the study should be selected so as not to adversely affect the biological functions of the soil. Thus, by analyzing research, agents that have a positive or neutral effect on soil biological functions can be used in agriculture. The use of other soil types and other fungicides is important for further research, it is recommended to set up further experiments to get an even more complete and comprehensive picture of the soil biological effects of fungicides as soil contaminants. It is suggested that further investigation of the mechanism of action of various fungicides on non-target microorganisms at the level of molecular genetics.

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EFFECTS OF SEWAGE SLUDGE APPLICATION ON THE SOME BIOLOGICAL ACTIVITIES IN THE RHIZOSPHERES OF COMMON BEAN AND CORN

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***Abstract**: Significant population growth has generated several problems over the last half century. Due to the increased land use, the amount of fertile land is constantly decreasing. Minerals released from the soil by crop production and extraction needs to be replenished, as its self-sustaining mechanism cannot reverse such damage. The utilization of sewage sludge is playing an increasingly important role in the field of environmental protection due to the expanding sewerage network. The further storage, treatment and disposal of sewage sludge generated as a by-product during wastewater treatment are a significant problem for wastewater treatment plants, mainly due to the increasing volume. However, its special feature is that, despite being a waste, it is an important source of nutrients that, when returned to the soil, improves its quality. The aobjective of the study was to measure the effect of sewage sludge on soil biochemical properties and its remedial effect. In the course of the research, soil samples were treated with different proportions of sewage sludge for the biological activities measurements. The study was carried out in the rhizospheres of two plant species (common bean, maize), to measure the enzyme potencial activity of urease, ß-glucosasease, dehydrogenase, and phosphatase based on the content of sewage sludge. Based on the results of the study, it can be concluded that the application of organic waste sludge improves the quality of the soil in all cases, however, after 15% treatment, a significant change can be observed; there was a spectacular increase in soil enzymatic potencial activity of the investigated enzymes. Finally, the study covers the situation of domestic agriculture and the legal framework of sewage sludge disposal.*

***Keywords** Sewages sludge, enzymatic activity, Risk assessment, soil, plant rhizosphere*

INTRODUCTION

Significant population growth has generated several problems over the last half century. Increased land use induced by feeding people. It causes a steady decline in the amount of fertile land even today. Minerals extracted from the soil by crop production and extraction must be replenished, as its self-sustaining mechanism cannot reverse such rapid and large-scale damage. Another burning problem is the growing amount of waste, with wastewater occupying a special place as it grows in proportion to the population, there

is no way to reduce it, but due to the expanding sewerage network, an increasing amount has to be addressed. The further storage, treatment and disposal of sewage sludge generated as a by-product during wastewater treatment is a significant problem for wastewater treatment plants, as it is a very time- and energy-intensive operation. However, its special feature is that, despite being a waste, it is an important source of nutrients and organic matter, which improves its quality when returned to the soil.
In the European Union, there are almost 12 directives related to waste water policy, which has, among other things, contributed to the ban on the dumping of sewage sludge at sea. The gradual introduction of Directive 91/271 / EEC on urban waste water treatment will increase the amount of sewage sludge that Member States are required to dispose of. A wide range of sewage sludge treatment technologies are used in EU countries. The predominant choice is the direct application of agriculture followed by composting, but significant quantities are burned and deposited. However, the rate of use of sludge in agriculture varies greatly from country to country. [1] The agricultural use of sludge from urban waste water is regulated by Directive 86/278 / EEC, which is transposed by the Member States. The main purpose of the directive is to encourage agricultural use and to regulate activities so as not to contaminate the soil with harmful components in sewage sludge. For this reason, the regulation mainly covers the limit values for heavy metals, organic pollutants and pathogens.
In wastewater treatment plants (WWTP), various physicochemical and biological processes take place in order to treat efficiently wastewater. These processes result in the creation of primary and secondary sewage sludge as a by-product. Consequently, in order to put circular economy into practice, it is necessary to assess and promote alternative long-term solutions for sludge utilization and materials' recovery. [2] There are several potential uses of biosolids (i.e., treated sludges) including the application in agricultural and nonagricultural land as well as energy valorization. Agricultural land application of biosolids for fertilization purposes is a viable solution that presents both financial and environmental benefits. Properly treated domestic sewage sludge can provide essential plant nutrients, such as N and P; replenish soil organic matter; and stimulate plant growth. [3]
In a recent European consultation, it has been found thatthere is a significant gap in information on emerging pollutants in biosolids and that there should be harmonization on sampling and analysis on metals, pathogens, and organic pollutants [4]. Hence, it is imperative that biosolids are fully characterized in order not to cause harm instead of benefit when released to the environment. [5] An effective way of assessing the environmental footprint of biosolids released into the soil or near aquatic receptors is the use of ecotoxicity tests. Ecotoxicological analyses, in combination with chemical analyses, highlight costeffectively toxic substances and evaluate their potential effects on organisms.
In Hungary, sewage sludge plays a significant role in agricultural utilization. In 2013, about 38% of the sludge generated was used for agricultural purposes, preceded only by use for soil remediation, mainly due to mining activities. In Hungary, two decrees cover agricultural posting, 50/2001. (IV. 3.), which regulates the agricultural use and treatment of wastewater and sewage sludge, and 36/2006. (V. 18.) of the Ministry of Agriculture and Rural Development, which deals with the licensing, storage, distribution and use of crop-increasing substances. [6]
The use of sewage sludge as a soil improver is becoming more widespread, especially for soils with low organic matter content. The composition and proportion of organic matter in sludges varies, but by examining a general composition, the effect of each substance on soil microorganisms can be determined. With the introduction of organic matter, the microorganisms become activated, their enzyme production begins, the change of which can be measured, thus allowing conclusions to be drawn. This amount of enzyme is the enzyme activity, which is actually a measure of reaction rate. [7] Enzyme production is also affected by the physical, chemical and biological properties of the soil, so the response to nutrient uptake gives an idea not only of the number and composition of microbes but also of the physico-chemical state of the studied soil. [8]
During the research work, soil mixtures treated with different proportions of sewage sludge are examined, with different application rates. The study is based on the rhizosphere enzyme activity of two plant species (common bean and maize) such as phosphatase, urease, *ß*-glucosasease, and dehydrogenase, based on the content of sewage sludge.

MATERIALS AND METHODS

The basis of the research work was a soil sample from the area of Szent István University in Gödöllő, which

is a brown forest soil. Its altitude is around 200m, and the average annual rainfall is between 540-580mm. The soil sample was taken from the top 25 cm layer of the ground cover. [9]
During the experiment the used sludge was collected from the Nyíregyháza wastewater treatment plant, which is domestic aerobically digested sewage sludge. Table 1 contains some physicochemical characteristics of the Gödöllő soil sample and the Nyíregyháza municipal sewage sludge sample.

Table (1) Physico-chemical characteristics of the tested soil and sewage sludge samples [10]

Parameters	Soil sample (Gödöllő)	Sewage sludge sample (Nyíregyháza)
$pH_{(KCl)}$	4.72	6.71
Dry matter content (%)	-	53
Organic matter (%)	-	21.7
Humus content (%)	1.24	-
Total-N (mg/kg)	-	7470
NO_3-N (mg/kg)	33	-
NH_4-N (mg/kg)	1.77	-
Mg (mg/kg)	201	2507
Na (mg/kg)	21	994
P_2O_5 (mg/kg)	69.1	28720
K_2O (mg/kg)	135	3171
Zn (mg/kg)	7.1	537
Cu (mg/kg)	2.3	110.4
Mn (mg/kg)	53	421
Fe (mg/kg)	1187	11308
Cd (mg/kg)	1.6	2.3
Pb (mg/kg)	1.1	66.9

Two test plants. Corn (Zea mays) and Common beans (Phaseolus vulgaris L.) were used and greminated in soil sample and soil samples mixed with different sewage sludge rations for 21 days (see Figures 1 and 2)

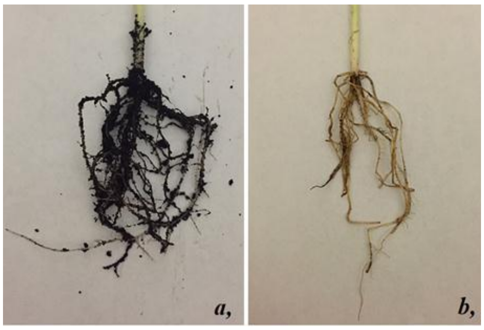

Figure (1) Vegetable bean root, before cleaning (a,) and after cleaning (b,)

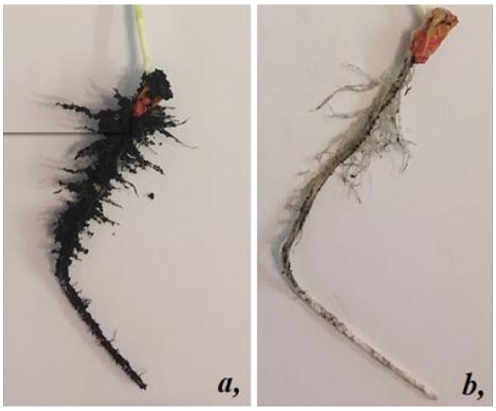

Figure (2) Corn root before cleaning (a,) and after cleaning (b,)

Dehydrogenase activity was measured according to the method of GARCÍA et al. [11]. I exposed 1 g of soil to 0.2 ml of a 0.4% INT (2-p-iodophenyl-3-p-nitrophenyl-5-phenyltetrazolium chloride) solution as an electron acceptor for 20 hours, 22°C, in the dark. The iodonitrotetrazolium formazan (INTF) formed was extracted with 10 ml of methanol by vigorous shaking for 1 min on a filter paper. INTF was measured spectrophotometrically at 490 nm. The results were expressed in μg INTF/g^{-1} soil. Urease activity was determined according to the method of Nannipieri et al. [12] in 0.1 M phosphate buffer at pH 7. One M urea as a substrate was used. Then, 2 ml of buffer and 0.5 ml of substrate were added to 0.5 g of soil sample, which was incubated at 30°C for 90 min. The enzyme activity was defined as NH_4^+ released in the hydrolysis reaction. The results were expressed in μmol NH_4^+ -N/ g^{-1} soil/h^{-1}. Phosphatase and β-glucosidase activities were performed according to the method of Tabatabai and Bremner [13].
P-nitrophenyl phosphate disodium (PNPD, 0.115 M) and p-nitrophenyl-β-D-glucopyranoside (PNG, 0.05 M) were added spectrophotometrically at 400 nm after incubation. Data were expressed in μmol PNP/g^{-1} soil/h^{-1}. The experiment was set up in a randomized block design, in three parallel studies, with three replicates. The results were represented the avarage of the replicated/treatment/ plant/sewage sludge dose. Then a simple linear regression analysis was used and the coefficients of determination (R^2) were calculated for all the examined parameters. The statistically significant difference between the treatments was calculated at the P <0.05 level.

RESULTS AND DISCUSSION

The biochemical activity of clay loam brown forest soil was investigated on the basis of the potencial activities of dehydrogenase, urease, β-glucosidase and phosphatase. Based on the results obtained, it can be determined, that in all cases, regardless of the degree of treatment, there was an increase in enzyme activity compared to the control. Even with 10% treatment, there is a visible increase in the enzyme activity.
Dehydrogenase activity (Figure 3) indicates oxidative processes of all soil microorganisms. Due to 10% treatment there is a small, however not a significant increase in activity, but a remarkable increase (P<0.05) above 15% treatment could be observed, compared to the control sample. The highest dehydrogenase enzyme activity was measured at the highest treatment (30%) and the lowest dehydrogenase enzyme activity was measured at the control. In the root-soil of corn, the values doubled as a result of 15% treatment, while a similar increase was achieved in case of common bean under the influence of a 20% sludge dose.

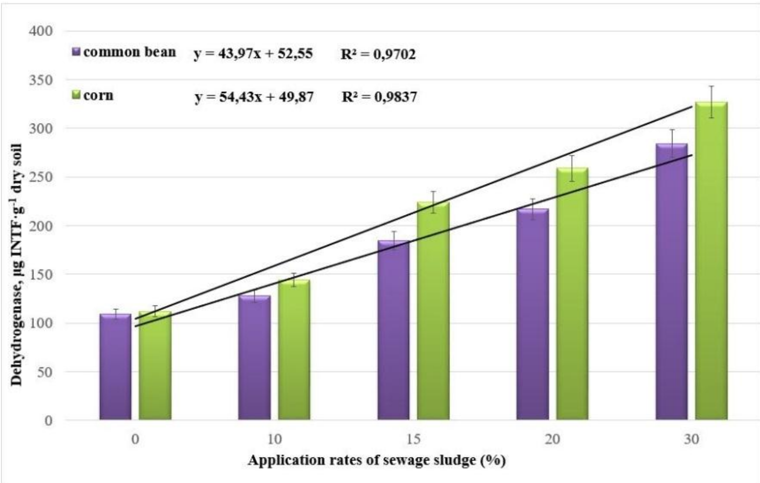

Figure (3) Changes in dehydrogenase activity in clay loam brown forest soil due to sewage sludge treatment

The urease enzyme is responsible for the hydrolysis of urease in the soil, which is included in the wastewater by human urine. Here the values were also lowest at the control sample. (Figure 4) The increase here was greater with 10% treatment than with dehydrogenase. A higher increase in maize values can be observed as a result of sludge treatment than in beans. The 30% treatment in the root-soil of corn nearly tripled the degree of urease activity compared to the control sample, while the growth of the values of common bean was just over double.

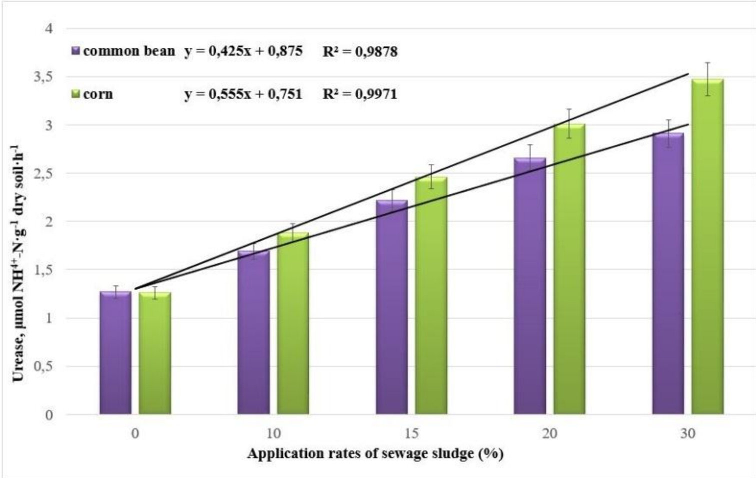

Figure (4) Changes in urease activity in clay loam brown forest soil due to sewage sludge treatment

β-glucosidase activity values (Figure 5) were similar to those of urease enzyme activity as a result of sewage sludge treatment. I experienced a slowing increase in values, as a result of an increase sludge dose. The increase in values is below 10% with 30% treatment compared to 20% treatment.

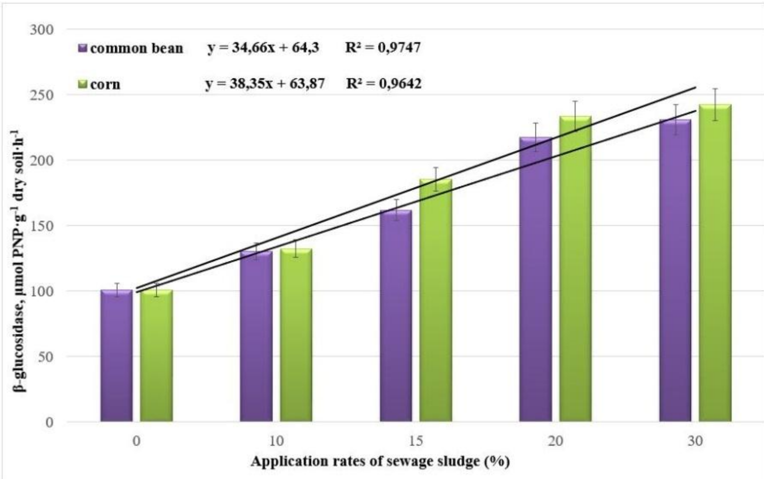

Figure (5) Changes in β-glucosidase activity in clay loam brown forest soil due to sewage sludge treatment

The application of sewage sludge significantly affected ($P < 0.05$) the activity of the enzyme phosphatase in the soil. (Figure 6) The values of the enzyme responsible for dismantling the various insoluble phosphate compounds increased significantly compared to the control sample, even under the influence of 10% sludge treatment. As a result of the 20% treatment, both plants experienced an increase of one and half times compared to the 15% treatment values. 30% sludge treatment caused the measured values to exceed four times the values of the control sample.
Based on the results, it can be seen that the evolution of enzyme activity is an important indicator of the functioning of microorganisms, which illustrates their reaction well to the nutrients introduced. The use of municipal sewage sludge for soil improvement will improve the biological and biochemical properties of the soil. The reason for the increase in enzyme activity detected in the soil is an increase in the number of microorganisms and the activation of their metabolism.
Considering my measurement results, it can be stated with absolute certainty that the introduced sludge had a beneficial effect on the soil properties in any amount. Soil respiration clearly increased with nutrient uptake compared to control soil, indicating that microorganisms were activated, their metabolic processes started, which is due not only to the amount of nutrients ingested but also to the heavy metal content of the sewage sludge used in the experiment.

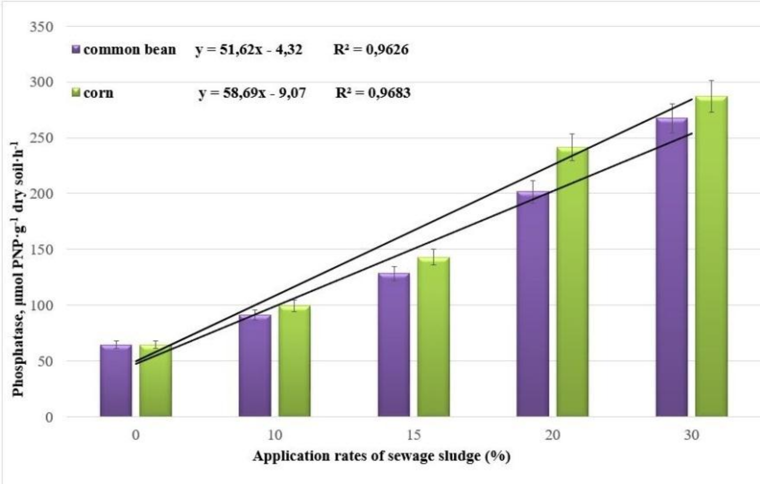

Figure (6) Changes in phosphatase activity in clay loam brown forest soil due to sewage sludge treatment

Sludge treatment increased the amount of aerobic heterotrophic bacteria, filamentous fungi, cellulose breakers and phosphate solvents in plant rhizospheres. As a result, the dehydrogenase, β-glucosidase, urease and phosphatase activities of the treated samples also increased. The activity of these enzymes shows a linearly increasing correlation with the soil organic matter content due to the sewage sludge added to the soils. [26]
According to EU data, municipal sludge production for the period of 2003–2006 is on the rise. [4], [14] Sludge contains significant quantities of N and P, and therefore, the biosolids may be used for crop fertilization. However, the possible presence of metals of toxicological interest in biosolids poses a risk for the humans and the environment. So, the concentration limits, which are laid out in Council Directive 86/278/EEC (1986) [15], should be respected.

CONCLUSIONS

It was found that the results of the study research are extremely positive, but to accurately determine the effects, field experiments are required under different conditions, and it is justified to examine the interaction between these conditions and sewage sludge in advance. Based on the results, it can be stated that the treatment increased with increasing sludge doses, and although the difference of 20% to 30% did not bring as much increase in the measured parameters as, say, the difference of 0% to 15%, it would be worthwhile to apply the effects of higher application rates to examine. In the long run, it can consider this to be the only option for soil improvement, as maintaining a cycle is an essential condition for the existence of the worldwide. However, the fact that sewage sludge also contains recovery inhibitors such as heavy metals, pathogens and organic micropollutants cannot be neglected. A significant proportion of these come from industrial effluents, so it would consider the separate collection of industrial effluents and the treatment of their sludge and their recovery in other ways (eg incineration energy recovery) to be a costly but long-term effective solution. This should minimize the release of dangerous substances by humans into the soil. In addition, further studies are needed, mainly on the effects of heavy metals on the agriecosystem productivity and on humans and animals health, as their effects do not have an immediate effect, and their accumulation in the body poses hitherto unknown dangers in the long-term. The legislation in Hungary is very strict regarding the disposal of agricultural sewage sludge, which is essential in order to avoid dangers.

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Analysing land use change in the Gödöllő Hills during 1990's

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Abstract: *: In Hungary, economic and social transformation after the political changeover played a major role in the evolution of the rapidly changing structure of the landscape. In order to reconstruct the earlier conditions, we need to familiarise ourselves with the history of the landscape. As the quality of the landscape has been deteriorating at a growing pace, we also need to examine the main parameters of the landscape components. Moreover, we need to devote special attention to the areas most sensitive from the perspective of nature conservation (e.g. the situation of wetlands and forest lands) to be able to monitor their alteration and mitigate the anthropogenic impact if possible. The main objective of this research work was focused on surveying land use change during 1990's.*

Keywords: *land use, land use change,*

INTRODUCTION

The area that my research has focused on is the Gödőllő Hills, a micro-region situated near the capital, in the metropolitan belt of the city. The proximity of the capital is both an advantage and a drawback for the Hills. Thanks to the favorable traffic system and its geographical situation, its population has been steadily growing. The development of the area has been determined not only by population growth, but also by industrial suburbanization [1, 2, 3].

However, all of the above may turn into a disadvantage: the growing number of inhabitants entails a heightened burden on the environment, one of the biggest stress factors for the region. Despite the trends of suburbanization, society has a growing need for a natural, "intact" environment, and ironically, in some cases, this desire seems to be the very motif of suburbanization. This is why research monitoring changes in landscape use is so important – research that simultaneously examines the extent of degradation and stability of the landscape. Regarding their physical geography, the Gödöllő Hills constitute an area of geomorphological transition, but due to their natural and landscape values their preservation is a key priority. Another reason why the specification of natural and quasi-natural areas is a quintessential task is that there are more and more factors leading to or projecting changes in this area.

The primary analysis of research findings concerning the presentation of changes in the landscape and in land cover is based on the examination of historical maps [4, 5, 6, 7, 8, 9, 10, 11], aerial photography [12, 13, 14, 15], as well as (GIS based) satellite images [16, 17, 18, 19]. The advantage of such approaches is that they make it possible to understand current events and to explore future possibilities. They can provide a basis for exploring the differences and similarities or the stability and changes between two or more points in time, even in terms of land use categories. They may also help to resolve disputed land ownership issues.

This study applies the latter direction, i.e. out of the different approaches; I have chosen the method that utilizes digitalised maps which showing the 1990 years.

MATERIALS AND METHODS

Location of the area under examination:
According to the micro-region typology of Marosi & Somogyi [20], as well as Dövényi (2010), the Gödöllő Hills are part of the macro-region called North Hungarian Mountains. Within that, they are located in the northern part of the group of micro-regions called Gödöllő–Monor Hills in the meso-region of the Cserhát. The Gödöllő Hills (stretching over 550 km2) are situated between 130 and 344 m above sea level, and gradually become lower towards the southeast [20]. Their location, geological and climatic conditions make them a transitory zone between the North Hungarian Mountains and the Great Hungarian Plain. Their independent hills are wedged between the latter two macro-regions.

Land covers survey:
I examined the changes in the landscape use of the Gödöllő Hills on the basis of literary sources and a topographic survey (EOV 1989) and a Corine survey (Corine land Cover Map 1998) in order to identity 1990 years structure of the landscape.
Using GIS tools and the ArcView 3.2 software, I digitalized the maps, identified the typical land use types, and prepared a comparative analysis between adjacent survey dates, displaying my findings on a map. I used Microsoft Excel to prepare a mathematical statistical analysis: I calculated the distribution of the individual land use types and expressed the difference between the various periods in percentage.
I distinguished seven typical land use forms: built-up/residential areas (artificial surfaces: built-up areas, farm buildings and industrial buildings, traffic routes); forests (scrublands and bushes); wetlands (surface waters, reedy marshlands); meadows and pastures; hobby plots and orchards; and vineyards.

RESULTS AND DISCUSSION

Regarding land use forms, the land cover map (1989) prepared on the basis of the EOV topographical map showed the sustained preponderance of arable lands (36.32%) in addition to forests (37.06%) in this period (Table 1). True enough, there was a decrease compared to the previous period: up until the 1970s, the proportion of arable lands dropped in nearly all of the settlements of the Gödöllő Hills. The growth (9.18%) of residential areas (built-up areas, industrial areas, traffic roads) signalled the restructuring of the micro-region. There was an increase in the distribution of hobby plots and orchards. This growth could be clearly put down to the flourishing of recreational areas in settlements near the capital. Not only orchards gained territory, but vineyards as well.

Table (1) Evolution of different land use types in Gödöllő Hills based on EOV topographic map (1989)

Land use type	Area (ha)	Area (%)
Built up area	4599.42	9.18
Forest	18573.33	37.06
Wetland	496.14	0.99
Pasture, meadow	5657.76	11.29
Arable land	18204.59	36.32
Orchard	2072.82	4.14
Vineyard	512.29	1.02

Although the time interval between the EOV survey and the CLC50 survey is shorter than the period previously examined, it still demonstrates the restructuring of the spatial structure of the landscape at the time of the political changeover. Transformation manifested itself in the form of the growth of the residential (or rather, built-up) areas (15.11%). This process was driven by the population increase due to the proximity of the capital. In the 1990s the settlements of the Gödöllő Hills, too, were increasingly affected by suburbanisation. Population swelled in each of the settlements: in the north, the growth rate was above 60% while it remained well below this figure in the middle and southern areas. It was especially high in Veresegyház (124%), where the number of inhabitants doubled in comparison with 1990, whereas in Erdőkertes (89%) and in Szada (86%), there was almost a twofold increase. The population of these two settlements has been growing at the same rate ever since.

CONCLUSION

There are three categories that can be distinguished according to the changing trends. The first category includes land use forms where we can see a clear increase, such as in the case of built-up areas: at the end of the 18th century, urban development was 0.62%, which leaped to 15.11% by the end of the 20th century. Growth was permanent, with no setbacks in any of the periods. The growth in the number of inhabitants also affects certain aspects of nature conservation as the latter is closely interrelated with the expansion of settlement and traffic infrastructure (construction of real estate, public buildings, industrial areas, railway lines and motorways). This further reinforces anthropogenic influence, and consequently leads to the reduction and fragmentation of undisturbed natural areas, diminishing the quality of the remaining areas.

The second category contains wetlands, meadows and pastures, and vineyards. These land use forms were characterized by a steady decrease due to the growing need for land (parallel to the trends described above). With the exception of vineyards, this led to a reduction in the size of lands that would have been potentially valuable from the perspective of nature conservation. The shrinking of the size of lands covered by water is a phenomenon whose relevance is not restricted to the territory of the Gödöllő Hills – it is typical of other areas in Hungary as well [21, 22]. The increasing importance of agriculture and settlements has played a major role in that.

The third category includes those land use forms where there were changing, yet opposite trends in the period examined, in the case of forests and arable lands. The forest lands of Hungary – and of the Gödöllő Hills – have become larger over the past 90 years [23]. However, there is a significant difference between the proportions of forest cover in the country and in this micro-region: the forest cover of the Gödöllő Hills is nearly twice as high (approx. 21%) as the national average and is nearly 10% higher than the average of the North Hungarian Mountains [23, 24].

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WORKING METHOD OF A HEAT PUMP

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Abstract *The operating principle of the air-source heat pump is based on the physical property that the boiling point of a fluid increases with pressure. A heat pump has four main components: evaporator, compressor, condenser and expansion device. The examined heat pump is used for making domestic hot water and air condition. Decreasing energy resources of the Earth and enhanced energy consumption are typical of our life. However, one of the basic conditions to survive is that the amount of the energy used every day should be reduced. The energy used to air-condition a room and the possible use of secondary energies generated by the air-conditioning is studied in the research. The heat energy distracted by a heat pump out of the room is not let outside as heat loss, but it is used for making domestic hot water. The efficiency of the heat pump is examined with varied air parameters inside. About 0.3 kW electric power taken by heat pump from national electricity network. Heat pump can be separated from united electrical network by solar energy system; this article shows solution for this method too.*

Keywords *Air-conditioning, coefficient of performance (COP), domestic hot water supply, effectiveness, heat pump.*

INTRODUCTION

In general, the purpose of air-conditioning is to generate temperature lower than the ambient temperature and keeping it constant inside the room to air-condition [8]. In practice, heat pumps driven by an electric compressor are generally used. The ratio of the heat energy egressed by the heat pump and the energy taken from the electric supply for driving the compressor (and the fans) is called the coefficient of performance of the cycle. The higher the coefficient of performance of a heat pump is the more economic it is, it varies between 2 and 5 according to the structure of the heat pump, the ambient temperature outside and the way of application. See the schematic diagram of a heat pump in Figure 1.

The following relation can be described between the energies in Figure 1:

$$Q_h = Q_c + W \tag{1}$$

where:

Q_c	the heat distracted from the room	[J],
Q_h	the quantity of heat egressed to the hot water tank	[J],
W	electric energy taken by the heat pump	[J].

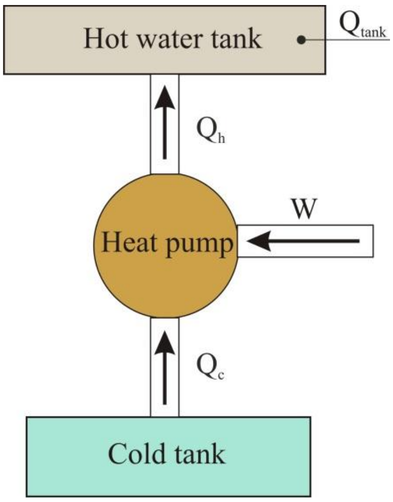

Figure (1) Schematic diagram of a heat pump

Theoretical coefficient of performance of the heat pump [1-6]:

$$COP = \frac{Q_h}{W} = \frac{Q_c + W}{W} \qquad (2)$$

where:

COP coefficient of performance of the heat pump [-].

The heat energy stored in the hot water tank of the heat pump as hot water:

$$Q_{\text{tank}} = m_w c_w \Delta T_w \qquad (3)$$

where:

Q_{tank} heat energy stored in a hot water tank [J],

m_w mass of the heated water [kg],

c_w specific heat of the water, $\left[\frac{\text{kJ}}{\text{kg}^\circ\text{C}}\right]$,

ΔT_w difference of the mean temperature at the bottom and on the top of the water tank $\left[^\circ\text{C}\right]$.

As a result of the losses of the system:

$$Q_h > Q_{\text{tank}}. \qquad (4)$$

The heat loss on the condenser side:

$$Q_{loss} = Q_h - Q_{\text{tank}} \qquad (5)$$

where:

Q_{loss} loss generated in the heat exchanger (condenser) [J].

Thus the relation of the actual and theoretical coefficients of performance can be written on the operation of the heat pump, using relation (3):

$$COP > COP_{\text{actual}} = \frac{Q_{\text{tank}}}{W} = \frac{m_w c_w \Delta T_w}{W}. \qquad (6)$$

The heat pump system is a cycle that consists of two heat exchangers (evaporator, condenser), a compressor and a butterfly valve [7]. Each element is joined by a pipe filled with transfer medium. The operation of the heat pump is illustrated in Figure (2).

1 The compressor condenses the gaseous transfer medium (R134a) using electric energy (which heats) and circulates it in the system permanently.

2 The heat of the hot gas inside the fan-coil unit - through a water heat exchanger - is used for making hot water, while the medium cools down, precipitate and turned into fluid again.

3 The liquid medium flows to a space of bigger cross section, through an expansion valve, to the evaporator. The pressure declined hereby makes the medium, which expands and strongly cools accordingly, gaseous again.

4 By utilizing hundreds of cubic meters of air sucked through the evaporator, heat is distracted from the surroundings, which makes the air cool down in the room. Then this hotter vapour is condensed again starting from the first step.

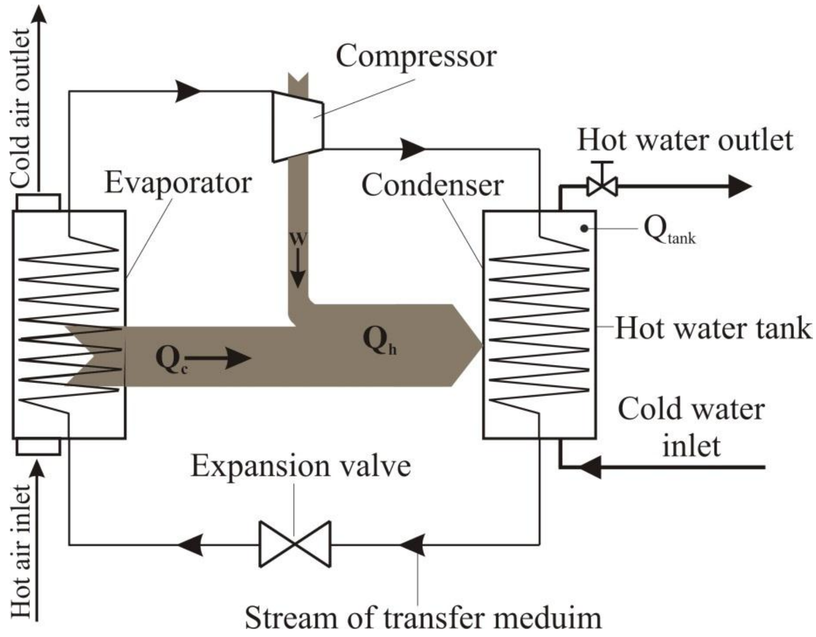

Figure (2) Working process of the heat pump cycle

Heat pumps are heat engines of reverse operation. The thermodynamic cycle can be followed on the temperature-entropy (T-s) diagram (Figure 3). The process starts from point 1, where the medium at p_i pressure and T_i temperature occurs as saturated vapour. Processes 1 and 2 are adiabatic compressions that happen in the compressor. Normally, this change of state is indicated in the diagram as a vertical line (isentropic compression), but in reality the change of state is irreversible, entropy permanently increases, thus the curve slightly bends to the right.

Processes 2 to 5 happen in the condenser: processes 2 and 3 are the distraction of overheating heat; in point 3 the vapour reaches saturated state at pressure p_f . In processes 3 and 4 the temperature does not change, more and more vapour precipitates and the liquid state emerges in point 4. Processes 4 and 5 in the condenser is the possible after-cooling of the fluid medium, then processes 5 and 6 is the thermodynamic process, which results in sudden fall of the pressure, at the end of which the medium expands to p_f pressure and T_f temperature, the liquid partly (approximately half of it) evaporates suddenly and the medium turns into wet, vapour state. This is an isenthalpic process, i.e. during the process the enthalpy does not change.

Finally, in processes 6-1, the medium takes heat in the evaporator from the space to cool at permanent temperature and pressure, while the moisture content of the vapour declines gradually. Then the medium returns to the starting point of the cycle, to state 1, and the process starts again. Naturally, all mentioned above apply to an ideal medium; the processes rather differ in deed [10].

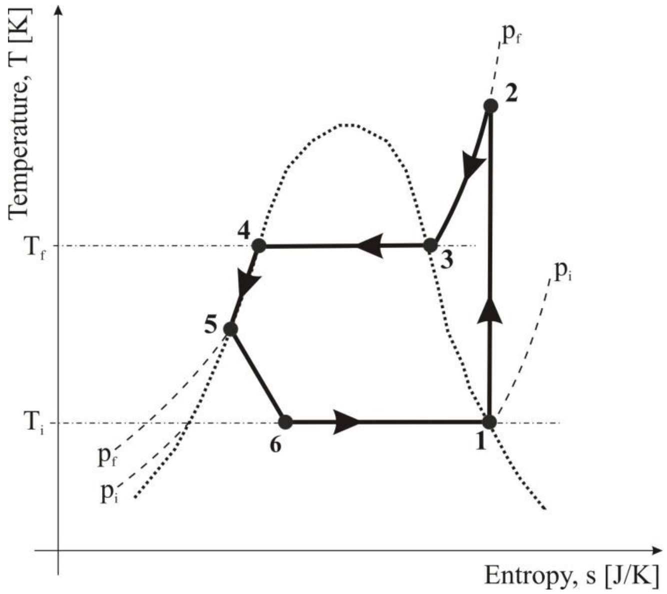

Figure (3) Cycle of the vapor-compression refrigerator on the temperature-entropy diagram

MATERIALS AND METHODS

A heat pump installed in one of the rooms of the site of Óbuda University in Doberdó Street is examined focusing on the economy of air-conditioning. The examination is performed depending on the measuring order illustrated on Figure 4.

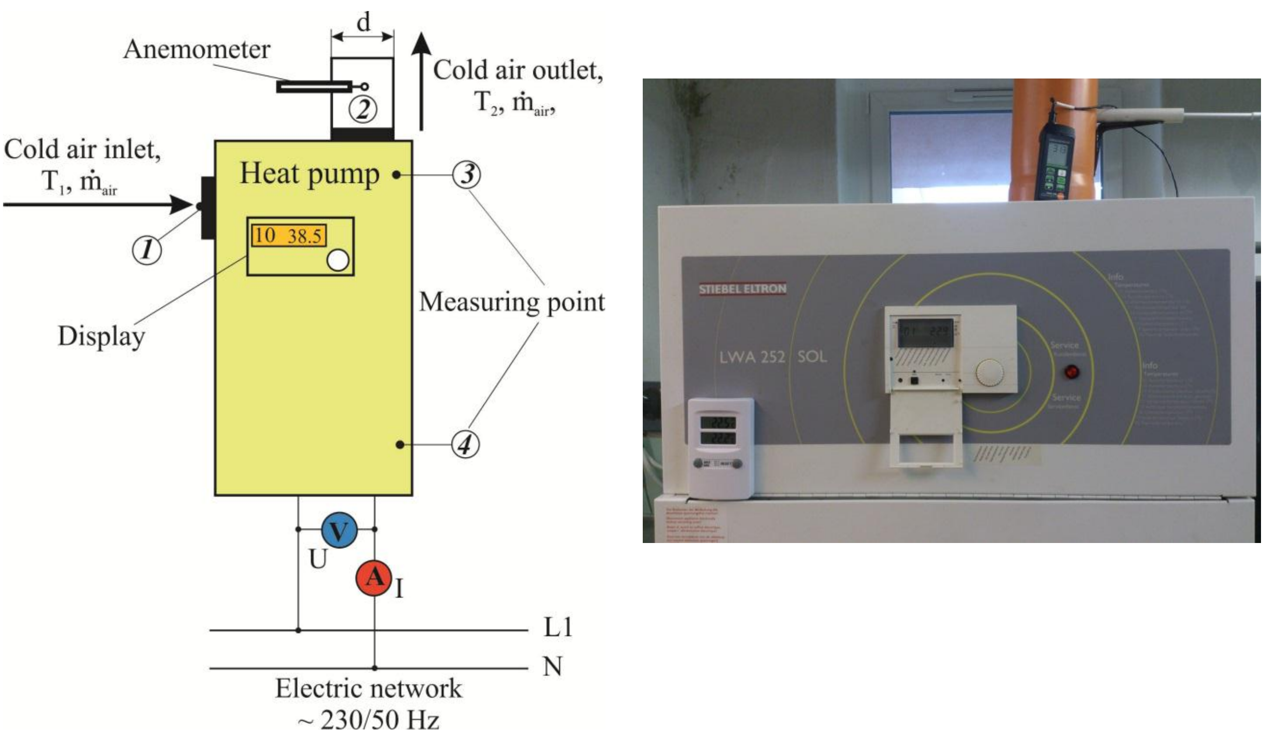

Figure (4) Measuring order of a heat pump

The measuring system consists of the following main elements:

- air-water heat pump to examine,
- anemometer type testo 435,
- ammeter and voltmeter,
- thermometers built in the heat pump.

RESULTS

The temperatures of the air let in and out of the pump are measured at the measuring points 1 and 2 as illustrated on Figure (4). At point 2 the air flows out of the pump through a pipe end of 160 mm diameter. The speed of the air let out of the pump is measured with an anemometer type testo 435, the average of which is: $v_{air} = 3.3 \ \mathrm{ms}^{-1}$. During the time of warming up ($t = 242 \ \min \approx 4 \ \mathrm{h}$) the volume flow rate of the air blown out is $237.6 \ \mathrm{m}^3\mathrm{h}^{-1}$. The outcoming values relating to the measuring time are illustrated in Microsoft Excel. Afterwards, the trend lines are defined by using regression, indicating the determinant coefficients R^2.

Table (I) Temperature measuring results

Measuring time, t [min]	Inlet air temperature, T_1 [°C]	Outlet air temperature, T_2 [°C]	Hot water temperature up, T_3 [°C]	Hot water temperature down, T_4 [°C]
0	24.2	22.5	26.9	26.4
5	24.2	17	27	26.4
10	23.5	13.2	27.6	26.4
15	23.1	12.5	28.2	26.4
30	22.6	12.1	30	26.4
45	22.5	11.4	31.6	26.5
60	22.4	11.1	33.2	26.5
75	22.3	10.9	34.7	26.6
105	22.2	10.9	37.5	26.7
135	22.2	11.1	40.3	27
165	22	11.1	43.1	27.4
195	21.8	11.2	45.8	27.9
225	21.7	11.3	48.5	28.5
242	21.7	11.2	50	29.8

Figures 5 and 6 illustrate the inlet and outlet temperatures of air listed in Table (I).

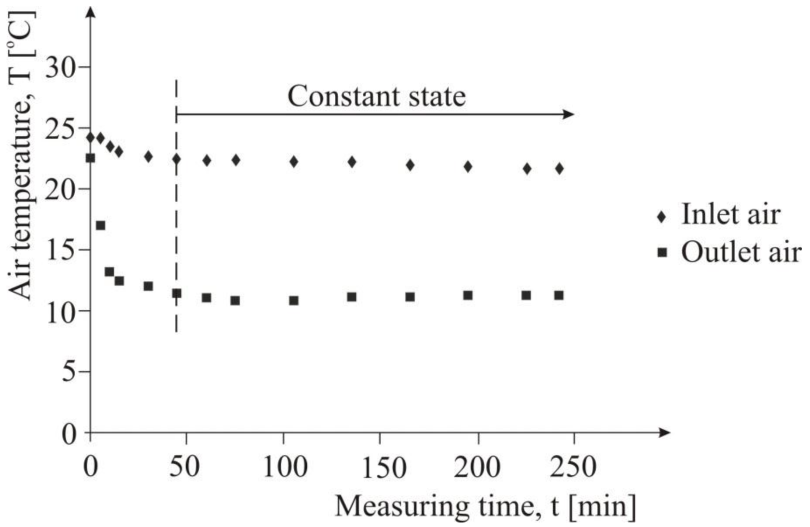

Figure (5) The temperatures of inlet and outlet air during the operation of the heat pump

Figure (6) indicates the regressive approach of the air let in and out, also marking the determinant coefficients.

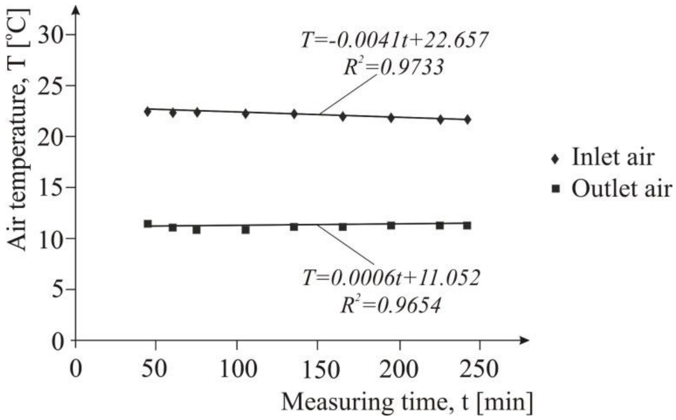

Figure (6) The temperatures and regression of inlet and outlet air in the constant state

At measuring point 3 in Figure (4), the temperature is measured at the top of the hot water tank, and at point 4, the temperature is measured at the bottom of the tank. Table (I) contains the measuring results. Figure (7) shows the temperatures of the hot water tank.

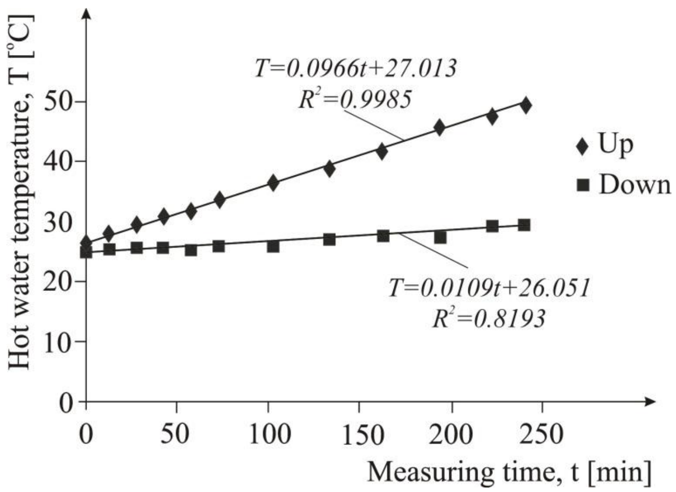

Figure (7) The temperatures of the hot water tank up and down

Figure (8) indicates the temperatures of the evaporator.

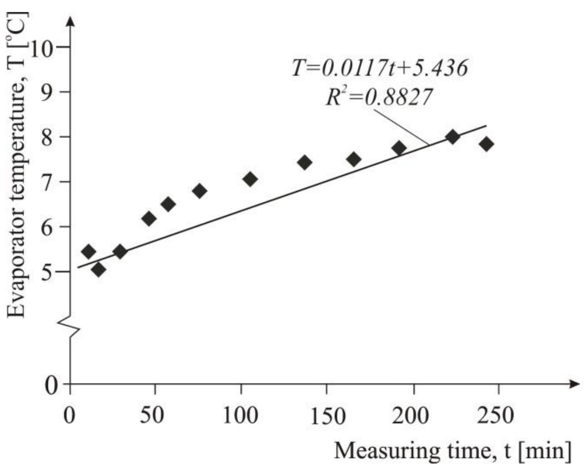

Figure (8) Temperature ranges of the evaporator

Figure (9) presents the current consumption of the heat pump with constantly $U = 224\ \mathrm{V}$ alternating voltage; the graph indicates increasing current consumption. The value of the power factor during the operation of the heat pump is $\cos\varphi = 0.9$.

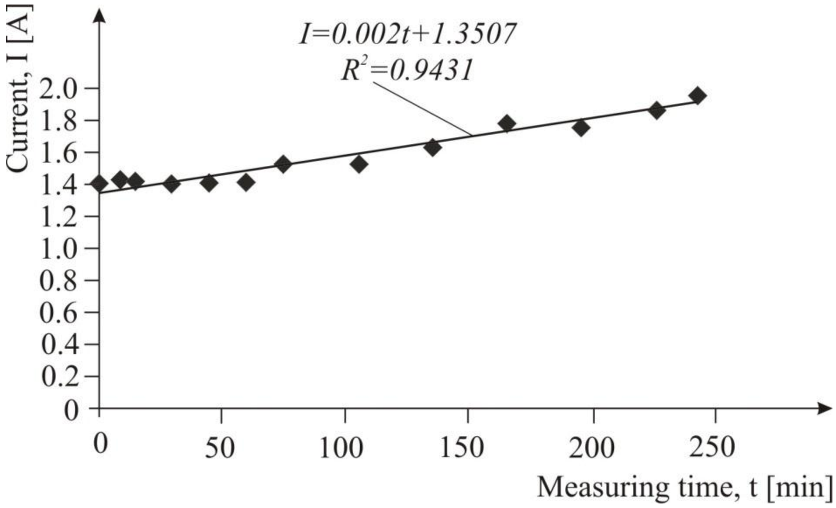

Figure (9) Current consumption of the heat pump

Rewriting relation (6) to performances:

$$COP_{actual} = \frac{Q_{\text{tank}}}{W} = \frac{P_{\text{tank}} \cdot t}{P_e \cdot t} = \frac{P_{\text{tank}}}{P_e} \qquad (7)$$

where:

P_{tank}	heat power of the hot water tank	[kW],
P_e	electric power taken by the heat pump	[kW].

Taken electric power based on the measured data:

$$P_e = U\bar{I}\cos\varphi = 224 \cdot 1.53 \cdot 0.9 = 308.5\,W \approx 0.3\,kW. \qquad (8)$$

where:

U	effective value of the alternating voltage	[V],
$\bar{I}$	average of the measured currents (based on the data of Figure 9).	

Volume flow rate of the inlet and outlet air:

$$\dot{V}_{air} = A\bar{v}_{air} = \frac{d^2\pi}{4}\bar{v}_{air} = \frac{0.16^2\pi}{2}3.3 = 0.02 \cdot 3.3 = 0.066\,m^3/s = 237.6\,m^3/h. \qquad (9)$$

where:

A	cross section of the and air pipe end in and out	[m^2],
d	diameter of the air pipe end in and out (Figure 4)	[m],
$\bar{v}_{air}$	the average speed of the air outlet in the cross section out	[m/s].

The mass flow of the inlet air:

$$\dot{m}_{air} = \dot{V}_{air}\rho_{air} = 0.066 \cdot 1.2 = 0.0792 \approx 0.08\,kg/s = 288\,kg/h. \qquad (10)$$

here:

ρ_{air}	density of the air	[kg/m^3].

Heat power extracted from the air:

$$\dot{Q}_c = \dot{m}_{air}c_{air}\Delta T_{air} = \dot{m}_{air} \cdot c_{air}\left(\bar{T}_1 - \bar{T}_2\right) = 0.08 \cdot 1 \cdot \left(22.6 - 11\right) = 0.928 \approx 0.93\text{ kW}. \qquad (11)$$

where:

c_{air} specific heat of the air at constant pressure $\left[\frac{kJ}{kg\,^\circ C}\right]$,

ΔT_{air} difference of the mean temperatures of the inlet and outlet air $[^\circ C]$.

Quantity of the heat of the hot water based on (3) and Figure (10):

$$Q_{tank} = m_w c_w \left(\bar{T}_{34f} - \bar{T}_{34i}\right) = 290 \cdot 4.2 (40.0 - 26.65) = 16260.3 \text{ kJ} \approx 16.26 \text{ MJ}. \quad (12)$$

where:

$\bar{T}_{34i}$ the mean temperature of the water tank at the beginning of measuring $[^\circ C]$,

$\bar{T}_{34f}$ the mean temperature of the water tank at the end of measuring $[^\circ C]$.

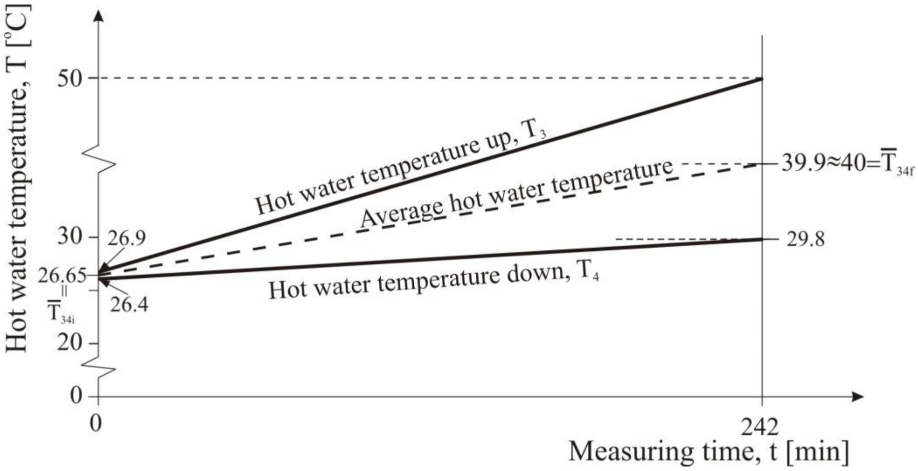

Figure (10) Temperature ranges of the hot water tank depending on measuring time

Heat power:

$$P_{tank} = \dot{Q}_{tank} = \frac{Q_{tank}}{t} = \frac{16.26 \cdot 10^6}{14.52 \cdot 10^3} = 1.119 \approx 1.12\, kW. \quad (13)$$

where:

t measuring time (warming up time) [s].

Applying this factor the result is relation (7), i.e. the actual coefficient of performance of the heat pump:

$$COP_{actual} = \frac{P_{tank}}{P_e} = \frac{1.12}{0.3} = 3.73 \approx 3.7. \quad (14)$$

CONCLUSION

The value of the coefficient of performance, while examining the heat pump energetically, is $COP = 3.7$, which corresponds to the value defined in the technical literature.

At present, concerning air intake air conditioners, the heat energy taken from the space to air-condition is generally let outside the room. In our research a system is established that enables the heat energy that has been managed as loss so far, to be utilized for making domestic hot water. This energy decreases the amount of electricity taken for making domestic hot water. Thus the efficiency of the system (air-conditioning and making domestic hot water), having been examined, is nearly 100%.

The time of the static return of investment of the system may be defined by the following relation [9].

$$\text{Time of return of investment} = \frac{\text{Invested sum of money}}{\text{Savings annually}}. \quad (15)$$

Return of investment of this system may be expected within 5 years.

On the effect of more intensive radiation of the sun the temperature of the air is increasing. On this effect the warmer feed-water produced by solar collector and connected to the inlet arm for cold water of the heat pump increases the efficiency of the heat pump.
The production of the electricity of the solar panel system is also increasing while the electricity supply of the heat pump is rendered. The air-water heat pump working in this way is an effective device for energy production. The theoretical scheme of its realization is shown in Figure (11).

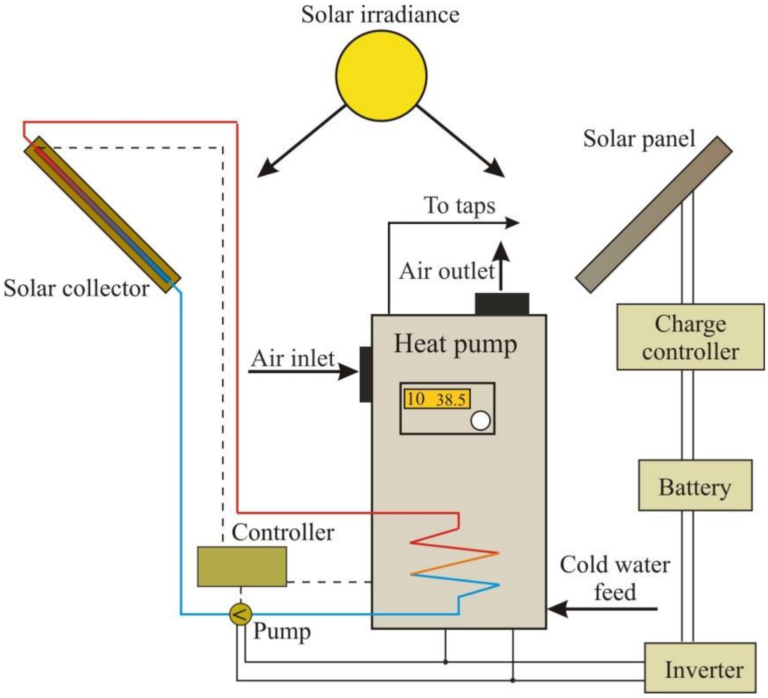

Figure (11) Used of solar energy system

This makes possible the disconnection from the national mains. Thus the supply of energy (domestic hot water, air conditioning) and the electricity of a family house can be realized from renewable energy-sources.

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PROJECT EDUCATION IS A STRATEGY OF PROJECT PEDAGOGY

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Abstract: *The new strategy of higher education - Graduation in Higher Education, Guidelines for the Development of Performance-Based Higher Education - expects a higher proportion of practice-oriented education in engineering education, as it provides the basis for the development of professional competencies. This includes in particular the co-emergence of knowledge, skills, attitudes and the ability to take responsibility. The competency development of students majoring in environmental engineering s need to be supported by field work and practical activities based on examples taken from the real life problems and the solutions. Practice-oriented education promotes the development of internal, self-regulatory motivation, which is necessary for the further acquisition of knowledge in an individual way, for the development of ability of lifelong learning. By providing an opportunity to expand the teaching-learning space and considering fieldwork as an integral part of the training, project education creates the conditions for competence-based training, contributes to the development of responsible, environmentally conscious behaviour towards the environment, as well as the system approach that is essential for engineering activities.*

Keywords: *project education, environmental attitude, field work, systems approach*

INTRODUCTION

The modification of the training and output requirements for the basic training of environmental engineers already takes into account and emphasizes the implementation of competence-based training at several points. In this, special emphasis is given to interoperability – graduate "*can cooperate with social organizations dealing with environmental protection, but ready to debate in order to develop optimal solutions. Open to professional cooperation with specialists working in other fields related to their profession. Strives to solve tasks and makes management decisions by getting to know the opinions of employees, preferably in cooperation. Shares experiences with the staff, helping them to grow*", self-education - "*Strives to continuously improve knowledge through self-education and to keep knowledge up to date about the world. By participating in organized trainings he/she continously develops his/her knowledge in the field of environmental protection*" - and about responsibility for the environment: „*undertakes and authentically represents the social role of environmental protection and, its fundamental relationship with the world; responsibly professes and represents the values of the engineering profession, openly accepts professionally grounded critical remarks* " [1]
In addition to teaching scientific theoretical knowledge, the task to be solved in the education is to develop system approach, problem recognition and solution, ability of lifelong learning and responsibility for the environment. Recognizing and solving global and regional environmental problems cannot be without technical intelligence with a high level of scientific knowledge and responsible behavior towards the environment. "*Environmental protection is especially a profession that can only be performed with solid*

professional knowledge, scientific readiness and ethical engineering thinking. Environmental education is based on the respect and responsibility we feel for human life, the natural environment and the domestic 'gray stock' of knowledge as the best values". [2]
The pedagogical methods used in higher education must be chosen and renewed in accordance with this goal. Education, which is primarily based on the method of lecture, should be replaced by practice-oriented pedagogical methods, one of the methods of which has been proven to be effective for decades, the project method.

PROJECT EDUCATION IS THE LEARNING TO LEAR

"*Project education is a problem-oriented open education strategy"* [3], in which the activity-oriented, task-oriented organizational forms and methods areappeared. Its aim is to guide the student from the formulation of the problem to its solution through a teaching-learning process, the end product of which proves the understanding of the contexts and development of the problem-solving ability. In addition to all this, it provides an opportunity to develop an environmentally conscious, responsible lifestyle, which requires real life situations and experiences. The aim of the self-directed, self-regulated learning process implemented in connection with the independent exploration of topics is to develop the ability of lifelong learning. During self-regulated learning, the student is able to formulate his/her personal goals in accordance with his / her own needs, to work for achieving them and to set new and new goals in connection with the experience of success, thus to motivate oneself. The internal motivation encourages learning.
Project education is theoretically suitable for acquisition of all learning units, but it is indispensable in those complex topics where the task is to understand the contexts, to acquire a behavior that presumes acquisition of specific experience in the cognition process.

Strategic steps in project education

During project education, the path to achieve personal goals can be divided into three well-separable spheres of activity. [4]

1) Students choose a topic (or the teacher chooses a topic in a guided way) and in connection with the chosen topic they recognize, understand the problems related to the given project topic, their cause effect contexts and designate the main goal leading to the solution. They form groups and formulate further specific problems and sub-goals within the group or individually that are necessary to achieve the main goal. They select the sub-topic they feel they are able to solve.
2) During the elaboration and planning process, the tasks necessary to achieve the sub-objectives are formulated and their solution plan is elaborated. Data is collected, work is distributed, the appropriate form of work and durations are specified. They appoint responsible team members.
3) In the execution phase, they analyse the facts, systematize and process the data, solve the problem, and present the finished product.

Within the three main areas of activity, steps of the teaching-learning strategy of project education are the following:

- Students recognize and understand the problems of a given or chosen project topic (project), their cause effect contexts, and identify the main goal leading to the solution.
- With the help of the teacher, students formulate additional specific problems in groups or individually and formulate goals (sub-goals) to achieve the main goal.
- In the voluntary groups, the students choose topics from the problems coming up and formulated, which they feel they will be able to solve.
- Students make a plan for the solution process and formulate the tasks.
- They discuss in groups the distribution of tasks, the locations of data collection, the selection of potential informants, they plan potential sponsors and contributors, and appoint team members Responsible for such sub-tasks.
- Active implementation is completed with -optional- teacher assistance in group, pair or individual work.
- The product presentation, presentation of the project process takes place in front of the teams.

- Project evaluation: the self-evaluation focuses on the project preparation process, the team evaluation focuses on the presentation, the jury evaluation focuses on the project activity and the product.
- Make the necessary adjustments based on the suggestions made during the evaluation.
- Final publication of the project after completing the corrections.

In the process of project education, learning basically takes place in groups or individualized organizational forms. When organizing the activity and solving the tasks, the emphasis is on working together, helping and accepting each other, and acquiring communication skills and techniques.

Project planning should meet the following criteria [5]:

1) The project should focus on a problem.
2) The problem solving through the activity should be related to the real situations.
3) Provide opportunities for individualized work (portfolio).
4) Give opportunity to work in groups.
5) The duration of the project should cover the diligence period of one academic semester.
6) The goal should be to solve a real environmental problem.
7) Create a connection between subjects, characterized by multidisciplinarity.
8) The relationship between the student and the instructor should be characterized by a partnership.
9) Students should make their own decisions and be responsible for their decisions.
10) Roles of the teacher are the encouragement, organization, consultancy, guiding works from the background.
11) Students should be able to collaborate.

Defining method of project teaching is the project method, which is always purposeful, problem-oriented, based on interest and active activity of the students. Its direct connection to the real world presupposes the expansion of the school learning environment. In the project method, there is a high level of interaction about the events of the project, thus the project activity becomes a real created activity [6].

CONCLUSION

One of the cornerstones of engineering education is whether, in addition to high-level scientific theoretical training, we can implement practice-oriented training in the future, which creates an opportunity to develop the abilities and skills expected of engineers - responsibility, environmental awareness, ethical thinking. The driver to do this seems to be reflected in the training and output requirements, which clearly articulate the need to develop the competencies expected from the eduction However, this is only possible with well-chosen pedagogical methods, so in addition to lecture and explanation methods, which were the most important in education so far, activity-oriented methods must also appear, as they provide the opportunity for independent and group work, research and experiments, where students can gain experience.

During the project work, the students processed the professional curriculum independently with a flexible schedule, helping each other's work in a group activity. Their knowledge has become applicable knowledge, which is due to a greater proportion of activity-oriented methods built into the educational process. Working together developed interoperability, human relationships, social competencies, and adaptability. The students' portfolios and work diaries testify that the students enjoyed the work, they had motivation to learn, in which the successes also appeared as an important factor.

The results confirm that project education is suitable for the implementation of competence-based environmental engineering basic training and in the future, based on the developed educational methodology, it should be gradually applied within more and more professional subjects. However, an important condition for this is that instructors must also be prepared to apply new pedagogical methods.

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GREEN SYNTHESIS OF METAL NANOPARTICLES WITH RESPONSE IN INFRARED SPECTRAL REGION FOR MEDICINAL APPLICATIONS

Ruslan Mariychuk

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Abstract: *With the development of nanotechnologies, a growing number of scientists going to apply the green chemistry approach to the synthesis of nanoparticles and nanomaterials. The synthesis and application of nanomaterials have become a key technology in many fields – optics, electronics, sensorics, drug delivery systems etc. Introducing of green chemistry principles deliver important benefits such as the sustainability, cost-effectivity, low time consuming, and biocompatibility of new nanomaterials. Application of nanomaterials in medicine request not only control over the size of nanoparticles but also their morphology (shape). Recent successes in the development of chemical methods for the synthesis of metal nanoparticles have delivered a wide range of preparation tools. However, the effective control of morphology involves the utilization of toxic reducing agents (sodium borohydride, methoxy polyethylene glycol, potassium tartrate, and hydrazine), and stabilizers (sodium dodecyl benzyl sulphate, and polyvinyl-pyrrolidone). These factors limit the applications of the nanoparticles in medicine. Therefore, extensive studies are directed on the development of green methods of nanoparticles synthesis. Many modern techniques are usually involved in the characterization of nanoparticles: ultraviolet, visible and infrared spectroscopy, surface and transmission electron microscopy, atomic force microscopy, energy-dispersive X-ray spectroscopy, dynamic light scattering. The present report will be focused on the analysis of recent successes in green synthesis of gold and silver nanoparticles with controlled size and shape [1-2]. Formation of irregularly shaped (nanotriangles, nanoprisms and others) gold nanoparticles shows that extracts of selected plants (juniper, goldenrod, spearmint, lemon balm etc.) can be successfully used for preparation of plasmonic materials. The perspectives of utilization of such nanoparticles in medicine will be discussed.*

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Keywords: *nanomaterials, nanoparticles, phytosynthesis, plasmonic materials, spectroscopy*

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EFFECT OF THE GREEN WASTE COMBUSTION ON THE AMBIENT AIR'S QUALITY

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Abstract: *The contamination of the ambient air poses a risk and the quality of life also worsens due to the not adequate air: respiratory and also cardiovascular diseases can form. Industry, traffic and domestic heating are the main factors of the air contaminations. There are several parts of Hungary where industrial emissions do not exist although other activities influence the concentration of the pollutant materials in the air. In Hungary the combustion of green waste is permitted in the case if the national regulations are followed. This study focused on the quality of the ambient air during these alternatives: samplings carried out at first in a one-week then in a three-week period. During the investigations the permission of the green waste combustion was only one day therefore the effect of the burning on the ambient air's quality was detected efficiently. Based on our results the quantity of the flying ash (PM10) increased significantly.*

Keywords: *ambient air's quality, PM10, local air quality, green waste*

INTRODUCTION

The quality of the ambient air defines our life- the contaminations effects our health, respiratory and cardiovascular diseases can also form due to the contaminated ambient air. Industry, traffic and domestic heating are the main factors of the air contaminations [1]. In Hungary there are several parts of the country where the industrial emissions do not exist but other activities of the population can influence the concentration of the pollutants in the air. There are several pollutants in the ambient air for e.g. solid particles as the flying ash which has many negative effects on health [2]. Pollutants with high dosage in the air e.g. flying ash pose a risk for human health even if the air pollution exists locally and only for short time [3, 4].

In Hungary the quality of the ambient air is continuously controlled by the National Air Pollution Measurement Network therefore there are thousands of data available about the condition of the ambient air [5]. Although there are several part of the country where measurement network (even 20-30 km distance far) do not exist thus the local air pollution data are not known. Locally, low volume activities may also influence the quality of the ambient air nevertheless their recognition approves the protection of the local population's life quality.

In Hungary the green waste combustion is forbidden [6] although it should be considered that local authorities are able to allow the activity if certain conditions satisfied- local population can practise the outdoor combustion of green waste collected in their own property [7]. Slowly burning of green waste on low temperature is a burning process under uncontrolled conditions which increases the concentration of potentially pollutant materials in the air e.g. solid particles [8].

The aim of the present study was the investigation of these permitted activities:

1) the study focused on the effect of the outdoor combustion of green waste; and also
2) the quality of the ambient air was controlled at first in a one week then in a three week period.

MATERIALS AND METHODS

Sampling

Samplings were carried out in the interior part of Sülysáp which is a small city in Hungary; the sampling point was a randomly chosen private house. This city is a typically poorly ventilated (basin positioned) part of Hungary where industrial activities do not exist and the heating habits of the population is considered to be average (mainly natural gas, less solid firing are applied). Although, in Sülysáp according to the 8/2009 (X.15.) local governmental regulation [9] the combustion of green waste is permitted once a week (on Friday) which activity does not exist in the neighbourhood of Sülysáp therefore the effect of the green waste burning on the quality of the ambient air can be well investigated.
The regulation controls the weather conditions of the green waste combustion: due to fire safety reasons this activity is permitted only windless circumstances (Picture 1.). Although this weather condition allows the increasing of the air pollutants in addition pollutants stay locally and without ventilation materials can not attenuate.

Picture 1. Green waste combustion in Sülysáp (31st March 2017)

Samplings and investigations were carried out at first in a one-week period: between 29nd March 2017 and 4nd April 2017, after that in a three-week period between 13nd October 2017 and 5nd November 2017 in the same point in every case. Sampling dates were chosen in consideration of the habits of the local population: generally, in spring and in autumn when green waste combustion occurs. Nevertheless, in spring samplings were carried out in the end of the heating period while in the autumn in the beginning of heating period to protect the investigations against the emission of the materials come from heating.

Determination of pollutants

During our studies the following air pollutants were investigated: nitrogen-oxides (NO, NO_2, NO_x); sulphur-dioxide (SO_2); carbon-monoxide (CO); ozone (O_3); fly ash (PM_{10}); BTEX (benzol, toluol, etil-benzol, xilols). All parameter was determined on the spot with installed devices (continuously investigations), materials with known composition were applied to calibrate the equipment.
During measurements the meteorological parameters (temperature, humidity, wind velocity, wind direction)

of the ambient air were also detected with site installed meteorological station. The applied methods and the investigated parameters are shown in Table (1).

Table (1) List of the applied standard methods and parameters

Method type	Parameter	Method
on site continuous	NO, NO_2, NO_x	ISO 7996:1993 [10]
on site continuous	SO_2	MSZ 21456-37:1992 [11]
on site continuous	CO	ISO 4224:2003 [12]
on site continuous	O_3	MSZ 21456-26:1994 [13]
on site continuous	flying ash (PM_{10})	ISO 10473:2003 [14]
on site continuous	BTEX	MSZ 21456-16:2004 [15]
on site continuous	air temperature	MSZ 21457-2:2002 [16]
on site continuous	air humidity	MSZ 21457-2:2002 [16]
on site continuous	wind velocity	MSZ 21457-2:2002 [16]
on site continuous	wind direction	MSZ 21457-2:2002 [16]

RESULTS AND DISCUSSION

Most parameters had the normal fluctuation as the time of day determines it during the investigated period. The negative effects of the green waste combustion are mainly showed by the flying ash. During the spring period, on Friday (on the 31st of March 2017), the concentration of the flying ash multiplied when green waste combustion happened although there were only three places when burning occurred (Figure 1.).

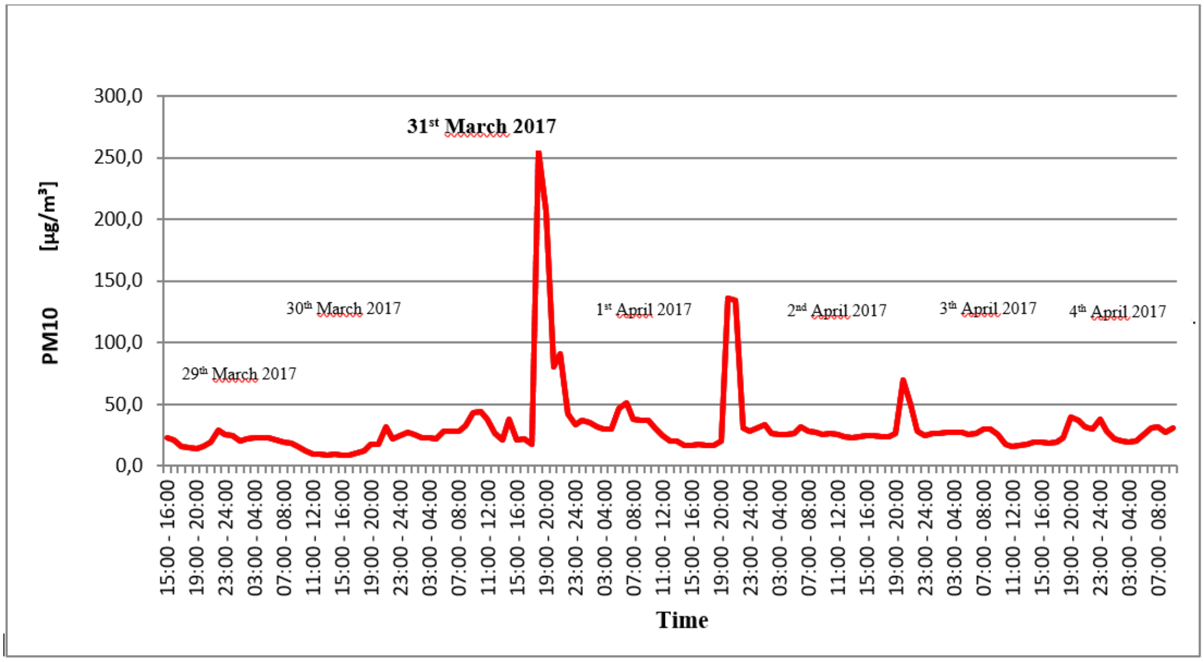

Figure (1) The average concentration of PM10/hours in spring period

The average concentration of PM_{10} was 17.7 µg/m^3 before the green waste combustion, and then increased 50.8 µg/m^3 on Friday. The effect of the air pollution was detected also one day after (37.7 µg/m^3). The PM10 value decreased only the following day (<30 µg/m^3) when the concentration of flying ash was equal with the previous period when combustion was not applied. On the 31st March 2017, the concentration of PM_{10}

exceeded the limit values according to the 4/2011. (I.14.) VM regulation [17]. It should be considered that according to the regulation hour limit values do not exist although the hour average values exceeded the 200µg/m^3.
The meteorological parameters in the autumn period were stable, the weather was windless. Figure (2) shows the concentration of PM_{10} and the values of the wind-force: on the 13th of October 2017 and on the 27th of October 2017 the wind-force was 8-10 m/s and the PM10 values did not increase significantly. On the 2nd of November 2017, the wind-force decreased from 6 m/s to 0 m/s while the hour average value of PM10 reached 150 µg/m^3. On the 20th October 2017 the wind-force decreased again from 5 m/s to 0-3 m/s and the concentration of PM10 was 200 µg/m^3.

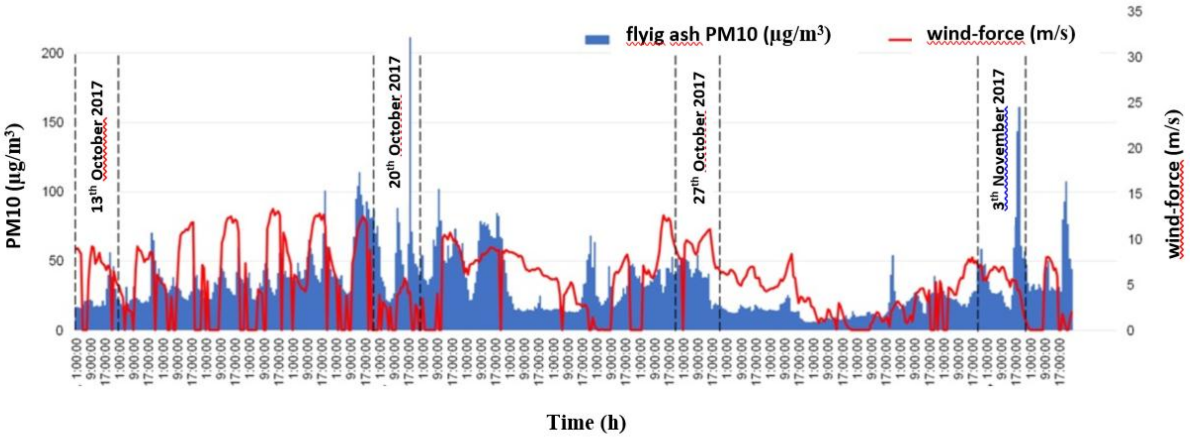

Figure (2) The average concentration of PM10/hour and the wind-force depending on time

Most probably according to the local regulation (windless weather) [9] and the basin positioned city, the concentration of pollutants can also multiple during other circumstances when larger volume activities occur. It should be noted that the outdoor green waste combustion has negative effects on the ambient air; locally this activity has local environmental harmful results. This effect is significant in the case of flying ash (PM_{10}). Based on our results outdoor green waste combustion should be forbidden in every case also by the local government.

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ENVIRONMENTAL PROBLEMS OF AIRCRAFT MAINTENANCE AND RENOVATION AT THE LISZT FERENC REPAIR BASE – SUMMARY

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Abstract: *During my research I tried to draw attention to the environmental risks arising during the activities of the airplane repair base at Liszt Ferenc Airport. Since its foundation, 58 Boeing and 42 Airbus aircraft have rolled out of the Liszt Ferenc repair base in a brand new, refurbished condition. It is worth mentioning here that in a hangar they usually deal with the repair of two machines at the same time. It is planned that over time, wide-body aircraft will also be repaired in Hungary. In my research I describe the environmental problems caused by transport, including aviation. I describe the emissions to the environment during the maintenance and renovation of aircrafts at the repaiar base. Within this topic, I would like to discuss in more detail the problems of waste generation, waste management, wastewater discharge, noise pollution and air pollution in the light of the technological processes of maintenance, repairs and renovations. In addition to the effects on the environment, special attention must be paid to the effects that adversely affect the health of the workers on the Repair Base. In the course of my work, I focus on one of the most critical technologies of major repairs, paint removal in connection with the renovation of machine bodies, and air pollution during the painting process. I examined the extent of personal exposure of workers and the qualitative and quantitative characteristics of air pollution, taking into account the presence of toxic substances that are extremely harmful to health and the environment. My aim is to highlight the critical points associated with environmentally harmful emissions in order to protect the environment and the health of workers, and to draw attention, where necessary, to the need to take appropriate measures. It would be useful to extend the scope of separate collection not only to paper and wood waste, but also to other recyclable waste materials. The waste on the base is transported, disposed of and recycled by specialized companies contracted for this purpose only.*

Keywords: *Environmental problems, environmental risks, environmental problems caused by transport*

In September 2009 there was an accident involving a kerosene spill, 4 people were involved. The case started as a relatively simple fixing work. They wanted to replace a leaking valve in the center tank. They also embarked on the work, although it was a unique system that no one has been working on before. It was not quite clear whether the wing tanks needed to be downfueled or not, so the seemingly simpler solution was chosen. The fuel was not downfueled.
The valve was removed, but as a result, fuel immediately began to flow from the discharge branch into the centrifuge tank, where one of the mechanics was also located. He quickly climbed out of there, and the direct staff who worked in the same place shut down the tank while naturally running kerosene on them. Other colleagues nearby started the "usual" procedure: they immediately stopped the spread of kerosene to prevent it from entering the manhole, which also contained electrical wires (risk of explosion), started soaking, of

course, unplugging the room (to prevent sparks) and care adequate ventilation. Of course, in the meantime, the Airport Fire Department was also notified, because there is always a risk of an explosion.

During my research I tried to draw attention to the environmental risks arising during the activities of the airplane repair base at Liszt Ferenc Airport. Since its foundation, 58 Boeing and 42 Airbus aircraft have rolled out of the Liszt Ferenc repair base in a brand new, refurbished condition. It is worth mentioning here that in a hangar they usually deal with the repair of two machines at the same time. It is planned that over time, wide-body aircraft will also be repaired in Hungary.

In my research I describe the environmental problems caused by transport, including aviation. I describe the emissions to the environment during the maintenance and renovation of aircrafts at the repaiar base. Within this topic, I would like to discuss in more detail the problems of waste generation, waste management, wastewater discharge, noise pollution and air pollution in the light of the technological processes of maintenance, repairs and renovations. In addition to the effects on the environment, special attention must be paid to the effects that adversely affect the health of the workers on the Repair Base.

In the course of my work, I focus on one of the most critical technologies of major repairs, paint removal in connection with the renovation of machine bodies, and air pollution during the painting process. I examined the extent of personal exposure of workers and the qualitative and quantitative characteristics of air pollution, taking into account the presence of toxic substances that are extremely harmful to health and the environment. My aim is to highlight the critical points associated with environmentally harmful emissions in order to protect the environment and the health of workers, and to draw attention, where necessary, to the need to take appropriate measures.

It would be useful to extend the scope of separate collection not only to paper and wood waste, but also to other recyclable waste materials. The waste on the base is transported, disposed of and recycled by specialized companies contracted for this purpose only.

It is important that the base uses environmentally friendly technology and products for their activities in as many cases as possible.

In the case of technologies and materials that pose a risk to the health of workers, such as the work phases related to painting, air pollution is significant, but the risk of damage to health can be significantly reduced with the use of appropriate protective equipment.

In most cases, the situation is satisfactory in all areas.

However, with regard to the activities taking place at the base, I would like to highlight a few things.

Based on the example, I see the biggest problem in the initial stage of employees ’environmentally conscious approach.

I would like to emphasize once again the repair and replacement of equipment related to the fuel and oil system of aircraft. In this case, the oil or fuel may spill unintentionally, and the interior design of the aircraft makes it difficult to access these areas with collection containers.

Instead, use materials with good absorbency (the best in the world for this purpose, silica aerogels).

We have now reached the point where environmental considerations are important in the life of an airline company. People at the company, at the various authorities, and on the street, all expect this.

Whenever we talk about some kind of pollution, it is a sign that our operation is not efficient enough. This is a waste of energy, material, and labor time at the same time, which has to be paid for separately. Continuous improvements would be needed to reduce its scale.

It would be expedient to introduce an environmental management system to each airline companies.

As other foreign airline companies, they have EMAS (Regulation EC 761/2001, Eco-Management and Audit Scheme), this would be the most appropriate for the Hungarian subsidiary due to the uniform operating criteria.

The scheme is nothing more than a voluntary European Union organization that aims to support the assessment and development of organizations' environmental performance and to inform the public about the organization itself and its environmental performance.

With its help, the operation in accordance with the environmental regulations and expectations can be realized at the same time, and also that everyone knows about it!

Recommendation

I recommend EMAS instead of ISO 14001, because in the case of certification according to the ISO 14001

standard, the interested party only receives information that an independent organization has found the system to be suitable. On the other hand, it does not know the actual environmental effects, the pollution that may be caused. In the case of ISO 14001, it is also not clear what the company actually does to protect the environment.
In contrast, EMAS registered organizations issue an annual environmental statement, the authenticity and conformity of which are verified each time by an independent body.
Interested parties and partners can receive accurate and credible information every year.

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BIOPOLYMERS COULD BE THE SOLUTION FOR PLASTIC WASTE MANAGEMENT?

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PERSPECTIVES FOR USING CLEAN AND ENERGY EFFICIENT ROAD VEHICLES

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ABSTRACT: *The development of the economy promotes the growth of the travel market, creating challenges and opportunities for the development of the transportation system. Increased income and personal demands are also conditions for people to buy and use vehicles. Habits and needs are one of the main leading causes of environmental pollution, especially air pollution. This article focuses on the pollution caused by vehicles. The process of checking the quality of a car before it is put into production is very complicated, combining many inspection steps. This article is about the PEMS method that meets Euro 6 standards, should be widely applied in the future not only for passenger cars but also for heavy vehicles and others. According to the measurements, Volkswagen Golf met the Euro 6b limits for the NEDC and PEMS test in lighter conditions. Detected values were well below the limit value. Skoda Octavia is well below the limit value for carbon monoxide in the RDE-PEMS test; however, NOx emissions were 2-3 times higher than in the NEDC test. Emissions of vehicles in the laboratory test are different from the actual environment, so the use of PEMS for vehicle testing is necessary.*

Keywords: *Perspectives, using clean energy, energy efficient, road vehicles, quality of a car*

INTRODUCTION

The transportation industry always comes with a range of problems such as air pollution, noise, congestion, accidents, etc. Currently, air pollution control is not only an urgent issue and a local top priority, but also has significant potential for controlling greenhouse gas emissions.[4] A massive percentage of urban air pollution is responsible for the transportation industry - as well as a primary greenhouse gas emission source. Increased greenhouse gases and the polluted air environment caused by transportation are increasingly severe, threatening the ecosystems and habitats of human life and creatures on Earth. According to the European Environment Agency (EEA), 36.48% NOx released to the air environment caused by road transport and 14.05% by commercial, institutional, and households. For PM2.5 related values are 10.67% and 55.49%, respectively. [1]
Based on WHO data from 2016, are attributed to ambient (outdoor) air pollution caused by about 4.2 million premature deaths. In general, higher urban air pollution levels cause an increased risk of cardiovascular and respiratory diseases, cancer and adverse birth outcomes, and also associated with a higher death rate.[2] Illnesses and deaths related to air pollution are most closely associated with exposure to small particles (Particulate Matter PM) less than 10 or 2.5 microns in diameter (PM_{10} and $PM_{2.5}$). Small particles bypass the body to defend against dust, penetrate deep into the respiratory system. They also carry on their surface a mixture of substances harmful to health, such as heavy metals, sulfurs, carbon compounds and carcinogens

including benzene derivatives.[2]
Transport is a significant and growing contribution to airborne particle pollution exposure. Road transport is estimated to account for up to 50% of PM emissions in the Organization for Economic Cooperation and Development (OECD) countries and up to 30% of PM emissions in European cities - mainly due to diesel engine transport. However, it can be very different between the total contribution of transport to particulate air pollution, from 12% to 70% of the overall pollution mix. Low- and middle-income countries suffer disproportionately due to traffic-related infections, especially in Africa, the Middle East, and Asia. In part, it is also due to the use of inefficient and old diesel engine vehicles and the lack of public and operational transport networks.[2]
Urban air pollutants are transport-related air pollutant that harms health. A mix of a critical factor in chronic respiratory (e.g., asthma), containing nitrogen oxides (NO_x), sulfur dioxide (SO_2), as ground-level ozone (O_3) precursors, carbon monoxide (CO) and volatile organic compounds (VOCs), poses a specific risk for vehicle drivers and passengers in closed spaces (e.g., garages); CO_2 and methane, which is a reliable greenhouse gas.[2]
Transport has been one of the standard policy areas within the European Union for more than 30 years. The harmonization of national laws, regulations and administrative provisions, and of the technological, social, and tax environment in which transport services provided, has steadily risen in importance. Moreover, the completion of the European single market, the abolition of internal borders, the drop in transport prices as a result of the opening-up and liberalization of transport markets, and changes in manufacturing and stock management systems have all led to an increase in goods and passenger volumes.[3]

Internal combustion engine (ICE)

For transport activities, emissions from vehicles are concentrated mainly on road traffic activities, and it depends on the type, quality, and fuel used by the vehicle. For example, diesel engines emit many times more black smoke than gasoline engines.
Diesel engines release a lot of suspended particles in the air. The air pollutants arising from road traffic activities are mainly CO, NO_x, SO_2, dust.
Not only emissions from diesel and gasoline but non-standard vehicles also create emissions that lead to air pollution. That is why the EU introduces a series of "Euro" standards, of which the "Euro 6" standard is the latest and most stringent. Diesel technology is also constantly developed with the aim of eliminating harmful gases. Clean diesel technology was created with a three-part system that is a highly efficient diesel engine, ultra-low sulfur diesel, and advanced emissions controls. Clean diesel complies with the "Euro 6" legislation on emissions. This standard requires test vehicles to meet standard conditions, including the Real-Driving Emissions (RDE) and the Portable Emissions Measurement System (PEMS). [4]

Clean and energy effective vehicles

A hybrid is a car that uses a combination of a traditional internal combustion engine and one or more electric motors to create traction. These two types of engines on hybrid vehicles combine to achieve different criteria, depending on the purpose of the manufacturer, i.e., to save fuel. [39] Range extender hybrid (REx) vehicle is an electric car that uses generators powered by gasoline installed on the vehicle. ICE does not drive the wheel; it is used to charge the car battery only. This setting allows the range extender system to continue running on electricity without having to stop to charge. [5] Plug-in hybrid vehicles (PHEV) are hybrid vehicles but have the ability to charge the battery with additional power from the outside. A PHEV has the characteristics of both a conventional hybrid electric vehicle (with an internal combustion engine and an electric motor); and of an all-electric vehicle with a plug to connect to the electrical grid. [6]
Electric cars with large battery (BEV) have a completely higher electric power range than plug-ins. Electric vehicles have many benefits over conventional vehicles. Although electric power plants can emit pollutants, the electric vehicle does not on the spot, emitted pollutants come from energy generation of plants. Black electricity origins from coal combustion grey electricity or/and from nuclear and thermal power plants. Green electricity supplied from solar, wind or hydropower plants, not to pollute the air, so we can say an electric vehicle is environmentally friendly. In addition, electric motors perform well and require less maintenance than ICE that provides performance benefits. [7]
Fuel-cell electric vehicles (FCEV) are powered by electrochemical "engines" that have the ability to

transform chemical energy directly into electrical energy through the redox process, usually hydrogen fuel and oxygen or air by an electrochemical reaction. The generation of electric power is carried out in fuel-cells by hydrogen gas. Electrical energy stored in batteries or supplied to electric motors. Small air channels are milled in bipolar plates, through which hydrogen gas is introduced on one side, and the other side is air or oxygen.

Benefits

The increase in vehicles has a lot of damage to the environment, especially the air. If we continue polluting, soon, we will destroy our own life and other creatures. That's why clean vehicles are researched and developed, which use electricity to operate. Unlike conventional vehicles, clean and effective energy vehicles bring great benefits to the environment and human life. If they are developed and widely used, the future environment will be improved, and our lives will be better. Here are some examples:

Health effects: Clean vehicles help improve the air environment and human health, reducing dust and smoke, which are harmful to humans when inhaled—thereby reducing diseases from air pollution such as pneumonia, rhinitis, CO poisoning, etc. Clean cars cause little or no noise due to running on electricity, and unlike diesel vehicles, noise pollution is also significantly improved. A clean and noise-free environment helps people live healthier lives.

Reduced exhaust emissions: Clean vehicles use the main source of electricity is electricity (batteries and electric motors). It reduces the number of toxic gases released into the environment when the vehicle is operating at all speeds and all types of weather. Therefore, the use of these environmentally friendly cars will help make the environment healthier and safer.

Slow down global warming: Ordinary vehicles emitting substances not only cause devastating effects on the environment but also contribute to global warming. Clean vehicles that need less fuel or use electricity, hence do not release toxic and global warming substances into the air on the spot.

Better gas mileage: Clean vehicles are designed using full electricity or a combination of electricity and gasoline. The other type is better than conventional vehicles because it only uses gasoline when the vehicle is running out of electricity. Therefore reduce the amount of gasoline consumed when using the car.

Less dependence on foreign oil: According to EIA, the United States imported about 9.10 MMb/d of petroleum from about 90 countries, exporting 8.57 MMb/d of petroleum to 140 countries and 4 US territories in 2019. Clean vehicles reduce the amount of gasoline consumed. This is an economic improvement for the United States and other countries. They will not have to depend on expensive foreign oil from the Middle East. Other countries can also improve financially and politically because they can use domestic gasoline rather than importing it from abroad. [8]

Saves drivers money: Clean vehicles have replaced that source in part with electric motors, fuel costs have been cut in half. For electric vehicle users, they will no longer have to go to a gas station and buy gasoline so that they can save even more.

Driving in safe: According to the WHO, more than 1.35 million people die each year in road traffic accidents. Distracted driving is one of the causes of traffic accidents. Statistics show that many drivers still send messages while driving, resulting in an increase in annual road accidents. To minimize the number of people injured by traffic accidents, a driver assistance system was created. The driver assistance system is an electronic system that helps the driver in the processes of driving and parking. Advanced driver assistance systems are known as systems developed to automate, adjust, and enhance vehicle systems to ensure better safety and driving. Automated systems provided by Advanced Driver-Assistance Systems (ADAS) can minimize human error, which has proven to reduce road deaths. [9]

Volkswagen emissions scandal

In September 2015, Volkswagen's emissions scandal occurred while the US Environmental Protection Agency issued a notice that violated the Clean Air Act against German automotive corporation. The agency found that during the emissions test in the laboratory, Volkswagen intentionally programmed the direct-injection turbocharged diesel engine to activate emissions control to help produce NOx emissions of vehicles that meet US standards during regulatory testing. But in fact, it emits 40 times more NOx when driving in the real world. [9]

Basic law ((EU) 2019/1161)

Directive (EU) 2019/1161 of the European Parliament and of the council of 20th June 2019 is used to amend Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles.[10] The law is intended to reduce greenhouse gas emissions further, to increase the rate of renewable energy consumption, save energy, reduce vehicle CO_2 emissions, and reduce air pollution and noise caused by road vehicles. Towards hiring, buying, and using green and clean transportation. Not just personal vehicles, but also public transportation, freight. The Directive sets out mandatory minimum procurement goals in each Member State for environmental protection vehicles, trucks, and buses in 2025 and 2030.

Because air quality varies mostly due to emissions from personal vehicles, laws like these are needed to improve the problem. For vehicles after the Directive and in the future, they will need to meet a certain standard to be produced and used on the world market. After applying this Directive, the atmosphere has been partially enhanced, reducing pollution and the danger of global warming.

RDE/PEMS

Real Driving Emission (RDE) As a result of the scandal, each vehicle form (passenger cars) due for initial emission certification will be tested as per the Worldwide Harmonized Light-Duty Vehicle Test Procedure (WLTP) beginning in September 2017. New European Driving Cycle (NEDC) usage values will continue to be calculated in parallel and will continue to be used in sales documentation as the legally necessary data as well as in all other publications. Additionally, all new models due for launch are tested in an on-road test, the so-called real driving emission test (RDE), to assess if Euro 6 limit values for nitrogen oxide and particulate concentrations are exceeded when taking into account the conformity factors. [11]

RDE measures contaminants, such as NOx emitted from cars when driving on the road and describes the vehicle's emissions test under actual road conditions. Exhaust gas analysis used to be carried out only at test stations for model sequence authorizations. RDE serves to confirm laboratory test results and will ensure cars provide low pollution emissions on the road.

Portable Emission Measurement System (PEMS) is a vehicle emission measuring tool for the calculation of nitrogen oxide (NOx), carbon monoxide (CO), carbon dioxide (CO2) emissions and particle number (PN).[11] PEMS is compact and light enough to be carried inside or shifted with a motor vehicle driven during measuring; the necessary pollution test projects are economically viable. PEMS applies directly from the vehicle in calculating and evaluating exhaust emissions while on an actual road trip; fuel consumption measurement; engine performance analysis and after-treatment exhaust; component examination. Simply put, further research can be performed quicker, with less staff; increasing significantly the amount of testing completed over a given period, decreasing the "cost per test" dramatically, but at the same time improves the overall accuracy expected in a real-world setting. [12]

PEMS measurements have increased in recent years and will continue to grow, not only because they form part of the EU regulation on type-approval and in-service monitoring, but also because they are useful and accurate instruments for vehicle market surveillance on the roads and assist vehicle manufacturers in the production of new vehicles. The Member States will be able to take steps against non-compliant vehicles sold in their national markets (including ordering vehicle recalls and revoking type-approval certificates). The new motor vehicle type-approval and market surveillance law were voted in favor of 19th April 2018 and replaced the Directive 2007/46/EC in September 2020. [13]

PEMS are placed outside the car, on a tow bar or frame, or in the back of the car. When in operation, the following factors are taken into account by PEMS: the location of the car, based on data given by a GPS, local weather conditions generated by a local weather station, and vehicle data from the control unit of the engine. While monitoring these factors, PEMS (1) is used to assess the car's emission rates, including its gas mileage, while a valid driver drives the car on real roads. The test results are compared to those of other cars of the same family (based on many factors including the form of propulsion, method of fueling, or recirculation of exhaust gases). Changes to or disassembly of the tested vehicle such as exhaust drilling, removal of intake air system, need to be examined by both fleet managers and drivers, especially on passenger-carrying vehicles, for their acceptance. [13] [14]

Figure (1) PEMS is installed at the back of the car.

MEASUREMENT

The measurement was done by KTI Institute for Transport Sciences Non-Profit Ltd., Budapest, using PEMS equipment rented from the Austrian AVL company. After measured, KTI had to send the measurement data to the Austrian company, and they performed the calculation. The evaluation softver is CONCERTO[15], which calculation formulas do not public, approved by the TÜV. The softver functions as required in the (EU) 2016/427 regulation. The tests were performed on two brands of cars Volkswagen Golf and Skoda Octavia.
Test condition and test run requirements RDE emissions shall be verified by testing vehicles operating on the road under normal driving conditions, standard conditions, and usual payload. The RDE test must be representative of the operation of the vehicles on real routes and under average load, hence the measurement conditions and run requirements, determined by Directive EU 2017/1151 should be fulfilled.

Detailed measurement results

The following Figures (2 and 3) summarize the results of the measurements. During PEMS measurement, the data is recorded and stored by the system control. The sample is to be taken at least every 1 second. Effect of repeatability, highway (I) and urban (II) routes and cold/hot ignition (start) were investigated. The AVL PEMS samples every 0.1 seconds. Abbreviations are as follows: D: diesel, I/II: 1st or 2nd routes, C: cold start, H: hot start.

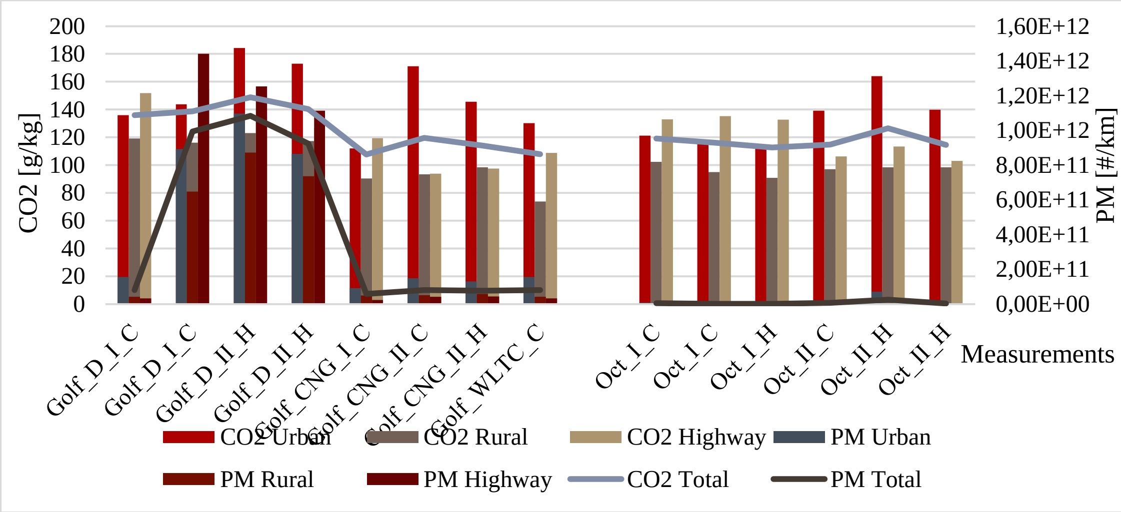

Figure (2) CO_2 and PM Emission of VW Golf and Skoda Octavia [g/kg]

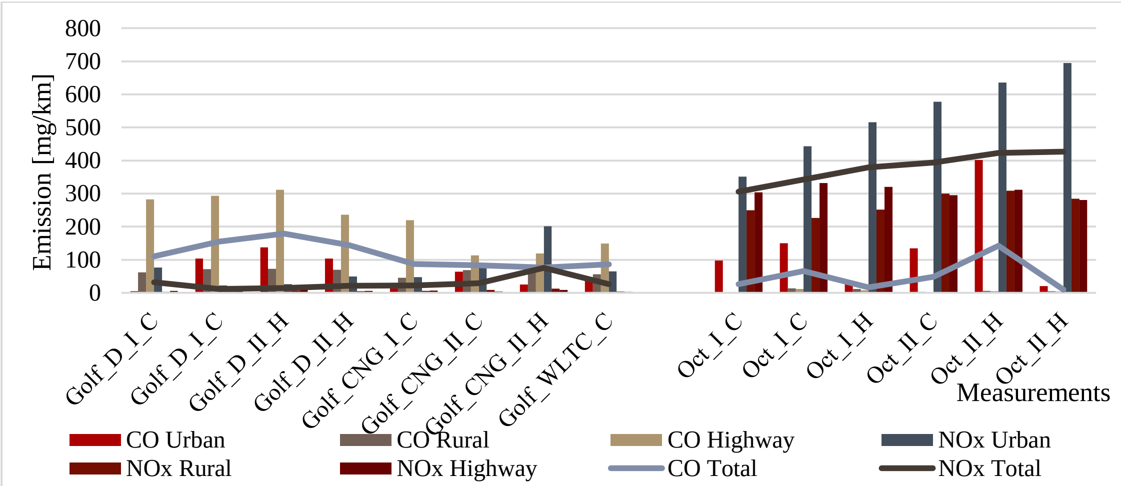

Figure (3) CO and NOx Emission of VW Golf and Skoda Octavia [g/kg]

Euro limits - type test values

The type of the approval limit and emission standard for Volkswagen Golf is Euro 6b class in petrol and CNG mode (no specific limits for gas operation), for comparability is also given below (Table 1). The values refer to the NEDC test performed on a laboratory roller dynamometer.

Table (1) Euro 6b and type certificate limits for the VW Golf (codes: engine CPWA, gear FD7) and Skoda Octavia tested

Limits	CO mg/km	THC mg/km	NMHC mg/km	NO_x mg/km	PM mg/km	PN #/km	CO_2 city g/km	CO_2 highway g/km	CO_2 mixed g/km
Euro 6b	100	100	68	60	4,5	6×10^{12}	--	--	--
VW Golf Petrol	287,9	35,0	30,4	12,6	0,54	$8{,}81\mathrm{x}10^{11}$	150	101	119
Golf CNG	41,5	49,8	6,0	17,2	--	--	120	77	92
Euro 5a	500			180		0,05			
Octavia WLTC	171,1	26,7	25,0	391,9	8		153,0	232,2	163,3

Comparison of measurement results with Euro limits

Volkswagen Golf In the more stringent RDE-PEMS test, the Volkswagen Golf met the Euro 6b limits for the NEDC test in lighter conditions. The measured values are well below the limit value. There is no specific limit for gas operation.

Skoda Octavia of the Euro 5a limits set for the NEDC test, Octavia is well below the limit value for carbon monoxide in the RDE-PEMS test. The absolute amount of particulate emissions cannot be assessed. NOx emissions in the RDE-PEMS test were 2-3 times higher than in the NEDC test. According to the literature, there is no such difference between the measurement procedures, i.e., Skoda would presumably not meet the level of the NOx emission requirement applicable to it.

Summary

Emissions from vehicles in the laboratory test are different from the actual environment, so the use of PEMS for vehicle testing is necessary. Vehicles are tested for their official emission values, and reference fuel consumption is regulated and relatively narrow laboratory conditions. On the road, however, atmospheric and driving conditions can differ across a wide range, often causing higher emissions than those measured in the lab. The compilation and definition of the route are clearly essential for CO_2 emissions, and the other components showed different tendencies. The repeatability of the measurements - taking into account the specifics of the RDE-PEMS measurement - is quite suitable for CO_2, generally good for the other components. For each fuel, vehicle, and part, the specific emissions in the urban phase are usually higher. That is, the air pollution effect is enhanced in the urban environment. The impact of a cold start in the urban period often results in increased emissions, but there is a difference from component to component. The CO_2 emissions of the gas mode are approximately 20% smaller than in gasoline mode. Particulate emissions are 1-2 orders of magnitude lower in gas mode, which is a very significant advantage. The carbon monoxide emissions of Euro 5, 6 cars are almost negligible. Built-in Skoda Octavia, the EA189 engine involved in the Volkswagen diesel scandal, emits exceptionally high levels of nitrogen oxides, especially in urban traffic. The effect of the recall correction was not seen on the NOx values.
It can be stated that the repeatability and accuracy of PEMS measurements are not as excellent as those of laboratory tests. New vehicles are expected to emit lower emissions. Thereby, the use of PEMS helps control vehicle quality better to reduce the number of harmful gases released into the air environment of the vehicles.

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RANKING LIST AND ROADSIDE ENVIRONMENTAL TRAFFIC INSPECTIONS FOR TRANSPORT GREENERING IN HUNGARY

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***Abstract**: Air pollution is one of the most significant environmental concerns. It can cause adverse health effects like cancer, cardiovascular diseases and high levels of mortality. High population size is a key contributory factor to air pollution in industrial and metropolitan areas. This article focuses on pollution caused by vehicles, presents extensions to the current methods and future methodologies that are used to the decarbonisation of transport and to estimate the association between air pollution exposure and the risks to human health. This paper is centered around two specific topics, all of which focus on greenering transport. First is about air quality problems in Hungary caused by transport and the possible environmental projects ranked by KTI expert group for decision makers to choose the appropriate one for solve current problems; the second is a practical one, presents a special Hungarian project for greenering transport: a roadside inspection survey of the actual vehicles' technical condition and its emission in traffic, to explore the causes of high emissions, to look for ways to reduce emissions; to make feasibility studies for options of greenering and to plan action projects based on these feasibility studies.*

Keywords: Ranking list, roadside environmental traffic inspections, transport greenering, Hungary

INTRODUCTION

Air pollution is a change in the composition of air, mainly due to smoke, dust, vapors, or toxic gases that cause climate change, adversely affect human health, or may damage the natural environment of many other species. Air pollutants may either be released into the atmosphere (primary air pollutants) or produced within the atmosphere (secondary air pollutants). The local, urban, regional and global air pollution range can be differentiated, mainly based on the atmospheric lifetime of different air components. Primary air pollutants include sulfur dioxide, nitrogen oxides, carbon monoxide, volatile organic compounds (VOCs) and particulate matter (PM10). Secondary air pollutants are caused by chemical reactions of primary pollutants in the atmosphere and often include natural environmental components such as oxygen and water. Ozone, nitrogen oxides, is significant secondary pollutants in the air. The varieties of sources are identified, including transport, industry, combustion and natural sources.
Air pollutants kill an expected 7,000,000 individuals worldwide consistently [1]. World Health Organization

(WHO) data shows in which nine out of ten individuals inhale air containing significant levels of toxins. Air pollution raises the risk of stroke, neurasthenia, cardiovascular disease, cancer, and a series of respiratory diseases such as asthma, pneumonia, even lung cancer is increasing. People with heart or lung disease, elders and children are easy to be affected by air pollution, as vulnerable groups.
Explaining the root cause of this problem, according to experts, motor vehicles use gasoline and diesel as fuel, the process of leakage, evaporation, and burning of fuel also leads to many types of toxic gases such as VOC, Benzene, Toluene, etc. The emission of transportation is shown to depend heavily on the quality of vehicles, fuel, speed, drivers, congestion, and roads.
Transport takes place as Hungary's source of greenhouse gas emissions of 20% and rising since 2012. This trend needs to be reversed rapidly in the sense that it needs to be decarbonized in the mid-century under the Paris Agreement. The research focuses on reductions in pollution from road transport falling under the scope of the European Climate Action Regulation, which enforces a seven percent emission reduction goal for Hungary in 2030 compared to 2005 (including all sectors). Eventually, policy recommendations are brought out so that Hungary can achieve the most ambitious targets [2].

Emission of vehicles

Cars, light and heavy duty vehicles, and fossil-fuel-powered buses are major contributors to air pollution. Transportation currently emits more than half of our air's nitrogen oxides and is a significant source of global warming emissions. While this air pollution poses major risks for human health and the environment, we can dramatically reduce emissions from our cars and trucks through the clean vehicle and fuel technology and help transform transport. Throughout their life cycle, automobiles, trucks, and buses generate air pollution, including emissions generated during vehicle operation and fuel production. Additional emissions are correlated with fuel production and storage, and to a smaller extent, vehicle manufacturing and disposal.
Trucks and buses play a significant role in our lives, transporting goods every day from factories to stores, cleaning up our garbage, delivering parcels, and transporting thousands of people across cities. Yet such cars do have a significant effect on public health and global warming. Heavy-duty vehicles constitute just around five percent of all on-road vehicles, but they produce more than twenty-five percent of global warming emissions from the transport sector and large quantities of air pollution. The problem of reducing pollution from this sector will continue to rise as countries move more and more freight each year. Addressing pollution from heavy-duty vehicles is vital to improving air quality and reducing global warming emissions in communities around the world.

Problems of Hungary

In recent years, rapid urbanization and the growth of motor vehicles have had a serious impact on human life and its environment. Extremely high levels of urban air pollution affect most cities around the world, especially in the form of CO, SO_2, NO_2, PM (Particulate Matter), and RSPM (Respirable Suspended Particulate Matter). Transport sectors contribute dramatically (around seventy percent) to environmental emissions. One of these pollutants CO is the main pollutant from the transportation sector, contributing 90% of total emissions. Hydrocarbons are next to CO. It is interesting to note that the contribution of the transport sector to particulate pollution is as small as 3-5%, most of the SPM (Suspended Particulate Matter) is produced by the re-suspension of dust from which PM10 is the most significant air pollutant. NOx is yet another significant indicator of air quality. Both circumstances suggest that air pollution is becoming a major problem, and the need to create a safe environment and increasing the level of research around the world is important. The present study is an analysis of an evaluation model for pollutants released and effective strategies for reducing air pollution by road transports [3].
The expert group of KTI Institute for Transport Sciences Ltd. has gathered the most important problems that describe the harmful environmental effects of transport. There is also a correlation between some of the problems listed below. In evaluating the proposals for greening transport, we consider the solutions to these problems and the strength of their impact.

1. *High emissions*
   The problem has several components. One is the unfavorable specific emissions of the outdated, high average age, inadequately maintained vehicle fleet, the other is high traffic, and especially congestion.

2. *The average age of vehicles is high*
The average age of passenger cars is 14 years. In the last few years, the import of used cars was at the level of 150 thousand units per year, and except for the year 2019, it significantly exceeded the sales of new cars. As a result of the complex economic situation caused by the crown virus, solvent demand, and thus new car sales will certainly fall significantly. In 2019 156 thousand used imported passenger cars were registered in the country, on average, 11 years old. 38 percent of used cars arriving in the country were between the ages of 11 and 15, and 22 percent were older than 16 years.
3. *Congestion of metropolitan road traffic*
This problematic point is also related to several of the following points. One of the serious problems with traffic in big cities is traffic jams, congestion, which no longer manifests itself not only in the morning and evening rush hour traffic but also extends to almost the entire daytime period in certain areas and periods. This causes significant excess emissions.
4. *Problems of public transport*
Local bus transport plays a significant role in urban air pollution. Unfortunately, in some large cities, e.g., the situation in Budapest has also deteriorated dramatically recently. Highly smoky blue buses in the capital provide a constant sight. It is the level of carcinogenic organic matter and soot that is emitted directly by walkers, especially young children sitting in prams or walking with low noses, as a vulnerable age group.
5. *Cycling problems*
The cycle path network in big cities is still more suitable for hobby cycling than for commuting to everyday work. The lack of bike paths in some places makes cycling almost completely impossible or dangerous.
6. *Deficiencies in traffic management*
This point includes a comprehensive package of measures. It is not the measures that require large investments in the future that need to be considered, but the relatively low-cost interventions that are possible in the current situation.
7. *Communication, public information*
Public information and the formation of environmental attitudes are extremely important not only in the field of transport but also in general. Attitude-building is the tool that can help with all transport-related problems because if the approach is appropriate, there is no need for excessive sanctions or incentives.
8. *Lack of vehicle maintenance*
A high average age would be accompanied by an increased need for maintenance. Parts and equipment that affect or reduce exhaust emissions are worn out and would need to be replaced in older cars.
9. *Air polluted, poor air quality (PM and NOx)*
The air in our cities is often heavily polluted, especially about PM10 and NOx. According to expert estimates, premature deaths of the order of 10,000 can be attributed to air pollution in Hungary.
10. *Unfavorable CO_2 emissions*
Unfavorable CO_2 emissions are closely related to the high age of vehicles, and thus to higher petrol/diesel consumption. This includes the depletion of public transport fleets, but urban congestion also significantly increases consumption and thus CO_2 emissions.

Environmental projects for solution

The expert group of KTI calculated a ranking list of possible environmental projects for solution, based on the technique of Multi-criteria decision analysis (MCDA) [4]. Twenty transport greenering projects were ranked and the result of first four places listed here as follows:

1. Conversion of public transport to electric vehicles Air pollution is most significant in large cities. The technical sophistication of electric buses has already reached the level that, apart from a few cases, they are suitable for satisfying the required daily running power. But trolleybuses are also a great alternative. According to government’s intention, from 2020 onwards, in settlements with a population of more than 25,000, only electric buses can be put into operation in case of stock exchange or expansion.

2. Conversion of service vehicles (taxi, post office, courier services, service vehicles, etc.) to electric vehicles With the exception of passenger cars (e.g. taxis), there is currently no supply of electric vehicles in this area that would be desirable, but due to EU regulations, it is expected that there will be an adequate choice here in the next 2-3 years. In one part of the segment, the vehicles are operated by private companies, while in the other part by public companies. Public procurement companies also have an EU obligation to purchase clean and energy-efficient vehicles. The details are set out in Directive (EU) 2019/1161. In some cases, e.g. taxi, courier services, etc. obligations may be imposed, together with aid. The aid results in a direct, immediate reduction in air pollution [5],[6].

3. Restrictions on imports of outdated used vehicles It is well known that one of the most important problems of the Hungarian passenger car fleet and vehicle sales is the import of second-hand vehicles, which are used from the European Union, obsolete and thus environmentally unfavorable, highly polluting vehicles. This has recently been accompanied by the importation of first-generation rechargeable hybrids in the EU due to the green license plate, while these vehicles are barely suitable for electric operation due to battery wear.

4. Selective aid for the purchase of electric cars As price of all-electric cars has been significantly higher than a similar conventional car since their inception, support has been and will be needed for their proliferation. This will not change fundamentally in the medium term. The price of a family-sized electric car far exceeds the possibilities of an average Hungarian buyer, however lowered price makes it available for them. [7]

Measurement

"Measuring exhaust emissions from vehicles are a complex issue, and it's a topic that has been extensively discussed in the media over the past months. This report explains in simple terms how vehicle emissions occur and how they are tested, and the reasons for the gap between tested and real-world driving emissions. - European Environment Agency (EEA) Executive Director Hans Bruyninckx"[8]
Pollutant emissions produced by road traffic have a major impact on air quality and are known to depend on traffic, road, and vehicle characteristics, on atmospheric conditions and on driving behavior.

Environmental review technology Environmental inspection shall verify that the environmental condition of the vehicle complies with the manufacturer's specifications and its air pollution does not exceed the limit value specified by the manufacturer or specified in a separate legal act. Instruments designed, calibrated, and accurately checked in accordance with the applicable metrological regulations may be used for the environmental inspection. In addition to gas analyzers and smoke measurement instruments and other equipment capable of measuring characteristics, OBD readers capable of communicating with the on-board computer of vehicles must also be able to be connected to the IT system of the transport authority [9].
The classification of vehicles into environmental protection is regulated by Decree 6/1990. (IV. 12.) KöHÉM on the technical conditions for the placing on the market and entry into service of road vehicles. Based on the design characteristics determining the pollutant content of the vehicle's exhaust gas and the fulfillment of the pollutant emission requirements set out in the annexes to the regulations of the Decree, vehicles are classified in the environmental classes [9].

XXIII. Road Transport Environmental Action, carried out by transport authority is an organic continuation of the previous work, for five days, inspections in 4 big cities and changing locations are basically events that form the basis of technical development, which provide an opportunity to:

- a roadside inspection survey of the actual emissions of motor vehicles in domestic traffic,
- to explore the causes of high emissions,
- look for ways to reduce emissions,
- feasibility studies for the options,
- planning action projects based on feasibility studies.

In Budapest, Győr, Szeged and Debrecen, between 23 and 27 September 2019, 517 vehicles were in the line of sight of professionals. The tool of the Action is the annual review of the environmental condition of vehicles. As a result of regular inspections and information, in ten years out of ten vehicles inspected, on average, experts found something objectionable.

The survey was implemented on a city-by-city basis, so we also address regional differences in the evaluation. Figure (1) shows the percentage of petrol and diesel vehicles, and the compliance by engine type and by city.

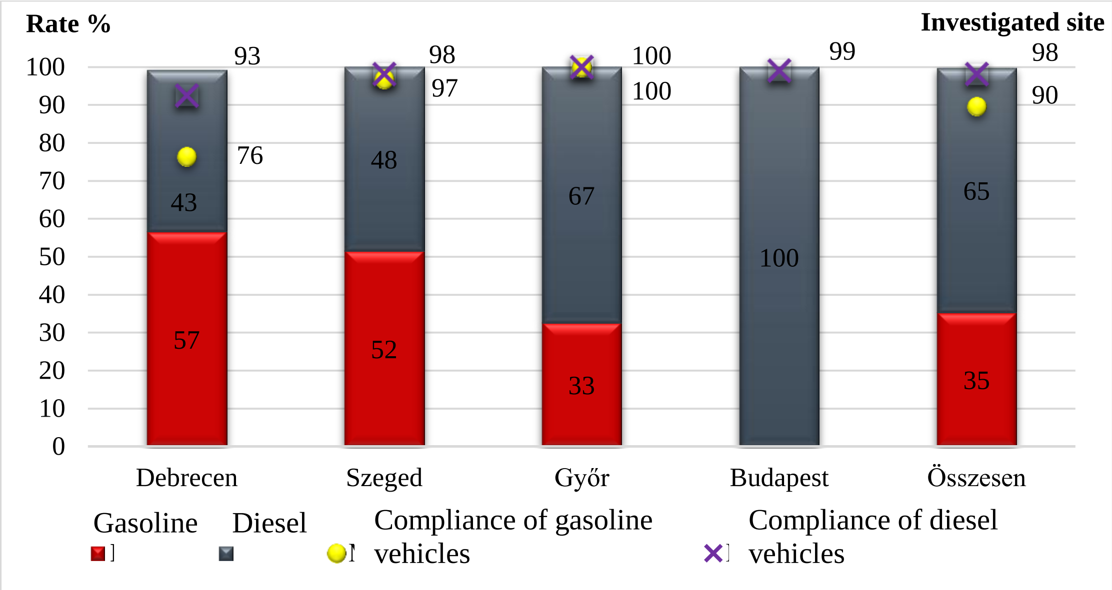

Figure (1) Distribution and compliance of the examined vehicles by category and engine type

In total, it can be said that during the roadsite inspection of the vehicle fleet in Debrecen, 115 out of 127 vehicles passed the test (90%). 93% of diesel and only 76% of gasoline-powered cars met the requirements. In most cases, exceeding the limit value and leaking the exhaust system was the problem. The drivers of these vehicles received a warning. The 24 small trucks and one truck performed well in the inspection.

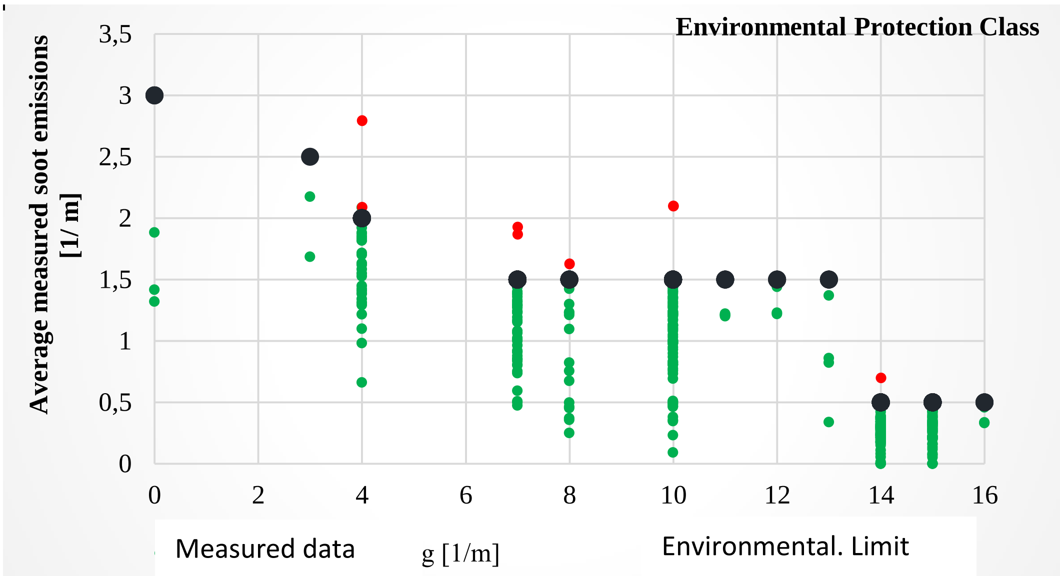

Figure (2) Carbon black emissions as a function of environmental protection class

Figure (2) presents the results of carbon black emission versus Environmental Protection Class and Figure (3) is for hydrocarbon emissions depending of the year of place on the market. These curves describe the inverse ration emission with the Euro class and proportional age of engines.

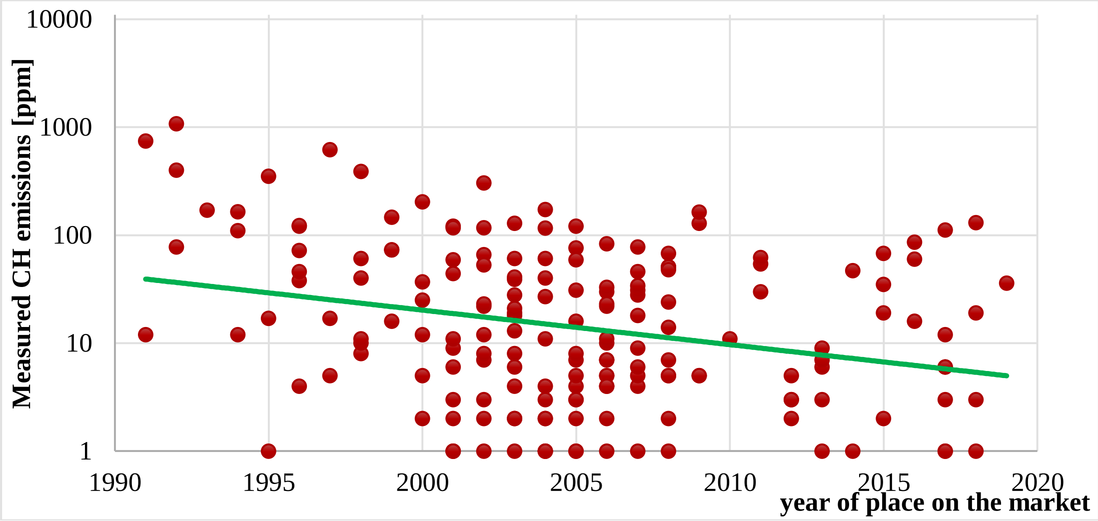

Figure (3) Age-related hydrocarbon emissions of the examined vehicles on a logarithmic scale

Assessing the condition and examining the emission values of the vehicles inspected during the Road Transport Environmental Action may draw attention to the problems mentioned earlier. As a result, environmentally conscious car owners can replace their older types of cars, reducing the number of high-emission vehicles or, if they do not have the financial means, pay more attention to maintenance, including their own safety and a cleaner environment.

Summary

Before, when it comes to air pollution, we often only think of developing countries and densely populated countries like China, India, etc. According to the latest WHO data, 97% of cities in low- and middle-income countries do not meet WHO air standards. For high-income countries, the rate drops to 49%. By all collected data in Measurement part, air pollution caused by transportation was found as the most serious problem to not only human beings but also the ecology and the worldwide economic.

That's why regular measurements of road and greening projects are needed; because the less air pollutant means the better air quality, the lower the number of people with health problems. Due to all of the researched information above, solutions for greening transport are identified. Some parts of them have been applied in several countries, including Hungary.

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