



**VIIth International Annual
Symposium-2023**

**“Environmental Health and
Biosecurity Strategy”**

**Proceedings Book
May 4th – 5th, 2023**

**Obuda University
Budapest - Hungary**

Proceedings Book



VIIth International Annual Symposium-2023

**“Environmental Health and
Biosecurity Strategy”**

**May 4th – 5th, 2023
Budapest - Hungary**



2-DAY EVENT Online

**VIIth International Annual Symposium-2023 on
“Environmental Health and
Biosecurity Strategy”**

**PROCEEDINGS BOOK
(PROGRAM, ABSTRACT & Full Papers)**

Venue:

Obuda University
Budapest -Hungary

Date:

May 04 - 5, 2023

Editor-in-Chief

Prof. Dr. Hosam BAYOUMI HAMUDA



**VIIth International Annual Symposium-2023 on
“Environmental Health and
Biosecurity Strategy”**



Considering the unprecedented circumstances, and the uncertainty due to the travel restrictions imposed by different countries, the Organizing Committee has made the decision to hold the VIIth Symposium virtually.

Online

May 04th – 05th, 2023
RKK – Obuda University
Budapest - Hungary



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INTRODUCTION

Dear Distinguish Friends, Guests & Colleagues

According to World Health Organization (2016), around 24% of global deaths are caused by violations of environmental protocols. People required fresh water to drink, clean air to breathe, and places to live free of toxic substances and hazards through sustainable environmental practices to secure future growth potentials and help build prosperous communities.

Currently, we are witnessing global climatic, biological & geological transformations taking place on the Planet & having a significant impact on all aspects of modern human life. Environmental ecology changes affect all countries & continents, their negative consequences are felt not only by underdeveloped states, but also by states that are usually referred to as "post-industrial", i.e. states with a high level of economic development & advanced technologies.

Based on environmental monitoring data, the current state of the environment is characterized, especially in areas of intensive industrial production, negative anthropogenic factors are identified that violate the ecological balance in the territories of active resource extraction, & the environmental threats arising in this connection. It is noted that in the context of increasing economic activity & global climate change, compliance with environmental safety requirements becomes a factor capable of ensuring sustainable economic development.

In the context of large-scale environmental degradation, ensuring sustainable socio-economic development is impossible without achieving the required level of environmental safety, which allows carrying out production activities without going beyond the capacity of the biosphere.

The main approaches of the Symposium-2023 are mentioned below.

- Discusses a new environmental strategy based on the biosphere approach & considering the regularities of biosphere development & includes supplementary material on the influence of technologies on global climate change, the development of natural disasters & biosphere degradation.
- Highlights the contradictions between the market economy & ecology as well as the Symposium-2023 provide new facts about the global environmental crisis to be expected in the following 10 years.
- Ensuring environmental security is among the global strategic tasks. This problem is related to the rapidly aggravating threats caused by increasing population growth on the Earth, diminishing life-supporting resources, technologies, global climate change, & escalating natural disasters.
- Environmental safety becomes the most important factor controlling human survival on the Planet.

The VIIth International Annual Symposium-2023 examines the state of natural environment & the causes of its degradation using the biospheric approach. The increasing human population has resulted in people being more involved in research & innovation to find means of dealing with the increasing demands for food.

The 21st century has witnessed numerous challenges affecting human life. One of these challenges is problems encountered in achieving food security by many nations across the globe, resulting in many people being unable to meet their basic human need of access & affordable food. The innovation of

human beings is in increasing food production & ensuring food security through biotechnology. As such biotechnology plays a part in food security which refers to the secure, adequate supply of food for everyone.

The COVID-19 pandemic disease now affects the entire world & has many major effects on the global economy, environment, health, & society. Focusing on the harm COVID-19 poses for human health & society. The world is unsure about the possible determining factors of the COVID-19 pandemic, which need to be known through conducting nonlinearity relationships, which caused the pandemic crisis. The study should examine the nonlinear relationship between COVID-19 cases & carbon damages, managing financial development, renewable energy consumption & innovative capability in a cross section of most global countries.

Advances in sector of vaccinology & immunology dependency on innovations in biotechnology, especially genomics, signature tagged mutagenesis, proteomics, immune modulation, computational simulations & complicated system analysis. These fields gain experience quickly growing or developing knowledge which increased realizations of the human immune system & pathogens.

Artificial intelligence is an important field of computer science & engineering to make machine capable to show intelligence like human. The idea of artificial intelligence is discovered upon the concept which human think & reasoning procedures is conventionally expressed, collected & conventionally embedded into machines. Artificial intelligence includes intelligent agents (e.g., systems which recognize their environment & make decisions & take actions) to execute operation like reasoning, planning, knowledge extraction, learning, perception, communication, moving & also handling & operating objects.

The field of Artificial intelligence is flourishing thanks to large investments & big companies with heavy ecological footprints can use it to make their activity more sustainable. This field focuses on multiple areas where Artificial intelligence can be helpful in achieving such goals. Thanks to the use of artificial intelligence – specifically relationships between both people & computers (for example, different elevation or land cover datasets, or hydrologic models, are consistently labelled with clear, uniform & unambiguous descriptors).

Artificial intelligence plays an important role in achieving not only environmental but all other Sustainable Development Goals- from ending hunger & poverty to achieving sustainable energy & gender equality to protecting & preserving biodiversity.

Artificial intelligence has the potential to accelerate global efforts to protect the environment & conserve resources by detecting energy emission reductions, CO₂ removal, helping develop greener transportation networks, monitoring deforestation, & predicting extreme weather conditions. Artificial intelligence provides means to tackle the most pressing environmental challenges such as climate change, biodiversity & conservation, ocean health, water issues, healthy air, weather forecast & disaster resiliency.

Several studies have demonstrated the negative impacts of environmental pollution on population health; in general, few studies have examined the potential differential effects on the physical health of middle-aged & older populations. It is widely recognized that non-communicable chronic diseases have become more prevalent than infectious diseases in the world. Environmental pollution is associated with a range of chronic conditions & represents a major public health burden.

Environmentally, problems of air pollution occurred in many of worldwide. Recent studies demonstrated that environmental pollution significantly increased the number of chronic diseases as

well as the risk of being sick, thereby highlighting the corrosive effect of pollution on physical health status. This negative effect was stronger as pollution intensity grew. The growing prevalence of chronic conditions over the last 20 years has become a serious health problem & the main cause of premature mortality.

Pollution problems are severe in Worldwide. Presently, air pollution is a burning problem for every part of the globe. More than 100 pollutants which pollute air have been identified. They may be in the form of solids, liquids or gases. They differ significantly from place to place depending upon the complex of contaminant source & atmospheric conditions. The air pollutants emitted from both natural as well as anthropogenic sources. Air pollution has become a severe environmental stress to crop plants due to increasing industrialization & urbanization during last few decades.

One way to reduce pollution is through green innovation which is defined as the implementation of new, or significantly improved, products, processes, marketing methods, organizational structures & institutional arrangements which, with or without intent, lead to environmental improvements compared to relevant alternatives. It is one of the most important choices that firms make to deal with environmental issues & build sustainable development.

Green investment refers to the investment necessary to reduce greenhouse gas & air pollutant emissions, so green investment is also called environmental protection investment, ecological investment, etc.

In global, groundwater not only provides valuable freshwater resources but also supports agricultural cultivation & industrial production activities, playing an increasingly important role in human life, ecosystems, & sustainable development. However, many countries in the world are facing the pressure of water resources & environmental problems, such as water shortage, water pollution, & frequent occurrence of extreme hydrological events under the influence of climate change & anthropogenic activities. Understanding the quality & associated hydrogeochemical evolution process of groundwater are urgently required for managing & utilizing groundwater resources in the world.

Drainage of treated wastewater to surface water is a severe threat to the health of aquatic organisms. A major human activity or natural event may cause changes to the surface attributes immediately or after a period. Water is the source of life.

Facing the increasingly serious shortage of fresh water & pollution of the water, remote sensing-based monitoring of water has received widespread attention. Urban rivers are closely related to the lives of urban residents & remote sensing data has also been widely used to monitor changes in water quality of urban river.

Environmental pollution from petroleum compounds has become a major problem, both biologically & economically. Oil spills in aquatic ecosystems are among the worst catastrophic events that can affect & compromise aquatic life. The contamination of aquatic ecosystems with oil may be caused by accidental oil leakage from petroleum reservoirs & oil deposits, damage to pipelines, oil extraction platforms, & discharge of effluents from refineries, etc. Crude oil is a toxic compound mixture with a high potential for bioaccumulation in the body of aquatic organisms.

Plastics continue to have a critical & essential role in human society such as food packing, product packages & building materials. Plastic waste spreading around our planet has become one of the biggest concerns of this century. Massive production & use of plastic products bring convenience to people while leading to the accumulation of plastic pollutants in the environment.

In total, 80% of plastic wastes can accumulate in landfills or be released into natural environments. Every year, open oceans are dumped with an estimated 4.8 to 12.7 million tons of plastics due to

improper waste management strategies. The recycling is much less than the generated plastic waste & accounts for only 9% of the total plastic waste discarded. In the meantime, it has been recognized as a global sustainability priority to study & mitigate pollution of plastics & the associated unknown impacts from ultrafine plastic particles.

Microplastics particles, for instance, have been detected in the aquatic environment globally & have raised scientific interests & environmental concerns. The larger plastics in turn are fragmented by chemical reactions, UV radiations, wave action & biodegradation to form small plastic pieces, termed microplastics. Microplastic pollution has gradually become a global problem & attracted much attention

from scientists. Plastic particles have invaded almost every ecosystem of the earth & their significance can be marked by the fact that they are even seen in drinking water.

The pollution of soils & plants & their location in different climatic, physiographic & geochemical conditions require not only constant monitoring of the soil condition, but also the development of differentiated approaches to assess & prevent the risk of pollution. The development of technologies for the rehabilitation of soil properties, including its fertility is also a challenge.

The problem of soil monitoring & rehabilitation is becoming increasingly topical due to population expansion to abandoned mining areas & other industrial areas. It was especially important evaluate the variation & spatial distribution of natural & man-made associations of macro & microelements as a key to understanding the dynamics of sustainability of natural & anthropogenic substances and their spatial structures formed in soils that we need to know to return to safe operation of polluted land.

The socio-environmental crisis & the complexity of urban problems highlight the importance of better understanding the emergence & configuration of social innovation ecosystems & their impact on cities. The globalization index is composed of economic, social, & political factors. Economic globalization is generally the combination of financial factors as well as trade dimensions. Many empirical studies investigated the effects of globalization on the ecological footprint.

In 2018, global energy utilization increased by 2.9% & this rate of increase was almost doubled compared with the average rate of 1.5% per annum in the preceding 10 years. In addition, the overall resource consumption has already surpassed the resource generating capacity of the earth causing an ecological deficit that can have detrimental effects on global population.

Despite the economic development, most world nations could not develop their industrial sector to the desired extent.

Therefore, the financial sector has an undeniable role in the structural transformation & energy transition of these nations. This structural transformation helps in the reduction of environmental pressure since the service sector produces less ecological damages.

The ecological footprint is a strategy advanced by the Global Footprint Network (2020) to quantify human requirements on natural capital—the number of natural resources required for an individual or an economy.

The Earth has undergone warming & cooling numerous times since its formation over billions of years ago. These changes have emanated from several atmospheric & land use systems leading to natural disasters which are the biggest global, regional & local challenges in recent years.

Climate adaptation & low-carbon investment in areas such as climate change, renewable energy, & clean technology in green investment. Considering pollution control within environmental protection investment is green investment in a narrow sense, while a broader definition of green investment should consider multiple aspects of the environment, the economy, & society.

Climate change has a large impact on tourism activities in terms of the change of spatial & temporal distribution of temperatures, the availability of beaches for recreation, & the quality of the coastal environment. Climate change will have far-reaching effects on many aspects of human activity, including agricultural & industrial productivity, real estate markets, human health, & even recreational opportunities. Crafting efficient climate policy requires a comprehensive understanding of these many consequences.

Today, climate change primarily takes the form of an increase in temperature which induces a global rise in sea level. The low-lying coastal areas, including but not limited to coastal tourism, will be at risk depending on the preparedness & the resilience of different societies. Coastal tourism is a climate-dependent industry & is closely linked to natural resources such as climate, beaches & sea.

Global climate has undergone unprecedented changes due to several natural- & human induced factors. Residents undertake temporal evacuations with financial assistance from local financial institutions.

Global warming has resulted in the formation of several large-scale climate events in the twenty-first century. Sea level rise has resulted in the submersion of coastal lands. Notable among these is sea level rise which is an adverse impact of global warming. This has eventually amplified submersion & occasional flooding tide in low-lying coastal environments.

The coasts of sub-Saharan Africa & those along the Pacific particularly have not been spared from the harsh effects of climate hazards. For instance, the WHO in 2002 estimated an annual death rate of about 150,000 caused by climate hazards in the sub-Saharan region every year. Concurrently, urbanization is a sensitive indicator that has exacerbated climate hazards in cities due to poor planning & the changes done to land cover. In growing coastal cities, sea level rise, inundation & submersion among other climate hazards have claimed lives & destroyed properties worthy.

This phenomenon is again driven by human activities such as deforestation of mangroves & coconut trees that play primary roles in carbon sequestration & serve as coastal defence systems. A consistency ratio of 10% based on pairwise comparisons of risks along with associated impacts show the judgements from respondents are pragmatic.

Crop productions are highly vulnerable to climatic changes associated with the increase in annual temperature & changing patterns of rainfall. The increasing average annual temperature change has the potential to distort the productivity growth of major agricultural crops & aggravate food security conditions in world.

As biotechnology, phytoremediation uses the potential of plants to remove pollutants & contaminants from the environment, which occurs through different processes. Most phytoremediation studies for water purification focus on the use of aquatic macrophytes. These plants species have different levels of contaminant tolerance & when used in combination in a decontamination system, they provide an environmentally sustainable & economically viable technology.

Moreover, ornamental plants can be used to compose buffer strips mitigating contamination of rural areas in the vicinity of contaminant sources & the resulted biomass used for bioenergy production. However, more studies also need to assess the ornamental quality of plants produced in contaminated environments as well as the accumulation of contaminants in the marketable organs of ornamental plants, such as flowers & foliage, aiming to evaluate the feasibility & safety of their commercialization. Ornamental plants can be used for Phytostabilization, promoting the beautification of contaminated sites, tourism & environmental education.

Impacts of Eco-Innovation on the Environmental Safety are become modern technology to increase the development & more biosphere security. The concept of eco-innovation has begun to be considered as

a solution to preventing environmental damage, especially since the 1990s. Eco-innovation is expected to reduce amounts of waste, air pollution, & material resource usage.

However, the effect of eco-innovation on environmental & financial performance has received limited attention. While factors such as global agreements, market conditions, technologies & regulations have important implications for the environment, eco-friendly investment can still be considered an additional charge for companies. New technologies have significantly changed production concepts. It has been a matter of curiosity to us how this situation will change financial & environmental performance.

The use of pesticides, insecticides, & fertilizers has become indispensable in agricultural production for higher yield of crops to meet the growing demands for food on a global level. Out of the total consumption of 6 million tons worldwide of these chemicals, only 1% reaches the target pest & the rest ends up in different environmental segments posing a potential risk to non-target organisms.

There is growing recognition of the potential environmental & socio-economic benefits of applying a circular approach to urban organic waste management through resource recovery. Decisions around planning & implementing circular urban waste systems require estimates of the quantity of resources available in waste streams & their potential market value. However, studies assessing circular economy

potential have so-far been conducted mostly in high-income countries, yet cities in low- & middle-income countries have different challenges when developing a circular economy.

Global environmental investment, as an effective means of world investment, provides financial & human support for globe's green technology innovations that require a large amount of capital investment. The proportion of global environmental investment reflects the importance that the global attaches to green technology innovation. Environmental investment & the application of green technologies is bound to influence global energy efficiency.

Subsequently, energy value & environmental concerns rise to imperil the sustainability of the developing economy. Oppositely, renewable energy is shaped after topped off natural resources to upgrade energy security & obliging the issues of environmental change & a worldwide temperature alteration.

Renewable energy implies a fundamental component for achieving continuous economic advancement. The energy significantly boosts the level of economic growth according to the energy-led growth hypothesis & energy reduction policies effectively depressed the level of economic growth. This relationship is also called unidirectional association between energy & growth; therefore, the energy acts as the complement of the other inputs & imperative ingredient of the production process.

The VII.th International Annual Symposium-2023 will provide the newest innovate approaches & methods to prevent the environment & secure the environmental elements (Air, Soil, Water, Biodiversity, Food, Health, Wastes, etc.) based on research on life sciences, engineering, modern biotechnology & also provide the platform for all experts from academia, industry & research laboratory to discuss the latest hot research & achievements.

Based on the huge success of last events, I am strongly confident that the VII.th Symposium-2023 will be a great success & meet our expectations. Moreover, the VII.th Symposium-2023 offers a valuable platform to create new contacts in the field of Traditional & Alternative technologies, by providing valuable networking time for you to meet great personnel in the field.

The above facts indicate that improving environmental quality can significantly reduce health risks & increase social welfare. Based on the above, the bilateral relationship between these five factors

Environmental Health, Quality, Regulations, Safety, Security level should be considered in the future of the scientific basic research all over the World.

The International Council of Environmental Engineering Education (ICEEE) & the Obuda University, Rejto Sandor Faculty of Light Industry & Environmental Engineering (RKK) & Institute of Environmental Engineering & Natural Sciences have the great pleasure & cordially thank you to participate in the program of the VIIth. International Annual Symposium-2023 on “**Environmental Health and Biosecurity Strategy**” ONLINE event during 4th and 5th of May 2023 at Obuda University RKK, Budapest - Hungary.

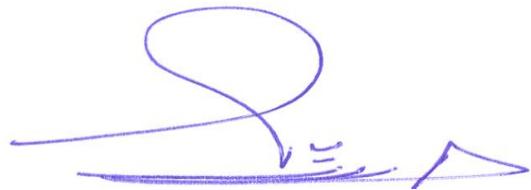
Publication of the abstracts & full papers are published in the **ISBN Proceedings book** with the code: **978-963-449-324-2**.

For more information, please visit the following websites:

- <https://www.iceee.hu>
- <https://www.kti.rkk.uni-obuda.hu>

I sincerely look forward to meeting you & your colleagues in next event.

Yours Sincerely,



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ACKNOWLEDGMENT

Dear Guests and Colleagues

Thank you very much for your attendance in the VIIth International Annual Symposium-2023 which was in Budapest during May 4-5, 2023, online in Budapest at Obuda University, Hungary.

The VIIth International Annual Symposium-2023 is a meeting where researchers, environmentalists, scientists, scholars and students, share their ideas, experiences, advancements, and research results. There were a plenty of opportunities for organisations, projects and consortia hold side events (meetings, seminars and workshops) on the Symposium 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 VIIth International Symposium-2023 was to deals with „Environmental Safety and Biospheret”. Environmental Sustainability is projected to harm human health through adverse changes in security of the lifestyle.

The VIIth International Annual Symposium-2023 bring together plenary, 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 themes reflect an integrated approach to identifying solutions to the complex global challenge of environmental quality.

The main goals of the VIIth International Annual Symposium-2023 were 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.

Here, the organizing committee of the VIIth International Annual Symposium-2023 identify opportunities for thanks the international participants from civil society, global partners, and researchers who contribute to a high quality of global effort towards environmental health systems.

We, the editor, would like to thank the members of the organizing, scientific, and administrative committees and all the supporting staff for giving this opportunity. We would also like to extend our sincere thanks to all the contributors and reviewers who have made this Proceedings Book

possible. We hope that the papers in this Proceedings Book will inspire further research and innovation in this important field.

Sincerely,

At the end, the organizing committee of the VIIth International Annual Symposium-2023 wish all the best for all the participants and thank their attendance.

*Prof. Dr. Hosam E.A.F. Bayoumi Hamuda
President of ICEEE
Chair, VIIth International Symposium-2023
Editor, Proceedings Book
Chair of Organizing Committee*



IMPRESSUM

For the Program, Abstracts and the Proceedings Book of the papers of the VIIth International Annual Symposium-2023

- The official language was English.
- The Program, Abstracts and Full papers of the VIIth International Annual Symposium-2023 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 Symposium.
- All reviewed papers for the VIIth International Annual Symposium-2023 are published in the Conference Proceedings Book with the ISBN **978-963-449-324-2**. in CD-ROM format and online (electronic) on the website of ICEEE: www.iceee.hu
- The selected high-quality manuscripts will be also published in the online journal.
- The scientific information and quality of the manuscript is due to the corresponding author of the paper.
- Individual authors at their manuscripts shall be responsible for any possible errors
- The Publisher of the Program, Abstracts and the Proceedings Book of the VIIth International Annual Symposium-2023, Institute of Environmental Engineering and Natural Sciences, Rejto Sandor Faculty of Light Industry and Environmental Engineering, Obuda University, Budapest, Hungary.
- Publication year of the Proceedings is **2023**.
- Important Website: www.iceee.hu

Attention:

- ✚ The VII.th Symposium-2023 will be held through **Microsoft Teams**.
- ✚ To join the Symposium:
 - There is a short guide with useful information about how to use the Microsoft Teams during the Symposium
 - The participants will have the link of the Symposium
 - The time of the Symposium is related to the **Hungarian time**.
- ✚ Please check the time with your time at home

Time of Oral Presentations Online (Microsoft Teams)

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



VII International Symposium-
2023

Please note that:

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

For Full paper:

The deadline to send the full paper is the end of June (30th of June 2023) in word document form.

30th of September 2023.

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Statistical Analysis of the VIIth International Symposium-2023

The International Council of Environmental Engineering Education (ICEEE) had the pleasure to announce about the **VIIth International Symposium-2023 Online** (Microsoft Teams)

Topic: **Environmental Health and Biosecurity Strategy**

Date: **May 4th – 5th, 2023**

Total given scientific abstracts covering the following technical sessions were 78 classified as following:

Plenary Lectures: 7

Keynote Lectures: 3

Technical Sessions: 38 Lectures

- Agriculture and Soil Improvement, Food Security and Green Growth
- Water Security: Treatment and Management
- Air Quality, Climatic Changes, Energy Production and Industrial Pollution
- Environmental Risk and Human Health
- Resources and Wastes Management and Recycling
- Social-Ecological Systems Research for Monitoring Sustainable Development

POSTER SESSION: 30 Posters

Before closing the Symposium-2023, a workshop was carried out to discuss the topic: **The Future of our Biosphere.**

The participants in this Symposium came from **26** countries covering as examples of Africa, Asia, Europe

The full articles of the given abstracts will be published in the form of **ISBN Proceedings Book.**

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VIIth International Symposium-2023

Organization & Committees

Principal Organisers:

- International Council of Environmental Engineering Education (ICEEE)
 - Institute of Environmental Engineering & Natural Sciences (KTI)
 - Rejtő Sándor Faculty of Light Industry & Environmental Engineering (RKK)
 - Obuda University (OU)
-



Presidency of the Symposium-2023

VIIth International Symposium on Environmental Health and Biosecurity Strategy with the following keywords:

*Air, Biosphere, Environment, Food, Health, IT, Pollution, Quality,
Safety, Security, Soil, Waste, Water,*

is carrying out under the auspices of:

Prof. Dr. Levente KOVÁCS

**Rector
Obuda University**

Presidency of the Conference:

Dr. László KOLTAI

Dean

Rejto Sandor Faculty of Light Industry & Environmental Engineering

Dr. Rita BODÁNE-KENDROVICS

Director, Institute of Environmental Engineering & Natural Sciences

Prof. Dr. Hosam BAYOUMI HAMUDA

**President, International Council of Environmental Engineering Education
(ICEEE)**

Chair, VIIth International Annual Symposium-2023



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VIIth International Annual Symposium-2023

Principal Publishing Partners:

- Tájökológiai Lapok: Hungarian Journal of Landscape Ecology (SCOPUS)

- Euro-Mediterranean Journal for Environmental Integration (<https://www.springer.com/journal/41207>)

- ISBN Proceedings book (978-963-449-324-2)



SYMPOSIUM'S HIGHLIGHT TOPICS

Form the above-mentioned reasons, the special VIIth. International Annual Symposium-2023 on **Environmental Health and Biosecurity Strategy** aims to provide a comprehensive perspective on changes in environmental quality affecting ecosystem & human health adopting global perspective concepts of climate change, modelling, & ecosystem services. For this purpose, valuable studies were gathered for the special Symposium-2023. Most of the selected papers will be focused on the quality of environmental elements (air, landscape, soil, water, food, health & waste) as well as treatment & systems of management.

The VII.th Symposium-2023 provides leading forum for the presentation (plenary, keynote, oral & poster) of new advances & research results in the fields of on Environmental Health and Biosecurity Strategy. Accordingly, Topics of interest for paper submission include, but are not limited to:

Session (A): Agriculture and Soil Improvement, Food Security and Green Growth

Session (B): Water Security: Treatment and Management

Session (C): Air Quality, Climatic Changes, Energy Production and Industrial Pollution

Session (D): Environmental Risk and Human Health

Session (E): Resources and Wastes Management and Recycling

Session (F): Social-Ecological Systems Research for Monitoring Sustainable Development:



AWARDS of the BEST PRESENTATION, POSTER & MUNSCRIPTS

This award recognizes individuals from poster presenters who have display their outstanding research & findings for an innovative future. Recipients of the award are the Best Poster Presenter of the VIIth International Annual Symposium-2023.

Criteria:

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

VIIth International Symposium-2023 Excellence Awards for best papers & presentation was instituted sine the year 2010 & have been given to the researchers for significant papers, to municipalities, temples, industries for their significant achievement in environmental health, quality, safety, etc. as well as the protection of the environment from pollution. The awards of the VIIth International Symposium-2023 were given to the most outstanding researchers of the symposium under below three categories.

SELECTION PROCESS

1. CRITERIA FOR THE SESSION'S BEST ORAI PRESENTATION AWARD

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

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



2. CRITERIA FOR THE BEST POSTER PRESENTATION AWARD

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

1. **Depth of Content (40%)**
2. **Introduction & Abstract (15%)**
3. **Content knowledge & organization (20%)**
4. **Poster Design & Overall Visual Appeal (10%)**
5. **Verbal Interaction (15%)**

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

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

1. **Total Marks gained in the presentation (100%)**
2. **Significance of the paper to the field (30%)**
3. **Theoretical contribution (15%)**
4. **The ability of practical implementation (20%)**
5. **Use of appropriate methodological rigor (20%)**
6. **Originality (15%)**

The organizing committee is waiting for your join the atmosphere of the VIIth. International Annual Symposium-2023 in Budapest & contribute to these exciting debates on the Biosphere & Environmental Safety to shape the future of our biotic & abiotic factors in our planet!

Based on the huge success of last events, I am strongly confident that the VIIth Symposium-2023 will be a great success & meet our expectations. Moreover, the VIIth Symposium-2023 offers a valuable platform to create new contacts in the field of Traditional & Alternative technologies, by providing valuable networking time for you to meet great personnel in the field.

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



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

Yours Sincerely,

Best regards,

Prof. Dr. Hosam Bayoumi Hamuda
President of ICEEE
Chair, VIIth International Symposium-2023
Editor, Proceedings Book
Chair of Organizing Committee



AWARDS CEREMONY

List of the Best presentations in VIIth International Annual Symposium-
2023

Environmental Health and Biosecurity Strategy

Congratulations to all our participants and the
Awards winners in VIIth International Annual Symposium-
2023

PROFESSIONAL RESEARCHERS

1. **Rim Tinhinen MAOUGAL, Malika BARKAT, Meriem BENAMARA, Nouha BOULMAIZE, Raouya MERAGHNI**

Physico-Chemical and microbiological characterization of 4 olive pomace

2. **Ágnes BÁLINT, Zoltán ANGYAL, Xuechu WANG, Csaba MÉSZÁROS**

Analysis of inorganic nitrogen forms and heavy metal concentrations in the Rákos stream near the wastewater treatment plant in Pécel

3. **Iryna GUMENIUK, Olena DEMYANYUK, Alla LEVISHKO, Viktoriya TSVIGUN, Yeuheniia TKACH**

Development of a system of biological indicators for assessing the ecological and functional soil conditions

4. **Sumera ZAIB**

Discovery of hydrazone scaffold as potent and selective multi-target-directed ligands for the treatment of neurodegenerative disorders: in vitro and in silico screening



5. Emőke IMRE, Miklós Juhász, Diego, Lachlan BATES, Stephen FITYUS

Soil profiling from short dissipation CPT data

6. Malika BARKAT, Rym Tinhinen MAOUGAL, Souad CHERRAK, Meriem BENAMARA

Evaluation of compounds extracted from olive pomace generated by the traditional process with a view to their valorization

7. Joghi Sivakumar Thatha GOWDER

Environmental chemicals and human risk assessment. a critical overview

8. Ana VUKMIROVIĆ, Boris OBROVSKI, Ivana MIHAJLOVIĆ

Evaluation of water quality assurance parameters to study WWTP performance



YOUNG RESEARCHERS

1. Monia ENNOURI

Opuntia flowers: A promising medicine and food resources

2. Anirban BHOWMIK, Subhabrata PANDA

Impact of agricultural land use practices and monsoon at micro-watershed level on soil properties including earthworm population and crop production in red and laterite agroclimatic zone under moist sub-humid region of West Bengal state in India

3. Sagrario CORRALES MARTINEZ, Tibor SZILI-KOVÁCS, Hosam E.A.F. BAYOUMI HAMUDA

Comparison of soil biological activities between grassland and arable soil

4. Sunaeda ALJGAMI, Rami WATFA, Tharwat IBRAHIM

Effect of interaction between internal Arbuscular Mycorrhizal Fungi and soil media on some characteristics of Stevia rebaudiana sugar plant, and the chlorophyll content of its leaves

5. Sihem HEDJAL, Abdelwaheb BENAMARA

Water suitability for irrigation in the Guerbes-Sanhadja wetlands complex

6. Dóra KÓHALMI¹, Hosam E.A.F. BAYOUMI HAMUDA¹, Tünde TAKÁCS²

Investigation of relationship between soil glomalin-content and land use

7. Kenza IRINISLIMANE

Storage of highly flammable and toxic products



PhD STUDENTS RESEARCHERS

1. Hanane MEROUCHI, Abdelkader BOUDERBALA, Hamida TAIBI

Groundwater recharge estimation using an empirical relationship between soil permeability and surface electrical resistivity method in the upper cheliff's alluvial aquifer Algeria

2. Yara EzAl Deen SULTAN, Kanni Raj Arumugam PILLA

On climatic change: Causes, impacts on wildfires and human health

3. Mythili MADHUSUDHAN, N.K. AMBUJAM

Hydromentality of the region of Chennai, India: social-ecological insights from an IWRM perspective

4. Lara Rúbia BORGES SILVA, Levente KARDOS

Management methods and challenges for distillery spent wash composting: a comprehensive review

5. Csenge NAGY-MEZEI, Anikó BEZSENYI, Imre GYARMATI², Levente KARDOS

Removability of medicines and medicine derivatives from wastewater

6. Elhem BOUCHIBA, Ali ELLAFI, Sonia BEN YOUNES, Mohamed Ali BORGHI

Isolation and preliminary identification of extremophile bacterial isolate from effluents of phosphate fertilizers industry in Southern Tunisian



7. **Attila FÜRÉSZ, Szilárd SZENTES, Zsombor WAGENHOFFER, László SIPOS, Levente VISZLÓ, Ildikó TURCSÁNYI-JÁRDI, Eszter SALÁTA-FALUSI, Péter PENKSZA, Márta BAJNOK, Gabriella FINTHA, Károly PENKSZA**

Grazing by domestic water buffaloes (*Bubalus bubalis*) as a habitat management and control option against the invasive *Solidago gigantea*

8. **Hamida TAIBI1, Abdelkader BOUDERBALA2**

Valorization of irrigation in arid and semi-arid climate areas: case study of upper Cheliff Plain, Algeria

9. **Khalid AZIZ, Mounir EL ACHABY, Rachid MAMOUNI, Nabil SAFFAJ, Faissal AZIZ**

A New micro-composite-based copper-doped Mollusca shells@Alginate beads for highly pesticide sorption from wastewater

Budapest, 9th of May 2023.

*Prof. Dr. Hosam E.A.F. Bayoumi Hamuda
President of ICEEE*

*Chair, VIth International Symposium-2023
Institute of Environmental Engineering &
Natural Sciences
Óbuda University*

*E-mail: bayoumi.hosam@uni-obuda.hu
WhatsApp/viber/messenger: +36-30-390-0813*

The certificates will be sent to all the awardees in e-mail by 30th of September 2023. In case of non-receipt of the certificate, please write to us with your contact details to:
bayoumi.hosam@uni-obuda.hu

**Online
Scientific Program of the
VIIth International Annual
Symposium-2023**



**Environmental Health and
Biosecurity Strategy**

May 4th – 5th, 2023

**Obuda University
Budapest - Hungary**



VII International Symposium-
2023

4th of May 2023 (Thursday)

09:00 a.m. – 09:30 a.m. Opening Ceremony

Prof. Dr. Hosam BAYOUMI HAMUDA
*President, International Council of Environmental
Engineering Education (ICEEE)*
Symposium Chair

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

Dr. Csanák Edit
*Vice-Dean, Rejtő Sándor Faculty of Light Industry &
Environmental Engineering*

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

Honour guest of the Symposium:

- Prof. Dr. Sadhan Kumar Ghosh***
- Prof. Dr. Ahmed KETTAB***
- Prof. Dr. Gamal Abdalla ELBADRI***
- Prof. Dr. Barkat MALIKA***
- Prof. Dr. Larbi DJABRI***
- Prof. Dr. Borbála Biró***
- Prof. Dr. Bhanu Singh PANWAR***



VII International Symposium-
2023

09:30 – 11:35

Plenary Session

Chair of the Session:

Hosam BAYOUMI HAMUDA

PL1 09:30 – 09:55

Sadhan Kumar GHOSH^{1,2}

¹Director General, Sustainable Development and Circular Economy Research Centre,

²International Society of Waste Management, Air and Water (ISWMAW), India

Decarbonisation of the industrial processes

PL2 09:55 – 10:20

Gamal Abdalla ELBADRI^{1,2}

¹Department of Mechanical Engineering, Jadavpur University, Kolkata India, ²School of Energy Studies, Jadavpur University, Kolkata, India,

²International Society of Waste Management, Air and Water

Control of root-knot nematodes using plant extracts

PL3 10:20 – 10:45

Ahmed KETTAB

National Polytechnic School of Algiers

Water resources, climate change and water stress in the world: realities, issues, conflicts; strategies; policies challenges and prospects

PL4 10:45 – 11:10

Larbi DJABRI¹, Saad BOUHSINA², Cheseddine FEHDI³, Linda ACHOU⁴

¹Laboratoire Ressource en Eau et Développement Durable, Université Badji Mokhtar, Annaba, Algérie. ²Vice Président Délégué, directeur du pôle universitaire de Dunkerque. 220 Avenue de l'université. Bp 5526 Dunkerque. Cedex01. France.

³Laboratoire Eau & Environnement. Université de Tébessa, Algérie ⁴Université Houari Boumediene-Alger. Algérie

Participatory management: a guarantee of water saving in a context of acute climate change



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2023

PL5 11:10 – 11:35

Ágnes BÁLINT¹, Zoltán ANGYAL², Xuechu WANG², Csaba MÉSZÁROS²

¹*Óbuda University, Budapest, Hungary*

²*Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary,*

Analysis of inorganic nitrogen forms and heavy metal concentrations in the Rákos stream near the wastewater treatment plant in Pécel

11:35– 11:45

Break



VII International Symposium-
2023

11:45 – 12:45

Technical Session A1

AGRICULTURE AND SOIL IMPROVEMENT, FOOD SECURITY AND GREEN GROWTH

Chair of the Session: **Ágnes BÁLINT**

Rim Tinhinen MAOUGAL, Maya KECHID, Abdelhamid DJEKOUN

GBBV, freres MENTOURI University Constantine 1, 25000 Ain El Bey, Constantine, Algeria

Bacteria associated with lentil for a less fertilizer-dependent crop

Souha CHOKRI^{1,2}, Ali ELLAFI^{1,3}, Ahmed Slaheddine MASMOUDI², Sonia BEN YOUNES^{1,4}

¹*Faculty of Sciences of Gafsa, Department of Life Sciences - University campus of Ahmed Zarroug, 2112, University of Gafsa, Gafsa, Tunisia.*

²*Laboratoire de Biotechnologie et Valorisation de Biogéoresources à l'Institut Supérieur de Biotechnologie de Sidi Thabet (ISBST) LR11ES31, Sidi Thabet-Tunisie.*

³*Laboratory of Analysis, treatment and valorisation of environment pollutants and products, Faculty of Pharmacy, Monastir University, Tunisia.*

⁴*Unit Research n°17/ES/13, Faculty of Medicine of Tunis, 15 rue Jebbel Lakhdar, University of Tunis El Manar, Tunisia.*

Evaluation of the anti-oxidant activity of three polysaccharides extracted from Tunisian plants

Hamida TAIBI¹, Abdelkader BOUDERBALA²

¹*Water, Rock and Plant research laboratory. University of Djilali Bounaama, Khemis Miliana, Algeria.*

Valorization of irrigation in arid and semi-arid climate areas: case study of upper Cheliff Plain, Algeria

Monia ENNOURI

Olive tree institute Sfax, University of Sfax, TUNISIA

Opuntia flowers: A promising medicine and food resources



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Maya KECHID^{1,2}, Rim Tinhinen MAOUGAL^{1,2}, Nassira RIAH¹, Kaouthar RAMMECHE², Issra Karawan BECHOUA², Zakaria Larbi BENLABIOD¹, Charaf Eddine BELHADEF¹, Abdelhamid DJEKOUN¹

¹*GBBV laboratory, Université Frères Mentouri, Constantine 1, Algeria*

²*BIOQUAL laboratory, INATAA, Université Frères Mentouri, Constantine 1 Algeria*

Effect of *Rhizobium leguminosarum* strains inoculation on Durum wheat growth

Iryna GUMENIUK, Olena DEMYANYUK, Alla LEVISHKO, Viktoriya TSVIGUN, Yeuheniia TKACH

Department of Agroecology and Biosafety, Institute of Agroecology and Environmental Management of NAAS, Kyiv, Ukraine.

Development of a system of biological indicators for assessing the ecological and functional soil conditions

12:45 – 13:00

Lunch time



VII International Symposium-
2023

13:00 – 14:00

Technical Session A2

**AGRICULTURE AND SOIL IMPROVEMENT, FOOD SECURITY AND
GREEN GROWTH**

Chair of the Session: **Csaba ÁGOSTON**

**Loucif CHEMACHE¹, Farida KEHAL¹, Olivier LECOQ², Hacène
NAMOUNE¹, Driss OULAHNA²**

¹Laboratoire de Nutrition et Technologie Alimentaire (LNTA), Institut de la Nutrition, de
l'Alimentation et des Technologies Agro-Alimentaires (INATAA), Université des Frères
Mentouri Constantine 1, 25000, Constantine, Algérie.

²Centre Rapsodee, IMT Mines-Albi. Campus Jarlard, 81000 Albi, France.

**Impact of hydration water salinity and incorporation of soft wheat
flour on the wet agglomeration properties of durum wheat
semolina for couscous production**

Tadesse Endale TEFERRA

Mettu University, Mettu, Ethiopia

**Investigating effect of eggshell ash and crushed stone powder on
geotechnical properties of expansive soil: In case of Dukem town,
Ethiopia**

Anirban BHOWMIK¹, Subhabrata PANDA^{1,2}

¹Department of Soil and Water Conservation, BCKV, Mohanpur, Nadia, West Bengal, India,

²AICRP on Agroforestry, Regional Research Station (Red & Laterite Zone), BCKV,
Jhargram, West Bengal, India,

**Impact of agricultural land use practices and monsoon at micro-
watershed level on soil properties including earthworm population
and crop production in red and laterite agroclimatic zone under
moist sub-humid region of West Bengal state in India**



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Sagrario CORRALES MARTINEZ¹, Tibor SZILI-KOVÁCS², Hosam E.A.F. BAYOUMI HAMUDA¹

¹*Óbuda University, Rejtő Sándor Faculty of Light industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary,*

²*Institute for Soil Sciences, Centre for Agricultural Research, ELKH, Budapest, Hungary*

Comparison of soil biological activities between grassland and arable soil

Ágnes BÁLINT¹, Duan ZHENGQI¹, Xuechu WANG²

¹*Óbuda University, Budapest, Hungary,*

²*Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary*

Nitrate content in fruits and vegetables

Éva Rakó GUZMICSNÉ, 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

Effect of environmental contamination with pesticides on plant growth



VII International Symposium-
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11:45 – 12:45

Technical Session B1

WATER SECURITY: TREATMENT AND MANAGEMENT

Chair of the Session:

Hosam BAYOUMI HAMUDA

Hanane MEROUCHI, Abdelkader BOUDERBALA, Hamida TAIBI

Plant chemistry – water- energy research laboratory. Hydraulics Department, Faculty of Civil Engineering, Hassiba Ben Bouaali University, Chlef, Algeria.

Groundwater recharge estimation using an empirical relationship between soil permeability and surface electrical resistivity method in the upper cheliff's alluvial aquifer Algeria

Salah DIF^{1,2}, Yamina ELMEDDAHI^{1,2}, Salim HEDDAM³

¹Department of Hydraulic, Civil Engineering and Architecture Faculty, University of Hassiba Benbouali, Chlef, Algeria

²Vegetal Chemistry -Water-Energy Laboratory (LCV2E), Chlef, Algeria

³Faculty of Science, Agronomy Department, Hydraulics Division, University 20 Août 1955, Skikda, Algeria

Monthly streamflow prediction using hybrid extreme learning machine optimized by bat algorithm: case study of Tiguiguest Basin, Northern Algeria

Mehr ANGAIZ

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

Increasing the efficiency of wastewater treatment operations. The effect of salinity on the use of polymers

Ana VUKMIROVIĆ, Boris OBROVSKI, Ivana MIHAJLOVIĆ

University of Novi Sad, Faculty of Technical Sciences, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia,

Evaluation of water quality assurance parameters to study WWTP performance



VII International Symposium-
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**Osamah J. AL-SAREJI^{a,b}, Mónika MEICZINGER^a, Viola SOMOGYI^a,
Ruqayah Ali GRMASHA^{b,c}, Khalid S. HASHIM^{d,e}**

*^aSustainability Solutions Research Lab, Faculty of Engineering, University of Pannonia,
Egyetem str. 10, Veszprém H 8200, Hungary*

^bEnvironmental Research and Studies Center, University of Babylon, Babylon, Al-Hillah, Iraq

*^cUniversity of Pannonia, Faculty of Engineering, Center for Natural Science, Research Group
of Limnology, Egyetem u. 10, H-8200 Veszprem, Hungary*

^dSchool of Civil Engineering and Built Environment, Liverpool John Moores University, UK

*^eDepartment of Environmental Engineering, College of Engineering, University of Babylon,
Babylon, Al-Hillah, Iraq*

The synergistic effect of granular activated carbon in the removal of pollutants: adsorption and degradation study comparison

12:45 – 13:00

Lunch time



VII International Symposium-
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15:00 – 16:00

Session (C)

AIR QUALITY, CLIMATIC CHANGES, ENERGY PRODUCTION AND INDUSTRIAL POLLUTION

Chair of the Session:

Hosam BAYOUMI HAMUDA

Yara EzAl Deen SULTAN¹, Kanni Raj Arumugam PILLA²

¹Research Scholar, Department of Chemistry, School of Science & Humanities, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science & Technology, Chennai-600062, Tamil Nadu, India

²Professor, Department of Chemistry, School of Science & Humanities, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science & Technology, Chennai, Tamil Nadu, India

On climatic change: Causes, impacts on wildfires and human health

Brahim LOUATI^{1,2}

¹Faculty of Light Industry & Environmental Engineering (RKK), Institute of Environmental Engineering & Natural Sciences – Óbuda University. Budapest – Hungary

²Water Resources and Sustainable Development Laboratory, Faculty of Earth Sciences, Badji Mokhtar University Badji Mokhtar BP 12 Annaba –Algeria

Impact of effluents olive oil on the surface waters of middle Seybouse

Yanina ROMERO¹, Janette BESSEMBINDER², Nick van DE GIESEN³, Frans van DE VEN³

¹Beuningen, The Netherlands,

²Climate Services, Royal Netherlands Meteorological Institute (KNMI), De Bilt, The Netherlands

³Water Management, Delft University of Technology, Delft, The Netherlands

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



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Sara ALKHALDI¹, Katalin A. FŐGLEIN², Krisztina DEMÉNY¹

*¹Óbuda University, Rejtő Sándor Faculty of Light industry and Environmental Engineering,
Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary*

²KTI Institute for Transport Sciences Nonprofit Ltd., Budapest, Hungary

Environmental assessment of electrical vehicles

14:00 – 15:00

Technical Session (D)

ENVIRONMENTAL RISK AND HUMAN HEALTH:

Chair of the Session:

Sándor J. ZSARNÓCZAI

Asmaa RHAZOUANI^{1,2,3}, Halima GAMRAN^{1,3}, Faissal AZIZ^{1,2}

¹Laboratory of Water, Biodiversity & Climate Change, Cadi Ayyad University, B.P. 2390, 40000 Marrakech, Morocco

²National Centre for Studies and Research on Water and Energy (CNEREE), Cadi Ayyad University, B. P 511, 40000 Marrakech, Morocco

³Laboratory of Clinical, Experimental and Environmental Neurosciences, Cadi Ayyad University, Marrakech, Morocco

Toxicity of graphene oxide nanoparticles in male mice via intraperitoneal injection: a biochemical and histopathological study

Sumera ZAIB

Department of Basic and Applied Chemistry, Faculty of Science and Technology, University of Central Punjab, Lahore 54590, Pakistan

Discovery of hydrazone scaffold as potent and selective multi-target-directed ligands for the treatment of neurodegenerative disorders: in vitro and in silico screening

Joghi Sivakumar Thatha GOWDER

King Faisal University, College of Applied Medical Sciences, Al-Ahsa, KSA.

Environmental chemicals and human risk assessment. a critical overview

Fouzia HIZIR¹, Abderrezak KRIKA²

¹Geological Engineering Laboratory (LGG), University of Mohamed Seddik Benyahia, Jijel, Algeria

²Laboratory of Biotechnology, Environment and Health, University of Mohamed Seddik Benyahia, Jijel, Algeria

Influence of anthropic activities on the degradation of the quality of surface waters: case of the RHUMEL Wadi (NORTHEAST ALGERIA)



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Fouzia HIZIR¹, Abderrezak KRIKA²

¹Geological Engineering Laboratory (LGG), University of Mohamed Seddik Benyahia, Jijel, Algeria

²Laboratory of Biotechnology, Environment and Health, University of Mohamed Seddik Benyahia, Jijel, Algeria

Study of the metallic contamination of the surface sediments of the Oued Rhumel (NORTHEAST ALGERIA)



VII International Symposium-
2023

15:00 – 16:30

Technical Sessions

**SESSION (E):
RESOURCES AND WASTES MANAGEMENT AND RECYCLING
SESSION (F):
SOCIAL-ECOLOGICAL SYSTEMS RESEARCH FOR MONITORING
SUSTAINABLE DEVELOPMENT:**

Chair of the Session: Hosam BAYOUMI HAMUDA

Sándor J. ZSARNÓCZAI^{1,2}, Csaba LENTNER²

¹University of Public Service, Budapest, Faculty of Governmental and International Studies, Kálmán Széll Public Finance Pub, Ludovika tér 2., H-1083 Budapest, Hungary
Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering
Institute of Environmental Engineering, Doberdó u. 6, H-1034 Budapest, Hungary,

²University of Public Service, Budapest, Faculty of Governmental and International Studies, Kálmán Széll Public Finance Pub, Ludovika tér 2., H-1083 Budapest, Hungary

Main economic features of France between 2019 And 2023

Ali Dawood SALMAN^{1,2}

¹Sustainability Solutions Research Lab, University of Pannonia, Veszprem, Hungary

²Department of Chemical and Petroleum Refining Engineering, College of Oil and Gas Engineering, Basra University for Oil and Gas, Basra, Iraq

Recover scandium element from Hungarian bauxite residue: treasure from the waste

Mythili MADHUSUDHAN¹, N.K. AMBUJAM²

¹School of Architecture, Meenakshi College of Engineering, Chennai, India,

²Retd., Centre for Water Resources, Anna University, Chennai, India,

Hydromentality of the region of Chennai, India: social-ecological insights from an IWRM perspective

Kenza IRINISLIMANE

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

The migration of pollutants into the soil



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Lara Rúbia BORGES SILVA, Levente KARDOS

*Hungarian University of Agriculture and Life Sciences, Institute of Environmental Sciences,
Department of Agro-environmental Studies, Budapest, Hungary*

Management methods and challenges for distillery spent wash composting: a comprehensive review

Ruqayah Ali GRMASHA^{1,2}, Csilla STENGER-KOVÁCS^{1,3}, Osamah J. AL-SAREJI^{2,4}, Raed A. AL-JUBOORI^{5,6}, Mónika MEICZINGER⁴, Marwan H. ABDULAMEER⁷, Zaid AL-GAZALI⁸, Khalid S. HASHIM^{9,10}

¹*University of Pannonia, Faculty of Engineering, Center for Natural Science, Research Group of Limnology, H-8200 Veszprém, Egyetem u. 10, Hungary*

²*Environmental Research and Studies Center, University of Babylon, Al-Hillah, Iraq*

³*ELKH-PE Limnoecology Research Group, H-8200 Veszprém, Egyetem utca 10. Hungary*

⁴*Sustainability Solutions Research Lab, Faculty of Engineering, University of Pannonia, Egyetem Str. 10, Veszprém H, 8200, Hungary*

⁵*NYUAD Water Research Center, New York University-Abu Dhabi Campus, Abu Dhabi, P.O. Box 129188, Abu Dhabi, United Arab Emirates*

⁶*Water and Environmental Engineering Research Group, Department of Built Environment, Aalto University, P.O. Box 15200, Aalto, FI-00076, Espoo, Finland*

⁷*College of Environmental Science, Al-Qasim Green University, Iraq*

⁸*Nasiriyah Teaching Hospital, Ministry of health, Al-Nasiriyah, Thi-Qar, Iraq*

⁹*School of Civil Engineering and Built Environment, Liverpool John Moores University, UK*

¹⁰*Department of Environmental Engineering, College of Engineering, University of Babylon, Al-Hillah, Iraq*

The level of polycyclic aromatic hydrocarbons (PAHs) in the main water bodies in Iraq: An update status

Csenge NAGY-MEZEI^{1,2}, Anikó BEZSENYI², Imre GYARMATI², Levente KARDOS¹

¹*Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary*

²*Budapest Sewage Works Pte Ltd., Budapest, Hungary*

Removability of medicines and medicine derivatives from wastewater



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Afef SAI^{1,2}, Ali ELLAFI^{1,3}, Younes MOUSSAOUI⁴, Mohamed Ali BORG^{1,2}, Sonia BEN YOUNES^{1,5}

¹Faculty of Sciences of Gafsa, Department of Life Sciences - University campus of Ahmed Zarroug, 2112, University of Gafsa, Gafsa, Tunisia.

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³Laboratory of Analysis, treatment and valorisation of environment pollutants and products, Faculty of Pharmacy, Monastir University, Tunisia.

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⁵Unit Research n°17/ES/13, Faculty of Medicine of Tunis, 15 rue Jebbel Lakhdar, University of Tunis El Manar, Tunisia.

Contamination evaluation and environmental risks of trace metals from phosphate wastewater in Gafsa Metlaoui ore

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

Relationship between soil respiration and application of fungicides in agricultural land



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POSTER SESSION (A, B, C, D, E & F) **16:30 – 18:30**

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

Viktor GRÓNÁS, Márk PÁLFI, Csaba CENTERI¹, Zsolt BIRÓ
*Institute for Wildlife Management and Nature Conservation, Hungarian University of
Agriculture and Life Sciences, Gödöllő, Hungary*

Comparison of pedological characteristics of two solar parks for planning biodiversity management

**Abdousalam A. ALGAID¹, Hosam E.A.F. BAYOUMI HAMUDA², Ibrahim
Issa ABDELMOULA³**

*¹Sabha University, Faculty of Science, Department of Microbiology, Sabha, Libya,
²Óbuda University, Rejtő Sándor Faculty of Light industry and Environmental Engineering,
Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary,
³Sirt University, Faculty of Agriculture, Department of Soil Science, Sirt, Libya,*

Effect of Heavy Metals and Temperature on Nitric Oxide and Carbon Dioxide Emissions from Cultivated Soil

**Emőke IMRE^{1,2}, Péter FELKER¹, Tamás WEIDINGER⁶, Martin
MAYER³, Tibor PÁLINKÁS¹, Gábor MILE⁴, Bálint SINKOVICS⁵, Lily
TANUI⁷, Ulsbold AYURZANA⁷, Delphin. KABEY², Ágnes BÁLINT²,
László ARADI⁹, Zoltán KAPROS¹⁰**

*¹Bánki Donát Faculty, Óbuda University, Budapest, Hungary
²Hydro-Bio-Mechanical Systems Research Center, Óbuda University
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University of Technology and Economics, Hungary
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Sándor Faculty, Óbuda University, Budapest, Hungary
⁹Faculty of Engineering and Information Technology, University of Pécs, Hungary ¹⁰Ministry
of Construction and Transport, Hungary*

Solar irradiance measurement in a landfill site



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Emőke IMRE^{1,2}, László TÓTH², Péter FELKER¹, Ákos NEMCSICS^{2,5}, A. ÜRMÖS^{2,5}, Tamás WEIDINGER⁶, Martin MAYER³, Tibor PÁLINKÁS¹, Gábor MILE⁴, Lily TANUI⁷, Ulsbold AYURZANA⁷, Delphin KABEY², Ágnes BÁLINT², Zoltán KAPROS¹⁰

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⁹*Faculty of Engineering and Information Technology, University of Pécs, Hungary* ¹⁰*Ministry of Construction and Transport, Hungary*

Wind velocity measurement in a landfill site

Emőke IMRE^{1,2}, Miklós Juhász⁵, Diego³, Lachlan BATES⁴, Stephen FITYUS²

¹*Bánki Donát Faculty, Óbuda University, Budapest, Hungary*

²*Hydro-Bio-Mechanical Systems Research Center, Óbuda University*

⁵*Studio Prof. Marchetti Italy*

³*University of Newcastle, Newcastle, Australia*

⁴*Debrecen University, Hungary*

Soil profiling from short dissipation CPT data

Emőke IMRE^{1,2}, Tibor FIRGI^{2,3}, Delphin KABEY^{2,4}, Ágnes BÁLINT^{2,5}, László RADI⁹, Daniel ARRETO⁷

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⁶*Faculty of Engineering and Information Technology, University of Pécs, Hungary*

⁷*Edinburgh Napier University, United Kingdom*

A parameter identification in relation to the water retention curve and the grading curve of sands



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Farida KEHAL^{1,2}, Loucif CHEMACHE², Esra CAPANOGLU³, Malika BARKAT¹

¹Laboratoire de recherche Biotechnologie et Qualité des Aliments (BIOQUAL), Institut de la Nutrition, de l'Alimentation et des Technologies Agro-Alimentaires (INATAA), Université Frères Mentouri Constantine 1, Route de Ain-El-Bey 25000, Constantine, Algérie

²Laboratoire de Nutrition et Technologie Alimentaire (LNTA), Institut de la Nutrition, de l'Alimentation et des Technologies Agro-Alimentaires (INATAA), Université Frères Mentouri Constantine 1, Route de Ain-El-Bey 25000, Constantine, Algérie. . ³Department of Food Engineering, Faculty of Chemical and Metallurgical Engineering, Istanbul Technical University, 34469 Maslak, Istanbul, Turkey.

Effect of solar drying on phenolic profile and antioxidant activity of figs (*Ficus carica*) azanjar variety

Tünde TAKÁCS, Péter JUHÁSZ, Sándor PABAR, Katica KOCSIS, Anna FÜZY

Institute for Soil Sciences, Centre for Agricultural Research, ELKH, Budapest, Hungary

Impact of soil tillage and fertilization on arbuscular mycorrhizal fungi produced glomalin

Sihem Hedjal¹, Abdelwaheb Benamara²

¹MAB, Department of Geological Sciences. Mentouri Brothers University. Constantine1,

²Water Science Research Laboratory National Polytechnic School of Algiers

Water suitability for irrigation in the Guerbes-Sanhadja wetlands complex

Dóra KÓHALMI¹, Hosam E.A.F. BAYOUMI HAMUDA¹, Tünde TAKÁCS²

¹Óbuda University, Rejtő Sándor Faculty of Light industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary

²Institute for Soil Sciences, Centre for Agricultural Research, ELKH, Budapest, Hungary

Investigation of relationship between soil glomalin-content and land use



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Lida Alikhani

University of Tabriz, Iran

Modelling technical efficiency and production risk (case study: cold water fish farms in the Kurdistan of Iran)

Abdelali EL MAALLEM¹, Sara El HAMJI^{2,3}, Said GHARBY⁴, Khalid MAJOURHAT¹, Faissal AZIZ^{2,3} Karim SBIHI²

¹Laboratory of Geo-Bio-Environmental Engineering and Innovation Faculty Polydisciplinary of Taroudant, University Ibn Zohr, Taroudant, Morocco

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⁵Laboratory of Analysis, Modelling, Engineering, Natural Substances and Environment, Natural Substances, Health and Environment Team, Polydisciplinaire Faculty of Taroudant, University Ibn Zohr, Morocco

Identifications, growths, biochemical characterizations and antioxidant activities of three benthic diatoms for applications as food supplement

Rim Tinhinen MAOUGAL, Malika BARKAT, Meriem BENAMARA, Nouha BOULMAIZE, Raouya MERAGHNI

BIOQUAL, INATAA, freres MENTOURI University Constantine 1, 25000 Ain El Bey, Constantine, Algeria

Physico-Chemical and microbiological characterization of 4 olive pomace

Malika BARKAT, Rym Tinhinen MAOUGAL, Souad CHERRAK, Meriem BENAMARA

Biotechnology and Food Quality Laboratory (BIOQUAL), Institute of Nutrition, Food and Agro-Food Technologies (INATAA), Frères Mentouri Constantine 1 University, 7 km, 25000 Route de Sétif. Constantine, Algeria

Evaluation of compounds extracted from olive pomace generated by the traditional process with a view to their valorization



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Abdelkader BOUDERBALA

PRAVDURN research laboratory. Department of Earth Sciences, Djilali Bounaama University of Khemis Miliana, Algeria

Impact of agricultural activities on groundwater quality in coastal aquifer of Nador in Tipaza, Algeria

Fatima ZOHRA MAKHLOUF^{1,2}, Malika BARKAT¹, Antonella PASQUALONE³, Giacomo SQUEO³, Francesco CAPONIO³

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³Department of Soil, Plant and Food Sciences, Food Science and Technology Unit, University of Bari Aldo Moro, Via Amendola, 165/A, 70126 Bari, Italy

Valorization of underexploited bioresource to produce a functional biscuit: acorn flour

Zoltán NAÁR

Tokaj-Hegyalja University, Sárospatak, Hungary,

Changes in the colony morphology of filamentous fungi caused by heavy metals *in vitro*

Meriem BENAMARA-BELLAGHA, Rym MAOUGAL, Ines SALHI, Maroua ZERIBA, Malika BARKAT

Laboratory of Biotechnology and Food Quality (BIOQUAL), INATAA, University of Constantine, 25000 Constantine, Algeria

Encapsulation of natural pigments from beet root peel (*Beta vulgaris*)

Sunaeda ALJGAMI, Rami WATFA, Tharwat IBRAHIM

Damascus university, Damascus, Syria

Effect of interaction between internal Arbuscular Mycorrhizal Fungi and soil media on some characteristics of *Stevia rebaudiana* sugar plant, and the chlorophyll content of its leaves



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Sunaeda ALJGAMI, Rami WATFA, Tharwat IBRAHIM

Damascus university, Damascus, Syria

Effect of mycorrhiza and different soil media (pumice and peat moss) on some growth parameters of *Stevia rebaudiana* (bert.) bertonii

Issam BOUDRAA^{1,2}, Hassan A YADI^{2,3}, Badreddine BOUDIAF³, Sabrina HALLADJA³

¹*Laboratoire de Technologie des Matériaux Avancés, Ecole Nationale Polytechnique de Constantine, Algérie.*

²*Unité de Recherche de Chimie de l'Environnement Moléculaire Structurale, Université Frères Mentouri - Constantine 1, Algérie.*

³*Département de chimie, Université 20 août 1955 Skikda, Algérie.*

Synthesis, characterization, and properties of ZnO-Go/NiO.5 MnO.5Fe₂O₄ for application in dye removal

Elhem BOUCHIBA^{1,2}, Ali ELLAFI^{1,3}, Sonia BEN YOUNES^{1,4}, Mohamed Ali BORGJ^{1,2}

¹*Faculty of Sciences of Gafsa, Department of Life Sciences - University campus of Ahmed Zarroug, 2112, University of Gafsa, Gafsa, Tunisia.*

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³*Laboratory of Analysis, treatment and valorisation of environment pollutants and products, Faculty of Pharmacy, Monastir University, Tunisia.*

⁴*Unit Research n°17/ES/13, Faculty of Medicine of Tunis, 15 rue Jebbel Lakhdar, University of Tunis El Manar, Tunisia.*

Isolation and preliminary identification of extremophile bacterial isolate from effluents of phosphate fertilizers industry in Southern Tunisian

Kenza IRINISLIMANE

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

Storage of highly flammable and toxic products



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Malika BARKAT, Louiza HIMED, Lamia ZOUBIRI, Fatima Zohra MAKHLOUF, Imen LAIB, Farida KEHAL

Biotechnology and Food Quality Laboratory (BIOQUAL), Institute of Nutrition, Food and Agro-Food Technologies (INATAA), Frères Mentouri Constantine 1 University, 7 km, 25000 Route de Sétif, Constantine, Algeria.

Effect of variety and cooking on crude fiber, total polyphenols, and free radical scavenging activity of eggplant

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

Relationship between soil microbial biomass and application of fungicides in agricultural land

Karim SBIHI^{1,2}, Abdelali EL MAALLEM³, Sara El HAMJI^{2,4} Siham LGHOUL⁵, Faissal AZIZ²

¹Laboratory Analysis, Modelling, Engineering, Natural Substances and Environment, Biotechnology, Analytical Sciences and Quality Control Team, Polydisciplinary Faculty of Taroudant, University Ibn Zohr, Agadir, Morocco

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³Laboratory of Geo-Bio-Environmental Engineering and Innovation Faculty Polydisciplinary of Taroudant, University Ibn Zohr, Taroudant, Morocco

⁴Laboratory of Water, Biodiversity & Climate Changes, Semlalia Faculty of Sciences, B Marrakech, Morocco, ⁵Laboratory of Pharmacology, Neurobiology, Anthropobiology and Environment, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakesh, Morocco.

Bibliometric analysis of microalgae biosorption of chromium using web of science database



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Siham LGHOUL¹, Karim SBIHI^{2,3}, Abdelhafid BENKSIM⁴, Mohamed LOUKID¹, Faissal AZIZ^{3,5}

¹Laboratory of Pharmacology, Neurobiology, Anthropobiology and Environment, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakesh, Morocco.

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⁴High Institute of Nursing and Technical Health, Marrakesh, Morocco.

⁵Laboratory of Water, Biodiversity & Climate Changes, Semlalia Faculty of Sciences, B.P. 2390, 40000, Marrakech, Morocco

Premenstrual syndrome, seasonal and other associated factors (female adolescents)

Csaba CENTERI, Viktória VONA, Márton VONA, Zsolt BIRÓ

Institute for Wildlife Management and Nature Conservation, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary

Effects of common mole (*Talpa europaea*) on the diversity of soil properties in urban landscapes

Attila FŰRÉSZ¹, Szilárd SZENTES², Zsombor WAGENHOFFER², László SIPOS^{3,4}, Levente VISZLÓ⁵, Ildikó TURCSÁNYI-JÁRDI¹, Eszter SALÁTA-FALUSI¹, Péter PENKSZA³, Márta BAJNOK², Gabriella FINTHA^{1,6}, Károly PENKSZA¹

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³Hungarian University of Agriculture and Life Science, Institute of Food Science and Technology, Budapest, Hungary

⁴Institute of Economics, Centre of Economic and Regional Studies, Budapest, Hungary

⁵Pro Vértes Nature Conservation Foundation, Csákvár, Hungary

⁶Eszterházy Károly University, MTA-EKE Lendület Environmental Microbiome Research Group, Eger, Hungary

Grazing by domestic water buffaloes (*Bubalus bubalis*) as a habitat management and control option against the invasive *Solidago gigantea*



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Zsófia Kiss¹, Dávid Pilling², Hosam E.A.F. BAYOUMI HAMUDA¹

*¹Óbuda University, Rejtő Sándor Faculty of Light industry and Environmental Engineering,
Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary,*

²Richter Gedeon NyRt, Budapest, Hungary.

The future of solvent regeneration at Richter Gedeon NyRt's Dorog site



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5th of May 2023 (Friday)

09:00 – 09:50

Plenary Session

Chair of the Session:

Hosam BAYOUMI HAMUDA

Pl6: 09:00 – 09:25

**Bhanu Singh PANWAR¹, Vikas AHLAWAT², Olha KHLIESTOVA^{3,4},
Katarzyna Ewa BUCZKOWSKA^{3,5}, Iryna GUMENIUK⁶**

¹Department of Soil Sciences, CCS Haryana Agricultural University, Hisar

²Agriculture Manager, Haryana Co-operative Bank, Hisar, Haryana, India

³Department of Material Science, Faculty of Mechanical Engineering, Technical University of Liberec, Liberec, Czech Republic.

⁴Department of Primary Science Institute of Modern Technologies, Pryazovskyi State Technical University, Dnipro, Ukraine.

⁵Department of Materials Technology and Production Systems, Faculty of Mechanical Engineering, Lodz University of Technology, Poland.

⁶Department of Agroecology and Biosafety, Institute of Agroecology and Environmental Management of NAAS, Kyiv, Ukraine.

Nickel: Beneficial or toxic element in soil-plants

Pl7 09:25 – 09:50

**Borbála BIRÓ¹, Zsolt KOTROCZÓ¹, Tamás KOCSIS², Hosam E.A.F.
BAYOUMI HAMUDA³**

¹Hungarian University of Agriculture and Life Sciences, Department of Agri-environmental Studies,

²Hungarian University of Agriculture and Life, Department of Microbiology and Biotechnology, MATE, Budapest

³Óbuda University, Rejtő Sándor Faculty of Light industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences, Budapest, Hungary

Soil-Health parameters and potential risk of food-safety important microbes at sewage sludge applied soils in a model experiment



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10:00 – 11:30

Technical Session (A, B, & C)

Chair of the Session:

Hosam BAYOUMI HAMUDA

Keynote:

1. 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*

Microbial indicators for soil quality under salt stress

2. Faissal AZIZ^{1,2*}

*¹Laboratory of Water, Biodiversity, and Climate Change, Faculty of Sciences Semlalia, Cadi
Ayyad University, Marrakech, Morocco.*

*²National Center for Research and Studies on Water and Energy (CNEREE), Cadi Ayyad
University, Marrakech, Morocco.*

Biobased fertilizers for a smart and sustained agriculture

3. 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*

**Assessing the impacts of climate change on the economic growth,
availability of fossil fuels and opportunities for achieving
environmental sustainability in the worldwide countries**

Following the posters and lectures as well as the open discussion



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11:30 – 13:15 **Continuing the**
Technical Session (A, B, C, D, E & F)

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

Khalid AZIZ¹, Mounir EL ACHABY², Rachid MAMOUNI¹, Nabil SAFFAJ¹, Faissal AZIZ^{3,4}

¹Laboratory of Biotechnology, Materials and Environment, Faculty of Sciences, Ibn Zohr University, Agadir, Morocco.

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⁴National Centre for Research and Study on Water and Energy (CNEREE), University Cadi Ayyad, Marrakech, Morocco.

A New micro-composite-based copper-doped Mollusca shells@Alginate beads for highly pesticide sorption from wastewater

Imane HAYDARI^{1,2}, Khalid AZIZ³, Naaila OUZZANI^{1,2}, Laila MANDI^{1,2}, Faissal AZIZ^{1,2}

¹Laboratory of Water, Biodiversity, and Climate Change, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakech, Morocco.

²National Center for Research and Studies on Water and Energy (CNEREE), Cadi Ayyad University, Marrakech, Morocco.

³Laboratory of Materials and Environment, Faculty of Sciences, Ibn Zohr University, Agadir, Morocco.

New green synthesis of reduced graphene oxide and their use for column adsorption of phenol from olive mill wastewater



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Ghizlane AKHOUY^{1,2}, Salima ATLAS³, Majdouline BELAQZIZ¹, Yasin AKGUL⁴, Mehmet DURMUS Calisir⁵, Faissal AZIZ^{1,2}

¹Laboratory of Water, Biodiversity, and Climate Change, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakech, Morocco

²National Center for Research and Studies on Water and Energy (CNEREE), Cadi Ayyad University, Marrakech, Morocco.

³Polydisciplinary Faculty, Sultan Moulay Slimane University, Beni-Mellal, Morocco

⁴Karabuk University Iron and Steel Institute, KARABÜK, Turkey

⁵Istanbul Technical University, Istanbul, Turkey

Transforming waste into value: developing active packaging materials from olive pomace biopolymers

***Closing the Symposium with workshop:* THE FUTURE OF OUR BIOSPHERE**

13:15

Closing the Symposium



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Acknowledgement

We, the editor, would like to thank the members of the organizing, scientific, and administrative committees and all the supporting staff for giving this opportunity. We would also like to extend our sincere thanks to all the contributors and reviewers who have made this Proceedings Book possible. We hope that the papers in this Proceedings Book will inspire further research and innovation in this important field.

Sincerely,

Prof. Dr. Hosam E.A.F. Bayoumi Hamuda
President of ICEEE
Chair, VIIth International Symposium-2023
Editor, Proceedings Book



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ABSTRACTS



VII International Symposium-
2023

Plenary Session



DECARBONISATION OF THE INDUSTRIAL PROCESSES

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Abstract:

Green industrial revolution is the focal point of the nations in the globe at present. The nations have been trying to reduce the global extraction rates of natural resources, climate actions and decarbonisation in all the industrial processes. Researchers, policy makers, NGOs, and governments led by the United Nations have been holding the meetings like conference of the parties (COP), about the climate change and how countries are planning to tackle it who signed the United Nations Framework Convention on Climate Change (UNFCCC) - a treaty agreed in 1994. Green movement for economic success and environmental responsibility go hand in hand. Environmental calamities, e.g., climate change, extreme weather, loss of biodiversity, extracted ocean and eroded soil - stem from the collision of two systems: Earth's natural system and humankind's economic system. In the global perspective, presently we have entered the Anthropocene era, where humans have become the single most influential species on the planet, causing significant global warming and other changes to land, environment, water, organisms, and the atmosphere. All these pushes to a critical juncture of humanity. Scientists have alerted that the current economic model has been pushing the carrying capacity of Earth's systems to their limits, and that unless the course is changed, the global community will be thrown into unprecedented uncertainty. Tackling the climate requires total systems transformation, from the energy sector to food, cities and production, and consumption. The way our societies and businesses are organized, massive changes are essential to have a transition to sustainable development. Most of the industrial processes progressed based on the extract-produce-consume-dispose-deplete (epcd2), the linear economy concept that will lead the processes decarbonised. We must act to decarbonise the processes which will definitely help reducing carbon footprints. We must change and act now immediately and generate awareness among the researchers and policy makers.

Keywords: Decarbonisation, Circular Economy, Industries, Eepcd2, carbon footprints.

Biography



Prof. Sadhan Kumar Ghosh, Director General, Sustainable Development and Circular Economy Research Centre, of the International Society of Waste Management, Air and Water (ISWMAW), India. He is the Founder & the President, ISWMAW & IPLA Global Secretariat, chairman and editor in chief, IconSWM-CE, project leader, Global status of implementation of circular economy. He serves as the Editor-in-chief, Journal of Solid Waste Technology and Management, and Associate Editor, International Journal of Materials Cycles and Waste Management. He was the Professor & Former Head, Mechanical Engineering Dept., and the Dean of Faculty of Engg & Technology, Jadavpur University, India. He has collaboration with more than 45 countries.



CONTROL OF ROOT-KNOT NEMATODES USING PLANT EXTRACTS

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Abstract:

The mortality of the juveniles of root knot nematodes found to increase with the increased with exposure time. The nematicidal substances found in the seeds more than in leaves. Thus, we can conclude that flora extracts and/or powders can control plant parasitic nematodes. This result can serve many purposes like e.g. Manage plant parasitic nematodes and decrease the population inoculum in the soil, especially if the method is repeated many times in addition some of them can add some fertility to be absorbed by the plant. Saving the ecosystem from applying toxic nematicides like e.g. Temik, Furadan and other fumigants and conserve the Ozone layer”. This is a very cheap easy methods and practical for small farmers especially for fresh eaten vegetables. This beside we can use conserve the natural flora found in the roadside and ignored by researcher. Many of these extracts can be further studied and the nematicidal substance (s) can be utilized for industry of commercial bionematicides for global use.

Keywords: not more 6 words: Herbal extracts, Root-knot nematodes- Vegetables -Biocontrol

Biography



Gamal A. Elbadri graduated in crop protection from the Gezira university in 1984. I joined the Agricultural Research Corporation (ARC), (In the field of plant pathology) in 1986 after 2 years' experience in the Rahad Agricultural Scheme as a field inspector. Then I received the first master's in technology of crop protection in 1991 from New Castle Upon Tyne, UK; and my second master's in biology 1997 from Gent University (Belgium). PhD in Biology (Nematology) in 2000 from Gent University. I came to Sudan, to work as research scientist in Plant pathology section then headed the section from 2006-20010. During 2006-2007, I did my post-doctoral fellowship in Biology from S. Korea in Gyeongsang National University. In 2010-2012, I was appointed as a director of Gezira Research Station (GRS). In 2012 (End of the year I was appointed as a director of Crop Protection Research Center at the ARC until 2014. Currently, working as a Professor of Biology at Bisha University, Faculty of Science teaching invertebrates' biology courses, parasitology, histology, genetics, human physiology, chordata, ...etc. My research is focused on the Plant parasitic nematodes on Banana and vegetables (Biology and control, including taxonomy). During my stay in the ARC, I attended four workshops on Research management from PICO team (In Kenya, Sudan). I contributed in many national and international conferences and workshops having more than 60 contributions. As well having published 45 papers in International and National, scientific Journals Currently having six PhD students from different universities in Sudan. AS major supervisor. I worked for university of Bisha as full Professor of Biology for 9 years. Contact: gamal.elbadri@gmail.com, Mobile: 00966532410975

WATER RESOURCES, CLIMATE CHANGE AND WATER STRESS IN THE WORLD: REALITIES, ISSUES, CONFLICTS; STRATEGIES; POLICIES CHALLENGES AND PROSPECTS

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Abstract:

Water is an essential and irreplaceable resource. So far, none of the current technologies allows water production and nothing can be a substitute for it. It must therefore be protected by strict regulations and considered as a very precious commodity because it is increasingly rare. Water, an increasingly scarce natural resource, is part of the national and human heritage. The preservation, enrichment, and development of accessible resources within the framework of natural balances are the main axes of national and international action. We must respect this value and consider water as an economic and social treasure of which the access is a common right for every individual. It is true that the right to water is an absolute prerogative, but our duty is not to pollute it, or waste it. This is why several international organizations such as the UN, the World Water Council, the African Union, UNESCO, FAO, WHO, etc. are carrying out in-depth reflection on policies for sustainable resources management and on the rules of its governance towards sustainability. It is now widely accepted that the establishment of sustainable development requires equating social, economic, and environmental concerns, considering the essential and limiting factor that is water. Water has become a major issue and only those nations that have managed to preserve their water potentialities will be able to survive. African countries mostly considered water-deficient will increasingly face water scarcity, as the demand from agriculture, industry and populations is significant and growing. In this context, water has socio-economic, environmental, and geopolitical significance. Technical and economic solutions imply, in fact, solidarity between regions and states. The COP21 held in December 2015 in Paris-France; and the various COPs that followed showed that climate change is an additional constraint on water since the problems raised (floods, droughts, increase in sea level, temperature, etc.) and all the debates on climate change are in fact about water and its cycle. Water is a common heritage of humankind. Individual and collective health depends on it; agriculture, industry and domestic life are linked to it. There is no access to prosperity without access to water. Every member of the human community has the right to water especially drinking water, with decent quality and quantity for life and economic activity. Water is therefore essential for humanity and for life in general. It has always played an important role in the history of humankind and its civilization. As source of life, it is also a source of conflict in many regions around the world. The sustainable management of water must primarily consider security issues and for this a certain number of agreements and conventions are essential. In this conference, realities and challenges will be developed; strategies, challenges, and prospects in Africa and worldwide, but also recommendations for sustainable development in Africa by 2030/2050 concerning:

- *The current state of water resources, the future issues and challenges.*
- *The various evaluation indicators, noting their usefulness and their limitations.*
- *Climate change, floods; drought.*
- *Major water transfers: a necessity?*

- *Management policy: institution, regulation, legislation*
- *The right to water and sanitation: myth or reality?*
- *Scientific research, training, capacity building*
- *Wastewater treatment and its reuse*
- *The consumption model: awareness, water pricing ...*
- *Integrated water resources management and good governance: attempts!*
- *Transboundary water management and possible conflicts.*

Keywords: Water, World, right to water, sustainable development, organization, strategies, issues, Conflicts

Biography



Laureate of the third edition of Scopus Awards Algeria 2013 (Environmental Science)

INTERNATIONAL CONSULTANT/EXPERT

Research professor at the National Polytechnic School of Algiers (Ecole Nationale Polytechnique (E.N.P) d'Alger)

International lecturer: water, strategies; hydro-politics, hydro-diplomacy.

Member of the African Water Association (AFE)

Member of the French Water Academy

Member of the Mediterranean Water Institute (IME)

Member of the International Union of Engineers and Scientists using the French language-UISF

Founding member of the Arab Water Council

Member of the French Water Partnership (PFE)

Coordinator of a Mediterranean Water Action Group

Member of scientific committees of several renowned international journals.

Planner of several international seminars and symposiums Honorary Editor- in-chief of the journal ALJEST: www.aljest.webs.com Associate editor of the journal LJEE: www.ensh.dz

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PARTICIPATORY MANAGEMENT: A GUARANTEE OF WATER SAVING IN A CONTEXT OF ACUTE CLIMATE CHANGE

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Abstract:

The aquifer contract is a design allowing controlled water management. This management involves the participation of all water users. The elaboration of a water table contract goes in the direction of improving the efficiency of the use of water resources to guarantee the quantity, quality and sustainability of groundwater resources, according to the evolution (climatic; industrial; demographic and agricultural). Therefore, the purpose of the implementation of the contract is to guarantee sustainable environmental and socio-economic development, it is a question of:

- Rebalancing the balance of the water table and restoring the flow rates of the springs; lakes; securing the water drinking.

- Protect and preserve ecological systems and ensure the development of tourism sectors; industrial, economic, environmental, and particularly that of agriculture knowing that it is the sector that consumes a large quantity of water resources.

The establishment of a water table contract requires the involvement of citizens who will benefit from this management method. The area targeted by our project is that of Drean, located 25 kilometers south of Annaba and conceals in its basement a significant water table known as the "gravel tablecloth", it is free to the south and therefore susceptible to be polluted and is captive in the north and therefore protected. It has the particularity of being overexploited. The establishment of the aquifer contract is an opportunity to identify the users and especially the quantities taken by each of them and this within a legal framework. The committees involving all the parties will ensure the smooth running of the operations, which will firstly result in perfect knowledge of the water inflows and outflows, and therefore knowledge of the groundwater balance. In the second part, we must make users pay the appropriate sums (according to the quantities used), which will limit waste. Concise and factual. It should briefly state the purpose of the research, the principal results, and major conclusions.

Keywords: *Algeria, management, Water, protect, Drean, committee.*

Biography



Born on July 1, 1957, in Tebessa (Algeria), I did my primary, secondary and higher education in Annaba. In June 1983 I got my degree in hydrogeological engineering from Badji Mokhtar Annaba University.

After this first degree, I received a scholarship from the Algerian government to continue my postgraduate studies abroad. I landed at the Structural and Applied Geology laboratory of the University of Franche Comté. It was under the direction of Professor Jacky Mania that I completed my doctoral thesis, defended on June 9, 1987.

Back home I was recruited at the University of Annaba as an assistant professor. From 1988 and always under the direction of Pr Jacky Mania, I registered for the realization of a doctorate of state on hydrochemistry, these years of research were punctuated by the defense of my thesis on March 06, 1996. In parallel with the work of the thesis, I continued to teach, and I supervised more than 100 engineering dissertations. This framework was a support for my thesis.

*Before the defense of my doctorate, I took part in numerous seminars and two publications were produced, which enabled me to apply for and obtain the grade of lecturer in 1997. This grade enabled me to open a magister training for my former students (the majority have risen through the ranks and are currently Professors). I have supported at least 15 Magister. In 2002, following the meeting of the National University Commission (CUN), I was admitted to the rank of Professor based on my scientific work (4 publications). In addition, I supported 10 doctorates, I participated in several national (15) and international (10) projects. I held the position of Faculty Dean twice and President of the Scientific Council. Currently I count more than 60 international publications and more than 20 national ones. **I continue to publish and frame***



ANALYSIS OF INORGANIC NITROGEN FORMS AND HEAVY METAL CONCENTRATIONS IN THE RÁKOS STREAM NEAR THE WASTEWATER TREATMENT PLANT IN PÉCEL

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Abstract:

It is important to carry out studies in the environment of our natural waters. In this case, we are carrying out monitoring studies in and along the Rákos stream to determine whether these areas are contaminated. Pécel, measurements were carried out in the Rákos stream and its surroundings, near the local wastewater treatment plant. The analyses covered the measurement of heavy metals (Zn, Cd, Ni, Pb, Fe, Mn, Cr, Al, Cu) in the Rákos stream - in its water, sediment, and the soil of its channel wall - and inorganic nitrogen forms (nitrite-N, nitrate-N and ammonium-N) in the stream water. Three sampling events were carried out: soil, sediment, and water sampling. Laboratory measurements were taken after each sampling. The values of heavy metal concentrations measured in soils and sediments were compared with the B contamination limit values set in the joint Decree 6/2009 (IV. 14.) of the Ministry of Agriculture, Forestry, Environment and Water Management, which showed that only the amount of Cd exceeded the contamination limit value. According to the MSZ 12749: 1993 for surface water, the water of the Rákos stream is classified as largely or heavily contaminated for the measured heavy metals, which indicates that further measures, such as phytoremediation, are necessary. In the light of the measurement results, further investigations would be needed to determine why cadmium levels are higher in soil and sediment, and where the high levels of heavy metals in the Rákos stream are coming from. The higher ammonium-N and nitrate-N concentrations measured in the Crayfish Creek would also require intervention. For agricultural irrigation purposes, the Rákos stream could be suitable based on its ammonium-N and nitrate-N concentrations but would not be recommended based on its high heavy metal content.

Keywords: ammonium-N, heavy metals, nitrate-N, monitoring, stream

Biography



Dr. Ágnes Dr. habil. Mészáros-Bálint (Ágnes Bálint is the author's name) had her **Highest educational degree:** MSc, Chemistry and Physics, ELTE, Budapest, Hungary. **Scientific degree:** PhD; habilitation, in the field: Environmental Sciences, SZIE, Gödöllő, Hungary

Institution: Obuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences and HBM

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Specialties: 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



NICKEL: BENEFICIAL OR TOXIC ELEMENT IN SOIL-PLANTS

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⁵Department of Materials Technology and Production Systems, Faculty of Mechanical Engineering, Lodz University of Technology, Poland.

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Abstract:

The sustainability of a healthy agricultural ecosystem is a prerequisite for protecting the food chain from bioaccumulation of hazardous substances e.g., heavy metals. Among the pollutant elements, Nickel is of great environmental concern as it is hazardous and highly carcinogenic in excesses intake by plants from polluted soils. A screen house study was carried out to evaluate the effect of a chelating agent, FYM, vermicompost, and microbial inoculants (*Azotobacter* and *Pseudomonas*, Bio-mix) on the phytoremediation capability of Indian mustard from Ni enriched sandy loam soil. A greenhouse experiment was conducted using two cultivars of Brassica species on both natural and artificially contaminated soils containing Ni. Both natural and amended soils were treated with disodium salt of EDTA and found that application of 2 EDTA created conditions that favored the transformation of Cd and Ni less soluble form to more plant-available forms in both natural and metal amended soils. The results revealed that FYM and vermicompost led to higher biomass production as compared to unamended soil. The EDTA led to a decrease in biomass as compared to FYM and vermicompost. The Ni concentration increased significantly in *Brassica juncea* with the application of EDTA. The application of FYM and vermicompost increased the concentration of Ni. The highest concentration of Ni was recorded in EDTA treatment. The concentration of Ni was higher in root as compared to shoot. Among all the treatment combinations, vermicompost with bioinoculants treatment combination led to higher uptake of Ni. The EDTA and FYM also increased uptake of Ni but it was very less as compared to vermicompost. The results suggested that vermicompost combined with bioinoculants is best for increasing the uptake of Nickel. The EDTA and FYM as implications were helpful in the phytoremediation of Ni metal from polluted soils. However, there is a strong need for further investigation in this aspect, with hyperaccumulator genomics.

Keywords: *Brassica juncea*, EDTA, FYM, Nickel, microbial inoculants, vermicompost

Biography

Professor Dr. B.S. Panwar

- *Ph.D. (Soil Science), specialized in “Soil and Environmental Sciences” from CCS, Haryana Agricultural University, Hisar (India) in 1994.*
- *M.Sc. (Soil Science & Agricultural Chemistry), specialized in “Dynamics of major nutrient in soil-plant systems” from Agricultural University, Udaipur in 1979.*
- *International Intensive Tempus Course: “Soil, water and Environment: Soil pollution” at Agricultural University of Debrecen, Debrecen, Hungary, in 1997.*
- *Position held:*
- *Professor, Senior Soil Scientist – Environmental research on toxic heavy metals in soil/plant system*
- *Professional Societies:*
- *Active member of Indian Society of Soil Science.*
- *Member in Editorial Advisory Board of International Journal ‘GREEN FARMING’.*
- *Total Research Experience:*
- *35 years on Environmental sciences specialized in fate of toxic metals in soil-plant-water ecosystems.*

Research Areas:

- *The fate of toxic metals in soil-plant eco system.*
- *Speciation, availability, and mobility.*
- *The impact of organic bi-product, compost, sewer, sludge, FYM application to polluted, waste land soils.*
- *Characterization of soil pollution, developing risk assessment methodology and phytoremediation technologies.*
- *Projects*
- *Interactive study of major plant nutrients, fertility status, saline & alkaline soils reclamations – 1980-1985.*
- *Impact of applied high doses of Agro-chemicals, pesticides and fertilization on soil-plant-water ecosystem, toxic metals in canal/underground, sewer water and industrial effluent applied vegetable growing areas in vicinity of cities and agricultural soil – 1986-1990.*
- *Detoxification/mobility of toxic heavy metal (cadmium) in legume crop species affected by farmyard manure and phosphorus application in soils – 1991-1994.*
- *Land use planning – Land capability classification, detail soil survey of desert / waste / polluted soils – 1995-2003!*
- *Natural Resource Management for Sustainable Agriculture- 2004-2008.*
- *Site Specific Nutrients Management-2009*
- *Soil Test Crop Responses-2008-2015*
- *Soil Environment Consultant: Free lancer*

International and Collaborative Scientific Research Projects:

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

Institutes: RISSAC-HAS, Budapest, Hungary CCS HAU, Hisar – India

Nodal Financial agencies: INSA, New Delhi and HAS, Budapest

Period: 1997-2002 (Five Years)

Project Co-ordinator:

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

II. Phytoremediation of potentially toxic heavy metals contaminated soils by agricultural crop genotypes.

Nodal Financial agencies: DST, New Delhi, and MOE- HAS, Budapest

Period: 2006-08 (Two Years)

Project Co-ordinator:

- *(Hungarian) Dr. Marton Laszlo, (Senior Scientist, RISSAC-Budapest)*
- *(Indian) Dr. B.S. Panwar (Senior Soil Scientist, CCS HAU, Hisar)*



Doc. Dr. Olha Khlietova

Researcher at the Technical University in Liberec, Faculty of Mechanical Engineering, Department of Material science and Cand. of Eng. Sciences, Associate Professor, Head of the Department of Labor protection and environment State Higher Educational Institution "Priazovskyi State Technical University", Dnipro, Ukraine. She received his PhD in improving the efficiency of transport and technological scheme blast furnace at the Dnepropetrovsk National University of Railway Transport named after Academician V. Lazaryan in Dnipro, Ukraine. Her research interests were mainly: Resource-saving technoeology and environment protection against hazardous discharges, energy resource management, alternative energy sources. Personal Summary: 2022 – 2025 Technical University in Liberec, Faculty of Mechanical Engineering, Department of Materials, researcher in the project: Development of geopolymer composites as a material for protection of hazardous wrecks and other critical underwater structures against corrosion (MarWreck), mERA.NET (call 2021).; - 2022 – 2023 State Higher Educational Institution «Priazovskyi State technical University», Mariupol, Ukraine, Department of Labor protection and environment, Principal investigator in the project: Research of methanogenesis of aquatic plant biomass in order to obtain an alternative source of energy-fuel biogas in a three-stage bioreactor, call of the Joint Ukrainian-Lithuanian R&D projects Project Financing Agreement no.S-LU-22-2. The project is being implemented in accordance with the Lithuanian Ministry of Education and Science of the Republic of Ukraine Ministry of Education and Science Cooperation Science and Program 2022-2023 in technology: - 2018-2021 (CRENG,). Member of the Erasmus+ project: Crisis and Risks Engineering for Transport Services (CRENG, 2018-2021);- 2019-2020 jury of the competition of social projects "City - OUR HANDS" 2019; - 2019 – 2020 Executor of the project Interactive Laboratory "Bioresources of the Sea of Azov"; - 2015-2020 Chairman of the jury of the city and regional stages of the Competition of Minor Academy of Science of Ukraine; -2015-2017 The Guarantor of new specialty 183- "Environmental Protection Technologies"; Educational research and academic experience -23 years; -2017-2021 Member of working group and implementer of the innovations at the innovative educational projects: "Preparation of high-skilled specialists on the order of enterprises PJSC "AZOVSTAL IRON & STEEL WORKS"; "Preparation of high-skilled specialists on the order of enterprises PJSC "Ilyich Iron and Steel Works"; "School-University-Enterprises"; "Solution approaches of the ecological problems at the metallurgy of ferrous metals" Extra education: May 2020 International postgraduate practical internship "New and innovative teaching methods". University of Economics in Krakow, Poland Certificate NR 2315 /MSAP/2020, June 2018 National Academy of Pedagogical Sciences of Ukraine. SHEI "University of Education Management" Central Institute of Postgraduate Pedagogical Education. SP35830447 / 1544-18 dated June 30, 2018. Advanced training in the category "Heads (heads) of departments of universities, academies, institutes" June 2012-May 2012 Vilnius Gediminas Technical University (VGTU), Department of Environmental Protection, Lithuania. International project TEMPUS PROMENG training courses (lecture and seminar) regarding the delivery of Master degree courses in the area of Environmental Engineering. Certificate. <http://promeng.eu/index.php/project-meetings/92-training-course-and-coordination-meeting-in-vgtu>

**Ing. Katarzyna Buczkowska Ph.D.**

Researcher at the Technical University of Liberec at the Faculty of Mechanical Engineering and the Lodz University of Technology at the Faculty of Mechanical Engineering. She completed doctoral studies at the Faculty of Mechanical Engineering of the Lodz University of Technology in the field of Materials Science. Currently, she is the head of the geopolymer composites laboratory at the Technical University of Liberec. Her research interests include: innovation management, environmental aspects and material engineering - composite materials, in particular geopolymer composites reinforced with short fibers and 3D printing for geopolymers and foundry technologies. She has experience in



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



SOIL-HEALTH PARAMETERS AND POTENTIAL RISK OF FOOD-SAFETY IMPORTANT MICROBES AT SEWAGE SLUDGE APPLIED SOILS IN A MODEL EXPERIMENT

Borbála BIRÓ¹, Zsolt KOTROCZÓ¹, Tamás KOCSIS², Hosam E.A.F. BAYOUMI HAMUDA³

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²Hungarian University of Agriculture and Life Sciences, Department of Microbiology and Biotechnology, Budapest, Hungary

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Abstract:

Communal and/or the industrial sewage might have a potential risk in the environment. Sewage sludge forms are frequently applied in soil, and there is a potential risk, therefore regarding the food quality and safety micro-organisms. Very little is known, how the soils of different physical chemical characteristics might be responded to those potential effects? The impact of long-term sewage sludge application was studied in 4 Hungarian representative soil types in a microcosm model experiment. Municipal sludge with extremely high Zn-content ($6157 \text{ mg.kg}^{-1} \text{ d.w.}$) and an industrial sludge with extreme Cr-content ($5226 \text{ mg.kg}^{-1} \text{ d.w.}$) were used as increasing doses (0, 2.5, 5.0, 10 and 20 g.kg^{-1} , i.e. 0, 7.5, 15, 30 and 60 $\text{t. ha}^{-1} \text{ d.w.}$).

The study was performed for four years with green pea (*Pisum sativum* L). The presence of beneficial microsymbiont arbuscular mycorrhizal fungi was studied. Potential risk of some pathogens (i.e. the Coliforms, *Enterobacter* sp., *Clostridium* sporeformers... etc.) were studied. The AM fungal colonization was increasing with doses and application. Their colonization and/or function, however, was found to be reduced from the 3rd years due to the nutrient availability and/or the strongly and time-lapse accumulating heavy metals and toxic elements. Potential pathogens, considered as food-quality and safety role was found to be increasing with the application rates of sludges. An especially great differences were found between the soil-types, used. Soils with high sand-content and with greater acidic character was creating a higher risk both for the heavy metals and for the potential pathogen microorganisms.

bundance of the beneficial biofertilizer symbiotic microbes on the other hand was reduced by the increasing sewage sludge doses. The model experiment highlighted the necessity of studying soil-environmental health aspects when sewage sludge might be applied for improving soil-fertility.

Keywords: soil-health parameters, potential risk of food-safety, important microbes, sewage sludge applied soils, model experiment

Biography



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



VII International Symposium-
2023

Keynote Session



MICROBIAL INDICATORS FOR SOIL QUALITY UNDER SALT STRESS

Hosam E.A.F. BAYOUMI HAMUDA

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Abstract:

*Under greenhouse conditions, pot experiment was conducted to examine the changes in brown forest soil (Gödöllő, Hungary) quality because of salt treatment on biological activities in the rhizosphere of white clover (*Trifolium repens* L.) plants. The experiment was investigated the effect of different salt concentrations (0.0, 0.2, 0.4, 0.6 and 0.8 wt %) on the composition of the bacterial population and the activities of different soil enzymes. It was found that the soil salinity directly affected the population of fluorescent pseudomonads isolates as well as the nodulation pattern. The densest population could be measured in the soil containing 0.2% NaCl, where *Pseudomonas putida* and *P. fluorescens* were the most abundant among the fluorescent pseudomonads. In this study, *Pseudomonas* tolerates high NaCl content in the treated soil and can develop root colonizing activity even in soil with a high NaCl content. Increasing the salt concentration initially from 0.2 to 0.4% significantly increased the activities of the dehydrogenase, catalase, and urease enzymes. The maximum activity of the protease enzymes fell at the level of 0.2% NaCl concentration. At concentrations higher than 0.4%, the activity of all four enzymes and the bacteria population decreased to a level like the control. The phosphatase and β -glucosidase activities, on the other hand, decreased significantly compared to the control in proportion to the concentration because of increasing the NaCl dose. According to our assumption, the change in the enzymatic activities was also caused by the change in the composition of the microbiota because of the salt treatment as well as the osmotic pressure in the soil.*

Keywords: *microbial indicator, fluorescent Pseudomonads population, NaCl, white clover rhizosphere, activity of soil enzymes*

Biography



Prof. Dr. Hosam Bayoumi Hamuda is working at Óbuda University. He is Environmental Microbiologist and Soil Biotechnologist. He is a member of Environmental Sciences Doctor's School (Hungarian University of Agriculture and Life Sciences) and Material Science and Technology at Óbuda University. He was a supervisor of many PhD students as well as the Leader of Agricultural and Environmental Microbiology and Soil Biotechnology PhD Program. also, a leader of Microbial Biotechnology MSc Program dealing with the interactions between the microbiomes and the environment for increasing soil quality and saving the soil from pollutants. His investigations are on the role of waste management, soil quality and fertility, crop production and environmental impacts related to the application of organic wastes; measurements soil microbial biomass and enzymatic activities in wastewater sludge amended soils; and roles of engineered metal oxide nanoparticles in biosphere.

Research Interest: Waste Management; Environmental Biotechnology; Soil: Protection; Sustainable; PGPR and Microbial Inoculants; Gut Microbiomes and Human Health as well as Modern Biology. Prof. Dr. Hosam Bayoumi Hamuda was invited as visiting professor to the 13th Flanders (Belgium) Inspires International Visitors. He is the broad editorial member and reviewer of many international journals as well as a member of many organizing committees of various international conferences also, acted as plenary or keynote speaker. Prof. Dr. organize annually and Hosam Bayoumi Hamuda is the president of the International Council of Environmental Engineering Education and annually he organizes two International Meetings, one in November in term of ICEEE, and the second in May as International Symposium.



BIOBASED FERTILIZERS FOR A SMART AND SUSTAINED AGRICULTURE

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Abstract:

The increasing worldwide population and the decreasing arable land pose a huge tension in agro-food production. Applying chemical fertilizers to agricultural production dramatically increased food production in the past decades, contributing to about 50% extra crop yield. However, with the wide utilization of chemical fertilizers, the negative impacts on the environment receive increasing attention worldwide. Recently, more and more attention has been paid to biobased fertilizers due to the unique properties of nutrients and water slow-releasing. In the aim of the PRIMA program, the CILICA project explores a model of biobased fertilizer and their application on real farms. The CILICA project aims to promote an alternative farming system based on nano-biotechnology principles with novel eco-friendly superabsorbent polymers (SAPs) and fertilization using indigenous Arbuscular Mycorrhizal Fungi (AMF); this consortium is considered a holistic model of slow release of water and nutrients. Combining fertilizer and superabsorbent helps improve plant nutrition, depreciates water evaporation losses, and reduces frequent irrigation and fertilization. Advanced research on improving the performance of these polymers and the production of new nature-friendly SAP molecules have been carried out during this project. Nevertheless, the results surveyed from our project indicate that applying based SAPs and microorganisms as biofertilizers is a viable way of promoting sustainable agriculture.

Keywords: Biobased, Sustain agriculture, Superabsorbent, Arbuscular Mycorrhizal Fungi.

Biography



Professor AZIZ Faissal is currently an Associate Professor at Cadi Ayyad University, Morocco. Prof. AZIZ is a young researcher at MENA NWC (Middle East and North Africa Network of Water Centers of Excellence) in Nanotechnology for the water treatment field. He supervises ten thesis subjects on wastewater treatment and reuses; he has published over 70 papers and co-edited one book. In addition, he coordinates many research projects on wastewater treatment and biomaterial engineering in collaboration with national and international partners.



ASSESSING THE IMPACTS OF CLIMATE CHANGE ON THE ECONOMIC GROWTH, AVAILABILITY OF FOSSIL FUELS AND OPPORTUNITIES FOR ACHIEVING ENVIRONMENTAL SUSTAINABILITY IN THE WORLDWIDE COUNTRIES

Hosam E.A.F. BAYOUMI HAMUDA

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Abstract:

Today, climate change is the most pressing problem facing the worldwide, and the future of economic growth is entangled with climate change. The partitioned goals of development and environmental protection must be viewed in tandem. At the same time, the climate crisis is becoming ever more urgent. Unchecked, climate change will pose a significant and escalating threat to world economic and social stability, if irreversible “tipping points” are triggered. Natural resources like coal, petroleum, and gas are linked with environmental contamination. Thus, along with economic development, carbon dioxide (CO₂) emissions expanded by around 50% after the inception of the great industrial revolution, resulting in environmental deterioration. The outcomes revealed that natural resource rents enhance CO₂ emissions while green energy use decreases CO₂ emissions. Many solutions have been investigated in the climate change, but it has been blocked by global dependency on fossil fuels and the fossil fuel industry’s lobbying power. The fossil industry, mainstream economic thinking, national and international interests, and political strive for short-term interests present key barriers to climate mitigation. A continuation of such trends is reflected in the Dice model, leading to a 3.5°C temperature increase by 2100. It is well-established that the deforestation, chainsaw operations, and mining trigger adverse consequences for biodiversity, and severe air, soil, and water pollution. Economic growth also encourages the modernization of society and urbanization levels that trigger the extraction and utilization of coal, gas, and oil, and these natural resources are well known to intensify environmental pollution. This study focuses on framing the increasingly urgent climate crisis in the context of the current international economic and social circumstances. It includes better characterising and integrating the non-linear impacts of climate change. The negative economic, social and environmental effects of fuel subsidies are widely recognised and are particularly felt in developing countries. Subsidising energy acts as a boost for fossil fuels and continues to skew incentives in their favour, especially when there is an increasing focus on transitioning to clean energy. With the energy sector being the largest contributor to the climate crisis, accelerating the phasing-out of fossil fuel subsidies could lead to a 10% reduction in energy sector emissions by 2030. According to a 2021 study on global mortality and fossil fuel consumption, pollution from fossil fuels caused about 8.7 million deaths a year, nearly one in five of all deaths globally. The energy sector accounts for 73% of global human greenhouse gas emissions. The environmental impacts of multilateral fossil fuel subsidy reforms on developing countries are generally positive. Reforms can lead to reduced emissions of greenhouse gases and other pollutants, which can help to mitigate climate change. In addition, reforms can promote energy efficiency and the development of renewable energy sources, which can help to reduce air pollution and improve air quality. It is, therefore, essential to align fossil fuel subsidy reforms with sustainable development by

evaluating the economic, social and environmental impacts of the reforms and adopting measures to counterbalance any negative effects. This requires directing investment and transferring technologies to developing countries to help them build capacity to generate clean energy using their existing resource endowments. Achieving carbon neutrality and reducing global temperature rise below 2°C necessitates shifting from conventional energy to renewable energy and ensuring sustainable use of natural resources. The main message that emerges is that climate change will cause income divergence across individuals, sectors, and regions, adjustment in energy markets, increased inflation variability, financial markets stress, intensified innovation, increased migration, and rising public debt. Climate change is now the most pressing, central challenge facing the world. Developing economies must aim not just to grow, but to grow sustainably. While developing countries are most vulnerable to climate change, they are also most likely to contribute to it in the future. New and increasingly affordable innovations can propel developing countries towards a greener growth path, and providing good jobs, especially in services, and introducing a climate management mindset hold the key to achieving sustainability.

Keywords: Climatic changes, economic growth risk, natural resources, clean energy, CO₂ emissions

Biography



Prof. Dr. Hosam Bayoumi Hamuda is working at Óbuda University. He is Environmental Microbiologist and Soil Biotechnologist. He is a member of Environmental Sciences Doctor's School (Hungarian University of Agriculture and Life Sciences) and Material Science and Technology at Óbuda University. He was a supervisor of many PhD students as well as the Leader of Agricultural and Environmental Microbiology and Soil Biotechnology PhD Program. also, a leader of Microbial Biotechnology MSc Program dealing with the interactions between the microbiomes and the environment for increasing soil quality and saving the soil from pollutants. His investigations are on the role of waste management, soil quality and fertility, crop production and environmental impacts related to the application of organic wastes; measurements soil microbial biomass and enzymatic activities in wastewater sludge amended soils; and roles of engineered metal oxide nanoparticles in biosphere.

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VII International Symposium-
2023

Oral Technical Sessions



VII International Symposium-
2023

Technical Session A1

**AGRICULTURE AND SOIL IMPROVEMENT, FOOD SECURITY AND
GREEN GROWTH**



BACTERIA ASSOCIATED WITH LENTIL FOR A LESS FERTILIZER-DEPENDENT CROP

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Abstract:

*PGPR are soil bacteria that can directly or indirectly stimulate plant growth by providing substances that are usually in limited amounts in the soil or slowing the growth of pathogens. Legumes have long been the most cultivated seed plants with cereals by humans. In the Mediterranean basin, lentils (*lens culinaris*) occupy an important place in human and animal food, it is classified 3rd legume crop after beans and peas. In order to promote the cultivation of this legume under low input conditions a comparison study of the effect of inoculation of 14 previously isolated and characterized rhizospheric bacteria for the potential to promote the growth of lentils in Hydroponics culture was conducted. The effect of the stimulatory activity of the 14 rhizospheric bacteria was demonstrated on the growth over the length of the stems, roots, fresh weight and dry plants of the lentil (*Lens culinaris*) and determination of accumulated phosphorus in inoculated lentil plants. The results obtained show that inoculation with bacteria leads to a root and aerial increase mainly for strains 29, 23, 17, 6, 82, 58 and 46. After the results obtained, these bacteria seem to be excellent lentil PGPR candidates. The results also show an excellent accumulation of phosphorus in the root part compared to the aerial part, specifically for bacteria 29.*

Keywords: *lentil (*Lens culinaris*), growth improvement, phosphorus accumulation, PGPR, inoculation, hydroponics.*

Biography



*After a DES in biochemistry, Rim Tinhinen MAOUGAL specialized in plant biotechnologies with a magister on production of Rhizobial inoculum then a PhD in cotutelle with Supagro Montpellier France on the adaptation of *Phaseolus* to low availability of phosphorus. She received the Habilitation to Conduct Research in Science in 2020. Recruited at INATAA freres Mentouri University, Constantine 1 since 2005, she was responsible for master training course in food biotechnology from 2013 to 2019. She Has been part of several national and cooperation projects.*



EVALUATION OF THE ANTI-OXIDANT ACTIVITY OF THREE POLYSACCHARIDES EXTRACTED FROM TUNISIAN PLANTS

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Abstract:

Polysaccharides, the most abundant macromolecules, have attracted much attention from researchers in the food and biomedical fields, due to their various biological and physiological activities such as biodegradability, non-toxicity, and antimicrobial activities. The aim of this work is to extract, the *Juglans regia* water-soluble polysaccharides from the bark (JrWSPB), the *Rhamnus alaternus* water-soluble polysaccharides from leaves (RaWSPL) and stems (RaWSPS) and to investigate some of its antioxidant activities. The extraction yield of JrWSPB was 3.86 % of RaWSPL was 3.25% and of RaWSPS was 3%. The spectral characterization showed the presence of a major peak between 200 and 225 nm could be attributed to the unsaturated carbonyl groups and carboxyl groups. In addition, a second peak at 245-255 nm indicated the presence of xylose, a third one between 260 and 270 nm, for sucrose and glucose presences and the last one at 675 nm could be attributed to chlorophylls. A low absorption at 280 nm testifies the poorly protein presence. These results were confirmed by FTIR analysis. The three polysaccharides JrWSPB, RaWSPL and RaWSPS extracts exhibited a strong antioxidant activity towards DPPH ($IC_{50} = 405, 615$ and $628 \mu\text{g/ml}$), and ABTS ($IC_{50} = 788, 470$ and $559 \mu\text{g/ml}$), respectively. In addition, the reducing power capacity and the chelating power were evaluated ($IC_{50} = 338.36, 203.89$ and 141.76 mg/ml), and chelating power ($IC_{50} = 299, 219$ and $225 \mu\text{g/ml}$) respectively for JrWSPB, RaWSPL and RaWSPS.

Keywords: Polysaccharides, *Juglans regia*, *Rhamnus alaternus*, anti-oxidant activities

Biography



VALORIZATION OF IRRIGATION IN ARID AND SEMI-ARID CLIMATE AREAS: CASE STUDY OF UPPER CHELIFF PLAIN, ALGERIA

Hamida TAIBI¹, Abdelkader BOUDERBALA²

¹Water, Rock and Plant research laboratory. University of Djilali Bounaama, Khemis Miliana, Algeria.

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Abstract:

Due to the expanding agricultural development, the need for water irrigation in agricultural practices has been increasing annually. This necessitates the adoption of sustainable methods to enhance agricultural production while ensuring global food safety. The primary objective of sustainable agriculture is to maximize crop production while minimizing the use of irrigation water, fertilizers, and energy. Over the last decade, agriculture has faced numerous constantly changing requirements resulting from natural and anthropogenic impacts. Meeting these demands is essential to maintaining food security and avoiding socio-economic problems. Therefore, the development of innovative agricultural production systems is necessary to decrease inputs for crops, including irrigation, fertilization, and pesticides while maintaining acceptable agricultural yields. An experimental study was conducted in the Upper Cheliff Plain to focus on the efficient use of water irrigation and application of fertilizers to achieve sustainable agricultural management. Industrial tomatoes were chosen for the investigation of a new strategy for optimum irrigation water. The tomatoes were cultivated in the Upper Cheliff Plain, and our irrigation program was compared with that of local farmers. The results showed that our irrigation scheduling gave us a gain of 15% of irrigation water volume for the vegetative cycle of tomatoes compared to the farmer's method, and consequently, we also decreased the use of fertilizers. This research discusses the adopted strategies for optimum irrigation water that can be used in similar climate areas.

Keywords: Irrigation efficiency, Tomato, Sustainable agriculture, low inputs, Agricultural production

Biography



Hamida TAIBI is currently a PhD student at the Djilali Bounaama University of Khemis Miliana, specializing in hydro-agricultural development. She earned her engineering degree in hydraulics from the Higher National School of Hydraulics in Blida and her master's degree in hydro-agriculture from the University of Khemis Miliana. Her research focuses on the sustainable management of water resources in agriculture to enhance the valorization of irrigation water.



OPUNTIA FLOWERS: A PROMISING MEDICINE AND FOOD RESOURCES

Monia ENNOURI

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Abstract:

Flowers are considered as precious food and medicine resources. Extracts from edible flowers like decoction, infusion and maceration are recently much studied and presented as having numerous therapeutic properties. Opuntia flowers are useful in numerous fields, such as traditional medicines and in food applications. The study of composition and the biological activities of aqueous extracts of opuntia ficus indica flowers from fresh and dried flowers show that the best antioxidant activity and the higher polyphenols content were found in the dry flowers. Active compounds in the flower extracts like flavonoids and phenolic compounds revealed antibacterial and anti-inflammatory potentialities. Applied topically, opuntia flower extracts accelerate wound contraction and perform beneficial effects on experimentally induced skin wounds in rats. The maceration of opuntia flowers in olive oil revealed an improvement in quality and oxidative stability of the oil due to the diffusion of the pigments and polyphenols from flowers to oil. Our findings comfort the application of Opuntia flowers as a therapeutic agent for dermal wound healing and as a stabilizer for oil by amplifying its resistance to oxidation.

Keywords: *opuntia, flowers, anti-inflammatory, antioxidant, polyphenols*

Biography



Monia ENNOURI is an Associate professor at Olive tree institute of Sfax, Tunisia, her main specialty is Food bioprocess (transformation and valorization of Agri-Resources).

Areas of expertise is in Food Science and Technology specially Research & Development in typical products: olives, olive oil, prickly pear, lipidic seeds, aromatic plants, fruits,; quality control of olive oil sensory analysis laboratories; formulation and functional properties of food products.



EFFECT OF RHIZOBIUM LEGUMINOSARUM STRAINS INOCULATION ON DURUM WHEAT GROWTH

Maya KECHID^{1,2}, Rim Tinhinen MAOUGAL^{1,2}, Nassira RIAH¹, Kaouthar RAMMECHE², Issra Karawan BECHOUA², Zakaria Larbi BENLABIOD¹, Charaf Eddine BELHADEF¹, Abdelhamid DJEKOUN¹

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Abstract:

Durum wheat has an important place in the Algerian diet. However, its productivity does not always satisfy the request of the consumer. To improve its yield, it is necessary to improve its growth. To achieve this aim, we have tested the response of durum wheat cultivated in presence of three strains of *Rhizobium leguminosarum* (SL9, CS15 and CL4), each strain was inoculated independently of the others. At first, we have tested some biochemical characteristics of these three strains, like their ability to solubilize phosphorus and auxin production. Then, in the second part, these three strains have cultivated on the Yeast Mannitol Broth (YMB) and inoculated separately with seedlings of durum wheat grown in pots containing compost. The pots are placed in a grow room, with controlled temperature and light conditions. After 4 weeks of growth, the effect of *Rhizobium* inoculation on the morphological and physiological response of durum wheat was observed. Some parameters including: the measurement of fresh and dry weight of the leaves and roots, the water content, the number of leaves, the rate of chlorophyll and carotenoid and the percentage of mineral matter was measured. Our results showed that these three strains are able to solubilize phosphorus and produce auxin, to increase the content of mineral elements and the rate of chlorophyll and carotenoids.

Keywords: Durum wheat, *Rhizobium leguminosarum*, PGPR, inoculation

Biography



Maya KECHID obtained a university degree in microbiology in 2001, after that, she is specialized in plant biotechnologies with a magister degree in 2005, in the same year, she was Recruited at INATAA institute specialized in Agro-Food, after that, she obtained a PhD in cotutelle with university of Montpellier, France in 2013 on plant nitrate transporter at *Arabidopsis thaliana* in presence of Plant Growth Promoting rhizobacteria (PGPR). She received the Habilitation to Conduct Research in Biology Science in 2022, affiliated of university of Frères Mentouri, Constantine 1, She has participated of several national and cooperation projects.



DEVELOPMENT OF A SYSTEM OF BIOLOGICAL INDICATORS FOR ASSESSING THE ECOLOGICAL AND FUNCTIONAL SOIL CONDITIONS

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TSVIGUN, Yeuheniia TKACH**

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Abstract:

Climate change and its consequences are one of the most pressing issues of our time. It is known that every living organism will respond to any changes in its environment in all possible ways – by adapting or acclimatizing. Soil sampling and determination of the number of microorganisms of the main ecological, trophic, and taxonomic groups were determined by generally accepted methods. The direction of microbiological processes in the soil was determined according to K. Andreyuk, G. Iutynska, and co-authors by calculating environmental coefficients. The following indicators were proposed to determine soil condition: number of earthworms, diversity of soil microflora, soil biological activity, and soil enzymatic activity. In our work, to assess soil quality through biological indicators, it was a good decision to use "direct" and "indirect" indicators for a comprehensive assessment of Minimal Data Set (MDS). To assess the direction of microbiological processes in the soil, we calculated the coefficients of oligotrophicity, pedotrophicity, and mineralization-immobilization. The complex studies of soil enzymatic activity make it possible to determine the effect of an additional supply of bioavailable forms of minerals on the activity of hydrolases and oxidoreductases. In addition, it helps to identify the most informative criteria for assessing the condition of soil processes under the influence of various environmental factors. The enzymatic activity of soil microorganisms significantly depends on the climatic characteristics of the soil. In particular, the moisture level determines the degree of solubility of nutrients and their bioavailability and the concentration gradient in the soil-microorganism system, soil temperature determines the rate of enzymatic processes and the living conditions of biota, etc. Thus, a MDS of biological indicators for assessing the ecological and functional condition of soil under climate change was developed and ecologically justified. It will help in understanding the properties of microbial communities' resilience, which determined by their ability to withstand and recover from disturbances, and in characterizing the functioning of the ecosystem in general. The application of this system will contribute a comprehensive study of soil conditions, objective diagnostics, and assessment of its condition under the influence of various factors (including hydrothermal).

Keywords: *Climate change, microorganisms, biological indicators, Minimal Data Set (MDS),*

Biography



Iryna Gumeniuk has completed her PhD at the age of 26 years (Institute of Agroecology and Environmental Management of NAAS) in Biological Sciences (Ecology). She is Senior Researcher in Laboratory Microbial Ecology (Department of Agroecology and Biosafety of Institute of Agroecology and Environmental Management of NAAS). Author of 35 scientific works, including 4 publications that are included in SCOPUS or Web of Science databases, co-author of 1 monograph, 2 training manuals, and 2 methodological recommendations.

Scientific interests: *Ecology of soil microorganisms; Microbiology, agroecology, and biosafety; Legume-Rhizobium symbiosis; Developing biological preparations based on agronomically beneficial microorganisms. Member of National Public Organization Vynohrads'kyj Society of Microbiologists of Ukraine (SMU) and FEMS; Member of All-Ukrainian Public Organization "Vavilov Society of Geneticists and Breeders of Ukraine"; Member of the All-Ukrainian Public Organization "Association of Agroecologists of Ukraine"; Head of the microbiological testing group of TL "DAB"; Lecturer of the course of lectures "Environmentally safe agricultural technologies", "Biological safety of agroecosystems", "Ecology of microorganisms".*

Technical Session A2

**AGRICULTURE AND SOIL IMPROVEMENT, FOOD SECURITY AND
GREEN GROWTH**



IMPACT OF HYDRATION WATER SALINITY AND INCORPORATION OF SOFT WHEAT FLOUR ON THE WET AGGLOMERATION PROPERTIES OF DURUM WHEAT SEMOLINA FOR COUSCOUS PRODUCTION

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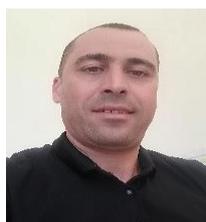
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Abstract:

Introduction. The addition of salt to the hydration water and the incorporation of soft wheat flour (SWF) are common practices in the artisanal manufacturing of couscous. Objective. This work aims to explore the effect of NaCl addition to the hydration water and the addition of SWF on the rheological properties of durum wheat semolina (DWS) during its wet agglomeration into couscous and to predict the optimal liquid-solid (L/S) wetting ratio for granulability. Materials and methods. The Mixer Torque Rheometer (MTR-Caleva[®]) was used to monitor the granulability of solid-liquid mixtures. The couscous agglomerates were then shaped using a high shear granulator-mixer Mi-Pro[®]. Results and discussion. The salinity of the hydration liquid decreases the inter-granular cohesion during solid-liquid mixing (effect on liquid surface tension and solid wetting) and results in the production of less dense agglomerates of spread sizes. The addition of SWF to DWS presents rheological profiles accentuating the inter-granule cohesive-adhesive effect. The optimal liquid ratio (for maximum cohesion development) depends on the studied effects: the optimal L/S ratio tends to decrease with salinity and increase after adding SWF. Conclusion. The combined effect (water salinity and SWF addition) in granular agglomeration shows the "wetting effect vs cohesion effect" character governing the creation of inter-grain bridges generating couscous granules. Water salinity also influences the water sorption cycles during wetting before agglomerate generation.

Keywords: Semolina, NaCl, Wet agglomeration, Couscous, Hydration rate, MTR-Rheometer

Biography



Loucif CHEMACHE is a teacher-researcher in food science at the University Frères Mentouri Constantine 1 (INATAA). He is an active member of the university's nutrition and food technology research laboratory (LNTA), where he also serves as team leader for the Cereals and Cereal Products (CCP) research group. He is recognized for his expertise in food technology, particularly in the areas of food powders and shaping and transformation operations of cereals and cereal products. As a researcher, he is interested in the development and formulation of innovative and functional starchy foods.



INVESTIGATING EFFECT OF EGGHELL ASH AND CRUSHED STONE POWDER ON GEOTECHNICAL PROPERTIES OF EXPANSIVE SOIL: IN CASE OF DUKEM TOWN, ETHIOPIA

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Abstract:

Expansive soils are those having the ability to undergo excess swelling-shrinkage behaviour due to available smectite mineral in soil mass and which causes distress on overlaid structures as moisture content varies. This soil type covers more than 40% of land area in Ethiopia, and currently it becomes an alarming issue throughout the overall world. So, to overcome such problems this study was tried to apply ground improvement by using different stabilizing agents like eggshell ash (ESA) and crushed stone powder (CSP) which are selected based on their cost-effectiveness, availability, pollutant reducibility and environmental compatibility. For this study expansive soil samples from three different test pits were collected to be categorized and identified as the weakest based on their plasticity property, gradation, swelling property and compressive strength and further the weakest soil, selected additives and soil-additive mixtures were characterized for their mineralogical compositions using Fourier transform infrared spectroscopy (FTIR), scanning electron microscope (SEM) and X-ray diffraction (XRD) analysis. This paper also presents the results of some index and engineering properties including Atterberg limits, compaction, free swelling, and unconfined compressive strength of expansive soil mixed with the ESA at 2%, 4%, 6%, and 8% by dry weight of soil. The result shows that the decrease in liquid limit (84.38% to 78.23%), plasticity index (47.16% to 32.65%), maximum dry density (1.32g/cm³ to 1.29g/cm³), free swelling index (95% to 36.36%), free swell ratio (1.95 to 1.36), and linear shrinkage (21.96% to 18.87%) with the addition of ESA up to 8%. Whereas increase in optimum moisture content (35.78% to 36.36%), plastic limit (37.22% to 45.58%), and UCS from 94.74KPa to 149.17KPa (uncured) and 177.68Kpa (cured) were observed for addition of ESA to soil sample. And 6% ESA was combined with CSP at 5%, 10%, 15% and 20% by dry weight of soil to investigate their effect on properties of natural soil. Again, the result shows better improvement of soil properties by reducing plasticity property, shrinkage capacity, optimum moisture content, swelling characteristics, and degree of compressibility and increasing rate of consolidation, maximum dry density, and compressive strength of natural soil. Results also shows that curing have positive impact on improvement of expansive soil related to strength. Based on the overall test results, the optimum ratio of ESA and CSP for the improvement of expansive soil in this study was proposed as 6% and 15% respectively.

Keywords: *Crushed stone powder, Eggshell ash, Expansive soil, Fourier transform infrared spectroscopy (FTIR), Scanning electron microscope (SEM), X-ray diffraction (XRD)*

Biography



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IMPACT OF AGRICULTURAL LAND USE PRACTICES AND MONSOON AT MICRO-WATERSHED LEVEL ON SOIL PROPERTIES INCLUDING EARTHWORM POPULATION AND CROP PRODUCTION IN RED AND LATERITE AGROCLIMATIC ZONE UNDER MOIST SUB-HUMID REGION OF WEST BENGAL STATE IN INDIA

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Abstract:

The study revealed that agricultural land use practices and monsoon had impacts on changing soil properties, fertility, crop production and matured earthworm population in soil. The study was conducted in the years of 2020 and 2021 within three micro-watersheds in the Paschim Medinipur district (22°57' 06.4"N Lat., 87°21'41.0"E Long. to 21°46'06.4"N Lat., 87°24'06.9"E Long. in N-S; and 22°23'00.0"N Lat., 87°18'15.0"E Long. to 22°23'41.7"N Lat., 87°39'05.7"E Long. in E-W) within Red and Laterite Agroclimatic Zone under the moist sub-humid region of West Bengal state in India. Data from twenty different farming practices, i.e., treatments were analysed following Duncan's Multiple Regression Test (DMRT) involving eleven different crops including kharif rice, and potato in rabi season as the main crops. Significant changes were found in soil characteristics including matured earthworm population after monsoon period and agricultural land use practices, including bunding, organic manure application, boundary plantation, etc. In 2020, the C14 land use system had the highest average number of earthworms of 7.33m⁻², while the lowest value was found in C5 with 3.00m⁻². In the same period in 2021, C2 had the highest average number of earthworms of 6.67m⁻², while C5 had the lowest value of 3.33m⁻². From the overall results for 2020 and 2021, it was found that yield of kharif rice ranged from 1.73tha⁻¹ in C12 to 2.25tha⁻¹ in C6 agricultural land use system, while the yield of potato varied from 17.63tha⁻¹ in C12 to 18.36tha⁻¹ in C9 agricultural land use system, whereas earthworm population ranged from 3.00m⁻² in C5 to 6.67m⁻² in C13 and C14 agricultural land use systems. Through principal component analysis (PCA), it was revealed that earthworm population and crop production were influenced by soil properties like bulk density, porosity, total aggregate, moisture, permeability, infiltration, pH, organic carbon, available nitrogen and land use practices.

Keywords: agricultural land use, monsoon, micro-watershed, soil properties, crop yield, earthworm

Biography



Anirban Bhowmik

Anirban Bhowmik, an M.Sc. (Agriculture) in Soil and Water Conservation, is a university Ph.D. research scholar with the Department of Soil and Water Conservation, Bidhan Chandra Krishi Viswavidyalaya (BCKV) at Mohanpur, Nadia, West Bengal, India.



Subhabrata Panda

Dr. Subhabrata Panda, M.Sc. and Ph.D. (Agriculture) in Soil and Water Conservation, is an Assistant Professor in Soil and Water Conservation and Scientist with All India Coordinated Research Project on Agroforestry (AICRP on AF), Bidhan Chandra Krishi Viswavidyalaya (BCKV), West Bengal, India.



COMPARISON OF SOIL BIOLOGICAL ACTIVITIES BETWEEN GRASSLAND AND ARABLE SOIL

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Abstract:

We have compared two different land uses, cropland and grassland at three soil types (Arenosols, Chernozems and Cambisols) for the soil microbial respiration as an indicator for soil quality. Soil samples were taken from the upper soil layer (0-20 cm) in May of 2022. All measurements with altogether 24 soil samples were made in the Institute for Soil Sciences (Budapest, Hungary) using MicroResp technique for detecting the catabolic level physiological profile (CLPP) of soil microbial communities. Basal respiration and cumulative substrate-induced respiration resulted in significant differences between grassland and cropland at each soil type investigated with the higher respiration rates for grasslands. Inverz Simpson index showed higher values also at the grasslands, but the difference was significant only at Balatoncsicsó (Cambisols). CLPP was significantly different across all sites investigated and evaluated by permutational analysis of variance (PERMANOVA) and with the principal coordinate analysis. The most significant substrate respiration rates responsible for discrimination between sites were different, not only one substrate but at least five substrates had a significant effect on soil group separation.

Keywords: soil respiration, CLPP, cropland, grassland.

Biography



I am a Mexican environmental engineer student from Óbuda university living here in Budapest since 2019. I did my internship and research at the Institute of Soil Sciences and Research to analyse and compare the soil respiration between arable soil and grassland soil and how does the usage of fertilizer affects the overall health of the soil.

I am currently applying for a master's degree in environmental sciences here in Budapest.



NITRATE CONTENT IN FRUITS AND VEGETABLES

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Abstract:

Harmful effects of nitrates on the body from nitrite to nitrite and mainly to nitrosamines in the preparation of food, digestion in the intestinal tract, and storage (nitrate-rich foods such as spinach or carrots, at room temperature). In a healthy human, NO_3^- is excreted, but the but the 10% nitrite produced from the remaining nitrite is not enough to loss of haemoglobin can cause methemoglobinemia in adults. As we known nitrate can be found in fruits and vegetables. Nitrate is necessary to human body. But if human take too much nitrate will cause some problem. So, it is important to know how much nitrate you take per day. In this paper It was chosen different samples from different shops. Though the experiment to learn the concentration in those samples. And I will try to find if there are any different in those fruits and vegetables which from different shops. And analysis the samples themselves which part of them will be healthy.

Keywords: ammonium-N, heavy metals, nitrate-N, monitoring, stream

Biography



Dr. Ágnes Dr. habil. Mészáros-Bálint (Ágnes Bálint is the author's name) had her **Highest educational degree:** MSc, Chemistry and Physics, ELTE, Budapest, Hungary. **Scientific degree:** PhD; habilitation, in the field: Environmental Sciences, SZIE, Gödöllő, Hungary

Institution: Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Institute of Environmental Engineering and Natural Sciences and HBM

Phone: +36303721342; **Position:** Associate Professor

Specialties: 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



EFFECT OF ENVIRONMENTAL CONTAMINATION WITH PESTICIDES ON PLANT GROWTH

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Abstract:

Throughout the course of the measurements, we receive simple and reproduceable results, which can be utilized in everyday situations, as the effects of pesticides as well as the soil's fertility can be measured. Due to their relationship with soil biology, the presence of soil enzymes provides useful soil quality indicators, given that (1) soil enzymes can be measured accurately, (2) these precise measurements are reproduceable, and (3) soil enzymes give great insight into the soil management's past. Pesticides are biologically active chemical compounds. Their precise application is important, because unintended consequences can include significant changes in biological activity, which in turn can influence the soil's microbial ecological balance and its fertility. The growing reliance on pesticides in sustainable agriculture may reach concerning proportions as, due to their ecotoxicological effects, pesticides can be dangerous for the environment, the animal world, and, both directly and indirectly, humans. The pesticides used during the cultivation of cultigens influence enzymatic activity, which serve as soil quality indicators. The aim of this investigation was to gain insight into the effects of pesticides on the soil's rhizosphere, with special attention directed towards (1) dehydrogenase and FDA activity, (2) the population of soil bacteria, (3) the germ count of aerobic endospore-forming bacteria, (4) the development cellulose-decomposer population, (5) the development of phosphate solubilizing bacteria- and filamentous fungus populations, and (6) the development of yeast germ counts. These factors of the soil greatly influence the productivity, crop yield, and economic efficiency of the cultigens planted therein. The examinations also pointed out how the plant itself reacts to the effects of the given dose of pesticides, based on the dry substance content, the length of the plant's stem- or root, and the chlorophyll content of plants exposed to different degrees of pesticide pollution. We have observed favorable effects on the cultigens and the rhizospheres surrounding their roots that were subjected to appropriately proportioned pesticides, the amount of which was determined by previously conducted experiments. It is important however to take into consideration the investigation's other factor when an incorrect amount of chemical compound was applied. The reduced amount of pesticide did not produce the expected results, and so the economic efficiency was worsened. Overapplication also resulted in decreasing tendency, but the overuse of pesticides will, on the long term, damage its immediate and wider surroundings and its ecosystem. Our history and choices warn us to the dangers of irresponsible, nonchalant damage we leave behind, and to the neglect of the consequences. But this retrospection also shows as which are the go-to, tried and true methods with which the crop yield, agriculture, and ecosystem can all be sustained despite the ever-growing populations. A lot of effort and initiative is focused towards creating and maintaining a tighter connection with the environment both in the countryside and in large cities. We believe that measurements like that of this investigation, which will be applied in the future, will contribute to cultigens, forage, and the food made directly or indirectly from it to be cultivated through technologies that take into consideration the needs of the soil, the plants, the animals, and people equally.

Keywords: Pesticides, tomato growth and rhizosphere, soil quality, enzymes and microbiomes activities

Biography



Prof. Dr. Hosam Bayoumi Hamuda is working at Óbuda University. He is Environmental Microbiologist and Soil Biotechnologist. He is a member of Environmental Sciences Doctor's School (Hungarian University of Agriculture and Life Sciences) and Material Science and Technology at Óbuda University. He was a supervisor of many PhD students as well as the Leader of Agricultural and Environmental Microbiology and Soil Biotechnology PhD Program. also, a leader of Microbial Biotechnology MSc Program dealing with the interactions between the microbiomes and the environment for increasing soil quality and saving the soil from pollutants. His investigations are on the role of waste management, soil quality and fertility, crop production and environmental impacts related to the application of organic wastes; measurements soil microbial biomass and enzymatic activities in wastewater sludge amended soils; and roles of engineered metal oxide nanoparticles in biosphere.

Research Interest: Waste Management; Environmental Biotechnology; Soil: Protection; Sustainable; PGPR and Microbial Inoculants; Gut Microbiomes and Human Health as well as Modern Biology. Prof. Dr. Hosam Bayoumi Hamuda was invited as visiting professor to the 13th Flanders (Belgium) Inspires International Visitors. He is the broad editorial member and reviewer of many international journals as well as a member of many organizing committees of various international conferences also, acted as plenary or keynote speaker. Prof. Dr. organize annually and. Hosam Bayoumi Hamuda is the president of the International Council of Environmental Engineering Education and annually he organizes two International Meetings, one in November in term of ICEEE, and the second in May as International Symposium.

Technical Session B1

WATER SECURITY: TREATMENT AND MANAGEMENT



GROUNDWATER RECHARGE ESTIMATION USING AN EMPIRICAL RELATIONSHIP BETWEEN SOIL PERMEABILITY AND SURFACE ELECTRICAL RESISTIVITY METHOD IN THE UPPER CHELIFF'S ALLUVIAL AQUIFER ALGERIA

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Abstract:

The aim of this study is to determine the groundwater recharge rate in upper Chéiff's alluvial plain in Algeria. An approach based on measurements of the resistivity of the topsoil layers (167 resistivity sounding measurements), regression, and GIS was adopted to determine the infiltration coefficient throughout the plain territory. The empirical relationship established between soil permeability K and the resistivity ρ is a third-order polynomial equation with a determination coefficient R^2 of 0.996. The theoretical permeability obtained by applying the modeling equation, which used to produce infiltration maps and to calculate the average annual potential recharge for each administrative sector. This study establishes a good approach for determining the spatial distribution of infiltration therefore recharge in areas where experimental on-site permeability values are not available by using geophysical data.

Keywords: *Electrical resistivity, Groundwater recharge rate, permeability, soil*

Biography



Hanane is currently a PhD student at the Hassiba ben Bouaali University of Chlef, specializing in Hydraulics. She earned her engineering degree in hydraulics from the Higher National School of Hydraulics in Blida and her master's degree water and géoenvironment from the University of Khemis Miliana. Her research focuses on the estimation of groundwater recharge by several methods.

MONTHLY STREAMFLOW PREDICTION USING HYBRID EXTREME LEARNING MACHINE OPTIMIZED BY BAT ALGORITHM: CASE STUDY OF TIGUIQUEST BASIN, NORTHERN ALGERIA

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Abstract:

Streamflow prediction can provide strategic information and contribute to improved water resource management systems. Machine learning models have recently been proposed to predict monthly streamflow's (Q) using only precipitation (P). The proposed models are based on a nonlinear relationship between P and Q and have proven to be robust modeling tools. This study was mainly motivated by evaluating the contribution of metaheuristic algorithms to improve the performance of machine learning for streamflow modeling Q . We propose a new approach for monthly streamflow forecasting based on the extreme learning algorithm (ELM) and the Bat metaheuristic algorithm (BAT-ELM). The performance of BAT-ELM was compared with ELM, support vector regression (SVR) and multilayer perceptron neural network (MLPNN). The proposed models were applied using data from the Oued Lili hydrometric station (code 012501) which monitors the flow of the Tiguiguest sub-basin in the large Cheliff watershed in northern Algeria. It was shown that the BAT-ELM was more satisfactory than the stand-alone models. The results obtained showed that the BAT-ELM presented an interesting alternative algorithm for predicting extreme flow data.

Keywords: Streamflow, Prediction, ELM, Bat, SVR, MLPNN.

Biography



PhD student at Department of Hydraulic, Civil Engineering and Architecture Faculty, University of Hassiba Benbouali, Chlef, Algeria



INCREASING THE EFFICIENCY OF WASTEWATER TREATMENT OPERATIONS. THE EFFECT OF SALINITY ON THE USE OF POLYMERS

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Abstract:

This study aimed to investigate the effect of salinity on the efficiency of wastewater treatment operations using two polymers, Polymer-55502 and Polymer-55702. The results indicate that the efficiency of the polymers is affected by the type of salt in the solution as well as the salinity of the solution. The data shows that an increase in the NaCl concentration in the digested sludge will increase the effect of polymers. At the same time, an increase in MgSO₄ concentration will also increase the impact of polymers until a certain point, after which it will reduce the effect. The study also found that the two polymers have different reactions to different distilled water samples, which means that both polymers will not react in the same way under the same conditions. The salinity of the three WELLS tested was different. The reactions of the two polymers varied with each well, indicating that the specific composition of the solution affects each polymer's reaction differently. It is important to use specific polymers with the appropriate salinity in the solution to make wastewater treatment operations environmentally and economically friendly. This way, the wastewater plant will use less polymer for the operation, and fewer chemicals will be released into the environment. This will help us economically and save our marine ecosystem from exposure to the high dose of these chemicals.

Keywords: wastewater treatment operations. salinity, polymers

Biography

Environmental Engineering student at Obuda University, Budapest, Hungary



EVALUATION OF WATER QUALITY ASSURANCE PARAMETERS TO STUDY WWTP PERFORMANCE

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Abstract:

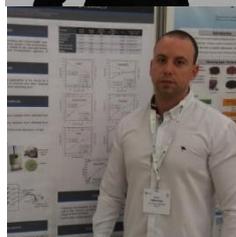
Proper operation of the municipal wastewater treatment plant (WWTP) is essential for any municipality to protect the environment and public health. Statistical models can be used to assess treatment efficiency and effluent water quality as well as to help operators to optimize plant operations and improve treatment process. The aim of the research is to study correlations between water quality assurance parameters such as chemical oxygen demand (COD), biological oxygen demand (BOD), ammonium (NH_4^+), sulphate (SO_4^{2-}), total nitrogen (TN), total phosphorus (TP) and suspended matter (SM) in raw wastewater and effluent to evaluate performance of treatment process in municipal WWTP. Statistical data processing (independent sample t test and Pearson's correlation analysis) was performed using the software IBM SPSS version 25. The big database (more than 1400 samples of raw wastewater and effluent) was used for statistical analyses. The results indicated high treatment efficiency more than 80 % for COD, BOD, NH_4^+ and SM, but low efficiency for SO_4^{2-} (10.90 %). Significant correlation between the concentrations of raw wastewater was noticed between COD and SM ($r=0.354$), as well as SM and TP ($r=0.349$). In effluent, significant correlation between COD and SM ($r=0.456$), BOD and NH_4^+ ($r=0.358$), BOD and N ($r=0.306$), and N and NH_4^+ ($r=0.503$) was observed. A positive correlation indicates that with an increase in the concentration of one parameter, the concentration of the other water quality assurance parameter also increases.

Keywords:

Biography



Ana Vukmirovic was born in Novi Sad in 1982. She completed her bachelor's and master's degree at the Faculty of Natural Sciences at the Department of Biology, University of Novi Sad. Doctoral studies enrolled at the Faculty of Technical Sciences at the Department of Environmental Engineering.



Boris Obrovski was born in Novi Sad, in 1988. He received the B.Sc., M.Sc. and Ph.D. degrees in environmental engineering from the Faculty of Technical Sciences (FTS), University of Novi Sad (UNS), Serbia in 2011, 2012, and 2020, respectively. Currently, he is a Research Associate at the FTS, UNS. His areas of interest are application of sensors and laboratory analysis of inorganic parameters in water samples.



Ivana Mihajlović was born in Bor in 1984. She received the B.S. and M.Sc. degrees in physical chemistry from the University of Belgrade in 2008 and 2009, and PhD degree in environmental engineering from University of Osnabruck. From 2020, she is an associate professor at the Faculty of Technical Sciences in Novi Sad, at the Department of Environmental Engineering.



THE SYNERGISTIC EFFECT OF GRANULAR ACTIVATED CARBON IN THE REMOVAL OF POLLUTANTS: ADSORPTION AND DEGRADATION STUDY COMPARISON

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Abstract:

This work describes pollutant removal by using enzyme-free and enzyme-loaded granular activated carbons. According to the findings by fourier-transform infrared spectroscopy (FTIR), Boehm titration, scan electron microscopy (SEM), Energy dispersive X-ray spectroscopy (EDS) mapping analysis, and specific surface area (SBET), laccase has been effectively immobilized on carbon via adsorption. The optimal immobilization conditions were determined to be pH 5, 30 oC, and a laccase dosage of 2 mg/mL. The adsorption of pollutants onto carbon fitted well with the Langmuir isotherm and first-order kinetics. Up to six reuse capabilities of the immobilized enzyme were determined. The addition of the pollutants (50 mg/L) resulted in complete removal. However, 74% removal was achieved using only adsorption. This study suggests that granular activated carbon can be deployed successfully as a substrate and adsorbent for the removal of pollutants.

Keywords: *Laccase, pollutants, adsorption, degradation*

Biography



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Session (B2)

AIR QUALITY, CLIMATIC CHANGES, ENERGY PRODUCTION AND INDUSTRIAL POLLUTION



ON CLIMATIC CHANGE: CAUSES, IMPACTS ON WILDFIRES AND HUMAN HEALTH

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Abstract:

A climatic change happens when the climate's standards undergo critical variations, which causes perilous problems for the environment and society. Any defect in the climate conditions leads to alter in humidity, temperature, and precipitation. This process has a detrimental impact on the balance of the ecosystem. This review article distinguishes two types of climatic change causes, viz, natural and anthropogenic. As far as natural causes are concerned, harmful gases emission by volcanic eruptions are major detrimental problems to the environment, rise in average earth temperature and snow melting and in turn rise of sea level result in changes in the climate metrics which, in turn, lead to disagreeable effects on all forms of life on the earth. Meanwhile, it is noticeable that anthropogenic effects got more complicated in the recent decades. Human activities have led to an increase in global warming through deforestation, increasing the emission levels of greenhouse gases, and producing more pollutants to be stuck in the atmosphere and water bodies. This paper aims at pointing out the relationship between climate change and wildfires specifically. The impact of climate change on the forest fire and vice versa. It is worth noting the effects of climatic change on the health of flora and fauna and local peoples. This review throws some light on the climate and gives a brief conceptual review of climate change to search for the best methods to minimize the negative human impacts on climate which help us to conserve the environment and improve human health.

Keywords: Anthropogenic, Wildfires, Health, Global warming.

Biography



Yara EzAl Deen Sultan from Syria, I'm a volunteer in the Scout of Syria. I got a bachelor's degree in Geography and Education Habilitation Diploma degree – from Tishreen University-Syria. I got a master's degree in environmental science from Marwadi University Rajkot- India and I'm a Ph.D. scholar in- the Chemistry department- at Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology Chennai- India, my specialty is Environmental Science. I participated before in The V. International Symposium on Environmental Quality and Public Health. I'm interested in all Environmental issues like climate change, wildfires, renewable energy, Wildlife.... etc



IMPACT OF EFFLUENTS OLIVE OIL ON THE SURFACE WATERS OF MIDDLE SEYBOUSE

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Abstract:

Seybouse wadi, considers one of the most important rivers in the North East of Algeria, the latter, it undergoes industrial pollution, and in particular that of the organic, Among these industrial activities, the fatty substances industry includes in particular the olive oil production units (olericulture) generally located on the banks of the river in the middle Seybouse, whose waste water (margins) is extremely loaded in organic matter, particularly phenolic compounds, which flow into the natural environment without any prior treatment, and which present serious environmental problems, causing possible pollution of surface and ground water. Indeed, campaigns analyses were carried out at the effluents level of (06) oil mills located in the Seybouse average during the production season (2012-2014). The exploitation of the results of the analyzes showed that the physicochemical and biological quality of the wastewater is too loaded with organic matter from vegetable waters. Indeed, high values of COD (> 20 g/l), BOD5 (>10 g/l) and a mean concentrations of oils and fats > 5 mg/l, as well as, average values of electrical conductivity (1.0 to 7.04 mS.cm⁻¹) as well as dissolved oxygen (<1 mg/l) were recorded in discharges from oil mills, which are widely above the limit values for a discharge into an urban or natural environment. In summary, the waters of the Seybouse are extremely impacted by organic pollution from the effluents of the olive oil mills, and the latter, requiring adequate treatment systems to preserve the natural waters of the Seybouse and its ecosystem.

Keywords: effluents, environment, oil mill, organic pollution, Seybouse.

Biography

*Brahim LOUATI is working at Badji Mokhtar University-Annaba -Algeria
He is specializing in Hydrogeology and environment*



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

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Abstract:

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

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

Biography



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



ENVIRONMENTAL ASSESSMENT OF ELECTRICAL VEHICLES

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Abstract

In the past couple of years, electric vehicles started becoming popular and they are now considered one of the tools to develop sustainable cities and reduce the emissions. The aim of the research was to investigate the energy consumption and emissions of a plugin hybrid (PHEV) and battery electric vehicle (BEV). The emissions of the vehicles were examined in different energy scenarios of electricity production. The scenarios were the Hungarian generation mix emissions and lower emissions technologies. The results showcased that the emissions of the BEV and all electric mode of PHEV were lowest using and lower emission technologies for electricity production, due to their low carbon intensity. This was not the case for the PHEV all the time, as the emissions changed for the plug-in hybrid depending on the degree of dependency on the electricity and gasoline. The conclusion is that the effect and influence of electric vehicles on reducing emissions depended on the source of energy used to power the vehicle. Furthermore, the fuel cycle of electric vehicles will produce lower emissions through the usage of lower emission technologies and all electric mode.

Keywords: BEV, PHEV, energy consumption, emission, generation mix

Biography

Sara Alkhaldi

“I am an environmental engineering student in her last year at Obuda University. I am enthusiastic about sustainability and clean energy.”

Technical Session B3

SESSION (D) ENVIRONMENTAL RISK AND HUMAN HEALTH:



TOXICITY OF GRAPHENE OXIDE NANOPARTICLES IN MALE MICE VIA INTRAPERITONEAL INJECTION: A BIOCHEMICAL AND HISTOPATHOLOGICAL STUDY

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Abstract:

Graphene oxide (GO) is a graphene derivative with numerous applications, including in biomedicine. Applying this nanomaterial in the medical field could improve diagnosis, treatment, and prevention techniques. Also, GO is characterized by various physicochemical properties, including nanoscale size, high surface area, and electrical charge. However, its safety for such applications is unclear. We synthesized GO and assessed its toxicity in male mice to address this issue. To do this, we studied the effects of this nanomaterial by administering GO intraperitoneally to mice at different doses (2 mg/kg and 5 mg/kg) for five days. We conducted biochemical analyses of blood serum, measuring liver and brain peroxidase and malondialdehyde (MDA) activity. We also performed histological sections to evaluate the pathological and morphological changes in the liver and brain. The biochemical analyses revealed that GO impacted the level of biochemical parameters. The oxidative stress assay showed increased peroxidase and MDA activity after GO intoxication, indicating that GO induced oxidative stress. Moreover, histopathological analysis of liver sections revealed that GO caused liver inflammation. However, at the brain level, GO did not affect neuronal cells. Overall, the results suggest that GO has toxic effects and that its toxicity may be mediated by oxidative stress.

Keywords: Graphene oxide, toxicity, biochemical analyses, histological sections, oxidative stress.

Biography

Asmaa RHAZOUANI is a PhD student at Cadi Ayyad University, Marrakech, Morocco



DISCOVERY OF HYDRAZONE SCAFFOLD AS POTENT AND SELECTIVE MULTI-TARGET-DIRECTED LIGANDS FOR THE TREATMENT OF NEURODEGENERATIVE DISORDERS: IN VITRO AND IN SILICO SCREENING

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Abstract:

The multifactorial nature of Alzheimer's and Parkinson's diseases with intricate etiology and nebulous pathogenic mechanisms provide compelling reason to drug discovery community to explore new inhibitors and treatment modalities. These strategies include cholinesterase (ChE) and monoamine oxidase (MAO) as the most important targets for their treatment. In this context, new and diverse series of hydrazone derivatives (5a-o) were designed and synthesized through facile and multistep synthetic approach. Chemical structures were elucidated by spectroscopic techniques such as FTIR, ¹H- and ¹³C-NMR. In vitro bioactivity analysis was performed using Ellman's method and obtained results demonstrated selective and potent inhibitory potential of hydrazone derivatives against acetylcholinesterase (AChE) and butyrylcholinesterase (BuChE) enzymes. Among all the tested compounds, 5a remarkably emerged as a lead candidate exhibiting potent and selective inhibition of AChE with an outstanding IC₅₀ value of 0.63 ± 0.01 μM, comparable to galantamine (0.62 ± 0.09 μM), a standard inhibitor. The synthesized compounds were further tested for inhibitory potential against monoamine oxidase enzyme by using fluorometric method, where compound 5i delivered the strong potency and selective inhibition towards MAO-A with an IC₅₀ value of 0.89 ± 0.04 μM. Moreover, compounds 5k (IC₅₀ = 2.06 ± 0.01 μM) and 5n (IC₅₀ = 2.06 ± 0.05 μM) were identified as lead inhibitors of MAO-B in addition to showing significant inhibitory potential towards MAO-A isoform. Molecular docking studies of potent and selective inhibitors exhibited various important interactions with amino acid residues in active pocket of both enzymes, thus strengthening our in vitro results. Kinetics analysis of the most potent compound 5a against AChE revealed competitive mode of inhibition whereas molecular dynamics simulations were performed to investigate the energetically stable complex formation ability of potent compounds with target protein. Finally, the results of in silico ADME properties showed that potent compounds have promising pharmacokinetic profile.

Keywords: Alzheimer's disease; Parkinson's disease; Hydrazone; Acetophenone; Thiophene; Cholinesterases; Monoamine oxidases; Molecular docking.

Biography



***Dr. Sumera Zaib** received her PhD degree in Biochemistry. During her PhD, she has visited University of Bonn, Germany, as a DAAD research fellow. Dr. Zaib has worked as a Postdoctoral Research Fellow for over 2 years. Afterwards, she worked as Assistant Professor and is currently working as Associate Professor at University of Central Punjab, Lahore, Pakistan. She has successfully produced >155 meritorious publications in highly prestigious international journals with h-index of 29 and >585 impact factor. Her research interests include protein chemistry and enzymology with special emphasis on clinical biochemistry and enzyme inhibition studies.*



ENVIRONMENTAL CHEMICALS AND HUMAN RISK ASSESSMENT. A CRITICAL OVERVIEW

Joghi Sivakumar Thatha GOWDER

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Abstract:

n this industrial world, environmental chemicals are the major cause of diseases in the human/ animal population. It leads to an increase in the number of premature deaths, high economic losses and and degradation of our ecosystems. The environmental chemicals include a wide array of compounds: toxic metals, plastic materials, industrial manufactured chemicals, pesticides, fertilizers, pharmaceutical chemicals, food chemicals and other known or unkown chemicals derived from industries, agricultural runoff and sewage wastes. Environmental pollution or toxicity is a globular problem and day by day, the frequency of toxicity to the living organisms (human and animals) is increasing with an increase in the frequency of critical diseases. We can consider environmental pollution or toxicity as natural as well as manmade ones. Recent earthquakes in Turkey, Syria, etc are the natural ones that lead to pollution. Men made ones are none other than Russia and Ukraine war and the current internal war in Sudan. Toxic chemicals of the environment: consumer products, pesticides, food chemicals lead to health issues including cancer, Alzheimer's diseases, and other severe diseases. Preying of fish, meat of domestic wild animals is unsafe in the current situation of the environment. In order to evaluate diseases concerned to environmental chemicals, more animal studies (in vivo) and cell lines (in vitro) are recommended. International agencies (WHO, etc) should implement policies concerned to restrictions in handling of consumer products, pesticides or fertilizers, food chemicals etc. concerned to human health hazards.

Keywords: Environmental chemicals; Human Health; Toxicity; Diseases.

Biography



Dr Sivakumar Joghi Thatha Gowder received his academic training and carried out his research in institutions of high academic ranking in India and US (University of Madras -Chennai, India; All India Institute of Medical Sciences - New Delhi, India; UT Southwestern Medical Center -Dallas, TX, US; LSH Health Sciences Center, Shreveport, LA, US and University of Pittsburg School of Medicine, Pittsburgh, PA, US). Sivakumar served as a faculty member at the medical / health sciences sectors at the universities in the US, Caribbean and Vietnam. Currently, he is a faculty member of King Faisal University (College of Applied Medical Sciences), KSA. He has also served as a consultant for many concerns in foreign nations; director of pharma and education management agencies; and brand ambassador of a corporate sector in India.



INFLUENCE OF ANTHROPIC ACTIVITIES ON THE DEGRADATION OF THE QUALITY OF SURFACE WATERS: CASE OF THE RHUMEL WADI (NORTHEAST ALGERIA)

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Abstract:

Water is a major issue for the needs of living beings. In recent years it has become one of the major concerns of the world and especially of countries with arid and semi-arid climates. The sub-watershed of Oued Rhumel occupies the upstream part of the watershed Kebir-Rhumel, it covers an area of about 2241 km². It is considered as one of the most important hydrological basins of the Algerian North-East. Its geographical location, its water capacities, its agricultural and industrial characteristics, makes it vulnerable to pollution. The water resources of this wadi are exposed to strong anthropic pressures caused by the development and extension of agricultural activities as well as industrial and domestic. To determine these physico-chemical characteristics we proceeded to a sampling campaign of surface waters. The results obtained show a high conductivity marked at station S4 (1646 $\mu\text{s}/\text{cm}$), and very high concentrations of ammonium (15.06 mg/l), nitrite (2.49 mg/l) and phosphate (7.91 mg/l) exceeding the standards of potability. The highest levels of metallic elements are recorded in the downstream part of the sub-basin, which would be linked to wastewater discharged directly, without prior treatment.

Keywords: wastewater, water, pollution, Oued Rhumel, physico-chemical.

Biography

Fouzi Hizira is currently PhD student in hydrogeology at the Geological Engineering Laboratory (LGG), Department of Earth and Universal Sciences, Faculty of Natural and Life Sciences, Mohamed Seddik Benyahia University - Jijel (Algeria). My thesis topic is titled "Spatial and temporal characterization of water and sediments of the Kébir-Rhumel Wadi facing pollution problems" under the supervision of Dr. Krika A and Dr. Kessasra F.



STUDY OF THE METALLIC CONTAMINATION OF THE SURFACE SEDIMENTS OF THE OUED RHUMEL (NORTHEAST ALGERIA)

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Abstract

The contamination of sediments by metallic trace elements following the various anthropic discharges draw the attention of scientists and managers, because of their persistence in the environment and the danger they present for water, living species and for human health. The objective of the present study is to evaluate the level of polymetallic contamination of the sediments of Oued Rhumel considered as one of the most important water resources in North-East Algeria. It is subject to very high demographic and industrial pressures. The latter affect the wadi by different types of pollutants among which the TMEs. Four sediment sampling stations were systematically selected from upstream to downstream of the wadi. Four TMEs (zinc, copper, lead, cadmium) were measured using an atomic absorption spectrometer. The results of this study reveal a spatial variability of metal contents analyzed along the wadi, they are of the order of: 44.53 µg/g for Cu, 0.86 µg/g for Cd, 169.73 µg/g for Zn and 85.63 µg/g for Pb and which always remain higher than the standards. This assessment shows that the sediments of this watercourse present a significant toxicity risk for the living organisms of this aquatic system. This risk increases when sediments are resuspended by natural phenomena and/or by human activities.

Keywords: metals, Contamination, Sediments, Oued Rhumel, Algeria.

Biography

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

Technical Session C1

SESSION (E):

RESOURCES AND WASTES MANAGEMENT AND RECYCLING

SESSION (F):

**SOCIAL-ECOLOGICAL SYSTEMS RESEARCH FOR MONITORING
SUSTAINABLE DEVELOPMENT:**



MAIN ECONOMIC FEATURES OF FRANCE BETWEEN 2019 AND 2023

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Abstract:

The study overviews the main economic variables as features of France between 2019 and 2023, naturally the data concerning 2023 are estimated. The main variables which are focused on by the study concern the real GDP, domestic demand, private consumption, public consumption, gross fixed investment, gross national savings, gross domestic investment, general government balance as budget and general government gross debt in percent of GDP. Also, the study emphasizes the employment issue based on the Employment, and Unemployment rate. The balance of payment in current account and trade balance of goods and services based on the export and import conditions contribute to the main economic conditions of the France economy. According to the above-mentioned economic variables the role and importance of France can be characterised by foreign direct investment as net balance and the net international investment position in percent of GDP of France. The statistical methods are wide side needed for discovering the main correlations among the different economic variables. The public financial issues have recently been going wrong in France which can be proofed that the negative general government balance as budget increased from 3.1% in 2019 to 5.3% in 2023 and the general government gross debt increased 97.4% in 2019 and 112% in percent of GDP. The unemployment decreased from 8.4% in 2019 and to 7.6% in 2023, which decrease was little measure than the level required by the policymakers. It can be summarised that the French economy has not been strengthened for the latest period from point of view of public financial conditions and net international investment position. The solution is for escaping from the negative economic trends to increase the innovative investment and to strengthen the international economic conditions of France.

Keywords: domestic demand, employment, general government balance, general government gross debt, international economic conditions, private consumption

Biography



Sándor J. Zsarnóczai CSc, in 1991 economic sciences, Hungarian Academy of Sciences, Budapest and Dr. of University, World Economics, Budapest Corvinus University of Economics. In 2017 Habilitate Doctor, in social sciences, in Management and Business Administration, Kaposvár University. From 1987 work at Szent István University in Gödöllő. From 2017 work at Obuda University. Participation at Doctoral School. Research areas: Economics, EU Study, Regional economics, Environmental economics. He published 220 publications with 260 independent citations, of which 200 foreign language citations.

His publications were published in Arab, English, Spanish, Russian languages. International scientific conferences in Turkey, Canada, Moldavia, Czech Republic, Slovakia, Lithuania, Romania. Research project in Finland, Sweden, Denmark, Italy, Spain, France.

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



RECOVER SCANDIUM ELEMENT FROM HUNGARIAN BAUXITE RESIDUE: TREASURE FROM THE WASTE

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Abstract:

The aim of this study was to recover Sc as the main product and Fe as a by-product from Hungarian bauxite residue/red mud (RM) waste material by solvent extraction (SX). Moreover, a new technique was developed for the selective separation of Sc and Fe from real RM leachates. The presence of high Fe content (~38%) in RM makes it difficult to recover Sc because of the similarity of their physicochemical properties. Pyrometallurgical and hydrometallurgical methods were applied to remove the Fe prior to SX. Two protocols based on organo-phosphorus compounds (OPCs) were proposed, and the main extractants were evaluated: bis(2-ethylhexyl) phosphoric acid (D2EHPA/P204) and tributyl phosphate (TBP). The results showed that SX using diethyl ether and tri-n-octylamine (N235) was efficient in extracting Fe(III) from the HCl leachate as HFeCl_4 . Over 97% of Sc was extracted by D2EHPA extractant under the following conditions; 0.05 mol/L of D2EHPA concentration, A/O phase ratio of 3:1, pH 0–1, 10 min of shaking time, and a temperature of 25 °C. $\text{Sc}(\text{OH})_3$ as a precipitate was efficiently obtained by stripping from the D2EHPA organic phase by 2.5 mol/L of NaOH with a stripping efficiency of 95%. In the TBP system, 99% of Sc was extracted under the following conditions: 12.5% vol of TBP, an A/O phase ratio of 3:1, 10 min of shaking time, and a temperature of 25 °C. The Sc contained in the TBP organic phase could be efficiently stripped by 1 mol/L of HCl with a stripping efficiency of 92.85%.

Keywords: Scandium, D2EHPA, TBP, Bauxite residue, Diethyl ether

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 Sustainability Solutions Research Lab, University of Pannonia, Veszprem, Hungary.



HYDROMENTALITY OF THE REGION OF CHENNAI, INDIA: SOCIAL-ECOLOGICAL INSIGHTS FROM AN IWRM PERSPECTIVE

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Abstract:

Accessibility to water to all, particularly in dense urban situations is of concern in many countries the world over. Recent literature specifies 'hydropsychological' and 'hydrosocial' turns to water related attributes of human living. In this paper, we have approached the 'hydromentality' (which pertains to the water-related administration) of the city of Chennai, India, and the implications of this term over a chronological extent. This becomes significant in our pursuit of sustainability in terms of urban living and water management. While urban water supply determines indicators of community well-being, the well-being of the ecosystem is an offshoot of several other factors. These include land and water management and inter-disciplinary approaches to real-world situations like climate change effects, water pollution, loss of biodiversity, lack of adequate housing resulting in the urban poor occupying land associated with water bodies. This paper examines the situation in hand, in Chennai, India and offers suggestions and solutions based on knowledge from other cases, experience of humanities/ engineering and social sciences experts' literature.

Keywords: Hydromentality, hydrosocial, hydropsychology, Chennai, Urban water supply, IWRM

Biography

Mythili MADHUSUDHAN is a PhD Student



THE MIGRATION OF POLLUTANTS INTO THE SOIL

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Abstract:

The problems of soil pollution are common nowadays; the presence of pollutants is a problem of toxicity when these pollutants migrate into the soil. The objective of this study is to optimize depollution processes in the context of studies on soil contamination by hydrocarbon pollutants. Many non-aqueous organic liquids (NAPLs "No Aqueous Phase Liquids") are used in large quantities by many industries worldwide. Unfortunately, because of their use, these liquids are among the most widespread pollutants in soil and groundwater. Unfortunately, it is extremely difficult to clean up underground water due to their relative inaccessibility, their large volume, and flow slowly. Which is why the pollution of groundwater can cause a very serious ecological damage and long-term, especially because the pollutant removal takes times. In the context of polluted sites, numerical modeling is a tool for understanding the behavior of contaminants in the subsurface and to predict their future in space and in time. The work consists in reproduce by simulation; some physical phenomena frequently encountered in practice and identify the parameters that govern them. To do this, we studied the problem on a reduced and through the laws of physical similarity model; the results can be extended to real applications.

Keywords: *Groundwater, pollution, flow, environment, numerical simulation*

Biography

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MANAGEMENT METHODS AND CHALLENGES FOR DISTILLERY SPENT WASH COMPOSTING: A COMPREHENSIVE REVIEW

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Abstract:

Distillery spent wash, a by-product of the alcoholic beverage industry, is an organic waste that poses significant challenges for its management due to its acidity, high organic load, and notable content of polyphenols, macronutrients, micronutrients, and heavy metals. In Europe, around sixteen billion liters of distillery waste is generated annually, and its eco-unfriendly disposal can cause severe environmental and health impacts. Composting is a viable management strategy option to treat and manage the distillery slop, promoting the recycling and stabilization of the organic matter and nutrients present in this type of material. The review examines different composting methods, such as traditional composting, vermicomposting, and co-composting, along with their benefits and drawbacks. To optimize composting effectiveness, various materials such as sewage sludge, vinasse, green and animal manure, inorganic amendments, bagasse, filter cake, bio-inoculation, straw, and municipal solid waste, among other agro-food and animal bio-wastes, can be used as a source of nitrogen and microorganisms. Also, the usage of different materials and mixtures aims to enhance the composting process, increasing the degradation rate and the quality of the compost. The challenges of distillery spent wash composting are also covered in the paper and are mainly due to its characteristics, including high salt content, low nitrogen-to-carbon ratio, low pH, and potential phytotoxicity. The paper concludes that composting distillery spent wash is a feasible, effective, and sustainable waste management solution for recovering valuable nutrient resources and producing a stable nutrient-rich organic soil amendment. The produced compost can improve crop yields, nutrient absorption by plants, plant biomass, and heavy metal adsorption in the growing media and it might contribute to soil properties, losses, and restoration. The review provides valuable insights into the current state of distillery spent wash composting and recommends future research directions to improve efficiency and expand potential applications.

Keywords: *composting, distillery spent wash, vermicomposting, co-composting, organic waste*

Biography



Lara Rúbia, Brazilian and 3-year Ph.D. candidate in Environmental Sciences at the Hungarian University of Agriculture and Life Sciences. B.Sc. in Environmental Engineering at UFU, Brazil, researched the Application of Ecosystem Services on a Landfill's Environmental Assessment. In 2014, got a scholarship for an exchange program at the University of Montana, USA and a summer internship at Cornell University focused on Sustainable Bioenergy. After graduating, she got a scholarship for a M.Sc. in Environmental Science at ELTE, Hungary where she started researching Pálinka waste composting which is still her Ph.D. project, aiming to improve the technological conditions for Pálinka distillery mash composting.



THE LEVEL OF POLYCYCLIC AROMATIC HYDROCARBONS (PAHS) IN THE MAIN WATER BODIES IN IRAQ: AN UPDATE STATUS

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Abstract:

The concentration of Polycyclic aromatic hydrocarbons (PAHs) in the water and sediment of the Euphrates and Tigris rivers has been studied. High molecular weight PAH (5–6 rings) predominated in water and sediment samples collected during the two largest campaigns in both rivers at multiple locations. The diagnostic ratios of PAHs suggest that most of the PAH pollution originated from the combustion of petroleum products. Based on sediment quality guidelines (SQGs), the majority of sites exhibited a range of probable biological effects for the majority of PAH concentrations in all sediment samples. The preponderance of the 16 PAHs detected in both rivers' water and sediment samples was derived from pyrogenic sources. The estimated value of the incremental lifetime cancer risk (ILCR) indicated a high risk of adverse health outcomes, including cancer. The findings require immediate attention from the environmental authorities of the Western Asian nations that share this vital water source.

Keywords: Polycyclic aromatic hydrocarbons, water, sediment, Euphrates, Tigris

Biography



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REMOVABILITY OF MEDICINES AND MEDICINE DERIVATIVES FROM WASTEWATER

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Abstract:

In wastewater treatment, organic micropollutants that pose an environmental and health risk are receiving more and more attention. They are difficult to break down biologically, so they often pass through traditional wastewater treatment systems unchanged. They can have harmful effects on the biosphere: they can be toxic or induce the development of resistant pathogens (e.g. effect of the presence of antibiotics). The concentration of antibiotics in wastewater is low ($\mu\text{g/L}$ and ng/L) to destroy the bacteria in the wastewater or inhibit their reproduction. At the same time, this environment is favorable for the development of resistance, so in addition to hospitals, wastewater treatment plants are also hot spots to the appearance of multiresistant strains. In recent decades, many technological innovations have appeared to remove the micropollutants, but they can mainly be applied by installing a quaternary treatment stage, which has a high investment and operating cost. In the majority of wastewater treatment plants, only the activated sludge treatment unit is currently available. With the help of activated sludge, only a few medicine molecules can only be broken down metabolically (e.g. ibuprofen, diclofenac). To break down medicine molecules with higher probability, the bacteria of activated sludge can be induced. During cometabolic processes, bacterial enzymes are able to randomly break down molecules with complex structures, even micropollutants (e.g. medicines). For the bacteria's enzymes to have a higher probability of breaking down the medicine molecules, we feed them thoroughly with their natural substrates, thereby increasing the chance of random breakdown. By taking advantage of this natural process, we can help the biological transformation of medicine molecules during wastewater treatment.

Keywords: wastewater, medicine derivatives, antibiotic resistance, cometabolism, quaternary treatment

Biography

Csenge NAGY-MEZEI is a PhD student at Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary



CONTAMINATION EVALUATION AND ENVIRONMENTAL RISKS OF TRACE METALS FROM PHOSPHATE WASTEWATER IN GAFSA METLAOUI ORE

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Abstract:

The phosphate industry is considered as a key economic sector in many countries including Tunisia. However, it is a major source of environmental pollution and can also cause human health damage due to the discharge of huge volume of potentially toxic heavy metals and hazardous wastewater into the ecosystem. The continuous discharge of the phosphate wastewater into the environment is of serious eco-toxicological concerns and requires urgent attention for the protection of environment and human health. In this work, we investigated the different aspects of heavy metals discharged by phosphate industry as hazardous materials with special focus on their toxicity, and bio-accumulative potential. The bioaccumulation of these elements and its environmental risks on Radish, Lentil, Durum wheat, Fenugreek are discussed. A geochemical characterization was achieved by analyzing phosphate ore, for trace metals (Cd, Cu, Zn, Pb). This characterisation has revealed that the samples are highly enriched with metals. Pollution indices were evaluated, results showed that samples are ranging between moderately and very strongly polluted with heavy metals. Heavy metal toxicity increases with the augmentation of the effluent concentrations. Therefore, the results of the present work are useful and encouraging for the development of sustainable agricultural systems. Finally, waste management's legislation should be established in Gafsa phosphate industry in order to control waste.

Keywords: Phosphate Processing Wastewater, mineral composition, microbiological composition, phyto-toxicity, germination tests phosphate, heavy metals, environmental risks

Biography



RELATIONSHIP BETWEEN SOIL RESPIRATION AND APPLICATION OF FUNGICIDES IN AGRICULTURAL LAND

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Abstract:

Many of these agrochemicals can negatively affect the populations and functions of soil microorganisms. Decrease in bacterial and fungal biomass can lead to decrease the activity of soil respiration, affect the soil enzymes and microbial diversity and decline the carbon and nitrogen turnover rates. Microbial metabolic activity in soil is usually measured based on the catabolic respiratory activity since respiration is an important process in the global carbon cycle and of critical importance in the partitioning of energy in soil. Consumption of O₂ and liberation of CO₂ are maintained by aerobic respiratory processes and these events lead to a loss of C from ecosystems to the atmosphere. Organic matter and plant exudates are transformed, and respiratory processes of microorganisms mineralize nutrients in the soil. One of the most important functions of soil microorganisms is the turnover of organic matter that happens mainly by the degradation of plant and animal debris and is reflected in the soil fertility and agro-environmental quality. As toxic fungicide residues may persist in agricultural lands and cause environmental pollution. The soil microbial activities can be evaluated by the microbial respiration which can be measured by the O₂ consumption, but the CO₂ emission is considered more sensitive. Soil microbial respiration is considered one of the most suitable biosensors because it reflects the cycling of organic matter by the soil microorganisms and is used to measure the changes in the heterotrophic microbial activity caused by fungicide residues. The effects on the CO₂ emission have been used as bioindicator of the fungicide effects on soil microbial activity. The goal of the present study was (1) to compare the impact of different pesticides on soil microbial respiration under field conditions, and (2) to characterize the recovery time of soil microbial respiration after pesticide application. Therefore, a mesocosm experiment was performed to ascertain the dissipation and impact of seven fungicides (Zineb 20%, Ridomil, Carbendazim, Iprodione, Triazole, Mancozeb and Metalaxyl) on soil (i.e., basal) respiration of two brown forest soils (sources: Gödöllő and Budapest). The value of soil respiration in the upper 10 cm soil layer was determined after fungicides applied at different concentrations. The soil respiration parameter was followed during 28 days after soil treatment. The CO₂ emitted by the microbial respiration was trapped in NaOH (0.1 M) which was changed each two hours during the first 10 h, and 1, 3, 5, 7, 14 and 28 days after the treatments. The synthetic Carbendazim caused 16.4% and 2.6% inhibition of the respiration, respectively of the Gödöllő brown forest soil and Budapest brown forest soil, respectively. The analysis of obtained data demonstrated high variability of the values of CO₂ emissions for two soils caused by the applied fungicides. In this study, recommended field dose of fungicides applied to the soils had no negative effect on soil microbial respiration in two brown forest soils. In addition, higher doses of these fungicides generally enhanced soil microbial activity. However, increasing concentrations of moderate and high doses of Carbendazim and Iprodione significantly inhibited soil respiration. The effects of the seven fungicides at moderate and high concentrations were additive throughout the entire incubation time.

Keywords: Fungicides, soil respiration, incubation time, carbon dioxide emissions

Biography



Prof. Dr. Hosam Bayoumi Hamuda is working at Óbuda University. He is Environmental Microbiologist and Soil Biotechnologist. He is a member of Environmental Sciences Doctor's School (Hungarian University of Agriculture and Life Sciences) and Material Science and Technology at Óbuda University. He was a supervisor of many PhD students as well as the Leader of Agricultural and Environmental Microbiology and Soil Biotechnology PhD Program. also, a leader of Microbial Biotechnology MSc Program dealing with the interactions between the microbiomes and the environment for increasing soil quality and saving the soil from pollutants. His investigations are on the role of waste management, soil quality and fertility, crop production and environmental impacts related to the application of organic wastes; measurements soil microbial biomass and enzymatic activities in wastewater sludge amended soils; and roles of engineered metal oxide nanoparticles in biosphere.

Research Interest: Waste Management; Environmental Biotechnology; Soil: Protection; Sustainable; PGPR and Microbial Inoculants; Gut Microbiomes and Human Health as well as Modern Biology. Prof. Dr. Hosam Bayoumi Hamuda was invited as visiting professor to the 13th Flanders (Belgium) Inspires International Visitors. He is the broad editorial member and reviewer of many international journals as well as a member of many organizing committees of various international conferences also, acted as plenary or keynote speaker. Prof. Dr. organize annually and. Hosam Bayoumi Hamuda is the president of the International Council of Environmental Engineering Education and annually he organizes two International Meetings, one in November in term of ICEEE, and the second in May as International Symposium.



A NEW MICRO-COMPOSITE-BASED COPPER-DOPED MOLLUSCA SHELLS@ALGINATE BEADS FOR HIGHLY PESTICIDE SORPTION FROM WASTEWATER

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Abstract:

The engineering of a novel biocomposite based on *Cerastoderma Edule* shells doped with copper and alginate (Ce-Cu@Alg) forming hydrogel beads was used for batch and dynamic adsorption thiabendazole (TBZ) pesticide from water. The prepared biosorbent was analyzed by various characterization techniques such as scanning electron microscopy (SEM), X-ray diffraction analysis (XRD), Brunauer-Emmett-Teller analysis (BET), and energy dispersive spectroscopy (EDS), thermogravimetric and differential analysis (TGA-DTA). The results of the TBZ batch biosorption by Ce-Cu@Alg composite showed that the Langmuir model was the most adequate to describe the adsorption process, with a maximum adsorption capacity value of 21.98 mg/g. Moreover, the adsorption kinetics were adjusted by the pseudo-second-order model. The optimal conditions determined by the RSM approach coupled with the CCD design were 100 ppm of initial TBZ concentration, a Ce-Cu@Alg beads dose of 6g/L and a contact time of 180 min for maximum removal of 83.42 %. On the other hand, the TBZ sorption on a fixed bed of Ce-Cu@Alg beads was effective at high column height, low effluent flow and low solution concentration. The Thomas model was best fitted to the kinetic data. This study shows the possibility of using this new hybrid biocomposite in the industrial sector to treat large effluent volumes.

Keywords: Adsorption, Biocomposite, Pesticide, *Cerastoderma Edule*, Wastewater, Response surface methodology (RSM).

Biography

Khalid AZIZ is a PhD student at Laboratory of Biotechnology, Materials and Environment, Faculty of Sciences, Ibn Zohr University, Agadir, Morocco



NEW GREEN SYNTHESIS OF REDUCED GRAPHENE OXIDE AND THEIR USE FOR COLUMN ADSORPTION OF PHENOL FROM OLIVE MILL WASTEWATER

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Abstract:

Verbena officinalis was used as a green and reducing agent in a novel synthesis of reduced graphene oxide (RGO). RGO was encapsulated in sodium alginate (SA) by cross-linking to form SA-RGO beads. These SA-RGO beads were used to treat wastewater from olive oil mills (OMWW). This wastewater is rich in phenolic compounds that inhibit biological degradation and are toxic at high concentrations. Freshly prepared SA-RGO beads were characterized by scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), X-ray diffractometry (XRD), BET surface analyzer, and Fourier transform infrared spectroscopy (FTIR). In addition, the organic compounds of verbena were determined by high-performance liquid chromatography (HPLC) to reveal the reduction mechanism of graphene oxide (GO). Finally, batch and fixed bed column adsorption tests were performed to evaluate the performance of SA-RGO beads. Kinetics, isotherm models, and adsorption thermodynamics show that the pseudo-second-order and Freundlich models best describe phenol adsorption and endothermic reaction. On the other hand, the Thomas and Yoon-Nelson models satisfactorily describe fixed-bed column adsorption. The optimized adsorption parameters were 3.68 g L⁻¹ adsorbent dose, pH 4.0, 135 min adsorption time, and 25°C temperature. The SA-RGO beads and regeneration experiments with 0.5 M hydrochloric acid (HCl) were reused in fixed-bed reactors. The results showed a phenol adsorption capacity of 994 mg g⁻¹ for an initial concentration of 4000 mg L⁻¹.

Keywords: Biosorbent; Olive oil mill wastewater; reduced graphene oxide; batch and fixed bed column adsorption; Phenolic compounds.

Acknowledgment: This work was supported by the Morocco-Tunisian bilateral scientific cooperation project (20 /PRD-MT-02).

Biography

Imane HAYDARI is a PhD student at Laboratory of Water, Biodiversity, and Climate Change, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakech, Morocco.



TRANSFORMING WASTE INTO VALUE: DEVELOPING ACTIVE PACKAGING MATERIALS FROM OLIVE POMACE BIOPOLYMERS

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Abstract:

In recent years, the development of active packaging materials has gained significant attention due to their ability to prolong the shelf-life of food products and enhance their safety. In this study, we aim to develop active packaging materials using biopolymers extracted from olive pomace through electrospinning. Olive pomace is a waste product of olive oil production, rich in biopolymers such as cellulose, hemicellulose, and lignin. These biopolymers have excellent properties such as biodegradability, biocompatibility, and low cost. Therefore, electrospinning is a versatile and efficient method for producing nanofibrous materials with high surface area and porosity, making them suitable for various applications, including active packaging. In this study, we extracted biopolymers from olive pomace using a chemical extraction method and characterized them using FTIR, XRD, and SEM techniques. Then we will use electrospinning to produce nanofibrous mats from the extracted biopolymers and characterize them for their morphology and mechanical properties. Finally, we will evaluate the antimicrobial and antioxidant properties of the active packaging materials using standard tests. Overall, this approach can provide a sustainable and cost-effective food packaging solution while reducing the environmental impact of olive pomace waste.

Keywords: biopolymers, biodegradability, electrospinning, food packaging, nanofibrous, olive pomace:

Acknowledgments: This work was supported by the Morocco-Turkish bilateral scientific cooperation project (CNRST/TUBITAK., 23/24).

Biography

Ghizlane AKHOUY is a PhD student at Laboratory of Water, Biodiversity, and Climate Change, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakech, Morocco.

Poster Sessions

(A, B AND C)



COMPARISON OF PEDOLOGICAL CHARACTERISTICS OF TWO SOLAR PARKS FOR PLANNING BIODIVERSITY MANAGEMENT

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Abstract:

In 2015, the UN adopted the sustainable development agenda and 17 Sustainable Development Goals until 2030. The European Commission is committed to reach these goals and therefore places the Green Agreement at the scope of its efforts. The "Biodiversity" and "From producer to consumer" strategies form part of this policy package. In recent years the Hungarian photovoltaic installed capacity turned into an exponential growth. Large-scale solar farms in Hungary are almost exclusively installed in open fields, areas taken from agricultural production, reducing their biological activity. However, after proper planning and implementation solar parks can improve local environment and biological diversity. In our research, we examine the pedological background that can help to carefully choose native plant species to improve the ecological potential and biodiversity of these areas. Soil samples were taken from 0-10, 10-20, 20-40 and 40-60 cm depths along the fences of two solar parks, on a nearby forest and a grassland, and on a nearby arable field. Samples were then analysed with a Near Infrared Scanner. Statistical analyses yielded interesting results, e.g., in the 0–10 cm layer only the P and K content was significantly different between the forest and the grassland while in the 10–20 cm layer soil organic matter, organic carbon, total and potentially mineralizable N, Ca, Mg and cation exchange capacity is all significantly higher in the grassland. This data can help to choose the potential plant species to be reintroduced on the solar park area.

Keywords: renewable energy, biodiversity, management plan, soil, comparison

Biography



Csaba Centeri is an associate professor (Dept. of Nature Conservation and Landscape Management, Szent István Campus, Hungarian University of Agriculture and Life Sciences, Gödöllő). He has published 2 D1, 21< papers in Q1 and Q2 journals and has been serving as a chief editor in the Hungarian Journal of Landscape Ecology, guest editor of special issues in the journal of Water, Sustainability, Forest and Remote Sensing. His main research interest is soil water erosion, soil erosion modelling, land-use change, ecosystem services, soil-plant, soil-wildlife and other soil-zoology interactions, with special emphasis on nature conservation and landscape related issues.



EFFECT OF HEAVY METALS AND TEMPERATURE ON NITRIC OXIDE AND CARBON DIOXIDE EMISSIONS FROM CULTIVATED SOIL

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Abstract:

Agricultural activities are the largest source of nitric gases and carbon dioxide emitted from the soil, which result from the excessive use or misuse of nitrogen-containing fertilizers, which is the increase in the rate of photosynthesis in plants that results from an increase in levels of carbon dioxide in the atmosphere, fertilization with nitrogen and organic matter controlling the accumulation of nitric oxide and carbon dioxide in soil and their release to the atmosphere in closed laboratory model experiments, the headspace gas content of closed glass vessels of soil samples was analysed, the nitric oxide and carbon dioxide concentration of gas samples was analysed by chemiluminescent and gas chromatographic methods, the production of gases were significantly depending on the soil nitrogen and carbon ratio

Keywords: NO and CO₂ emission; heavy metal; microcosm; temperature.

Biography

Dr. Abdousalam A. ALGAID is one of the staff members of Sabha University, Faculty of Science, Department of Microbiology, Sabha, Libya



SOLAR IRRADIANCE MEASUREMENT IN A LANDFILL SITE

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Abstract:

In the last few decades, about fifty modern municipal landfill sites have been established in Hungary. Considering the 5, 10 or 15 km vicinity of these municipal landfills, the 24%, 44% and 60% of the total population are found here within the 16%, 37% and 53% of the villages and cities, so a large, decentralised energy system could be made by using all landfills. In the frame of a research on the complex energy utilization of the MSW landfill hills (gas, solar and wind units), solar intensity measurements have been started on the top of the Pusztázámor (~ 60 m high, 1 stage) landfill hill. In parallel, some independent data sets are processed from meteorological station data. Using the measured and computed data, a local prediction method is calibrated.

Keywords: *pyranometer, solar intensity meter, octa, cloudiness, MSW landfill*

Biography



She completed habilitation in 2005 at BUTE. She is the Head of HBM Research Centre Óbuda University. Research interest: Granular matter, Coupled consolidation models, Applied Math, Inverse problem solution and reliability testing, Unsaturated Soils, In situ and lab testing evaluation software (eg CPT dissipation tests, laboratory oedometric relaxation and compression test, water retention curve), Modeling of municipal landfill waste and energy utilisation of the landfill gas.



WIND VELOCITY MEASUREMENT IN A LANDFILL SITE

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Abstract:

In the last few decades, about fifty modern municipal landfill sites have been established in Hungary. Considering the 5, 10 or 15 km vicinity of these municipal landfills, the 24%, 44% and 60% of the total population are found here within the 16%, 37% and 53% of the villages and cities, so a large, decentralised energy system could be made by using all landfills. In the frame of a research on the complex energy utilization of the MSW landfill hills (gas, solar and wind units), wind velocity measurements have been started to be made partly on the Pusztazámor ~ 55 m high landfill hill (surface, slopes, the top with of the with a 18 m high pole). A nearby state meteorological station is also used for the wind velocity measurement. The data are processed, and a local prediction method is calibrated. The first results are in full agreement with the meteorological data available showing that at the relative altitude of 100 m excellent wind energy potential does exist nearly everywhere in Hungary, practically independently of the geographical location. Therefore, wind energy units can be advantageously installed on municipal solid waste landfill hills practically regardless of geographical location. The solar panels are suggested to be placed parallel to the landfill slopes.

Keywords: wind velocity distribution, anemometer, wind turbine

Biography



Not more 100 work She completed habilitation in 2005 at BUTE. She is the Head of HBM Research Centre Obuda University. Research interest: Granular matter, coupled consolidation models, Applied Math, Inverse problem solution and reliability testing, Unsaturated Soils, In situ and lab testing evaluation software (eg CPT dissipation tests, laboratory oedometric relaxation and compression test, water retention curve), Modeling of municipal landfill waste and energy utilisation of the landfill gas.



SOIL PROFILING FROM SHORT DISSIPATION CPT DATA

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Abstract:

Major part of the in-situ dissipation tests of CPT are not used in the lack of proper evaluation methods. The wider aim of the research is to get more information from the dissipation tests by using mathematically precise evaluation methods. Especially, the short dissipation tests performed when the steady penetration is stopped for a few second long technical break in case of the S832 equipment, in every 50 cm, are not evaluated even though the 50 cm frequency may have given sufficient information since the affected zone extends several tens of diameters away. To elaborate an evaluation method for the simple f_s or simple q_c test, at first a data set measured in the Szeged and Debrecen test sites were statistically analysed. According to the results, the mean dissipation curves were dependent on the soil type differently for f_s (controlled by the effective stress on the shaft) and q_c (controlled by the total stress on the tip). The time dependency of the mean dissipation curves were explained here by a newly suggested consolidation model. The paper presents these results and compares them with some recently published DMTA short dissipation test data showing similar pattern.

Keywords: dissipation, cone penetration test, consolidation, constitutive law, dynamic amplifier

Biography



Not more 100 work She completed habilitation in 2005 at BUTE. She is the Head of HBM Research Centre Obuda University. Research interest: Granular matter, coupled consolidation models, Applied Math, Inverse problem solution and reliability testing, Unsaturated Soils, In situ and lab testing evaluation software (eg CPT dissipation tests, laboratory oedometric relaxation and compression test, water retention curve), Modeling of municipal landfill waste and energy utilisation of the landfill gas.



A PARAMETER IDENTIFICATION IN RELATION TO THE WATER RETENTION CURVE AND THE GRADING CURVE OF SANDS

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Abstract:

A well-known method (Wang et al, 2020) is applied for computing SWRCs of unsaturated soils from the gradation curve. The POSD is obtained from gradation curve, initial void ratio or porosity and specific gravity of soil grains which is modified to account for the imposed volumetric strain assuming that the change in pore diameters is proportional to current diameter. The parameter alpha of this method is identified using measured SWRC data and the fitted van Genuchten model. In addition, an approximate formula is used to compute the suction of sands from the grading curve using relative density and the minimum – maximum dry density chart interpolated on the grading entropy diagram from data measured by Lőrincz. The result support the applicability of the approximate methods.

Keywords: unsaturated soil, grain size distribution, pore size distribution, granular matter.

Biography



She completed habilitation in 2005 at BUTE. She is the Head of HBM Research Centre Obuda University. Research interest: Granular matter, Coupled consolidation models, Applied Math, Inverse problem solution and reliability testing, Unsaturated Soils, In situ and lab testing evaluation software (eg CPT dissipation tests, laboratory oedometric relaxation and compression test, water retention curve), Modeling of municipal landfill waste and energy utilisation of the landfill gas.



EFFECT OF SOLAR DRYING ON PHENOLIC PROFILE AND ANTIOXIDANT ACTIVITY OF FIGS (FICUS CARICA) AZANJAR VARIETY

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Abstract

Figs are a bioresource of great importance. The surplus of figs production is usually valorized by solar drying into dry figs. This practice could induce profound changes on the phenolic composition. The present work aims to study the effect of drying of Azanjar figs on the phenolic profile and antioxidant activity. The determination of phenolic compounds (total polyphenols, total flavonoids and total anthocyanins) was performed by colorimetric methods and the phenolic profile by HPLC Waters 2695 with a PDA detector. Antioxidant activity was evaluated by ABTS+ radical scavenging, DPPH radical reduction, copper reduction (CUPRAC) and ferric reducing power (FRAP) methods. The results obtained showed very high contents of total polyphenols, total flavonoids and total anthocyanins in both fresh and dried figs. The main phenolic compounds detected in fresh and dry figs are 19 including 9 phenolic acids and 10 flavonoids and the impact of solar drying was negative on the content of phenolic compounds. For the antioxidant activity, it was shown that fresh figs had a higher antioxidant activity than dry figs, which indicates that solar drying could induce the decrease of phenolic compounds contents and consequently a clear decrease of the antioxidant activity. At the end of this study, it is recommended to propose practical solutions allowing the preservation of the phenolic content of figs during their drying.

Keywords: solar drying, phenolic profile, antioxidant activity, ficus carica azanjar variety

Biography



Dr. Farida KEHAL is a research professor at the Institute of Nutrition, Food and Agro-Technologies at the University of Constantine 1, Algeria. Dr. KEHAL received her PhD in Food Science from the University of Constantine 1, Algeria, and has published numerous articles in peer-reviewed journals. She is also an experienced teacher, having taught courses on food science, nutrition, and food processing at the university level. Dr. KEHAL is committed to advancing the field of food science and improving the nutritional value and safety of our food supply.



IMPACT OF SOIL TILLAGE AND FERTILIZATION ON ARBUSCULAR MYCORRHIZAL FUNGI PRODUCED GLOMALIN

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Abstract:

The optimization of agricultural land use managements contributes to both yield and soil security. Soil organic matter stock fundamentally determines soil fertility, it affects aggregates, water storage, chemical properties, protective functions of soil and it has an important role in the regulation of many atmospheric constituents. The importance of arbuscular mycorrhizal fungi (AMF) is undoubted in facilitating carbon conservation of soils through affecting host plant productivity and through glomalin production. Glomalin produced by AMF hyphae forms a significant part of soil organic carbon. However, intensive fertilization and tillage harm AMF diversity and functions just like glomalin production. The effect of soil management on glomalin (Easily Extracted Glomalin-Related Soil Protein; EE-GRSP) has been examined at sites of three long-term field experiments: (1) NPK fertilization experiment with and without farmyard manure treatments; (2) conventional and organic farming fields (Martonvásár; Hungary) and (3) no-tillage, mouldboard ploughing and deep cultivation (Józsefmajor; Hungary) treatments were tested. There were no significant correlation found between the AMF root colonization parameters and the soil glomalin content. However, close correlations were detected between the soil humus and nitrogen content, the pH and the dissolved organic carbon, the macroaggregate stability and the EE-GRSP. The soil disturbance had the most significant effect on soil EE-GRSP. The soil glomalin were ranged from 0.2 mg/g soil to 0.77 mg/g soil in different long-term experiments. The highest soil glomalin contents were found in no-tillage system and N-fertilized plots. The synthesis of our data could result in a land use effect assessment considering the quantity of soil glomalin. Glomalin is not just a C storage, but it is also a very important soil health indicator. The project was funded by the Eötvös Loránd Research Network (SA-26/2021) and Hungarian Academy of Sciences (FFTNP).

Keywords: soil organic carbon; land use; arbuscular mycorrhizal fungi; glomalin; soil health

Biography

Dr. Tünde TAKÁCS is senior research worker at Institute for Soil Sciences, Centre for Agricultural Research, ELKH, Budapest, Hungary



WATER SUITABILITY FOR IRRIGATION IN THE GUERBES-SANHADJA WETLANDS COMPLEX

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Abstract:

The wetland complex of Guerbes-Sanhadja (north-eastern Algeria), has experienced in recent years a certain economic expansion, particularly agricultural, about 47% of the useful agricultural area marked by several varieties of crops ranging from market gardening to speculative crops, requiring large quantities of water for irrigation purposes, however the swampy areas are the main sources used for irrigation purposes in this practice. It is therefore necessary for this water to have physicochemical properties adapted to plants, particularly the absence of salinity. This study was done to evaluate the status of the swamp's areas quality and its suitability for irrigated agriculture. To achieve this objective, water samples from ten swamps areas water were collected from Guerbes-Sanhadja in February and June of 2016. The water quality of these swamps was estimated from different water quality parameters such as pH and electrical conductivity (EC), the chemical parameters like Na^+ , K^+ , Ca^{2+} , HCO_3^- , SO_4^{2-} , Cl^- , BOD_5 , NO_3^- , NO_2^- , NH_4^+ and PO_4^{3-} . Based on the physico-chemical analyses, irrigation quality parameters like sodium absorption ratio (SAR), percent sodium (% Na), residual sodium carbonate (RSC), permeability index (PI), and magnesium hazard (MH) were calculated. The results showed that the overall concentration of nitrate was very high. About 60 percent of the swampy areas had suitable water quality for chloride, and they had a concentration below the permissible limit for crop irrigation. From the Richards diagram, it is observed that most of the samples from the study area fall in the good to permissible classes for irrigation purpose

Keywords: Algeria, irrigation, residual sodium carbonate (RSC), sodium absorption ratio (SAR), water quality, wetland complex of Guerbes-Sanhadja

Biography

Dr. Sihem HEDJAL is MAB at the Department of Geological Sciences. Mentouri Brothers University. Constantine1, Algiera



INVESTIGATION OF RELATIONSHIP BETWEEN SOIL GLOMALIN-CONTENT AND LAND USE

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Abstract:

The goal of sustainable agriculture is to protect the productivity of the soil as a natural resource, to improve unfavorable conditions, thereby solving the population's food problem. In order to achieve these goals, it is important to carry out continuous monitoring, soil tests, and assessment of the nutrient requirements of cultivated plants. Restoring damage caused by previous inappropriate activities and ensuring conditions close to natural. Through soil-friendly cultivation, erosion, the deterioration of the soil structure, the reduction of nutrients and biodiversity can be prevented, and the unfavorable conditions that have already developed can be reversed. The tests described in the research work contribute to the development of gentle agriculture and point to the effective use of simple and cost-saving methods. The tests were carried out in the case of three cultivation methods with different disturbances, focusing on the content of organic matter, humus, nitrogen and glomalin. Together, these components represent the quality of the soil well. The three treatments were plowing, cultivator and direct seeding tillage. The tested materials also confirmed the beneficial effects of low cultivation separately, and cultivator and direct seeding were the most favorable in each test. Glomalin is little known due to its mycorrhizal origin and its ability to measure soil quality.

Keywords: Soil glomalin-content, land use, sustainable agriculture, simple and cost-saving methods

Biography

Dóra KŐHALMI is Environmental Engineering student at Obuda University, Budapest, Hungary



MODELLING TECHNICAL EFFICIENCY AND PRODUCTION RISK (CASE STUDY: COLD WATER FISH FARMS IN THE KURDISTAN OF IRAN)

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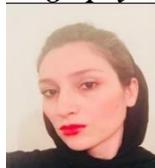
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Abstract:

Due to growing of significant facilities and potentials for producing large amounts of aquatic products It also can be achievable in different regions across the country. Accordingly, the purpose of this study is evaluating the technical efficiency of fish farming units with taking in to consideration of production risk in these farms. Data and information compiled through a questionnaire from 55 units in Palengan area of Kamiyaran city. To achieve the goals, the stochastic frontier model was used, which the production function, risk and inefficiency were estimated simultaneously. The results illustrated that food inputs, labor and fingerlings have a meaningful significant relationship with the amount of fish production. The result of calculating technical efficiency in these units with Considering the risk of production, 73% was obtained, which is influenced by experience, coopting farmers onto committee and access to the markets.

Keywords: *fish farming, production risk, technical efficiency, Kamiyaran, stochastic frontier model*

Biography



She is graduated in Agriculture Economic from University of Tabriz, Iran



IDENTIFICATIONS, GROWTHS, BIOCHEMICAL CHARACTERIZATIONS AND ANTIOXIDANT ACTIVITIES OF THREE BENTHIC DIATOMS FOR APPLICATIONS AS FOOD SUPPLEMENT

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Abstract:

Benthic freshwater diatoms are photosynthetic microorganisms that produce numerous bioactive molecules of interest. These microorganisms constitute an underexploited and unexplored resource in Morocco but could potentially be used for economic development. Our study aimed to evaluate the environmental impact of these microorganisms and explore their potential use in the food supplement industry while examining their food security. In this study, we identified, cultured, and biochemically characterized three benthic diatoms collected from the Ourika and Tassaout river (south and north of Marrakech, Morocco): *Craticula subminuscula* (Manguin), *Nitzschia palea* (Kützing), and *Navicula radiosa* (Kütz). We also investigated their antioxidant activities to determine their potential use in food supplements. After culturing these three species for 15 days, we observed significant growth rates (*C. subminuscula* 0.246 J-1, *N. palea* 0.235 J-1, *N. radiosa* 0.167 J-1), comparable to those of other widely used species in the industry. Furthermore, biochemical analysis revealed that these diatoms are a significant source of protein (29.51-32.68% dry matter) and carotenoids (1.56-4.69 mg/g dry matter), with low concentrations of phenolic compounds and total sugars (less than 0.48 mg gallic acid equivalent per g dry matter for total polyphenols, 2.1 mg quercetin equivalent per g dry matter for flavonoids and 2.53 mg glucose equivalent per g dry matter for total sugars). In addition, the antioxidant capacity study indicated that all three diatoms exhibited antioxidant activity. Our results suggest that these diatoms are an important natural source of proteins and minerals, which could be potentially used in the food industry and human nutrition. However, using these diatoms as a food source requires biosecurity measures to ensure their safety for human consumption and minimal impact on animal and plant life and health.

Keywords: Benthic diatoms, food supplement, mineral elements, proteins, antioxidant activity, biosecurity, environmental health.

Biography



Abdelali El Maallem is a first-year PhD student at the Faculty Polydisciplinary of Taroudant, University Ibn Zohr, Morocco. The theme of his work is evaluate the environmental impact of benthic diatoms and explore their potential use in the food supplement industry, while also examining their food security.

PHYSICO-CHEMICAL AND MICROBIOLOGICAL CHARACTERIZATION OF 4 OLIVE POMACE

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Abstract:

The olive industry, in addition to its main production, which is oil, leaves two main residues, one liquid called margine and the other solid called olive pomace. We are interested in this work to the valorization of these olive pomace by characterizing them. For this we have done physicochemical analysis of olive pomace from several Algerian regions (Jijel, Béjaïa, Skikda, El 'oued) and research from this pomace of different microorganisms with an interest in biotechnology, The results of the physicochemical analyses are consistent with several studies carried out on olive pomace. Microbiological analyses show the biodiversity of the microorganisms present in the olive pomace (a total aerobic mesophilic flore varied between $2.67.10^5$ CFU/ml and $2.75.10^5$ CFU/ml, yeast and mould varied between $2.24.10^5$ CFU/ml and 3.10^5 CFU/ml, lactic bacteria varied between $2.81.10^5$ CFU/ml and $3.17.10^5$ CFU/ml). Based on our study we found that the antibacterial activity of lactic acid bacteria isolated from the olive pomace s is more or less important and that this activity is different from one lactic bacterium to another which may be due to the nature of the inhibiting agent or the species of bacteria selected. We can conclude that the olive pomace tests are very rich in microorganisms and additional studies are necessary in order to identify these microorganisms that can be valued by several methods (biological, thermal, energy, etc.)

Keywords: olive pomace, lactic acid bacteria, antibacterial activity, recovery, waste

Biography



After a DES in biochemistry, Rim Tinhinen MAOUGAL specialized in plant biotechnologies with a magister on production of Rhizobial inoculum then a PhD in cotutelle with Supagro Montpellier France on the adaptation of Phaseolus to low availability of phosphorus. She received the Habilitation to Conduct Research in Science in 2020. Recruited at INATAA freres Mentouri University, Constantine 1 since 2005, she was responsible for master training course in food biotechnology from 2013 to 2019. She Has been part of several national and cooperation projects.



EVALUATION OF COMPOUNDS EXTRACTED FROM OLIVE POMACE GENERATED BY THE TRADITIONAL PROCESS WITH A VIEW TO THEIR VALORIZATION

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Abstract:

Algeria, like other olive oil producing countries, registers each year large volumes of olive waste. Their discharge, without treatment, causes serious problems for both the public health and the environment because of their high load in non-biodegradable organic matter and phenolic compounds. According to the International Olive Oil Council (2003), in the traditional system of olive oil extraction, the processing of 100 kg of olives produces about 40 kg of pomace olive. Their chemical composition varies within wide limits depending on the stage of maturity of the olives and other factors. Their biochemical characterization may open perspectives for their valorization. This study is carried out in this context, with the aim of characterizing of five samples of olive pomace generated by the traditional process and collected from five different regions. The main analyses carried out concerned pH, moisture content, dry matter, mineral matter, organic matter, organic carbon, crude fibre, fat, total polyphenols and pigments (chlorophyll a, chlorophyll b and carotenoids) as well as the antiradical potential. The main results obtained show that olive pomace contains remarkable levels of carotenoids, polyphenols, crude fiber and fat. A significant difference in the regional effect has been observed. Some work has already demonstrated the non-toxicity of these compounds, and trials on the incorporation of fat and carotenoids in food matrices (yoghurt, cookies ...) are to be envisaged.

Keywords: olive waste, traditional system, regions, polyphenols, pigments, fat, valorization

Biography



Malika Barkat is a research professor at the Institute of Food, Nutrition and Agrifood Technologie (INATAA), Frères Mentouri Constantine1 University (Algeria). His area of research is food science. Currently, she is a team leader in the food quality biotechnology laboratory (BIOQUAL). She is the author of several publications: <https://scholar.google.fr/citations?user=9MzIzvKAAAAJ&hl=fr>.



IMPACT OF AGRICULTURAL ACTIVITIES ON GROUNDWATER QUALITY IN COASTAL AQUIFER OF NADOR IN TIPAZA, ALGERIA

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Abstract:

Groundwater is a critical resource for the Wadi Nador small coastal aquifer, providing drinking water and irrigation for agriculture. Unfortunately, anthropogenic factors have led to the degradation of this resource in recent years. Seawater intrusion near the sea coast at 1.5 km has been observed due to overexploitation, climate change, and sea level rise. Additionally, minerals have dissolved, and pesticides, fertilizers, and chemicals have infiltrated groundwater. To better understand the mineralization origin, a study collected and analyzed 19 water samples in October 2016. The study found significant electrical conductivities ranging from 1200 $\mu\text{S}/\text{cm}$ to 4500 $\mu\text{S}/\text{cm}$, indicating the presence of dissolved minerals. The major chemical elements found in the samples, such as chloride, calcium, and nitrates, indicate groundwater degradation. Seawater intrusion caused chloride levels to rise, and nitrate pollution resulted from nitrogen fertilizers' use. The study emphasizes the need to address the problem of groundwater degradation in the Wadi Nador small coastal aquifer urgently. Possible solutions include artificial recharge of the aquifer using treated wastewater or desalinated water, reducing overexploitation, implementing sustainable water management practices, and controlling pollution from fertilizers and chemicals. Regular groundwater monitoring and studies are essential to track problem evolution and adapt management strategies accordingly. To ensure the sustainability of the aquifer, the local community and stakeholders must work together to protect this vital resource. The use of treated wastewater and desalinated water for artificial recharge can help replenish groundwater and reduce freshwater dependency. Furthermore, minimizing aquifer degradation can be achieved through reducing overexploitation, implementing sustainable water management practices, and controlling pollution from fertilizers and chemicals. By implementing these measures, the Wadi Nador small coastal aquifer can be preserved for future generations.

Keywords: Groundwater, Coastal aquifer, Seawater intrusion, Anthropogenic factors, Nitrate pollution, Overexploitation.

Biography



Abdelkader Bouderbala is a distinguished researcher and academic specializing in water resources. He earned his Ph.D. and HDR in Hydraulics from the University of Hassiba Benbouali in Chlef, Algeria. Dr. Bouderbala's research focuses on groundwater resources in arid and semi-arid regions, including groundwater characterization, management, investigation, and the evaluation of groundwater quantity and quality, as well as hydrogeophysics. He has published over 25 research articles in peer-reviewed journals and has also served as a reviewer for many journals.



VALORIZATION OF UNDEREXPLOITED BIORESOURCE TO PRODUCE A FUNCTIONAL BISCUIT: ACORN FLOUR

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Giacomo SQUEO³, Francesco CAPONIO³**

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Abstract:

Oak acorns (*Quercus*) are among the underutilized vegetable resources in the agri-food sector. The aim of the work was to explore the feasibility of using acorn flour as a novel and healthy ingredient in wheat-based biscuits to enhance this neglected bioresource. In this frame, an acorn biscuit was elaborated, and the benefits and acceptability of acorn flour as a novel food ingredient were reviewed. The physicochemical characteristics (colorimetric, protein, fat, total dietary fiber and carbohydrates contents) and antioxidant proprieties (total phenolic compounds, total flavonoid compounds and antioxidant activity) of acorn flour obtained from three *Quercus* species, namely *Q. ilex* L., *Q. suber* L., and *Q. coccifera* L. were compared. Acorns of *Q. coccifera* L. were the most antioxidant and were therefore used for preparing biscuits at two levels of addition, 30 and 60 g 100 g⁻¹ on wheat flour basis. The physico-chemical, technological (volume, texture, friability, etc.) and sensory (odor, color, taste, etc.) characteristics were then assessed. Acorn-added biscuits showed significantly ($p < 0.05$) higher content of phenolics, antioxidant activity and oxidative stability than control biscuits, prepared without acorn flour. As for appearance, the acorn-added biscuits were darker, larger, more voluminous and more friable than control biscuits. Therefore, according to the obtained results, the enrichment of biscuits with acorn flour proved to be a very effective strategy for increasing fiber content and antioxidant activity, two factors that today represents a primary objective in food production.

Keywords: *Quercus*, functional biscuit, physicochemical characteristics, antioxidant activity technological proprieties

Biography

Dr. Fatima ZOHRA MAKHLOUF is working at the National Higher School of Biotechnology of Constantine, Algeria. She is professional in Food Science and Biotechnology.



CHANGES IN THE COLONY MORPHOLOGY OF FILAMENTOUS FUNGI CAUSED BY HEAVY METALS IN VITRO

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Abstract:

*The changes in fungal colony morphology caused by environmental factors are rarely studied because of expensive apparatus and software required. In this work we simplified an inexpensive but labour-intensive method and tested it for suitability for investigations of various fungal species and isolates. The fungal colonies (five different *Trichoderma* species and six cultivated *Agaricus bisporus* strains) grown on agar medium were digitised with official scanner and the border fractal dimension (*D*-value) was computed with ImageJ software, because its changes correlate well with the disturbance of hyphal branching system. It was found that *D*-value did not change during the development of the colony and is well reproducible providing the possibility to apply it in studies dealing with effects of various environmental factors. To test the effect of heavy metals a concentration series (0,1-10 mM) of Cd, Mn, Mo, Zn prepared in half-strength PDA medium were inoculated with mycelial agar disks of 13 *Trichoderma* species, incubated at room temperature and scanned as abovementioned. The heavy metals influenced the mycelial development in various manner, although all of them caused significant reduction of colony growth. In general, Cd, Mn and Zn reduced the fractal dimension, whereas Mo varied in its effect. *T. virens* isolates reacted in the same direction to the treatments but in different extent, which did not show any correlation with the pollution of originating soil. The mycelial development of various *Trichoderma* spp. was disturbed in markedly different ways by Mo: *D*-value decreased in *T. atroviride*, *T. harzianum*, *T. koningii*, *T. pseudokoningii*, and *T. piluliferum*, four species (*T. asperellum*, *T. ghanense*, *T. reesei*, *T. saturnisporum*) did not react even to the highest concentration, whereas the fractal dimension increased in the colonies of *T. aureoviride*, *T. longibrachiatum*, *T. parceramosum*, and *T. virens*. All the three other heavy metals lowered the border fractal dimension of *Trichoderma* spp. but at various extents.*

Keywords: colony morphology, heavy metals, fractal dimension,

Biography

Dr. Zoltán NAÁR is one of the staff members as associated professor of Tokaj-Hegyalja University, Sárospatak, Hungary



ENCAPSULATION OF NATURAL PIGMENTS FROM BEET ROOT PEEL (BETA VULGARIS)

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Abstract:

The beet is vegetable rich in carbohydrates, fats, proteins, micronutrients and which also contains several functional constituents with significant health-promoting properties. It is composed of two parts: the pulp which is edible and used in meal preparation and the peel, which is inedible and often considered waste. The red colour of beets is due to the presence of a pigment called betalains. The aim of this work is valorising beet peels by extracting, characterizing, and encapsulating the natural pigments present in them. Betalain contents (betacyanin 32.83 ± 0.01 mg/l, betaxanthins 12.99 ± 0.01 mg/l) are appreciable. The polyphenol level is 2.56 ± 0.02 mg EAG/g of dry extract. Antioxidant content using 2,2-diphenyl-1-picryl-hydrazyl (DPPH) and 2,2'-azino-bis-(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS+) free radical scavenging methods) resulting in antioxidant contents of 7.69% and 42.10%, respectively, for both methods. Encapsulation is used to stabilize, protect, and extend the shelf life of sensitive compounds. In this work, the extracted pigments were immobilized in sodium alginate beads and the optimal conditions for the inclusion of betalains were determined.

Keywords: *Beta vulgaris; Betalain; antioxidant activity; encapsulation*

Biography

Dr. Meriem BENAMARA-BELLAGHA is Teacher researcher in Plant Biotechnology at Laboratory of Biotechnology and Food Quality, University of Constantine, Constantine, Algeria.



EFFECT OF INTERACTION BETWEEN INTERNAL ARBUSCULAR MYCORRHIZAL FUNGI AND SOIL MEDIA ON SOME CHARACTERISTICS OF STEVIA REBAUDIANA SUGAR PLANT, AND THE CHLOROPHYLL CONTENT OF ITS LEAVES

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Abstract:

The research was carried out with the aim of studying effect of Mycorrhiza and Different Soil Media (pumice and peat moss) on some growth parameters of Stevia rebaudiana (Bert.) Bertoni. Soil mixtures were prepared from pumice and peat moss in different proportions, and the experiment was designed according to a completely randomized design with two factors: the soil medium (pumice and peat moss) in different proportions and Mycorrhiza (with-without). 10g Mycorrhiza was added per kilogram of Soil Medium. The results of the statistical analysis indicated that the treatments of Mycorrhiza were significantly superior to their non-Mycorrhiza counterparts in some growth parameters (plant height - number of leaves - number of branches - the fresh weight of the vegetative and root groups- the dry weight of the vegetative and root groups- root lengths) ,and Stevioside concentration, The proportion of the substance dissolved in aqueous solution, NPK,and chlorophyll A and A+B. The Soil medium of peat moss and pumice 2:1 was significantly superior to some soil media in plant height - number of leaves - the fresh weight of the vegetative and root groups- the dry weight of the vegetative and root group , Stevioside concentration , phosphor, potassium, and Stevioside concentration. The Soil medium of pumice only was significantly superior to root lengths and chlorophyll a. The interaction between the soil media of peat moss and pumice 2:1 and Mycorrhiza significantly affected in plant height - number of leaves - number of branches - the fresh weight of the vegetative and root groups- the dry weight of the vegetative and root groups- root lengths , Stevioside concentration, phosphor, and potassium. The interaction between the soil media of peat moss and pumice 1:2 and Mycorrhiza significantly affected in number of branches. The interaction between the soil media of pumice only and Mycorrhiza significantly affected in root lengths and chlorophyll A, and The interaction between the soil media of peat moss only and Mycorrhiza significantly affected in the proportion of the substance dissolved in aqueous solution. Microscopic examination of the internal structures of the roots of the stevia plant the internal structures of the roots treated with Mycorrhiza were stained in a dark blue color, while the internal structures of the roots not treated with Mycorrhiza were not colored blue.

Keywords: *Mycorrhiza, Glomus sp, Stevia rebaudiana, chlorophyll, Stevioside, NPK*

Biography



Agricultural Engineering Certificate in Renewable Natural Resources and Environment.

Master's degree in Agricultural Engineering with a specialization in renewable natural resources and environment.

I have been working in the Directorate of Agriculture and Agrarian Reform in Swaida, in Department of Geographic Information Systems and Remote Sensing since 2019.

I have founded a home project to multiply and spread the cultivation of the sugary stevia rebaudiana plant, and I distributed the plant free to diabetic patients, and sold it at a very cheap price to the people of my country with the aim of self-sufficiency of the plant.



EFFECT OF MYCORRHIZA AND DIFFERENT SOIL MEDIA (PUMICE AND PEAT MOSS) ON SOME GROWTH PARAMETERS OF STEVIA REBAUDIANA (BERT.) BERTONI

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Abstract:

The research was carried out in the year 2019-2021 AD in Abi Jarash farm and the laboratories of the General Authority for Biotechnology at the Faculty of Agricultural Engineering at Damascus University with the aim of studying Effect of interaction between internal Arbuscular Mycorrhizal Fungi and soil media on some characteristics of Stevia rebaudiana sugar plant, and the chlorophyll content of its leaves Soil mixtures were prepared from pumice and peat moss in different proportions, and the experiment was designed according to a completely randomized design with two factors: the soil medium (peat moss and pumice) and Mycorrhiza. different proportions and Mycorrhiza 10g Mycorrhiza were added per kilogram of Soil Medium. The results of the statistical analysis indicated that the treatments of Mycorrhiza were significantly superior to their non-Mycorrhiza counterparts in some growth parameters number of branches (34.93 branch), the root lengths (18.32cm), and chlorophyllA, A+B (1.65 ,3.03) respectively, and The Soil medium of pumice only was significantly superior to root lengths (16.28 cm) and chlorophyll A (1.81). The interaction between the soil media of peat moss and pumice 2:1 and Mycorrhiza significantly affected in chlorophyll A+B (3.71), The interaction between the soil media of peat moss and pumice 1:2 and Mycorrhiza significantly affected in number of branches (39 branch), while the interaction between the soil media of pumice only and Mycorrhiza significantly affected in root lengths (20.33 cm) and chlorophyll A(2.20)

Keywords: Mycorrhiza, Stevia rebaudiana, chlorophyll, Soil Medium

Biography



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STORAGE OF HIGHLY FLAMMABLE AND TOXIC PRODUCTS

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Abstract

The modeling and simulation of industrial accidents is an essential tool for assessing their impact on the environment and on human beings. Oil or black gold is one of the most sought-after raw materials in the world today, given its importance in economic, energy and technological development in general. As part of its activities relating to risk, one must determine security perimeters. Following a loss of stored product, the risks incurred can be instantaneous, such as fire and the explosion of highly flammable product. In this work we use the ALOHA computer code, which is perfectly suited to our problem: it considers a wide range of accident scenarios, provides information concerning the safety of individuals and allows the visualization of risk areas. The ALOHA software models the dispersion according to the elements entered and determines the concentrations of pollutants at ground level. It considers the nature of the product, the leak and the atmospheric conditions. It is also possible to set the mathematical simulation model, or by default to let the software consider a model, hence the objective of this work is to give details about a real or potential chemical release, and then it will generate threat zone estimates for various types of hazards.

Keywords: *Environment, modeling, explosion, toxic zone, dispersion.*

Biography

Dr. Kenza IRINISLIMANE is specialized in Mechanical Engineering working as senior lecturer class b at the Faculty of Technology, M'Hamed Bougara University of Boumerdes, Algeria.



SYNTHESIS, CHARACTERIZATION, AND PROPERTIES OF ZNO- GO/NIO.5 MNO.5 Fe₂O₄ FOR APPLICATION IN DYE REMOVAL

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Abstract:

Environmental pollution has been a significant issue recently. For this reason, scientists concentrated their efforts on creating materials that can effectively remove contaminants. The purpose of this work is to create a new composite made of graphene oxide (GO), ferrite Ni 0.5Mn 0. Fe₂O₄, and zinc oxide for use in the removal of contaminants pollutants. The first part was devoted to the synthesis of the ZnO-GO/ Ni 0.5Mn 0.5Fe₂O₄ composite, this synthesis was carried out in four principal's steps. The second part of this study focused on the characterization by the X-ray diffraction, infrared spectroscopy and Raman spectroscopy, to evaluate the effectiveness of our composite in photocatalysis for the elimination of Methylene blue. The findings of this work offer hope for the manufacture of magnetic composites that will be used in photocatalytic removal of organic contaminants.

Keywords: ZnO, Graphene oxide, ferrites, X-ray diffraction, Raman spectroscopy, Photocatalysis.

Biography

Dr. Issam BOUDRAA is working as Class A lecturer at Ecole Nationale Polytechnique de Constantine, Algérie. He is specialized in the field of analytical and physical chemistry



ISOLATION AND PRELIMINARY IDENTIFICATION OF EXTREMOPHILE BACTERIAL ISOLATE FROM EFFLUENTS OF PHOSPHATE FERTILIZERS INDUSTRY IN SOUTHERN TUNISIAN

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Abstract:

The wastewaters from phosphate fertilizer industries (WPF) discharged into the environment without any prior treatment constitute a real threat for ecosystems and human health. In this study we determined the physico-chemical characteristics of the effluent as well as its bacterial contents. The obtained results showed that WPF was highly acid (pH 2), saline (58 g/l) with elevated electric conductivity ($EC = 44.80 \text{ ms cm}^{-1}$). In addition, it contained heavy metals such as Cd, Pb, Cr and Fe with 0.7, 2.06, 4.70 and 44.12 mg/l, respectively. Also, they were overloaded with phosphate (1352.42 mg/l), sulfate (1347.4 mg/l), fluorine (1072.60 mg/ml), sodium (9271.56 mg/l) and chlorine (1310.94 mg/l). All these elements exceeded the national and international standards. The microbiological characterization showed the presence of low charge of revivable aerobic bacteria as total coliforms, fecal coliforms and sulfite-reducing bacteria. We have isolated five presumed pure strains (S_1 , S_2 , S_3 , S_4 and S_5) which were characterized for their morphological, cultural and biochemical properties as well as their resistance to extreme conditions. The preliminary identification of the isolated strains via API 20E test resulted in 4 different genera (*Providencia*, *Vibrio*, *Chyseeobacterium* and *Stenotrophomonas*). These genera had remarkable resistance to potentially toxic elements (especially towards Cd, Pb, Cr and Fe), revealed by Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentrations (MBC) methods.

Key words: extremophile bacteria, biochemical characterization, heavy metals, MIC, MBC:

Biography

Elhem BOUCHIBA is a PhD student at Faculty of Sciences of Gafsa, Tunisia. She has profession in Biology sciences and biotechnology and her Master diploma was in Ecology and environment



EFFECT OF VARIETY AND COOKING ON CRUDE FIBER, TOTAL POLYPHENOLS, AND FREE RADICAL SCAVENGING ACTIVITY OF EGGPLANT

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Abstract:

*Eggplant (*Solanum melongena* L.) is a commercially important species, cultivated and consumed in many countries. Nutritionally, it is characterized by its richness in fibers, a good mineral density, a low energy intake due to its richness in water and its low content of energy elements, a diversified supply of vitamins, and the presence of organic acids and gallic tannins. Eggplants contain phenolic compounds, including phenolic acids, the main phenolic acid of which is chlorogenic acid. The benefits attributed to this compound include anticancer, antimicrobial, antiviral properties and inhibition of low-density lipoprotein cholesterol. The objective of this study is to compare three eggplant varieties, before and after cooking, based on their composition in crude fibres, total polyphenols, and their antiradical power. The varieties are Miniature, White and Graffiti. They were collected during November 2022 in Sidi bel Abbes (West Algeria). Eggplant skin and pulp of each variety were immersed separately in a stainless-steel container with water and cooked at 100°C. Samples were drained, crushed, and freeze-dried. The determination of different parameters (phenols, fiber, etc.) was performed according to the referenced methods. The results assert that the Miniature variety is richer in polyphenols, crude fiber than the other varieties, cooking has a significant effect on these compounds and the extracts of peel have a very high antioxidant capacity relatively to the pulp.*

Keywords: *Eggplant, varieties, polyphenols, fiber, antiradical power, cooking, peel, pulp*

Biography



Malika Barkat is a research professor at the Institute of Food, Nutrition and Agrifood Technologie (INATAA), Frères Mentouri Constantine1 University (Algeria). His area of research is food science. Currently, she is a team leader in the food quality biotechnology laboratory (BIOQUAL). She is the author of several publications <https://scholar.google.fr/citations?user=9MzIzvkAAAAJ&hl=fr>.



RELATIONSHIP BETWEEN SOIL MICROBIAL BIOMASS AND APPLICATION OF FUNGICIDES IN AGRICULTURAL LAND

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Abstract:

Sustainability of soil functions is endangered by land use changes in combination with agricultural intensification, which has proved to lead to soil deterioration, reducing its production capacity and affecting soil microbial communities. Microbial biomass in soil serves as one of the indicators of its biological activity and is often used in assessing the impact of anthropogenic activity and natural changes on the soil microbiome. Significant spatial and temporal variation of the indicator at the level of ecosystems, soil typological units, land use types, etc., makes it difficult to interpret the data obtained during mass monitoring. The aim of the study was to determine the background values of microbial biomass content in the upper soil surface of agricultural land. The application of fungicides to horticultural crops has raised public concerns worldwide. In fact, it has been demonstrated that such fungicides have an impact on non-target microorganisms in the rhizosphere. Soil degradation involves soil physical, chemical, and biological changes. Modern agriculture largely relies on the extensive application of agrochemicals, including inorganic fertilizers and pesticides. The application of agrochemicals is a common and critical method used to improve crop yield. It is widely known that agrochemicals can affect non-target soil microorganisms by altering soil microbial community structure and functions. The present study highlights the impact of seven fungicides (Zineb 20%, Ridomil, Carbendazim, Iprodione, Triazole, Mancozeb and Metalaxyl) on soil microbial biomass in agricultural land. The value of microbial biomass in the upper 10 cm soil layer was determined after fungicides applied at different concentrations. The analysis of obtained data demonstrated high variability of the values of microbial biomass content in soils caused by the nature of the applied fungicides.

Keywords: Soil microbial biomass, application of fungicides, agricultural land

Biography



Prof. Dr. Hosam Bayoumi Hamuda is working at Óbuda University. He is Environmental Microbiologist and Soil Biotechnologist. He is a member of Environmental Sciences Doctor's School (Hungarian University of Agriculture and Life Sciences) and Material Science and Technology at Óbuda University. He was a supervisor of many PhD students as well as the Leader of Agricultural and Environmental Microbiology and Soil Biotechnology PhD Program. also, a leader of Microbial Biotechnology MSc Program dealing with the interactions between the microbiomes and the environment for increasing soil quality and saving the soil from pollutants. His investigations are on the role of waste management, soil quality and fertility, crop production and environmental impacts related to the application of organic wastes; measurements soil microbial biomass and enzymatic activities in wastewater sludge amended soils; and roles of engineered metal oxide nanoparticles in biosphere.

Research Interest: Waste Management; Environmental Biotechnology; Soil: Protection; Sustainable; PGPR and Microbial Inoculants; Gut Microbiomes and Human Health as well as Modern Biology. Prof. Dr. Hosam Bayoumi Hamuda was invited as visiting professor to the 13th Flanders (Belgium) Inspires International Visitors. He is the broad editorial member and reviewer of many international journals as well as a member of many organizing committees of various international conferences also, acted as plenary or keynote speaker. Prof. Dr. organize annually and. Hosam Bayoumi Hamuda is the president of the International Council of Environmental Engineering Education and annually he organizes two International Meetings, one in November in term of ICEEE, and the second in May as International Symposium.



BIBLIOMETRIC ANALYSIS OF MICROALGAE BIOSORPTION OF CHROMIUM USING WEB OF SCIENCE DATABASE

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Abstract:

Chromium is present in different industrial effluents, responsible for environmental pollution. Traditionally, chromium removal is made by chemical precipitation. This study reviews 741 documents published about the biosorption of chromium by microalgae in the international context from the Web of Science Core Collection (WoSCC) (1990-2022). Two different processing software applications were used, SciMAT-v1.1.04 and VOSviewer 1.6.19. This research field is characterized by high interdisciplinarity and a rapid increase in the subject categories of engineering applications. The basic supporting categories mainly included “Environmental Sciences & Ecology”, “Biotechnology Applied Microbiology”, “Engineering”, and “Marine Freshwater Biology”. In addition, the results showed a significant increase in the concern over biosorption of chromium by microalgae in the past ten years, especially in Brazil, China, USA, Czech Republic, and other developing countries. China surpassed the USA and became the second most productive country in 2022. Although the number of articles and total citations of Brazilian articles is the highest worldwide, the average citation per article is lower. Soccol CR, an author from the Federal University of Paraná in Brazil, is very competent in researching this field. Bioresource Technology is the most important journal in the research field of biosorption of chromium by microalgae. Bibliometric analysis is a useful method to measure research hotspots and trends qualitatively and quantitatively in the biosorption of chromium by microalgae. It can be widely used to help new researchers review the available research in a certain field.

Keywords: Microalgae, chromium, biosorption, bibliometric, web of science

Biography



Dr. Karim SBIHI is an Assistant Professor and member of the Laboratory Analysis, Modelling, Engineering, Natural Substances and Environment, Biotechnology, Analytical Sciences and Quality Control Team, Polydisciplinary Faculty of Taroudant, University Ibn Zohr, Agadir, Morocco. His Principal research is the use of algae for wastewater treatment and the algae bio-remediation technology to manage a variety of industrial effluents, including chemical, textile and leather industries.



PREMENSTRUAL SYNDROME, SEASONAL AND OTHER ASSOCIATED FACTORS (FEMALE ADOLESCENTS)

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Abstract:

Premenstrual syndrome (PMS) is a heterogeneous disorder that includes physical and affective symptoms that most females of reproductive age experience during the luteal phase of their menstrual cycle. This study aims to investigate the factors associated with PMS among adolescent schoolgirls and to assess the severity of PMS.

A cross-sectional study was conducted among 102 adolescents representing Marrakesh city. A structured questionnaire was used. Data analysis was done with SPSS version 26. The rate of mild to severe PMS was 52.9 %, 25.5 % and 21.6 %, respectively. The most common physical symptoms were backache (52.9%) and breast tenderness (36.3%), while the most common affective symptoms were irritability (49 %), anxiety (46.1 %) and mood swelling (45.1 %). Neither season of birth nor season at menarche was associated with PMS. Significant differences were observed between PMS group and non-PMS group in the level of education ($p < 0.05$), sweets consumption ($p < 0.05$) and family status ($p < 0.05$). There was no significant association between PMS and BMI.

Based on the findings, it seems that the occurrence of PMS is associated with sweet consumption frequency. This study also showed that irritability and backache were the most common PMS symptoms.

Keywords: Adolescents, anthropometry, premenstrual syndrome, school health.

Biography



Siham Lghoul has completed his PhD in the year 2021 at Faculty of Sciences Semlalia, Cady Ayyad, University, Marrakech, Morocco. The theme of his work is to determine age at menarche and its deviations from normal in relation to anthropometric and seasonal factors.



EFFECTS OF COMMON MOLE (*TALPA EUROPAEA*) ON THE DIVERSITY OF SOIL PROPERTIES IN URBAN LANDSCAPES

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Abstract:

Moles play a crucial role in soil formation on natural and also in urban areas. They are often considered as non-favourable due to their little mounds on lawns. The recent research is examining the effects of the European common mole (*Talpa europaea*) in an urban environment. One site was on the Szent István Campus, one site was in a family garden and one was in the shopping district, nearby the Rákos Creek, all sites are grasslands and situated in Gödöllő. Soils of the mole mounds and the nearby undisturbed control areas were compared. Samples were analysed with a Near Infrared Scanner. The mounds at the university show great differences to the controls: only the Fe and Al were significantly higher in the mounds, all other parameters were smaller. The only difference between the mole mound and the control of the garden was in the soil moisture content (control > mound). Along the creek the total N, the exchangeable Ca and Mg and the cation exchange capacity was significantly higher in the control than in the mound. The results show that there can be huge differences in the effects of moles on the surface soil properties. It is important because we can prepare a scale that shows the minimum and maximum of these effects. Furthermore, these differences are also depending on the properties of the solum. The shallower the soil, the biggest the effects (most likely).

Keywords: soil-zoology, man-made environment, environmental change

Biography



Csaba Centeri is an associate professor (Dept. of Nature Conservation and Landscape Management, Szent István Campus, Hungarian University of Agriculture and Life Sciences, Gödöllő). He has published 2 D1, 21 < papers in Q1 and Q2 journals and has been serving as a chief editor in the Hungarian Journal of Landscape Ecology, guest editor of special issues in the journal of Water, Sustainability, Forest and Remote Sensing. His main research interest is soil water erosion, soil erosion modelling, land-use change, ecosystem services, soil-plant, soil-wildlife and other soil-zoology interactions, with special emphasis on nature conservation and landscape related issues.



GRAZING BY DOMESTIC WATER BUFFALOES (BUBALUS BUBALIS) AS A HABITAT MANAGEMENT AND CONTROL OPTION AGAINST THE INVASIVE SOLIDAGO GIGANTEA

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Abstract

Nowadays, there is a global problem with the aggressive expansion of invasive plant species in terms of the nature conservation and economic reasons. One of the main dangerous species is *Solidago gigantea*. Many livestock cannot consume it because of the high saponin content of the plant. However, domestic water buffalos have a good digestive capacity. Based on this, the following question have been formed: Whether grazing by water buffalo (*Bubalus bubalis*) can be applicable for the control of *Solidago gigantea*? This study was carried out in three areas of Csákvár in Hungary. We investigated on various habitat like *Molinia* meadows and a typic Pannonian dry grassland which had high cover of *Solidago* species. In addition, we compared their data with an untreated control area. In the 2 sample areas, grazing was carried out with domestic water buffalo (*Bubalus bubalis*) since 2013. During the study, we carried out a coenological survey to follow change of cover of plant species from 2014 to 2021, their feed values and biomass of the grassland. Based on to the results, invasive *Solidago* has been suppressed completely within 6 years. For example, on the meadow the cover decreased from 16% to 1% and the dominant species has become *Sesleria uliginosa* which is a useful grass species for turf management. On the other hand, in the typic Pannonian dry grassland the cover declined from 67% to 1%. Thus, we have found that grazing with buffalo is suitable as a habitat management method against the *Solidago gigantea*. Supported by the ÚNKP-22-3-I-MATE/2 New National Excellence Program of the Ministry for Culture and Innovation from the source of the National Research, Development and Innovation Fund, and AKGF-119-1-202.

Keywords: giant goldenrod, nature conservation management

Biography



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



THE FUTURE OF SOLVENT REGENERATION AT RICHTER GEDEON NYRT'S DOROG SITE

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Abstract:

Today, environmental protection plays an increasingly decisive role worldwide. It is required by the rapidly developing industry, which promotes the improvement of the quality of life, but its continuous development puts more and more burden on the environment and exploits resources. Therefore, it has become necessary globally to introduce technologies, design processes, and create environmental protection regulations that reduce the environmental footprint of these industries. During the pharmaceutical production at the Dorog branch of Richter Gedeon Nyrt., most of the contaminated waste comes from the production of the active ingredient, which is disposed of by incineration. During my thesis, we were looking for an effective waste management method that takes into account recoverable materials and their recyclability. We considered the solution to this problem to be the regeneration of solvent mixtures, which is important not only from the point of view of environmental protection, but also from the point of view of cost effectiveness. To implement this, we worked with distillation, which we implemented in two steps: in preparative conditions and in operation. During my work, I carried out the distillation of ethanol and ethyl acetate on a semi-automatic Propack column. During the experiments, two typical problems arose, the inadequate water content and the presence of the typical unknown pollutant in the system, which we were able to finally remedy by adding the right amount of water and taking the right amount of pre-distillate. After the successful laboratory experiments, we also carried out the production under preparative conditions, which was also successful. After that, commissioning began, the purpose of which is to regenerate the material to be regenerated under operating conditions, thus already contributing to production. As a result, it was possible to produce a suitable quantity and quality of regenerated ethanol and ethyl acetate, which can be recycled into the final stage of intermediate production. No environmental problems arose during production.

Keywords: solvent regeneration, environmental protection, quantity and quality of regenerated ethanol and ethyl acetate, cost effectiveness

Biography

Environmental Engineering student at Obuda University, Budapest,
Hungary



VII International Symposium-
2023

MANUSCRIPTS OF ORAL AND POSTER PRESENTATIONS



PARTICIPATORY MANAGEMENT: A GUARANTEE OF WATER SAVING IN A CONTEXT OF ACUTE CLIMATE CHANGE

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Abstract: The aquifer contract is a design allowing controlled water management. This management involves the participation of all water users. The elaboration of a water table contract goes in the direction of improving the efficiency of the use of water resources to guarantee the quantity, quality, and sustainability of groundwater resources, according to the evolution (climatic; industrial; demographic and agricultural). Therefore, the purpose of the implementation of the contract is to guarantee sustainable environmental and socio-economic development, it is a question of 1) Rebalancing the balance of the water table and restoring the flow rates of the springs; lakes; securing the water drinking. 2) Protect and preserve ecological systems and ensure the development of tourism sectors; industrial, economic, environmental, and particularly that of agriculture knowing that it is the sector that consumes a large quantity of water resources. The establishment of a water table contract requires the involvement of citizens who will benefit from this management method. The area targeted by our project is that of Drean, located 25 kilometres south of Annaba and conceals in its basement a significant water table known as the "gravel tablecloth", it is free to the south and therefore susceptible to be polluted and is captive in the north and therefore protected. It has the particularity of being overexploited. The establishment of the aquifer contract is an opportunity to identify the users and especially the quantities taken by each of them and this within a legal framework. The committees involving all the parties will ensure the smooth running of the operations, which will firstly result in perfect knowledge of the water inflows and outflows, and therefore knowledge of the groundwater balance. In the second part, we must make users pay the appropriate sums (according to the quantities used), which will limit waste. Concise and factual. It should briefly state the purpose of the research, the principal results, and major conclusions.

Keywords: Algeria, management, Water, protect, Drean, committee

INTRODUCTION

In Algeria, as in many countries, the water resource is managed administratively where the state takes charge of the destiny of the water. However, in the field, many shortcomings appear, amounting to the fact that this mode of management does not meet current requirements. Starting from the fact that the groundwater resource has the characteristics of a "common good" in the economic sense: there is rivalry in its use, i.e. the extraction of water

from a groundwater by a given user can limit the possibility or increase the cost of water extraction by other users of the same aquifer (we speak of congestion externality or negative stock externality - Provencher and Burt (1993)) ; and on the other hand there is non-exclusion: a situation in which any newcomer can in turn draw from the aquifer. When the exploitation of this type of good is left to the game of the market, that is to say to the search for short-term individual profit, it leads to the "tragedy of the commons".

Users compare their private profit with the only private cost (their technical cost of pumping in this case), without considering the "social cost" linked to the restriction of use or the increase in costs for other users., i.e. the cost of the externality. This misalignment of costs and benefits is a "market failure" that results in all-out exploitation of the resource that can lead to fatal overexploitation of the resource. This finding is more accentuated for groundwater where independent users with direct access to the resource can number in the hundreds or even thousands, penalizing future generations, because the resource is renewable (effects of climatic changes). This centralized management has resulted in a failure of the market and requires regulatory mechanisms in which the State, guarantor of general well-being, must play a more pronounced role by using the instruments available typically include action on prices (establishment taxes or operating royalties aimed at aligning private costs and social costs or on the quantities withdrawn (withdrawal authorizations, extraction quotas). Faced with the difficulties and transaction costs involved in exclusively centralized management, and to cope with the growing overexploitation of groundwater, many Mediterranean countries are turning to solutions with a variable degree of decentralization and user involvement, through "aquifer contracts" or similar mechanisms.

History:

The aquifer contract was initiated in the countries bordering the Mediterranean, whether north or south. This project aims to introduce a new way of managing water resources. It goes in the direction of a collective and collegial management of water. The following table gives an overview of the aquifer contracts carried out in the neighboring countries of Algeria. In Algeria, because of the management acquired for a long time (centralised), it is almost impossible to carry out such a project. To move towards this type of management, it will be essential to decentralize management and involve the citizen by making them aware of this new concept. This is the case of Tunisia (Bsissi), Morocco (Souss Massa), Jordan (Azraq), Spain (Mancha) and France (Roussillon and Astien). This shows that Algeria is lagging these countries in terms of this management.

The theory of aquifer contracts:

In general, contract theory encompasses neo-institutional theory, in the sense that "contracts serve as the foundation for a large part of economic analysis". Every exchange goes through some form of contract, whether explicit or implicit.

For groundwater, the role of the principal is held by the State or by a regulatory authority accountable for the general objectives of sustainable management of the resource (an intermediate body" or again "intermediate bodies" in charge of management activities It is difficult for the administration to directly control all users and constrain their behavior. This choice will allow us to know the way in which such and such behavior contributes to the objectives. The role of the administration is to design the appropriate framework that will lead the agent(s) to act in the direction of its objectives, through a system of incentives and sanctions. the establishment of a water table contract requires the involvement of citizens who will benefit from this management method. As a result, and in the first place, the steering committee must be appointed. This committee must be composed simultaneously of citizens and representatives of the administration in charge of water management.

The steering committee is appointed by the Wali and must be composed of:
-Representatives of the State (Wilaya, Daira, Department of water resources at the level of the wilaya, Department of the environment, Health, industry, and agriculture, etc.),
- Local authorities and representatives of users: Town, subdivision composed of approximately 35 members.

The steering committee is chaired by a member chosen by the Wali, the other members are volunteers or will be chosen according to the division of the study area that will be carried out.

The composition of the steering committee, once made, will be the subject of a nominative decree signed by the competent authority (Wali), which will allow the work to be carried out within a regulated framework.

The steering committee has the following three essential components:

The steering committee (fig.1):

it supports the destinies of the aquifer contract. It is made up of representatives of the actors who can intervene in the management of the aquifer. He is the one who makes all the decisions.

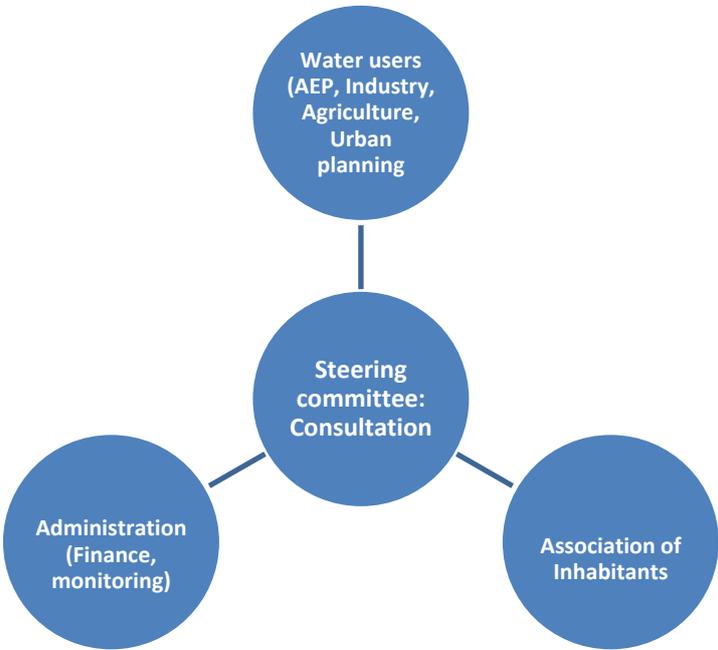


Fig.1: Overview of the composition and operation of the consultation workshop (proposals)

The technical committee fig.2):

He has a monitoring role and is particularly responsible for the technical aspect. It is made up of technicians. It provides information on the hydraulic network, the flow rates used.

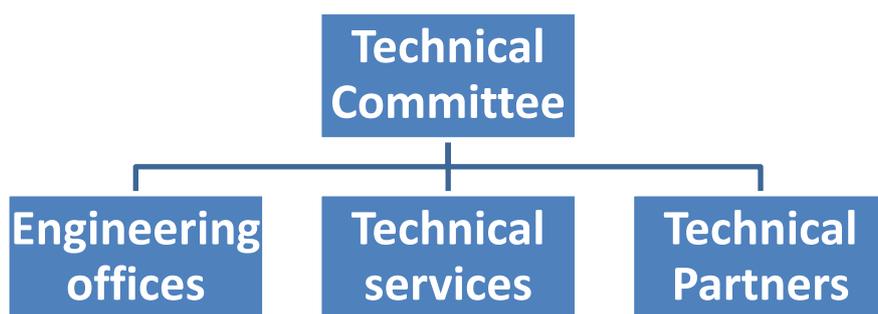


Fig.2: The technical committee and its component.

The consultation committee (fig.3):

Includes all parties involved in monitoring the groundwater contract. Its main role is to validate the proposals made at different stages.

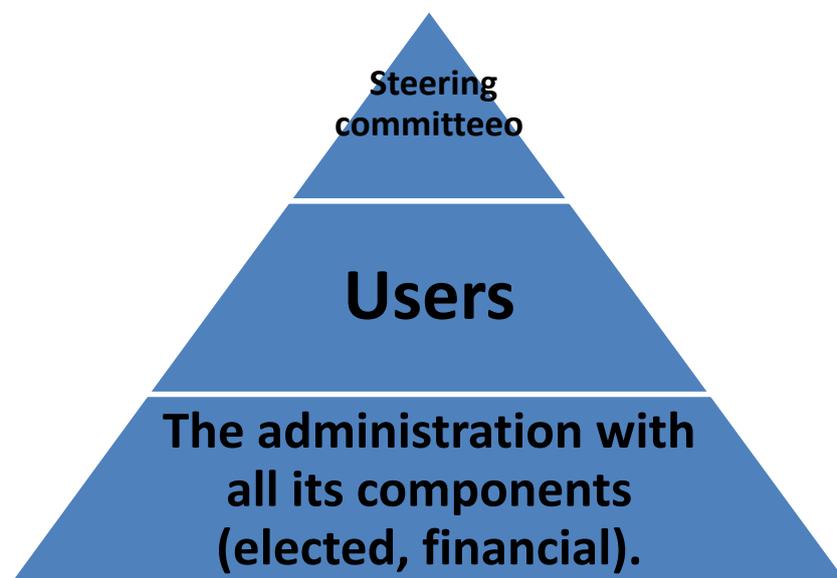


Fig.3: Composition of consultation committee

The creation of the various committees (consultation, steering and technical) is a prerequisite for any work. Without the establishment of these committees nothing will be possible.

METHODOLOGY

Once the various committees have been set up, a plan will be drawn up defining the steps to be followed for the realization of the aquifer contract.

The steps to follow:

- 1- Diagnosis Issues: this step is spread over six (6) months during this period we must make a bibliographic study on the state of the groundwater, which will allow us to trace the objectives. This step is mainly the responsibility of the technical committee.

2- Definition of objectives: also lasts a semester, during this period We agree on what to do (objectives) and we formalize with all the actors the roadmap to follow (signature of the charter involving all the partners)

3- Contractualization of the action program: for a period of six (6) months, this contractualization relates to the development of a program of actions of the Contract involving the location, the costs, the project management and the funding...). Leading to the official signing of the groundwater contract. During this stage, the members of the steering committee are mainly involved.

4- Implementation of the Contract: lasts the rest of the project. We will work more on the ground.

Application to the Graviers of Drean aquifer:

Geographical and geological situation:

The studied area is situated in the Algerian Northeast (Fig. 4). It is bound by the Mediterranean Sea to the north, by Drean city to the south, Wadi Mafragh to the east and Lake Fetzara to the west. The plain is supplied westerly by streams originating from the Edough mount, and is also supplied from the south by water upstream

J. M. Villa in 1980 demonstrated in his work that the geological formations at the outcrop extend from the primary to the current quaternary. He demonstrated two types of formations which are:

- the metamorphic formations dating from the Paleozoic constituting the Edough massif,
- the sedimentary formations occupying the rest of the study area.

The Palaeozoic reaches west to the block of Edough, Belilieta, and Boukhadra in the west of Annaba. It is constituted primarily of gneiss. The Mesozoic is found immediately south of the studied zone towards Guelma and Bouchegouf at the south of Annaba.

These formations are not illustrated in Figs. 3 and 4, but do contribute to the salinity of water by groundwater flow. The Triassic is formed by an association of dolostones, dolomitic limestone, and gypsum; the Jurassic is constituted of black dolostones and calcareous schists; and the Cretaceous is composed of dolomitic limestone.

The Miocene and the Pliocene are represented by marine and continental facies. The river facies are well developed in the plains of Annaba; it is formed of pebbles, sand, and clay alongside the riverbeds. Blue marls with limestone intercalations characterize the marine facies. The continental facies are constituted by alluvial deposit, pebble, and gravel. They are related to the subsidence basin deposits that are Ben Ahmed subsidence graben, oriented S–N, and Ben M'Hidi subsidence basin, oriented SW–NE. These two subsidence grabens are separated by the Daghousa horst in the center.

The Quaternary is represented by dunar and alluvial formations, which are further distinguished as Old Quaternary (high terraces), containing the alluvial aquifer composed of sands, clays, and gravels; Recent Quaternary, corresponding to low and the average terraces; and Current Quaternary, including the alluvial of the current riverbeds constituted by sands and gravels. The evaporitic formations are localized in the region of Guelma (located upstream) and are constituted by sulphate and calcium characteristics of the gypsiferous formations.

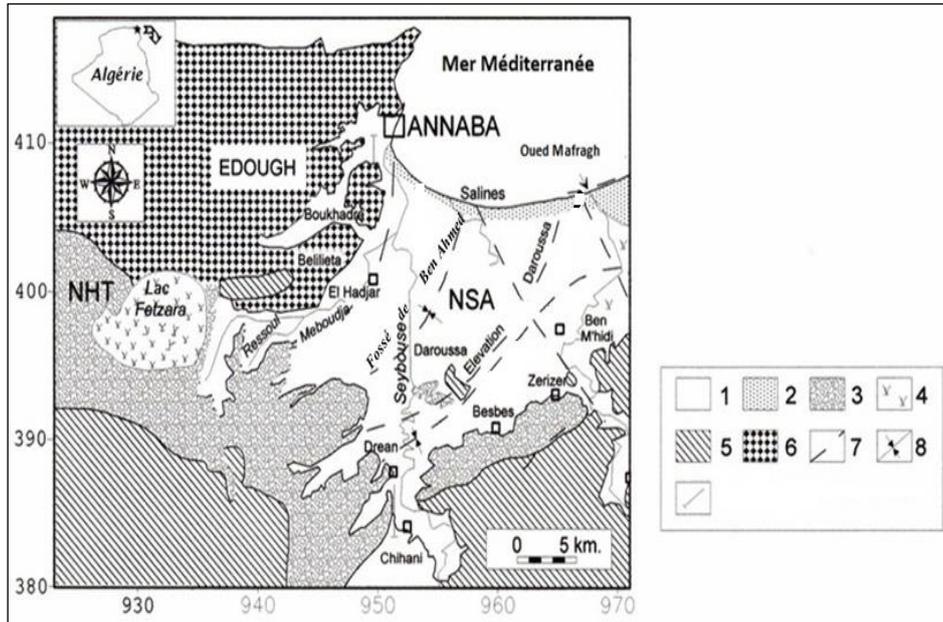


Fig. 4. Geographic location and geological characteristics of the study area.

Legend: 1: Recent and current Quaternary; 2: Dunes; 3: Early Quaternary; 4: Swamp or lake; 5: Numidian sandstone and clay; 6: Metamorphic formations; 7: Rift; 8: Axis of the pits.

Hydrogeological information:

The Annaba region contains two superposed aquifers (fig.5), the first superficial and is located a few meters deep. This level is captured by domestic wells and its waters are used mainly by local farmers, often landowners. The second deep, this aquifer is confined in its northern part and becomes free in its southern part towards Dreaan. In this aquifer are located boreholes operated largely for irrigation.

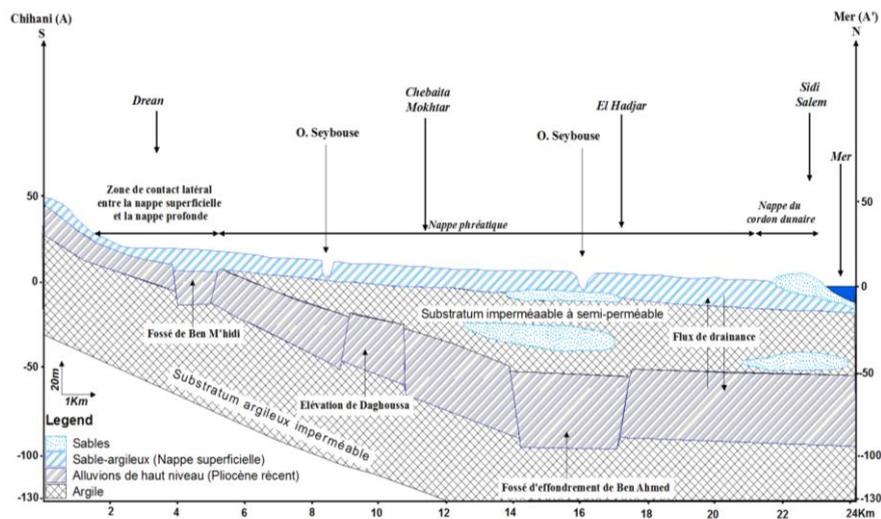


Fig.5: Hydrogeological cross-section showing the superposition of the two aquifers.

The surface layer

Field observations and results acquired during various studies (Khérici, 1993; Djabri, 1996 and Debièche, 2002), it has been shown that the phreatic aquifer of the Annaba plain has poor

hydrodynamic characteristics and cannot be exploited only for supplying a few hamlets or for irrigating small plots of land.

The gravel layer:

The counting of 105 test pumpings carried out in the boreholes made it possible to determine the hydrodynamic parameters of the main aquifer horizons (table N°1). The data comes from the services of the National Agency for Hydraulic Resources (ANRH) as well as the Hydraulic Directorates of the Wilayas of Annaba and El-Tarf.

Table N°1: Somme indications of the aquifers.

N°	X (km)	Y (km)	Depth (m)	thickness (m)	T (10 ⁻³ m ² /s)	K (10 ⁻³ m/s)	N°	X (km)	Y (km)	Depth (m)	thickness (m)	T (10 ⁻³ m ² /s)	K (10 ⁻³ m/s)
01	950	405,7	75	8	0,82	0,11	23	958,75	401,1	?	23	7	0,3
02	952,7	399	64,5	14,5	4,2	0,29	24	958,25	399,15	?	12	5,5	0,46
03	948,75	404,2	?	5,5	3,5	0,14	25	944,65	394,85	?	2,1	0,078	0,037
04	953,29	401,51	78	33	14	0,42	26	950,5	398,15	?	16	12	0,75
05	952,65	401,4	72	15	7,7	0,51	27	957,95	397,8	?	10	3,5	0,35
06	957,2	403,1	75,5	30,7	5,2	0,17	28	953,9	392,65	?	24	5,4	0,23
07	955,96	402,74	90	6,7	6	0,89	29	952	394,4	?	15	10	0,67
08	952,35	398,75	72	15	5,1	0,34	30	954,3	393,3	60	26	8,8	0,34
09	952,75	400,6	73	10,5	12	1,1	31	950,25	393,95	?	20	6,8	0,34
10	951,2	402,85	60,5	3,3	4,8	1,5	32	951,25	388,3	?	17	2	0,12
11	956,35	402,8	90,8	21,3	8,6	0,4	33	950,15	395,1	61	22	4,1	0,19
12	952,45	401,85	67	22	0,76	0,034	34	953,9	384,85	80	33,6	6,4	0,19
13	950,55	403,225	66	14	0,74	0,053	35	953,4	387,7	35	17	1,5	0,089
14	951,15	401,2	> 64	17	2,4	0,14	36	955,2	403,28	106	48	5,4	0,11
15	959,95	400,5	89	38	1,3	0,034	37	970,05	387,35	?	20,3	3,1	0,15
16	943,85	394,35	45	3	0,095	0,032	38	953,75	384,8	43	35,7	12	0,34
17	950,35	396,45	?	23,4	12,5	0,53	39	957,75	403,4	111	41	5	0,12
18	953,4	389,85	?	21	12	0,57	40	956,75	402	122	46	8,9	0,19
19	953,575	388,1	35	26	12	0,46	41	966,6	394,5	89	52	2,5	0,048
20	951	404	?	18	12	0,67	42	952,35	387,6	40	28	0,11	0,0036
21	955,95	402,5	110	26	5,1	0,196							
22	954,05	400,1	90	> 17	45	2,6							

There is a variation in the depths captured and, in the hydrodynamic characteristics. However, the values obtained testify to the presence of a productive aquifer.

History of measured piezometers

The measurement points are particularly numerous along the Seybouse wadi (fig.6).

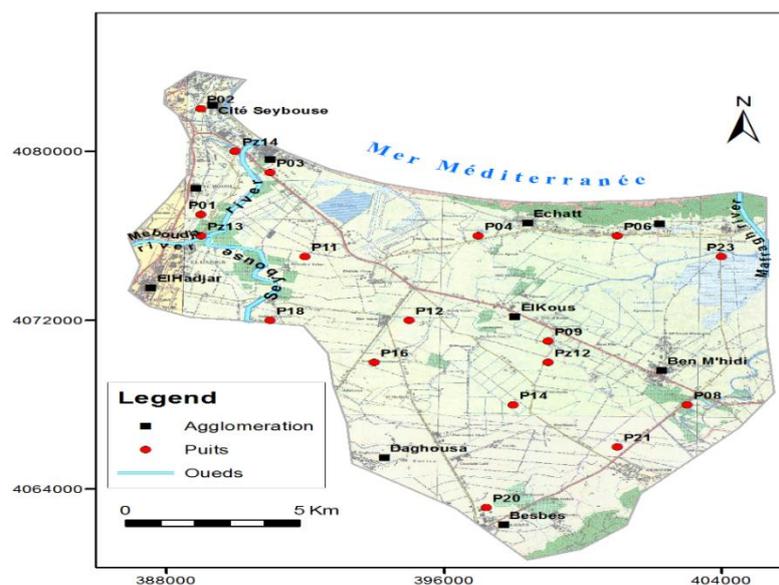


Fig. 6: Wells location in the Annaba plain.

Piezometry history:

The study of groundwater circulation is based on the analysis of the piezometric surface.

Piezometric map in 1996.

Observation of the piezometric map produced (fig.7) shows a south-north flow with a mixed wadi aquifer relationship. In addition, and at the edge of the sea, the direction of the flow becomes North-South, from the sea towards the water table; this change is linked to the topographical change caused by the hillock of Daghoussa. Topography is an element that can contribute to facilitating marine intrusion.

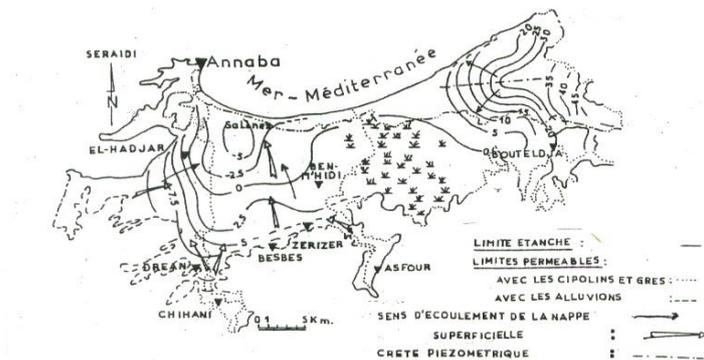
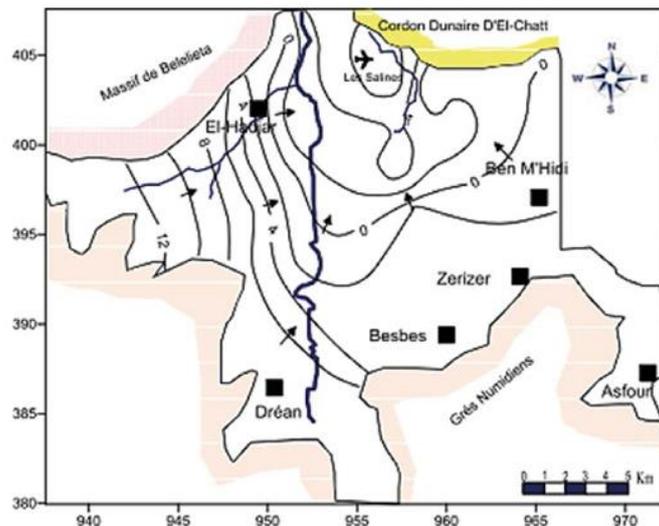


Fig.7: Piezometric map of the gravel aquifer 1996 (In Ramdani)

Piezometric map 2003:

The map taken from the work of Djabri L (fig.8), carried out in 2010, shows a flow going from south to north, these same flows in the northern part converge the battery of boreholes at Salines. We also note the presence of a mixed Oueds aquifer relationship (Seybouse and Meboudja).



Légende:

-  Commune
-  isopiezies curve
-  watercourse
-  Direction of flow

Fig. 8: Piezometric map of the gravel aquifer.

The piezometric map April 2015 (fig. 9):

Shows a south-north flow with a mixed wadi aquifer relationship. At the seaside, the direction of the flow is North-South, from the sea towards the aquifer; this change is caused by the variation of the topography caused by the hillock of Daghoussa. Topography is an element that can favor marine intrusion.

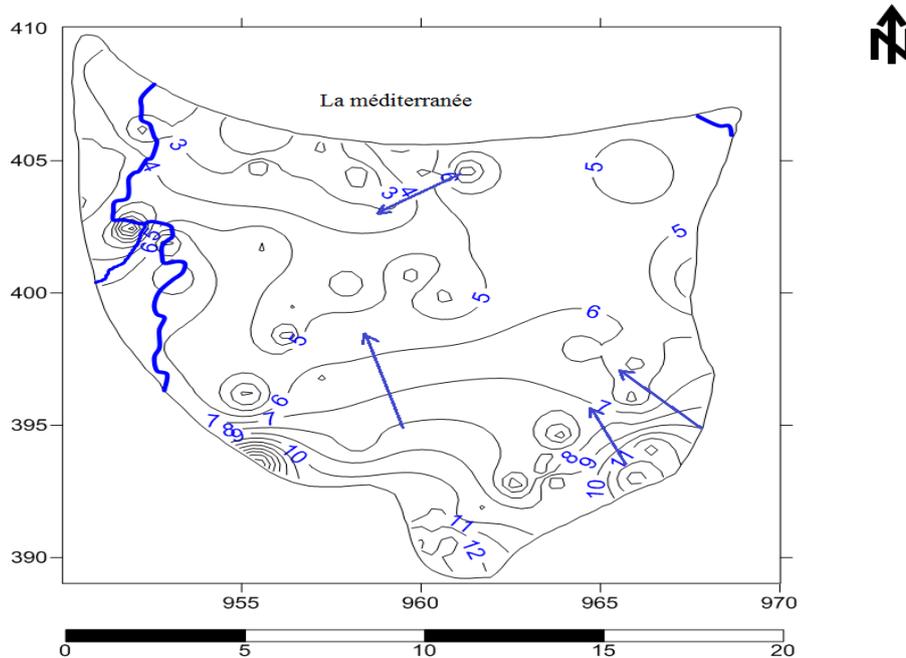


Fig.9: piezometric map of the Annaba plain. (In Bengrid, 2015)

Origin of the waters supplying the city of Annaba (fig.10):

- Surface waters: We notice that the surface water comes mainly from the dams located in the wilaya of El Tarf, they come from the two dams which are the Cheffia dam and the Mexa dam.

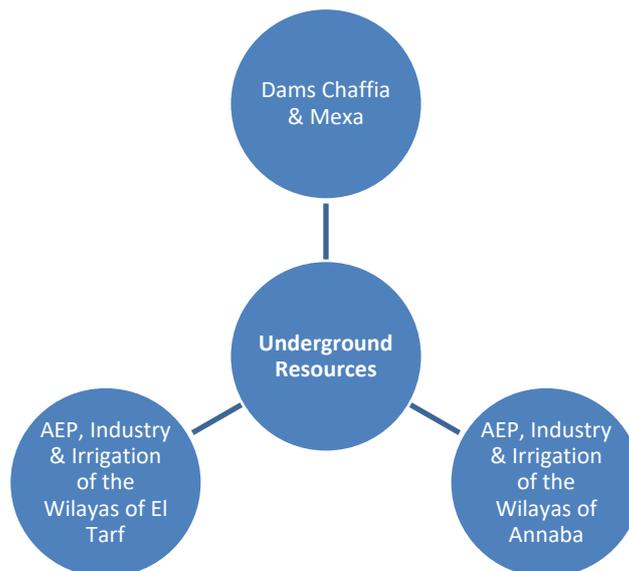


Fig.10: Satisfaction of the water needs of the two wilayas.

The waters are intended to cover all the amenities of the two wilayas (Annaba & el Tarf) (Table 2).

Table 2: Inputs from the Cheffia & Mexa dams

production Transfert	Designation	Volume (m ³ /d)
Barrage Chaffia_ ST CHAIBA	Water volume traited for Annaba	72000
Barrage MEXA_ ST CHAIBA	Water volume traited for Annaba	85000
Total volume		157000

The quantities of water from small dams (hill reservoirs):

The region has 86 hillside reservoirs, mostly built during the 1980s, with a total capacity of 8,895,000 m³. A number of these facilities have been damaged by flooding and siltation and are out of use or abandoned. Distribution by municipality of hill reservoirs in the Wilaya of Annaba, (See Table 3)

Table.3: showing the distribution of hill reservoirs at the level of the Wilaya of Annaba

Municipality	hill reservoirs	
	Number	Capacity (m ³)
El-Bouni	01	90000
Berrahal	09	1070000
O.Aneb	08	555000
Treat	11	1356000
Ain Berda	18	1945000
Cheurfa	10	706000
Eulma	16	2368000
Chétaibi	13	805000
Total	86	8 895 000

The surface resource remains low and below expectations in the wilaya of Annaba. Anarchic urbanization has meant that sites for the installation of dams and hillside reservoirs are rare. In addition, with the aim of avoiding overexploitation and marine intrusion, many boreholes (Salines) have been voluntarily shut down. This makes the resource scarce.

As an indication, the real DWS needs of households and industry are around 210,000 m³ /d.” The desalination of sea water will bring 300,000 m³ /d but not in the immediate future this will make it possible to remedy the problems of shortage in the region, including the wilaya of Annaba which will benefit from a quantity of around 170,000 m³ /d more than half of production.

Groundwater (fig.8):

The region is supplied by the neighboring wilayas of El Tarf, Skikda (Guerbes) and Guelma (Guelâat Bousbaa), plus the boreholes located in the territories of the Wilaya.hey would come from the neighboring wilayas of El Tarf, Skikda (Guerbes) and Guelma (Guelâat Bousbaa), plus the boreholes located in the territories of the Wilaya.

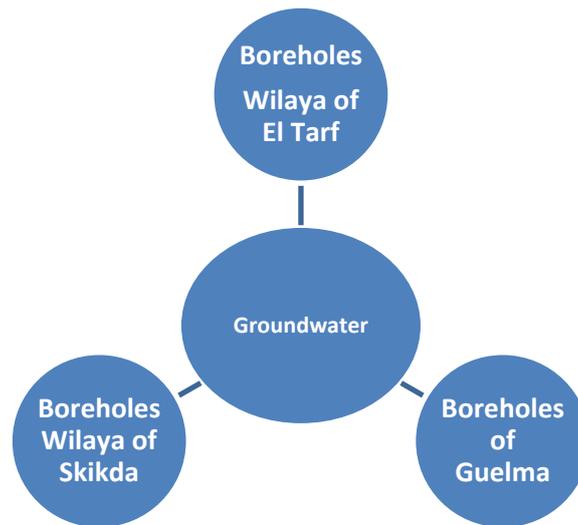


Fig.8: Origins of groundwater used in the region

The next table N°4: summarizes the contributions by the various capturing fields.

Table N°4: summarizes the contributions by the various capturing fields

N°	Designation	Volume (m ³ /d)	N°	Designation	Volume (m ³ /d)
01	Guerbes	11232	08	El Eulma	5184
02	Berrahal	1382	09	Chetaibi	1900
03	Gueireche	1036	10	Oued Aneb	864
04	Tacha	1036	11	LES SALINES	3283
05	Draa Riche	1132	12	Fedzara	1036
06	Treat	4492	13	Guelaat Bousbaa	5529
07	El Eulma	5184	14	Pont BOUCHET	5184
Total volume (m ³ /d)			43290		

The contribution of groundwater is very important in the water balance of the region.

Global and exhaustive assessment of the water table:

The following Table N°5 shows the state of the balance sheet. We notice a deficit which is increasing because the climate of the region is impacted by climatic variations.

Table N°5: provides an overview of the balance sheet

Global Throughput (10 ⁶ m ³ .an ⁻¹)			
	Oued	Superficial aquifer	Ddeep aquifer
Inputs	964.8	24.66	17.21
Outputs	941.35	24.41	17.84
Difference	-23.45	-0.25	-0.63
Percentage Difference	-2.43	-1.03	-3.68

We note that the balance is negative, despite the region's water wealth. Indeed, this area receives good year in bad year around 850 mm/year. This observed deficit is caused by the

anarchy of the use of water, hence the recourse to the aquifer contract which could constitute a solution to the observed waste.

Map of water families: (fig.9):

The distribution map of water families (fig.9), shows three water families:
 - the family of sodium chlorinated waters, characterizing the littoral zone of the saltworks,
 -the family of mixed waters are present throughout the plain,
 -the family of calcium sulphate waters accompanied by nutrients. In this part irrigation is important.

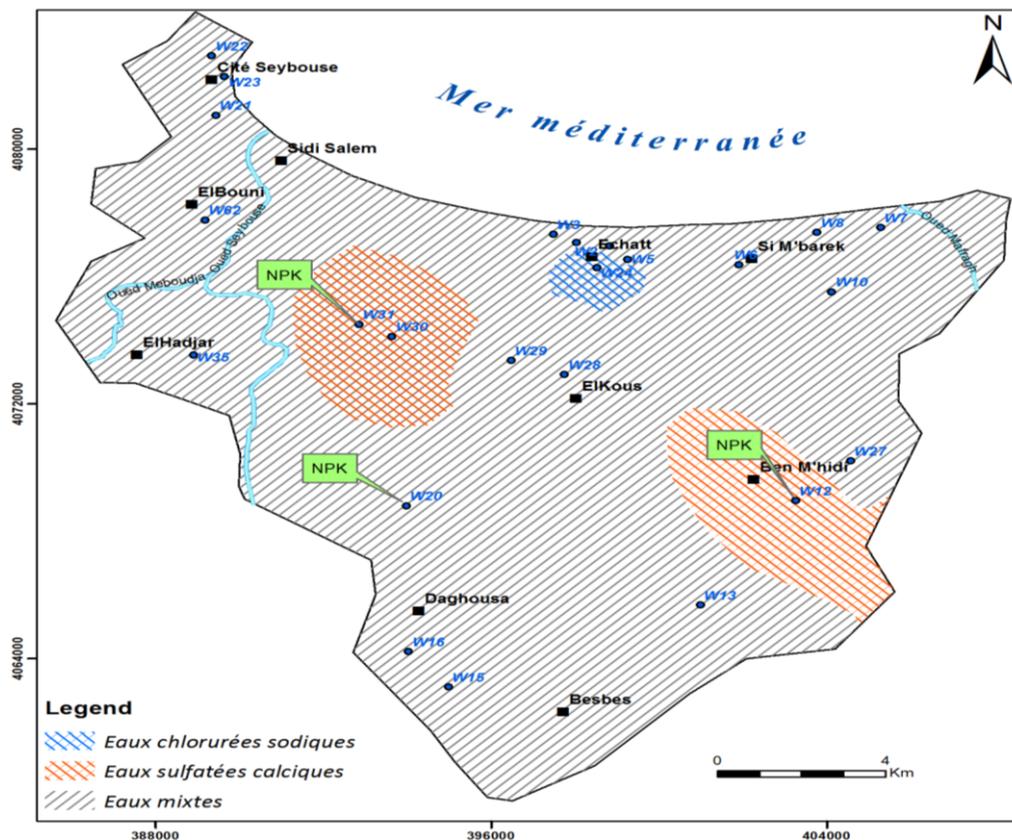


Fig.9: Map of water families

The implementation of the aquifer contract:

Starting from the observation made on the field where each user exploits the water in his own way, which has resulted in an overexploitation of the water tables resulting in reality in a deficit which is accelerated by the climatic variations, forced the officials to seek a new method of water management.

The principle of the groundwater contract:

participatory management in the distribution of the resource is not a new fact our ancestors used in time the FOGGARAS system based on the equitable sharing of the resource. Today to achieve our objective, the purpose of the aquifer contract is the participatory management of the population (state & individual). To succeed in uniting the different fringes of society, we must find

Problems encountered:

The first and most important problem is to unite users to this new concept. We must start from a management made according to each other towards a management where the destination of each liter must be known. Violators should be penalized.

The mission is divided into three parts:

- convince users to adhere to this new policy,
- share knowledge of the field,
- do self-monitoring.

The first point is accepted by all because it is for the general interest.

The second point poses a problem because the actualisation of the data poses a problem.

-The third point is accepted but we must pay attention to the tacit agreements between each other.

CONCLUSION

The initiation of this project is linked to the support of the population and the goodwill of the authorities. These two parameters are not yet acquired. However, we continue to move forward by taking inventory of the various parameters (number of boreholes, number of wells, contributions from dams, etc.), allowing to go quickly in the realization of this project.

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ANALYSIS OF INORGANIC NITROGEN FORMS AND HEAVY METAL CONCENTRATIONS IN THE RÁKOS STREAM NEAR THE WASTEWATER TREATMENT PLANT IN PÉCEL

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Abstract: Conducting studies in our natural waters' environment is important. In this case, it was monitored in and along the Rákos stream to determine whether these areas were contaminated. Pécel, measurements were carried out in the Rákos stream and its surroundings near the local wastewater treatment plant. The analyses covered the test of heavy metals (Zn, Cd, Ni, Pb, Fe, Mn, Cr, Al, Cu) in the Rákos stream - in its water, sediment, and the soil of its channel wall - and inorganic nitrogen forms (nitrite-N, nitrate-N and ammonium-N) in the stream water. There were three sampling events: soil, sediment, and water sampling. Laboratory measurements were taken after each sampling. The values of heavy metal concentrations measured in soils and sediments were compared with the B contamination limit values set in the Joint Decree 6/2009 (IV. 14.) of the Ministry of Agriculture, Forestry, Environment and Water Management [1], which showed that only the amount of Cd exceeded the contamination limit value. According to the MSZ 12749: 1993 [2] for surface water, the water of the Rákos stream is classified as largely or heavily contaminated for the measured heavy metals, which indicates that further measures, such as phytoremediation, are necessary. Given the measurement results, further investigations would be needed to determine why cadmium levels are higher in soil and sediment and where the heavy metal content in the Rákos stream comes from. The higher ammonium-N and nitrate-N concentrations measured in Rákos stream would also require intervention. The Rákos stream could be suitable for agricultural irrigation based on its ammonium-N and nitrate-N concentrations. Still, it would not be recommended based on its high heavy metal content.

Keywords: ammonium-N, heavy metals, nitrate-N, monitoring, stream

INTRODUCTION

Today, alongside information technology and biotechnology [3], the environment has the biggest impact on our society and economy. There is a growing wish to pass on a better, more liveable planet to the next generation than what was inherited. [4]. Consequently, there is an increasing need to describe the state of the environment around us as accurately as possible to measure the impact of environmental pressures on the biosphere and humans [5].

Our planet's natural mediums for life are water, air, and soil. Through agricultural, industrial and community activities, the Earth's environmental elements are polluted with many harmful

substances [6]. The rate of spread of these pollutants is not uniform, being relatively slower in soil than in surface water, groundwater, and air.

In the latter two, the substance, whether harmful or harmless, can travel vast distances quickly without regard to national or continental boundaries. Consequently, one of society's major tasks in environmental protection is monitoring pollution in space and time [7]. Although significant improvements have been achieved in recent decades in reducing the number of harmful substances emitted, the will to further reduce and monitor pollution has increased.

It is safe to say that this feedback is essential to achieve sustainable development. This feedback provides sufficient authority to make the appropriate laws and regulations. Of course, the basis for the rules is the evidence gathered through scientific monitoring.

To create regulations that benefit the environment and people, they need to have a strong justification. It is important that measurements well support the evidence of pollution. This means that they need to be repeatable, usable, and subsequently standardised to silence various interests and lobbies.

The most common way of doing this today is continuous instrumental monitoring. What they have in common is that they allow us to monitor the quality and quantity of pollutants entering water, air, and soil.

Water was the birth of life; it is still a condition of life. All living organisms "feed" primarily on water, the basis of much of their body mass. Most of the water is found in the ocean basins. However, the Earth's water is in constant flux through circulation, linking all the spheres. This is why protecting our environment - soil, air, and water resources- is important.

Only 3% of the Earth's water is potable freshwater [8]. The drinking water use rate is increasing worldwide, particularly in developed countries. At the same time, according to a UNICEF and WHO report that 1 in 3 people have access to healthy and safe drinking water [9].

"Citizens, nature, and industry all need healthy rivers and lakes, groundwater, and bathing waters. The Water Framework Directive (WFD) focuses on ensuring good qualitative and quantitative health, i.e., reducing and removing pollution and ensuring that there is enough water to support wildlife at the same time as human needs." [10].

This paper aims to assess the pollution of a section of the Rákos stream, namely the wastewater treatment area of Pécel. Investigations will include the measurement of inorganic nitrogen forms (nitrite-N, nitrate-N and ammonia-N) and heavy metal loads in the water, sediment and soil of the Rákos stream.

MATERIALS AND METHODS

Sampling

The water samples (3 samples) were taken from the Rákos stream; the first sampling site was at the outfall of the wastewater treatment plant in Pécel, the second 1 m from the spout and the third 10 m from the spout (see Figure 1 and 2.).

Water samples for the determination of inorganic nitrogen forms were taken on three occasions, while for heavy metal analyses, sampling was done on two occasions (times 2 and 3). The first sampling was on 17 March, the second on 24 March and the third on 31 March. The water samples were sampled using MSZ EN ISO 5667-1:2007 [11].

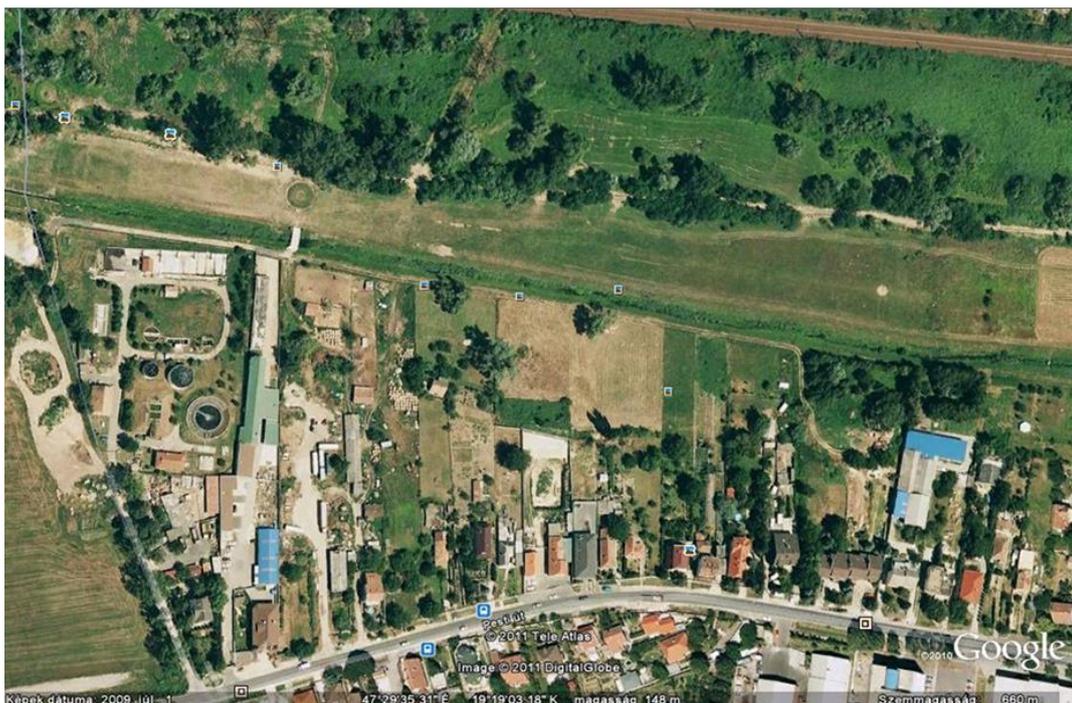


Figure 1. The sampling area

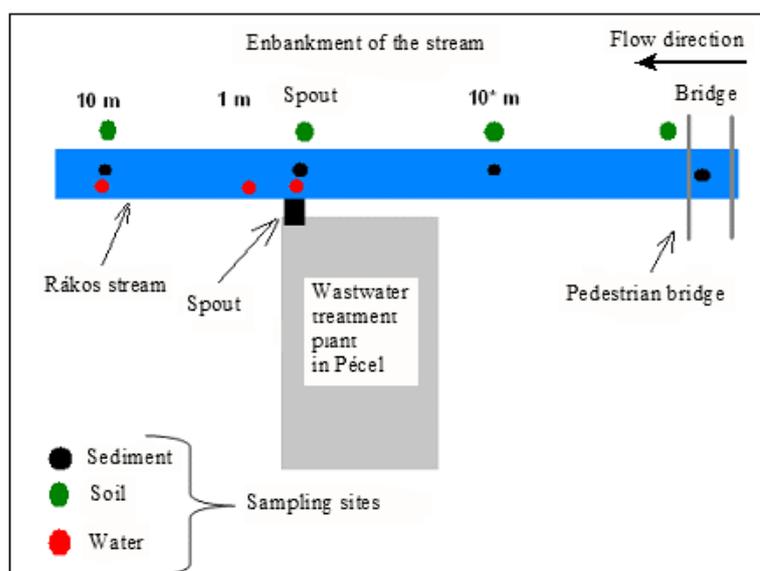


Figure 2. Sampling places

Sediment and soil samples were also collected on these dates. 4 soil samples and 4 sediment samples were taken according to MSZ-21470-1:1998 [12]. The sediment samples were taken from the Rákos stream bed, while the soil samples were taken from the stream channel. There were four to four sampling sites. Samples were taken directly at the spillway and 10 m from the spillway, but two additional samples were also collected upstream. The sampling locations are shown in the figure.

Preparation of soil and sediment samples

As a first step, all samples were poured into separate plastic trays and then pre-sorted to remove large gravel, wood, roots, and other debris. After drying, they were sieved through a 2 mm mesh sieve, and then a small portion of each sample was also sieved through a 0.2 mm mesh sieve.

Determination of dry matter content (MSz-08-0205-1978 [13])

5 g of the air-dry sample was weighed on an analytical balance into a grinding weighing pan of known weight. The vessels containing the air-dry sample (with an open lid) were placed in the drying cabinet and dried at 105°C to constant weight. This took approximately 72 hours. After drying, the samples were placed in an exicator until cool and weighed again on an analytical balance. The concentration values were corrected for the dry matter content of the soil.

Digestion of soil, sediment, and water samples

From the air-dry soil and sediment samples, about 0.5 g of soil was weighed into Teflon bombs, followed by adding 5 cm³ of 65% nitric acid and 2 cm³ of 30 % hydrogen peroxide.

From the water samples, 5 cm³ was measured into the Teflon bombs, adding 5 cm³ of 65% nitric acid and 1 cm³ of 30% hydrogen peroxide.

Digestion was done using a Milestone (MLS) 1200 mega Teflon bomb microwave digestion oven. Digestion was performed according to the program given in Table 1.

After digestion, the samples were cooled for half an hour and then filtered through 0.45 µm pore size filter paper into 25 cm³ flasks. The samples were placed on the mark and homogenised. The samples were poured into labelled plastic containers and stored in the refrigerator until measurement.

Table 1. Digestion program for measuring heavy metal concentrations.

Steps	Soil and Sediments		Water	
	Required time (minutes)	Operation	Required time (minutes)	Operation
1.	5	Digestion, 250Watts	6	Digestion, 250Watts
2.	2	Ventilation	6	Digestion, 400Watts
3.	5	Digestion, 400Watts	6	Digestion, 650Watts
4.	5	Digestion, 250Watts	6	Digestion, 250Watts
5.	7	Digestion, 700Watts	5	Ventilation
6.	5	Ventilation	-	-

Measurement of heavy metal content by ICP-AES

Pseudo-total heavy metals in soil, sediment and water samples were determined using a Jobin-Yvon 24 inductively coupled plasma source atomic emission spectrometer (ICP-AES).

Determination of ammonium-N

The ammonium ion reacts with phenol and phenol compounds in alkali in the presence of hypochlorite to form a bluish indophenol, the formation of which is catalysed by Na₂[Fe(CN)₅NO] (nitroprusside sodium).

To 5 cm³ of a water sample, 0.5 cm³ of salicylate reagent was added, then after thorough mixing, 0.5 cm³ of oxidising reagent was added and shaken thoroughly. After 30 minutes of standing time, but within 60 minutes, the absorbance was measured with a Spekol spectrophotometer at 680 nm against a blank test.

Determination of nitrite-N (MSZ-448-12:1982 [14])

Interaction of nitrite ions with p-amino benzenesulfonic acid (sulphanilic acid) in acid yields a diazonium compound converted to a red azo dye by α -naphthylamine. The colour intensity of the solution at certain pH values is in proportion to the concentration of nitrite ions.

The stock solution was: 0.217 mmol NaNO₂. For the calibration series, 0.5-1-2-5 cm³ of the working solution was added to 50 cm³ flasks and then made up to the mark with double distilled water. 10 cm³ of the sample was weighed into 50 cm³ volumetric flasks. 25 cm³ of double distilled water was used as a blank solution. To the prepared solutions, 1cm³ sulphanilic acid and, after standing for 5 minutes, 1 cm³ α -naphthylamine were added and made up to the mark with double-distilled water. Between 40 and 120 min, the absorbance of the solutions was measured at 540 nm using the same photometer.

Determination of nitrate-N

Determination of nitrate-N concentration according to MSZ-448-12:1982 [14]

The working solution was a 0.016mM KNO₃ solution. The calibration series was prepared: 0.5-1.0-2.0-5.0-10.0cm³ of the working solution was measured into a 50 cm³ standard volumetric flask and made up to the mark with double distilled water. 5 cm³ of the samples were measured into an evaporating beaker. The blank solution was 5 cm³ of double distilled water. 1 cm³ of sodium salicylate solution was added to the prepared solutions, and the solution was evaporated to dryness in a drying oven. After cooling the dry residue, 1cm³ of concentrated sulphuric acid was added. After dissolution, 25 cm³ of distilled water and 10 cm³ of 10 molar NaOH solution were added to the mark in a 50 cm³ flask with distilled water. The absorbance of the solutions was measured with a spectrophotometer at 410 nm wavelength against the blank solution.

STATISTICAL ANALYSIS

Statistical data analysis was performed using descriptive statistics and two-way analysis of variance [15] with SPSS 14.0.

RESULTS AND DISCUSSION

Heavy metal concentration in the soil of the embankment along the Rákos stream

The concentration of heavy metals in the Rákos stream gravel soil was measured three times in the vicinity of the wastewater treatment plant in Pécel. The results were compared with the B contamination limit values in Joint Decree 6/2009 (IV. 14.) of the Ministry of Agriculture, Forestry, Environment and Water Management [1]. The measurement results for each sampling point are presented in Table 2.

Table 2. Average heavy metal concentrations in the embankment soil of the Rákos stream near Pécel

The average concentration of heavy metals in embankment soil (mg/kg d.m.) (\pm SD)								
Zn	Cd	Ni	Pb	Fe	Mn	Cr	Al	Cu
43.40 \pm 11.80	1.36 \pm 0.20	9.30 \pm 1.47	14.69 \pm 2.08	8637.51 \pm 2116.35	286.37 \pm 33.67	16.44 \pm 2.63	9909.25 \pm 1725.52	11.63 \pm 2.77

The results showed that the Bridge samples (see Figure 2) had the highest concentrations of all heavy metals. The results also show that the concentrations of zinc, nickel, total chromium, and copper in the soil are always below the contamination limit. There are no limits in the Regulation for measured iron, manganese, and aluminium heavy metals.

The average manganese content of the area is 286.37 \pm 33.67 mg/kg dry matter (hereafter referred to as d.m.), which is to the soil data for Hungary given by several authors [16-18]. According to Pais [10], the iron content of Hungarian soils is high, averaging 30,000 mg/kg. The iron content measured in the survey averaged 8637.51 \pm 2116.35 mg/kg d.m. below this value.

Among the heavy metals, the concentration of cadmium exceeded the contamination limit. Its average concentration in the survey area was 1.36 \pm 0.20 mg/kg d.m. A two-way (location and time) random block design with two-way analysis of variance confirms (Table 3) that there is no significant difference in soil cadmium concentrations by sampling location ($LSD_{5\%} = 0.33$) and time ($LSD_{5\%} = 0.29$).

Table 3. Two-way random block order variance table for cadmium concentrations in the sediment of the Rákos stream

Factors	SQ	FG	MQ	F	p	$LSD_{5\%}$
Correction factor	44.227	1	44.227	655.897	0.000	
Replicates	0.167	1	0.167	2.472	0.144	0.23
Site	0.342	3	0.114	1.691	0.226	0.33
Time	0.221	2	0.111	1.639	0.238	0.29
Site*time	0.321	6	0.053	0.792	0.595	0.57
Error	0.742	11	0.067			
Total SQ	1.792	23				

The studies in the Galga River [19] found that the river sediment was highly contaminated with cadmium. It was found that the heavy metals were moved from the area by the rolled material mainly because of higher amounts of precipitation. This was because only traces of cadmium were detected in samples taken after the wetter weather.

Heavy metal content in sediments of the Rákos stream

The heavy metal load of the sediments of the Rákos stream was also determined based on the B contamination limits set in the Joint Decree 6/2009 (IV. 14.) of the Ministry of Agriculture, Forestry, Environment and Water Management [1]. In the stream sediments, only the concentration of cadmium exceeds the pollution limit value, even for the bottom sediment (Table 4).

Table 4. Average heavy metal concentrations in the sediment of the Rákos stream near Pécel

Average concentration of heavy metals in sediment (mg/kg d.m.) (\pm Standard Deviation)								
Zn	Cd	Ni	Pb	Fe	Mn	Cr	Al	Cu
76.77 \pm 32.63	1.35 \pm 0.35	9.57 \pm 3.28	16.55 \pm 6.01	9825.39 \pm 2734.88	387.76 \pm 143.81	23.86 \pm 10.7	9912.48 \pm 2964.67	19.39 \pm 8.82

The average cadmium concentration in the sediment was 1.35 ± 0.36 mg/kg d.m., but there is a significant difference ($LSD_{5\%}=0.23$) between sampling sites (Table 4. shows the ANOVA results), with cadmium concentrations decreasing away from the bridge, but with a significant maximum at the spout. The average cadmium concentration at the spout was 1.43 ± 0.37 mg/kg d.m. The cadmium concentration at the sampling point 10 m downstream of the outfall of the wastewater treatment plant is already below the limit value. This, therefore, means that a significant amount of cadmium is also being discharged from the treated effluent. The distribution of cadmium by sampling point is shown in Figure 3.

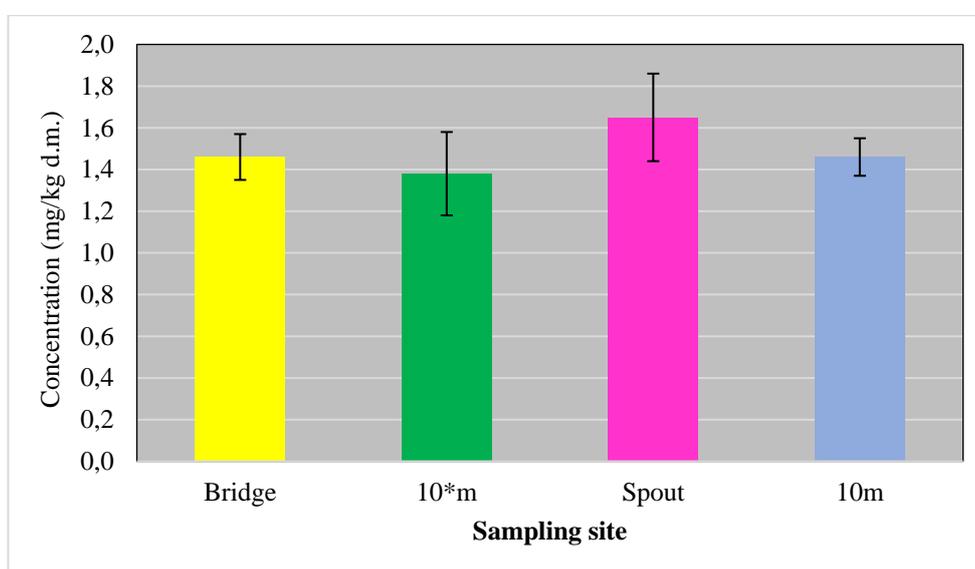


Figure 3. Cadmium concentration in sediments of the Rákos stream

Table 4. Two-way random block order variance table for cadmium concentrations in the sediment of the Rákos stream

Factors	SQ	FG	MQ	F	p	LSD _{5%}
Correction factor	43.578	1	43.578	2713.869	0.000	
Replicates	0.024	1	0.024	1.499	0.246	
Site	1.321	3	0.440	27.424	0.000	0.23
Time	0.882	2	0.441	27.466	0.000	0.14
Site*time	0.538	6	0.090	5.580	0.007	0.28
Error	0.177	11	0.016			
Total SQ	2.941	23				

For the other heavy metals, except for chromium, aluminium, and copper, it can be stated that the values at the outfall are, on average higher than at other sampling points, but below the pollution

limit. Chromium, copper and aluminium Concentrations are highly variable over time at the sampling sites at Bridge and 10* m. Their concentrations are always higher in samples taken at the end of March than before. However, the attention of sediment samples taken at the wastewater treatment plant in Pécel and 10 m from the outfall (10 m) show relatively constant values over time.

The higher cadmium concentrations in the sediment and embankment soil around the wastewater treatment plant in Pécel (Tables 2 and 3.) were nearly constant over the period studied, while the sediment and water of the stream were also contaminated with cadmium. This suggests that it is very likely that the cadmium in the environment comes from the water of the treatment plant. Due to its poor water-solubility, which depends on the pH and organic matter content of the medium [20-23], cadmium is mainly not present in dissolved form, but adsorbed on organic and inorganic colloidal surfaces, trapped in soil sediments by occlusion, precipitation with other compounds and biological organic binding [24].

Heavy metal content in the water of the Rákos stream

The concentration of heavy metals in the water of the Rákos stream has been compared with the limit values established by MSZ 12749:1993 [2]. This standard specifies five water quality classes for surface water quality.

Based on the measurement results, it can be concluded that the lead concentrations were below the detection limit, and the attention of manganese was in the excellent quality class in all cases. The same could not be said for the other heavy metals, as the water in the Rákos stream was mostly highly polluted. Most of the time, it had to be classified in the fifth category, i.e., highly polluted, according to the degree of contamination.

The zinc (Figure 4) load of the Rákos stream water was highly polluted on both sampling days. The concentration of copper also exceeded the 75 µg/l limits (water quality limit values for pollutants according to Decree No 10/2010 (VIII. 18.) VM of 18.08.2010) [1] for the heavily polluted water quality class. Thus, the stream is classified as highly polluted based on copper and zinc contamination.

Chromium (Figure 4) contamination in Rákos stream is relatively constant over time, but the highest value was measured at the outfall, but there is no significant difference between sampling sites. Aluminium (Figure 4) shows highly variable values over time compared to chromium. Higher values were measured on the second sampling day. The measurement results show that aluminium is present in higher concentrations 1 m after the spout. Still, the measurement data are very scattered so no significant difference can be found for aluminium between sampling sites and time.

The loading of zinc, chromium, copper, and aluminium in the Rákos stream water is shown in Figure 4.

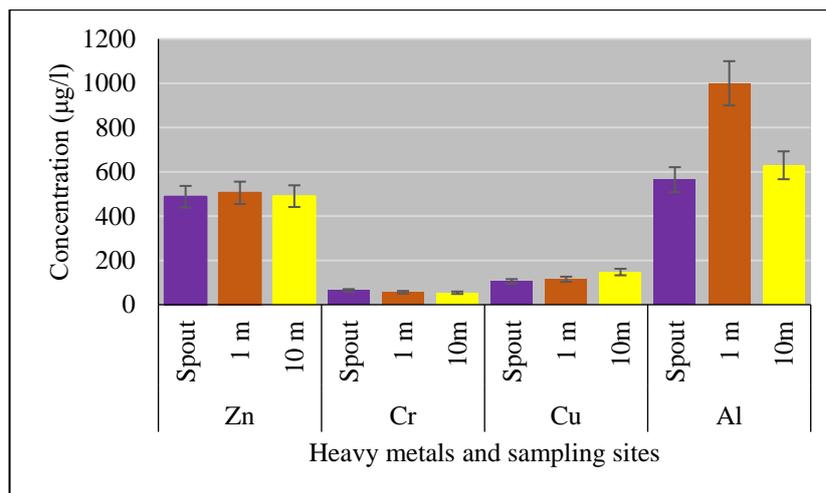


Figure 4. Concentrations of zinc, chromium, copper, and aluminium in the water of the Rákos stream

The tests also included cadmium, nickel, and iron in the stream water. Cadmium (Figure 5) exceeded the contamination limit in the bedrock and sediment of the Rákos stream and was also present in the water in significant quantities. Cadmium concentrations were highest at the spout, averaging 8.75 ± 0.002 mg/l. The data are scattered for samples taken at 1 m, so no significant difference between sampling sites can be detected. The cadmium concentration in the stream water is classified as contaminated or highly contaminated.

The Rákos stream receives treated wastewater from several locations, but not all measure such high contamination levels. A 2007 SZIE-RET project [25] investigated how much water flowing through the Fiók-Rákos branch is polluted by heavy metals, among other factors under investigation. The tests showed that the Rákos stream's water quality was rated as excellent for all heavy metal components. The nickel (Figure 5) concentration in the water of the Rákos stream is within a constant value interval over time. Its value averages 3.58 ± 3.15 mg/l in the area.

The iron (Figure 5) concentrations in the water at the 10 m sampling point are scattered and, therefore, unavailable for analysis. At and near the outfall, the values are nearly the same, and the concentrations do not vary much over time. The stream is again classified as water quality class V in light of the results obtained. The concentrations of cadmium, nickel and iron in the stream water are illustrated in Figure 5.

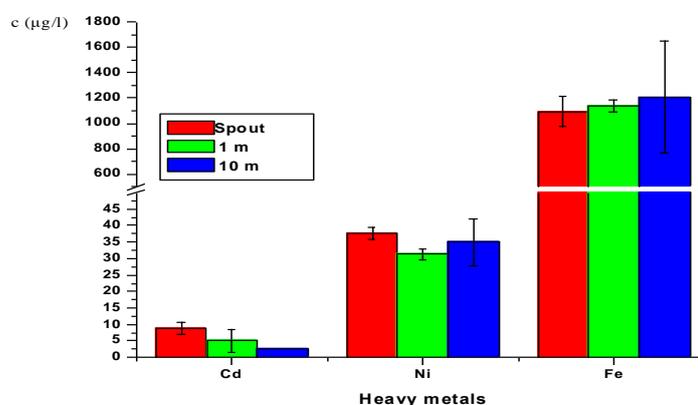


Figure 5. Cadmium, nickel, and iron concentrations in the water of the Rákos stream

Bowen [26] determined the average concentration of each metal in the geosphere and hydrosphere (Table 5). The data are typical of the uncontaminated state. Comparing the measured data with these values, the average concentration of all heavy metals is above these values with the export of iron (and aluminium). Therefore, the wastewater treatment plant in Pécel has a high environmental impact on the recipient.

Table 5. Average concentrations of metals in the geo- and hydrosphere (without pollution) [26]

Element	Average concentration			
	in earth crust mg kg ⁻¹	in soils mg kg ⁻¹	in freshwaters µg dm ⁻³	in marine waters µg dm ⁻³
Ag	0.07	0.01-8	0.01-3.5	0.03-2.7
As	1.5	0.1-40	0.2-230	0.5-3.7
Cd	0.11	0.01-2	0.01-3	<0.01-9.4
Cr (III)	100	5-1500	0.1-6	0.2-50
Cr (IV)				
Cu	50	2-250	0.2-30	0.05-12
Fe	4.1*10 ⁴	4-55*10 ⁴	10-1500	0.03-70
Hg	0.05	0.01-0.5	0.0001-2.8	0.01-0.22
Mn	950	20-10000	0.02-130	0.03-21
Mo	1.5	0.1-40	0.03-10	4-10
Ni	80	2-750	0.02-27	0.13-43
Pb	14	2-300	0.06-120	0.03-13
Sb	0.2	0.2-10	0.01-5	0.18-5.6
Se	0.05	0.01-2	0.02-1	0.052-0.2
Zn	75	0-900	0.2-100	0.2-48

Ammonium-N, nitrite-N and nitrate-N in the Rákos stream

Based on the results obtained after the measurements, the Rákos stream has been classified according to MSZ 12749:1993 [2] for inorganic nitrogen forms (Figure 6-8).

The concentration of ammonium-N in the Rákos stream (Figure 6) and at all time points and sampling locations was well above the limit value for category V (>2 mg/l), i.e., it was highly contaminated. Based on the nitrite-N concentration (Figure 7), the stream was classified as polluted (IV; 0.3 mg/l) in all cases. The nitrate-N concentration (Figure 8) showed that in all cases, the stream was classified as heavily polluted (V; >25 mg/l) with one exception, the sample taken at the outfall on 17 March was polluted (IV; 25 mg/l).

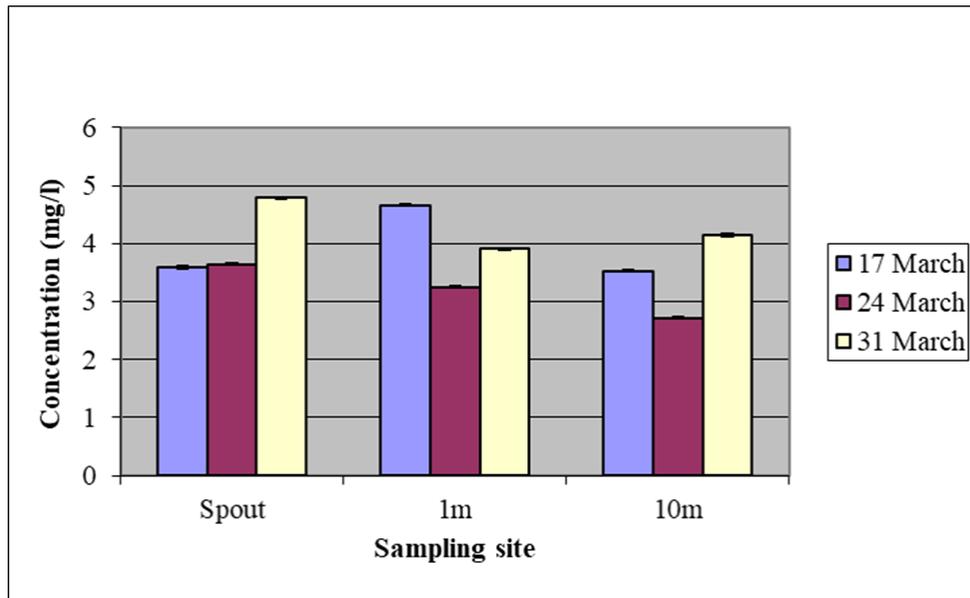


Figure 6: Ammonium-N concentration in the water of the Rákos stream

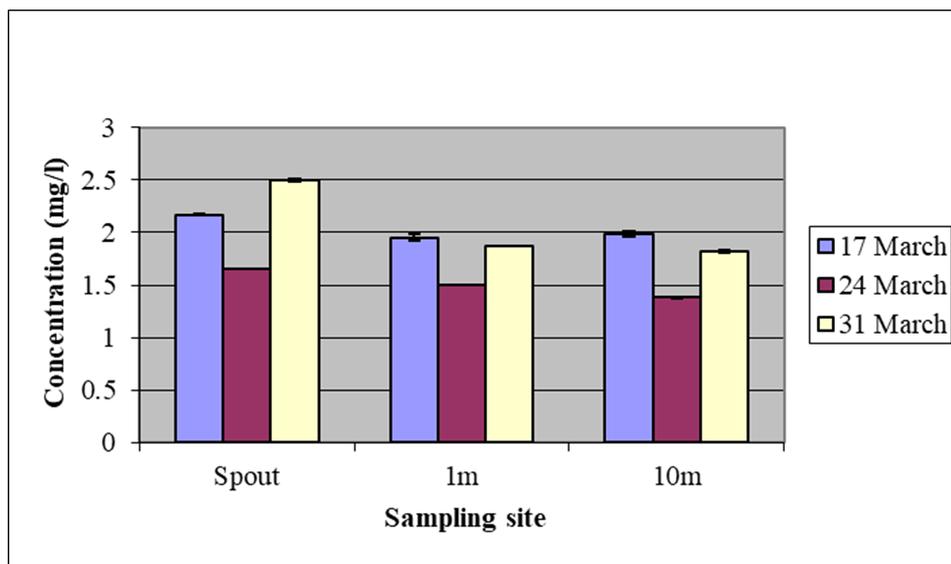


Figure 7: Nitrite-N concentration in the water of the Rákos stream

Based on the measured data, it is striking that the concentration of nitrate-N in the water increases away from the wastewater treatment plant. There have been many studies on the Rákos stream from many different perspectives. There has also been a biological survey. According to one of the surveys [27], 15 sampling points were chosen. One of the sampling points was just outside Pécel. It was sampled 7 times from December to August. Nitrite-N, nitrate-N, and ammonium-N were also measured in this survey.

Biological classification was also carried out. Taxons were measured. From this point of view, the water quality class of the stream at Pécel was III at the March sampling. The concentration of nitrate-N was about 9 mg/l, nitrite-N about 0.4 mg/l and ammonium-N: 1.4 mg/l.

The average concentrations of ammonium-N were 3.8 mg/l, nitrate-N between 15.3 mg/l and nitrite-N between 1.9 mg/l. In all the authors' measurements, the average concentrations were higher than those measured by others. Further investigation is needed to determine why the

concentrations of the three inorganic nitrogen ions were elevated compared to previous measurements.

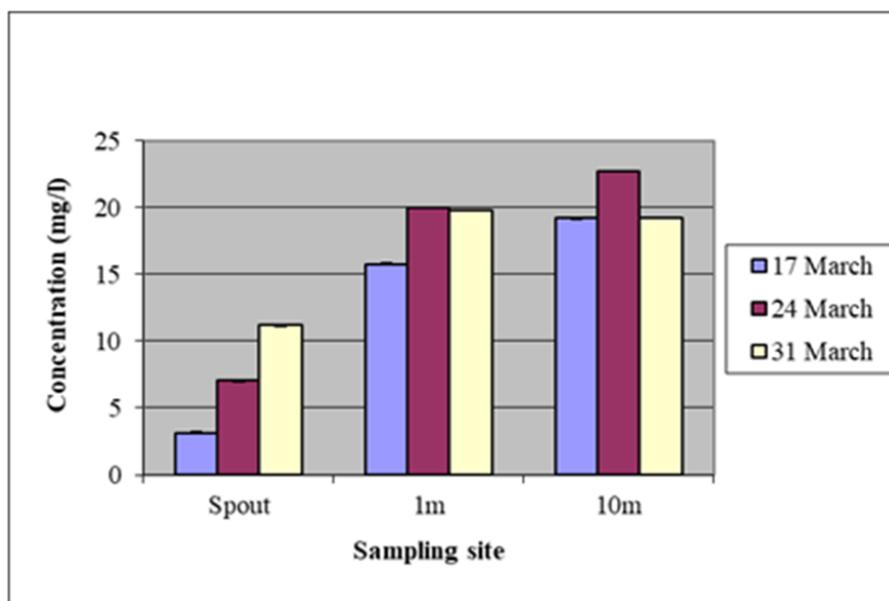


Figure 8: Nitrate-N concentration in the water of the Rákos stream

In 2020, ZÖLD XVII Environmental, Nature Protection and Urban Development Association [28] surveyed the Rákos stream, where nitrate-N, nitrite-N and ammonium-N concentrations were measured at several sites using colourimetric methods. Nitrite-N (0-0.4 mg/l $\text{NO}_2\text{-N}$); Nitrate-N (0-40 mg/l $\text{NO}_3\text{-N}$); Nitrogen ammonia (0-3.0 mg/l $\text{NH}_4\text{-N}$). Higher values were measured in the area around the Péceli spout. 10 m from the spout of the water treatment plant, quite high values of around 20 mg/l were measured.

CONCLUSION AND RECOMMENDATIONS

The results clearly show that in the section of the Rákos stream, the only heavy metal concentration of the 9 heavy metals tested in the samples of the copper soil and sediment that exceeded the contamination limit was cadmium. Cadmium is considered one of the most dangerous heavy metals due to its toxic and carcinogenic effects. Methods such as phytoremediation and electrokinetic cleaning may be appropriate to reduce the concentration of cadmium in the study area. Electrokinetic cleaning is based on the principle that charged particles, including contaminants, migrate to an anode or cathode in the soil when exposed to an electric current [29]. However, electrokinetic cleaning is an expensive process and requires electricity. Therefore, a cheaper cleaning technology would be phytoremediation, which uses plants to clean the environment of inorganic or organic chemical pollutants. Phytoremediation is an environmentally friendly, relatively inexpensive technology [30]. The higher concentrations of ammonium-N and nitrate-N measured in the Rákos stream would also require intervention. The concentration of ammonium-N and nitrate-N in the Rákos stream could be suitable for agricultural irrigation. Still, its heavy metal content would make it unsuitable for irrigation, except after its removal. As there is no known deliberate pollution in the area, further investigation would be needed to determine the exact cause of the higher pollution levels.

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IMPACT OF AGRICULTURAL LAND USE PRACTICES AND MONSOON AT MICRO WATERSHED LEVEL ON SOIL PROPERTIES INCLUDING EARTHWORM POPULATION AND CROP PRODUCTION IN RED AND LATERITE AGROCLIMATIC ZONE UNDER MOIST SUB-HUMID REGION OF WEST BENGAL STATE IN INDIA

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Abstract: The sustainability in soil fertility, crop production and the population of matured earthworms in the soil were influenced by both agricultural land use practices and the monsoon rainfall. The study was conducted in the years of 2020 and 2021 within three micro watersheds in the Paschim Medinipur district (22°57' 06.4"N Lat., 87°21'41.0"E Long. to 21°46'06.4"N Lat., 87°24'06.9"E Long. in N-S; and 22°23'00.0"N Lat., 87°18'15.0"E Long. to 22°23'41.7"N Lat., 87°39'05.7"E Long. in E-W) within Red and Laterite Agroclimatic zone of West Bengal state in India. Data from twenty different farming practices, i.e., treatments were analysed following Duncan's Multiple Regression Test involving various soil physicochemical, biological properties and yield of the crops. Significant changes were found in various soil characteristics including matured earthworm population after monsoon period and agricultural land use practices, including bunding, organic manure application, boundary plantation, etc. In 2020, the C14 land use system had the highest average number of earthworms at 7.33 m⁻², while the lowest value was found in C5 with 3.00 m⁻². In the same period in 2021, C2 had the highest average number of earthworms at 6.67 m⁻², while C5 had the lowest value of 3.33 m⁻². The overall yield of kharif rice ranged from 1.73 tha⁻¹ in C12 to 2.25 tha⁻¹ in C6 land use system, while the yield of potato varied from 17.63 tha⁻¹ in C12 to 18.36 tha⁻¹ in C9 land use system. Earthworm population ranged from 3.00 m⁻² in C5 to 6.67 m⁻² in C13 and C14 land use systems. Principal component analysis revealed that earthworm population and crop production were influenced by soil properties such as bulk density, porosity, total aggregate, moisture, permeability, infiltration, pH, organic carbon, available nitrogen, and land use practices.

Keywords: Agricultural land use, crop yield, earthworm, monsoon, micro watershed, soil properties.

INTRODUCTION

Land use plays a vital role in the existence and advancement of human civilization. To create human settlements and semi-natural environments such as cultivated fields, pastures, and managed forests, it is necessary to manipulate and modify the natural wilderness into

developed ecosystems. Effective management of land use is crucial for both the directing land allocation for specific purposes and conserving natural resources for the wellbeing of future generations.

Changes in land use patterns may result in changes in land cover patterns, which could have an impact on the structure of ecosystem. The physical, chemical, and biological activities of the soil are all significantly impacted by the changes in land use and land cover (Bahrami et al., 2010; Kizilkaya and Dengiz, 2010). The qualities of soil are the dominant factors of soil degradation related to land and soil mismanagement practices, whereas planting of suitable crop types in a cropping system can play a crucial role in improving the soil organic matter and soil nutrient status essential for both plants and soil microorganisms (Sharma et al., 2012). In such background, present study was conducted to investigate the impact of different cropping systems on soil properties, especially before and after the monsoon period, at the micro watershed level. The objective of the study was to evaluate suitable agricultural land use practices towards conserving sustainability in efficient ecosystem services of land resources and securing sustainable food productions.

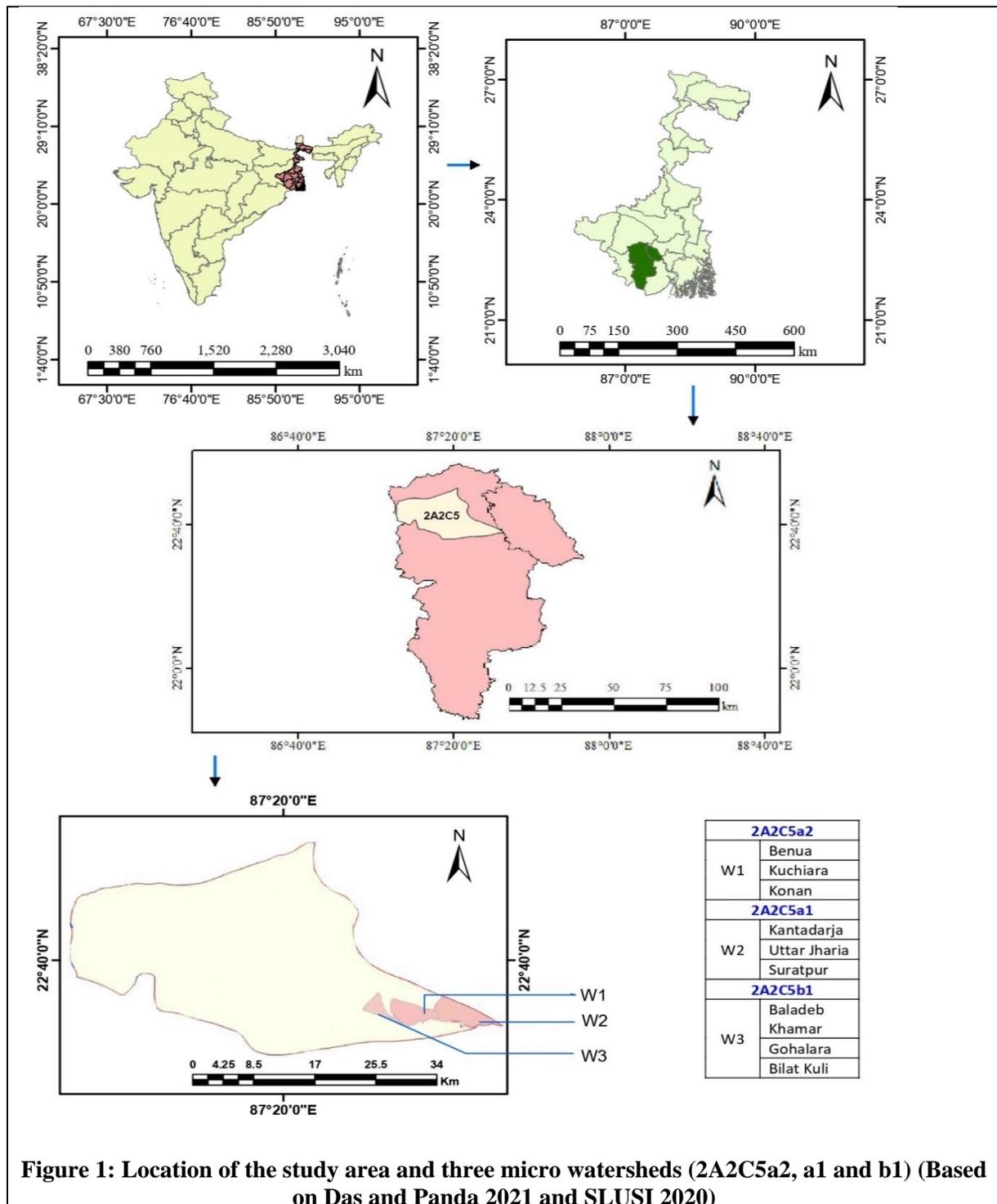
MATERIALS AND METHODS

Location of the study area: The study area (Fig. 1) is located in the Paschim Medinipur district (N-S: 22°57' 06.4"N Lat., 87° 21'41.0"E Long. to 21°46'06.4"N Lat., 87°24'06.9"E Long.; and E-W: 22°23'00.0"N Lat., 87° 18'15.0"E Long. to 22°23'41.7"N Lat., 87°39'05.7"E Long.) with the district headquarters at Medinipur within the state of West Bengal in India (Das and Panda, 2022; SLUSI, 2020). The experimental sites, considered as treatments in the present study, are farmers' fields, located in three micro watersheds within one watershed (Table 1; AISLUS, 1984, and 2020) in the Red and Laterite agroclimatic zone in West Bengal.

According to the "Watershed Atlas of India" (AISLUS, 1984), three micro watersheds (2A2C5a2, a1 and b1) are situated within Water Resource Region 2 (Rivers flowing into the Ganges), 2A (lower Ganges basin), 2A2 (left bank of the Ganges and Bhagirathi from delta up to the confluence with Ghugri catchment), 2A2C (Rupnarayan sub-catchment), 2A2C5 watershed. The villages of Benua, Kuchiarra, and Konan (Fig. 3.1a) were selected (SLUSI, 2020) for field research within micro watershed W1 (2A2C5a2). The distances between these areas and Keshpur, the block headquarters, are 8.2, 7.3, and 10.5 kilometres, respectively. In micro watershed W2 (2A2C5a1), Kantadarja, Uttar Jharia, and Suratpur villages (Fig. 3.1b) were chosen for field investigations (SLUSI, 2020). From the block headquarters at Daspur, those villages are 7.2 km, 7.9 km, and 3.2 km apart respectively. In micro watershed W3 (2A2C5b1), Baladeb Khamar, Gohalara, and Bilat Kuli villages (Fig. 3.1c) were chosen for field investigations (SLUSI, 2020). From Keshpur, the block headquarters, those villages are 6.4 km, 8.3 km, and 10.6 km apart respectively.

Climate and weather information during experimental period: In the study area, a hot tropical monsoon climate is prevalent, and that area was classified as the moist sub-humid climate (Raju et al. 2014). Summer lasts from mid-April through mid-June. Rains caused by the southwest monsoon can sometimes continue up to September during the monsoon season, which remains active lasts from mid-June to August. Winters prevail from December to January; however, they can sometimes continue up to February. The mean maximum and minimum temperatures varied significantly throughout the year in different seasons. The meteorological information was obtained from the NASA Earth Science/Applied Science

Program-funded POWER Project at the NASA Langley Research Center (LaRC, NASA 2022).



Experimental details: Twenty land use systems (Table 2) were chosen in the study area (Fig. 1) to fulfil the goals of the current study. Major soil physicochemical and hydrological parameters were chosen to evaluate the year-to-year effects of specified land use regimes.

Experimental Design

Season: Premonsoon (*pre-Kharif*), Monsoon (*Kharif*), Post-monsoon (*rabi*); **Duration:** 2 years (2020-2021);

Experimental Plots for crops: Farmers' fields in micro watersheds (Fig. 1); **Replications:** 3 (in each micro watershed); **Design of the experiment:** Duncan's Multiple Range Test.

Table 1 List of three micro watersheds under study within the watershed 2A2C5 in Paschim Medinipur district, West Bengal, India*

Sl. No.	Micro watershed No.	Location (Latitude-Longitude)	Reference
1.	W1	Benua -22° 36' 24"N 87° 28' 28"E Kuchiara-22° 36' 13"N 87° 28' 33"E Konan – 22° 35' 55"N 87° 30' 21"E	Microwatershed Map:2A2C5a2
2.	W2	Kantadarja- 22° 35' 39"N 87° 34' 58"E Uttar Jharia- 22° 35' 28"N 87° 34' 13"E Suratpur- 22° 35' 12"N 87° 33' 23"E	Microwatershed Map: 2A2C5a1
3.	W3	Baladeb Khamar- 22° 35' 36"N 87° 27' 43"E Gohalara- 22° 36' 47"N 87° 26' 57"E Bilat Kuli-22° 37' 00"N 87° 27' 16"E	Micro watershed Map: 2A2C5b1

*Based on SLUSI, 2020

Table 2 List of Treatments (i.e., prominent agricultural land use systems selected) in each watershed

Treatments	Cropping seasons			Land use management farmers' choices					
	Pre-Kharif	kharif	Rabi	Irrigation During Pre-Kharif	Boundary plantation	Organic manure	Tillage operation	Livestock Grazing	
								During Fallow	Between Two Crop seasons
1. (C1)	Fallow	Rice	Rice	without	with	with	With	With	With
2. (C2)	Fallow	Rice	Rice	Without	without	without	With	With	without
3. (C3)	Sesame	Rice	potato	With	with	with	With	Without	without
4. (C4)	Sesame	Rice	potato	With	without	without	With	Without	without
5. (C5)	Rice	Rice	Potato	With	with	with	With	without	without
6. (C6)	Rice	Rice	Potato	With	without	without	With	without	without
7. (C7)	Cucumber	Rice	Cauliflower	With	with	with	With	without	With
8. (C8)	Cucumber	Rice	Cauliflower	With	without	without	with	without	without
9. (C9)	Groundnut	Rice	Potato	With	with	with	With	without	without
10. (C10)	Groundnut	Rice	Potato	With	without	without	With	without	without
11. (C11)	Ridge gourd	Rice	Potato	with	with	with	With	without	without

12. (C12)	Ridge gourd	Rice	Potato	with	without	without	With	without	without
13. (C13)	Fallow	Rice	Mustard	without	with	without	With	with	without
14. (C14)	Fallow	Rice	Mustard	without	without	without	With	with	without
15. (C15)	Sesame	Rice	Fallow	with	with	with	With	with	without
16. (C16)	Sesame	Rice	Fallow	with	without	with	With	with	without
17. (C17)	Jute	Fallow	Tomato	with	with	with	With	with	With
18. (C18)	Jute	Fallow	Tomato	with	without	without	With	with	without
19. (C19)	Jute	Fallow	Cabbage	with	with	with	With	with	without
20. (C20)	Jute	Fallow	Cabbage	with	without	with	With	without	without

MATERIALS AND METHODS

Soil analysis

Collection of soil samples:

During the study period, augers were used to randomly collect soil samples from the top 15 cm of the surface layer from each of the 20 specified agricultural land use systems, i.e., treatments. Then soil samples were dried under the shade and then those were passed through a 2 mm sieve and were finally put into fabric bags for further laboratory analysis. In the laboratory, soil samples were used for (i) Soil mechanical analysis, (ii) Soil physical and hydrological analysis, and (iii) Soil chemical analysis.

Soil physical and hydrological analysis

Bulk density:

The bulk density of the soil was determined by core sampler method by Piper (1966). **Porosity:**

The Porosity of the soil was determined by core sampler method as described by Piper (1966).

Soil moisture content:

The soil moisture content was determined by gravimetric method by Yoder and Claude (1936).

Soil aggregation:

Aggregate size distribution of soils was determined by Wet sieving method by Yoder (1936).

Infiltration rate:

The infiltration rate was determined by following single cylinder infiltrometer method by Bouwer (1986).

Permeability:

Soil permeability rates have been determined with constant head permeability test by Darcy (1856).

Soil chemical analysis

Soil pH:

The pH of the soil samples was determined in soil-water suspensions (soil: water: 1:2.5) method by Jackson (1973).

Soil Organic Carbon (SOC):

SOC was estimated by oxidizing soils with 1 N $K_2Cr_2O_7$ in presence of concentrated H_2SO_4 and back titrating the remaining $K_2Cr_2O_7$ with ferrous ammonium sulphate solution using diphenylamine indicator, following the wet digestion method of Walkley and Black (1934).

Soil Available Nitrogen:

The available nitrogen content of the soil samples was determined by modified Kjeldhal method using distillation with alkaline potassium permanganate as described by Subbiah and Asija (1956).

Soil biological property:

Numbers of matured earthworm per hectare: a) Numbers of earthworm per one square meter from four inward corners and middle places in each replicated plot, b) Average of No. of earthworms per m^2 plot = (earthworm m^{-2}), c) Average (earthworm ha^{-1}) = (earthworm m^{-2}) X 10000.

Crop data: Crop yield ($t\ ha^{-1}$) data were collected from each replicated plot.

Monsoon Analysis: Rainfall data were collected from NASA (2020); and occurrences and ends of monsoon periods were analysed following the standard methodology (Raman, 1974; Ashok Raj 1979).

STATISTICAL ANALYSIS

One-way ANOVA was used to analyse how each treatment affected the parameters of the soil. The means of the various soil parameters were compared using Duncan's multiple range test (DMRT, Gomez and Gomez, 1984). Statistical Package for Social Science (SPSS 22.0) was used to conduct the statistical analysis (IBM, 2022). Some of the variables being interrelated, Principal Component Analysis (PCA) was followed to measure how each variable was associated with one another using a covariance matrix. In PCA, eigenvalues are coefficients applied to eigenvectors that give the vectors their length or magnitude. Thus, PCA could help to understand the directions of the spread of our data using eigenvectors. An eigenvector with reversed signs for all its components is still considered a valid solution. Through PCA, data with multiple dimensions, were transformed into principal components (or, scores), and then a biplot and scree plot were generated (Jolliffe, 2002; PAST 2022).

RESULTS AND DISCUSSION

During the post-monsoon period of 2020, the C14 land use system recorded the highest average number of matured earthworms, with a value of 7.33. The C13 land use system followed closely that value with an average of 7.00 matured earthworms, while the minimum average number of matured earthworms was recorded in C5 with 3.00, followed by 4.00 in C4 (Table 3).

Scatter diagram (Fig. 3) and loading diagram (Fig. 4) obtained through PCA showed the impact of soil moisture, infiltration, porosity, bulk density, SOC and the corresponding agricultural land use systems on earthworm population in soil.

In the post-monsoon period of 2021, the C2 land use system had the highest average number of matured earthworms, with a value of 6.67. The C9 land use system followed that value closely with an average of 6.33 matured earthworms, while the minimum average number of matured earthworms was recorded in C5 with 3.33, followed by 3.00 in C4 (Table 3). Scatter diagram (Fig. 5) and loading diagram (Fig. 6) obtained through PCA showed the impact of soil moisture, infiltration, porosity,

bulk density, SOC and the corresponding agricultural land use systems on earthworm population in soil.

From the overall results for 2020 and 2021, it was found that matured earthworm population ranged from 3.00 in C5 to 6.67 in C13 and C14 agricultural land use systems (Fig. 2).

Table 3: Numbers of matured earthworms in post-monsoon period:

Treatment	No. of earthworms per m ² area (Mean of three replicated plots)	
	2020	2021
C1	6.00 ^{abc}	5.00 ^{abcde}
C2	6.33 ^{abc}	6.67 ^a
C3	5.67 ^{abcd}	5.00 ^{abcde}
C4	4.00 ^{cd}	3.33 ^{de}
C5	3.00 ^d	3.00 ^e
C6	4.00 ^{cd}	4.33 ^{abcde}
C7	4.67 ^{abcd}	3.67 ^{cde}
C8	5.00 ^{abcd}	4.00 ^{bcde}
C9	5.67 ^{abcd}	6.33 ^{ab}
C10	5.00 ^{abcd}	5.67 ^{abcd}
C11	4.00 ^{cd}	3.00 ^e
C12	4.33 ^{bcd}	5.00 ^{abcde}
C13	7.00 ^{ab}	6.33 ^{ab}
C14	7.33 ^a	6.00 ^{abc}
C15	6.00 ^{abc}	5.33 ^{abcde}
C16	6.00 ^{abc}	5.67 ^{abcd}
C17	4.67 ^{abcd}	4.00 ^{bcde}
C18	4.33 ^{bcd}	4.67 ^{abcde}
C19	4.00 ^{cd}	3.00 ^e
C20	5.67 ^{abcd}	4.33 ^{abcde}

For a column, values followed by different letters differ significantly at $p < 0.05$ by Duncan's Multiple Range Test (Gomez and Gomez, 1984; IBM, 2022).

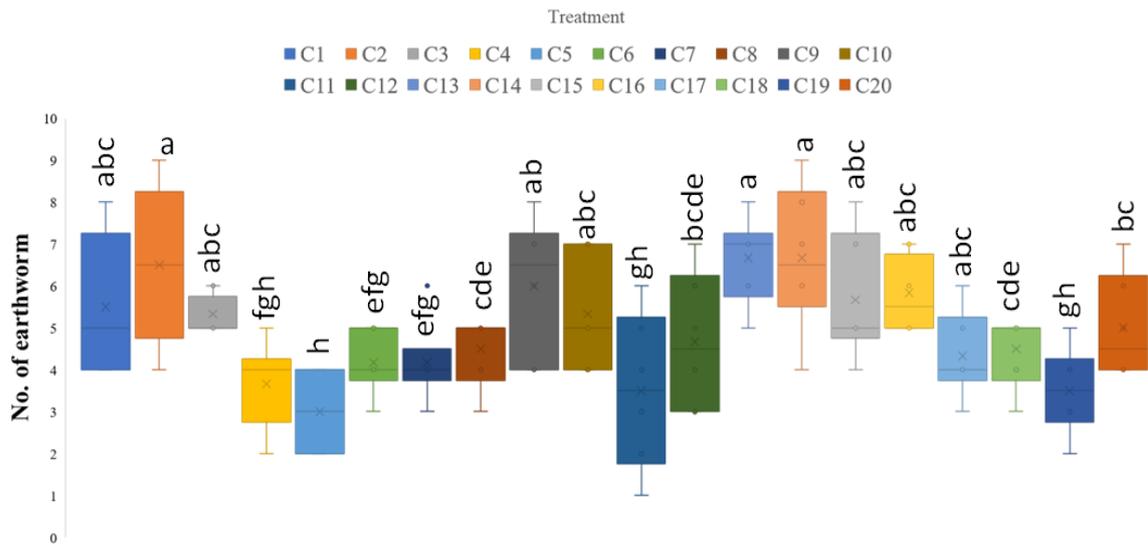


Figure 2: Overall (2020 and 2021) number of matured earthworms in the study area

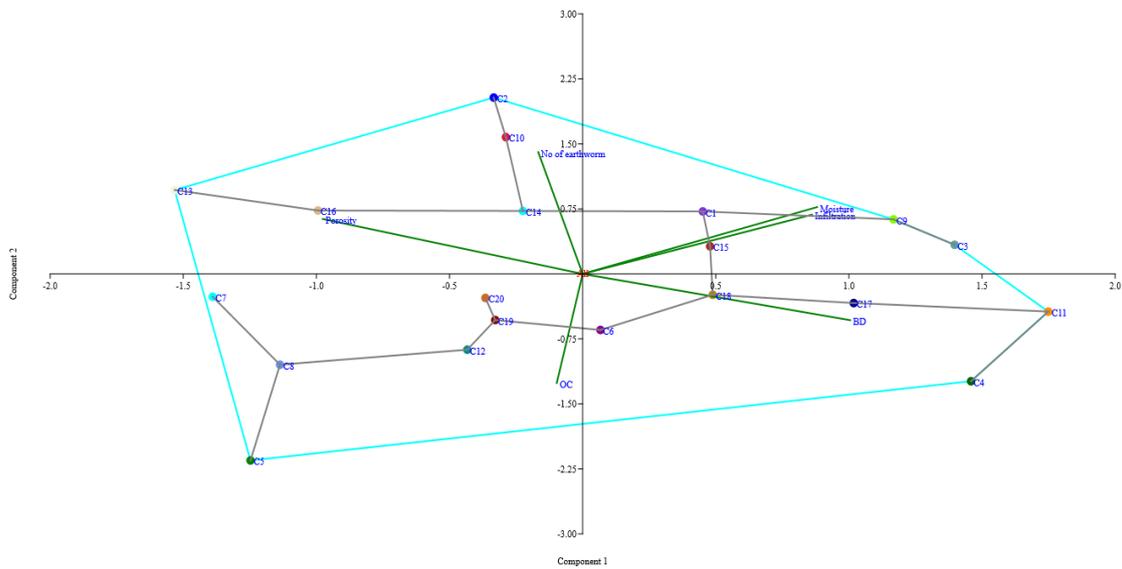


Figure 3: PCA Scatter plot:
Relationship of earthworm population (2020) with other soil parameters under different agricultural land use practices

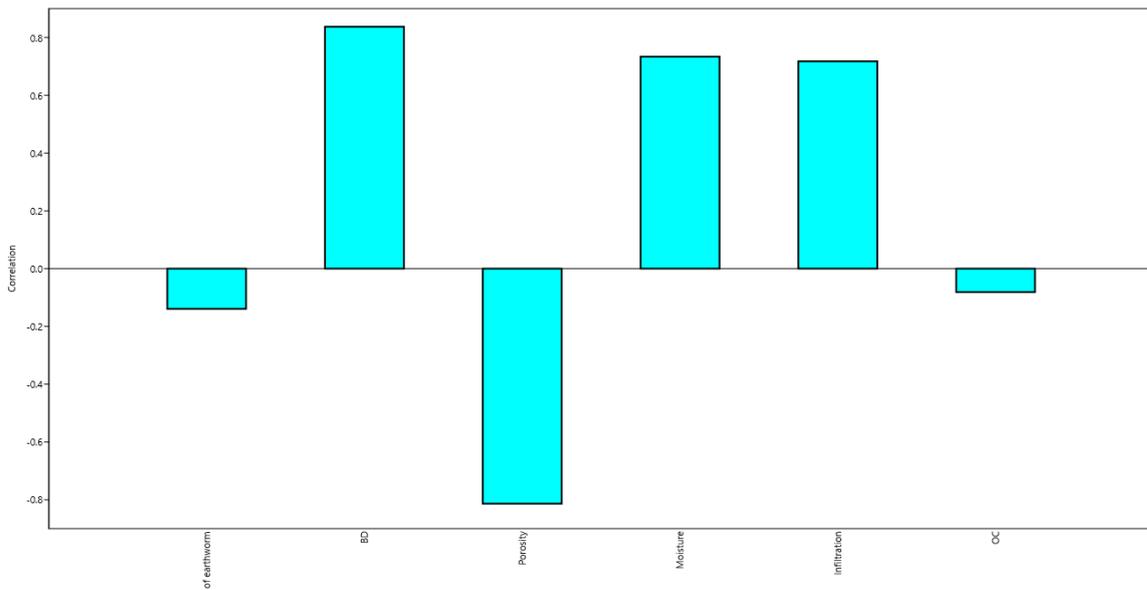


Figure 4: PCA loadings plot:
Relationship of earthworm population (2020) with other soil parameters under different agricultural land use practices

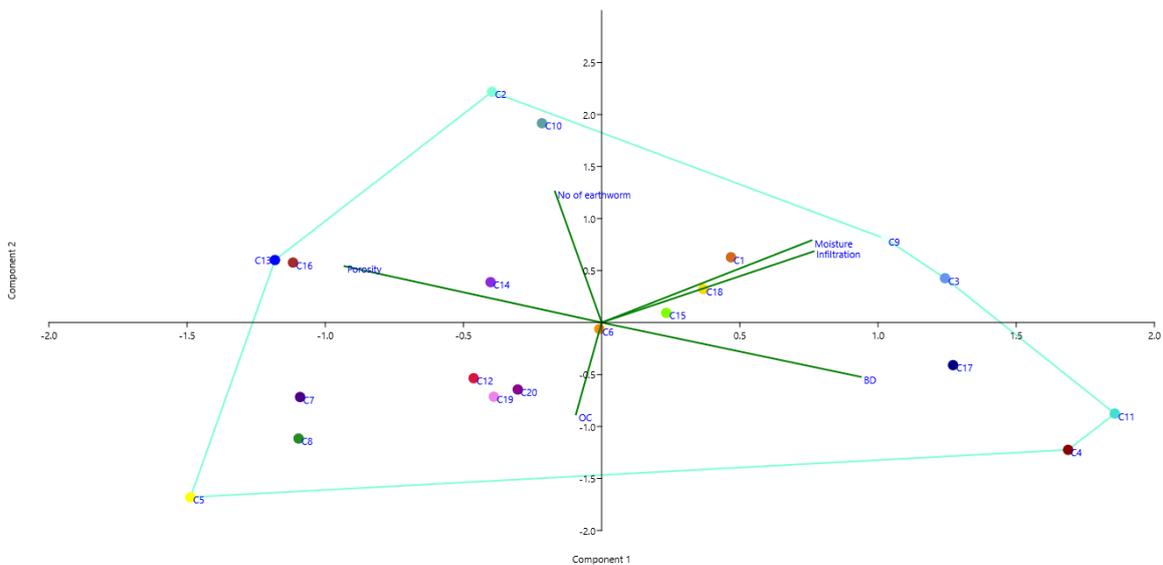


Figure 5: PCA Scatter plot:
Relationship of earthworm population (2021) with other soil parameters under different agricultural land use practices

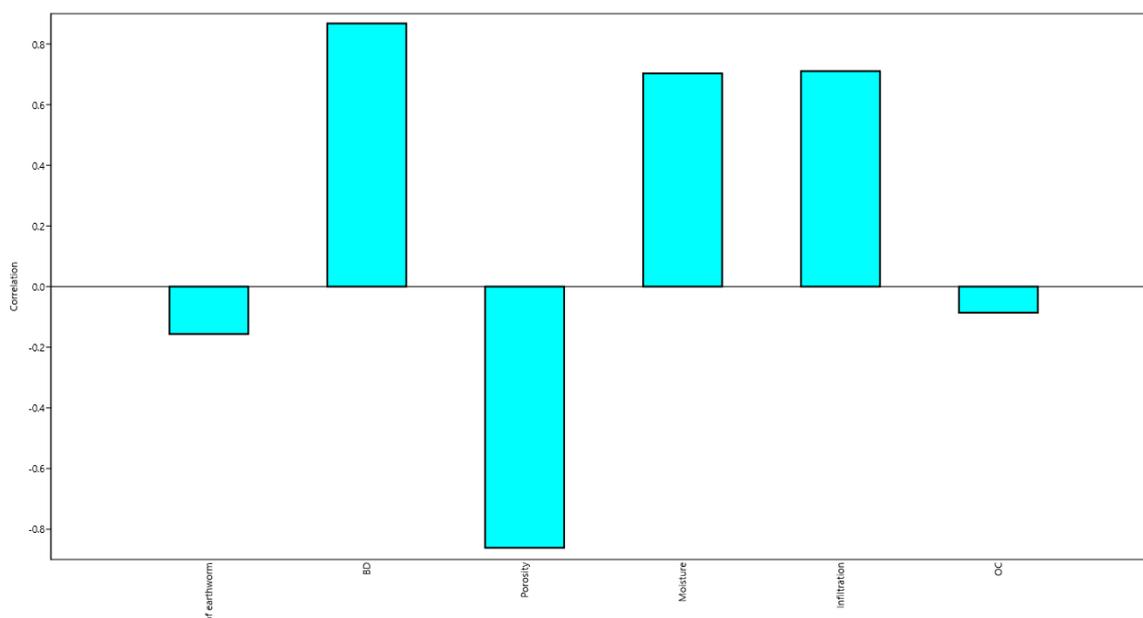


Figure 6: PCA loadings plot:
Relationship of earthworm population (2021) with other soil parameters under different agricultural land use practices

Crop data

From the preliminary survey, it was revealed that rice and potato were found to be the main cultivated crops during *kharif* and *rabi* seasons respectively in the study area. On the other hand, other crops like pre-*kharif* crops of sesame, rice, cucumber, groundnut, ridge gourd and jute; and also, the *rabi* season crops of cabbage, cauliflower, mustard and tomato were sparsely cultivated in two to four treatments, i.e., those subsidiary crops during pre-*kharif* and *rabi* seasons, mostly covered ten percent to 20% (only jute) of all the treatments under the present study (Tables 4 and 5).

Table 4: Crop yield (t/ha) of individual crops in 2020

Treatment	Crops grown (2020)			Yield (t/ha) (Mean of 3 micro watersheds)		
	Pre- <i>kharif</i>	<i>Kharif</i>	<i>Rabi</i>	Pre- <i>kharif</i>	<i>Kharif</i>	<i>Rabi</i>
C1	Fallow	Rice	Rice	-	2.02 ^{bc}	2.51 ^f
C2	Fallow	Rice	Rice	-	1.78 ^c	2.40 ^f
C3	Sesame	Rice	potato	0.38 ^g	1.91 ^{bc}	18.01 ^c
C4	Sesame	Rice	potato	0.32 ^g	1.86 ^{bc}	17.86 ^c
C5	Rice	Rice	Potato	1.91 ^f	2.12 ^b	18.23 ^c
C6	Rice	Rice	Potato	1.97 ^f	2.68 ^a	17.50 ^c
C7	Cucumber	Rice	Cauliflowe r	6.37 ^e	1.70 ^c	6.98 ^e

C8	Cucumber	Rice	Cauliflowe r	6.16 ^e	1.72 ^c	6.90 ^e
C9	Groundnut	Rice	Potato	1.63 ^f	2.00 ^{bc}	18.11 ^c
C10	Groundnut	Rice	Potato	1.59 ^f	1.95 ^{bc}	18.03 ^c
C11	Ridge gourd	Rice	Potato	8.81 ^d	1.83 ^{bc}	17.64 ^c
C12	Ridge gourd	Rice	Potato	8.54 ^d	1.80 ^{bc}	17.20 ^c
C13	Fallow	Rice	Mustard	-	2.01 ^{bc}	0.71 ^g
C14	Fallow	Rice	Mustard	-	1.92 ^{bc}	0.65 ^g
C15	Sesame	Rice	Fallow	0.31 ^g	2.00 ^{bc}	-
C16	Sesame	Rice	Fallow	0.28 ^g	1.84 ^{bc}	-
C17	Jute (*bales/ha)	Fallow	Tomato	14.34 ^{ab}	-	15.00 ^d
C18	Jute (*bales/ha)	Fallow	Tomato	14.01 ^{bc}	-	14.48 ^d
C19	Jute (*bales/ha)	Fallow	Cabbage	14.50 ^a	-	23.71 ^a
C20	Jute (*bales/ha)	Fallow	Cabbage	13.60 ^c	-	21.55 ^b

For a column, values followed by different letters differ significantly at $p < 0.05$ by Duncan's Multiple Range Test. (Gomez and Gomez, 1984; IBM, 2022). *1bale = 180 Kg

Table 5: Crop yield (t/ha) of individual crops in 2021

Treatment	Crops grown (2021)			Yield (t/ha) (Mean of 3 micro watersheds)		
	Pre-kharif	kharif	Rabi	Pre-kharif	Kharif	Rabi
C1	Fallow	Rice	Rice	-	2.09 ^a	3.00 ^f
C2	Fallow	Rice	Rice	-	2.03 ^{ab}	2.92 ^f
C3	Sesame	Rice	potato	0.41 ^f	1.89 ^{ab}	18.68 ^c
C4	Sesame	Rice	potato	0.38 ^f	1.85 ^{ab}	18.57 ^c
C5	Rice	Rice	Potato	1.81 ^e	1.90 ^{ab}	18.20 ^c
C6	Rice	Rice	Potato	1.70 ^e	1.82 ^{ab}	18.11 ^c
C7	Cucumber	Rice	Cauliflower	6.68 ^d	1.98 ^{ab}	8.33 ^e
C8	Cucumber	Rice	Cauliflower	6.08 ^d	1.90 ^{ab}	8.15 ^e
C9	Groundnut	Rice	Potato	1.82 ^e	1.78 ^{ab}	18.60 ^c
C10	Groundnut	Rice	Potato	1.75 ^e	1.70 ^{ab}	18.31 ^c
C11	Ridge gourd	Rice	Potato	9.45 ^c	1.69 ^{ab}	18.11 ^c

C12	Ridge gourd	Rice	Potato	9.30 ^c	1.66 ^{ab}	18.05 ^c
C13	Fallow	Rice	Mustard	-	1.72 ^{ab}	0.78 ^g
C14	Fallow	Rice	Mustard	-	1.63 ^b	0.71 ^g
C15	Sesame	Rice	Fallow	0.37 ^f	1.80 ^{ab}	-
C16	Sesame	Rice	Fallow	0.31 ^f	1.70 ^{ab}	-
C17	Jute (*bales/ha)	Fallow	Tomato	13.27 ^a	-	17.95 ^d
C18	Jute (*bales/ha)	Fallow	Tomato	13.20 ^{ab}	-	17.40 ^d
C19	Jute (*bales/ha)	Fallow	Cabbage	12.67 ^{ab}	-	26.37 ^a
C20	Jute (*bales/ha)	Fallow	Cabbage	12.50 ^b	-	24.55 ^b

For a column, values followed by different letters differ significantly at $p < 0.05$ by Duncan's Multiple Range Test. (Gomez and Gomez, 1984; IBM, 2022). *1bale = 180 Kg

In the year 2020, the yield of kharif rice ranged from 1.70 t/ha in C7 to 2.68 t/ha in C6 agricultural land use system, while the yield of potato was 17.20 t/ha in C12 to 18.23 t/ha in C5 agricultural land use system (Table 4).

In the year 2021, the yield of kharif rice ranged from 1.63 t/ha in C14 to 2.09 t/ha in C1 agricultural land use system, while the yield of potato was 18.05 t/ha in C12 to 18.68 t/ha in C3 agricultural land use system (Table 5).

From the overall results for 2020 and 2021, it was found that yield of *kharif* rice ranged from 1.73 t/ha in C12 to 2.25 t/ha in C6 agricultural land use system, while the yield of potato was 17.63 t/ha in C12 to 18.36 t/ha in C9 agricultural land use system (Figs. 7 and 8).

Scatter diagram (Fig. 9) and loading diagram (Fig. 10) obtained through PCA showed the impact of soil moisture, total aggregate, infiltration, porosity, soil pH, SOC, soil available N, number of earthworms in soil and the corresponding agricultural land use systems on yield of *kharif* rice in 2020 and 2021.

Scatter diagram (Fig. 11) and loading diagram (Fig. 12) obtained through PCA showed the impact of soil moisture, total aggregate, infiltration, porosity, soil pH, SOC, soil available N, number of earthworms in soil and the corresponding agricultural land use systems on yield of potato in *rabi* season in 2020 and 2021.

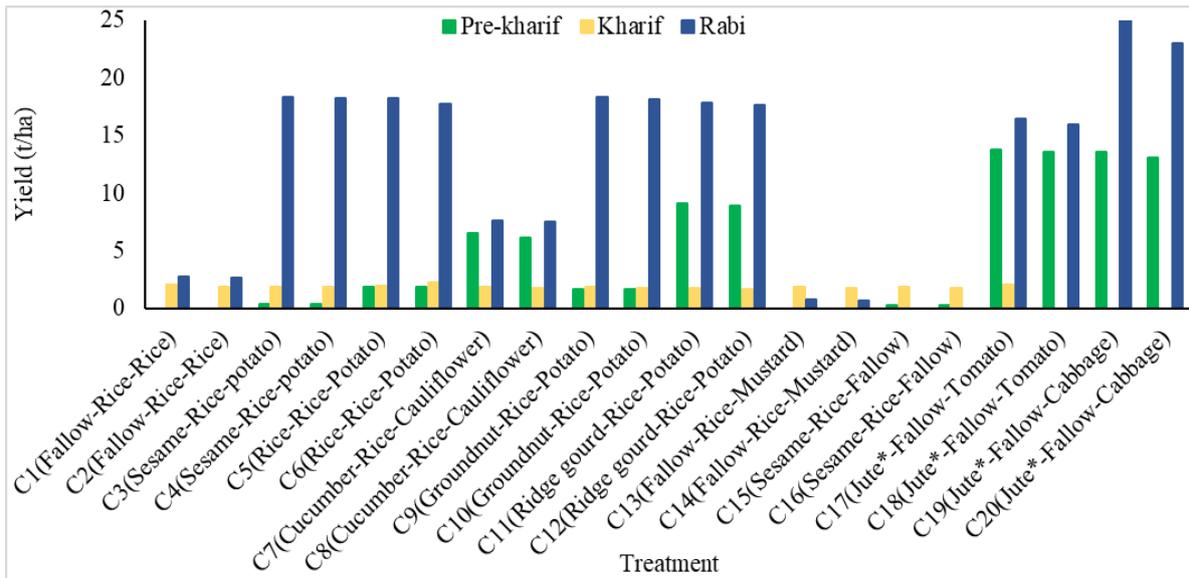


Figure 7: Crop yield (t/ha) of individual crops in 2020 and 2021

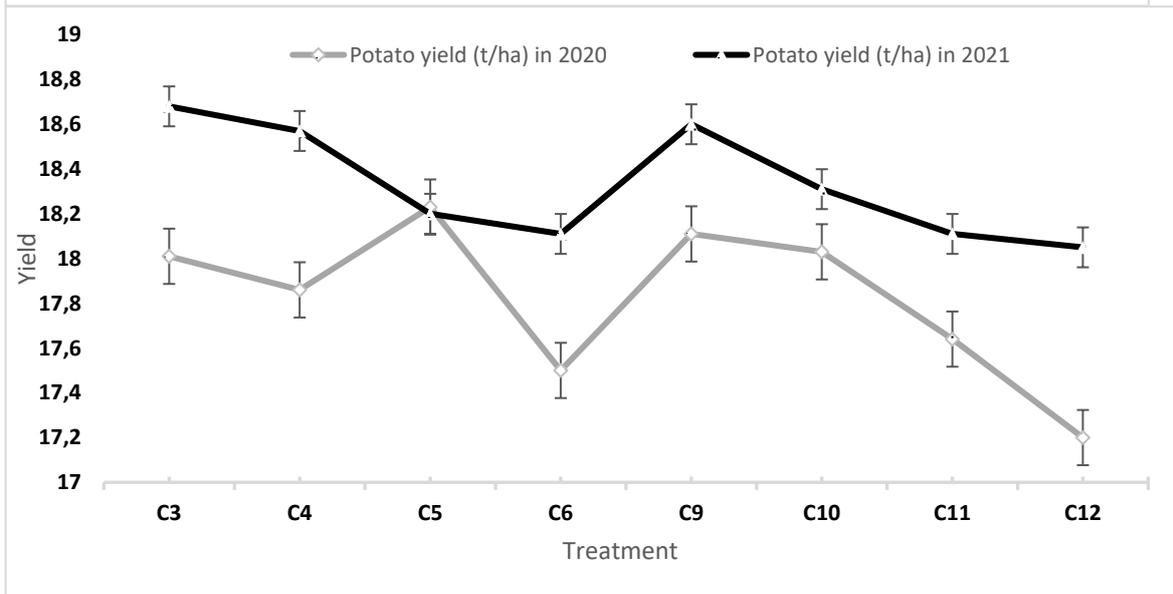
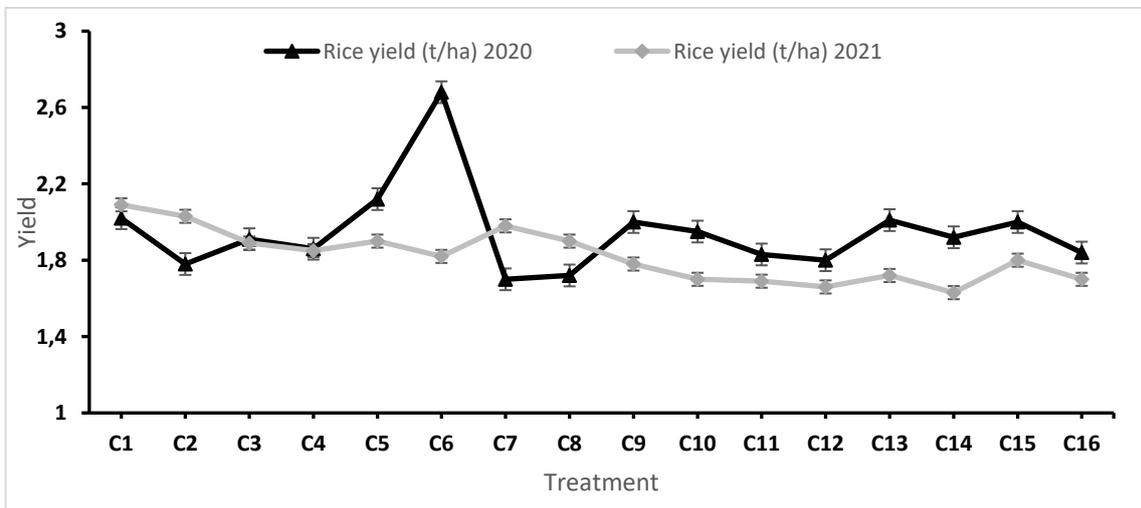


Figure 8: Rice and potato yield overall (2020 and 2021) under various agricultural land use practices, i.e., treatments

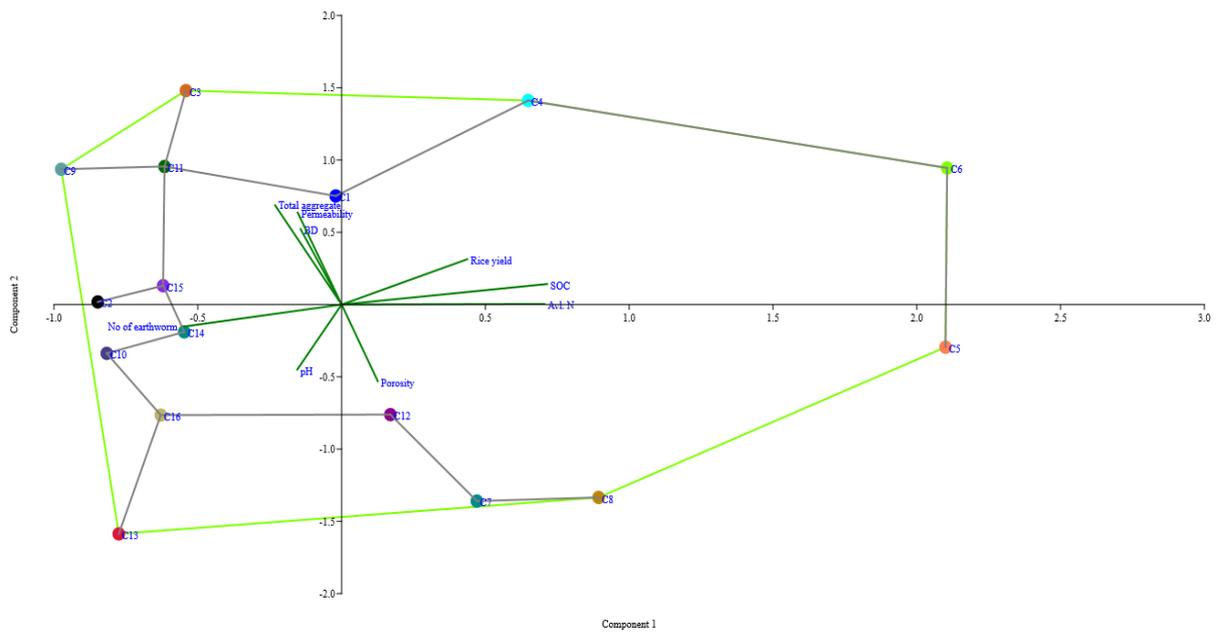


Figure 9: PCA Scatter plot:
Relationship of rice yield (Overall 2020 and 2021) with other soil parameters under different agricultural land use practices

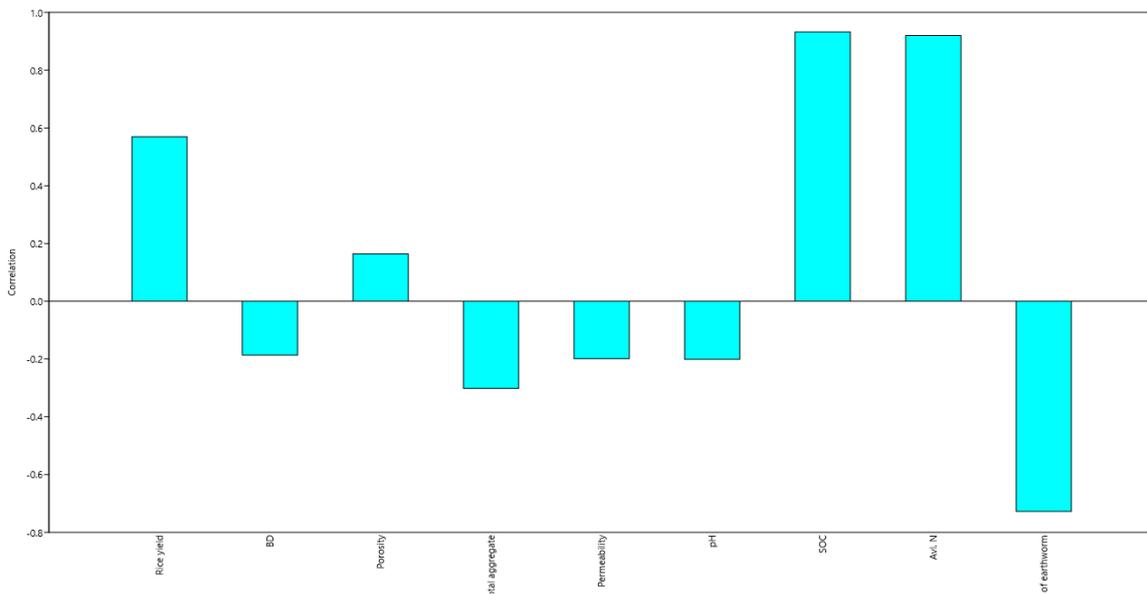


Figure 10: PCA loadings plot:
Relationship of rice yield (Overall 2020 and 2021) with other soil parameters under different agricultural land use practices

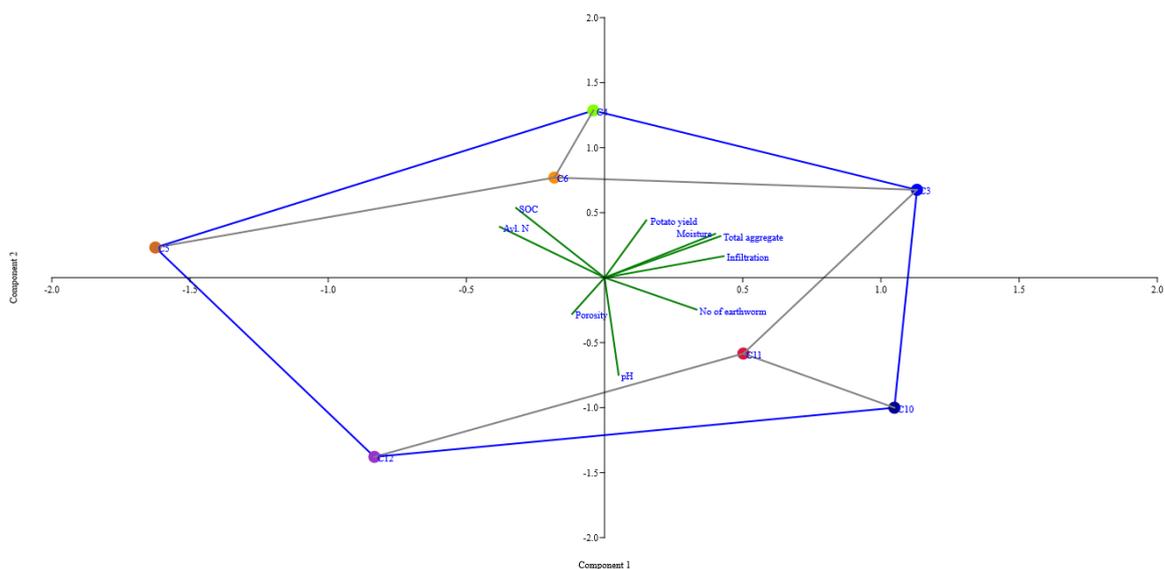


Figure 11: PCA Scatter plot:
Relationship of potato yield (Overall 2020 and 2021) with other soil parameters under different agricultural land use practices

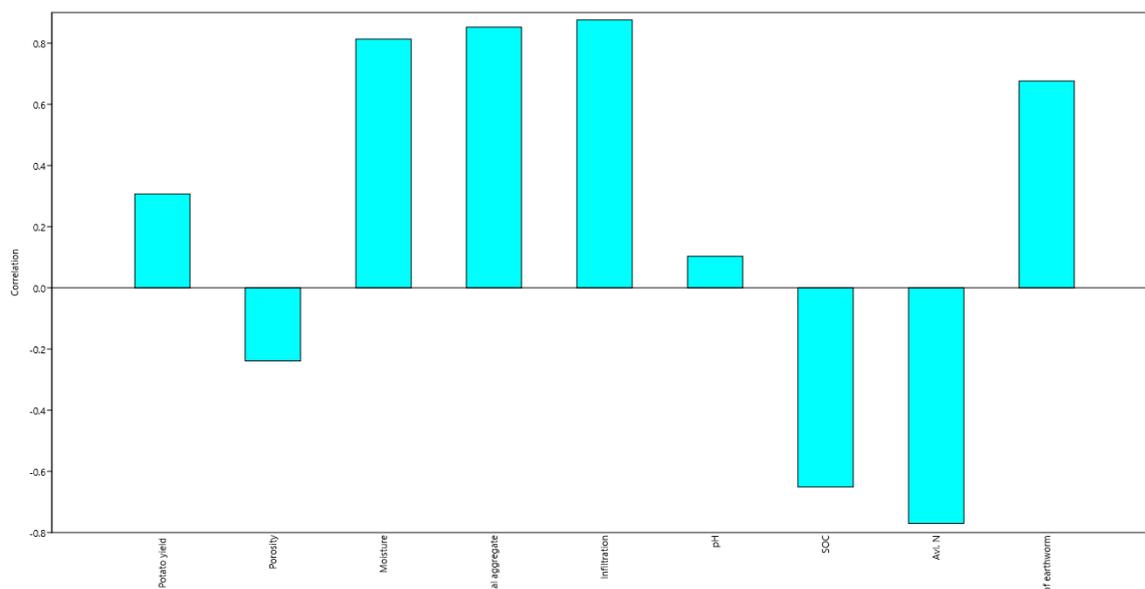


Figure 12: PCA loadings plot:
Relationship of potato yield (Overall 2020 and 2021) with other soil parameters under different agricultural land use practices

CONCLUSIONS

Based on the comprehensive results obtained for both the years of studies 2020 and 2021, it was determined that the matured earthworm population varied within a range of 3.00 in the C5 agricultural land use system to 6.67 in the C13 and C14 agricultural land use systems. The matured earthworm population demonstrated a clear correlation with soil moisture, infiltration, porosity,

bulk density, and soil organic carbon (SOC) levels, indicating their influence on earthworm abundance in soil.

Based on the preliminary survey, it was discovered that rice and potato were the primary cultivated crops during the kharif and rabi seasons, respectively, in the study area. However, other crops such as sesame, rice, cucumber, groundnut, ridge gourd, jute (during pre-kharif season), and cabbage, cauliflower, mustard, and tomato (during rabi season) were cultivated to a lesser extent. Additionally, the yield of kharif rice; and potato during the rabi season in 2020 and 2021 was influenced by factors such as soil moisture, total aggregate, infiltration, porosity, soil pH, soil organic carbon (SOC), soil available nitrogen (N), and the number of earthworms in the soil and the corresponding agricultural land use systems.

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COMPARISON OF SOIL BIOLOGICAL ACTIVITIES BETWEEN GRASSLAND AND ARABLE SOIL

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Abstract: We have compared two different land uses, cropland and grassland at three soil types (Arenosols, Chernozems and Cambisols) for the soil microbial respiration as an indicator for soil quality. Soil samples were taken from the upper soil layer (0-20 cm) in May of 2022. All measurements with 24 soil samples were made in the Institute for Soil Sciences (Budapest, Hungary) using MicroResp technique to detect the catabolic level physiological profile (CLPP) of soil microbial communities. Basal respiration and cumulative substrate-induced respiration resulted in significant differences between grassland and cropland at each soil type investigated with higher respiration rates for grasslands. Inverz Simpson index showed higher values also at the grasslands, but the difference was significant only at Balatoncsicsó (Cambisols). CLPP was significantly different across all sites investigated and evaluated by per-mutational analysis of variance (PERMANOVA) and with the principal coordinate analysis. The most significant substrate respiration rates responsible for discrimination between sites were different, not only one substrate but at least five substrates had a significant effect on soil group separation.

Keywords: CLPP, cropland, grassland, soil respiration.

INTRODUCTION

Soils are a vital component of the functioning mechanisms of terrestrial ecosystems which provide the essential service to the ecosystems. Some of these essential services are nutrient cycling, water regulation and support of the biodiversity of the ecosystem, among many others. The biological activity of every soil plays a crucial role in soil health maintenance and thus proper functionality, including the organic matter decomposition, microbe and plant-based interactions and many others. All these functionalities and services in higher pictures of ecosystems can be influenced by many other varying external factors of which the most important ones are human factors from which the most influential ones are agricultural practices and traditions of people of the habitats place.

In this work, we will be dealing with three types out of many soils found here, in Hungary. We have visited 4 major places from which we drew the data and based our research on. These sites are Örbottyán, Martonvásár, Bicske and Szentantalfa. These soil types are chernozem, arenosols and cambiosols, which are relatively characteristic soils of this region of the world and contain many different characteristics and various levels of biodiversity as well as bioactivity which would be the focus of our work here as part of the great picture of comparison of bioactivity between grassland and arable soils.

Grasslands are generally known as areas dominated by grass with exceptionally high plant-based diversity and low human interactions with it. On the other hand, great contrast can be seen in arable soils which are generally known as agricultural lands which are used for agricultural purposes and made them subject to various agricultural practices like fertilization, pesticide application, tillage, and many others. We will explain them in more depth as we go further in our work. The impacts of these traditions and measures on the biological activity of the soil require deep investigation, however, we will give a short introduction to them here.

Arenosols are soils that are found in sandy areas and are formed by sand-type parental materials. The main characteristic relevant to our research is that it contains extremely low nutrient levels and water-holding capabilities. Moving up the ladder we have cambiosols which are soils specific by the accumulation of organic forestry matter with good mineral accumulation. Lastly, chernozems are the types of soils that are most heavily influenced by agriculture since these lands are having enormous reserves of organic-rich layers that penetrate deep. On top of that, they contain extremely high amounts of nutrients and water-holding capabilities making them extremely fertile ground which must be efficiently utilized.

The key aspect of this study is to compare these soil types of biological activities and physical properties with respect to their arable or grassland-type background of them. This will include spectating for health indicators of soils like microbial biomass, enzyme activity, respiration levels etc. With respect to physical parameters, we will look at the moisture content.

The results of this study should be providing the audience with insight into the impacts of agricultural traditions and practices on soils biological activities and biodiversity and thus, its influence on soil quality and ecosystem functioning. In good hope, this study will show the results of proper or improper use of these soils and its effects on the ecosystem of the regions and be used as potential guidelines for better future appliances of these soils.

The objective of this study is to do the investigation of the impact of fertilizer usage on soil health. The goal is to achieve this by comparing the community-level physiological profiles (CLPP) of arable and grassland soils. We used several locations in our work to achieve the diversity of data. We compared the CLPP from particularly arable soils and grasslands from the Pest, Fejér and Veszprém counties, where we looked at both meadows as representative of grasslands as well as croplands which are representative of arable soils. These cropland soils have been treated with KNP fertilizer mixtures of unknown contents close to grassland soil that has not been spoiled. The testing was to be done by using various methods which will be elaborate further in the work. These methods will be our foundation in corroboration of the fact that the microbial function of the arable soil is less compared to the other proving then that the usage of fertilizers, in this case, KNP treatment does significantly affect the soil's quality. The samples of the analysis were taken from areas of Örbottyán, Martonvásár, Bicske and Balatoncsicso.

MATERIALS AND METHODS

Sampling Sites

Altogether 6 sites were investigated during this study all of them represent different soil types (Arenosols, Chernozems and Cambisols) which are all abundant soil types in Hungary. In each soil type, a pair of different land uses cropland, and a grassland (or meadow) were selected. At each of the 6 sites, 4 plots were appointed for soil sampling. Here I describe the sites in detail, geographic locations are given in WGS84 and EOVS systems:

Site 1: Calcareous sand (Arenosols according to the WRB classification) at Örbottyán

- Site 1a: Meadow on sandy soil

Located: near Örbottyán village, near the Tece stream.

Geographical location: N 47°41'30"; E 19°13'37" [EOV= 663473; 260887]

- Site 1b: Cropland site on sandy soil

Located: near Örbottyán village.

Geographical location: N47° 40' 22,41"; E19° 14' 51,42" [EOV=665030; 258803]

Site 2: (Loess soil, Chernozem soil type) at Bicske and Martonvásár

- Site 2a: Meadow site at Bicske on loess soil

Geographical location: N47° 28' 11,22"; E18° 39' 22,44" [EOV= 620508; 236277]
N47° 28.187'; E18° 39.374

- Site 2b: Cropland site at Martonvásár on loess soil

Geographical location: N47° 19' 52,26"; E18° 47' 23,16" [EOV= 630523; 220827]
47°19.871'; 18°47.386

Site 3: (Calcaric Cambisol - Raman brown earth) at Balatoncsicsó.

- Site 3a: Grassland (meadow)

Geographical location: between Balatoncsicsó and Dörgicse. N46° 54' 44,35"; E17° 41' 51,14" [EOV= 547173; 175120] 46.91232° N, 17.69754° E,

- Site 3b: Cropland soil

Geographical location: between Balatoncsicsó and Dörgicse. N46° 55' 35,36"; E17° 40' 56,86" [EOV= 546052; 176715] (46.92649° N, 17.68246° E)

All samples were taken from the upper 2–12 cm soil layer by sample corer at three sampling points per land use evenly distributed along an approximately 15-m-long transect line.

EXPERIMENTS

Soil Dry Mass and Water Content:

It is necessary to measure the soil water content and dry mass in all types of soil studies. The soil samples are put into a drying cabinet at 105 ± 5 °C until mass constancy is reached. In order to get the water content of the soil we need to measure the differences in masses before and after drying them. The water content is calculated on a gravimetric basis: (g water /100 g dry soil). The determination of dry mass on a mass basis can be described by this procedure.

Measuring Soil Chemical Characteristics:

In order to get all the chemical analyses, the soil samples were air-dried state soils. We got the humus content with the Shimadzu UV-1601 spectrophotometer (MSZ-08-0210:1977). The soil organic C and total N content were analysed by Dumas type dry combustion analysis by Leco CN628 element analyser. We were able to determine the total salt content based on the conductivity of the saturated soil paste by WTW InoLab Cond 730 (MSZ-08-0206:1978.2.4.) CaCO₃ content was determined by a Scheibler type calcimeter (MSZ-08-0206-2:1978.2.2).

pH_{KCl} and **pH_{H₂O}** solutions were both determined at a soil: solution ratio of 1:2.5 (weight : volume) Thermo Orion Star2 pH meter according to the Hungarian standard (MSZ-08-0206-2:1978.2.1). Soil nitrate N was analysed from 1N KCl extract by Shimadzu UV-1601 spectrophotometer. Ammonium-lactate (AL) soluble P₂O₅.

Soil samples were homogenized and analysed for total nitrogen content, NH₄⁺-N, NO₃⁻-N, K₂O (AL soluble), P₂O₅ (AL soluble), soil organic carbon (SOC), electrical conductivity, and pH_{H₂O}. NH₄⁺-N and NO₃⁻-N values were obtained based on KCl extraction and steam distillation technique. SOC contents were measured by wet digestion using the Tyurin method. The total nitrogen was determined using the modified Kjeldahl method (ISO 11261:1995). K₂O and P₂O₅ measurements were done using an inductively coupled plasma optical emission spectrometry (Quotation ICP-OES, Ultima 2) after ammonium lactate extraction (AL). Most of these measurements in the present study were chosen as basic indicators to analyse soil chemical changes and nutrient dynamics, so we could get a more complete picture of carbon and nitrogen cycling at the investigated sites. In addition, we also measured CaCO₃ contents using Scheibler calcimeter for the arable and vineyard soils. Soil element concentrations are reported as mg kg⁻¹ dry-weight soil.

Measuring Soil Community Level Physiological Profile (CLPP) by MicroResp™:

The MicroResp™ system was designed to quantify the microbial activity of soils. The procedure was performed in accordance with the Technical Manual of the MicroResp™ system. [1]

The soil samples were taken from the fridge with their moisture set to approximately 40% water holding capacity; then they were added and incubated in the deep-well plate(s) for 5 days prior for the addition of the carbon sources and detection plate. We used the MicroResp™ filling device for this step but. We inserted the Perspex sheet in between the filling device and placed the filling device on top of the deepwell (DW) plate. We got rid of the excess soil over the filling device by brushing the soil into the wells until they are evenly filled and tapped it once to evenly arrange and compact the soil before adding more soil. Then repeat. The Perspex sheet was removed from between both plates, letting the soil fall into the deepwells. Stocked soil particles, pushing down into the wells using a clean rod. The soil weight in each plate was then determined by weighing the deepwell plate with soil inside it on a balance (after weighing the plate without soil). Next, we placed a piece of Parafilm M over the DW plate. In order to compute the dry mass of soil filled into the deepwell plates, we measure the soil moisture in a piece of the sieved soil. For five days prior to measurements, we placed all of the filled and Parafilm M-covered plates into a plastic box with a baker with sodalime (to get rid of the CO₂ in the box) and wet wipes.

We removed the substrate-plate from the freezer (-20 °C) the day before the MicroResp™ measurements and placed them in the refrigerator at 4° C. We removed the substrate plate from the refrigerator the following morning to bring it to room temperature. Additionally, we removed the Parafilm M cover from the soil-containing DW-plates in the container box and set them on top of a lab table.

Then, we poured 25 µl of each chosen substrate into the appropriate wells of the deepwell plate using the 8-channel electronic pipette with 1000 µl pipette tips. After dispensing each substrate, we switched pipette tips. Each deepwell plate contained four replicate substrates for each of the 23 substrates plus distilled water. We waited for 40 minutes to equilibrate with the air to remove abiotic CO₂ production after dispensing all substrates for all plates. The deepwell plate(s) were then sealed with the Microresp™ seal (blue Teflon-coated silicon sheet).

The computer and spectrophotometer microplate reader with ADAP software were then turned on in the following step. In order to read the detection plate at a wavelength of 570 nm for absorbance, we first removed the Parafilm cover off the top of the detector plates and put them in the spectrophotometer. These are the values that will be "At0" at time=0 hour. The application (ADAP) automatically saves values. Additionally, we put the detection plate over so that A1 matched up with A12 on the deepwell plate before attaching it to the MicroResp™ seal. To properly seal and hold the plates in a MicroResp™ clamp, apply firm pressure. We sealed all the plates and incubated them at 25°C for 5 hours. We took the assembly out of the clamp, took the detecting plate out, and peeled the seal after 5 hours of incubation. In the following, we read the detection plate by photometer and saved the results "At5" to file as we did before. Practically, the "A" is replaced by the number of the detection plate for identification.

After a thorough wash, the deepwell plates can be utilized once more. As long as the agar has not dried out and the detection plates have restored to their normal colour and absorbance measurement, they can also be used again. Then, the Microresp™ seals were cleaned with detergent and rinsed with deionised water and put to dry. These Seals can withstand autoclaving at 160°C and cleaning with ethanol/disinfectant. We used 23 different substrates and distilled water in 4 replicates for 96 wells in each plate. These substrates were prepared and stored at -20 °C in the deep-well plates:

- L-(+)-arabinose (80 g/L),
- D-(+)-xylose (80 g/L),
- D-galactose (80 g/L),
- D-glucose (80 g/L),
- D-(-)-fructose (80 g/L),
- L-(-)-rhamnose (80 g/L),
- mannose (80 g/L),
- trehalose (80 g/L),
- myo-inositol (80 g/L),
- D-mannitol (80 g/L),
- D-(+)- D-sorbitol (80 g/L),
- DL-malate (40 g/L),
- succinate (40 g/L),
- citrate monohydrate (40 g/L),
- K salt of gluconate (40 g/L),
- L- 3,4-dihydroxy-benzoate (12 g/L),
- L-alanine (40 g/L),
- L-serine (20 g/L),
- L-asparagine-monohydrate (20 g/L),
- L-glutamine (20 g/L),
- glutamate (12 g/L),
- L-lysine-monohydrochloride (40 g/L),
- L-arginine (12 g/L).

Distilled water served as a control substrate. The substrate solution was made by first preparing a 25 cm³ container for each substrate. All the substrates mentioned before were placed in glass flasks and weighed before being dissolved in deionized water. For acids and amino acids, the pH was then adjusted to 6.5 by adding a few drops of 1 mol/L NaOH or HCl solutions. During pH adjustment, the pH was measured using an electronic pH-meter and a glass electrode. Then all substrates were injected into the DW-plates (600 µl/well) in 4 consecutive replicate wells within a plate with another 8-channel electronic pipette. Therefore, substrate solutions from the 25 ml substrate solutions could be used to fill 10 DW-plates. A plate cover was used to seal these plates, and they were put in a deep freezer (-20°C). Within six months, the frozen substrate solutions can be applied. Twenty sample MicroResp™ measurements can be performed on a single substrate plate.

Agar and the indicator solution are each prepared separately. First, we purified Oxoid agar (1% concentration), which can be done by mixing it in a 1:2 ratio (agar : indicator) with the indicator solution. There is enough agar/indicator solution in 300 ml to make 15 plates. A 1000 ml indicator stock solution was made: Cresol red: 18.78 mg, 16.77 grams of potassium chloride (KCl), and 0.316 grams of sodium bicarbonate (NaHCO₃). A volumetric flask was filled with the components, 900 ml of warm (50°C), deionized water was added, and it was left overnight for the ingredients to thoroughly dissolve. After that, we added 1000 ml of deionized water. After combining the 200 ml solution, we transferred it into 250 ml with screw-caps bottles, yielding 5 bottles of 200 ml indicator solutions, which we then put in the refrigerator. For up to six months, this solution can be kept in the refrigerator (+5°C). On the day we put together the detection plates, we separately made fresh agar solutions. For this, 100 ml of deionized water and 3g of purified Oxoid agar were combined in a flask. The flask was then autoclaved at 121°C for 20 minutes. In addition to ensuring sterility, autoclaving checks that the agar has adequately dissolved.

When the sample was prepared, we put a bottle of indicator solution and the hot agar solution in a water bath that was set to 60°C. When the agar and indicator solutions both reached the necessary 60°C temperature, we combined them in an 800 ml glass baker, set it atop a heating magnetic stirrer with a magnetic rod to stir the solution gradually, and set a Petri dish on top of the baker to prevent evaporation loss. When the agar/indicator solution temperature reached 60 °C which we checked with a thermometer we dispensed 150 µl aliquots into wells of the microplates by using an electronic 8-channel pipette (1200 µl). We wait until solidification of the poured agar/indicator solution then covered them with Parafilm and placed them into a tightly closed plastic box (5-6 Liter volume approx.) which contains a baker of water and a baker of sodalime to prevent desiccation of the agar and also to absorb all CO₂ within the box. The plastic box with detection plates can be stored in a dark place or can be covered by aluminium foil because the cresol red is sensitive to light.

STATISTICAL ANALYSIS AND GRAPHICAL REPRESENTATION

In an Excel spreadsheet, we imported the files from the spectrophotometer ADAP program, and we sorted the Absorbance (A₅₇₀) data into a list format with the 0hr (At₀) and 5hr (At₅) data in single columns next to one another. By dividing the A₅₇₀ data by the A₅₇₀ data at time 0 (At₀) and multiplying the result by the mean of the A₅₇₀ reading at time 0 (At₀), we normalized the data (A_i) for both time 0 and time 5hour. To normalize:

$$t0_{norm}: A_i = (At0 / At0) \times \text{Mean}(At0)$$

$$t5_{norm}: A_i = (At5 / At0) \times \text{Mean}(At0)$$

%CO₂ calculations:

The following formula (Harris-model) converts the normalized 5hr data (t5norm) to %CO₂:

$$\% \text{ CO}_2 = 1/(A + (B*t5norm^C))$$

Where A = 2.078 B = 41.815 C = 4.593, if the Absorbance > 0.42

Where A = -0.042 B = 30.751 C = 2.83 if the Absorbance < 0.42

The formula (Harris-model) is for a hyperbola standard curve fit. As a result, we split the calibration into two halves. When the absorbance was less than or more than 0.42, separate parameters were employed in the same model to fit appropriately. Unfortunately, we were unable to create a model that matched well for the entire range.

$$\text{CO}_2 \text{ rate } (\mu\text{gCO}_2\text{-C/g soil/h}) =$$

$$(\% \text{CO}_2/100) \times \text{vol} \times (44/22.4) \times (12/44) \times (273/(273+T)) / (\text{soil fresh wt} \times (\text{soil \%dwt}/100)) / \text{incubation time}$$

The CO₂ rate is calculated by converting the 5 hr %CO₂ data (%CO₂) to μg/g/h CO₂-C using gas constants, and constants for incubation temperature in 0C (T), headspace volume (vol) in the well (μl), fresh weight (fresh wt) of soil per well (g), incubation time (hr) and soil sample % dry weight (dwt). Headspace volume (vol) is 945μl for our standard set-up. The following statistics were used during the evaluation of the results: ANOVA (one-way analysis of variance), principal coordinate analysis (PCoA), Analysis of Similarity (ANOSIM), and Similarity percentages (SIMPER) test.

Program used:

R statistics version 4.0.3. (R Core Team, 2018)

R-packages, used:

- rstatix version: 0.6.0 (Kassambra 2020a)
- pairwiseAdonis version 0.4 (Arbizu, 2020)
- vegan version: 2.5-7. (Oksanen et al. 2020)
- ggplot (Wickham, 2016)
- ggpubr version: 0.4.0 (Kassambra 2020b)
- dplyr version: 1.0.2 (Wickham et al. 2020a)
- devtools version: 2.3.2 (Wickham et al. 2020b)

ANOVA (one-way analysis of variance) of basal respiration, cumulative substrate induced respiration and inverz Simpson index with rstatix package. Metric multidimensional scaling (= principal coordinate analysis) using capscale function with Bray-Curtis distance in the vegan package was used for MicroResp™ data and also PERMANOVA (permutational multivariate analysis of variance) with adonis2 function in vegan package. Call data to R programme. [2] [3] [4] [5] [6] [7] [8] [9]

Cropland versus grassland 2022-year MicroResp™

We have altogether 6 sampling sites, all sites with 4 replicate plots, therefore 24 samples. The sites are situated on three soil types as mentioned in the materials and methods: Arenosols, Chernozem and Cambisols. At each soil type, two different land uses were compared, cropland versus grassland (Table 1).

Table 1: Experimental sites, soil samples and their codes used in this study.

Sites	Site codes	Land use	Land use code	Soil type	Soil type code
Örbottyán grassland	OM	grassland	M	Arenosols	O
Örbottyán cropland	OC	cropland	C	Arenosols	O
Bicske grassland	MM	grassland	M	Chernozem	M
Martonvásár cropland	MC	cropland	C	Chernozem	M
Balatoncsicsó grassland	BM	grassland	M	Cambisols	B
Balatoncsicsó cropland	BC	cropland	C	Cambisols	B

BASAL RESPIRATION, CUMULATIVE SUBSTRATE-INDUCED RESPIRATION, AND INVERZ SIMPSON INDEX

Data for soil basal respiration (abbreviated as Aqua), cumulative substrate induced respiration (abbreviated as sum substrate) and inverz Simpson index (abbreviated as invsimpson) for 24 samples, 6 sites, 2 land use type (cropland=C; grassland=M) in 3 soil types (Arenosols at Örbottyán=O; Chernozem at Martonvásár =M; Cambisols at Balatoncsicsó=B) altogether moved from excel to txt file resulting this:

	site	sample	land use	soil	Aqua	sum substrate	invsimpson
1	OM	OM1	M	O	0.201099435	17.72209194	20.49707518
2	OM	OM2	M	O	0.249667741	20.95842884	20.17406231
3	OM	OM3	M	O	0.270738462	19.24784669	21.29695008
4	OM	OM4	M	O	0.229677496	17.51454358	21.06057912
5	OC	OC1	C	O	0.116710413	7.712324161	19.94817829
6	OC	OC2	C	O	0.159739346	9.385210081	20.41347035
7	OC	OC3	C	O	0.136499215	10.43445054	19.66107574
8	OC	OC4	C	O	0.145792932	9.225825075	20.08789984
9	MM	MM1	M	M	0.331552284	47.22176277	19.20536964
10	MM	MM2	M	M	0.312618927	50.55301822	19.42399405
11	MM	MM3	M	M	0.351187999	50.33915045	19.55937754
12	MM	MM4	M	M	0.263610161	31.97171525	19.69403852
13	MC	MC1	C	M	0.131581775	7.128919528	17.15535787
14	MC	MC2	C	M	0.1311296	9.04746774	14.0250788
15	MC	MC3	C	M	0.152921381	8.710451474	19.89654019
16	MC	MC4	C	M	0.155780238	9.561678162	19.57950203
17	BM	BM1	M	B	0.785602195	53.93825954	20.3806037
18	BM	BM2	M	B	0.680626607	47.98635503	20.97709275
19	BM	BM3	M	B	0.78142608	51.04014601	21.23958117
20	BM	BM4	M	B	0.619670207	46.73140865	20.26844707
21	BC	BC1	C	B	0.290107116	21.01989386	18.69048725
22	BC	BC2	C	B	0.216847869	14.15497783	19.38188324
23	BC	BC3	C	B	0.180001909	16.7141674	17.46368526
24	BC	BC4	C	B	0.214080936	22.3906335	17.45585524

R statistics version 4.0.3. (R Core Team, 2018)

Table 2: Basal respiration averages (means) and standard deviations by sites.

	site	landuse	soil	variable	n	mean	sd
	<fct>	<fct>	<fct>	<chr>	<dbl>	<dbl>	<dbl>
1	BC	C	B	Aqua	4	0.225	0.046
2	BM	M	B	Aqua	4	0.717	0.081
3	MC	C	M	Aqua	4	0.143	0.013
4	MM	M	M	Aqua	4	0.315	0.038
5	OC	C	O	Aqua	4	0.14	0.018
6	OM	M	O	Aqua	4	0.238	0.03

Table 3: Cumulative substrate-induced respiration averages (means) and standard deviations by sites.

	site	landuse	soil	variable	n	mean	sd
	<fct>	<fct>	<fct>	<chr>	<dbl>	<dbl>	<dbl>
1	BC	C	B	sumsubstrate	4	18.6	3.81
2	BM	M	B	sumsubstrate	4	49.9	3.23
3	MC	C	M	sumsubstrate	4	8.61	1.05
4	MM	M	M	sumsubstrate	4	45	8.83
5	OC	C	O	sumsubstrate	4	9.19	1.12
6	OM	M	O	sumsubstrate	4	18.9	1.6

Table 4: Inverz Simpsopn index averages (means and standard deviations by sites.

	site	landuse	soil	variable	n	mean	sd
	<fct>	<fct>	<fct>	<chr>	<dbl>	<dbl>	<dbl>
1	BC	C	B	invsimpson	4	18.2	0.953
2	BM	M	B	invsimpson	4	20.7	0.467
3	MC	C	M	invsimpson	4	17.7	2.72
4	MM	M	M	invsimpson	4	19.5	0.208
5	OC	C	O	invsimpson	4	20	0.313
6	OM	M	O	invsimpson	4	20.8	0.514

Box plots (ggplot2 Wickham (2016), ggpubr Kassambara (2020b) packages)

Statistical test (T-test) for soil basal respiration

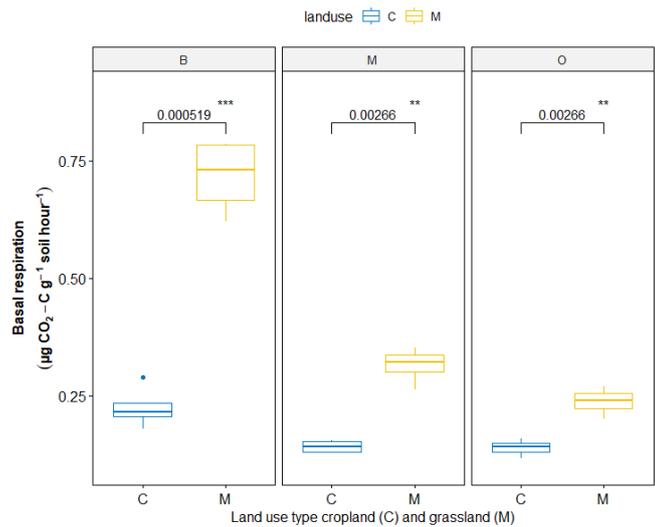


Figure 1: Boxplot of the basal respiration comparing cropland (C) and grassland (M) at the three soil type locations (B = Balatoncsicsó; M = Martonvásár/Bicske; O = Örtbottyán)

Statistical test (T-test) for cumulative substrate induced respiration.

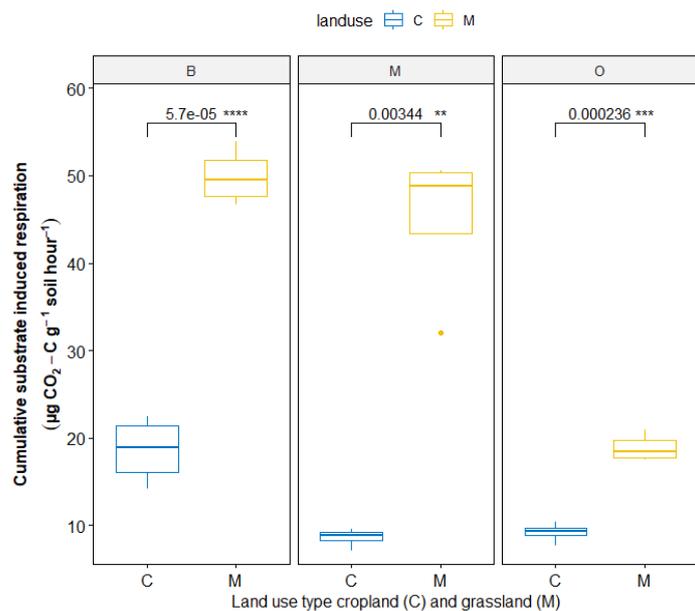


Figure 2: Boxplot of the cumulative substrate-induced respiration comparing cropland (C) and grassland (M) at the tree soil type locations (B = Balatoncsicsó; M = Martonvásár/Bicske; O = Örtbottyán)

Statistical test (T-test) for inverz Simpson index.

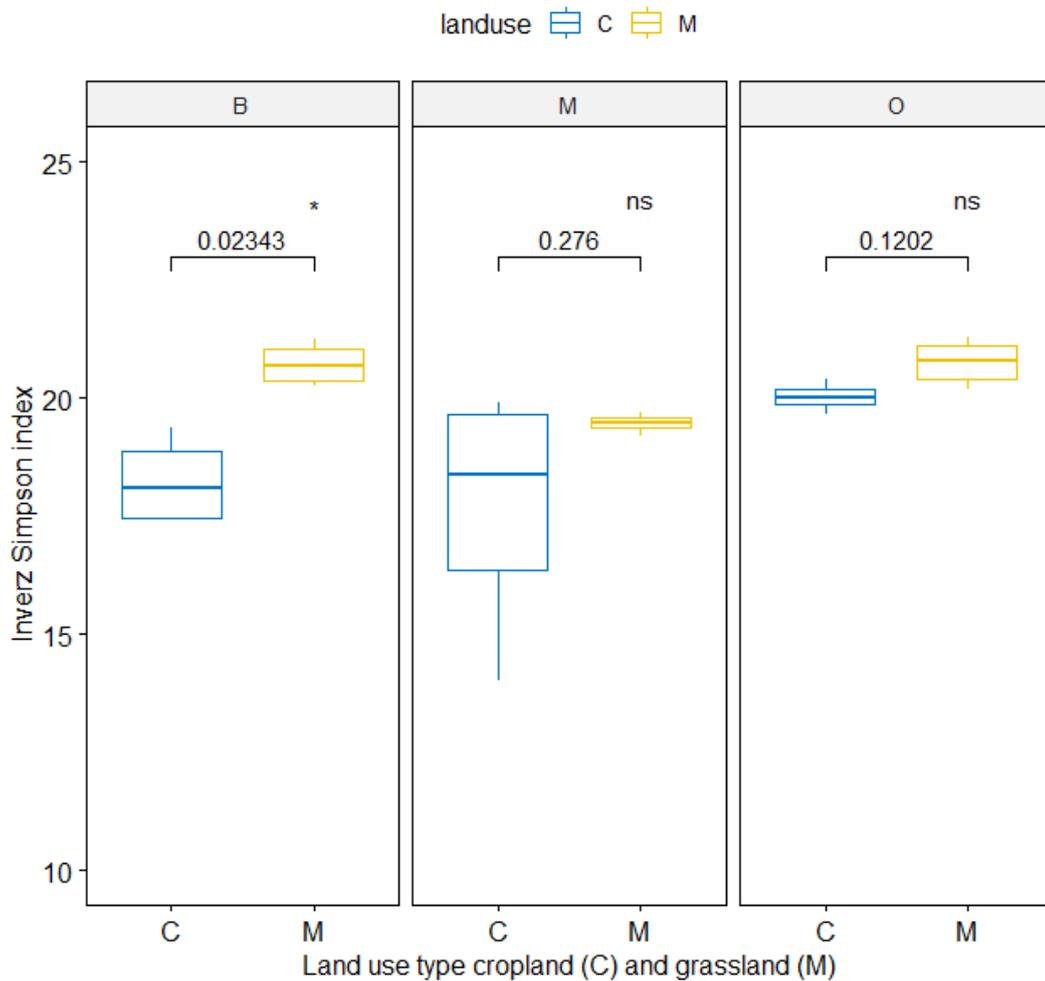


Figure 3: Boxplot of the Inverz Simpson index calculated from the substrate induced respiration data from 23 substrates comparing cropland (C) and grassland (M) at the three soil type locations (B = Balatoncsicsó; M = Martonvásár/Bicske; O = Örbottyán)

Data analysis Principal coordinate analysis and Permanova

Principal coordinate analysis - PCoA (identical as metric multidimensional scaling (abbreviated as mds)) using Bray-Curtis distance, standardized substrate induced respiration data for 24 samples with 23 substrates

Capscale pcoA (vegan package (Oksanen et al. 2020))

Eigenvalues for unconstrained axes:

MDS1	MDS2	MDS3	MDS4	MDS5	MDS6	MDS7	MDS8
0.26604	0.21606	0.13320	0.09497	0.07281	0.05446	0.05179	0.04505

(Showing 8 of 23 unconstrained eigenvalues)

Table 5: The first two axis of the principal coordinate analysis.

	MDS1	MDS2
1	-0.60551576	-0.473957411
2	-0.22577629	-0.278065545
3	-0.55648712	-0.312135728
4	-0.61038078	-0.416430292
5	-0.05323430	-0.331484114
6	-0.26555221	-0.384834056
7	0.11650360	-0.215512528
8	-0.12463206	-0.333181322
9	0.37227859	-0.021306060
10	0.30386795	-0.007334964
11	0.18828444	-0.116005179
12	0.18404584	-0.085541862
13	-0.64579632	1.257249815
14	-0.72446248	1.489261240
15	0.33532256	0.033095660
16	0.45098135	-0.012604809
17	0.67893135	0.240772864
18	0.49746303	0.045100489
19	0.85717513	0.282973546
20	0.86477748	0.367090697
21	0.01144175	-0.143292015
22	-0.19243200	0.123793867
23	-0.51805364	-0.329596729
24	-0.33875010	-0.378055564

Visualization figure:

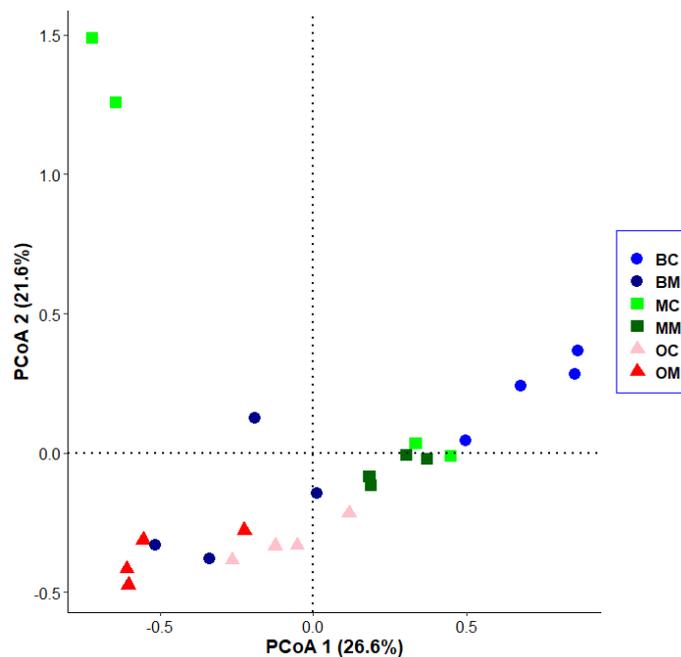


Figure 4: Principal coordinate plot showing the 24 samples belonging to 6 sites, Balatoncsicso cropland = BC; Balatoncsicsó grassland = BM; Martonvásár cropland = MC; Bcske grassland = MM; Örbottyán cropland = OC; Örbottyán grassland = OM.

Permanova

Table 6: Distance matrix from standardized MicroResp data (1-23)

	1	2	3	4	5	6	7
2	.08594202						
3	0.06871605	0.08221128					
4	0.07363068	0.11544039	0.06250533				
5	0.07633906	0.08716530	0.09217219	0.07915334			
6	0.06937009	0.08925815	0.08158253	0.06928781	0.03848128		
7	0.09444600	0.08934276	0.09744844	0.09325460	0.04926441	0.05485069	
8	0.08483552	0.09093445	0.08567418	0.07279067	0.04533220	0.03187281	0.05820957
9	0.11570491	0.09768496	0.10558495	0.13153133	0.09208346	0.10288218	0.07041264
10	0.12688084	0.10722515	0.10550213	0.12463035	0.08679321	0.09981209	0.06983569
11	0.10970400	0.08716379	0.09050771	0.11460552	0.08741150	0.08633154	0.06584757
12	0.11217244	0.09946439	0.08391055	0.11180449	0.09400187	0.10824095	0.07602973
13	0.16999329	0.17385601	0.15423724	0.17291748	0.16232850	0.15736332	0.15937171
14	0.19849083	0.19985746	0.18335286	0.19549772	0.19629812	0.19336781	0.19185382
15	0.12026927	0.10686527	0.10685236	0.11291958	0.07006082	0.07591408	0.07118639
16	0.11608399	0.09795882	0.11321211	0.11995228	0.05830323	0.07616101	0.04914583
17	0.15185244	0.13101899	0.13671864	0.14632587	0.09253085	0.11292628	0.08241588
18	0.11796326	0.09980984	0.10537448	0.12518040	0.07139212	0.08457216	0.06002198
19	0.16804256	0.14490520	0.16431774	0.17298147	0.11012514	0.13090334	0.10047206
20	0.17017656	0.14611598	0.15921341	0.17827988	0.11415645	0.13815217	0.10578705
21	0.09734591	0.10909530	0.09210953	0.10699509	0.07853342	0.09316726	0.06199052
22	0.15625925	0.16250766	0.12136766	0.13908173	0.14856241	0.15342109	0.14641028
23	0.06261651	0.10054996	0.05155282	0.07110795	0.08175652	0.07264865	0.08890385
24	0.06493539	0.09216660	0.08251258	0.09894085	0.08798385	0.09342838	0.09470678

	8	9	10	11	12	13	14
2							
3							
4							
5							
6							
7							
8							
9	0.09507001						
10	0.08711040	0.04217112					
11	0.07627737	0.03234984	0.03505796				
12	0.09636294	0.03545109	0.04389930	0.04132860			
13	0.16335047	0.16512777	0.15753211	0.16011306	0.16522699		
14	0.19267772	0.19712200	0.19613938	0.19154799	0.19490733	0.06767366	
15	0.07497166	0.07481344	0.09085113	0.08527840	0.08878555	0.16006795	0.18940096
16	0.07528630	0.06258523	0.06602204	0.07353716	0.08154218	0.16449527	0.19382828
17	0.09997960	0.07290673	0.06879112	0.08241695	0.08118801	0.17240117	0.20077813
18	0.07731263	0.05538243	0.06794030	0.06314211	0.06836302	0.16381158	0.19078456
19	0.11983381	0.09068922	0.10234518	0.10828892	0.10627625	0.20096201	0.22404926
20	0.12088976	0.08895145	0.09769975	0.10340024	0.10632138	0.19344933	0.21561540
21	0.09486348	0.07558297	0.06509313	0.07876870	0.06536988	0.16205365	0.19364147
22	0.15510003	0.13146388	0.12599442	0.13850813	0.11517352	0.18320249	0.21469355
23	0.07946343	0.10289622	0.09880302	0.08693391	0.08557329	0.15381809	0.18138062
24	0.09573852	0.08716312	0.09458874	0.08341238	0.08943344	0.17574126	0.20192108

	15	16	17	18	19	20	21
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16	0.03851586						
17	0.06895619	0.05205466					
18	0.04241772	0.03328220	0.04262669				
19	0.08272839	0.07130419	0.05884875	0.06586964			
20	0.08459643	0.07426525	0.05067607	0.06190308	0.02586613		
21	0.09219843	0.06967565	0.09064961	0.07585099	0.11947640	0.12081123	
22	0.14104136	0.13920195	0.14307197	0.13208000	0.17115195	0.16973410	0.10125617
23	0.10792660	0.10300835	0.12449969	0.10076126	0.15737831	0.15967576	0.06491686
24	0.11210227	0.10602961	0.13149575	0.10370645	0.14922121	0.15443507	0.09698772

	22	23
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23	0.11510738	
24	0.13795209	0.06564161

From the distance matrix, we make the Permanova analysis using the *adonis2* function in the *vegan* package.

	Df	SumOfSqs	R2	F	Pr(>F)	
Site	5	0.090555	0.57007	4.7734	0.000999	***
Residual	18	0.068295	0.42993			
Total	23	0.15885	1			

Signif. codes: '***' 0.001 '**' 0.01 '*' 0.05 Df: degree of freedom

Sum of squares

R²: determination coefficient

P value obtained by permutation (1000)

The Permanova analysis shows a strong significant (p=0.00099) effect on microrespiration pattern among 6 sites.

Another possible evaluation using two-factorial design one is the landuse (cropland or grassland).

Number of permutations: 1000

Table 7: The 2-way permanova analysis.

	Df	SumOfSqs	R2	F	Pr(>F)	
landuse	1	0.025698	0.16177	6.7729	0.000999	***
soil	2	0.035836	0.2256	4.7226	0.000999	***
landuse:soil	2	0.029021	0.18269	3.8244	0.001998	**
Residual	18	0.068295	0.42993			
Total	23	0.15885	1			

Signif. codes: '***' 0.001 '**' 0.01 '*' 0.05

The 2-way permanova analysis shows a strong significant (p=0.00099) effect for both land use types and soil types on microrespiration pattern. However, the strong significant interaction mean that the effect of land use can be different on different soil types.

Pairwise Adonis (Arbizu, 2020) package in R.

We used this package for the comparison between pairs of sites if they are significant or not.

Table 8: Pairwise comparison of the standardised substrate induced respiration data for 24 samples including 3 soil types and 2 landuse types based on.

	pairs			Df	SumsOfSqs	F.Model	R ²	p.value
1	OM	vs	OC	1	0.007591	3.318452	0.356116	0.03996
2	OM	vs	MM	1	0.017268	8.211998	0.577822	0.036963
3	OM	vs	MC	1	0.023827	3.292009	0.354284	0.028971
4	OM	vs	BC	1	0.035796	14.75897	0.710968	0.022977
5	OM	vs	BM	1	0.00941	2.214434	0.269578	0.048951
6	OC	vs	MM	1	0.012696	13.65042	0.694663	0.027972
7	OC	vs	MC	1	0.018267	3.011813	0.334207	0.030969
8	OC	vs	BC	1	0.017689	14.12089	0.701802	0.028971
9	OC	vs	BM	1	0.013217	4.29602	0.417251	0.032967
10	MM	vs	MC	1	0.020654	3.512339	0.36924	0.026973
11	MM	vs	BC	1	0.011914	11.15484	0.650245	0.027972
12	MM	vs	BM	1	0.010419	3.602819	0.375184	0.02997
13	MC	vs	BC	1	0.024233	3.906554	0.39434	0.023976
14	MC	vs	BM	1	0.022209	2.76683	0.315602	0.033966
15	BC	vs	BM	1	0.026473	8.235307	0.578513	0.01998

The pairwise comparison (Table 8) shows that all comparisons are significant ($p < 0.05$), but the significance level is not very low because of the limited number of observations, however there is strong evidence that both land use type (cropland versus grassland) and soil type have significant effect on the pattern of the catabolic activity profiles of soil microbial assemblages.

SIMPER-test (vegan package)

- Similarity percentage (SIMPER) – to identify the relative importance of each species in distinguishing between two levels of a categorical variable (Clarke, 1993) by vegan package `simper` function.
- `average` = average contribution of this species to the average dissimilarity between observations from the two groups. The sum of this column is the average dissimilarity between observations from the two groups.
- `sd` = standard deviation of the contribution of this species (i.e., based on its contribution to all dissimilarities between observations from the two groups).
- `ratio` = ratio of average to `sd`. Basically, a coefficient of variation (CV).
- `ava`, `avb` = average abundance of this species in each of the two groups. Only included if a grouping variable (group) was included in the original call to `simper` ().
- `cumsum` = cumulative contribution of this and all previous species in list. Based on average, but expressed as a proportion of the average dissimilarity and therefore the maximum value of this column is 1.
- **p** = permutation-based p-value; probability of getting a larger or equal average contribution for each species if the grouping factor was randomly permuted.

Table 9: Most important substrates for discriminating land use types at the three different soil types.

Contrast:	OM_OC							
	average	sd	ratio	ava	avb	cumsum	p	signif.
Mal	0.010749	0.00376	2.859	1.4886	1.9831	0.1271	0.009	**
Tre	0.008465	0.004775	1.7731	1.0968	0.75	0.2272	0.196	
Asn	0.007173	0.007152	1.0029	1.2242	1.5155	0.312	0.226	
Glc	0.005427	0.00376	1.4435	1.4842	1.6793	0.3762	0.939	
Dhb	0.005092	0.003244	1.5696	1.1136	0.8985	0.4364	0.871	
Suc	0.004132	0.001657	2.4936	1.2378	1.2279	0.4853	0.467	
Ala	0.004112	0.001579	2.6037	0.7974	0.6083	0.5339	0.055	.
Glu	0.003701	0.002045	1.8095	1.2297	1.064	0.5777	0.92	
Fru	0.003684	0.002347	1.5695	1.245	1.3572	0.6212	0.994	
Contrast:	MM_MC							
	average	sd	ratio	ava	avb	cumsum	p	signif.
Cit	0.034448	0.034306	1.004	0.8438	2.3994	0.2687	0.024	*
Tre	0.012723	0.003515	3.62	1.5012	0.916	0.368	0.005	**
Glc	0.009979	0.004584	2.177	1.9927	1.5337	0.4458	0.116	
Asn	0.007704	0.006399	1.204	1.4067	1.0542	0.5059	0.165	
Gla	0.007178	0.003649	1.967	0.6715	1.0017	0.5619	0.003	**
Fru	0.006178	0.004675	1.322	1.647	1.4636	0.6101	0.772	
Rha	0.005804	0.002038	2.847	0.4788	0.7458	0.6553	0.001	***
Contrast:	BC_BM							

	average	sd	ratio	ava	avb	cumsum	p	signif.
Mal	0.015044	0.002731	5.5094	2.0742	1.3821	0.1144	0.001	***
Glc	0.014754	0.006	2.4589	2.1466	1.468	0.2266	0.002	**
Fru	0.012779	0.004771	2.6788	2.0073	1.4194	0.3238	0.006	**
Tre	0.008327	0.003614	2.3043	0.8481	1.2311	0.3871	0.247	
Xyl	0.008127	0.004983	1.631	1.5552	1.1958	0.4489	0.008	**
Ino	0.006903	0.004695	1.4703	0.7011	0.9977	0.5014	0.042	*
Dhb	0.006277	0.004353	1.4419	0.4398	0.7094	0.5491	0.544	
Gln	0.005647	0.002891	1.9536	0.787	0.8866	0.5921	0.496	
Gal	0.005374	0.001603	3.3529	1.0787	0.8315	0.6329	0.003	**

Table 10: Most important substrates for discriminating soil types in grassland land uses.

Contrast:	OM_MM								
	average	sd	ratio	ava	avb	cumsum	p	signif.	
	Glc	0.011054	0.004244	2.605	1.4842	1.9927	0.1026	0.041	*
	Tre	0.008793	0.006233	1.4107	1.0968	1.5012	0.1842	0.155	
	Fru	0.00874	0.004136	2.1129	1.245	1.647	0.2653	0.284	
	Gln	0.007987	0.001869	4.2746	1.226	0.8586	0.3394	0.045	*
	Glu	0.00762	0.001342	5.6778	1.2297	0.8792	0.4101	0.007	**
	Dhb	0.007511	0.003147	2.3864	1.1136	0.7681	0.4798	0.184	
	Gla	0.00585	0.003133	1.8673	0.9406	0.6715	0.5341	0.021	*
	Asn	0.005714	0.006386	0.8948	1.2242	1.4067	0.5872	0.53	
	Suc	0.004751	0.00361	1.3161	1.2378	1.0577	0.6312	0.289	
Contrast:	OM_BM								
	average	sd	ratio	ava	avb	cumsum	p	signif.	
	Ino	0.009693	0.005087	1.9056	0.5518	0.9977	0.09638	0.001	***
	Dhb	0.008787	0.005021	1.7501	1.1136	0.7094	0.18374	0.052	.
	Gln	0.007424	0.005965	1.2445	1.226	0.8866	0.25756	0.079	.
	Asn	0.005944	0.00576	1.032	1.2242	1.3408	0.31666	0.462	
	Glu	0.005596	0.003775	1.4823	1.2297	0.9724	0.3723	0.214	
	Tre	0.005518	0.004921	1.1215	1.0968	1.2311	0.42717	0.936	
	Fru	0.004897	0.00345	1.4193	1.245	1.4194	0.47586	0.943	
	Arg	0.004707	0.002631	1.7891	0.6027	0.5819	0.52266	0.124	
	Sor	0.004604	0.003601	1.2786	0.8175	0.9254	0.56844	0.023	*
	Suc	0.004526	0.003256	1.3901	1.2378	1.283	0.61344	0.343	
Contrast:	MM_BM								
	average	sd	ratio	ava	avb	cumsum	p	signif.	
	Glc	0.011407	0.004388	2.5996	1.9927	1.468	0.1197	0.026	*
	Ino	0.006814	0.00469	1.453	0.6989	0.9977	0.1912	0.04	*
	Tre	0.005871	0.003277	1.7919	1.5012	1.2311	0.2528	0.901	
	Mal	0.005763	0.003302	1.7452	1.639	1.3821	0.3133	0.853	
	Gla	0.005547	0.001956	2.8354	0.6715	0.9267	0.3715	0.044	*
	Fru	0.005224	0.003421	1.527	1.647	1.4194	0.4263	0.905	

Suc	0.005148	0.003176	1.6209	1.0577	1.283	0.4803	0.162	
Xyl	0.005083	0.00351	1.4483	1.355	1.1958	0.5337	0.422	
Ala	0.005049	0.002595	1.9453	0.63	0.857	0.5866	0.009	**
Gln	0.00483	0.003036	1.5906	0.8586	0.8866	0.6373	0.741	

Table 11: Most important substrates for discriminating soil types in cropland land uses.

Contrast:	OC_MC							
	average	sd	ratio	ava	avb	cumsum	p	signif.
Cit	0.034548	0.034405	1.004	0.8349	2.3994	0.2809	0.023	*
Asn	0.010027	0.006785	1.478	1.5155	1.0542	0.3625	0.018	*
Gln	0.008532	0.003093	2.758	1.1401	0.7477	0.4318	0.016	*
Fru	0.00606	0.002944	2.058	1.3572	1.4636	0.4811	0.764	
Dhb	0.005931	0.004048	1.465	0.8985	0.6426	0.5293	0.68	
Glu	0.005917	0.002833	2.088	1.064	0.7918	0.5775	0.106	
Glc	0.00512	0.003479	1.472	1.6793	1.5337	0.6191	0.958	
Contrast:	OC_BC							
	average	sd	ratio	ava	avb	cumsum	p	signif.
Fru	0.014132	0.003776	3.742	1.3572	2.0073	0.1395	0.001	***
Glc	0.010508	0.005319	1.976	1.6793	2.1466	0.2431	0.062	.
Dhb	0.009972	0.003739	2.667	0.8985	0.4398	0.3415	0.01	**
Gln	0.007678	0.002321	3.308	1.1401	0.787	0.4173	0.065	.
Glu	0.007057	0.002239	3.152	1.064	0.7393	0.4869	0.024	*
Asn	0.006646	0.002729	2.435	1.5155	1.2098	0.5525	0.31	
Xyl	0.005975	0.003467	1.723	1.3008	1.5552	0.6115	0.178	
Ara	0.005292	0.002273	2.328	0.9143	1.1578	0.6637	0.004	**
Gal	0.005207	0.001884	2.764	0.8392	1.0787	0.7151	0.008	**
Lys	0.004054	0.001517	2.672	0.4724	0.2859	0.7551	0.002	**
Contrast:	MC_BC							
	average	sd	ratio	ava	avb	cumsum	p	signif.
Cit	0.035243	0.034734	1.015	2.3994	0.7887	0.2722	0.013	*
Glc	0.013326	0.006145	2.168	1.5337	2.1466	0.3751	0.006	**
Fru	0.011819	0.007325	1.614	1.4636	2.0073	0.4664	0.019	*
Xyl	0.007456	0.004189	1.78	1.2378	1.5552	0.524	0.019	*
Asn	0.006009	0.003928	1.53	1.0542	1.2098	0.5704	0.428	
Mal	0.005682	0.003523	1.613	1.8128	2.0742	0.6143	0.867	

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05

Permutation: free

Number of permutations: 999

Excessive use of fertilizer in soil impacts negatively the soil’s microbiome. To keep control of soil health from arable land there it’s a continuous investigation in the soil respiration between arable soil from specific locations in Hungary and the closest grassland to the previous, with the same type of soil to get more close accurate results. Four samples from arenosols were being used for cropping; four samples of arenosols from grassland; four samples from chernozem soils use for cropping; 4 samples from

chernozem soils from grassland; 4 samples from cambiosols for cropping; and 4 samples from cambisols from grassland. Each type of soil contains different physical characteristics; therefore, they will have different biological properties, consequently, their soil respiration will differ regardless if they are used for the same purpose or not.

The method that decided to use for the measurement of the soil's CO₂ was MicroResp™.

The CO₂ of the soil samples had to be measured with their original moisture, then dry it out; and then measure again without the moisture. To measure the results from the MicroResp it was necessary to use a spectrophotometer, the data collected by it went into the program R statistics version 4.0.3. (R Core Team, 2018) to interpret the results into statistical box & whisker plots. We were able to confirm that the use of fertilizers does indeed affect the soil microorganisms' presence, therefore, reducing the soil respiration.

CONCLUSION AND RECOMMENDATIONS

In conclusion, our study focused on comparing cropland and grassland land uses across three different soil types (Arenosols, Chernozems, and Cambisols) by examining soil microbial respiration as an indicator of soil quality. The research was conducted in May 2022, and a total of 24 soil samples were collected from the upper soil layer (0-20 cm) at the Institute for Soil Sciences in Budapest, Hungary. The MicroResp technique was employed to analyze the catabolic level physiological profile (CLPP) of soil microbial communities.

Our findings revealed significant differences in basal respiration and cumulative substrate-induced respiration between grassland and cropland, regardless of the soil type. Grasslands exhibited higher respiration rates compared to croplands across all soil types investigated. Additionally, the Inverse Simpson index, a measure of biodiversity, was also higher in grasslands, although the difference was only statistically significant in Balatoncsicso (Cambisols).

The CLPP analysis demonstrated significant differences among all the sites investigated. This was confirmed by both the permutational analysis of variance (PERMANOVA) and the principal coordinate analysis. Notably, the discrimination between sites was primarily influenced by substrate respiration rates. Multiple substrates, rather than a single substrate, had a significant effect on the separation of soil groups. At least five substrates played a crucial role in distinguishing between the different sites.

These findings highlight the impact of land use on soil microbial respiration and soil quality across different soil types. Grasslands exhibited higher microbial activity and biodiversity, indicating better soil health compared to croplands. The CLPP analysis further demonstrated that the microbial communities in grasslands and croplands differed significantly, emphasizing the importance of land use in shaping soil microbial composition.

Understanding the relationship between land use, soil microbial respiration, and soil quality is essential for sustainable land management practices. As humans, we cannot stop depending on the sources that the earth provides us with, but we have to learn how to take from it without disrupting it. Our study provides valuable insights into the potential benefits of promoting grassland ecosystems in maintaining and enhancing soil health. Further research is warranted to explore the long-term effects of land use on soil microbial communities and to develop targeted management strategies that can optimize soil quality in agricultural landscapes. This study has opened my curiosity to find out more about which would be the best alternative for common fertilizers that do not negatively impact the soil they have been put on to.

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A REVIEW ON CLIMATIC CHANGE: CAUSES, IMPACTS ON WILDFIRES AND HUMAN HEALTH

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Abstract: A climatic change happens when the climate's standards undergo critical variations, which causes perilous problems for the environment and society. Any defect in the climate conditions leads to alter in humidity, temperature, and precipitation. This process has a detrimental impact on the balance of the ecosystem. This review article distinguishes two types of climatic change causes: natural and anthropogenic. As far as natural far natural causes are concerned, harmful gases emission by volcanic eruptions are major detrimental problems to the environment, rise in average earth temperature and snow melting and in turn rise of sea level result in changes in the climate metrics which, in turn, lead to disagreeable effects on all forms of life on the earth. Meanwhile, it is noticeable that anthropogenic effects got more complicated in recent decades. Human activities have led to an increase in global warming through deforestation, increasing the emission levels of greenhouse gases, and producing more pollutants to be stuck in the atmosphere and water bodies. This paper aims at pointing out the relationship between climate change and wildfires specifically. The impact of climate change on the forest fire and vice versa. It is worth noting the effects of climatic change on the health of flora and fauna and local people. This review highlights the climate issues and gives a brief conceptual review of climate change to examine the preeminent and improve human health.

Keywords: Anthropogenic, Wildfires, health, Global warming.

INTRODUCTION

It is apparent that the climate of the Earth has been exceedingly changing; mostly due to anthropogenic causes that affect all forms of life. Scientists predict that this process is abnormally influences human life and the infrastructure as well [1]. It is obvious that natural disasters such as hurricanes, floods, drought, and wildfires have become more common in the last five decades, due to the planet's warming that can reach over 0.5°C, with more emissions these events will be more frequent. It is expected that the warming will increase four times to 4°C which exposes about 80% of the population all over the world to overheating [2].

The main changes that occur all over the world are those related to the climate and the atmosphere, including global warming as a result of human activities [3]. So, climate variability, recurrence, density, period, spatial extent, extreme weather, and climate events are basically the outcomes of climate change [4]. Globally catastrophic incidents, such as melting glaciers, sea level rise, increasing temperature, and altering the precipitation system, occur due to climatic change.

Climate change plays an essential role in the balance of the ecosystem and human beings. Since this phenomenon increased in recent decades, it is worth noting the causes of climate change both anthropogenically and naturally.

Considering that climate change is the most fundamental health bluster in the twenty-first century, tackling climate change crucial with regard to health [5]. Global warming, which results from human emissions of methane (CH₄), carbon dioxide (CO₂), and other greenhouse gases (GHG). [6]. Consequently, an alteration in the characteristics of the atmosphere is to be observed. [7].

The unpleasant human-made effects on climate have become numerous. These effects have led to producing extra greenhouse gases, thus releasing more pollutants into the atmosphere. Consistently increasing human greenhouse gases (GHG) affect the climate globally and regionally. [8]. On the other hand, natural factors like volcanic eruptions, ice melting, wind speed, etc, give rise to adverse climate conditions.

The amount of carbon dioxide, methane, and trace gases is increasing in the atmosphere owing to human actions. As long as the ice in the Arctic Ocean is melting, global warming will get aggregated, and it will affect forests, agricultural lands and water supplies. Besides, lots of coastal areas will disappear because of the raising sea level [9].

Changes in the climate would cause the displacement of various species of animals and plants. [10]. As well as this, it is observed that climate change plays a vital part in wildfires, which, in turn, influences the fire regime that identifies fire spread and severity. Climate change has disagreeable impacts on the environment and human health. In consonance with World Health Organization (WHO), climatic change and global warming are the utmost confrontations that humans face in the twenty-first century [11]. In the case of facing this disaster and reducing its negative effects, we need to highlight the causes and effects of climate change to reach our target.

CAUSES OF CLIMATE CHANGE

According to Environmental Protection Agency (EPA) 2014, both natural and anthropogenic factors bring about changes in the ecosystem's balance and climate change. Any of these factors would convert the amount of received radiation from the sun, or prevents the heat to escape from the Earth to space. So, it is important to distinguish between man-made and natural climate change.

❖ Anthropogenic Causes:

Human activities have increased and changed the characteristics of the atmosphere. Such actions include logging, burning fossil fuel, building roads, agriculture road expansion, industrial activities etc. All of which contribute to releasing greenhouse gases (GHG) into the atmosphere

1- Deforestation:

Forests play an essential role in the Earth's climate system in various ways. They grab carbon dioxide from the atmosphere and alter it through photosynthesis into the living biomass. Forests are natural strainers to absorb carbon dioxide (CO₂) from the atmosphere. Vegetation modulates the temperature of the surface and air by absorbing carbon dioxide (CO₂). Any reduction in the forest area leads to an increase in the temperature. Thus, increasing the greenery in tropical regions causes more evaporation that leads to making the weather cooler.

Once the evapotranspiration rises, there will be cooler days. After burning or cutting down the forests, for different reasons like agricultural purposes, pastoral purposes, urbanization etc, carbon flowing from the atmosphere to the forests, stops.

Deforestation has recently raised the amount of carbon dioxide (CO₂) in the atmosphere. Changes in the flora affect the temperature of the Earth's surface. Besides, the elimination of the forest cover converts the patterns of global and regional climate, which causes devastating rainstorms followed by long and dry seasons [12].

2- Alters in Land-use:

Changes in land use, the concentration of land use and climate change have taken in land degeneration and desertification. Converting the way of land use such as forests land use, farms land use, cities land use etc, affect the amount of reflected sunlight into the space. Unreasonable land use leads to changing forests to agricultural lands and increasing carbon dioxide (CO₂) emissions by 10-50 % [12].

3- Greenhouse Gases Emissions:

Greenhouse gas emissions (GHG) are essential for the world's food production. One of these gases is CO₂ which is considered as a major factor in climate change. The sources of Greenhouse gases are a major prevalent problem than any other environmental ones [13].

The temperature of the surface air of the Earth raises due to greenhouses gases emissions (GHG) [14], [12]. In the last 25 years, the temperature increased almost everywhere. Globally, more greenhouse gases emissions (methane, carbon dioxide, carbon monoxide) have increased owing to economic sectors, such as industry, fossil fuel combustion, transportation etc. Fossil fuel is a main source of greenhouse gases which emits 22% of anthropogenic greenhouse gases. Increasing the concentration of CO₂ is an essential reason for global warming. [12].

GHG, such as CO₂, absorb the surface Earth's heat. Since the beginning of the industrial revolution, human activities have led CO₂ to grow in the atmosphere by over 40%. This event is accompanied by a rise in sea level, warming of the ocean, melting of the glacier, and so extreme weather. Continuous emissions of GHG will cause more climate change and increase the surface Earth's temperature and change the regional climate [15].

4- Agricultural Expansion and other human activities:

Using composts that contain Nitrogen leads to an increase in the concentration of nitrogen dioxide (No₂) in the atmosphere causing climate change. The expansion of agricultural lands towards forests results in negative effects on biodiversity. Other human activities like ranching, filling landfills, using natural gases etc., lead to a rise in methane (CH₄), which is a major factor in climate change. [12].

❖ **Natural Causes:**

As human activities are the main reason for climate change which influences forest fires, there are some natural factors that lead to climate change and wildfires.

1- The intensity of the Sun:

The solar energy that reaches the surface of the Earth affects the climate. That there are many factors that influence the reception of heat energy, one of which is the angle of the sun, as it is variable based on the location, time of day, and season. All of that is associated with Earth's rotation.

2- Changes in the Earth's Orbit:

The author pointed out that the Earth's climate is affected by its position to the Sun. This includes Earth's axial angle tilt and the distances between the Earth and the Sun all year around.

3- Volcanic Eruptions:

Molten rocks (Lava) and greenhouse gases (GHG) erupt during volcanic eruptions, which throw dust, gases and ashes into the atmosphere. Volcanoes release water vapor and carbon dioxide which highly affect the climate. [12].

IMPACTS OF CLIMATE CHANGE ON WILDFIRES:

Climate changes heat up the planet, mainly due to human activities as they change the metrics of the atmosphere, and lead to an increase in the temperature of the atmosphere, oceans and ice melting. As well as this, it has fundamental effects on excessive events [16]. Given that wildfires are one of these destructive events, it is worth noting that the weather plays a critical role in forest fire incidents and

growth. The importance of weather in ignition factors, where is lightning a main agent of the forest fire [17], [18]. On the other hand, the weather determines ignition sources, such as fuel moisture, which determines the possibility of inflammation and weather the fire will grow or not.

Weather conditions, like temperature, wind speed, rainfall, and relative humidity affect fire spread [19]. Fire growth results from many variables. However, dry fuel and wind speed are the main factors for fire propagation [20], [17]. Climate trends have increased fire frequency, which extends to hundreds of thousands of hectares in large geographic areas, leading to destroying the forest's ecosystem, eradicating the biodiversity and extirpating the sources of the forest's raw materials [21]. Climate change contributes to fires worldwide, which will be the cause of more harsh fires in the next decade. Since climate change increases, the severity, duration and frequency of forest fires, it leads to longer fire seasons. Hence, the fast-paced process of ice cover melting and the increasing temperature lead to an increase in the incidence and intensity of wildfires. It is worth noting that the increase in temperature causes a high rate of evapotranspiration and reduces humidity [22], [23]. Authors have indicated that there is a relationship between large fires and wind speed. Climate change gives rise to circuitous results related to forest fires [23], which, in turn, affect vegetation allocation and human health [23], [20].

Conversely, the risk of pasture and bush wildfires in conditions of climate change is less clear, and active years of wildfires are associated with positive variables in moisture during the growing season prior to a year or more of the fire season [2]. It is important to mention that, the major climate variables affecting wildfires point out a raise in temperature and reduce in precipitation, especially in summer [24].

The author noted that forests deprivation due to wildfires lead affects the Earth's ability to absorb carbon dioxide (CO₂) and so cool the climate. Besides, wildfires release greenhouse gases (GHG) into the atmosphere, such as carbon dioxide (CO₂) and methane (CH₄) [25].

IMPACTS OF CLIMATE CHANGE ON HEALTH

It is anticipated that climate change will affect human health in the coming decades. It is expected that the Earth's surface temperature will increase to 2°C. The authors indicated that climate change has direct and indirect effects on global health which will be noticeable in food and water insecurity, threats to shelters and human settlements, population growth and migration, and extreme climate incidents. In addition, there will be an increase in vector-borne diseases and a rise in fatalities, especially among elderly people [26].

Since human health is sensitive to variations in relation to the patterns of weather, as mentioned above, the impacts of climate change are classified into two groups, direct and indirect effects.

Direct effects occur owing to extreme weather incidents, such as changes in rainfall, the temperature, the occurrence of floods, heat waves, drought, and fires. Indirect effects occur due to crop failures, migration, food insecurity, higher food prices, etc.

Increasing temperatures have raised the risk of death and illnesses related to rising temperatures. Local alters in precipitation and temperature led to a change in the distribution of some disease vectors and water-born illnesses, and decreased food production.

If the climate kept changing as expected, it would lead to a greater risk of death and ailments spread. As mentioned above, food insecurity, unemployment and low labour productivity of the populations are all affected by climate change [27], [28]. Besides, the increasing temperature of the sea surface led to the blooming of the alga which may cause cholera outbreaks [29] and reduce the availability of potable water [30].

Converts in climate parameters lead to growth in respiratory diseases and death rates among people who suffer from chronic lung diseases, such as asthma [5], [31], [32], chronic obstructive pulmonary disease (COPD), and cardiovascular diseases. Respiratory system diseases grow among children during heat waves since high temperatures and high humidity cause the emergence of symptoms of asthma. Similarly, cold weather and exposure to cold conditions lead to infections in the respiratory system among people that suffer from (COPD) [31], [32]. Some examples of how climate change may affect Health are demonstrated in figure 1.

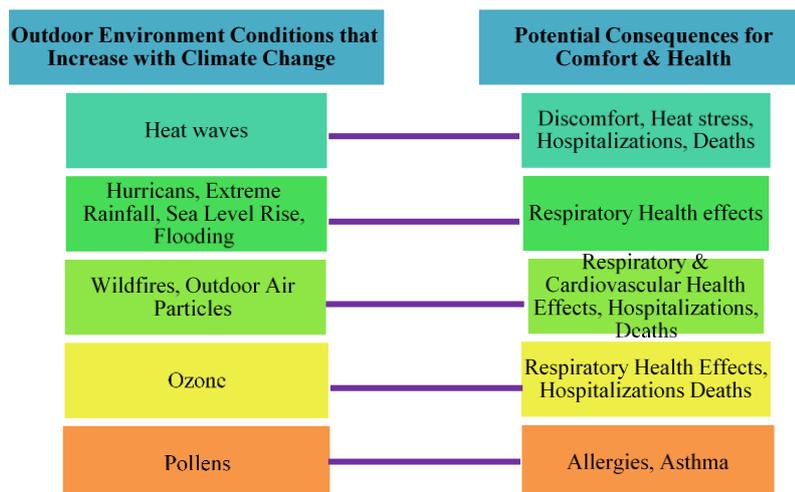


Figure 1. Examples of how CC may affect Health: Source [33]

CONCLUSION

The influence of volcanoes and changes in the solar activity would result in cooling off rather than warming over the past 50 years.

Global warming that is being witnessed over the past 150 years matches nearly perfectly what is expected to occur due to greenhouse gas emissions and other human activities. In other words, the accurate estimate of the human contribution to modern warming is around 100% as wildfire estimates show that 85% are human-made. Over the past 100 years, wildfires rose by 57% mostly owing to climate change.

After covering all climate change causes, and since climate change together with other natural and human-made health stressors, affect human health and disease spread in numerous ways, which leads to the extinction of animal and plant species, we need to take action to protect the environment because we can't assume how much the negative effects on natural sources are.

We are facing critical issues, and that's why we need to take precautions towards human activities to reduce the disagreeable impacts on the environment and health as well.

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

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Abstract: The Royal Netherlands Meteorological Institute (KNMI) has published the KNMI'06 climate scenarios in 2006. These scenarios give the possible states of the climate in The Netherlands for the next century. Projections of changes in precipitation were made for a time scale of 1 day. The urban drainage sector is, however, more interested in projections on shorter time scales. Specifically, time scales of 1 hour or less. The aim of this research is to provide projections of precipitation at these shorter time scales based on the available daily scenarios. This involves an analysis of climate variables and their relations to precipitation at different time scales. On the basis of this analysis, one can determine a numeric factor to translate daily projections into shorter time scale projections.

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

INTRODUCTION

Rising temperatures are generally expected to be accompanied by increases in rainfall intensities at mid- and high latitudes [1], [2]. Urban areas are especially vulnerable to increased rainfall intensities, especially during convective summer storms [3], [4], [5]. Regional impacts will differ from average climate predictions, which make regional studies necessary, such as this one for The Netherlands. The goal of this study is to examine the impact of possible climate change on rainfall intensities at a time scale of 1 h.

The Royal Netherlands Meteorological Institute (KNMI) developed four KNMI'06 climate scenarios that provide information on projected changes in daily precipitation. These scenarios are based on a large number of global and regional climate models. For urban drainage design, daily precipitation is less relevant; critical response times of storm sewerage and surface drains are in the order of minutes to hours [3], [6]. Regional climate model output on peak precipitation for shorter time scales is not (yet) reliable enough to allow for a publishable estimate. Therefore, a new method was developed to study the relation between daily and shorter time interval precipitation from historical data. The objective is to use variables available in the KNMI'06 scenarios to obtain conditional relations between daily and shorter interval precipitation. If it can be assumed that these relations will remain more or less the same in the future, estimates could also be made for short term peak precipitation in the future.

MATERIALS AND METHODS

The applied methodology involves selection of climate variables that are likely to affect rainfall intensities at the desired short time scales, acquisition and selection of historical data, and the analysis of correlations between variables available in the KNMI'06 scenarios and the ratio of 1 h and daily precipitation. The selection of the KNMI'06 scenarios is based on two steering parameters: change in global mean temperature and change in air circulation pattern. This resulted in four scenarios shown in Fig. 1. The scenarios span a large part of the uncertainty about our future climate, and they are a translation of larger scale climate change projections to climate change in The Netherlands. It was first assumed at KNMI in 2007 that extreme hourly rainfall would change in the same way as the extreme daily rainfall. This research aimed at checking this hypothesis and providing a further elaboration of the KNMI'06 scenarios with information about hourly precipitation extremes and quantification thereof. Explanatory climate variables that could be linked to the steering parameters in the KNMI'06 scenarios were selected to this end. These variables were then analyzed with hourly and daily precipitation.

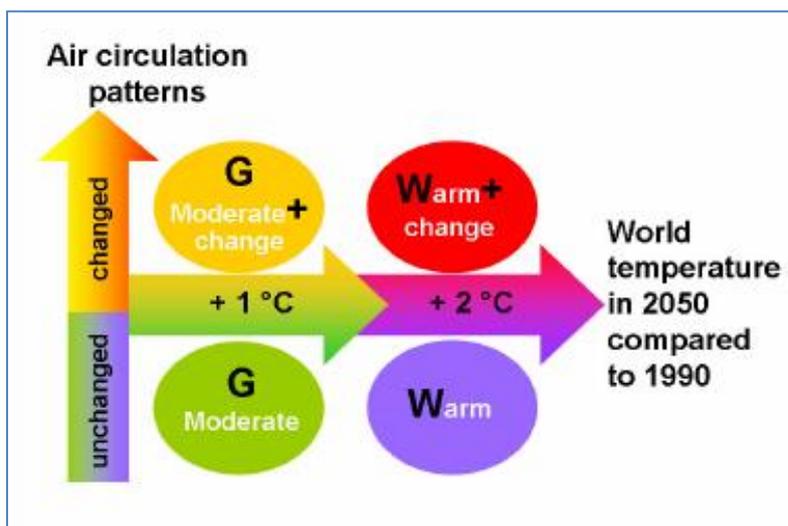


Figure 5: The Four KNMI'06 Climate Scenarios [7]

SELECTION OF CLIMATE VARIABLES

The main variables that, *a priori*, could have an influence on extreme precipitation include:

- wind (speed, direction) or wind at higher altitudes
- air temperature
- humidity
- air pressure
- sea-surface temperature (The Netherlands)

Based on literature study and expert consultation, wind direction and maximum daily air temperature were chosen to be used for further analysis. Some studies conducted in the Iberian Peninsula and the British Isles have led to the conclusion that a correlation exists between wind or atmospheric circulation and extreme precipitation [8], [9], [10]. KNMI concluded that wind direction but not wind velocity was an indicator for precipitation [11]. Wind direction or, better, geostrophic circulation (wind at higher altitudes) could be an explanatory climate variable linked with differences between the KNMI'06 scenarios. The wind direction at higher altitudes determines from where air masses are transported to The Netherlands, for example from over the ocean (generally moist) or over land (in summer often dry and warm). Rain cloud formation is often caused by south-westerly circulation, corresponding to a limited range of G-West values. Under such circulation patterns, warmer air from the Mediterranean region is transferred to The Netherlands after absorbing moisture over the North Sea. At the surface

the wind direction can be different, due to friction. G-west is a measure used at KNMI to quantify geostrophic wind from westerly direction. G-West is the magnitude of the velocity of the wind coming from the west at 270°. A negative value of -2.6 m/s would correspond to a wind coming from the east at 90° with a speed of 2.6 m/s. G-west is thought to be an important explanatory variable for precipitation. A data series was compiled based on data from the ERA-40 database [12] for The Netherlands and they are available from 1958. G-west is determined six times daily and is derived from surface pressure. For this study, average daily values are used.

Warm weather has been found to be key for short duration, high intensity rainstorms [3], [13], [14]. Former analysis showed that the annual maxima for 24 h and 4 h mostly occurred during the months May-September. KNMI experts also indicated that maximum daily temperature could be an explanatory climate variable that can be linked with differences between the KNMI'06 climate scenarios. Warmer air can contain more moisture which is favorable for precipitation. Maximum daily temperature can be used instead of average daily temperature because it can easily be linked to KNMI'06 climate scenarios, which provide average daily temperature. Based on observations over the last 30 years, the difference between maximum, minimum, and average daily temperature did not really change. It is assumed that this relation between maximum, minimum, and average temperatures will not change in the future.

SELECTION AND VALIDATION OF HISTORICAL DATA

KNMI has an automatic and manual rain gauge network to record precipitation. Until the 1970s, mechanical pluviographs were used as automatic rain gauges. Pluviographs have since then been replaced by electronic rain gauges. At the automatic stations, each hour recordings are made, at the manual stations only once per day. The 60-min precipitation data used in this paper were recorded with automatic rain gauges because the 60-min precipitation data recorded before 1980 have not yet been digitized. The quality of the 60-min automatic measurements was checked by comparing their daily sums with 24-h manual measurements.

At KNMI in The Netherlands, historical precipitation data is available for daily, 1-h and 10-min observational time segments. Many years of historical data are available for precipitation amounts daily. In comparison, fewer years of data are available on an hourly basis. Less than 25 years of data are available for shorter time intervals including 15-min or less. Five to 10 min data is the most interesting for urban drainage and urban water management. Urban water managers wish to have information about 10-min precipitation recordings as the characteristic time of urban runoff processes is of that order of magnitude [3], [15]. However, 10-min recordings are not validated and/or the available number of years is too limited to cover most of the natural variability.

That is why it was decided to use validated 60-min precipitation data recorded at the station De Bilt in The Netherlands for this research. The station De Bilt was chosen for the long (>50 years) time series available for both daily and hourly precipitation. A minimum of 30 years of data is generally used to describe most of the natural variability, but for extreme values preferably even larger time series are used [16]. In addition, De Bilt is a non-coastal location where there is hardly or no effect of seawater temperatures on extreme precipitation therefore making it easier to link extreme precipitation to air temperature and G-west. It is also recognized that urban areas may exacerbate formation of summer storms [6] due to the urban heat island and that this effect is also not reflected in the time series of De Bilt.

STATISTICAL ANALYSIS AND GRAPHICAL PRESENTATION

The analysis consists of three parts. First, an exploratory analysis of the correlation between temperatures and precipitation extremes is put forward. Second, a similar analysis concerning the correlation between circulation patterns (G-west) and precipitation extremes is given. Finally, the ratio between daily and hourly precipitation as a function of maximum daily temperature and G-west is given, which allows for temporal downscaling on the basis of climate projections.

RESULTS

Temperature and precipitation extremes

A visual technique was used to obtain a first idea of how maximum daily temperature and G-west correlate with daily precipitation. Scatter plots were made using other climate variables to obtain a sense of when and under which circumstances extreme precipitation occurs. Raw data hardly show a relation between daily precipitation and maximum daily temperature.

Based on the data series 1958-2006, Fig. 2 presents a scatter plot of maximum daily temperature versus maximum hourly precipitation per day. It shows no clear relation between precipitation and temperature. However, the maximum values seem to have some relation with temperature. An interesting point is that extreme hourly precipitation amounts of more than 20 mm (shown in Fig. 2) do indeed occur during warmer temperature days of 20°C and above. However, in a plot of the annual maximum precipitation against temperature, there is no clear relation. Annual maxima often occur during the summer half of the year with relatively high temperature [17]. The main focus of this research is extreme precipitation and therefore these months will be analyzed further.

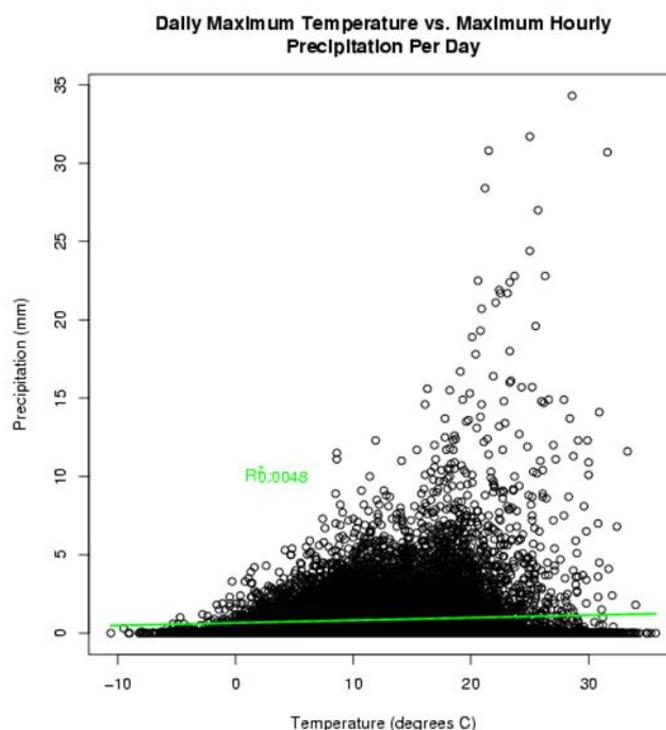


Figure 6: Maximum daily temperature vs. maximum hourly precipitation per day for De Bilt 1958-2006. Green line is the linear regression value of 0.0048

Circulation and precipitation

The second explanatory variable for climate change in The Netherlands is G-west. As mentioned earlier, G-west is derived from surface pressure. Fig. 3 shows a scatter plot of G-west and daily precipitation for De Bilt during summer months June, July, and August. Fig. 4 is a plot of G-west and maximum hourly precipitation per day.

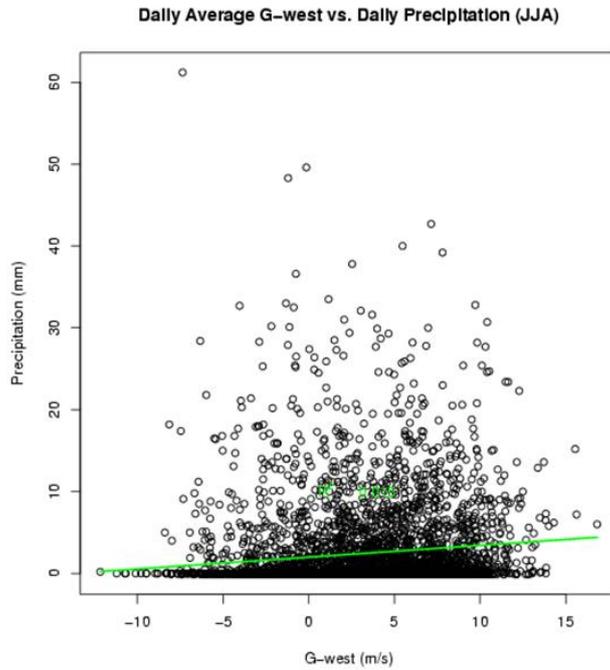


Figure 7: Daily average G-west vs. daily precipitation for summer months (De Bilt 1958-2006). Green line is the linear regression with a regression coefficient $r^2=0.015$

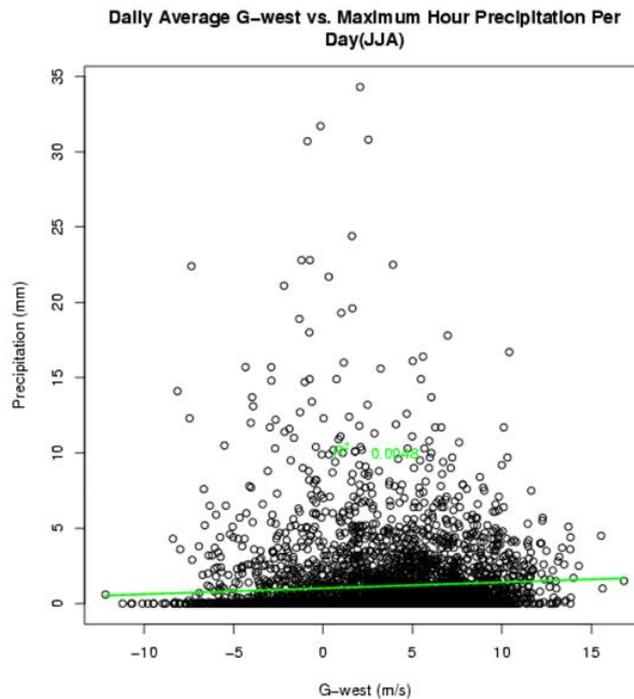


Figure 8: Daily average G-west vs. maximum hourly precipitation per day for summer months (De Bilt 1958-2006). Green line is the linear regression value with a regression coefficient $r^2=0.0048$

Both Fig. 3 and Fig. 4 show that extreme daily precipitation and extreme maximum hourly precipitation per day occurred with a G-west value close to 0 m/s. This suggests that daily maxima and hourly maxima may occur during the same or similar meteorological conditions. Correlation between maximum daily temperature and G-west was not significant (>95% confidence). Therefore, we can assume for the remainder of this analysis that maximum daily temperature and G-west are independent of each other.

Correlations between daily and hourly precipitation and climate variables

Since we are interested in extreme hourly rainfall and we only have information about the change of extreme daily rainfall in case of climate change we decided to investigate the ratio between maximum hourly versus daily rainfall in relation to temperature and G-west. We also determined the quantiles. Primarily the upper quantiles: 90%, 95%, and 99% are of interest to us, as these indicate extremes of the recorded daily and hourly precipitation versus maximum daily temperature and versus G-west respectively.

Fig. 5 shows a frequency representation (lower part of figure) of two climate parameters: maximum daily temperature and amount of precipitation (only wet days). The data represent the summer months May, June, July, August, and September for the years 1958-2006. In the upper half of Fig. 5, lines indicate the percentage of data that are below the line (90% quantiles equals 90% below, 10% above). Fig. 6 shows maximum daily temperature versus maximum hourly precipitation per day. Both figures allow for a comparison of maximum daily temperature with hourly and daily precipitation.

Below the horizontal axis, a histogram represents the frequency of the data. For both figures, more hours or days of precipitation occur with a maximum daily temperature value between 15°C and 20°C, at higher temperatures maximum hourly precipitation seems to increase with temperature. This is not clearly the case for daily precipitation. This is in line with our expectation that extreme precipitation is generally occurring during warmer days.

Fig. 7 presents a frequency representation of daily G-west and precipitation (only wet days). Fig. 8 shows G-west versus maximum hourly precipitation per day. Both plots show that more hours or days of precipitation occur with a G-west value of approximately 5 m/s.

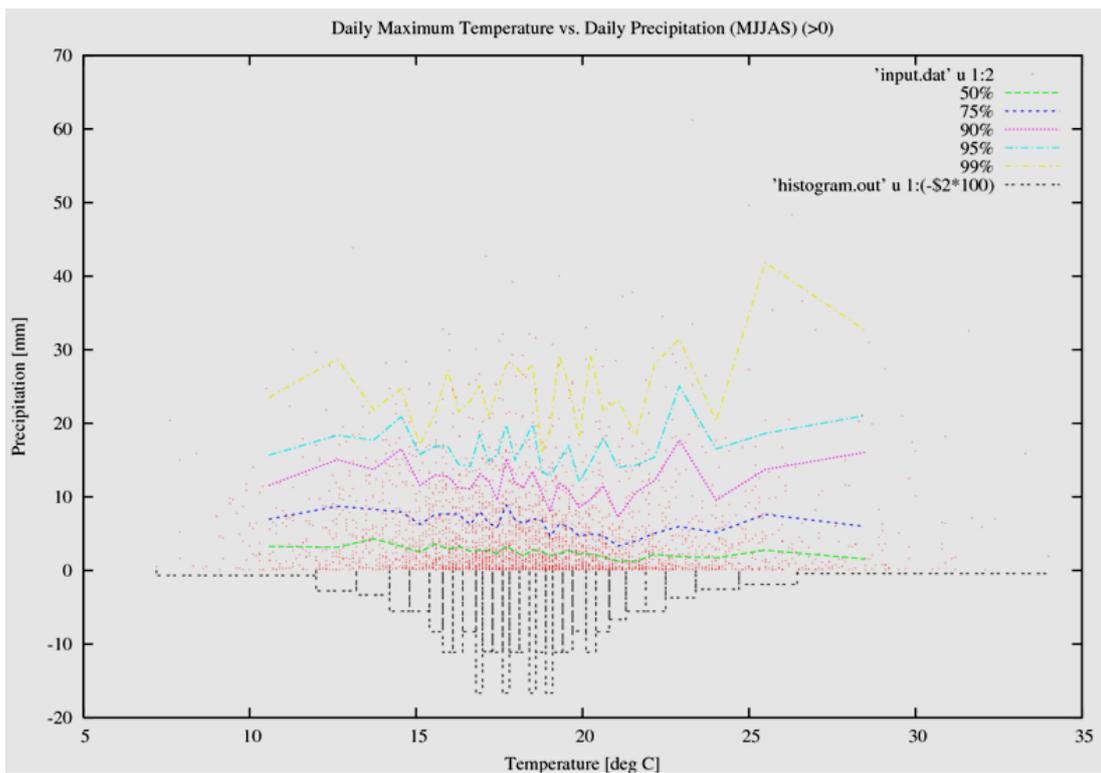


Figure 9: Maximum daily temperature vs. daily precipitation for summer months (May-September)

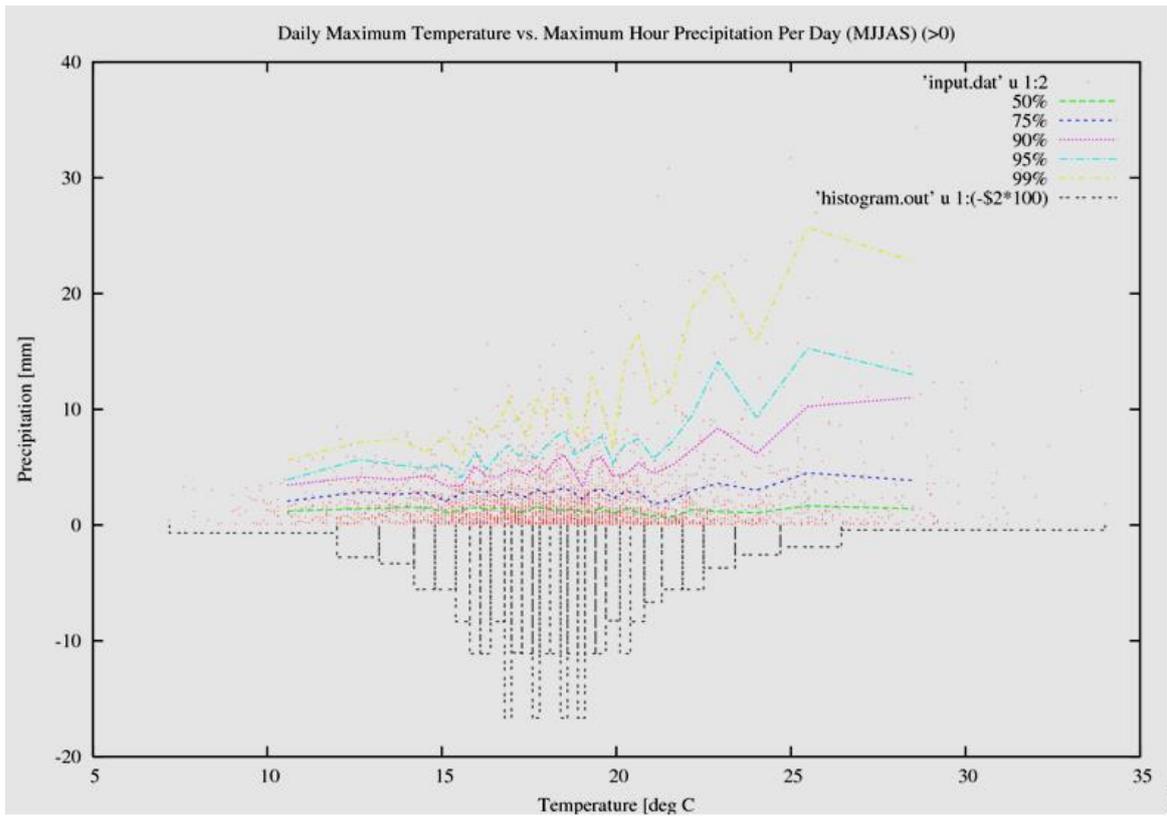


Figure 10: Maximum daily temperature vs. maximum hourly precipitation per day for summer months (May-September)

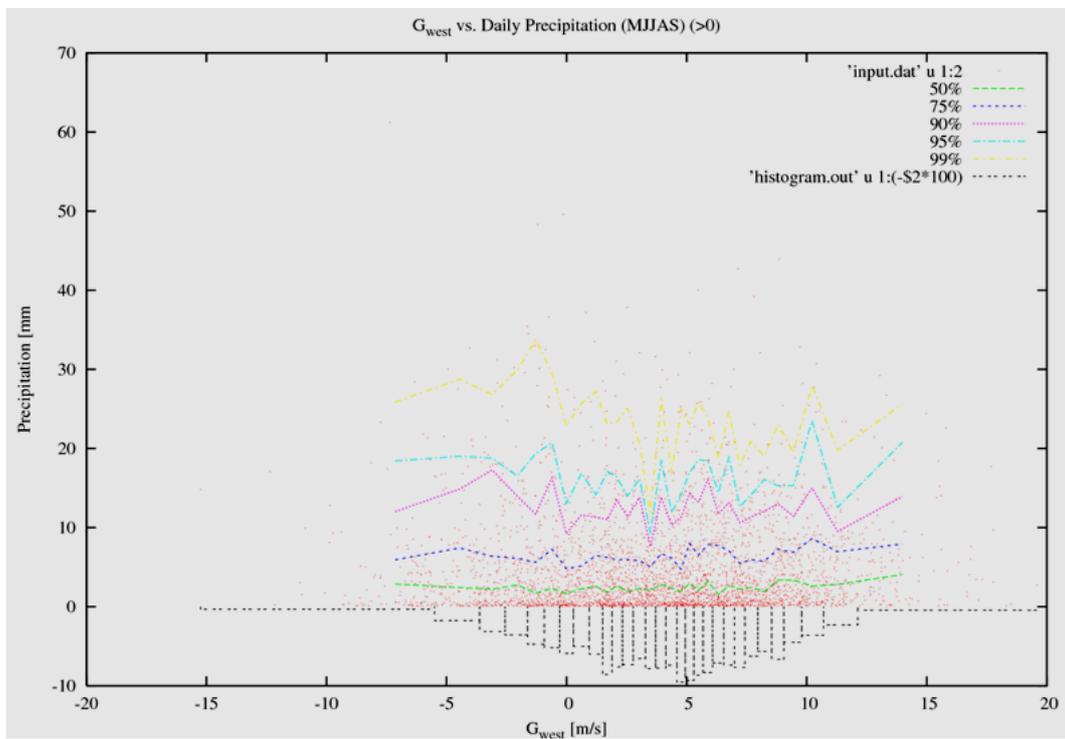


Figure 11: G-west vs. daily precipitation for summer months (May until and including September)

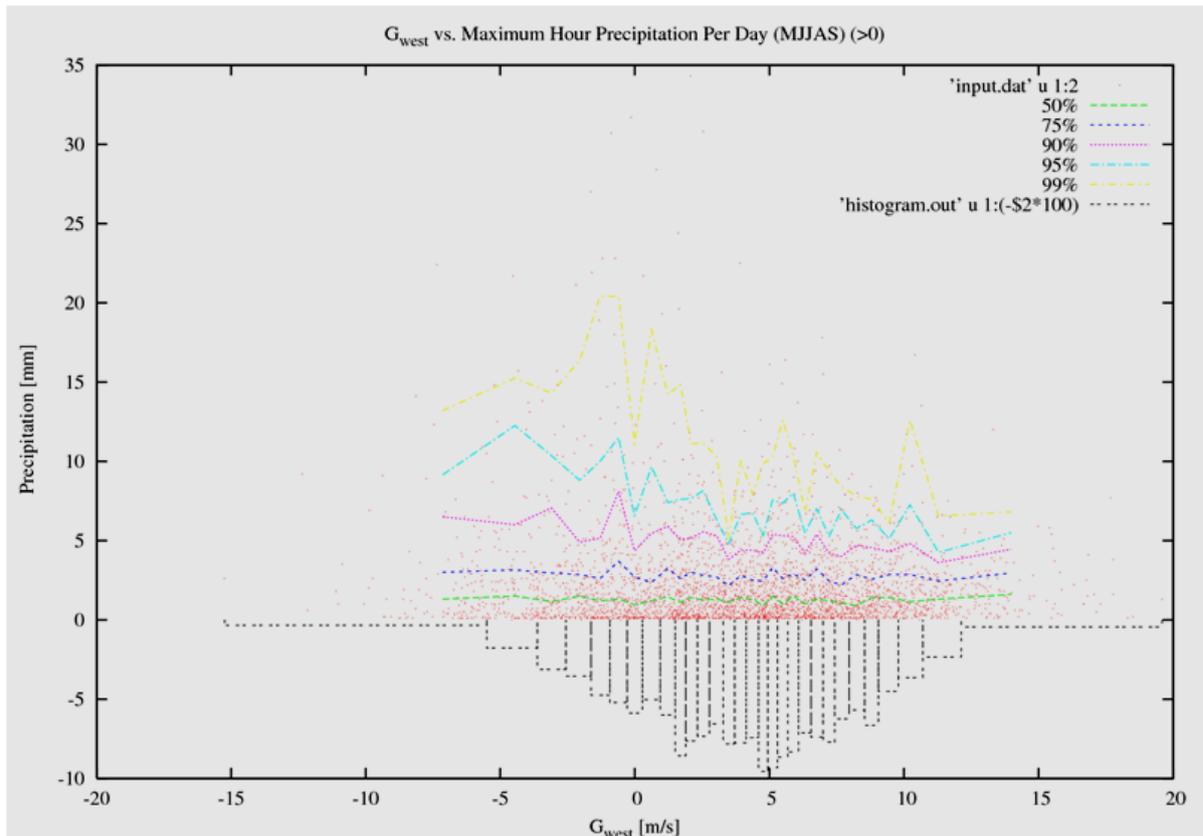


Figure 12: G-west vs. maximum hourly precipitation per day for summer months (May until and including September)

In the next step of our analysis, we started comparing points on the percentile lines for daily versus hourly precipitation. So we took the value of e.g. the 95% line of Figs. 5 and 6 for the same temperature and determined the ratio of daily versus hourly rainfall. We did this for the whole range of temperatures from 10-29°C. And a similar analysis was made for G-west.

Fig. 9 is a plot of the relation between daily and maximum hourly precipitation in relation to maximum daily temperature plotted in Fig. 5 and Fig. 6. The thin-dashed line is the 95% ratio. This was constructed by dividing the 95% percentile line for daily precipitation (Fig. 5) by the 95% percentile line for hourly precipitation (Fig. 6). If we assume a linear relation between these data points, the result is the bold-dashed line which gives the ratio of daily to maximum hourly precipitation versus maximum daily temperature. A change in ratio indicates a different relation with maximum daily temperature and therefore a different relation between daily and hourly precipitation. The linear equation for the bold-dashed line in Fig. 9 is,

$$y_{95} = -0.16x_{95} + 5.59$$

x = maximum temperature in °C
y = ratio of daily to hourly precipitation

A similar calculation was made for the 99% percentile line ratio, which is represented by the solid line. The linear equation for the solid line is,

$$y_{99} = -0.18x_{99} + 5.78$$

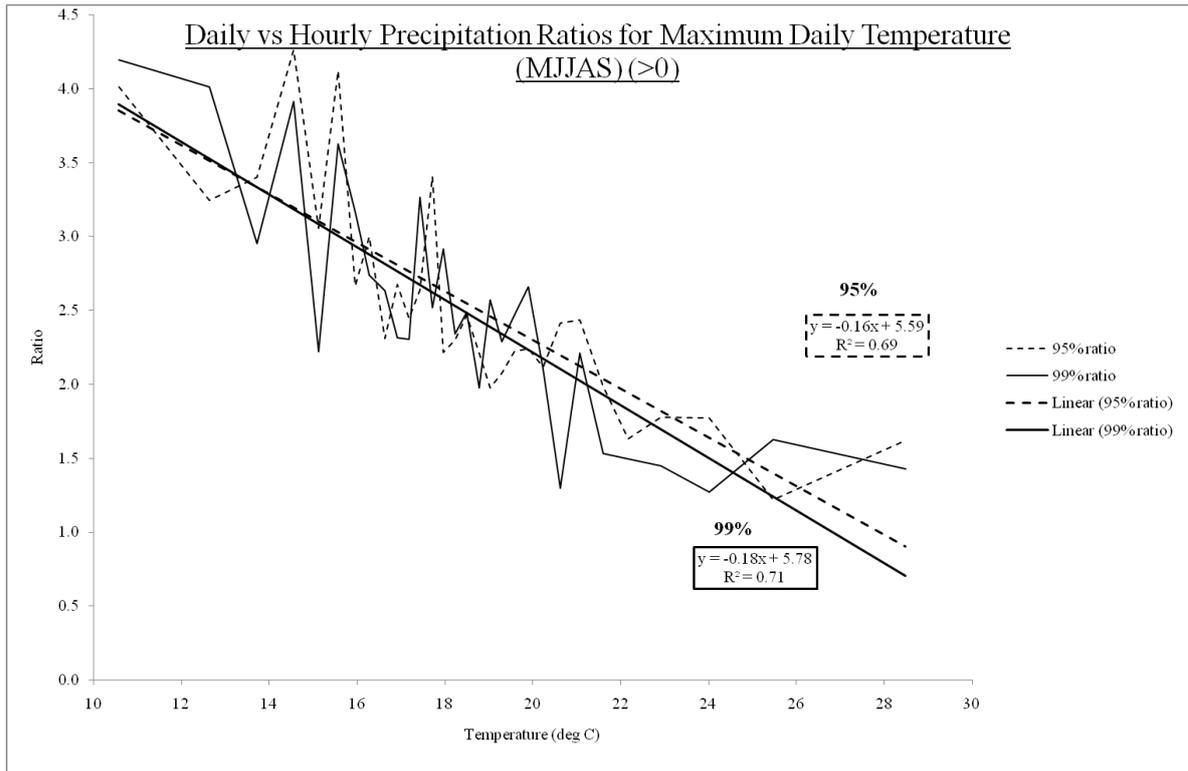


Figure 13: Daily/maximum hourly precipitation ratio in relation to maximum daily temperature for summer months (May-September). The bold-dashed line is the regression value of 0.69. The solid line is the regression value of 0.71

Fig. 10 is a similar representation as shown in Fig. 9, but now in relation to G-west. The bold-dashed line gives the ratio of daily to hourly precipitation for 95% percentile line versus G-west;

$$y_{95} = 0.09x_{95} + 1.99$$

$$x = \text{G-west in m/s}$$

$$y = \text{ratio of daily to hourly precipitation}$$

The same was done for the 99% percentile line ratio (solid line);

$$y_{99} = 0.08x_{99} + 1.92$$

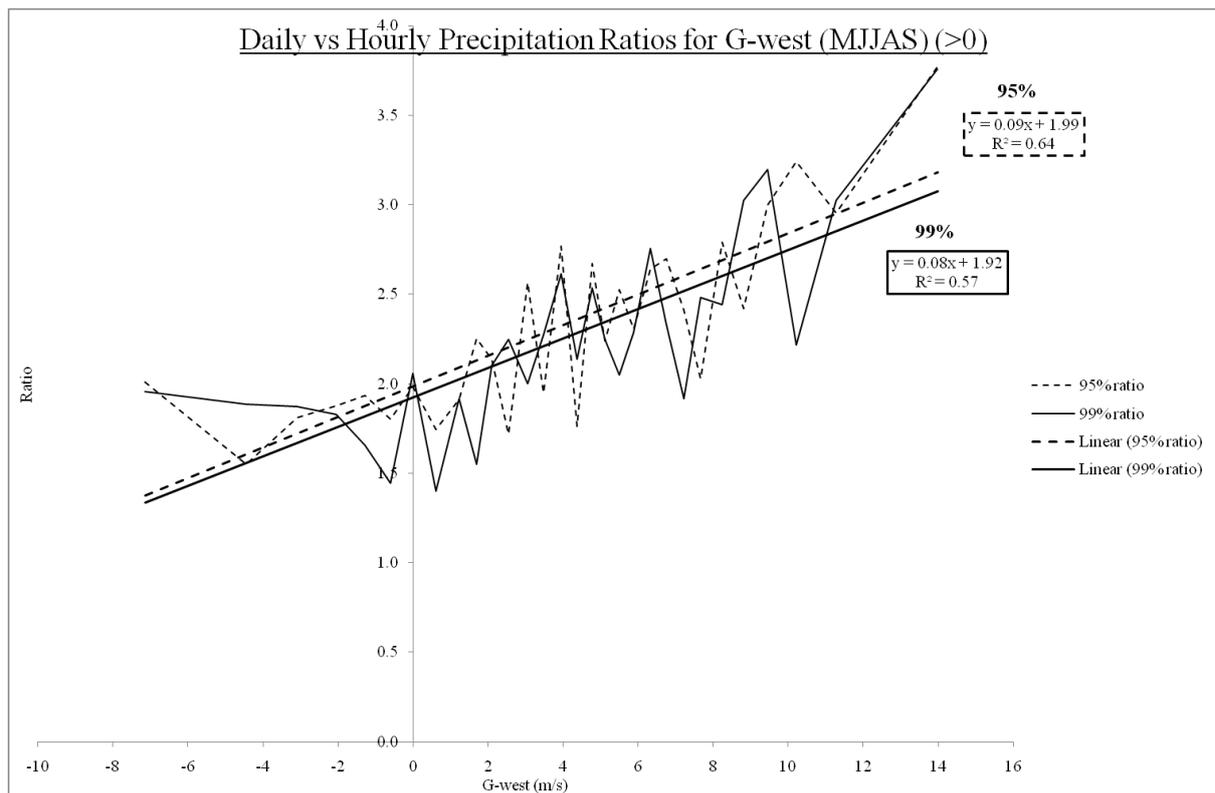


Figure 14: Daily/maximum hourly precipitation ratios in relation to G-west for summer months (May-September). The bold-dashed line is the regression value of 0.64. The solid line is the regression value of 0.57

Fig. 9 and Fig. 10 show that the ratios of extreme daily to hourly precipitation for temperature and G-west are certainly not constant. The higher the temperature the closer this ratio between daily and maximum hourly rainfall approaches the value 1 (which means that all daily rainfall occurs within 1 h). With strong westerly winds, daily rainfall is much higher than the maximum hourly rainfall. Now, a relation has been established for extreme daily and hourly precipitation with the explanatory climate variables average daily temperature and G-west. These relations allow us to transform design storms and existing time series of hourly rainfall to new, synthetic series of rainfall under the assumption of a certain climate change scenario. Synthetic series or design storms can now be produced with the aid of the four KNMI'06 climate scenarios using projected daily precipitation, G-West, and maximum daily temperature.

CONCLUSION AND RECOMMENDATIONS

Based on the KNMI'06 climate scenarios, projections have been made for daily precipitation events for the time horizons 2050 and 2100. The methodology described above enables us to project these daily precipitation events into maximum hourly precipitation events. By examining historical data and analysing the relationships between precipitation, at both daily and maximum hourly time scales, and explanatory climate variables, it was possible to determine a ratio to apply to daily precipitation projections that result in maximum hourly precipitation projections. Interestingly, although correlations between explanatory variables and precipitation were relatively weak, the correlation between explanatory variable and the daily/hourly precipitation ratio is strong. This strong correlation is the main finding of this paper.

A useful extension of this research would be construction of synthetic maximum hourly precipitation. This extension would allow us to transform design storms and existing time series of hourly rainfall into new synthetic series taking into account climate change scenarios. Eventually, as a second extension, these synthetic data can be used as input for an urban drainage model. With such a drainage model and

synthetic data for design storms or design series the effects of climate change on the systems' performance can be assessed and the efficiency of adaptive measures can be investigated.

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MAIN ECONOMIC FEATURES OF FRANCE BETWEEN 2019 AND 2023

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Abstract: The study overviews the main economic variables as features of France between 2019 and 2023, naturally the data concerning 2023 are estimated. The main variables of this study are real GDP, domestic demand, private consumption, public consumption, gross fixed investment, gross national savings, gross domestic investment, general government balance as budget and general government gross debt in percent of GDP. Also, the study emphasizes the employment issue based on the employment, and unemployment rate. The balance of payment in current account and trade balance of goods and services based on export and import conditions contribute to main economic conditions of the France economy. According to above-mentioned economic variables the role and importance of France can be characterised by foreign direct investment as net balance and the net international investment position in percent of GDP of France. The statistical methods are wide-sidle needed for discovering main correlations among different economic variables. The public financial issues have recently been going wrong in France which can be proofed that the negative general government balance as budget increased from 3.1% in 2019 to 5.3% in 2023 and the general government gross debt increased to level of 97.4% in 2019 and 112% in percent of GDP. The unemployment decreased from 8.4% in 2019 and to 7.6% in 2023, which decrease was little measure than the level required by the policymakers. It can be summarised that the French economy has not strengthened for the latest period from point of view of public financial conditions and net international investment position. The solution is for escaping from negative economic trends to increase the innovative investment and to strengthen the international economic conditions of France.

Keywords: domestic demand, employment, general government balance, general government gross debt, international economic conditions, private consumption

INTRODUCTION

Objective of the study is very recent and actual, because France as a mean leading and establishing economy in the EU-27, in G-7 countries including United States and Canada and member state of OECD (Organization for Economic Cooperation and Development) countries as highly developed economies of the world economy. Recently economic conditions have been wronging in France, because mostly

the global economic crisis based on the medical and energy difficulties, which last one was resulted by the Russian war in Ukraine from the beginning of 2022. Governments need agile fiscal policies as food and fuel prices spike spending imperatives from pandemic and war meet high debt and tight budget constraints [1].

The study analyses the latest economic conditions of France by using statistical analysing methods. The study overviews the main economic variables as features of France between 2019 and 2023, naturally the data concerning 2023 are estimated. The main variables which are focused on by the study concern the real GDP, domestic demand, private consumption, public consumption, gross fixed investment, gross national savings, gross domestic investment, general government balance as budget and general government gross debt in percent of GDP. Also, the study emphasizes the employment issue based on the employment, and unemployment rate. The balance of payment in current account and trade balance of goods and services based on export and import conditions contribute to main economic conditions of the France economy. According to above-mentioned economic variables the role and importance of France can be characterised by foreign direct investment as net balance and the net international investment position in percent of GDP of France. The latest data base used by this study come from Eurostat, France statistical offices and International Monetary Fund.

Because of increasing trends of debt-conditions even in France, the role of bank sector became more important accompanying with technical improvement for the faster financial transfer, as *Csiszárík-Kocsir (2021) [2] declared that since the mid-2010s smartphones have become more popular. From this point of view customers follow bank selection concerning the value-based analysis of the financial issues and their financial management [3], [4].*

The increasing financial transfers of either population or companies the national banks have more intensive role, which can be proofed by growth credit program of the and credit-installation assets of the National Bank of Hungary (MNB = Magyar Nemzeti Bank = National Bank of Hungary, 2016) [5]. The growth credit program launched by the National Bank of Hungary is the low -interest funding with the provision of interest reductions implemented - promoted the recovery of the small and medium entrepreneur (SME) sector lending, thereby supporting the SME sector growth. In addition, the program for the recruitment of investment or this program could also contribute to the reduction of corporate bankruptcy and liquidations, so the program could also help raise growth potential [5], [6]. We need to switch to an intensive growth model. The Hungarian economic model of the last decade has been an extensive model with intensive features. Sources of extensive growth are increasingly drowned. Success can only be made to exploit intensive growth sources. During the transition, the results achieved so far must be preserved. In addition to maintaining full employment to improve productivity, high in addition to the investment rate, the proportion of smart investments is needed. The technological and green transition, as well as the total digital turnaround, cannot be postponed in 11. Point [7]. According to the EU Nyikos-Kondor (2022) [8] declared that their original setup and objectives are already in accordance with the new expectations, and they invest mostly in economic sectors that the new taxonomy system classifies as sustainable.

Halmai (2022) [9] points to difficulties of euro when he analysed the unsustainable balance of the EMU (European Monetary Union) and stated that despite the progress of recent years, the EMU 1.0 remains an unsustainable balance. Its main characteristics are the lack of the financial union (deficiencies in the Banking Union and the Association of Capital Markets) and the lack of central fiscal stabilization function. In this context, the system does not contain a satisfactory mechanism of movement either at the private or government level [9].

Additionally, to the above mentioned, the net international investment position (NIIP) measures the gap between a nation's stock of foreign assets and a foreigner's stock of that nation's assets. Essentially, it can be viewed as a nation's balance sheet with the rest of the world at a specific point in time.

- A net international investment position (NIIP) measures the gap between a nation's stock of foreign assets and a foreigner's stock of that nation's assets.
- It can be viewed as a nation's balance sheet with the rest of the world at a specific point in time.
- A nation with a positive NIIP is a creditor nation, while a nation with a negative NIIP is a debtor nation [10].

- The NIIP position is an important barometer of a nation's financial condition and creditworthiness. A negative NIIP figure indicates that foreign nations own more of the domestic nation's assets than the domestic nation does of foreign assets, thus making it a *debtor nation*. Conversely, a positive NIIP figure indicates that the domestic nation's ownership of foreign assets is greater than the foreign nation's ownership of that domestic nation's assets, thus making it a *creditor nation* [10].

In the case-study the hypotheses are summarised, which are as follows:

It should be proofed that the *real GDP growth* (RGDP1) has important correlations with domestic demand (DoDem2), private consumption (PrivCon3), public consumption (PubCon4), gross fixed investment (GFixInv5), employment issue (Emp10) and net international investment position in France (FrNIIP17).

The domestic demand (DoDem2) has any correlations with the private consumption (PrivCon3), public consumption (PubCon4), gross fixed investment (GFixInv5) and net international investment position in France (FrNIIP17).

The private consumption (PrivCon3) has considerable correlations with public consumption (PubCon4), gross fixed investment (GFixInv5), employment issue (Emp10) and net international investment position in France (FrNIIP17).

It should be proofed that the public consumption (PubCon4) has important correlations with gross fixed investment (GFixInv5), employment issue (Emp10) and net international investment position in France (FrNIIP17).

It should be proofed that the gross fixed investment (GFixInv5) has any correlations with gross national savings (GNaSa6), employment issue (Emp10) and net international investment position in France (FrNIIP17).

It should be proofed that the gross national savings (GNaSa6) has important correlations with employment issue (Emp10), current account (BoPay12), trade balance of goods and services (TradeB13) and net international investment position in France (FrNIIP17).

The above-mentioned correlations should be proofed to clear the economic developing trend in France, which can show that this trend create better or less favourable economic conditions for France in the near future. Also, it is important to describe the possible solutions for economic difficulties resulted by the global economic-financial crisis.

MATERIALS AND METHODS

The statistical methods are wide side needed for discovering main correlations among different economic variables. In this case the most favourable statistical method is the SPSS [11]. The study uses main economic variables as features of France economy. The economic analyse introduces the real GDP (RGDP1), domestic demand (DoDem2), the private consumption (PrivCon3) and public consumption (PubCon4). Also, the study focuses on changes of gross fixed investment for extending fixed capital as machines, equipment, buildings (GFixInv5), gross national savings (GNaSa6), gross domestic investment (GDoInv7). The analyses overview main financial issues as general government balance (GGovBal8), general government gross debt (GGovDebt9) and current account (BoPay12) in percent of GDP, which show the financial dependence on national and international financial resources. The employment issues are based on data concerning changes in fields of employment and unemployment conditions (Emp10) (UnEmpl11).

The trade balance of goods and services in percent of GDP (TradeB13) can also contribute to change of the balance of payment based on the exports of goods and services (Export14) and imports of goods and services (Import15) in percent of GDP. The study analyses the foreign direct investment (FDI16) as net international investment position in France (FrNIIP17) in percent in GDP.

The study analyses correlations among economic variables concerning their importance of the economy of France in different years and principal component analysis concerning rotation method as varimax with Kaiser normalization within the SPSS statistical analyse. The correlations among economic variables can be very strong if the value is between 0.800 and 1.000 (80%-100%), if the value is between 0.500 and 0.800 (50%-80%) the correlations are titled as strong. Under the level of value 0.500 (50%)

correlations are not important for analysing. In some cases, values of economic variables are negative, which means that these economic variables are inversely proportional to the other positive variables, but the negative variables are direct proportional to themselves (Table 2 and Table 3).

STATISTICAL ANALYSIS

Table 1. France: Selected Economic Indicators, 2019–27 (In percent of GDP unless otherwise indicated)

	2019	2020	2021	2022	2023*
<i>Real economy (change in percent)</i>					
RGDP1	1.9	-7.9	6.8	2.6	0.7
DoDem2	2.1	-6.7	6.6	3.1	0.5
PrivCon3	1.8	-6.8	5.3	2.6	0.5
PubCon4	1.0	-4.0	6.4	2.3	0.3
GFixInv5	4.2	-8.4	11.3	2.2	0.5
<i>In percent of GDP</i>					
GNaSa6	24.9	21.8	24.9	23.5	21.9
GDoInv7	24.4	23.6	24.6	25.0	23.5
<i>Public finance (percent of GDP)</i>					
GGovBal8	-3.1	-9.0	-6.5	-5.0	-5.3
GGovDebt9	97.4	114.7	112.6	111.6	112.0
<i>Labour market (change in percent)</i>					
Emp10	0.8	-0.3	1.7	0.4	-0.1
UnEmp11	8.4	8.0	7.9	7.5	7.6
<i>Balance of payments (percent of GDP)</i>					
BoPay12	0.5	-1.8	0.4	-1.5	-1.6
TradeB13	-0.9	-1.8	-1.2	-1.7	-1.5
Export14	32.7	28.4	31.2	39.3	40.7
Import15	-33.6	-30.2	-32.4	-41.1	-42.2
FDI16	1.1	0.2	-0.4	0.4	0.8
<i>France - Net international investment position (percent of GDP)</i>					
FrNIIP17	-30.0	-23.2	-30.7	-32.1	-26.2

Sources: Haver Analytics, INSEE, Banque de France, and IMF Staff calculations, Trading Economics [12], IMF (International Monetary Fund, January 2023): Country Report No. 23/56, FRANCE. 2022 ARTICLE IV CONSULTATION - Press Release; Staff Report; Statement by the Executive Director for France [13].

* In 2023 data are estimated

Values reflect lockdown-related losses in value added due to public services not provided during the lockdown in 2020

Note for economic variables in the study in percent between 2019-2023:

RGDP1	Real GDP
DoDem2	Domestic demand
PrivCon3	Private consumption
PubCon4	Public consumption
GFixInv5	Gross fixed investment
GNaSa6	Gross national savings (percent of GDP)
GDoInv7	Gross domestic investment (percent of GDP)
GGovBal8	General government balance (percent of GDP)
(minus) GGovDebt9	General government gross debt (percent of GDP)
Emp10	Employment
UnEmp11	Unemployment rate

BoPay12	Current account (percent of GDP)
TradeB13	Trade balance of goods and services (percent of GDP)
(minus) Export14	Exports of goods and services (percent of GDP)
Import15	Imports of goods and services (percent of GDP)
FDI16 = FDI (net)	Foreign Direct Investment (percent of GDP)
(minus) FrNIIP17	NIIP (percent in GDP), France - Net international investment position

Table 2. Correlation Matrix^a

Correlation	RGDP1	Dom2	PrivCon3	PubCon4	GFIxInv5	GNaSa6	GDov7	GGovB8	GGovD9	Emp10	UnEmpl11	BoPay12	TradeB13	Export14	Import15	FDI16	FrNIIP17
RGDP1	1.000	.998	.997	.970	.975	.757	.668	.597	-.243	.837	-.131	.653	.589	.343	-.299	-.188	-.859
Dom2		1.000	.997	.974	.973	.778	.713	.588	-.241	.850	-.128	.656	.575	.321	-.278	-.210	-.885
PrivCon3			1.000	.956	.961	.760	.698	.638	-.274	.815	-.140	.638	.584	.379	-.334	-.142	-.887
PubCon4				1.000	.973	.755	.685	.396	-.081	.902	-.148	.648	.501	.184	-.148	-.419	-.817
GFIxInv5					1.000	.834	.629	.520	-.279	.929	-.042	.782	.685	.135	-.086	-.270	-.800
GNaSa6						1.000	.754	.561	-.597	.908	-.460	.925	.801	-.207	-.258	-.122	-.800
GDov7							1.000	.437	-.243	.657	-.073	.450	.262	.108	-.093	-.228	-.933
GGovB8								1.000	-.803	.310	.181	.492	.684	.518	.464	.656	.667
GGovD9									1.000	-.261	-.716	-.648	.813	.037	-.093	.686	.364
Emp10										1.000	-.255	.870	.678	.226	-.269	.452	.717
UnEmpl11											1.000	.655	.679	.699	.739	.258	.103
BoPay12												1.000	.931	-.350	.410	-.064	-.549
TradeB13													1.000	.151	.220	.272	.454
Export14														1.000	-.997	.415	-.327

a. This matrix is not positive definite.

Sources: Haver Analytics, INSEE, Banque de France [12], and IMF Staff calculations, Trading Economics, IMF (International Monetary Fund, January 2023): Country Report No. 23/56, FRANCE. 2022 ARTICLE IV CONSULTATION—Press Release; Staff Report; Statement by the Executive Director for France [13]. Owned calculation based on the SPSS

Table 2. Correlation Matrix^a (continued)

	RGDP1	DoDem2	PrivCon3	PubCon4	GFixInv5	GNaSa6	GDoInv7	GGovBal8	GGovDebt9	Emp10	UnEmpl11	BoPay12	TradeB13	Export14	Import15	FDI16	FrNIIP17
Correlation	Import15														1.000	-.389	.295
	FDI16															1.000	.067
	FrNIIP17																1.000

a. This matrix is not positive definite.

Sources: Haver Analytics, INSEE, Banque de France, and IMF Staff calculations, Trading Economics, IMF (International Monetary Fund, January 2023): Country Report No. 23/56, FRANCE. 2022 ARTICLE IV CONSULTATION—Press Release; Staff Report; Statement by the Executive Director for France. [12], [13]. Owned calculation based on the SPSS

Table 3. Rotated Component Matrix^a

	Component		
	1	2	3
PubCon4	.986		
DoDem2	.977		
GFixInv5	.971		
RGDP1	.964		
PrivCon3	.959		
Emp10	.924		
FrNIIP17	-.885		
GNaSa6	.837		
GDoInv7	.779		
BoPay12	.702		
Import15		.987	
Export14		-.974	
UnEmpl11		.798	
GGovDebt9			-.954
FDI16			.862
GGovBal8			.814
TradeB13			.701

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Sources: Owned calculation based on the SPSS

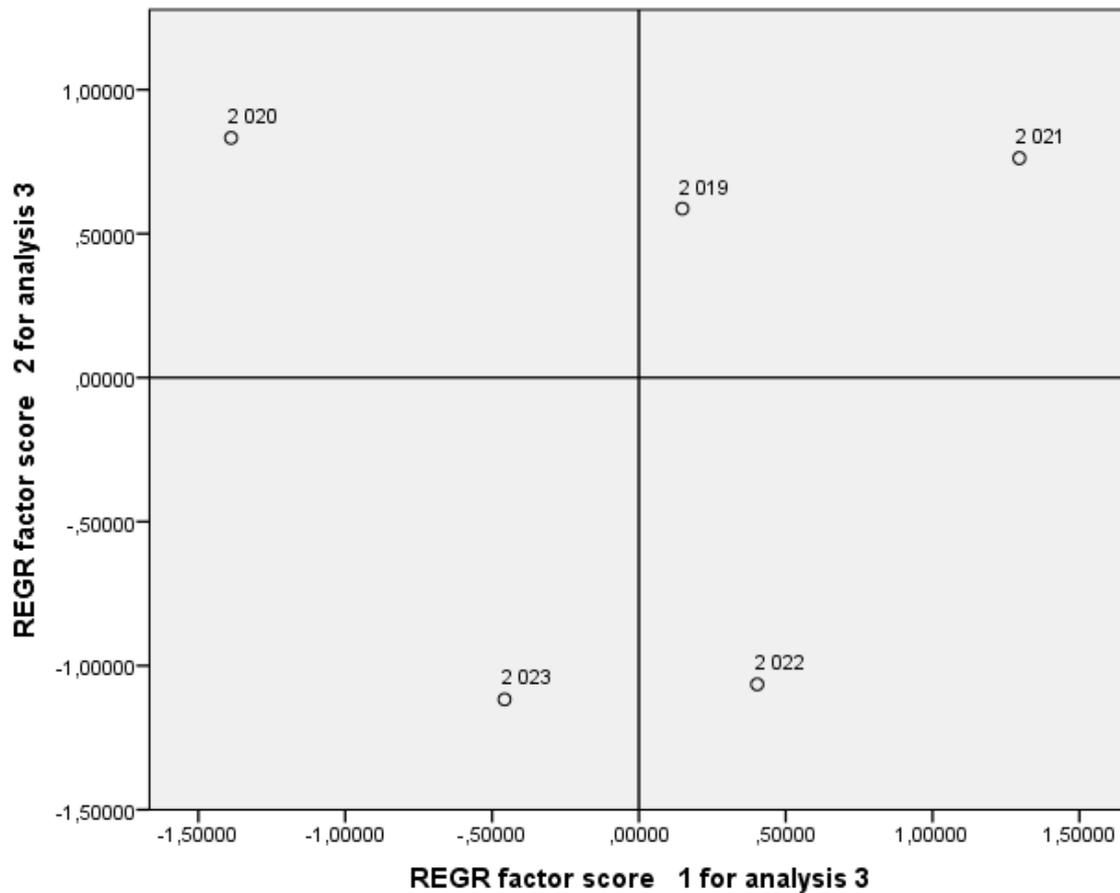


Figure 1. Regr factor score 1 and 2 based on the economic variables as economic features of years concerning the principal lines “X” and “Y” in France

Sources: Owned calculation based on the SPSS

Note: The economic variables at line “X”: PubCon4, DoDem2, GFixInv5, RGDP1, PrivCon3, Emp10, (minus) FrNIIP17, GNaSa6, GDoInv7 and BoPay12

The economic variables at line “Y”: Import15, (minus) Export14 and UnEmpl11

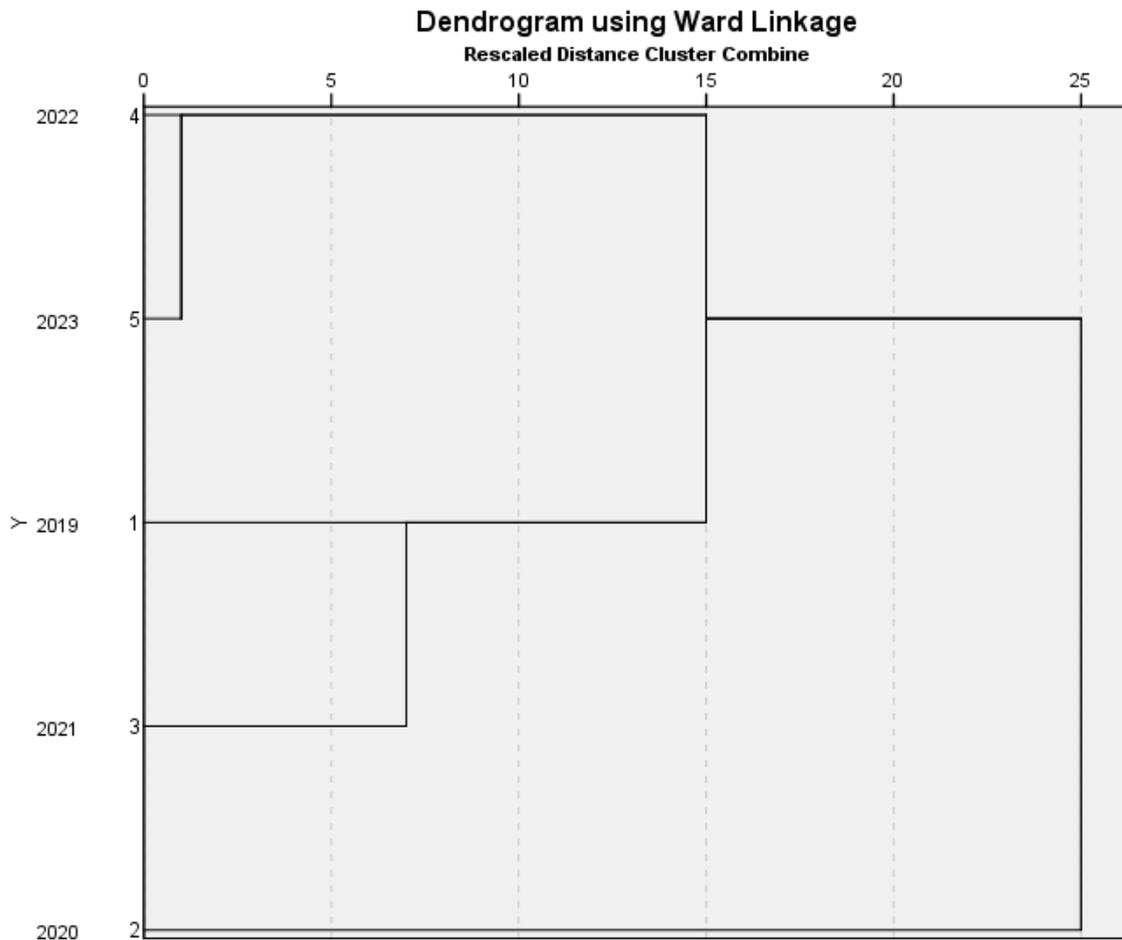


Figure 2. Clustering years based on the Dendrogram using Ward Linkage, rescaled distance cluster combine in France. *Sources:* Owned calculation based on the SPSS

RESULTS AND DISCUSSION

Some changing economic features of France

The public financial issues have recently been going wrong in France which can be proofed that the negative general government balance as budget increased from 3.1% in 2019 to 5.3% in 2023 and the general government gross debt increased 97.4% in 2019 and 112% in percent of GDP. The unemployment decreased from 8.4% in 2019 and to 7.6% in 2023, which decrease was little measure than the level required by the policymakers.

Table 2 shows the exact real strong correlations among different economic variables based on the data base summarised in Table 1. The real GDP growth (RGDP1) increased by 1.9% in 2019, which sharply declined by 7.9% because of the medical crisis as crown virus started at the beginning of 2020 within a global wide side crisis. After one year in 2021 the economic growth increased by 6.8%, which has over flown the level of 2019 mostly by three times. But the 2022 brought the Russian war crisis in Ukraine resulted lower decreasing trend by 2.6% less than growing level of 2021 and only little more than the level of 2019. The economic experts estimated as prognoses for real GDP growth only 0.7% by the end of 2023. This estimated trend shows that the economic decline will be continuing and result less favourable economic growth that this was in 2019. It seems that economic conditions of France will be more favourable than this was before global crisis.

Naturally the decline of GDP growth resulted by less *gross fixed investment* (GFixInv5), which was increasing by 4.2% in 2019, which has decreased by 8.4% in 2020 for only one year in France. In spite

that the investment increased by 11.3% in 2021, but the war-crisis condition resulted less further increasing trend by only 2.2% in 2022, which mostly half of growing trend in 2021. The economic estimation signed more decline by 0.5% comparably to result of 2019 and therefore the gross fixed investment continuously decreased, which makes more unfavourable conditions for the real GDP growth. Because of the negative declining trend of gross fixed investment, the domestic demand (DoDem2) decreased from the increasing level by 2.1% in 2019 to the level of 3.1% level by the end of 2022. The domestic level sharply decreased by 6.7% in 2020, as medical crisis year and by the end of 2022 as first Russian war year increased by 3.1%. In spite that this increase was little more than the level of 2019, but the estimation is further less increasing trend by 0.5% in 2023, which shows the deeper unfavourable economic growth in France. According to the unfavourable little increasing trend in the field of the domestic demand the estimations for growing trend in fields of private consumption (PrivCon3) and public consumption (PubCon4) also show less favourable increasing trend by the end of 2023. The private consumption increased by 1.8% in 2019 and sharply decreased by 6.8% in medical crisis year 2020. Also, the private consumption little increased by 2.6% in 2022 comparably to the increasing trend by 5.3% in 2021 and finally by the end of 2023 the little increasing trend of the private consumption will be by 0.5% as much as little trend of the gross fixed consumption. The public consumption (PubCon4) also was not in favourable conditions, because originally its increasing trend was by only 1% in 2019 before the global crisis and decreased by 4% in medical crisis year 2020 and moderately increased by 2.3% in Russian war year 2022. The negative trend also was in the field of the public consumption by only little increase by 0.3% in 2023 based on the estimations.

The *private consumption* decreased or little increased because of the gross fixed investment decreased therefore the work jobs also decreased and the purchase power parity of the population decreased.

Also, the *public consumption* decreased because of revenues of central governmental budget decreased therefore the public investment and consumption decreased.

The little increase of real GDP growth and the gross fixed investment made a negative impact on the employment issue in France in the researched period. Therefore, the *employment*, which increased mostly 0.8% in 2019, decreased by 0.3% in 2020 and increased only by 0.4% in 2022 as half measure of increasing trend in 2019. The war crisis also resulted further decline 0.1% for the employment rate by the end of 2023 according to the economic estimation of IMF.

The considerable decline in field of gross fixed investment had impact on the *net international investment position* of populations and firms in France (FrNIIP17). Therefore, activity of foreign investors increased in their investment in France, while the national investors of France decreased their investment activities out of France as “rest of the world”, which resulted their less portion in the field of the net international investment position as negative portion of 23.2% in 2020 and estimated negative 26.2% by the end of 2023. Relatively the foreign investments in France were more favourable than the national investment of France in rest of the world, therefore it can be hope that the employment rate will not considerably decrease in France.

According to results of the research within the researched period the Table 2 strengthened the real economic conditions based on the correlations among the economic variables.

There are *very strong correlations* of *real GDP growth* (RGDP1) with domestic demand (DoDem2) by 0.998 (99.8%), private consumption (PrivCon3) by 0.997 (99.7%), public consumption (PubCon4) by 0.990 (99%), gross fixed investment (GFixInv5) by 0.975 (97.5%), employment (Empl10) by 0.837 (83.7%) and with net international investment position in France (FrNIIP17) by minus 0.859 (-85.9%).

This last one means that if the net international position of foreign investors in France increases against the international position of domestic investors out of France the real GDP growth increases. Finally, this means that basically the domestic investors in rest of the world, as out of France can less increase than the foreign investors in France, but this can lead to increase of real GDP in France. In spite that the correlation between these two economic variables is contradictory, the increasing negative net international investment position can make more favourable conditions for increasing real GDP growth in France. *The more negative net international investment position in share of GDP of France can stimulate more real GDP growth.* From other point of view, it can be declared that the lack of domestic investors in France can be covered by the more intensive foreign investors in France.

Based on the above-mentioned correlations the private consumption (PrivCon3) has also very strong correlations with public consumption (PubCon4) by 0.956 (95.6%), gross fixed investment (GFixInv5)

by minus 0.961 (-96.1%), employment issue (Emp10) by 0.815 (81.5%) and net international investment position in France (FrNIIP17) by minus 0.887 (-88.7%). Naturally employment conditions are based on the gross fixed investment by increasing jobs, workplaces, strengthen the power purchase parity leading to the increasing trends of the private consumption. Generally, the public consumption can grow similarly with trends of the private consumption because the consumption of the populations has correlate with infrastructure investment partly in field of the gross fixed investment, for example in fields of education, health care network, water channel, electricity, fissile energy supply, public transport and media network.

Therefore, the *public consumption (PubCon4)* has very strong correlations with gross fixed investment (GFixInv5) by 0.973 (97.3%), employment issue (Emp10) by 0.902 (90.2%) and net international investment position in France (FrNIIP17) by minus 0.817 (-81.7%).

Also, it is proofed that the *gross fixed investment (GFixInv5)* has very strong correlations with *gross national savings (GNaSa6)* by 0.834 (83.4%), employment issue (Emp10) by 0.929 (92.9%) and net international investment position in France (FrNIIP17) by minus 0.800 (-80%).

Also, it is proofed that the *gross national savings (GNaSa6)* in share of GDP has very strong correlations with employment issue (Emp10) by 0.908 (90.8%), current account (BoPay12) by 0.925 (92.5%), trade balance of goods and services (TradeB13) by 0.801 (80.1%) and net international investment position in France (FrNIIP17) by minus 0.800 (-80%). The gross national savings could increase in France in the researched period by increasing employment level and the more positive balance of payment trade balance. Naturally gross national savings can be going on in the negative trend based on the unfavourable employment, balance of payment and foreign trade.

Generally, *gross national savings* have moderately been changing for the researched period, because in the better economic conditions these increased to level of 24.9% in share of GDP in 2019 and in 2021 and in less favourable year decreased to the level of 21.0% in medical crisis of 2020 and to level of 23.5% of GDP and estimated 21.9% in 2023. The savings increased in better income conditions of populations within the economic prosperity but in less favourable years the savings did not decrease considerably, because of the consumption decreased therefore savings could increase by little measure. *Gross domestic investment in percent of GDP (GDoInv7)* has very strong contradict correlation by minus 0.933 (-93.3%) with net international investment position in France (minus FrNIIP17). This means that when the foreigner's stock of that nation's assets in France increased more than the *nation's stock of foreign assets* out of France, therefore, the balance of these two sides continuously is a negative value, as percent of the GDP of France. If this negative value either decreases or increases, this will be remaining a negative value, because foreigner's stock of that nation's assets in France is more than the nation's stock of foreign assets out of France. If the negative value of this balance increases as in share of GDP of France, because the foreigner's stock of that nation's assets increases, therefore this results more gross domestic investment in percent of GDP in France. This means that if the nation's stock of foreign assets out of France in a value as percent of GDP, the more foreign economic activity results more increasing trend in field of gross domestic investment in percent of GDP in France. But this more foreign activity can realise more favourable national economic prosperity in the researched period. This data concerning net international investment position shows the measure of dependence of the national economy in field of gross domestic investment from the foreigner's investment.

The gross domestic investment in percent of GDP has moderately been changing for the period of 2019-2023, but value of this domestic investment can decrease resulting GDP decrease in crisis years as 2020 and 2022-2023. It can be declared that the real GDP growth was very strongly depending on the net international investment position (in percent of GDP), because when in 2019 the real GDP increased, also the negative net international investment position increased based on the increasing activity of foreign investment. In 2021 the real GDP growth increased by 6.8%, therefore the net international investment position also increased to level of -30.7 in percent of GDP, but the moderate increase of GDP was 2.6% because of the war Ukrainian conditions, therefore net international investment position little increased from the level of -30.7% in 2021 to level of -32.1% in share of GDP in 2022. But this investment can decrease in share of GDP by the end of 2023 based on the economic estimation. Naturally the net international investment position changed based on result of the global medical and war-political-financial crisis making negative influences on the global economic prosperity.

The current account, as balance of payment (BoPay12) has very strong correlation by 0.931 (93.1%) with the trade balance of goods and services (TradeB13). The balance of payment generally depends on the balance of foreign trade. In case of France the import value in percent of the GDP increased more than the value of export in share of GDP, which also resulted the increase of the negative balance of payment. It can be declared that the balance of payment mostly has changed as well as balance of foreign trade based on the import volume in share of GDP for the researched period. Because in 2020 negative balance of foreign trade was 1.8 percent in GDP as much as 1.8% negative balance of payment. Also, in 2022 and 2023 negative balances of payment and foreign trade were similarly closed to each-other 1.5% and 1.7% in 2022 and estimated 1.6% and 1.5% in 2023.

The negative *balance of general government budget* (GGovBal8) was at 3.1% in percent of GDP in 2019, which mostly increased by three times to level of 9.0% by the end of 2020 within one year. In spite that the negative balance decreased to the levels of 6.5% in 2021 and 5.0% in 2022, these were more than share of 3% of GDP accepted by the EU for introducing euro. The negative balance of general government budget contributed to increasing the *general government debt* (GGovDebt9), which show increasing trend of the government debt from 97.4% in 2019 to 114.7% in 2021. After this year the share of the general government debt in GDP has not changed considerably, because this was 112.6% in 2021 and 111.6% in 2022. The demand for introducing euro is 60% of GDP in field of general government debt, but this debt was mostly two times more than the level accepted by the EU. Therefore, the negative balance of general government budget should decrease as much as it can do. These two economic variables have very strong correlation by -0.803 (-80.3%). This means that if the negative balance of general government budget in share of GDP increases the value of general government debt in share of GDP also decreases. But if the negative balance of general government budget in share of GDP decreases the general government debt in share of GDP also decreases. This shows that the negative balance of general government budget has contributed to increasing general government debt in share of GDP for the researched period (Table 1; Table 2).

Figure 1 shows in the coordinate system different economic variables at line "X": PubCon4, DoDem2, GFixInv5, RGDP1, PrivCon3, Emp10, (minus) FrNIIP17, GNaSa6, GDoInv7 and BoPay12, the economic variables at line "Y": Import15, (minus) Export14 and UnEmpl11. The different years have special economic features based on the changing economic conditions in France, which can be followed in the data base summarised in the Table 1.

The Figure 2 provides the clustering years based on the Dendrogram using Ward Linkage, rescaled distance cluster combine in France. In this case the years are selected into different clusters based on their similar or different features. If their features are similar, they can be clustered into one cluster. In this case study different years can optimally be clustered into three clusters, where first cluster includes years 2022 and 2023, when the economic crisis can be deeper and more extending. The second cluster includes years 2019 and 2021, when a moderate economic prosperity was going and the third cluster includes only one year namely 2020, when the medical crisis resulted sharply decline in economic conditions.

CONCLUSION AND PROPOSALS

The economic developing trend of France can be clearly seen based on the analysed correlations among different economic variables in the researched period.

Naturally the *real GDP growth* has very strong correlation with consumptions either at level of domestic demand, and public consumption, which can be stimulated by increasing gross fixed investment. The extending employment can stimulate increasing GDP growth. But in the same period there is a contradictive very strong correlations between real GDP growth and net international investment position in percent of GDP in France. In spite that the negative balance of the NIIP in France increases the real GDP can increase, because the *foreigner's stock of that nation's assets* increased more than the *nation's stock of foreign assets*. But this means that the foreign capital and foreign investment are active or more active in domestic economy of France than the national investment out of France. Therefore, the real GDP can increase, for example in 2021, when the real GDP in France increased by 6.8% and the negative balance of NIIP increased as 30.7%. In 2022 the real GDP increased only by

2.6% in spite that the negative balance of NIIP was at very highly level 32.1% in France. The real GDP growth increased little because of the global economic crisis caused by the Russian war.

It can be summarised that the French economy has not been strengthened for the latest period from point of view of public financial conditions and net international investment position. The solution is for escaping from the negative economic trends to increase the innovative investment and to strengthen the international economic conditions of France.

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HYDROMENTALITY OF THE REGION OF CHENNAI, INDIA: SOCIAL-ECOLOGICAL INSIGHTS FROM AN IWRM PERSPECTIVE

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Abstract: Accessibility to water to all, particularly in dense urban situations is of concern in many countries the world over. Recent literature specifies 'hydropsychological' and 'hydrosocial' turns to water related attributes of human living. In this paper, we have approached the 'hydromentality' (which pertains to the water-related administration) of the city of Chennai, India and the implications of this term over a chronological extent. This becomes significant in our pursuit of sustainability in terms of urban living and water management. While urban water supply determines indicators of community well-being, the well-being of the ecosystem is an offshoot of several other factors. These include land and water management and inter-disciplinary approaches to real-world situations like climate change effects, water pollution, loss of biodiversity, lack of adequate housing resulting in the urban poor occupying land associated with water bodies. This paper examines the situation in hand, in Chennai, India and offers suggestions and solutions based on knowledge from other cases, experience of humanities/ engineering and social sciences experts' literature.

Keywords: Hydromentality, hydrosocial, hydropsychology, Chennai, Urban water supply, IWRM

INTRODUCTION

Water is the 'elixir of life', quoting the famous Indian scientist, Sir C. V. Raman. Water has nurtured civilizations the world over and sparked off controversies and wars over the years. The Sustainable Development Goals, of the United Nations (United Nations, n.d.) insist on guaranteeing the right to 'clean water and sanitation'. Nevertheless, shortage of water is a threatening issue in many countries, as are the issues of commons and uncommuning (Fournier, 2013) of land. Later in this article, we will explore the difference in approach of land planners and water managers. Water management is a complex exercise, which explores supply and demand (Sethuram, 2014), upstream and downstream conditions, top-down and bottom up (grassroots level) approaches. Water distribution, particularly urban water supply is a no mean engineering feat, and today, experts recommend an integrated approach with respect to water management, one which incorporates sustainability and inter-disciplinarily. The Integrated Water Resource Management (IWRM) approach considers, society, economy and environment, as in the pillars of sustainability.

In this context, recent and path-breaking literature on water management relates to the 'hydrosocial cycle' by Linton and Budds (Budds et al., 2014). To differentiate between the hydrological cycle and the hydrosocial cycle, one must envisage the hydrological cycle as physical and elemental, with water evaporating into clouds and precipitating and percolating, while the hydrosocial cycle comes with a man-made intervention component, wherein, water reaches urban areas by means of pipes, gets

released as grey water and goes through recycling processes. Water supply by means of desalination is another demonstration of such a hydrosocial cycle.

The hydrosocial cycle emphasises both the material and sociocultural relations to water and can be used to decipher the different human communities' relationships with water. Linton & Budds present this definition: "Whereas H₂O circulates through the hydrological cycle, water as a resource flow through the hydrosocial cycle, a complex network of pipes, water law, meters, quality standards, garden hoses, consumers, leaking taps as well as rainfall, evaporation and run-off". Thus, the hydrosocial cycle configures water as the product of H₂O and the social circumstances in which it becomes constituted.

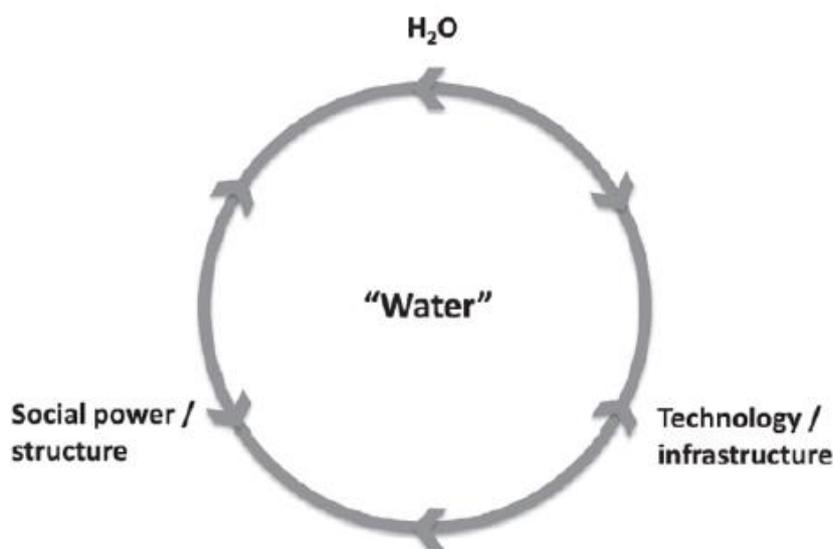


Figure 1: The hydrosocial cycle

For instance, the power relations behind dams that store water and generate electricity vary vastly from the worldview of indigenous groups that have entirely different socio-natural relations with water. Also, the politics behind desalinated water which involves seawater, technology, energy and economics is altogether different (Budds et al., 2014).

The hydromentality of the region of Chennai is shaped by its relationship with water. Chennai happens to be one of the acutely water-starved cities (Janakarajan, 2015, 2013; Sethuram, 2014), and its citizens have been subject to droughts in the distant and recent past. As described by Hellberg (Hellberg, 2020), according to the framework of critical geography, scarcity is not a natural or neutral phenomenon, but rather socially constructed within the present social and economic order. However, as it is being 'constructed', water accessibility, or the lack of it, is also inherently 'material'; the availability, distribution and use of water form the crux of the organisation of the economy, to survival, health and possible lifestyles, and to the processes of the functioning of ecosystems (or not). Hellberg goes on to explain, while the South African hydromentality (Hellberg, 2020) first was a modernist and racist one, it became tagged as both inclusive and sustainable after the democratic transition. In practice, however, the inequalities established in the apartheid era were maintained (Hellberg, 2020). The article explores the role of scarcity in this development. It argues that scarcity, as a governing device, has mainly been directed at poor people's water use and their access to water both for domestic and productive uses, which in current times has spread to all populations and community groups. In Sikkim's urban mountain waterscapes, Muller et al., (Müller et al., 2020) discuss the impacts of water scarcity on the mountain community.

Sivakumar (Sivakumar, 2011) discusses hydropsychology with respect to the conflict surrounding the Cauvery river basin, southern India. Difficulties in planning and management, and the scope for conflicts in these shared waters are far greater during times of hydroclimatic extremes, such as floods

and droughts. Since global climate change will likely result in extremes of greater frequency and magnitude, management of transboundary and other shared waters may turn out to be even more challenging, impacting waterscapes all over the world. Planning and management of shared waters (“shared waters” or “shared basins” refers to both international and intra-national shared basins), and water in general, involves consideration of many different aspects and associated challenges, which are interconnected in complex ways (Brinkmann et al., 2020; Goldman & Narayan, 2019). These include scientific, political, economic, environmental, social, cultural, racial, religious, linguistic and other aspects. The difficulties involved in the planning and management of the Mekong River basin can be attributed to the differences in culture among the countries sharing the basin (China, Myanmar, Thailand, Laos, Cambodia and Vietnam). Religion plays an important role in sharing the Jordan River among Israel, Jordan, Lebanon and Syria. The nature of the Cauvery water dispute in south India and the challenges in dealing with it include a strong linguistic component. This discussion serves as a demonstration of the social and socio-cultural associations with water. A study of water landscapes or water-based communities would be incomplete without due acknowledgement of these epistemological theories and ensuing concepts.

METHODOLOGY

STUDY AREA

Chennai is the fourth largest metropolitan city in India and the capital of Tamilnadu. The current area of CMA is 5904 sq.km (Bureau, 2022), extending towards the intended 8848 sq.km. The population of Chennai is 10.4 million (India, 2011). The climate of Chennai is tropical and humid, with a heavy downpour in the North-east monsoon in November. The annual precipitation is 128cm/yr. The Chennai basin, as shown in the figure comprises eight river basins and numerous natural and manmade water bodies. The water supply for the metropolitan area of Chennai is taken care of mainly by five reservoirs, namely, the Poondi, Chembarambakkam, Cholavaram, Red Hills and recently, the fifth, Thervoy Kandigai. According to Naga Kumar (Gangeswaran, 2016), the sources of water for Chennai city include.

Table 1: Water sources of Chennai

Source	Quantity in MLD
Poondi, Cholavaram, Red Hills Lake System	200
Ground water from Northern Well Fields	100
Southern Coastal Aquifer	5
Krishna Water I Stage	400
Krishna Water II Stage	530
New Veeranam (CWSAP-I)	180
CWSAP-ii (Proposed)	20
Sea Water Desalination	200
Total	1635

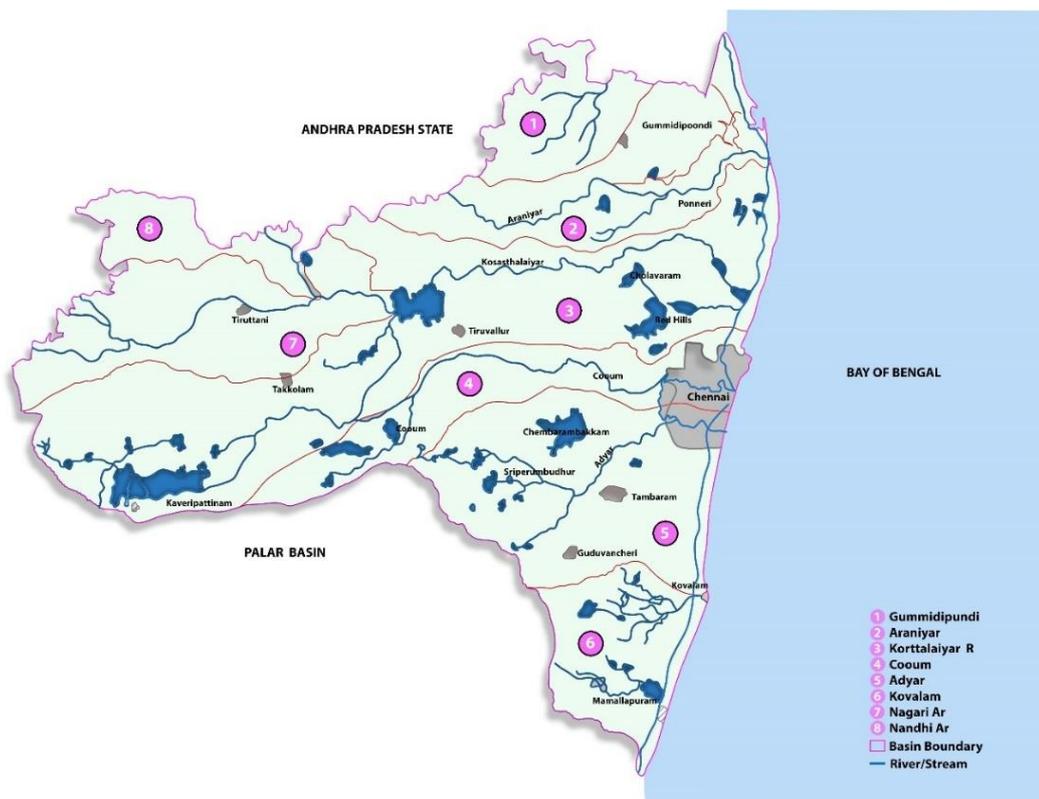


Figure 2: Sub-basins of Chennai

The following are the existing sewage treatment plants in Chennai:

1. Kodungaiyur sewage treatment plant – North
2. Villivakkam sewage treatment plant – Centre
3. Koyambedu sewage treatment plant – Centre
4. Nesapakkam sewage treatment plant – West
5. Perungudi sewage treatment plant – South

In addition, CMWSSB is engaged in various schemes of underground sewerage systems (UGSS) in various parts of Chennai including South Chennai.

HYDROSOCIAL PARADIGMS CHARACTERIZING CHENNAI

The importance of water, as a public good, or as a material contested over, features greatly in sociological studies. In fact, the social-ecological approach and the modern science of Urban Ecology take root in this body of literature and its demonstrations. In the case of Chennai, various parameters act in the daily activity of water consumption and urban living. Keeping in mind the epistemological theory of hydrosocial relations, we go on to differentiate various paradigms or worldviews with respect to Chennai's water story. They cover various aspects such as history, climate change, ecology, politics and administration, water policies and management and protection of water as a resource.

Historical paradigm

Examining the history of Chennai, we are able to trace periods of “blight” (Arabindoo, 2011) corresponding to the planned development. In the late 70s and 80s, various housing schemes were under implementation, though coupled with lack of amenities, while droughts prevailed. Water tankers have been supplying water to the city of Chennai since the mentioned period, and lack of precipitation in summers, due to Tamilnadu being on the leeward side (Srinivasan, 2015) during the south west monsoons, is a contributing factor to the ‘blight’ described above. Lack of water made Chennai a very unpopular city to live in, coupled with the hot and humid weather, and in the late

1990s, and early 2000, the then chief minister considered evacuating the city, a capital city to manage the situation. This information was obtained in a talk at a conference which included stakeholders, experts from the academic community, the industry and the government.

A particular model of hand-pump, the Mark II, quenched the city's thirst and few experts began to explore the concept of allowing water to infiltrate into the ground, since Chennai received copious rains from the north-east monsoon. Thereby, the mandatory rainwater harvesting (RWH) drive was initiated. This was implemented all over Tamilnadu, and the results were initially found to be satisfactory, with improved groundwater levels. Various NGOs (Ahn & Schmidt, 2019) are today exploring the idea of storing water in terraces or underground sumps, or infiltration wells, and harnessing road-driveway water also in a similar manner.

In this context, we need to examine water bodies, the erstwhile sources of water, mainly for irrigation. Before urbanization took over Chennai, many areas surrounding the city were of agricultural land use and the public harnessed the water for various purposes. The lands occupied by water were termed 'commons' as they did not belong to anyone. This was followed by a practice of encroaching upon the 'commons' also known as 'poramboke', which included the watershed of major and minor 'tanks', and inlet and outlet canals (Maringanti, 2011; Rukkumany & Vedamuthu, 2017). Instances of encroaching on canals, thus choking and depleting the water from its sources were practices of urban development.

Since water is a most essential commodity, and it is the management practices of water which need to be looked into, for ensuring clean and safe water for all, as per the SDGs (United Nations, n.d.), master planning efforts and to some extent, monitoring, maintenance and clearing of encroachments have given the semblance of a water body restoration movement in which the main stakeholders have been that part of the community which is initiating most awareness movements, including professionals, administrative and technical, activists, NGOs and similar public.

Climate change and climatic events paradigm

Climate change may be a recent concern at this massive scale, but Chennai being a coastal, peninsular city, concerns of seawater rise, cyclones and damage due to disastrous events, urban heat island (UHI) effect are featuring among the threats to the city and its people.

The drought that characterized the city of Chennai has been described. On the other hand, floods in the years of the North-east monsoons, have also rocked Chennai. Particularly in 2015, which has been cited by many as a manmade disaster, many low-lying parts of the urban area and susceptible regions, exposed to the water body edges have suffered due to inundation.

This is a concern because, drainage becomes key, and loss of life and property are also damaging. The economic loss due to the 2015 flood has been cited as over Rs. 15,000 crores impacting 10-15% of the country's production, which was suffered by the industry lobby (Rajan & Sridharan, 2016).

Demographics and land use paradigm

The population of Chennai has grown from 32.85×10^5 pax in 1981 to 10.4×10^6 pax. The area of the Chennai metropolitan area is projected as 8848 km^2 and the urban area is still growing to this extent. While the urban area engulfs the surrounding rural and urban territory, we need to examine the water basins. The Chennai basin consisting of eight river basin, is shown in the figure. The city of Chennai is primarily in the Cooum and Adyar sub-basins and the presence of these basins forms hydrological territories. In the urban basins, we witness what may be termed as the presence of hydrosocial territories. The rivers flow into the Bay of Bengal, and as a planning unit, the river basins act as hydrological boundaries, irrespective of administrative or other boundaries.

In this context, changing land use due to urban growth and development often puts pressure on natural resources, particularly water bodies. A study by Mathan and Krishnaveni (M & M, 2019) shows that in the Chennai Metropolitan area, the changes in land use are as follows: during the period of February 1988 to February 2017, the agriculture/fallow land, barren/semi-barren, vegetation, and water bodies/wetlands have decreased by 53.62%, 1.45%, 58.99%, and 30.59%, respectively. This decrease has contributed to an increase of 173.83% in built-up area.

Ecology paradigm

A study by Vencatesan (Daniels et al., 2020), discusses that the original landscape of the Chennai region was somewhat arid and Chennai did not boast of a tropical evergreen vegetation but rather of a dry forest, with palms and other arid region species. They go on to say that with the enthusiasm to 'green', one should not fall into the trap of afforestation, when the true nature of the land did not encourage such species.

Several water bodies and wetlands also characterized Chennai and the surrounding areas, and though many have been subject to urban pressures, reclaiming the lands, and restoring the natural resources is a possibility.

Administrative policies and governmental action paradigm

As we have described before, there are five major reservoirs supplying water to the city of Chennai. Smaller tanks like the Porur lake, which is the receiving point for water supply from the Veeranam lake, as per the scheme, have also contributed. In this context, the prime body for water supply and sanitation services, has the onus responsibility of supplying and managing the urban water. The various schemes under the Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB), include piped water supply all over Chennai, underground sewerage system projects, sewage treatment plants in growing urban areas, and other means to augment water supply for the city, such as desalination, which includes three functioning desalination plants. Desalination is an expensive option, but the practice is in place, and in many areas, in proximity to desalination plants, the water supply is available to the various communities, rich and poor.

EXISTING WATER SCENARIO

In a country like India, the water use policy has drawn attention but the policies are weakened due to low positive response (Sethuram, 2014). The society's response for a policy decision towards a goal, is crucial for it to achieve success. Hence, social acceptance, awareness and education are elements that are the crux of the community response. For example, in California when there is drought, watering lawns is prohibited except unless they use sprinkler systems, and the timings for use are also mandated, there are fines levied on policy violations (EPA, 2012). The "polluter pays" policy enables an effective reinforcement and may be necessary for India also. Not everyone adopted the policy instantly, but it is re-enforced many times with fines, so that most communities comply and have sprinkler systems installed in California. Hence, re-enforcement of policy achieves policy success (EPA, 2012). Every policy change effects positive changes within the community and the environment depending on how well it is accepted and re-enforced by the administrative bodies.

Water bodies in Chennai, namely rivers, canals and tanks and wetlands, are subject to various natural and anthropogenic impacts such as loss of biodiversity, pollution from harmful substances, extraction of ground water, loss of natural edge quality due to encroachments, According to Devaki Panini, (Panini, 1998), the earliest efforts to address the need for a National Wetland Policy had not been taken by the Government but by concerned individuals working on various aspects of wetlands and non-governmental organizations.

Loss of biodiversity in urban wetlands and processes which lead to encroachment of the commons in various metro cities of India (Kale, 2010; Maringanti, 2011; Rajashekariah & WWF-India, 2011; Vencatesan, 2007; Vencatesan et al., 2014) are cases which demonstrate the damage wrought upon the citizens. Since we are in dire need of inter-disciplinary solutions which will achieve the compromise between human aspirations and growth coupled with physical and external phenomena and the processes, institutions will take into account technical and advanced knowledge and effective management solutions for the same. Which is why, we are building eco-cities, at least, in policy and many stewards of water bodies and the environment have found a voice among the public.

DIFFERENCE IN APPROACH BETWEEN LAND PLANNERS AND WATER MANAGERS

IWRM perspective:

The concept of Integrated Water Resource Management (IWRM) assumes a holistic perspective for coordination of institutions, bring about stakeholder involvement, integrate all scales and disciplines to develop a sustainable management framework, and development of water resources. As we have discussed before land planners and water managers approach their job independently. The spatial turn in water management as demonstrated in many real world problems, has its repercussions in the common management of land and water. Land use has had impacts on water, but also water governance has influenced land use.

In most countries, spatial planning and water management are divided institutionally and thus relatively independent actors. The traditional strategy to manage land and water under different governance regimes no longer works with the changing environmental constraints and social arrangement of the two key regimes in urban development. For instance, coastal regions and delta areas like Chennai, Tamilnadu, are often intensively used areas. Climate change will lead to sea-level rise, which calls for adaptive and resilient spatial planning and water management solutions. Cities along rivers prepare for higher and more frequent floods due to climate change, on the one hand (Scholten et al., 2020), and growing vulnerabilities because of intensified land use, on the other (Scholten et al., 2020).

Other relationships and community engagement

Groundwater resources are modified by land use, and vice versa (Scholten et al., 2020). As the use of land and water becomes more pressured, interrelations increase. For example, freshwater and sewage management need to respond to demographic changes such as shrinkage and urbanization. Thus, successful water management correlates with the success or failure of spatial development policies.

Scholte et al., (Scholte et al., 2016) have researched on the perception of water by means of responses to ecosystem services concepts in Persina nature park, Bulgaria. Community perceptions play a major role in protection or stewardship of water bodies. In Chennai, an NGO, Arappor Iyakkam, has been playing a major role in monitoring of water bodies, and promoting activists to participate in administrative activities. Their documentation of urban lakes and up-to-date monitoring may be supporting individual and institutional research and knowledge creation. Perry & Gillespie (Perry & Gillespie, 2019) have discussed through semi-structured interviews, in Cambodia, the gender-bias which governs female participation in public occupations and their dependence on men. This is an aspect which is often discussed in socio-cultural studies related to water. A field survey undertaken in Kovalam, Chennai, India, pointed to the fact that the public were traumatized by the bias on their young women, given their cultural values and changing societal beliefs in urban coastal Chennai.

Tudor et al., (Tudor et al., 2016) have studied a sample population from various parts of Chennai and concluded that the public, in terms of their attitude, awareness and willingness to act, may be classified into five categories. Chiefly among these is a voluntary group of environmental activists. As mentioned before, committed individuals are called upon in every situation, whether it involves monitoring of water resources, or questioning the government, or supporting disaster management activities. NGOs and experts and activists (Arabindoo, 2011, 2017; Bremner, 2019; Saldanha & Rao, 2014; Vencatesan, 2007) have time and again enabled for the public, movements to protect their natural resources.

The reason it is always a reaction of a learned minority, questioning the government, has been attributed to the development-hungry majority supporting economic growth over environmental awareness and protection (Kumar et al., 2014; Maringanti, 2011; Roy, 2009). As with the nature-environment divide, which is prevalent in many parts of the world, not just India, (Aldeia & Alves, 2019), one needs to rethink our outmoded education which places nature on one end of the spectrum as against economics and urbanity.

CONCLUSION

One needs to establish and reiterate the essentiality of preserving natural resources especially as they form an essential unit of spatial planning, particularly in the context of gargantuan scales of development as we are currently witnessing in Chennai. The master planning for Chennai needs to be a hydrologically conscious one with hydrosocial cognizance as well, for achieving sustainable development and eco-conscious living. Bottom-up methods of management and planning, coupled with a participatory approach by the government will go a long way in ensuring that the SDGs are met with in our context as well as the rest of the developing world.

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MANAGEMENT METHODS AND CHALLENGES FOR DISTILLERY SPENT WASH COMPOSTING: A COMPREHENSIVE REVIEW

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Abstract: Distillery spent wash, a by-product of the alcoholic beverage industry, presents significant challenges in its management mainly due to its acidity, high organic load, and notable content of polyphenols, macronutrients, micronutrients, and heavy metals. Improper disposal of this waste can have severe environmental and health consequences. Composting has emerged as a viable strategy for treating and managing distillery slop, enabling the recycling and stabilization of organic matter and nutrients. This review explores different composting methods, including traditional composting, vermicomposting, and co-composting, and discusses their advantages and limitations. To optimize composting effectiveness, a range of materials such as sewage sludge, vinasse, manure, inorganic amendments, bagasse, filter cake, and bio-wastes can be used as nitrogen sources and microbial inoculants. These materials enhance the composting process, accelerating degradation rates and improving compost quality. However, challenges such as high salt content, low nitrogen-to-carbon ratio, low pH, and potential phytotoxicity need to be addressed. The review concludes that composting distillery spent wash is a feasible, effective, and sustainable waste management solution, allowing the recovery of valuable nutrient resources and the production of stable soil organic amendments. The resulting compost can enhance crop yields, nutrient absorption, biomass, and heavy metal adsorption in growing media while contributing to soil properties, mitigation, and restoration. The review offers valuable insights into the current state of distillery spent wash composting and suggests future research directions to enhance efficiency and expand potential applications.

Keywords: co-composting, composting, distillery spent wash, organic waste, vermicomposting.

INTRODUCTION

Industries worldwide contribute to an acute energy crisis and environmental degradation through the generation of vast amounts of liquid, gaseous, and solid waste, resulting in significant environmental pollution. The conventional disposal methods of open dumping or landfilling are unsustainable due to the leaching of toxic chemicals and metals, leading to contamination of groundwater, soil, and food resources. To address this issue, environmentally friendly technologies are needed to manage industrial waste effectively, while also being economically feasible and socially embraced [1].

One of the most polluting industries nowadays is alcohol distilleries. This industry has been experiencing significant global growth due to the widespread applications of alcohol in various sectors such as fuel for transport, chemicals, pharmaceuticals, and beverages [2]. According to Gebreeyessus [3], sugarcane molasses or other sugar sources readily available in local areas are utilized by the distillery industry to produce mild alcoholic beverages through a fermentation process, followed by distillation. Consequently, at the end of the distillation process, is generated an undesired

byproduct known as distillery spent wash (DSW), which can be also referred to as stillage, spent mash, alcohol/distillery waste, distillery wastewater/residue, or vinasse.

Distillery spent wash poses significant challenges as it is a complex, problematic, and highly oxygen-demanding organic waste produced by industrial operations [3]. Distilleries represent a highly environmentally burdensome sector because a significant proportion of their raw materials, approximately 88%, are transformed into waste and subsequently released mainly into water bodies, resulting in water pollution. Within the distillery operations, for each liter of alcohol produced about 15 liters of spent wash are formed and subsequently discharged [4].

The disposal of distillery mash is a challenging task due to its highly polluted nature. The characteristics of distillery mash include high chemical oxygen demand (COD) and biochemical oxygen demand (BOD) caused by the presence of various organic compounds such as polysaccharides, reduced sugars, lignin, proteins, and waxes. It also contains a significant amount of inorganic substances like nitrogen, potassium, phosphates, calcium, and sulfates, along with high salinity, temperature, dark brown color, obnoxious odor, low pH, heavy metals (iron, zinc, nickel, manganese, lead, mercury, copper, chromium), elevated ash content, and recalcitrant organic compounds such as brown polymers, melanoidins, anthocyanins, tannins, phenolics, steroids, and xenobiotic compounds [5,6,7]. Moreover, Kharayat [8] stated that these characteristics are greatly influenced by the choice of feedstock and aspects of the distillation process.

The proper management of distillery waste poses significant challenges for distilleries, scientists, and the government. Physicochemical treatment methods can effectively remove organic pollutants but have drawbacks such as the excessive use of chemicals, sludge generation, high operating costs, and sensitivity to variable water intake. These methods may not be able to remove certain contaminants like total dissolved solids and color to safe disposal limits. It is necessary to combine multiple treatment processes to effectively treat distillery waste [2].

The discharge of distillery spent wash (DSW) into water bodies has negative impacts on the aquatic ecosystem. Firstly, the intense color of the wastewater reduces sunlight penetration, leading to decreased oxygen production and harming aquatic life. Secondly, the high pollution load of DSW contributes to eutrophication, which can deplete oxygen levels in water streams and pose a threat to aquatic flora and fauna. Distilleries have a significant role in meeting the demand for alcohol, making eco-friendly management of DSW crucial. Therefore, sustainable treatment methods are necessary to prevent resource scarcity, protect human well-being, and maintain environmental and ecosystem balance [9].

Biotechnological processes offer effective solutions for treating organic waste, including distillery waste. Kharayat [8] demonstrated that these processes aim to remove biologically degradable organic compounds, COD, and color, either by transforming them into valuable materials or eliminating harmful waste. Various methods such as anaerobic (e.g., biomethanation) and aerobic treatments (e.g., tricking filters, activated sludge and aerated lagoon), composting, phytoremediation, and fungal, algal, enzymatic, and bacterial treatments are employed for high organic load wastes. Optimizing and identifying biotechnological treatment methods are crucial, and previous studies have highlighted the potential of biological treatments for managing distillery spent wash.

Composting has emerged as an effective approach for recovering resources from organic wastes, including distillery spent wash (DSW). It has proven to be successful in converting DSW into a stable and nutrient-rich soil conditioner.

Composting generates humus and provides nutrients to nutrient-deficient soils, leading to increased crop yields and reduced irrigation requirements. This method has demonstrated its value as an organic amendment and is recognized as a beneficial practice [10, 11].

This paper presents an overview of composting distillery spent wash, covering its composition, challenges, and potential applications. It examines various composting strategies that have been researched and implemented for managing this challenging organic waste. The challenges associated with composting distillery spent wash and the potential uses of the resulting compost in sectors like agriculture and soil amendment are also discussed.

METHODOLOGY

The review was conducted following a systematic approach to ensure a comprehensive and unbiased assessment of the topic. The methodology involved the following steps:

- *Selection of Databases and Keywords*

Relevant literature on the composting of distillery spent wash (DSW) was searched using electronic databases such as ScienceDirect, ResearchGate, and Google Scholar. The keywords used for the search included "composting," "distillery spent wash," "organic waste treatment," "distillery waste/stillage/vinasse", "brandy and fruit spirits", "alcohol production waste treatment", and "distillery wastewater management." The choice of keywords aimed to capture a wide range of studies related to the composting of DSW.

- *Inclusion and Exclusion Criteria*

A set of criteria was established to determine the eligibility of studies for inclusion in the review. Studies were included if they focused on the composting of DSW, provided detailed information on the composting process, and reported relevant outcomes and findings.

- *Search Strategy*

The search was conducted by combining the selected keywords using Boolean operators (AND, OR). The initial search generated a broad pool of articles related to composting, organic waste treatment, and wastewater management. The search was then refined by incorporating specific terms related to distillery spent wash composting.

- *Article Selection and Data Extraction*

The articles identified through the search were screened based on their titles and abstracts. The articles that met the inclusion criteria were then retrieved in full text for further evaluation. The data extraction process involved extracting relevant information, including study objectives, methodologies, key findings, and conclusions.

- *Number of Articles Reviewed*

A total of 79 articles were initially identified through the literature search. After applying the inclusion and exclusion criteria, 55 articles were included in the review. The selection process involved multiple reviewers to ensure consistency and minimize bias.

By following this methodology, a comprehensive overview of the composting of distillery spent wash was obtained, incorporating relevant studies that provided valuable insights into the topic.

OVERVIEW OF DISTILLERY SPENT WASH PRODUCTION

Distillery spent wash (DSW) is a byproduct generated during the production of alcoholic beverages, such as whiskey, rum, and vodka. As already mentioned, it is highly potent organic wastewater that poses significant environmental challenges if not properly managed. DSW is characterized by its high organic content, dark brown color, and strong odors, making it a complex and problematic effluent to handle.

Alcohol production, mainly ethanol, primarily relies on the utilization of cellulosic materials. Distilleries commonly employ various raw materials such as sugarcane molasses, grains, grapes, sugarcane juice, and barley malt. The production process in distilleries encompasses four primary steps: feed preparation, fermentation, distillation, and packaging [8].

In continuous processes, cellulosic materials undergo delignification, followed by acid hydrolysis of hemicellulose and cellulose, thereby converting them into simple sugars. These sugars are then fermented with yeast, yielding ethanol and carbon dioxide. Distillation is employed to separate the alcohol vapor from the fermentation solution, utilizing reduced pressure. Additionally, carbon dioxide gas may be introduced throughout the fermentation solution to facilitate the removal of alcohol. Researchers have contributed to understanding these processes and exploring their potential such as Saha [12], Tewari [13] and Satyawali [14]

- *Composition and Characteristics of Distillery Spent Wash*

Distillery spent wash is a complex mixture of organic and inorganic compounds that results from the fermentation and distillation processes in alcohol production. Its composition varies depending on the type of raw materials and production methods [15, 16]

DSW is rich in organic matter, containing high concentrations of sugars, alcohol, organic acids, and nitrogenous compounds. It has a high chemical oxygen demand (COD) and biochemical oxygen demand (BOD), making it highly polluting if discharged untreated. Moreover, its dark brown color and foul odors make it visually and olfactorily unpleasant. This characteristic color is mainly due to a recalcitrant compound called melanoidin and it comprises approximately 2% of the spent wash [17, 18]. These compounds exhibit antioxidant properties, which render them toxic to many microorganisms typically present in wastewater treatment processes [19]. The amount of wastewater produced through the distilling operation stages is shown in Table 1 and the specific characteristics of this material are provided in Table 2.

Table 1. Wastewater generation in various operations

Distillery operations	Average wastewater generation (kLD/distillery)	Specific wastewater generation (kL wastewater/kL alcohol)
Spent Wash (from distillation)	491.9	11.9
Fermenter cleaning	98.2	1.6
Fermenter cooling	355.1	2.0
Condenser cooling	864.4	7.9
Floor wash	30.8	0.5
Bottling plant	113.8	1.3
Others	141.6	1.2

Source: [8]

Table 2. Typical characteristics of different wastewater streams

Parameter	Spent wash	Fermenter cooling	Fermenter cleaning	Condenser cooling	Fermenter wash	Bottling plant
Color	Dark brown	Colorless	Colorless	Colorless	Faint	Colorless
pH	4-4.5	6.26	5.0–5.5	6.8–7.8	6	7.45
Alkalinity (mg/L)	3500	300	Ni	-	40	80
Total Solids (mg/L)	100,000	1000-1300	1000-1500	700-900	550	400
Suspended Solids (mg/L)	10,000	220	400-600	180-200	300	100
BOD (mg/L)	45,000-60,000	100-110	500-600	70-80	15	5
COD (mg/L)	80,000-120,000	500-1000	1200-1600	200-300	25	15

Source: [8]

- *Challenges Associated with Distillery Spent Wash Management*

Different approaches are currently employed for the treatment of distillery spent wash to ensure its proper disposal. These methods encompass physical, chemical, physicochemical, and biological techniques. Kharayat [8] demonstrated that the choice of treatment approach is contingent upon multiple factors, including the effectiveness of the treatment, associated costs, geographical and climatic conditions specific to the location, land usage, regulatory limitations, and the level of public acceptance of the treatment methods.

The challenges of DSW treatment include mainly high organic load, nutrient imbalance, foul odors and coloration of the material, and regulatory compliance. The organic matter in DSW can deplete oxygen in water bodies, leading to negative effects on aquatic ecosystems. The high nutrient content can cause eutrophication, disrupting aquatic biodiversity. Foul odors and dark brown color make direct disposal undesirable. Non-compliance with environmental regulations can result in legal consequences for distilleries [20, 21]. Proper management and treatment of DSW are essential to protect water resources, maintain ecological balance, and ensure sustainable practices within the distillery industry. To address these challenges, effective treatment methods such as composting have been explored to mitigate the environmental impact of DSW and transform it into valuable resources.

PRINCIPLES OF COMPOSTING

Composting is a natural biological process that involves the decomposition of organic waste materials, such as distillery spent wash (DSW), under controlled conditions. The process relies on the activity of microorganisms, such as bacteria and fungi, which break down the organic matter present in DSW into a stable, humus-like material called compost [10]. Compost is the main product generated by composting and it can be characterized by being an organic soil conditioner that has been stabilized to a humus-like product, a material free of human and plant pathogens, and that is beneficial to plant growth. The production of compost follows three steps, as cited by Diaz [22]: “(1) an initial, rapid stage of decomposition: (2) a stage of stabilization, and (3) an incomplete process of humification.” Moreover, the produced compost promotes resource recovery, increases crop yields, serves as a beneficial soil additive, and reduces irrigation demands [10, 11].

Biotechnology waste treatment system such as composting encompasses a range of scientific and engineering techniques that apply biological systems to produce valuable materials, transform substances, or eliminate problematic liquid, solid, or gaseous wastes [23, 24]. This approach can effectively remove a significant portion of biologically degradable organic matter, chemical oxygen demand (COD), and color from waste. Considering their potential applications, this section provides a detailed discussion on composting as an efficient biological treatment to alleviate the high pollution load of DSW [8].

In addition, composting promotes various benefits besides the use of compost as a soil amendment. It also provides an increase in the disposal site's lifespan and minimizes leachate quantity and quality in a landfill and the generated gases. Some soil properties are enhanced by the application of composts, such as water content and water retention, aggregation, soil aeration, soil permeability, water infiltration, cation exchange capacity, pH buffering, resilience, or carbon sequestration; it also decreases surface crusting [25].

The composting process requires specific conditions to produce high-quality compost. These conditions include having enough organic matter as a substrate for microbial decomposition, maintaining a balanced carbon-to-nitrogen (C/N) ratio, providing adequate moisture content, controlling temperature within mesophilic and thermophilic ranges, ensuring proper aeration for aerobic composting, maintaining an optimal pH range, and achieving compost stability and maturity. These principles optimize microbial activity, decomposition efficiency, nutrient availability, odor control, and the transformation of organic materials into stable compost. [11, 26]

Composting of DSW can have environmental impacts, both positive and negative. While composting is generally seen as an eco-friendly waste management approach, there are specific considerations when it comes to DSW. These include concerns about greenhouse gas emissions, leachate generation, and odors. Mitigation strategies involve optimizing composting conditions, addressing leachate management, and implementing odor control measures. Challenges include regulatory compliance, technology and infrastructure requirements, nutrient management, public perception, and the need for research and development. By collaborating, investing, and taking proactive measures, it is possible to minimize environmental impacts and promote sustainable composting of DSW.

Composting techniques for distillery spent wash (DSW) vary depending on factors such as feedstock, scale, and control of key composting conditions (e.g., aeration, temperature, humidity). Windrow composting is a technique that involves forming long piles of DSW on a composting pad, periodically

turning them for aeration and uniform decomposition. It is suitable for large-scale composting in agricultural and industrial settings. Static pile composting, on the other hand, involves forming compost piles without regular turning, allowing natural decomposition. It is simpler and suitable for smaller-scale operations, although it has slower composting and potential for anaerobic conditions and odor generation. Moreover, in-vessel composting uses enclosed containers with aeration systems for controlled decomposition and offers better temperature and moisture control, odor control, and the ability to handle larger volumes of DSW. However, it requires specialized equipment and higher capital investment [10].

Hence, composting is a practical solution for the waste management issue, especially for organic wastes e.g., DSW, due to the biological stabilization of this material [27].

- *Factors Influencing Composting of Distillery Spent Wash*

The composting performance of distillery spent wash (DSW) is influenced by several factors that can be optimized to improve the process [28]. These factors include the carbon-to-nitrogen (C/N) ratio, moisture content, temperature, aeration, microbial activity, pH, inhibitory substances, particle size and mixing, and nutrient availability.

Maintaining a balanced C/N ratio, typically around 25-30:1, promotes microbial activity and efficient decomposition. Adequate moisture levels, ranging from 50% to 60%, are necessary for microbial growth and activity. Controlling the temperature within thermophilic (50-70°C) or mesophilic (30-45°C) ranges supports decomposition and pathogen reduction. Proper aeration ensures oxygen supply, preventing anaerobic conditions and promoting aerobic microbial activity.

Microorganisms play a crucial role in composting, and a diverse microbial community with the right mix of bacteria, fungi, and actinomycetes is necessary for effective decomposition. Factors such as organic matter availability, moisture, temperature, and oxygen levels influence microbial activity. Maintaining favorable conditions for microbial growth and activity is vital for optimal composting performance.

Moreover, pH is an important parameter affecting composting performance, with an optimal range of 6.5 to 8.5. Extreme pH values can inhibit microbial activity and impact decomposition. Adjustments may be required using additives like lime to create a suitable pH environment.

DSW may contain inhibitory substances such as residual alcohol, organic acids, phenolic compounds, and toxic metals, which can hinder microbial activity and delay decomposition. Pre-treatment methods like dilution, detoxification, or adjusting the C/N ratio can help mitigate the inhibitory effects of these substances.

Particle size and proper mixing of DSW and bulking agents influence composting performance. Optimal particle size allows for aeration, moisture retention, and microbial colonization, while adequate mixing ensures uniform distribution of organic matter and promotes decomposition.

Nutrient availability, including carbon, nitrogen, phosphorus, and micronutrients, affects composting performance. Adjusting the C/N ratio using suitable bulking agents or co-composting materials helps create an optimal nutrient balance for microbial activity.

Regular monitoring and control of composting parameters such as temperature, moisture content, pH, oxygen levels, and nutrient content are essential for optimizing performance. Adjustments can be made to maintain optimal conditions throughout the composting process.

By understanding and managing these factors, composting performance and the quality of the final compost product derived from DSW can be significantly improved. Optimizing the composting process and creating favorable conditions for microbial activity allow for the effective and sustainable transformation of DSW into a valuable resource.

CASE STUDIES AND BEST PRACTICES IN COMPOSTING DISTILLERY SPENT WASH

There are several composting methods for DSW already researched and protocolled worldwide. The most common techniques can be divided into 1) traditional composting, 2) co-composting and 3) vermicomposting. This chapter examines different research articles that focused on the composting of distillery waste using one or multiple methods.

- *Traditional composting*

Traditional composting involves the natural decomposition of a single type of organic material through microbial activity. In this process, DSW can be mixed with inorganic amendments, bulking agents or additives to adjust pH, improve nutrient availability, reduce odor generation, and enhance compost stability. However, the excessive use of inorganic amendments should be carefully managed to avoid nutrient imbalances and potential environmental impacts. Traditional composting methods include outdoor windrows or enclosed composting systems.

A study by Silva [29] focused on composting Pálinka mash, a waste product from the production of a traditional Hungarian fruit spirit. The primary challenge in treating this waste was its low pH (around 4), which was effectively neutralized through composting in static piles with the addition of mineral additives. The use of mineral additives resulted in the production of valuable compost and positively influenced decomposition and synthesis reactions. Moreover, the mature mash compost showed the ability to adsorb heavy metals (iron and lead), as demonstrated in culture vessel experiments using lettuce and tomato plants grown in mash compost as a growing medium. The research contributes to understanding the composting process for Pálinka distillery mash, highlighting its potential for effective waste recycling and its applications in heavy metal adsorption and remediation.

Another technology is bio-composting which involves the aerobic decomposition of carbonaceous materials by heterotrophic microorganisms. Bio-composting converts wet materials into a stable form, eliminates pathogens, and reduces moisture content. Tiwari [30] focused on the utilization of distillery spent wash through bio-composting, employing both aerobic and anaerobic processes. Aerobic composting proved more efficient in utilizing spent wash and resulted in bio-compost with higher levels of organic carbon, nitrogen, phosphorus, and potassium, making it a valuable nutrient source for crops. Bio-composting also aids in the degradation of colored organic matter in distillery effluents, enriching the compost with essential nutrients. The utilization of distillery spent wash through bio-composting offers an environmentally friendly alternative to inorganic fertilizers in agriculture.

- *Co-composting*

Co-composting is a method that involves combining two or more organic waste materials during composting to improve the process and produce high-quality compost. It utilizes different waste streams like distillery spent wash, sewage sludge, manure, and more to address nutrient imbalances, enhance moisture retention, and promote microbial diversity. Co-composting is conducted in specialized facilities with controlled processes to ensure optimal decomposition and compost quality. A study conducted by Bustamante [31] focused on analyzing the co-composting process of winery and distillery wastes. They used multivariate techniques to classify and identify the parameters that best describe the composting process for this type of waste. The data analysis revealed key components that described compost maturity and quality, offering insights for more efficient composting practices. Overall, the research highlighted the potential of multivariate techniques in understanding and improving composting processes for winery and distillery wastes.

- ❖ Co-composting with Sewage Sludge

Co-composting DSW with sewage sludge facilitates the decomposition of DSW and offers benefits such as increased nutrient content, especially nitrogen, improved stability of the compost, and enhanced microbial activity. However, there are challenges to consider, including effectively managing the C/N ratio, potential heavy metal contamination from sewage sludge, and compliance with regulatory guidelines for sludge utilization.

The research carried out by Bustamante [32] focused on the composting winery and distillery wastes, specifically grape stalk and marc (GS and GM), wine lees (WL), and exhausted grape marc (EGM). These wastes present environmental challenges due to their seasonal nature and problematic characteristics, making composting a suitable treatment and recycling option. The experiment involved two composting piles (pile 1 and pile 2) containing mixtures of GS, GM, EG, and sewage sludge (SS), composted using the Rutgers static pile composting system. Initially, GS, GM, and EGM were mixed, and pile 1 was watered with fresh vinasse (V), a byproduct of the distillery process. After 17 days, SS was added to both piles as a source of nitrogen and microorganisms. Throughout the

composting process, various parameters were monitored, including temperature, pH, electrical conductivity, total organic carbon (C), total nitrogen (N), humic acid-like C, fulvic acid-like C, C/N ratio, cation exchange capacity, and germination index of the compost mixtures. The results showed that the addition of vinasse in pile 1 led to higher temperature values, greater degradation of total organic carbon, higher electrical conductivity, and similar pH and total nitrogen contents compared to pile 2. The addition of vinasse also increased the cation exchange capacity and prolonged the persistence of phytotoxicity. However, both piles ultimately exhibited stabilized organic matter and a reduction in phytotoxicity by the end of the composting process.

Another research undertaken by Bustamante [33] investigated the changes in microbial indicators and pathogen levels during the co-composting of winery and distillery wastes with sewage sludge, and cow and poultry manure. The study examined various piles containing different mixtures of these wastes and assessed the impact of the composting system employed. Different composting systems, including the Rutgers system and the turning system, were used for pile formation. One pile was also watered with vinasse. The study monitored microbial indicators such as sulphite reducers, clostridia, total *enterobacteriaceae*, total coliforms, faecal coliforms (*Escherichia coli*), *enterococci*, *Staphylococcus aureus*, and *Salmonella spp.* The results showed that the static aerated piles, which experienced relatively high temperatures of 50-60°C, were more effective in reducing pathogen content compared to the piles prepared using the turning system. The elevated temperatures contributed to a significant decrease in microbial groups like total and faecal coliforms (*E. coli*). However, it was observed that the characteristics of the raw materials used had a notable influence on the pathogen levels in the final compost product.

❖ Co-composting with Vinasse

Vinasse, a byproduct of ethanol production, can be co-composted with DSW to enhance the composting process. Vinasse provides additional nutrients and a source of moisture for composting. The advantages include improved moisture retention, increased nutrient content, and faster decomposition. However, the high organic load and moisture content of vinasse can lead to the need for additional bulking agents and careful monitoring of moisture levels during composting.

In the article by Madejón [34], two composts were produced through the co-composting of concentrated depotassified beet vinasse and two agricultural solid residues with distinct organic matter characteristics: spent grape marc as a lignin waste and cotton gin trash as a cellulosic waste. The composting process took place in aerated piles with mechanical turning under controlled conditions for a duration of four months. Temperature, pH, and inorganic nitrogen changes exhibited similar trends for both mixtures. However, variations in organic matter fractions differed depending on the co-composted material. The use of spent grape marc as a bulking agent resulted in lower degradation of organic matter due to its high lignin content. No phytotoxicity was observed in the final compost products. The chemical and physical properties of both vinasse composts indicate their potential utilization as fertilizers.

The study by Diaz [35] focused on optimizing the co-composting process of vinasse and spent grape marc. Various mixtures with increasing amounts of vinasse were incubated under aerobic conditions. The results showed that the pH values did not differ significantly among the mixtures. Mixtures with lower vinasse content had higher organic matter losses and greater biodegradability. The addition of vinasse increased the stability of the substrate-microorganism complex. However, higher vinasse ratios led to reduced microbial activity due to increased salinity and decreased pH. The study suggests that a moderate amount of vinasse, between 10% and 20%, is the best compromise for optimal co-composting.

❖ Co-composting with Green and Animal Manure

The advantages of co-composting DSW with green and animal manure include improved compost quality, enhanced nutrient content, and increased microbial diversity. However, challenges may arise from the availability and management of suitable quantities of green and animal manure.

In their study, Pinter [36] investigated the effects of adding goat manure, garden leaves, and alfalfa to exhausted grape marc during composting, as well as the influence of a plastic cover on the process and compost quality. They found that the compost made from the mixture of these materials had

higher levels of nutrients compared to compost made solely from grape marc. The plastic cover did not significantly affect the compost's physicochemical properties but did impact the composition of microorganisms. All composts showed stability and were free of pathogens. A plant growth experiment indicated that all composts had suitable quality, with the mixture compost performing the best. The study suggests that using a plastic cover can reduce microorganism content while composting diverse organic residues can enhance microbiological activity and improve compost quality.

The analysis performed by Bustamante [37] described the recycling of solid wastes from the winery and distillery industry through co-composting with animal manures. They created compost piles using exhausted grape marc and either cattle manure or poultry manure. Various parameters were monitored during the composting process, including pH, organic matter, nitrogen forms, humification indices, and phytotoxic compounds. The results showed that organic matter degraded following a specific pattern and composting effectively reduced phytotoxic compounds. The compost obtained was stable, humified, and suitable for agricultural use. Overall, co-composting proved to be a viable method for recycling and treating these wastes.

Torres-Climent [38] conducted a study with the objective of evaluating the co-composting of the winery and distillery wastes in combination with animal manures. Traditional chemical methods alone were insufficient to understand the humification process, so advanced instrumental techniques were employed. Three compost piles were created and analyzed using thermal analysis, Fourier Transform Infrared Spectroscopy (FT-IR), and Cross-Polarization Magic Angle Spinning Carbon-13 Nuclear Magnetic Resonance (CPMAS 13C NMR). The results showed that the advanced techniques provided valuable information about the transformation of organic matter during composting. Thermal analysis estimated the degradability and stability of the compost samples, while FT-IR and CPMAS 13C NMR revealed variations in organic compounds and carbon structures. The combination of these methods offered insights into the composting process and the quality of the end-products.

Marhuenda-Egea [39] managed a study to explore the use of thermal analysis for characterizing chemical changes during composting of winery and distillery residues. They analyzed compost samples from three piles using techniques such as differential thermal analysis (DTA), thermogravimetry (TG) and the first derivative of TG (DTG). Pile 1, prepared with grape stalk, grape marc, exhausted grape marc, and sewage sludge, showed different temperature patterns compared to piles 2 and 3, which used exhausted grape marc with cow manure and grape marc with poultry manure, respectively. Pile 1 appeared to be poorly composted. The researchers used CO₂ ion current curves and DTG curves to distinguish between well-stabilized (piles 2 and 3) and poorly stabilized (pile 1) organic matter. Energy release calculations and weight loss data provided insights into the composting process and helped determine the optimal point for compost harvest, potentially reducing the overall composting time.

❖ Co-composting with Bagasse and Filter Cake

Bagasse, a byproduct of sugar cane processing, and filter cake, a residue from juice filtration, can be co-composted with DSW. These materials serve as bulking agents and provide additional carbon and microbial diversity. The advantages include improved aeration, enhanced compost structure, and increased carbon content. However, the availability of bagasse and filter cake may depend on the local sugar industry, limiting the applicability of this technique in some regions.

The article by Zhang [40] explored the use of sugarcane bagasse and exhausted grape marc in composting green waste. The study found that adding a combination of 15% sugarcane bagasse and 20% exhausted grape marc improved composting conditions and resulted in high-quality compost. The optimized two-stage composting method allowed the compost to mature in just 21 days, much faster than traditional composting methods. This research highlights the potential for using lignocellulosic waste in composting to effectively dispose of waste while generating a valuable product.

The examination conducted by Wongkoon [41] aimed to study the decomposition of organic residues from sugar mills and alcohol factories, the properties of the resulting compost, and its impact on sugarcane growth. The compost made from filter cake and distillery slop reached maturity within 45 days and showed increasing levels of organic matter and nitrogen-phosphorus-potassium (NPK)

content over time. The use of KKV microbes in the compost resulted in better outcomes compared to commercial compost microbes. Supplementing the compost with chemical fertilizers improved sugarcane growth. Although the compost alone provided plant nutrients, better results were obtained when it was combined with NPK fertilizers.

The article by Sarangi [42] presented a method for rapidly composting sugar mill press mud and distillery spent wash using microbial culture. The compost generated from these materials exhibits favorable physicochemical characteristics and nutrient content, promoting healthy plant growth. Moreover, it has proven to be effective as a soil conditioner and nutrient replenisher for sustainable agriculture. The composting process effectively converted non-degradable components of the wastes, such as lignins, melanoidins, and humic acid, into humus, an essential soil component that enhances soil fertility and supports sustainable crop productivity.

❖ Co-composting with Straw and Municipal Solid Waste

Co-composting DSW with straw or municipal solid waste involves incorporating these materials into the composting process. Straw provides structure and aeration, while municipal solid waste contributes organic matter and diverse microorganisms. The advantages include improved compost stability, enhanced carbon content, and efficient utilization of solid waste resources. However, challenges may arise from the potential presence of contaminants in municipal solid waste and the need for proper waste segregation.

The study by Fernández [43] investigated the co-composting of exhausted grape marc (EGM) with different organic wastes. Four piles were created: EGM (control); EGM mixed with cow manure and straw (CMS); EGM mixed with municipal solid waste (MSW) and; EGM mixed with grape stalks (GS). The results showed that adding MSW and GS increased the rate constants of composting, while CMS reduced it. Co-composting reduced the remaining carbon concentration and increased the readily biodegradable carbon fraction. Only Piles 1 and 4 achieved thermal sanitization. The lowest nitrogen loss occurred when GS was added. The study recommended using GS as a co-substrate and bulking agent for co-composting with EGM.

• *Vermicomposting*

Vermicomposting utilizes earthworms to decompose organic materials, including DSW, into nutrient-rich vermicompost. Earthworms consume the waste and produce castings, which further break down and enrich the compost. This process enhances microbial activity, nutrient release, and organic compound breakdown. Vermicomposting can be done in worm beds or bins, maintaining specific conditions for earthworm growth. It offers advantages such as rapid decomposition, flexibility in space usage, and high-quality vermicompost production. However, it may be limited to smaller-scale operations and requires specific conditions. The resulting vermicompost can be used as a soil amendment to enhance plant growth and soil health. Vermicomposting is considered a sustainable and efficient method for DSW treatment, yielding high-quality vermicompost.

The research paper by Romero [44] examined the effects of vermicomposting on winery and distillery wastes. Three different substrates, spent grape marc (SGM), a mixture of SGM and lees cake (SGML), and a mixture of biosolid vinasse and vine shoots (BvS), were vermicomposted for 8 months using *Eisenia andrei* worms. The process resulted in changes in the substrates' chemical composition and the humic acid-like (HAL) fractions. Vermicomposting reduced the total organic carbon content and C/N ratio, while increasing total extractable carbon and humic acid carbon. The HAL fractions in the initial substrates were characterized by specific properties, but after vermicomposting, they became more similar to soil humic acids. This transformation involved a decrease in certain components and an increase in oxygenated and acidic groups. Vermicomposting was found to be a suitable method for enhancing the quality of winery and distillery wastes as soil organic amendments, with the mixture SGML showing slightly better results than SGM.

Suthar [1] investigated the use of *Eisenia fetida* earthworms to stabilize sludge from a sugar industry distillation unit mixed with cow dung. Different mixtures of these materials were tested under laboratory conditions for 90 days. The resulting vermicompost showed improvements in various parameters, including optimal pH and increased nitrogen, phosphorus, potassium, calcium, and magnesium content. The earthworms effectively decomposed the mixture, particularly with lower

proportions of distillery sludge. The study also found a reduction in extractable metals. Earthworm growth and reproduction were highest with 20% distillery sludge, while higher proportions of sludge led to increased earthworm mortality. Vermicomposting can be a useful method for managing distillery sludge and producing nutrient-rich compost for land restoration. It also helps mitigate metal toxicity and reduces the risk of soil contamination from industrial waste.

The study executed by Gomez-Brandon [45] investigated the use of vermicomposting to recycle and utilize distilled grape marc, a by-product of the winery industry. During a 56-day pilot-scale trial, it was found that the marc provided suitable conditions for earthworm growth, with increasing earthworm density and biomass. The pH levels and electrical conductivity of the marc also indicated optimal conditions for vermicomposting. After 14 days, microbial activity decreased, and the content of total polyphenols declined, suggesting stabilization. The resulting vermicompost met quality criteria for nutrient content and demonstrated its potential for environmentally friendly waste management and fertilizer production.

Nogales [46] explored the vermicomposting of various winery wastes (spent grape marc, vinasse biosolids, lees cakes, and vine shoots) into valuable agricultural products using the earthworm species *Eisenia andrei*. The vermicomposting process effectively biodegraded the winery wastes and also improved their agronomic value by reducing the C:N ratio, conductivity, and phytotoxicity, while increasing the levels of humic materials, nutrients, and pH. This suggests that winery wastes have potential as raw substrates for vermicomposting, although further research is needed for large-scale implementation.

The research paper by Hanc [47] examined the vermicomposting of distillery residues and wheat straw in a vertical-flow windrow system. They found that the top layer of the compost had high humidity, electrical conductivity, and earthworm biomass. It contained partially decomposed organic matter with favorable nutrient ratios. In contrast, the lower layers were more mature and had lower microbial activity, alkaline pH, and nutrient content. Potassium was the most abundant macronutrient, and phosphorus and magnesium increased with compost age. The top layer is suitable for starting new composting cycles and preparing extracts, while the older layers make a suitable organic fertilizer.

In the study conducted by Singh [48], distillery sludge was treated through vermicomposting using *Eisenia fetida* to convert it into soil-enriching material. The sludge was mixed with cattle dung in varying ratios, and the vermicomposting process was carried out with and without the presence of *Eisenia fetida*. The results showed that the presence of cattle dung positively influenced the survival rate, growth rate, maturity-onset, cocoon production, and population of earthworms. The optimal concentration of sludge for achieving the highest number of worms, cocoons, and hatchlings was determined using a response surface design. Nitrogen, phosphorus, sodium, and pH levels increased during vermicomposting, while they decreased in the absence of earthworms. Transition metal content increased in both cases, but organic carbon, electrical conductivity, and potassium showed an opposite trend.

Tejada [49] investigated the effects of co-composting beet vinasse with vermicompost on soil properties, soil loss, and soil restoration. It was found that the use of organic-rich waste as an alternative or complement to mineral fertilizers is environmentally beneficial, provided that the organic wastes are not heavily polluted. In the case of fresh beet vinasse, it had a negative effect on the soil's physical, chemical, and biological properties, leading to increased soil loss and decreased plant cover. This negative impact was attributed to the high levels of monovalent cations, such as Na⁺, present in beet vinasse, which destabilized the soil structure. The study aimed to assess the effects of co-composting beet vinasse with vermicompost made from green forages on soil properties and its potential contribution to soil loss and restoration. The experiment was conducted over three years in a semiarid region in Spain. The results showed that co-composting had a positive impact on the soil, improving its physical, chemical, and biological properties. It resulted in reduced soil loss by 31.2% and increased plant cover by 68.7% both compared to unamended soil. These findings suggest that the co-composting of beet vinasse with vermicompost is beneficial for soil protection and restoration, making it a promising approach for recovering semiarid areas.

The study conducted by Alavi [50] examined the efficiency of co-composting and vermicomposting of a mixture of vinasse, cow manure, chopped bagasse, and natural zeolite. The composting process lasted for 60 days and utilized *Eisenia fetida* earthworms. The results indicated a decrease in the

carbon-to-nitrogen ratio over time and an alkaline pH range for the final fertilizer. The total potassium content decreased while the total phosphorus content increased during the process. The compost showed a high germination index and a low cellular respiration maturity index, suggesting its stability. Overall, the study concluded that the compost obtained from the co-composting and vermicomposting process could serve as a beneficial soil amendment.

In conclusion, composting techniques for distillery spent wash (DSW) have specific advantages and limitations that should be considered based on local conditions and waste availability. Proper management practices, such as monitoring moisture levels and ensuring adequate aeration, are crucial for successful composting. Adherence to regulatory guidelines and quality standards is important for safe compost utilization. Co-composting and vermicomposting offer alternative approaches to traditional composting, optimizing the process and enhancing compost quality. These methods maximize the utilization of DSW as a resource in sustainable agriculture and soil management. Factors like scale, resources, space, and waste composition should be considered when choosing a composting technique for DSW treatment.

DISTILLERY SPENT WASH COMPOST

Composting distillery spent wash (DSW) can result in high-quality compost with desirable characteristics. The process breaks down organic matter, making nutrients more available for plants. It also forms stable compounds that enhance soil structure and fertility. Proper composting stabilizes pH, benefiting soil conditions. Additionally, composting reduces pathogens and weed seeds, ensuring the safety and quality of the compost. Overall, composting DSW produces nutrient-rich, humus-rich, pH-stable compost that promotes soil health and plant growth.

Several research papers have explored the applications of DSW compost, particularly its impact on crop yield and soil properties.

Villena [51] investigated the use of compost derived from winery and distillery waste in a melon crop. Different doses of compost were applied, and the effects on plant growth, nutrient accumulation, fruit yield, and quality were studied. The application of compost resulted in increased plant biomass and improved relative growth rate. Significant improvements in fruit yield were observed with a specific compost dose. The compost application was found to be environmentally safe, and it enhanced fruit quality. Overall, the study demonstrated the positive impact of winery and distillery waste compost on melon crop performance.

The research by Bustamante [52] investigated the use of composts made from distillery wastes as alternatives to peat in transplant production. Two types of compost were created using spent grape marc with either cattle or poultry manure. Different vegetable species were grown using various substrate mixtures containing peat and compost. The study found that the composts had suitable properties for use as growing media in horticulture. Composts from the co-composting of grape marc and cow/poultry manure were identified as viable substitutes for peat, with volumes of 25-50%, without compromising yield or nutritional outcomes compared to the control.

Paredes [53] focused on the composting of winery by-products, specifically exhausted grape marc (EGM) and vinasse, and its potential as an organic amendment in agricultural soils. Composting EGM helps eliminate phytotoxicity and produce a stable end-product with beneficial nutrients. Previous studies have already shown positive effects of grape marc compost on plant growth. Then, this study aimed to examine the impact of EGM compost on soil nitrogen dynamics during horticultural crop growth. The results indicate that EGM compost application improves soil fertility by increasing organic nitrogen. However, there is low nitrogen mineralization and a period of nitrogen immobilization, particularly when EGM and poultry manure compost are used. Organic nitrogen losses from the composts are minimal. The mineralization of organic nitrogen in mature composts is influenced by crop nutrient demands. The application rate of EGM compost is appropriate, as it yields similar lettuce production to commercial values. It is recommended to apply EGM compost one month before planting to avoid nitrogen immobilization.

The research conducted by Tejada [54] investigated the effects of different treatments on the restoration of soil using beet vinasse (BV), uncomposted *Trifolium pratense L.* (TP) - a leguminous

plant, and composted mixtures of TP and BV. The results showed that BV negatively impacted soil properties, including physical, chemical, and biological aspects. It decreased structural stability, increased bulk density, raised exchangeable sodium percentage, and decreased microbial biomass, soil respiration, and enzymatic activities. In contrast, TP application had positive effects on the soil physical and biological properties. When TP was co-composted with BV, especially at a 2:1 ratio, the resulting compost positively influenced soil properties. After four years, plant cover decreased in BV-amended plots but increased in TP and TP + BV compost treatments. These findings indicate that BV alone deteriorates the soil, while TP and TP composted with BV contribute to its restoration.

The study executed by Bustamante [55] aimed to investigate the impact of incorporating different organic materials into a calcareous vineyard soil over three growing seasons. The organic materials used included sheep manure and four composts derived from the winery and distillery waste treatment. The application of these organic materials resulted in increased soil microbial activity, higher levels of soil macro and micronutrients, and a gradual release of inorganic nitrogen. Overall, the study showed that incorporating winery and distillery waste composts had positive effects on the soil, improving its characteristics and nutrient content.

Therefore, DSW compost offers numerous benefits and potential applications. It can be used as a soil amendment to enhance soil quality, fertility, and structure. Compost provides slow-release organic nutrients, reducing the need for synthetic fertilizers and supporting sustainable agriculture. It can also aid in land reclamation projects, promoting vegetation growth and ecological recovery. DSW compost is valuable in horticulture and landscaping, improving soil fertility, plant growth, and aesthetics. Additionally, it has the potential for environmental remediation by assisting in the treatment of contaminated soils. However, adherence to regulatory guidelines and quality standards is crucial to ensure environmental and human health. It can be concluded that DSW compost contributes to sustainable waste management and the principles of the circular economy.

CONCLUSION AND RECOMMENDATIONS

Distillery spent wash composting is a promising waste management technique that can effectively convert this organic waste into a valuable resource. However, there are many factors influencing the composting of DSW as mentioned in this review. And the optimal management of these factors is critical for successful composting.

Various composting techniques, including co-composting and vermicomposting, have been used for DSW treatment. Co-composting with suitable co-substrates can improve the composting process and produce high-quality compost rich in organic matter, nutrients, and beneficial microbial populations. The resulting compost has potential applications as a soil amendment, fertilizer, or in land reclamation projects. However, composting DSW may have environmental impacts such as greenhouse gas emissions, leachate generation, and odor issues. Proper management practices and mitigation strategies are necessary to minimize these impacts.

Lessons learned and best practices for composting DSW involve optimizing composting parameters, utilizing co-substrates in co-composting, investing in suitable technology and infrastructure, implementing effective odor management measures, ensuring quality control and testing, and promoting research and development collaborations.

Furthermore, there are important implications, knowledge gaps, and future research directions to consider. These include studying the dynamics of microbial communities during composting, optimizing process parameters for different types of DSW, establishing standardized guidelines and regulations, exploring innovative composting techniques, examining the socio-economic implications, and conducting long-term monitoring studies to evaluate compost stability and its impact on soil properties and crop yields.

In conclusion, composting offers a sustainable solution for DSW management, and its optimization requires considering various factors and advancing research in the field. By addressing knowledge gaps, improving techniques, and adhering to quality standards, the value and sustainability of DSW composting can be maximized.

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THE MIGRATION OF POLLUTANTS INTO THE SOIL

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Abstract: *The problems of soil pollution are common nowadays; the presence of pollutants is a problem of toxicity when these pollutants migrate into the soil. The objective of this study is to optimize depollution processes in the context of studies on soil contamination by hydrocarbon pollutants. Many non-aqueous organic liquids (NAPLs "No Aqueous Phase Liquids") are used in large quantities by many industries worldwide. Unfortunately, because of their use, these liquids are among the most widespread pollutants in soil and groundwater. Unfortunately, it is extremely difficult to clean up underground water due to their relative inaccessibility, their large volume, and flow slowly. Which is why the pollution of groundwater can cause a very serious ecological damage and long-term, especially because the pollutant removal takes times. In the context of polluted sites, numerical modelling is a tool for understanding the behaviour of contaminants in the subsurface and to predict their future in space and in time. The work consists in reproduce by simulation; some physical phenomena frequently encountered in practice and identify the parameters that govern them. To do this, we studied the problem on a reduced and through the laws of physical similarity model; the results can be extended to real applications.*

Keywords: *Groundwater, pollution, flow, environment, numerical simulation*

INTRODUCTION

The study of fluid flows in porous media includes the description and characterization of both the fluid that the environment in which it operates. Hydrocarbons and chlorinated solvents constitute relatively widespread classes of pollutant in the subsoil. When these liquids are accidentally spilled on the ground surface or leak from underground reservoirs, their migration underground is controlled by three forces (capillary, viscous and gravity).

Due to the terrific development of means of reconnaissance highly heterogeneous subsurface formations, and the improvement opportunities for interpretation of complex data growing computer tool that allows the current problems concern mainly to the heterogeneity of natural porous milieu. The migration of immiscible oil and restoring aquifers where they are present involve multiphase process. At hydrocarbon migration, numerical modelling has allowed a better understanding of the phenomena that act in the gas phase (Baehr, 1987, Faltaand al, 1989) and in liquid form (Guarnacciaand al, 1997, and Moridis Pruess, 1995) [Burger, 1984].

Chlorinated solvents and petroleum hydrocarbons, in most cases, are poorly soluble chemicals (miscible) in water. They exist in the aquifer as separate liquid phases, often referred to as non-aqueous liquid phase or NAPL. A NAPL can consist of a single or many components compound. For example, trichlorethylene (TCE) and tetrachlorethylene (PCE) are simple compounds [Yra, 2006]. The underground water can be of two types: unconfined and confined aquifer [Angiboust, 2006].

Worldwide, all kinds of waste are discharged into the ground or are accidentally spilled on the surface. Fortunately, most hazardous waste is absorbed and broken down by natural processes such as bacterial activity. However, some are not easily degraded and, in some cases, the amount of toxic substances into the soil is such that the natural capacities of the latter to remove pollutants are exceeded, resulting in the pollution of groundwater. T

he vulnerability of groundwater depends on the type of water, free or captive, and the mode of flow of water in the aquifer. Confined groundwater is better protected by impermeable layers which surmount. Their supply of water is more limited, so easier to protect. Their pollution occurs when the impermeable protective level is pierced by a book (old drilling deep excavation). The unconfined aquifers are more vulnerable revenge pollutants from surface can diffuse freely in the soil and the groundwater level to unsaturated area [Yra,2006]. During the migration of NAPL in the porous milieu, a party may find themselves trapped under the action of capillary forces; the figure shows the free and trapped NAPL [Yra, 2006].

MATERIALS AND METHODS

For Modelling of multiphase displacements under UTCHEM, we use The UTCHEM code. This is a multiphase simulator 3D multicomponent particularly complex. Written in FORTRAN, it is very robust and can be run either on a super computer or workstation. This calculation code digital, still in development at the University of Texas in Austin, was originally developed by Pope and Nelson (1978) to simulate the process of oil recovery by the use of surfactants (surfactants) and polymers [Technical Documentation for UTCHEM, 2000].

The simulator has the ability to simulate adequately the complex phenomena [Alonso Bernardez,1999] and also allows us to consider the phenomenon of diffusion between all phases [Bour,2003] The simulator allows the modelling of more than 19 components: water, oil, surfactant, polymer, alcohol, air, plotters, gels, etc. which can form up to four (04) fluid phases [Alonso Bernardez,1999]: a gaseous phase three liquid phases: an aqueous phase ($l = 1$), an oil phase ($l = 2$) a micro-emulsion phase ($l = 3$).

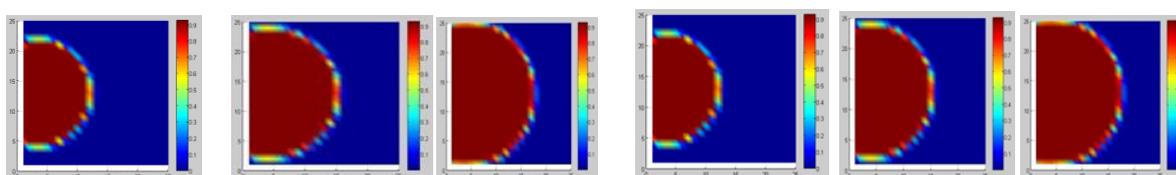
RESULTS

The product used in our application is Perchloroethylene or PCE is found in many other denominations 1, 1, 2, 2-tetrachlorethylene, tetrachloroethene ethylene tetrachloride, carbon dichloride. In this application we simulated from a simple model, the behaviour of a heterogeneous aquifer, considered as representative of a type of heterogeneity frequently found in nature (stratified milieu). The model used is a simplified physical model, similar to a stack of parallel layers of constant thickness and different characteristics (porosity, permeability).

The milieu considered in this study is a rigid aquifer initially saturated with the pollutant "PCE". The injection of the displacing fluid (aqueous phase) through an injection well, allows to push the contaminant to the recovery wells.

The aqueous phase consists of water, of polymer and surfactant. The injection of a surfactant solution is used to reduce the interfacial tension and decreasing the saturation of residual polluting, and injection of the polymers (often combined with the use of surfactants) increases the viscosity of the water and decreases the mobility ratio to improve sweep efficiency.

Exchanges between phases are not taken into account (no phenomenon of diffusion-dispersion) and the tank temperature is invariable (isothermal process).



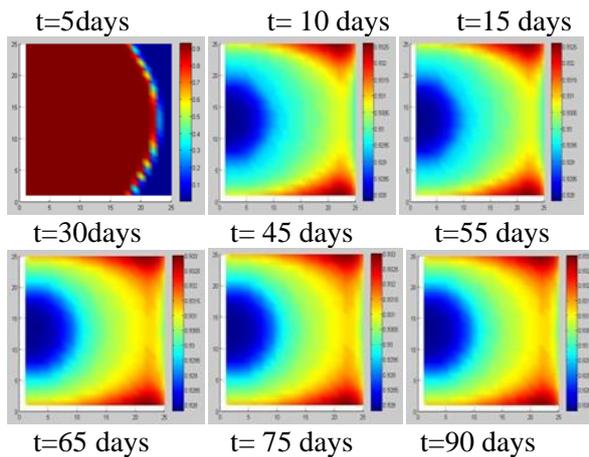


Figure 1: Saturation of the injectable Phase (Water, polymer, surfactant) in the layer 1.

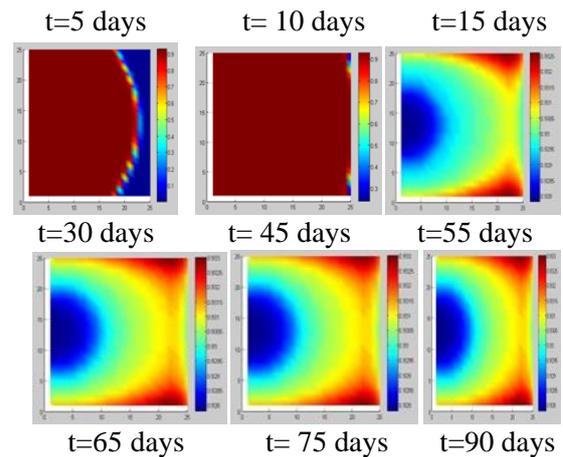


Figure 2: Saturation of the injectable Phase (Water, polymer, surfactant) in the layer 2.

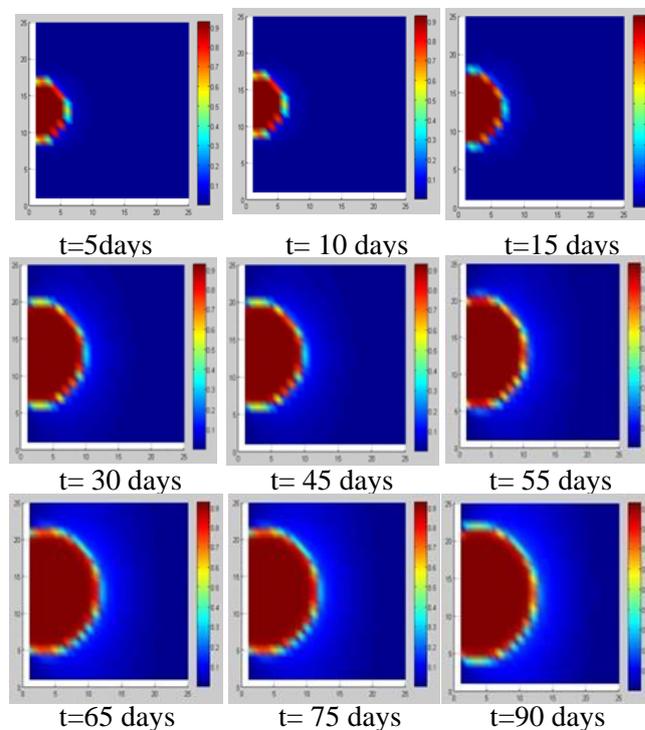


Figure 3: Saturation of the injectable Phase (Water, polymer, surfactant) in the layer 3.

DISCUSSION

The mesh used to discretize the milieu is a three-dimensional Cartesian grid. The finite difference scheme used is the TVD scheme; it consists in discretizing the domain into rectangular mesh. Values calculated are average values characterizing the mesh and not the values at the centre of the mesh. From the figures 1, 2, 3 we find that the injected aqueous phase moves quickly in the most permeable layers (1 and 2). So the permeability plays an important role in the movement of fluids through the aquifer.

The Variation of the saturation of the aqueous phase is initially recorded in the vicinity of the injection well of the same phase. Thereafter the spread of this phase front across the milieu is circular in shape, and forming surfaces iso-saturations. In layer 3, wherein the porosity and permeability is low, and also

because the depth to which is the displacement of the moving fluid is very long. Behind the displacement front, saturation occurs in this phase to a maximum value in the injection well that is complementary to the residual saturation PCE.

From the injection well, the saturation of the latter is gradually increased until the onset of the steady state, and stabilized at this value. By approaching the right boundary, the aqueous phase which serves to push the pollutant moves more southerly along flow axis see Figures 1, 2, 3 recovery wells. We also note that the vicinity of the two lateral boundaries is not completely swept away by the latter in the layer 1 and 2 before the first 30 days of the simulation.

CONCLUSION AND RECOMMENDATIONS

We focus in this study to determine the saturation fields of the fluid phases in the case of the method of recovery of the pollutant (PCE) by injection of an aqueous phase (water, polymer, surfactant). This study examines the influence of the injection of the aqueous phase of the displacement of PCE through the medium under consideration. Unfortunately, it is extremely difficult to clean up underground water due to their relative inaccessibility, their large volume, and flow slowly. Therefore, the pollution of groundwater can cause a very serious ecological damage and long-term, especially because the pollutant removal takes time. The study of fluid flows in porous milieu includes the description and characterization of both the fluid that the environment in which it operates. Due to the tremendous development of means of reconnaissance highly heterogeneous subsurface formations, and improving opportunities for interpretation of complex data and growing software tool that allows the current issues related mainly to the heterogeneity of natural porous media..

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SOIL PROFILING FROM SHORT DISSIPATION CPT DATA

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Abstract: Major part of the in situ dissipation tests of CPT are not used in the lack of proper evaluation methods. The wider aim of the research is to get more information from the dissipation tests by using mathematically precise evaluation methods. Especially, the short dissipation tests performed when the steady penetration is stopped for a few second-long technical break in case of the S832 equipment, in every 50 cm, are not evaluated even though the 50 cm frequency may have given sufficient information since the affected zone extends several tens of diameters away. To elaborate an evaluation method for the simple f_s or simple q_c test, at first a data set measured in the Szeged and Debrecen test sites were statistically analysed. According to the results, the mean dissipation curves were dependent on the soil type differently for f_s (controlled by the effective stress on the shaft) and q_c (controlled by the total stress on the tip). The time dependency of the mean dissipation curves was explained here by a newly suggested consolidation model. The paper compares the results with some recently published DMTA short dissipation test data showing similar pattern.

Keywords: consolidation, dynamic amplifier, displacement pile, CPT dissipation test, residual stress, soil profiling

INTRODUCTION

This research was initiated by the facts that the total stress, shaft and tip resistance dissipation tests made by the cone penetration tests (Table 1) cannot be evaluated and properly used. The in situ dissipation tests (except the pore water pressure dissipation test) are not used in the lack of proper evaluation methods (Table 1).

Table 1 Types of dissipation tests made with in situ equipment, only the pore water pressure test of dissipation tests are evaluated in the practice.

Measured variable	Notation	Name
Pore water pressure	CPT _u u_2 u_3 etc.	pore water pressure dissipation
Total stress *and pore water pressure	PSL* DMTA DMTC	piezo-lateral stress dissipation A-dissipation C-dissipation
Shaft f_s and tip resistance q_c	CPT f_s CPT q_c	simple f_s dissipation simple q_c test

Table 2 Plasticity and void ratio of the layers in Figures 3, 4

	I_p [%]	$e[-]$
Mo	7.4	0.68
Medium clay	20.	0.76
Fat clay	36.3	0.85

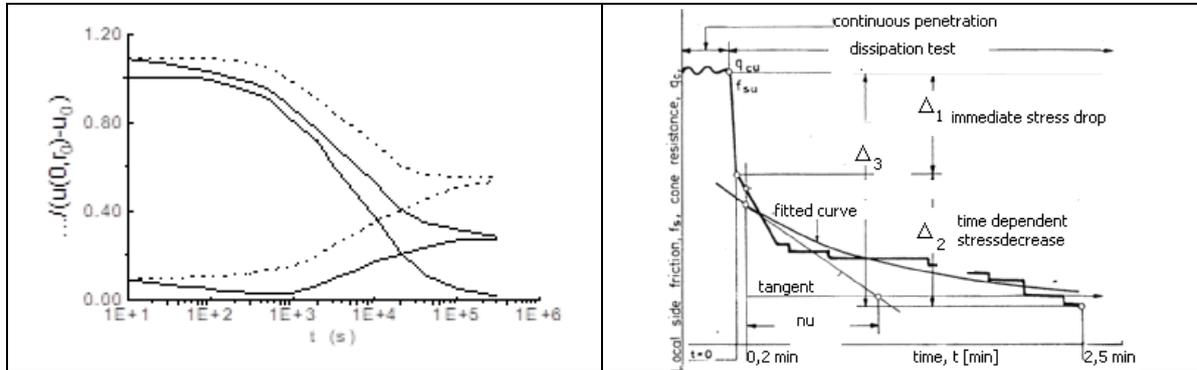


Figure 1: The solution of the joined model (solid lines) and the coupled consolidation model total stress model (dashed lines) [3, 4]

Figure 2: S832 CPT short f_s and q_c dissipation tests, analogue outputs with empirical parameters (from Imre, 1995 [1])

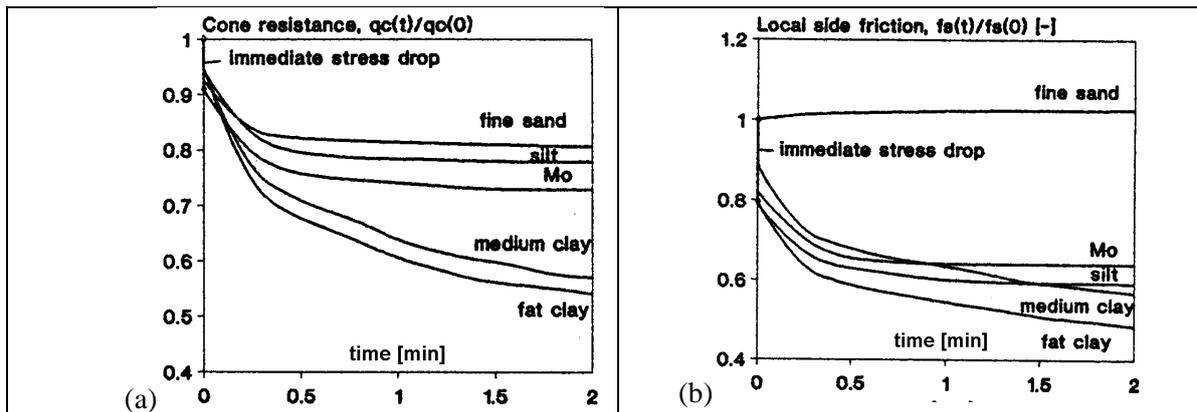


Figure 3: Soil group mean curves in terms of time with approximate time scale [3]. (a) Measured mean q_c -time relations (b) Measured mean f_s -time relations. Note the qualitatively different response for sandy and clayey soils.

The CPT can be used in a logging or in a rheological testing mode. Short CPT dissipation tests can be made at the technical stops of the steady penetration. In these stops the time variation of the local side friction and the cone resistance is recorded for a few seconds – minutes. Earlier, in the case of the CPT S832 equipment (made in UFA, Ural Mountain region [1 to 3]), several short tests were made.

In this work the short shaft and tip resistance dissipation tests made at the technical stops of the steady penetration with the CPT S832 equipment is analyzed, it is found that it can be used for soil profiling and that the results may apply to the DMTA short dissipation test as well.

MATERIALS AND METHODS

A short dissipation test can be performed with the S832 equipment in every 50 cm. This is done in such a way that the steady penetration is stopped due to technical reason, so that the rod is released then re-clamped. During this the local side friction f_s and the cone resistance q_c are continued to be measured. Figure 1 shows the typical S832 CPT short dissipation output which is an analogue record with saw-tooth-like features for both the short f_s and q_c dissipation tests (Imre, 1995, [1]).

The short dissipation output typically consisted of an immediate stress drop and a time dependent stress decrease period. According to our interpretation, this is due to the dynamic – static transition. There is a so called dynamic amplification factor expressing the ratio of the dynamic / static load, the load decreases if loading changes from dynamic to static, different during steady penetration and when penetration stops (Németh-Kocsis, 2013, [2]).

The aim of the research was to get more information from the dissipation tests by using mathematically precise evaluation methods. For this aim, statistical evaluation was made, and the results were started to explain by precise modelling. A radial consolidation model was used to explain the results (see Figs. 1, 2).

STATISTICAL ANALYSIS

A total of 135 rheological type cone penetration test records associated with the ten boreholes, selected from the data bank of the Geodesical and Geotechnical Institute FTV, were evaluated such that dissipation test groups of soil groups were defined from plasticity index I_p . The mean dissipation tests of soil groups indicated that the time variation of the local side friction short dissipation curves initially showed an immediate stress drop, then the shaft resistance decreased or increased during the time dependent dissipation period in the first minute for plastic or granular soils, respectively. The mean dissipation tests indicated that the time variation of the cone resistance short dissipation curves showed a time dependency which was controlled by the soil plasticity in intact layers. These results can be used for soil identification (Figs. 2 to 3, [1]).

Empirical parameters

The immediate stress drop Δ_1 was generally left out in the empirical evaluation, the time dependent stress decrease period was characterized by two parameters, the time dependent stress drop Δ_2 and the initial stress variation rate parameter Δ . These empirical parameters are used for the characterization of the simple rheological-type cone penetration test records (Imre 1995). One is the cone resistance parameter Δq_{c2} and, local side friction sounding parameter Δf_{s2} (Fig. 2) given by:

$$\Delta q_{c2} = q_c(t_i) - q_c(t_i + \Delta t); \text{ and } \Delta f_{s2} = f_s(t_i) - f_s(t_i + t_1); \quad (1)$$

where t_i is the time when the immediate stress drop is ended, and t_1 is a reference time. An additional sounding parameter Δ was defined by fitting the relaxation equation of the Poynting-Thomson model on the stress measured during the time dependent period (Fig. 1). The equation:

$$\sigma(t) = \sigma_\infty + (\sigma_0 - \sigma_\infty) e^{-\frac{t}{\nu}} \quad (2)$$

Factor analysis was made with the in situ and lab test data indicated strong correlations between the empirical parameters, permeability and plasticity index I_p , except at layer boundaries or in the case of secondary structure (if the permeability is larger than expected from soil type).

MATHEMATICALLY PRECISE ANALYSES

A coupled consolidation model

The system of equation of the consolidation part-model was developed on the basis of the field equations of the coupled consolidation Analytical solutions were made assuming new boundary conditions for the dissipation test problem [3]. In the modelling of the total stress at r_0 it is assumed that the constitutive equation is time dependent:

$$\sigma_r(t, r_0) = \sigma_r^c(t, r_0) + \Delta\sigma_r^r(t, r_0) \quad (3)$$

where superscript c and r indicate consolidation and relaxation, respectively. It is assumed that the relaxation term can be described as follows:

$$\Delta\sigma_r^r(t, r_0) = -s \cdot \sigma(0, r_0) \cdot \log \frac{t}{t_1}; t > t_1 \quad (4)$$

where s is the coefficient of relaxation, and t_1 is the delay time. The radial total stress at r_0 decreases with time due to consolidation and also relaxation. The effective stress at r_0 increases due to consolidation and decreases due to relaxation, the net effect depends on the model parameters, the coefficient of consolidation (c) and the coefficient of relaxation (s) both depending on soil type.

Simulation results, explaining the empirical parameters

In the qualitative validation, the radial effective stress response was simulated in the function of the consolidation and relaxation model parameters (using the software [4 to 5]). The time variation of the radial normal stresses acting at the shaft-soil interface was simulated with the joined model in such a way that the values of the coefficient of consolidation (c_v) and the coefficient of relaxation (s) were varied.

According to the results (Fig. 6), the time variation of the radial effective stress was a decrease or increase during the first minutes for plastic or granular soils, respectively.

The simulated radial normal stress - time functions were characterized with two parameters (Δf_{s2} , Δ) defined similarly to the foregoing two sounding parameters (Δf_{s2} , Δ). Results are shown in Figures 7, 8. The relations concerning the simulated sounding parameters (Δf_{s2} , Δ) - coefficient consolidation (c_v) were compared with the relations concerning the empirical sounding parameters (Δf_{s2} , Δ) - plasticity index (I_p). Similar to the shaft resistance during short dissipation, the simulated empirical parameters indicated the same dependence on the plasticity index I_p . In this way the correlation results between sounding parameters and the plasticity index (I_p) shown in Figures 2 to 5 were explained qualitatively, by using the theoretical model.

DISCUSSION

Residual stresses

The CPT is a displacement - type model pile due to the jacking ([7 to 8]). Therefore, it may be assumed on the basis of the foregoing experiences that plastic and granular soil behaviour also separates in the beginning of dissipation in clay or sand. This hypothesis is supported by the foregoing statistical evaluations known from literature, showing some additional plasticity dependence.

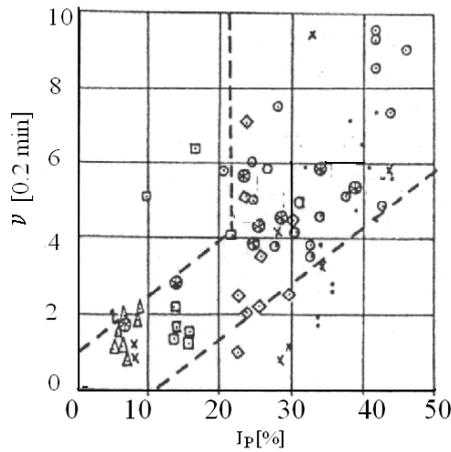


Figure 4: Empirical $\Delta - I_P$ relation – from measured q_c -time relations

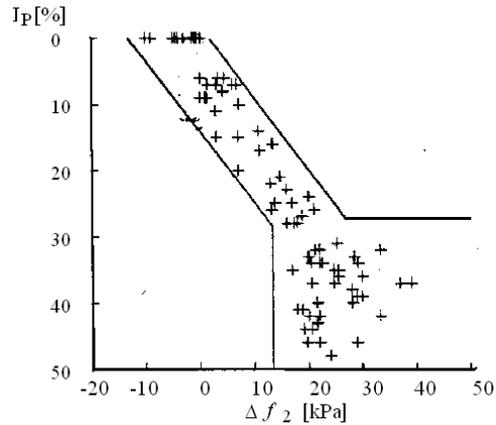


Figure 5: Empirical $\Delta f_{s2} - I_P$ relation – from measured f_{s2} -time relations

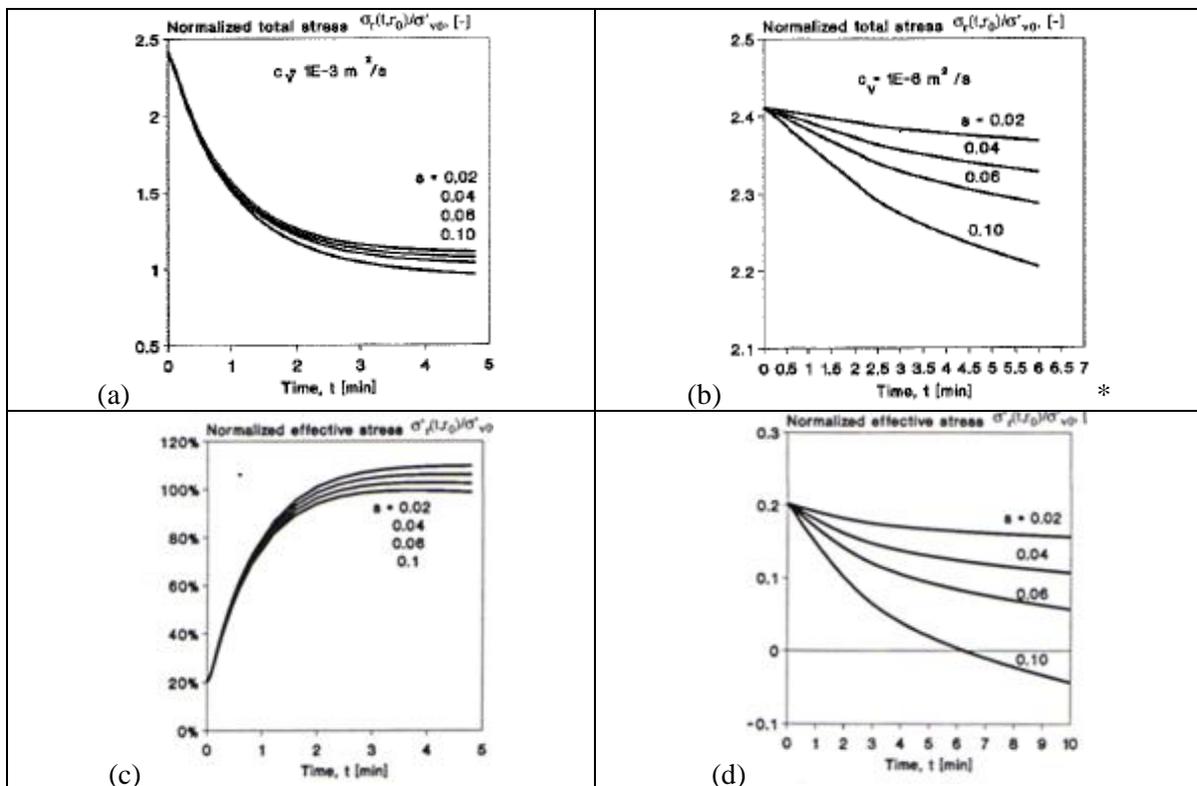


Figure 6: (a) and (b) The total stress on the shaft, large / small permeability soils, explaining the q_c tests. (c) and (d) The effective stress on the shaft, large and small permeability soil, explaining the f_{s2} tests.

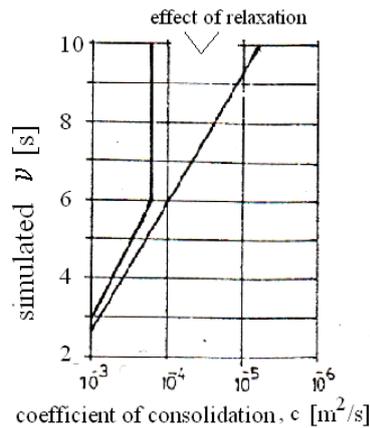


Figure 7: $\Delta - I_p$ relation determined from simulation.

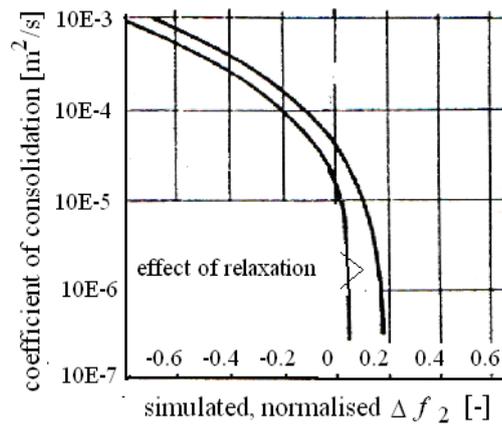


Figure 8: $\Delta f_{s2} - I_p$ relation determined from simulation.

It is well-known that there are residual stresses during displacement piling, which are small in clay and are significant in sand where huge negative side friction appears above the tip ([7 to 8]). It is well-known that there is a time dependent stress release in the soil causing an equipment vertical force redistribution, a decrease in the absolute value of the residual stresses pointwise, along the shaft.

The construction experiences in relation to re-driving resistance of piles (Yang, 1956 [9]) indicate a clear distinction between sand and plastic soils. The re-driving resistance is less in clays and is larger in sand at the end of the first driving than at the beginning of the first driving and the reverse is true later, in a few days after than at the end of the first driving.

An equilibrium condition of deep foundation shaft load transfer

It is well-known that there is a plastic zone around the displacement piles, and due to strain localizations. The vertical normal force equilibrium condition of a hollow cylindrical soil body around the CPT, bounded by the slip surfaces of the plastic zone (Imre, 1988 [10]) links the vertical soil normal stress at the level of the tip with the load transferred on the shaft, at inner surface of the cylinder. This link may explain the saw-tooth-like stress variation and the fact that the short dissipation curves are influenced by the load transferred on the shaft of the whole equipment.

Dissipation phenomena

The radial stress release components (irrespective of the effect of residual stress state) are as follows. Dynamic-static transition which can only be detected in case of continuous data acquisition before dissipation. (It is not occurring in case of a small displacement before the stress measurement which is the case for the DMT ([11]). Consolidation with time dependent constitutive law, and with thixotropic hardening in the failure zone (the time dependent constitutive law result in total stress relaxation which has the most significant effect at small t , due to the log law). The initial condition is permeability dependent, in NC clays and in sand the penetration is undrained or drained, respectively.

CONCLUSION AND RECOMMENDATIONS

The few second-long CPT dissipation test records - sampled in the technical breaks of the standard CPT procedure - was qualitatively investigated aiming at the use of a “no cost” method in soil characterisation. It was found that the aim is realized since there are significantly different records for the granular and the remainder soils in the short f_s dissipation tests, in sand increase, in the remainder soils a plasticity dependent stress decrease may occur. The latter is explained here by a permeability dependent nature of consolidation (besides post-depositional effects) in normally consolidated (NC) soils which may result in more than 50% stress drop. Further research is suggested in the effect of residual stress redistribution which is suggested to be observed by instrumented equipment and to be simulated in the function of the clamping effect by a sophisticated numerical approach including constitutive laws treating dynamic-static transition.

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WATER SUITABILITY FOR IRRIGATION IN THE GUERBES-SANHADJA WETLANDS COMPLEX

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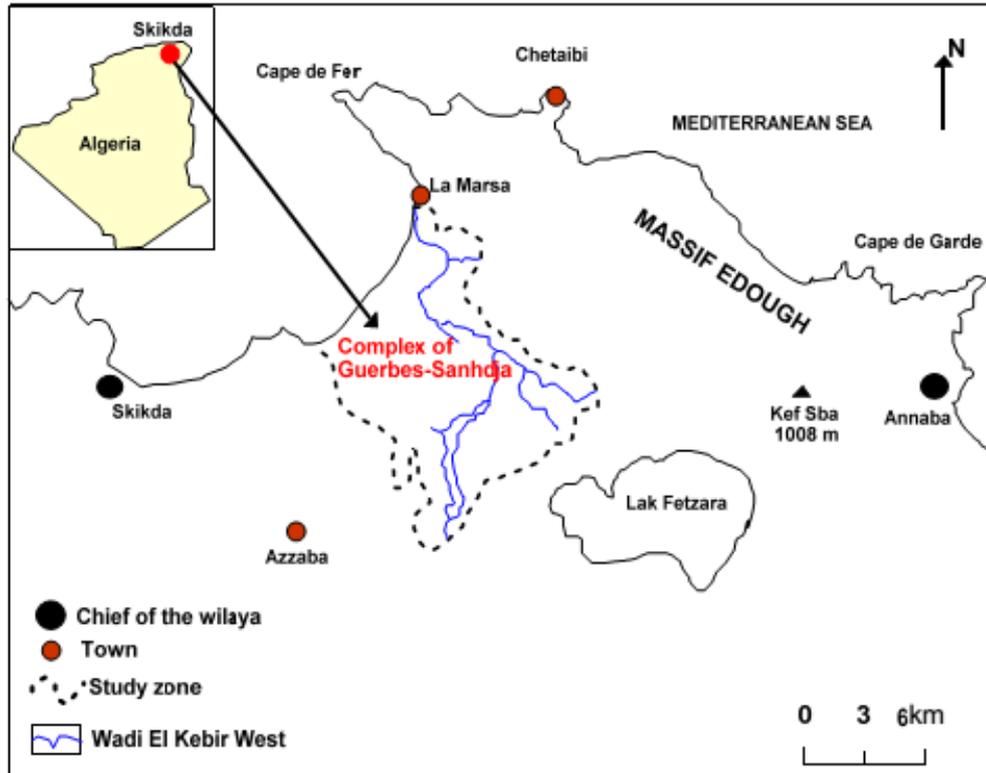
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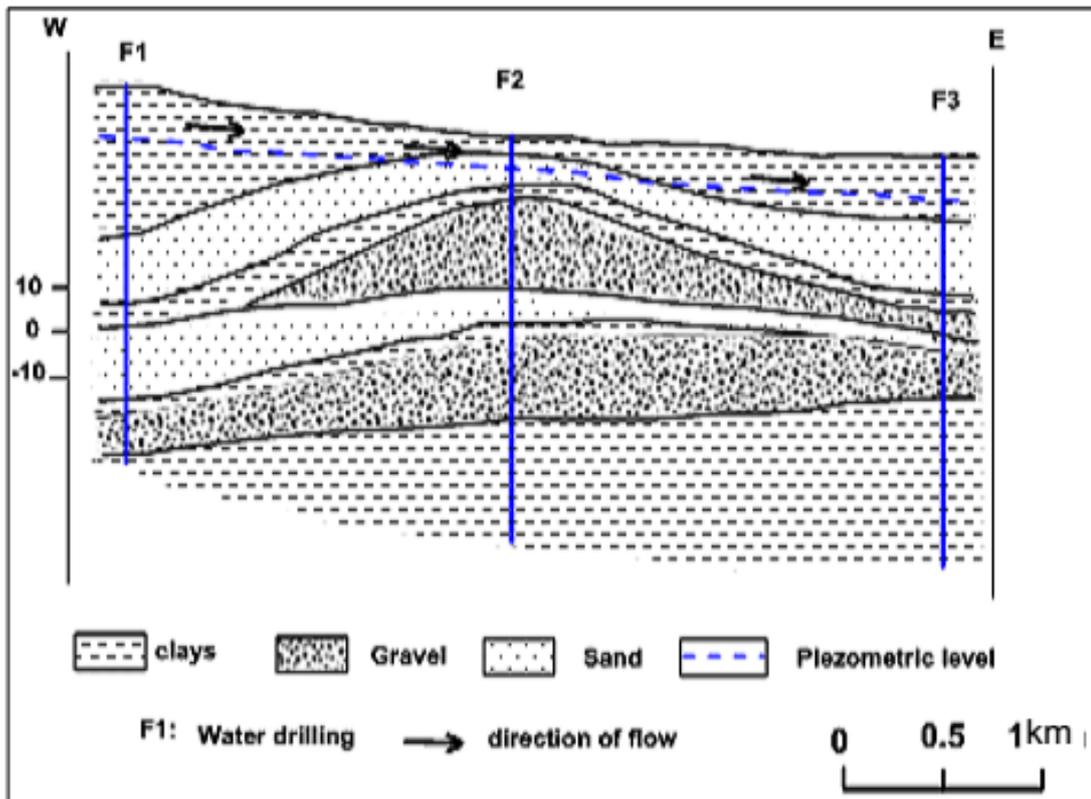
Abstract : The wetland complex of Guerbes-Sanhadja (north-eastern Algeria), has experienced in recent years a certain economic expansion, particularly agricultural, about 47% of the useful agricultural area marked by several varieties of crops ranging from market gardening to speculative crops, requiring large quantities of water for irrigation purposes, however the swampy areas are the main sources used for irrigation purposes in this practice. It is therefore necessary for this water to have physicochemical properties adapted to plants, in particular the absence of salinity. This study was done to evaluate the status of the swamps areas quality and its suitability for irrigated agriculture. To achieve this objective, water samples from ten swamps areas water were collected from Guerbes- -Sanhadja in February and June of 2016. The water quality of these swamps was estimated from different water quality parameters such as pH and electrical conductivity (EC), the chemical parameters like Na^+ , K^+ , Ca^{2+} , HCO_3^- , SO_4^{2-} , Cl^- , BOD_5 , NO_3^- , NO_2^- , NH_4^+ and PO_4^{3-} . Based on the physico-chemical analyses, irrigation quality parameters like sodium absorption ratio (SAR), percent sodium (% Na), residual sodium carbonate (RSC), permeability index (PI), magnesium hazard (MH) were calculated. The results showed that the overall concentration of nitrate was very high. About 60 percent of the swampy areas had suitable water quality for chloride, and they had a concentration below the permissible limit for crop irrigation. From the Richards diagram, it is observed that most of the samples from the study area fall in the good to permissible classes for irrigation purpose

Keywords: Algeria, irrigation, residual sodium carbonate (RSC), sodium absorption ratio (SAR), water quality, wetland complex of Guerbes-Sanhadja

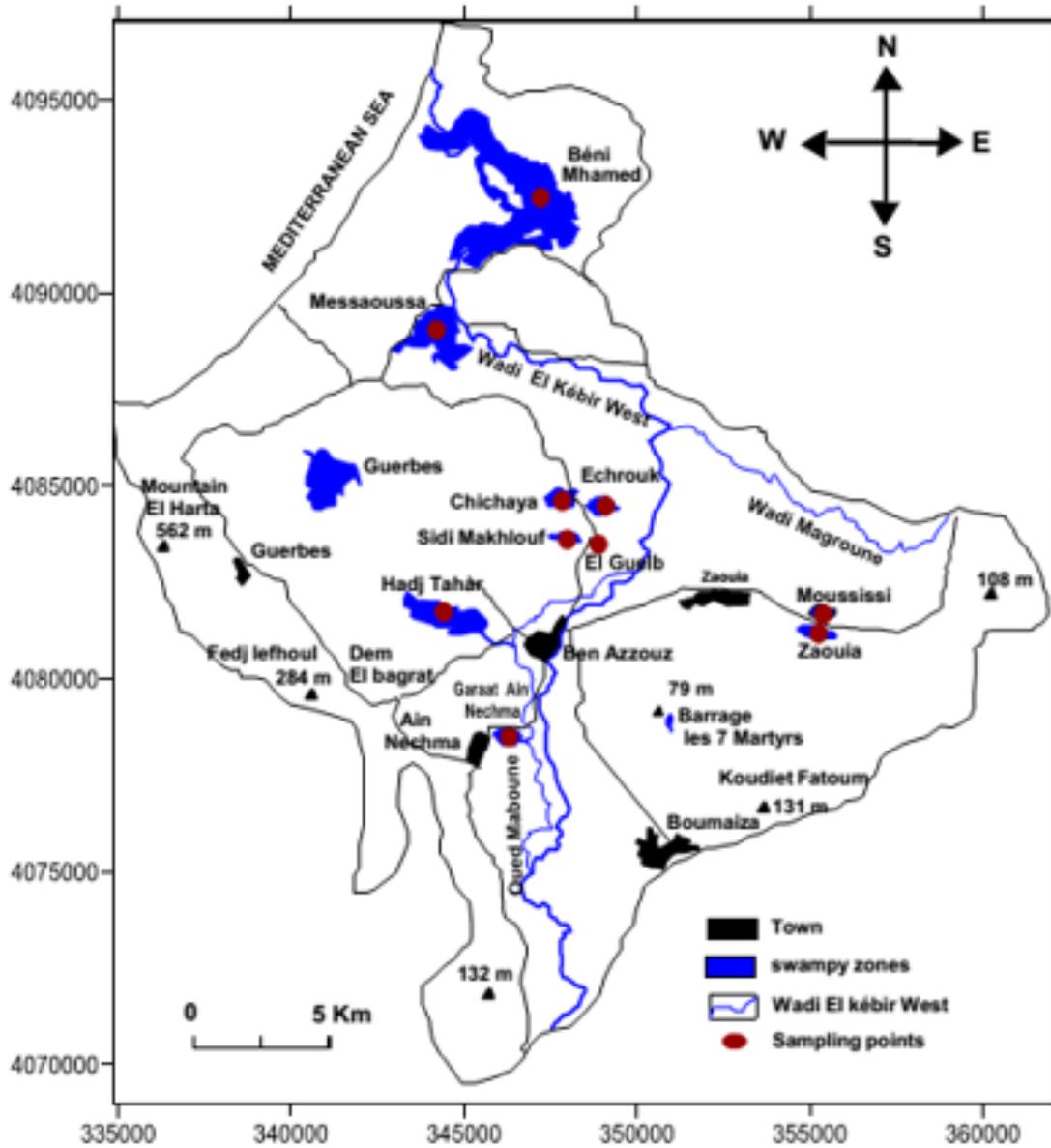
SITUATION MAP OF THE STUDY AREA



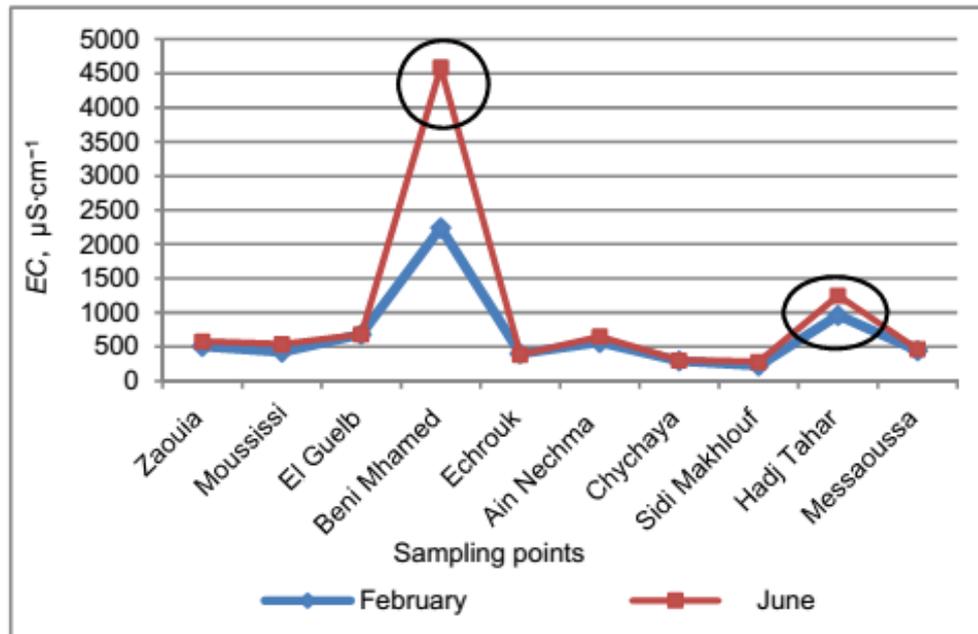
HYDROGEOLOGICAL CROSS-SECTION THROUGH THE STUDY AREA



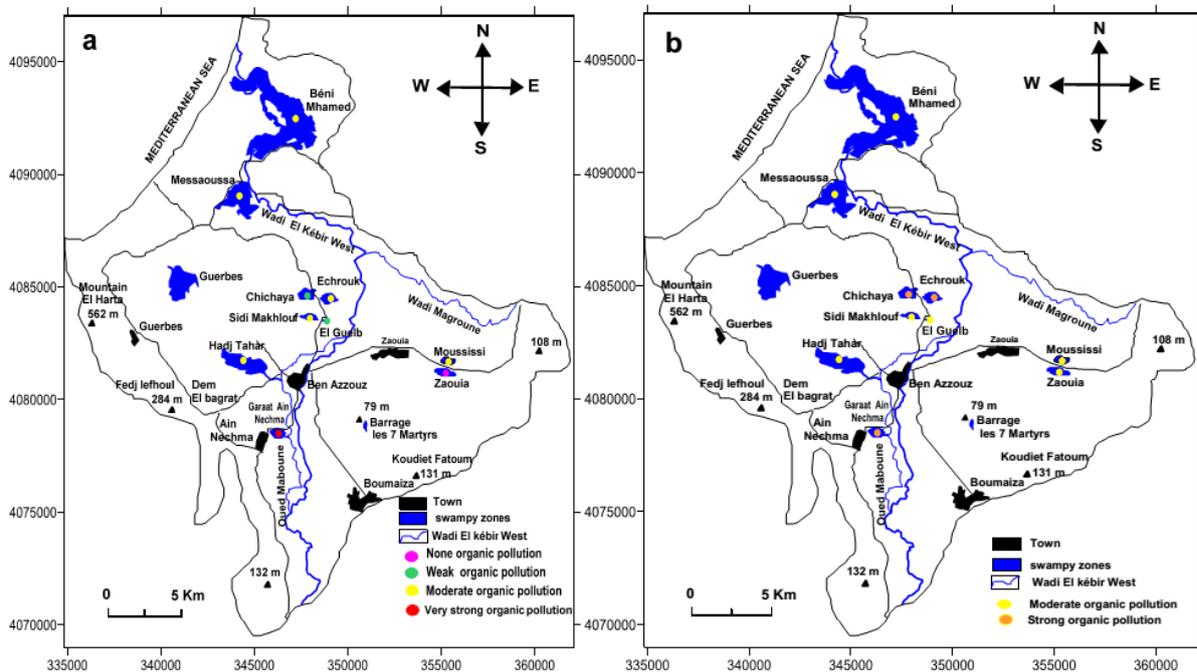
MAP INVENTORY OF WATER POINTS IN THE REGION



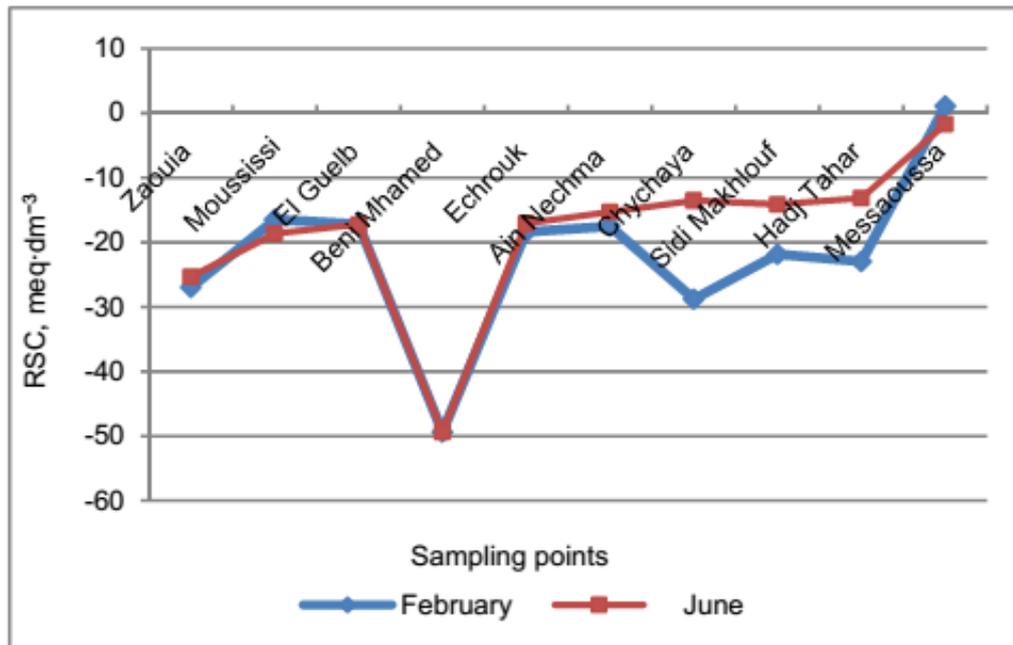
VARIATION OF THE ELECTRICAL CONDUCTIVITY (EC)



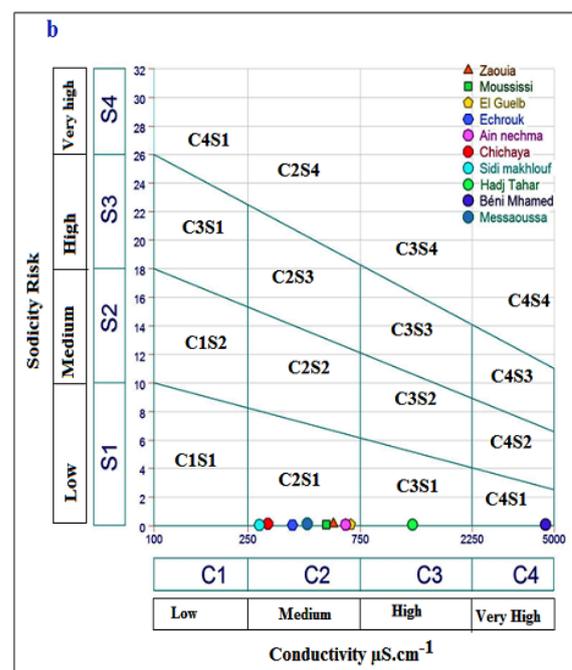
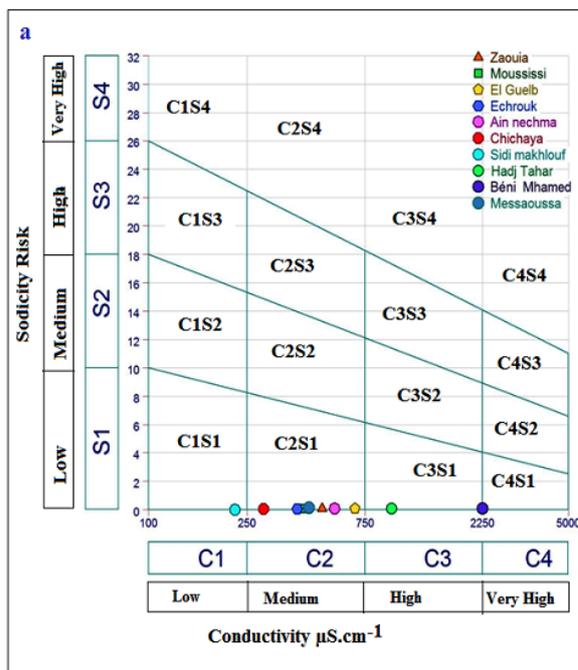
ORGANIC POLLUTION INDEX (OPI) MAP OF GUERBES-SANHADJA SWAMP WATERS: A) IN FEBRUARY 2016; B) IN JUNE 2016;



SPATIAL VARIATION OF RSC VALUES OF SWAMP AREAS



WATER QUALITY WITH RESPECT TO SAR AND EC: A) IN FEBRUARY 2016; B) IN JUNE 2016;



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PHYSICO-CHEMICAL AND MICROBIOLOGICAL CHARACTERIZATION OF 4 OLIVE POMACE

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Abstract: The olive industry, in addition to its main production which is oil, leaves two main residues, one liquid called wastewater and the other solid called olive pomace. We are interested in this work to the valorisation of these olive pomace by characterizing them. For this we have done physicochemical analysis of olive pomace from several Algerian regions (Jijel, Bejaia, Skikda, El oued) and research from these pomaces of different microorganisms with an interest in biotechnology. The results of the physicochemical analyses are consistent with several studies carried out on olive pomace. Microbiological analyses show the biodiversity of the microorganisms present in the olive pomace (a total aerobic mesophilic flore varied between $2.67.10^5$ CFU/ml and $2.75.10^5$ CFU/ml, yeast and mould varied between $2.24.10^5$ CFU/ml and 3.10^5 CFU/ml, lactic bacteria varied between $2.81.10^5$ CFU/ml and $3.17.10^5$ CFU/ml). Based on our study we found that the antibacterial activity of lactic acid bacteria isolated from the olive pomace is more or less important and that this activity is different from one lactic bacterium to another which may be due to the nature of the inhibiting agent or the species of bacteria selected. We can conclude that the olive pomace tests are very rich in micro-organisms and additional studies are necessary in order to identify these microorganisms that can be valued by several methods (biological, thermal, energy, etc.)

Keywords: antibacterial activity, aerobic mesophilic flore, lactic acid bacteria, olive pomace, recovery, waste

INTRODUCTION

The olive tree is a sacred tree of ancient civilizations, has always played a very important role in the Mediterranean population's life. The discovery of its oil the benefits, which is now an integral part of what is commonly known as the Mediterranean diet has given rise to a dazzling and deserved return to olive cultivation [1]

The Algerian olive industry generates, in addition to oil as the main product, large quantities of solid by-products (olive pomace, leaves and wood) and liquids (wastewater). Landfilling of this type of waste is not permitted by Algerian legislation [2].

Olive pomace contains most of the dry matter of the olive, consisting essentially by the epicarp of the fruit, the mesocarp (pulp of the olive) and the endocarp (shell and almond). It may contain a certain proportion of water which contains the water-soluble components of the olive which depend on the extraction system used [3].

World production of olive pomace can be estimated at about 2.9 million tonnes. Each year, olive-growing countries record large volumes of this by-product. On average, the treatment of 100 kg of

olives produces about 35 kg of olive pomace, 100 litres of wastewater and 25 kg of leaves and twigs annually [4].

The majority of the olive pomace released into the nature are considered as a source of pollution; either because they are contaminated by fungi or because they release toxic substances into the environment. Fungal toxins or polyphenolic compounds that resist to bacterial degradation can then leach and pollute nearby water sources, threatening human health and the environment. To compensate this pollution, the olive pomace is upgraded to beneficial products [5].

It is therefore necessary to further research into the development of new methods and technologies for bioremediation of olive pomace, in order to enhance them through microbial biotechnology [6].

With this context, the objective of our work is to focus on the physicochemical analysis of olive pomace and the research based on the pomace of the various micro-organisms with an interest in biotechnology, and mainly the characterization and highlighting of the antibacterial activity of lactic bacteria isolated from these olive pomaces in order to valuing this waste.

MATERIALS AND METHODS

1-Sampling: The olive pomace used in this study comes from the crushing of 80% of the «Chemlal» variety harvested during the olive growing season from November to January 2018/2019. These olive pomaces come from four Algerian oil mills located in different wilayas: Jijel, El-Oued, Bejaia and Skikda «Collo».

2-Physicochemical analyses

The pH determination consists in introducing the pH meter electrode into the olive pomace. The reading is done directly by the pH meter.

Moisture determination (NF V03-921, 1993) corresponds to the mass loss suffered by the sample after drying in the air circulation oven.

The determination of mineral matter (ash) (NF V03 760, 1981) is carried out on the residue of this pomace after destruction of the organic matter by incineration in a THERMO SCIENTIFIC muffle oven set at 550°C for 5.

The determination of butterfat (AOAC 2003.05, 2003.06) was made by extraction of fat from the olive pomace by hexane using the Soxhlet (Soxtec Foss 2043) device.

The determination of total nitrogen matter (AOAC 960.52, 1997) by the Kjeldahl method of nitrogen determination consists of three steps: Mineralization of organic matter by sulphuric acid in the presence of a catalyst, alkalization of the reaction product, distillation and titration of the released ammonia. the protein content is obtained by multiplying the nitrogen content by the factor 6.25.

The total nitrogen content of olive pomace is measured using three instruments: a FOSS TECATOR TM DIGESTOR AUTO, a DIICHI DISTILLATION UNIT K_355 and a titration device.

The raw fibres (ISO 6865(AOAC 978.10)) content of olive pomace is determined by the WEENDE method which is based on the solubilization of non-cellulosic compounds in the sulphuric acid and sodium hydroxide solution.

3-Microbiological analyses

The olive pomace was prepared according to [7]: the samples of the olive pomace used were ground using an IKA M20 crusher. 5 g of the olive pomace pulp shredded was dissolved in 50ml of sterile physiological water and left to macerate under agitation for 2 hours.

3-1-Bacterial enumeration

After several dilutions, it was carried out the search and the enumeration of Total aerobic mesophilic flora (TAMF), yeast and mould and lactic bacteria on MRS (De Man, Rogosa and Sharpe) agar for the latter.

3-2-Morphological study

This study is based on macroscopic and microscopic observation. For the macroscopic study it's allows to highlight the colony morphology obtained on solid media, it is an observation with the naked eye that consists in determining the following parameters (Size, colour and shape of colonies). The microscopic examination based on the Gram staining and catalase search.

The Gram staining is founded on the affinity of bacteria to certain dyes due to the constitution of their wall. This staining also allows to observe the morphology of bacteria (elongated forms for bacilli and rounded for cocci) [8,9]. The Catalase is involved in the decomposition of hydrogen peroxide H_2O_2 into oxygen and water. To determine whether a particular bacterial isolate is capable of producing a catalase enzyme, a small inoculum of bacterial isolate is mixed with a hydrogen peroxide solution (3%) and is observed for the rapid formation of oxygen bubbles. The lack of catalase is evident in a lack or low production of bubbles [10,11]. The gram+ and catalase -isolates are selected for detection of possible antibacterial activity.

3-3-Purification and preservation of isolated strains

In order to purify the strains, two successive transplants are carried out on MRS or M17 isolation media. The purification of the strains consists in seeding them in streaks on poured petri dishes with MRS (solid) media. The boxes are incubated at 37°C for 24 hours. The operation is repeated until the pure colonies are obtained [12].

3-4-Identification of antibacterial activity

Four reference pathogenic strains were used in this study: one gram-negative strain: *E. coli* and three gram-positive strains: *Staphylococcus aureus* 25, *Staphylococcus aureus* 43 and *Lactobacillus bulgaricus*. Antibacterial tests must be performed from young cultures (18-24h) in exponential growth phase.

In order to test the antibacterial activity of olive pomace, we used the standard antibiogram method, also known as the agar diffusion method (disc method).

The antimicrobial activity of lactic acid bacteria is evaluated against pathogenic strains. Lactic bacteria are cultured in the MRS medium and pathogens are also originally grown in their preferred environments according to [13]

STATISTICAL ANALYSIS

All determinations and measurements were carried out in triplicate and the results presented are the averages of this triplicates. Statistical analysis (mean) was performed by using the excel standard software package.

RESULTS AND DISCUSSION

1-Physico-chemical characterizations

Table 1 presents the results of physicochemical analyses of olive pomace from four different regions in Algeria (Jijel, El-Oued, Bejaia and Skikda).

Table 1. Values of physicochemical analyses of four types of olive pomace.

Wilaya	pH	Dry Matter %	Moisture content	Mineral matter	Fat Matter %	Raw Fibres %	Nitrogen Content %	Protein Content %
Jijel	6.39	93.34	6.66	4.50	12.33	44.62	0.80	5.05
El-Oued	5.16	92.83	7.16	1.95	8.7	NA*	0.72	4.55
Bejaia	4.46	92.41	7.58	2.78	5.38	49.26	0.77	5.8
Skikda	6.49	93.26	6.73	1.98	9.45	44.64	0.78	4.93

*NA: not available

The results obtained indicated that there is no pH difference between the two Skikda and Jijel regions (6.49 and 6.39 respectively). Our results are comparable to those found by [14], which found a pH of 6. For Bejaia and El-Oued, the pH is more acidic (5.46 and 5.16 respectively). These results are similar to those found by [15], with a pH of 5. This corresponds to the range cited in the literature, which is between 5 and 9 [16]. Thus, the pH of the four olive pomace is slightly acidic as cited by [17]. For the dry matter ratio, the highest values are Jijel and Skikda (93.34% and 93.26% respectively) followed by El-Oued and Bejaia (92.83% and 92.41% respectively). Exhaustion, an economically indispensable operation, makes it possible to have a product whose content varies between 3 and 4% of the dry matter [4].

The four samples of olive pomace had different moisture contents, the sample of the Bejaia region is the highest 7.58% followed by that of El-Oued 7.16%. The same observation was reported by [18] who found 7.6%. The Jijel and Skikda samples had low moisture content (6.66% and 6.73% respectively). They are comparable to the one found by [19] which is 6.20%. All our results are inferior to those found by [20] which indicated that the humidity of olive pomace is 8%. He reports that air drying has reduced moisture.

The mineral analysis gave a maximum value of 4.50 % to Jijel olive pomace followed by 2.78% Bejaia. For Skikda and El-Oued, the mineral content of olive pomace is very close (1.98% and 1.95% respectively). Our results are much lower than those found by [18] who reported that the rate of mineral matter is 5.6%. For [4], the mineral content is normally low (3-5%), the high levels are due to the absence of washing and the presence of olives collected from the ground.

Jijel olive pomace has a higher fat content of 12.33% compared to the others but it remains below the standard declared by [21] which has a percentage between 8-15%. According to [4] and [21] fat content is one of the most important variations. It is relatively high and varies mainly according to the technological process used, the time of the torque, grinding/mixing and the pressure exerted on the press greatly influence the extraction yield. The value which exceeds the standards can be explained by the lack of compliance with the technical standards of the technological process by the grinder [21].

The results of the analysis of the raw fibres obtained indicate that the Bejaia olive pomace has the highest content 62.26%. Jijel and Skikda samples have almost the same fibre value (59.62% and 59.64% respectively). The raw cellulose content is high (32-47%) and the sieving reduces them to 14-26%. Further analysis of the fibrous fraction shows that the olive pomace has high levels of parietal constituents and especially of lignin 'fibrous fractions' and especially lignin and cellulose. The parietal fraction of the olive pomace is characterized by a high lignin content (lignin detergent acid) which shows up to 30% of the total fibres [4].

For total nitrogen content, Jijel olive pomace has higher N₂ and protein values (0.80% and 5.05% respectively). Same value as [18] they found 0.80% for N₂. The others, El-Oued, Bejaia and Skikda have values close to N₂ and protein (0.72%, 0.77% and 0.78% for N₂ 4.55%, 4.8% and 4.93% for proteins respectively). [22] found 0.24% to 0.58%. Our N₂ results are lower than those found by [15] who found 1.86. On the other hand, EN ISO 17,225-1: 2014 reported that N₂ must be 1.5%. Nitrogen content varies less widely, on average around 10%, but most of it is related to the parietal fraction [4]. The chemical composition of olive pomace varies within very wide limits, depending on the stage of maturity, the oil extraction process and the solvent depletion. Technological processes modify the

relative proportions of the different components of the pomace (epicarp, mesocarp, endocarp and almond) that have different chemical compositions [4].

2-Microbiological Characterizations

The results of microbiological analysis of the samples are grouped in Table 2. The olive pomace tested was mainly colonized by the total aerobic mesophilic flora, including lactic bacteria, fungi and yeasts.

Table 2. Bacterial enumeration of four types of olive pomace.

	Jijel	El-Oued	Bejaia	Skikda
TAMF	2.67×10^5	2.75×10^5	2.73×10^5	2.5×10^4
Yeast and Moulds	2.53×10^5	2.24×10^5	3×10^5	2.87×10^5
Lactic bacteria	2.81×10^5	3.14×10^5	3.17×10^5	2.85×10^5

This study reveals that this four olive pomace contains a fairly large microbial load. The load of total aerobic mesophilic flora in the El-Oued and Bejaia samples is higher than in the other samples (2.75×10^5 CFU/ml and 2.73×10^5 CFU/ml respectively). The Skikda sample was the least contaminated with this flora, at 2.5×10^4 CFU/ml. All results are in the same range as [23] who found that the total aerobic mesophilic flore load varied from 2×10^4 to 10^7 CFU/ml.

The total aerobic mesophilic flore load of olive pomace samples reached high values, probably due to: prolonged storage in orchards in contact with the soil and exposure to microbial contaminants, as well as multiplication of microorganisms during olive crushing and pressing operations and prolonged open-air storage of pomace [23].

They also found that the olives pomaces are encumbered with yeast and mould, the results show that the average number of yeast and mould colonies in the Bejaia sample is higher than in the other samples (3×10^5 CFU/ml), followed by the Skikda sample (2.87×10^5 CFU/ml). The lowest average colony counts were obtained from the El-Oued and Jijel samples (2.53×10^5 CFU/ml and 2.24×10^5 CFU/ml respectively). These results are in line with those given by [23] who found that the average number of yeast and mould colonies ranged from 2×10^4 to 3×10^6 CFU/ml.

The presence of yeasts and moulds in olive pomace can be explained by their tolerance to environmental conditions (polyphenols, salt content, acid pH) [24]. According to [3] the cellulose-, fat, nitrogen- and mineral-rich composition of olive pomace can be a good source of yeast and mould isolation.

The isolation of new strains of lactic acid bacteria from raw and fermented olives and their derivatives has aroused the interest of several authors from Mediterranean countries [25]. The lactic acid bacterial load was high in the Bejaia sample, at 3.24×10^5 CFU/ml, followed by the Skikda sample at 3.18×10^5 CFU/ml. The samples El-Oued and Jijel samples had the lowest values (3.05×10^5 CFU/ml 3.08×10^5 CFU/ml respectively).

The load of lactic acid bacteria on MRS agar varied from sample to sample, being higher in the Bejaia and El-Oued samples than in the Skikda and Jijel samples (2.85×10^5 CFU/ml 2.81×10^5 CFU/ml respectively). The highest load of lactic acid bacteria was observed in the Bejaia sample, either by isolation on MRS agar or by isolation on M17 agar. Our results are largely inferior to those found by [23] who found lactic acid bacteria loads of 5.6×10^5 to 7×10^6 CFU/ml.

3-Selection of the lactic acid bacteria studied

Antimicrobial substances have the ability to selectively target pathogenic or spoilage bacteria, without inhibiting indispensable bacteria. These bioactive substances are also highly tolerant to pH variations and heat treatment. All these criteria suggest that bacteriocins could be an ideal substitute for chemical preservatives. Eight (08) colonies of lactic acid bacteria are selected for antibacterial activity. Strains are sub-cultured twice on coded SRMs of LB1, LB2, LB3, LB4, LB5, LB6, LB7 and LB8.

4-Morphological study of lactic acid bacteria

The macroscopic and microscopic appearance of lactic acid colonies are described in table 3.

Cultures obtained on petri dishes are observed with the naked eye after incubation 2 days at 37°C. Colonies appeared medium to small in size, from circular or creamy in shape, with a whitish color and a regular perimeter.

Table 3. Morphological characterization of lactic acid bacteria

Isolates	Macroscopic observation				Microscopic observation	
	Colour	Shape	Margin	size	form	Arrangement
LB1	White	Circular	Regular	medium	Cocci	pair and short chain
LB2	White opaque	Oval	Regular	large	Cocci	Isolated, pair and in short chain
LB3	White opaque	Circular	Regular	large	Bacilli	Isolated, pair and chain
LB4	White opaque	Circular	Regular	Large	Bacilli	Isolated, pair and chain
LB5	White	Circular flat	Regular	medium	Cocci	Isolated, pair and in short chain
LB6	White	Oval	Regular	medium	Cocci	Pair and short chain
LB7	White	Circular flat	Regular	medium	Bacilli	Isolated, pair and chain
LB8	White	Circular	Regular	Large	Cocci	Isolated, pair and in short chain

Gram-positive bacteria appear purple. Gram-negative bacteria are pink. This difference in coloration is due to the different nature of their walls: Gram-negative bacteria have thinner walls than Gram-positive bacteria, and are rich in lipids (the outer membrane of the wall), in which ethanol is highly soluble.

Most aerobic microorganisms possess catalase, especially aerobic Gram-negative bacilli. Its absence is therefore an interesting identification criterion. For example, among aerobic Gram+ bacilli, only Streptococcaceae are catalase negative. Lactobacillus and Erysipelothrix are the only groups of non-spore-forming aerobic Gram + bacilli lacking catalase [27]

4-Demonstration of antibacterial activity

The determination of the antibacterial activity of our isolates is demonstrated by diffusion on solid medium using the disk method [28] in comparison to pathogenic bacteria (*Escherichia coli*, *Staphylococcus aureus* 25, *Staphylococcus aureus* 43, *Lactobacillus bulgaricus*).

After incubation at 37 ° C and for 24 h, we noticed the appearance of a clear area around the selected strains. This zone indicates the inhibition of pathogenic bacteria by the selected strains (Table 4)

Table 4- Inhibition of the 8 Lactic acid strains isolated from olive pomace. (Radius of zone of inhibition measured in mm)

	LB1	LB2	LB3	LB4	LB5	LB6	LB7	LB8
<i>Escherichia coli</i>	10 mm	-	6 mm	5 mm	-	-	-	-
<i>staphylococcus aureus</i> 25	12 mm	-	-	7 mm	-	-	-	-
<i>Staphylococcus aureus</i> 43	-	-	-	-	-	-	-	-
<i>Lactobacillus bulgaricus</i>	-	-	-	-	-	-	-	-

The results of Table 4 indicate that the strains selected (LB1, LB3 and LB4) have antibacterial activity:LB1 against *staphylococcus aureus* 25, *Escherichia coli*. LB3 against *Escherichia coli*. LB4

against *staphylococcus aureus 25*, *Escherichia coli*. The strains (LB2, LB6, LB5, LB7 and LB8) do not have antibacterial activity opposite to pathogenic strains (absence of the clear zone or inhibition).

CONCLUSION AND RECOMMENDATIONS

The aim of our work was to characterize four samples of olive pomace using physicochemical and microbiological analyses, as well as isolating lactic acid bacteria and testing their anti-bacterial activity for their ability to inhibit the development of undesirable germs. The physicochemical analyses showed that the four olive pomace varieties produced very different results. Their pH ranged from 5.16 to 6.49, humidity from 6.66% to 7.38%, dry matter from 92.41% to 93.34%, mineral matter from 1.95% to 4.5%, fat matter from 5.38% to 12.33%, crude fiber from 44.62% to 44.64% and total nitrogenous matter including N₂ from 0.72% to 0.80% and protein from 4.55% to 5.05%.

For microbiological analysis, total aerobic mesophilic flora showed a high load of 2.5×10^4 CFU/ml to 2.75×10^5 CFU/ml. For yeasts and molds, colony counts ranged from 2.24×10^5 CFU/ml to 3×10^5 CFU/ml and can be explained by their tolerance to environmental conditions (polyphenols, salt contents, acid pH). The antibacterial activity of lactic acid bacteria isolated from pomace showed different diameter zones for three of the eight bacteria (LB1, LB3 and LB4), possibly due to the nature of the inhibiting agent or the species of bacteria selected.

For subsequent investigations, it is necessary to complete further research on olive pomace in order to valorise this waste, identify and characterize the antibacterial substance produced by lactic bacteria; characterize the producing strains; and the microorganisms isolated from olive pomace can be further explored as in the field of biotechnology and the agri-food sector

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MODELLING TECHNICAL EFFICIENCY WITH PRODUCTION RISKS: (CASE STUDY FISH FARMS OF KAMYARAN COUNTY)

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Abstract: In view of the significant features and potential to produce significant amounts of water every year across the country fishery products are produced here. Accordingly, the aim of this study was to evaluate the technical efficiency of fish despite the risks of production. Information required by the questionnaire were obtained from 55 Kamyaran county Palangan unit area. In order to accomplish the aim of the study was used to model the stochastic frontier production function in which risk and inefficiency were estimated simultaneously. The results confirmed that the adoption rate of feed inputs, labour and fry were associated with the production of fish. Result of technical efficiency in the units of production of 61% was obtained by considering risk. This amount is influenced by things like experience, membership in cooperatives and extension courses.

Keywords: Fish farming, Production risk, Technical efficiency, Kamyaran, Stochastic frontier model.

INTRODUCTION

The agricultural sector plays a major role in the economic development of the country. The importance of this sector in terms of food security, employment creation, preventing foreign exchange outflows, and its relationships with other sectors should be taken into consideration.

Generally, all productions are subject to uncertainty and risk, but the risks associated with agricultural products are particularly evident and tangible, resulting in significant damages for farmers and rural residents. In this regard, farmers and producers in the agricultural sector face a type of uncertainty in production. In this context, there is a wide range of intervention policies such as education, training, and program development that are considered efforts to increase the efficiency of agricultural products (Naghs and colleagues, 2010).

Aquaculture has shown the highest growth in food production among other sectors in the past two decades. According to the report of the World Food and Agriculture Organization, aquaculture is the only source that has the greatest motivation for poverty alleviation. The excessive population growth in most countries of the world, especially in developing and developing countries, has made it necessary to increase the annual production of fish products for countries that have the necessary water resources and facilities.

Due to the presence of uncontrollable factors and risky conditions, the efficiency of production units naturally declines. Therefore, the differences observed between actual and expected performance may reflect differences in efficiency, differences in the consequences of risky decisions, or both (Naghs and colleagues, 2011).

Due to the fact that some factors increase the level of variance in the standings (production risk) while others reduce it (Ash and Tors, 1999), reasons have been given for the importance of production risk resulting from the use of factors in empirical analysis of firm behaviour and productivity changes.

The first reason is that risk-taking producers choose the level of factors in such a way that it differs from the optimal level of factors used by neutral producers for risk. The second reason is that risk-taking producers, when adopting a new technology, do not necessarily choose a technology with the highest average production due to a lack of information about the technology, factors, or desired idea. Evaluating efficiency in the biological production sector has important consequences. These evaluations show the importance of the impact of factor in production risk (Genick and colleagues, 2003, Ilenau and Fleming, 2006). This means that the participation of production risk in measuring the efficiency of production units is important.

Despite having long maritime borders in the north and south of the country and abundant water resources in various parts, Iran has not made significant progress in the field of reproduction and cultivation of various marine fish, shrimp, and shellfish unlike other countries. Kurdistan province, due to its abundant water resources and mountainous region, is considered one of the suitable areas for expanding aquaculture and increasing related production.

According to available information, over 800 tons of edible fish are produced annually in this region, part of which is exported to Iraq in frozen form, in addition to domestic consumption (Kurdistan Agricultural Jihad Organization, 2013). Considering the considerable volume of aquaculture production in Kamyaran County, it is necessary to conduct scientific studies on various dimensions of production risks and technical efficiency towards better utilization of existing facilities and assisting planners in formulating essential policies, as understanding the factors affecting fish production, efficiency, and risk can provide producers with a realistic picture and enable policymakers and planners to adopt scientific and practical solutions tailored to the conditions and characteristics of production units. Therefore, the main objective of this article is to evaluate the technical efficiency and production risk in cold-water fish farms in Kamyaran County.

BACKGROUND OF THE RESEARCH

Numerous studies have been conducted separately on the technical efficiency and production risk in both domestic and foreign contexts, but studies that encompass the relationship between the two are very limited. Torkamani and Ghorbani (1995) examined the effect of different inputs on wheat risk. Mosavi and Khalilian (2005) studied the technical efficiency of wheat production in Shahr-e Kord using a stochastic frontier production function. Dashti et al. (2011) investigated the technical efficiency of broiler poultry units and the factors affecting it using a stochastic frontier production function and simultaneous estimation of the inefficiency model. The results showed that factors such as the number of one-day-old chicks, equipment level, and the number of production cycles per year have positive and significant effects on technical efficiency.

Kumbhakar (2002) studied the characteristics and estimation of risk preferences, production risk, and technical efficiency. Bukoshowa and Heckman (2006) studied risk and technical inefficiency as two potential sources of agricultural production changes in Russia. A production function was estimated to assess the impact of inputs on both risk and technical efficiency. The results showed that technical inefficiency increases diversity in Russian agriculture. According to the model estimates, production risk increases the instability of agricultural production, and farm responses to production risk are weak.

Ogunlade and Akinbogun (2010) modeled technical efficiency based on production risk in fish farms in Nigeria. The findings showed that fish production is significantly influenced by labour, fertilizer, and feed. Fertilizer and feed were introduced as inputs that increase risk while labour reduces production risk. Among other results of this study, farmers' educational level, market opportunities, and access to markets improved the technical efficiency of the farms in the study area.

Tideman and Wollni (2012) quantitatively demonstrated the importance of production risk and technical efficiency as two potential sources of diversity in organic and conventional agriculture in Germany. The factors affecting production risk and technical inefficiency can be examined based on the combination of Just and Pope's random production framework and stochastic frontier analysis. The results showed that production risk led to diversification of agricultural products in both farm groups. Land and labour were introduced as inputs that increase risk, while more capital, higher seed

costs, and better soil quality reduce risk. Technical inefficiency was also found to be an important secondary source of diversity in production.

There are two main approaches for estimating efficiency, parametric and non-parametric. Parametric approaches are characterized by a specific functional form, while non-parametric approaches do not require a specific form. Among these approaches, Data Envelopment Analysis (DEA) and Stochastic Frontier Production (SFP) have been widely studied and used. The first report on the relationship between the use of inputs and production risk was presented by Dillon and Anderson. The first attempts to quantify the relationship between the use of inputs and production risk were made by Just and Pope.

According to Just and Pope, a suitable production function for examining the effect of input usage on production risk should demonstrate the ascending, descending, or constant effect of using an input on production risk. Therefore, the main questions of this research are:

1. What factors affect the production of fish in the Kamyaran region?
2. What factors affect the production risk of fish in the Kamyaran region?
3. What are the most important factors affecting the technical efficiency of fish producers?

METHODOLOGY

Stochastic Frontier Analysis (SFA) is a parametric efficiency analysis method based on Aigner and colleagues (1977) and Meeusen and Van den Broeck (1977). Battese and Coelli presented the SFA model in equation (1):

$$y_i = f(x_i; \beta) + (v_i - u_i) \quad (1)$$

where y_i is the output of producer i , x_i is the input used to produce y_i , and β is a vector of parameters. The main characteristic of the SFA model is the error term, which is comprised of two parts, i.e., v_i measures the deviation from the production frontier due to random effects, while u_i measures the deviation from the production frontier due to technical inefficiency. Just and Pope proposed a model consisting of two functions:

$$y = f(x; \beta) + \varepsilon = f(x; \beta) + g(z; \gamma)v \quad (2)$$

where $f(x; \beta)$ represents the usual deterministic production function and $g(z; \gamma)$ is a stochastic component that reflects the link between input levels and output variability, and v is an error term with a normal distribution. As a result, the input x_i may have different effects on the expected level and variance of the output.

The expected level of output is $E(y) = f(x; \beta)$ and the variance of output is $V(\varepsilon) = g^2(z; \gamma)$.

The ultimate effect of input x_i , i.e., the partial derivative of variance with respect to this input, can be positive, negative, or zero:

$$\partial V(y)/\partial x_i = 2g(z; \gamma) \partial g / \partial x_i < \text{or} = \text{or} > 0 \quad (3)$$

When an increase in the input level leads to an increase in the variance of the output, it is said that the final risk of this input is positive, while an input with a negative final risk is one where increased usage leads to a decrease in the variance of the output. Just and Pope's empirical form is given by equation (4):

$$Y_i = f(x_i; \alpha) + h(x_i; \beta)v_i \quad (4)$$

where Y represents the output, x represents the input, $f(x)$ represents the production function, and $h(x)$ represents the variance or production risk, which allows for heteroscedasticity in the disturbance term v .

It is assumed that v_i has a normal distribution with a mean of zero and a variance of 2. The coefficient of the function $h(x)$ in the model represents the final production risk with respect to the input x , which may be positive or negative depending on the sign of h_j . There are three common methods for extending the Just and Pope model to include inefficiency:

1. Additive form: In this case, technical efficiency (inefficiency) is added to the production risk function, while the random component due to production uncertainty is also added. In fact, Battese and colleagues incorporated the usual SFP model proposed by Aigner and colleagues into the Just and Pope model. The result is an SFP model with an attractive risk-pulling feature, expressed as equation (5):

$$Y = f(x) + h(x)(v - u) \quad (5)$$

where y , x , $f(x)$, $h(x)$, and v are as defined earlier, and u represents the inefficiency component that considers technical inefficiency as $u^2 = h(x)$.

2. The multiplication form: In this case, the technical efficiency (inefficiency) is represented by the production function in the form of equation (6):

$$Y = f(x; (1-u)) * h(x; (6)) \quad (6)$$

In this case, an additional assumption is presented in the form of equation $u^{-1} = u \cdot \text{Exp}$

3. In a more flexible format proposed by Kumbakar (15), a cumulative acceptance function $q(x)$ is introduced to explain the efficiency (inefficiency) of a technique. Kumbakar extended Battis et al.'s (1997) model to represent the work of variation inputs and functional form on variance heterogeneity in v_u differently:

$$Y = f(x, \alpha) + h(x, \beta) v - q(z) u \quad (7)$$

$q(x, z)$ represents the effects of inputs and socio-economic variables of farmers on the effects of technical inefficiency, which allows the variance of heterogeneity in the inefficiency of the error term u to be $h(x) \sigma u^2$. Jinik et al. (2003) modified Kumbakar's (2002) model to include the variance of heterogeneity in the random disturbance component v and heterogeneity in the average inefficiency (u component). Just and Pope (1978) argued that $f(x)$ is implicitly defined by a generalized quadratic functional form as equation (8):

$$Y_i = \alpha_0 + \sum_{j=1}^n \alpha_j x_j + \sum_{j=1}^n \alpha_{2j} x_j^2 + \sum_{k=1}^n \alpha_{3k} x_k x_j \quad (8)$$

Also, similar to the studies of Kumbakar 2002, Jinik et al. 2003, Bokoshova et al., 2006, a functional form of Cobb-Douglas is used in the present study to estimate the variance of the function in the form of equation (9).

$$Y = h \left(\sum_{j=1}^n x_j \right) \quad (9)$$

It is assumed that the vector of variables x_j explain the variance of the function or the risk of production in the inputs. This case was used in many experimental studies. As Jinik et al. (2003) showed according to relation (10).

$$y_i = q \left(\sum_{j=1}^n x_j + t = 1 \right) z^t \quad (10)$$

y_i is the yield of the crop harvested by the i -th farm and $x(s)$ is a vector of explanatory variables j of inputs that can be used by the i -th farm. $z(s)$ are vectors of production characteristics T , social and economic variables of farmers and μ_i illustrates the Average inefficiency. β , ϕ , and δ are unknown parameters that must be estimated in order to obtain the elasticity of inputs, the final risk of inputs and the effects of inefficiency of inputs and socio-economic variables of farmers.

The parameters of SFP random frontier model are estimated simultaneously in terms of production risk and production inefficiency in the form of models 8, 9 and 10. For this purpose, the maximum likelihood linear estimation approach will be used.

In this study, according to the stated goals and in order to determine the factors affecting fish production, technical inefficiency and production risk, generalized quadratic function for production, simple linear function for technical inefficiency and Cobb-Douglas function for risk were used simultaneously. were estimated.

According to the investigations carried out in the study area, the amount of released fry at the beginning of the production period, food and work as explanatory variables and the manager's experience, participation in training classes and history of membership in the cooperative were determined as socio-economic variables.

Also, since the stochastic boundary function approach is parametric and the statistical inference is done for its parameters and coefficients, the accuracy of the estimation results should be tested. The technique will be more than the case where there is risk.

The statistical population of this research includes 55 active fish farming units in Kamiyaran city. Data collection has been done by completing the questionnaire. For this purpose, the data of the last production period of the fish breeding units of Kamiyaran city was collected in 2013, and finally the information related to 55 active fish breeding units was used for analysis.

According to the investigations carried out in the study area, the amount of fry released at the beginning of the production period, food and work as explanatory variables with W, F and L, respectively, as well as the manager's experience, participation in training classes and history of being a member of the cooperative. Individual-social variables were marked with E, N and H, respectively.

DATA ANALYSIS

The results related to the estimation of the stochastic frontier function with and without considering risk are presented in Table 1. The first part of the table shows the coefficients of the production function, the middle and the last part of the production risk and technical inefficiency functions.

The average elasticity values of inputs for food, labour and fry are 0.781, 0.397 and -0.038 respectively.

This shows that, for one percent change in food input, the amount of production increases by 0.781%, in the same way, one percent change in the use of labour input will affect the amount of production by 0.397%. According to the numerical values of the tensions, food and labour are inputs that are used in the economic area of production, i.e. the second area, although they may not be used optimally.

It means that the most profitable amount of these two factors should not be used in the fish production process. In the case of baby fish, it can be said that a one percent change in the amount of this input will reduce the amount of production by 0.038 percent.

Table 1. Estimation results of the stochastic frontier model of production and efficiency with and without risk

Variable	Parameters	The results of model estimation with respect to risk		Estimation results of the risk-free model	
		Coefficients	t	Coefficients	t
Production function					
Constant	0β	44.431***	-2.65	39.327***	2.73
F	β_1	14.682***	-2.29	-1.08*	-1.71
L	2β	-0.99*	-1.56	-1.597	-1.59
L	3β	-0.30**	2.03	-0.183*	-1.61
F2	4β	-0.40	0.28	1.78*	-1.38
L2	5β	-0.20	0.80	-0.003	0.05
W2	6β	0.0002	-0.34	-0.001*	-1.33

F*L	7β	1.53	-0.43	1.664***	2.45
F*W	8β	-0.0008	0.04	0.0491	0.028
L*W	9β	0.129***	3.10	0.0173	0.49
Risk function					
Constant	Ψ_0	-2.308	-1.17	-	-
ln L	Ψ_1	-0.607	-1.18	-	-
Ln F	Ψ_2	0.705	0.04	-	-
Ln W	Ψ_3	0.687	0.19	-	-
Technical inefficiency function					
Constant	0	3.70***	2.89	3.003	0.90
F	1	0.14	1.07	0.737*	1.78
L	2	-0.0028*	-1.66	0.0003***	-2.33
W	3	0.00037	0.17	-0.002	-0.21
E	4	-0.229**	-1.78	0.192***	-2.81
M	5	-1.02***	4.92	-1.86***	-4.68
N	6	-0.0279	-1.25	-0.134	-1.08
Number of observations					
	N	55	-	55	-
Wald test	Wald	185.79	-	230.19	-
Log likelihood	Llf	61.981	-	73.21	-

***, **, * indicate significance at 1, 5, and 10 percent levels, respectively.

These results are in line with the findings in the studies of Totras, (1999) and Ogundari, (2010). The total elasticity of inputs is equivalent to return to scale (RTS). In this way, the sum of the elasticities shows that if in the long term all the inputs are proportionally increased by one percent, the amount of production will increase by about 1.14 percent. In order to show the effects of risk in production, the generalized likelihood ratio test was used with the hypothesis that the coefficients of the variance function were zero at the same time in the form of the following relationship:

$$LR = 2 \cdot \ln[L(H_{UR}) - L(H_R)] = 22/45 = 2 \cdot \ln[(98/61) - (21/73)]$$

The LR value equal to 22.45 has been obtained, which is higher than the critical value of the table at the significance level of one percent (11.34), and therefore the assumption that the coefficients of the variance function are zero is rejected.

Table 2 shows the results related to technical efficiency assuming the presence of the elastic risk component and without it. It can be seen that the technical efficiency of farms without considering the elastic risk component has a range from 14.8 to 98.8% with an average value of 73.1%. While the average technical efficiency considering the elastic risk component is equal to 61.5%, the minimum and maximum of which will be 11.5% and 99.6%, respectively. In this way, it can be seen that the consideration of risk in the production process clearly affects the efficiency of fish farms. In such a way that without taking into account the risk of technical inefficiency, it is about 27% and considering the risk, it is 38.5%.

Table 2. **Technical efficiency with and without risk**

	inefficiency	average	maximum	minimum
Efficiency with risk	5/38	5/61	6/99	5/11
Efficiency without risk	9/26	1/73	8/99	8/14

CONCLUSION

This study has focused on technical efficiency estimation by generalizing the SFP model to investigate the risk of input production in 55 fish farms of Kamiyaran city. Estimation of generalized quadratic production function model along with risk and efficiency functions indicates a significant effect of fry, labour and food inputs on fish product production in the studied units. Research findings show that the technical efficiency of farms is unrealistic without considering the flexible risk component. The difference in the efficiency of the units in both cases shows that the production level can be increased significantly with the same inputs and facilities. This increase in production will increase when the sources of risk can be controlled. In this way, it can be concluded that in terms of production risk, it is possible to increase the amount of product production by 38% by effectively using the available resources and controlling the risk-creating resources, while without considering the risk, this figure reaches 27%.

The results also showed that the variable of fry and food increase the variability of production while work decreases the variability of the population. Estimating the technical efficiency of fish farms in Kamiyaran city shows that among other factors of experience, the history of membership in the cooperative and the number of times of going to training classes will improve the technical efficiency of the farms. Participation in educational and promotional courses is an important factor in improving the efficiency of production units, so it is suggested to continue holding educational and promotional courses according to the needs of producers. Considering the effect of the experience factor in reducing inefficiency, it is better to use experienced people as well as forces with relevant scientific knowledge in the management of production units. Also, work is a risk-reducing input, and food and fry are risk-increasing inputs, and therefore family labor should be used more in the production process.

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STORAGE OF HIGHLY FLAMMABLE AND TOXIC PRODUCTS

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Abstract: *The modelling and simulation of industrial accidents is an essential tool for assessing their impact on the environment and on human beings. Oil or black gold is one of the most sought-after raw materials in the world today, given its importance in economic, energy and technological development in general. As part of its activities relating to risk, one must determine security perimeters. Following a loss of stored product, the risks incurred can be instantaneous, such as fire and the explosion of highly flammable product. In this work we use the ALOHA computer code, which is perfectly suited to our problem: it considers a wide range of accident scenarios, provides information concerning the safety of individuals and allows the visualization of risk areas. The ALOHA software models the dispersion according to the elements entered and determines the concentrations of pollutants at ground level. It considers the nature of the product, the leak and the atmospheric conditions. It is also possible to set the mathematical simulation model, or by default to let the software consider a model, hence the objective of this work is to give details about a real or potential chemical release, and then it will generate threat zone estimates for various types of hazards.*

Keywords: *Environment, modelling, explosion, toxic zone, dispersion*

INTRODUCTION

Very early on, societies and geographers became interested in risks with a first approach to the dangers and disasters dating back to Antiquity. They were carried out by two geographers, Strabo and Hippocrates, whose work has been made available updated by K. Hewitt (1997) in region at risk (cited by V. November, 2002), and qualified precursors of risk studies.

The production, storage and use of an ever-increasing number of dangerous products lead in the industry to a considerable increase major accident risk. Most often, these major accidents correspond to the release of toxic products from the series of explosions (Margossian, 2011). To control these risks and protect the workers, the population and the environment, it is essential to implement systematically implements a set of well-defined measures. Despite the technical development of tools for evaluating the effects of hazards and its vast uses to the hydrocarbon industry in Algeria, studies in this direction at the level of drilling sites remain little compared to other oil activities. For this reason, this subject was chosen to give a general idea of the dangerous phenomena and their effects and of course the necessary safety measures during the drilling operation. Modelling the effects of hazards has two purposes. She certainly makes it possible to evaluate the distances of effects required by the regulations in a hazard study, but also to reinforce technical choices (for example the design of a network of sensors, number and positioning a leak detection chain to optimize the kinetics of detection/reaction). At the company level, there is no concrete study devoted to estimation of the effects of a major industrial accident at the drilling site tanker. Oil drilling activities, the location of work equipment such as that the huts are haphazard and haphazard. With this work we will estimate

the safety distances in the event of a major accident during the drilling operation Petroleum is a mixture of hydrocarbons with physicochemical properties that may vary from one deposit to another (Guo, 2007). The physical and chemical properties of petroleum raw materials vary considerably depending on the concentration of the various types of hydrocarbons (Weast, 1979). The chemical composition of oil will depend on the proportion of the different types of hydrocarbons present, which can be of the paraffinic, naphthenic or aromatic type (Chitour, 1999). Crude oils contain nitrogenous hydrocarbons in basic or neutral form (Wuithier, 1972). These compounds can be smelly or have a pleasant smell (Wuithier, 1956).

MATERIALS AND METHODS

The ALOHA software (Areal locations of hazardous atmospheres) is an integral type model that solves the equations for a large number of products.

The input

The input parameters provide information on the location of the accident, the substance chemical in question, the atmospheric conditions, the characteristics of the site and the gas pipeline as well as the release conditions.

Source description

This option allows you to define the origin of the pollutant. Our pollution involving a direct source, we choose the "direct" option corresponding to an explosion in the open air, the amount of gas burned instantly is approximately all the characteristics necessary for ALOHA are then filled in. The user can then decide to apply a Gaussian model, a heavy gas model or let ALOHA decide. Subsequently, he can then ask ALOHA to trace the types of threats: toxic zone, the potential flammability zone or the explosion zone.

RESULTS

Inputs

Location of the site: GPS coordinates (longitude, latitude, altitude).

Date and time of the accident.

Investigated chemical (database).

Atmospheric conditions: speed, direction of the wind and height at which made the measurement, air temperature, relative air humidity, stability class, temperature inversion, cloud cover.

Characteristics of the release: roughness of the ground, state of the release (product inflamed or no), pressure and temperature at the pipe inlet.

Characteristics of the gas pipeline: internal diameter, length, type of surface interior of the pipe.

Outputs

The graphical outputs of the software consist of:

- The temporal evolutions of the flow value (1D).
- The temporal evolutions of the concentration and the dose at a given point (2D).
- The trace on the ground of the concentration (2D).

Limits

The accuracy of the results obtained by ALOHA obviously depends on the quality of input information. However, although the values in input are the most accurate, ALOHA, like any other model, may not be reliable in certain situations, and cannot model certain types of chemical release.

-Predicting the areas affected by the explosion of the gas refining complex in Baraki.

First, the location must be determined using Google Earth with greater accuracy and choose the country. Then we choose the correct time zone.

After that we choose the building parameters.

For the time we can use internal clock of the pc or a constant time to costume the time of action.

The parameter of chemical is by default, or you can use modify button to change the parameter, in our case we are doing study about propane that are stocked in tanks of the refining complex.

For atmosphere we need to write the speed of wind and it direction and select the roughness of ground in our case the wind speed is 5mph and it from NE, in our case the humidity and cloud cover can affect the explosion so we need to select it.

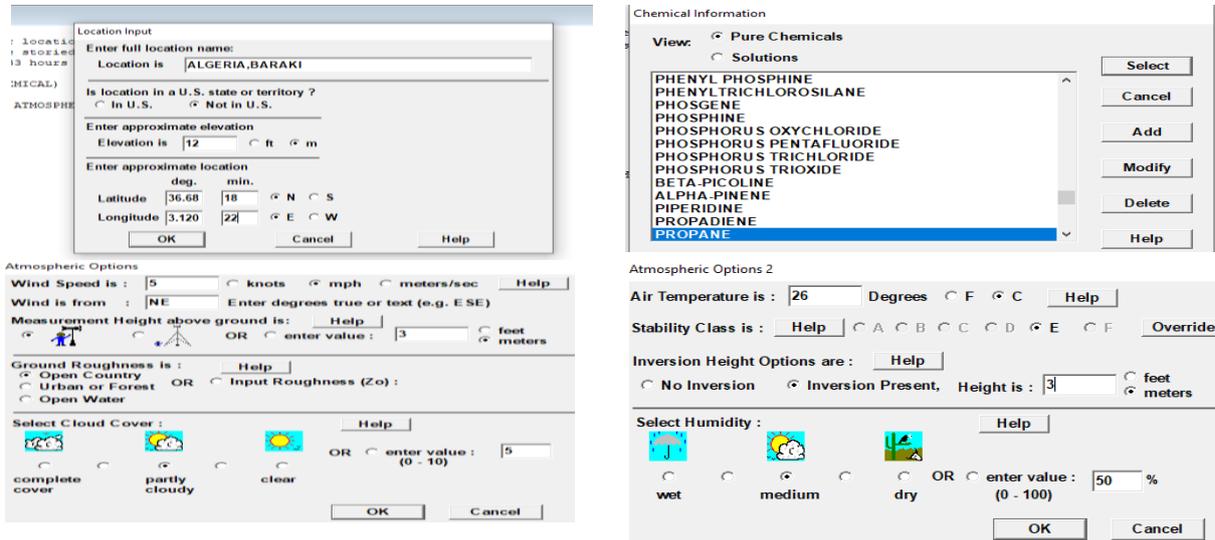


Fig.1 : application windows

ALOHA uses a Gaussian model for the atmospheric dispersion of gases neutrals and has an additional ALOHA-DEGADIS module for heavy gases. The software consists of two modules:

- The CAMEO module, which mainly contains databases chemical and toxicological
- The ALOHA module ("Areal Locations of Hazardous Atmospheres") which is a computer program for assessing, in emergency situations, the atmospheric dispersion, of compounds released under accidental conditions.

The model does not consider fires, explosions, reactions chemicals and mixtures of products but it gives information to assess the hazard fire or explosion.

This program considers the toxicological and physical properties of pollutants as well as the characteristics of the study area such as atmospheric conditions and discharge conditions. To select the source of explosion or pollution click in SetUp then source after choosing the correct. source in our case is tank.

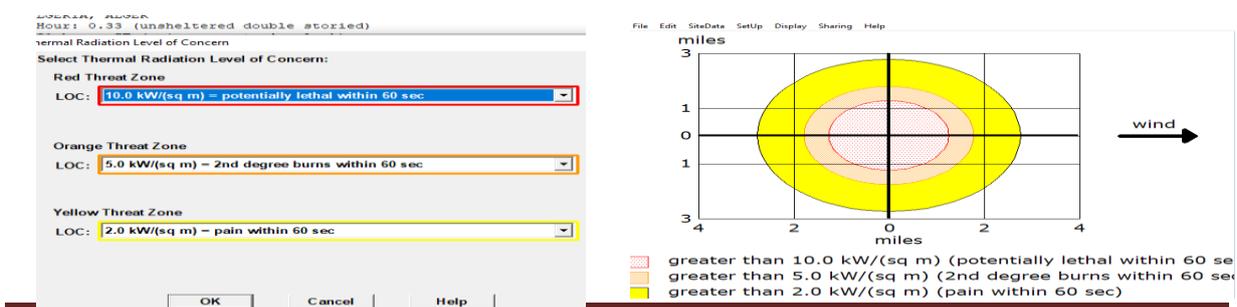
Select chemical state and its temperature.

In our case we choose liquid because the parameters are deferent between gas and liquid.

After entering all parameter, we will end her.

To display that information, we need to click in threath zone and select thermal radiation level of concern, In the end we get dimensions.

To display it in Google earth save it as km file and open it in Google earth and this is the result.



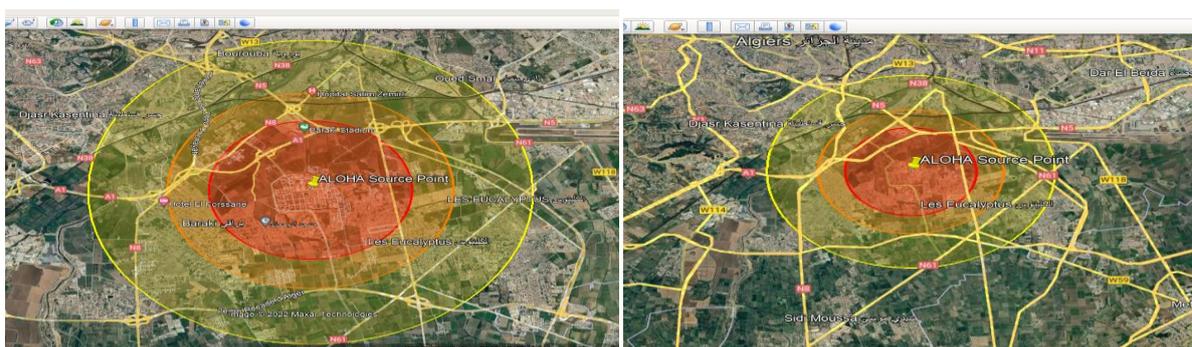


Fig. 2: Presentation

CONCLUSION AND RECOMMENDATIONS

Knowledge of the consequences and risks for populations, the environment and the surrounding territories contributes to better management of these by reducing them, implementing safety and mitigation measures, setting up emergency measures planning, and a risk management program adapted to the nature of the potential major accidents identified. The study concerns the modelling and simulation of accidental release into the environment. We were able to observe that the magnitude of the accident depends on the type of material spilled and its rate of dispersion in the atmosphere. Our results thus demonstrate a very large amplitude in terms of impacts on the population in the event of an accident. The locality in the region could be the most heavily affected by a major accident. According to the results of the modelling obtained, it is concluded that for the inhabited area around Beraki will be strongly touch. According to the ALOHA programme, everyone who lives near to this place 10km are in risk.

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