Ecology & Safety

32ND INTERNATIONAL CONFERENCE

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2023

BOOK OF ABSTRACTS

Ecology & Safety

32nd International Conference

14-17 August 2023

Burgas, Bulgaria

In collaboration with

Union of Scientists in Bulgaria

Science & Education Foundation, Bulgaria

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THE ABILITY OF LEGUMES TO INCREASE SOIL NUTRIENT CONTENT DURING PETROLEUM HYDROCARBONS-CONTAMINATED SOIL PHYTOREMEDIATION

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Abstract

Soil contamination with various chemical compounds and depletion of nutrients is a very important problem in the world. The most common soil pollutants are petroleum hydrocarbons (TPH). Soil pollution caused by TPH reduces the fertility of the soil by affecting the soil's biological properties. Due to the extensive and long-term use of petroleum products, the number of potential spots of soil pollution in Europe is estimated at 2.8 million. Various different methods are used to decontaminate soil pollution, but biological methods, especially phytoremediation, are highly desirable. A very promising type of plant for TPH-contaminated soil phytoremediation is legumes because they have the ability to fix nitrogen and increase soil fertility. Moreover, legumes can use insoluble sources of phosphorus and make them bioavailable.

This study is aimed to evaluate the potential of legumes to increase soil nutrient content during the soil phytoremediation process. Eight species from the Fabaceae plant family were selected for the study. Plants were grown in heavy fuel oil-contaminated soil (2.5 and 4 g kg-1) for 12 weeks. The implementation of legumes in TPH-contaminated soil treatment increased the concentration of ammonium and inorganic phosphorous with the highest increase in the case of L. corniculatus and Onobrychis viciifolia. Growing Phaseolus vulgaris, L. corniculatus, and M. albus maintained soil nitrates close to the initial level. The study demonstrated that M. sativa, L. corniculatus, and M. albus were the most efficient in TPH decontamination and had a positive effect on recovering soil nutrient content.

Keywords: *legumes, nutrients, phytoremediation, soil*

YEAST PREVALENCE AND BIOLOGICAL DIVERSITY IN BALTIC SEA WATER AT THE BUTINGE OIL TERMINAL IN 2021-2022

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Abstract

This study aimed to investigate the biodiversity of yeasts in the Baltic Sea in the area of the Butinge oil terminal and prevalence of oil hydrocarbon degrading yeasts.

For research, 56 Baltic Sea water samples were taken in the territory of the Butinge oil terminal. Samples were taken from 8 locations every quarter from Q2 2021 to Q4 2022. Water was filtered using 0.45 µm filters, which after filtration were placed on Rose Bengal CAF Agar (Liofilchem, Italy) and yeast medium with 1% diesel: ((NH4)2SO4 – 5.00 g/l, K2HPO4 – 0,15 g/l, KH2PO4 – 0.85 g/l, MgSO4 – 0.50 g/l, NaCl – 0.10 g/l, CaCl2 – 0.10 g/l, 1.0% diesel). The plates were incubated at +19.0±1.0°C for 3-4 days. The number of yeast colony-forming units per milliliter of water (CFU/ml) was evaluated. The isolated yeasts were identified using a MALDI-TOF mass spectrometer (Bruker, USA).

One hundred and fourteen yeast isolates were isolated and 33 yeast species were identified, of which the most common were: Rhodotorula mucilaginosa (78.57%), Rhodosporidium diobovatum (16,07%), Filobasidium magnum (14.29%), Debaryomyces hansenii (10.71%) and Aureobasidium pullulans (8,93%). Sixty-four oil hydrocarbon degrading yeast isolates were isolated and 16 oil hydrocarbon-degrading yeast species were identified. The most common species of oil hydrocarbon degrading yeasts were Rhodotorula mucilaginosa (62.50%), Rhodosporidium diobovatum (12.50%), Sporobolomyces roseus (8,93%). No major differences in yeast count (CFU/ml) were observed throughout the study period, with an average yeast count ranging from 0.08 CFU/ml to 0.33 CFU/ml. Oil hydrocarbon-degrading yeasts were detected in all tested samples, but no significant changes in their counts were observed. Their average count was between 0.07 and 0.27 CFU/ml.

Acknowledgments: *The research was carried out in the course of the "Environmental monitoring of the Butinge oil terminal 2021-2025" project of AB "ORLEN LIETUVA".*

MARINE ORGANISMS CONTAMINATION OF METAL IONS IN THE RED SEA OF SAUDI ARABIA

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Abstract

Seafood is the main source of food in many countries due to its healthy nutrients. Fishes and grabs are essential sources of human body proteins. Moreover, omega 3 present in these animals is essential for the human brain and heart. Saudi Arabia is a growing country in the Gulf region and many people depend on the seafood obtained from the red sea. Marine pollution due to toxic metal ions is a natural phenomenon owing to anthropogenic and industrial activities. Consequently, fishes and grabs are always at risk with the assimilation of toxic metal ions in the marine system. The present study deals with the concentrations of the most toxic metal ions viz. Cr (III), Co (II), Hg(II), Pb (II), Se (II), Ba (II), Mn (II), Li (I), As (III), Al (III), Cd (II) Ni (II), V (III), Cu (II), Fe (II), and Zn (II) found in fish and grabs. Fishes and grabs were collected from three different locations of the Red Sea i.e. Yanbu, Al Qunfudhah and Jazan, Western Saudi Arabia. These metal ions were detected in the gills and muscles of all fish species (Sardinella longiceps, Carangoides spp, and Herklotsichthys spp.) along with crabs (Portunus pelagicus). The concentrations of Zn (II) and Fe (II) metal ions were higher in the gills of the grabs than in fishes. However, the concentrations are not exceeded the international permissible limits. The highest concentrations of the metal ions were found in Yanbu reason, which may be due to being close to the industrial area. In addition, the concentrations of V (III) and As (III) in the fish muscles collected from Jazan were high i.e. 6.435 and 3.291 mg/kg respectively. In Al Qunfudhah, the concentration of Cd (II) was high in the gill fish i.e. 0.08432 mg/kg. The lowest and the highest concentrations of metals were in fish muscles and gills, respectively. Therefore, the metal ions were accumulated in the gills. This study highlighted the toxicities of metal ions and their sources of contamination.

Keywords: *Marine organisms contamination, Metal ions, Toxicities, Saudi Arabia*

CONVERSION OF PLASTER MOLDS WASTES INTO THE NEW INORGANIC PRODUCTS BY THERMAL DEHYDRATION

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Abstract

Solving the environmental issues by reducing the waste generated by the industries of building and ceramic materials is a global priority due to their impact on the human health and ecosystems. Recovery of plaster molds wastes from fine ceramic industry is an important topic to address in order to reduce the use of natural gypsum resources and address environmental issues generated by solid wastes from landfill disposal. The main objective of this paper is related to the thermal behaviour study of the calcium sulphate dehydrate during the calcination and to determine the kinetic parameters for the dehydration reactions. Also, the effects of different heating rates on the course of dehydration are investigated, pointing out that the general state of dehydration does not change, although at a given temperature the mass loss is the same for different heating rate. On the other hand, the increase in the heating rate displaces the reaction towards high temperatures. Thus, based on the kinetic study carried out, it was established that the dehydration process needs to take place approximately 50 minutes at a constant temperature of 373 K. Finally, the dehydrated waste is used to obtain a new inorganic material, which can be used for geopolymer preparation. For geopolymeric mortar, 5 % and 10 % from fly ash was replaced with gypsum. The solutions of NaOH 5M and sodium silicate were used to activate the geopolymer. The obtained results indicated a good geopolymer structure formation.

Keywords: *gypsum-based solid wastes, kinetic study of thermal dehydration, geopolymers, fly ash replacing, new building materials*

Acknowledgments: *7335/14.10.2022_Consultancy services in industrial research – for the project " Innovative technological project for the development of a group of AIM (Advanced Inorganic Materials) materials", SMIS 120951.*

SOIL FUNGI RESISTANT TO ORGANIC POLLUTANTS AS A POTENTIAL SOLUTION FOR AIR BIOFILTRATION

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Abstract

Human activity leads to the production and release of many aliphatic and aromatic compounds that have long been considered a major source of pollution that needs to be addressed. Especially those substances that possess one or several aromatic rings (MAHs and PAHs) and volatile organic compounds (VOCs) are of concern, and numerous studies have tried to understand mechanisms of degradation and develop biological solutions to this problem.

Many microorganisms, such as bacteria and fungi have been documented to be able to degrade and even use as a source of carbon and energy these types of organic pollutants. White-rot fungi are well documented for their ability to degrade aromatic compounds due to their enzyme system involved in lignin decomposition. However, several less studied anamorphic fungi and yeasts can grow on different organic compounds (including PAHs and VOCs) as a sole source of carbon. These species are of a great importance for developing strategies for organic pollutants biodegradation, and have often been isolated from sources traditionally contaminated, such as soil and industrial debris.

In this study, mycobiota from different types of soil contaminated with aromatic compounds has been studied to understand the way the pollutants affect the microbiome and fungal communities' composition. Several fungi have been demonstrated to grow well on contaminated soils and their potential for biodegradation of organic compounds is discussed. These insights contribute to moving forward the possible biological pathways involved in the biofiltration of the gaseous pollutants from urban automotive underground spaces and other related applications.

Keywords: *fungi, aromatic compounds, volatile organic compounds, biodegradation*

Acknowledgments: *This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS/CCCDI – UEFISCDI, project number PCE 39/2021, within PNCDI III.*

CONVERSION OF THERMAL POWER PLANT ASH INTO BUILDING MATERIALS FROM ECONOMIC AND ECOLOGICAL PERSPECTIVES

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Abstract

Due to economic advancement based on consumption, it has become necessary to substitute natural resources with waste in order to obtain new products. Considering the principle of sustainable development, a by-product of one industry can be a raw resource for another. Waste valorization has a significant economic influence on the environment by saving energy, raw materials, and minimizing pollutants produced by waste storage. This work presents research into the features of geopolymeric mortar created with ash from several power plants, sodium hydroxide pellets for activation, sodium silicate for Na/Si ration correction, and other additives. A class of innovative eco-materials was developed with the goal of consuming the least amount of energy and raw materials. The synthetized materials can be utilized to substitute cement in construction materials. It provides an innovative and low-cost solution to numerous challenges in which waste must be capitalized. The geopolymer mortar was obtained by mixing at ambiental temperature, and function of additives can be in synthesized as mono or bicomponent material. Raw materials and obtained samples were characterized by SEM, EDAX, FTIR, XRD, etc.

Acknowledgments: *The researches were made in frame of Doctoral School of Gheorghe Asachi Technical University of Iasi. Thanks to 7335/14.10.2022_Consultancy services in industrial research - project SMIS 120951*

THE USE OF WATER REDUCING ADDITIVES FOR DEVELOPMENT OF NEW ECOLOGICAL AND HIGH-PERFORMANCE MATERIALS

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Abstract

The decreasing amount of the world's water supply is a significant issue nowadays. Global warming is one of the key factors contributing to the increasing loss of water supplies, but wasteful water usage for domestic and industrial use is also a major factor. The water consumption reduction by using proper additives is a technique to reduce high water consumption in the construction sector. Sulphonated melamine formaldehyde, sulphonated naphthalene formaldehyde, modified lignosulphonates and polycarboxylate derivatives are examples of additives providing this feature. Condensed polymers are the basis for producing these additives. Their action mechanism consists in the de-flocculation of the cement granules and improving the workability of freshly mixed concrete. The water reduction potency of polycarboxylate derivatives is substantially higher than that of other additives. In the same time, the use of modified lignosulphonates also solves the problem of associated environmental pollution, being a by-product from the wood pulp processing by the sulfite process. Details about water consumption reducing additives will be presented in this paper based on literature review and on the author's own experience: the preparation methods, chemical composition and properties of the obtained building materials.

Keywords: *water consumption reduction, additives, environmental pollution, condensed polymers*

Acknowledgments: *This research was supported by the Gheorghe Asachi Technical University Doctoral School and POC/163/1/3/Innovative Technology Project, project number 399/390075/17.11.2021, Cod SMIS 2014: 120951.*

REDUCING THE CARBON DIOXIDE FOOTPRINT OF INORGANIC BINDERS INDUSTRY

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Abstract

Reducing the carbon footprint is a strategic objective established for environmental protection the European Union. It is proposed that Europe be climate neutral until 2050. This objective can also be achieved in Romania, if the large energy-consuming industries, that produce inorganic binders (cement, lime, plaster), implement the best available techniques. These techniques must ensure climate neutrality throughout the value chain of construction materials, such as: (1) reducing direct and indirect CO2 emissions; (2) increasing the use of alternative material and energy resources; (3) developing products with a reduced carbon footprint; (4) contributing to society's adaptation and combating climate change; (5) carbon capture, usage and storage. Partial substitution of the natural fuels with the alternative fuel and energy resources from sorted industrial and municipal waste can be promising techniques for the reducing of the carbon footprint. Thus, in the combustion process the following wastes can be used: industrial waste (oil tankers, used tires, non-recyclable packaging), non-recyclable municipal waste (wood, paper, plastic, textile, biomass, etc.), agricultural wastes, etc. This paper presents a case study regarding the reduction of the carbon dioxide footprint by using alternative resources such as tires waste and in the cement manufacturing at Tașca Cement Plant from Neamț country (Romania). It has been proven that the use of these resources leads to sustainable benefits related to the partial conservation of non-renewable energy and material resources, as well as to the reduction of carbon dioxide emissions. The measurements CO2 content at the chimney of the clinker showed a decrease between 0.4 % to 3 %. This proves that the introduction of slag at the cold area of the kiln has a positive effect on the reduction of CO2 emissions and implicitly over the environment.

Keywords: *alternative fuels, alternative materials, cement production, emission, slag, tires waste*

Acknowledgments: *This research was supported by the Gheorghe Asachi Technical University of Iasi, Doctoral School.*

ESSENTIAL OILS AND EXTRACTS OF PLANTS AS ALTERNATIVE BIOCIDES AGAINST MICROORGANISMS ISOLATED FROM STONE-BUILT HERITAGE

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Abstract

Stone-built heritage structures, such as historic buildings and monuments, are vulnerable to microbial growth and deterioration. Microorganisms such as bacteria, fungi, and algae can cause structural damage and aesthetic degradation of these cultural assets. The use of traditional biocides, of synthetic origin, to control microbial growth in stone-built heritage structures has raised concerns about their environmental impact and potential harm to human health. Essential oils (EOs) and plant extracts offer a promising alternative, as they are generally considered safe and environmentally friendly. The main objective of this work is the assessment of natural biocides obtained from endemic Portuguese plants, to be used in the preservation of built heritage contributing to sustainable use of ecosystems and development of local communities. The biocidal potential of EOs and solvent extracts (SEs) (ethanol and n-hexane) obtained from four plants were evaluated, namely: Thymus mastichina (Tm), Mentha pulegium (Mp), Foeniculum vulgare (Fv) and Lavandula viridis (Lv). Microorganisms collected at two emblematic sites of Portuguese cultural heritage, the Convent of Christ in Tomar and the ruins of the Roman city of Conímbriga, were used to evaluate the biocidal activity of the EOs and SEs. It can be concluded that: (i) Biocidal activity depends on the microorganism specie; (ii) The SEs exhibit fungicidal and bactericidal activity lower than the EOs; iii) The EOs of Mp, Fv, Lv, and Tm have antimicrobial activity against a broad range of microorganisms, providing a prospective application in the field of green conservation of building heritage; iv) Research to assess efficiency under field conditions is needed, as factors such as concentration, mode of application, and environmental conditions can influence biocidal effectiveness.

Keywords: *Biodeterioration, Built heritage, Plant extracts, Green biocides, Sustainable Conservation and Restoration*

REMOTE MONITORING OF ENERGY-AUTONOMOUS CONSTRUCTED WETLANDS

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Abstract

Constructed Wetlands systems (CW) are nature-based and sustainable technology for treating wastewater, contributing to the management and protection of freshwater resources. Moreover, CW can contribute to valorizing waste materials, producing reclaimed water for diverse applications, and producing plant biomass that can be material and energetically valorized. Because CW efficiency depends on several mechanisms such as physical, chemical, and biological, its real-time monitoring is essential to provide a better use of this technology. This work describes a smart framework for monitoring CW based on IoT devices and sensors, and data science tools providing real-time processing of gathered water quality parameters and environmental variables. Furthermore, the framework manages renewable energy sources to provide the required energy for CW operation and monitoring. Data collected from the sensor network show significant daily variations in water quality parameters. The future processing of these data can provide the development of models to improve the efficiency of the CW.

Keywords: *constructed wetlands, water quality monitoring, real-time analysis, embedded systems, distributed control systems, photovoltaic systems*

MITIGATING THE POLLUTION OF WATERS WITH INNOVATIVE NANOMATERIALS

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Abstract

Water pollution has been acknowledged as one of the major environmental problems confronting humanity in the last decade. Further, inland freshwater resources are becoming scarcer, affecting large populations across the globe. For this reason, various alternative technologies are sought after, to mitigate the pollution of water resources and transform them into drinkable water. These water purification technologies must also be energy efficient and easy to deploy. To achieve these goals, innovative materials must be found. Among the newest technologies, intelligent materials that float on water surface and are capable to extract and remove polluting heavy elements, or toxic molecules have been proposed. Here we introduce a new concept material, whose molecular structure is engineered such that it is capable to float on the surface of water, can collect and remove heavy polluting elements, or target molecules and can be easily collected from the water surface for regeneration. We believe that these materials can be deployed on demand in the areas where the water resources are present but cannot be used for human activities due to pollution. In addition, we believe that this material can become a viable platform for developing of further wastewater treatment technologies. Acknowledgements: This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS/CCCDI-UEFISCDI, project number PN-III-P4-PCE-2021-0306 (Contract Nr. PCE62/2022).

Keywords: *water pollution, Pickering emulsions, ion-imprinted polymers, water purification technologies*

Acknowledgements: *This work was supported by a grant of the Ministry of Research, Innovation and Digitization of Romania, CNCS/CCCDI-UEFISCDI, project number PN-III-P4-PCE-2021-0306 (Contract Nr. PCE62/2022).*

DESTRUCTION OF CHEMICAL WEAPONS IN POLISH MARITIME AREAS - LEGAL OBSTACLES - POSSIBLE SOLUTIONS

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Abstract

The problem of post-war chemical weapons lying on the seabed of the Baltic Sea is an issue which, in addition to posing environmental threats, may soon also have a direct impact on the realisation of many investments planned to be located in Polish maritime areas. In the nearest future this problem will concern in particular investors connected with the construction of offshore wind farms. Despite the fact that these investments are located outside the official sites of chemical weapons dumping, it is necessary to take into account the risk of the presence of chemical weapons in the area of the realised investment during its realisation, in particular at the stage of geological, and construction research. This is due to the fact that to date there is no comprehensive inventory of the Polish maritime areas in terms of estimating the total amount of dumped chemical weapons, the types of chemical warfare agents filling them, and the exact locations of their deposition. The presence of chemical weapons in the area of the planned investment may significantly delay its implementation, thus exposing investors to enormous losses associated with the downtime necessary to remove the threat. In the current Polish formal, and legal State, there is no specific legal basis for taking actions aimed at clearing sea areas designated for economic use of dangerous objects, such as dumped chemical weapons. There is no entity responsible for coordinating such activities, no entity capable of extracting, and destroying chemical munitions with their contained toxic warfare agents in accordance with the law in force, and there are no identified sources of funding for such activities. It is already necessary to take appropriate legal, administrative, and organisational steps for the extraction, and destruction of dumped chemical munitions in the areas of investment activities so that, among other things, the offshore wind farms can start producing energy as planned.

This article analyses the legal obstacles to the clean-up of maritime investment areas from chemical weapons, and identifies the need for legal, and organisational changes to enable investors to safely carry out their planned investments in Polish maritime areas. The aim of this article is not to analyse the issue of the clean-up of chemical weapons in the Baltic Sea, although this problem is also the subject of numerous discussions on the international forum, in particular the European Parliament.

Keywords: *Chemical weapons, Baltic Sea, Chemical Warfare Agents, Chemical Weapons Convention*

THE EFFECT OF CLIMATE WARMING ON MICROBIAL LOOP FUNCTION IN PEAT POOLS AND SPHAGNUM HOLLOWS: MESOCOSM EXPERIMENTS

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Abstract

Climate change models predict a possible increase in air temperature of 2–8°C. This means that global warming will significantly affect the functioning of various types of hydrogenic ecosystems. However, the effect of the temperature increase on microbial loop function in small water bodies associated with peat ecosystems (peat pools and Sphagnum hollows) is still unknown. We used mesocosm experiments (control and treatments with a 2°C, 4°C and 8°C temperature increase) to determine the response of bacterioplankton, flagellates, testate amoebae and ciliates to simulated temperature changes, taking into account seasonal variation in the temperate climate zone. The simulated increase in climate warming increased the species richness of ciliates and the abundance of bacteria, flagellates and ciliates. On the other hand, there was a decrease in the species number and abundance of testate amoebae, the top predators in peat ecosystems. At the same time, warming changed the population size structure of microorganisms in the direction of dominance of small forms, shifted the trophic structure of protozoa towards dominance of bacterivorous taxa, and strengthened top-down control mechanisms by ciliates. The results of the research indicate that climate warming enhances eutrophication processes and affects trophic interactions within the microbial loop. A better understanding of what regulates microbial populations and activity in small reservoirs in peat bogs and unravelling of these fundamental mechanisms are particularly critical in order to more accurately predict how peat bogs will respond to climate disturbances.

HOW CYANOBACTERIAL TOXINS AND OTHER METABOLITES INFLUENCE AQUATIC PLANT PHYSIOLOGY; AN EXPERIMENTAL APPROACH

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Abstract

Cyanobacterial blooms are a worldwide problem. Apart of cyanotoxins such as microcystins, cyanobacteria produce a variety of other oligopeptides. So far, their biological activities are not fully recognized and very little attention has been paid to their effects on aquatic plants. Therefore, acute toxicity tests on two aquatic plants Spirodela polyrhiza and Lemna minor exposed to a range of concentrations of some cyanobacterial metabolites: microcystin-LR (MC-LR), anabaenopeptin A (ANA-A), anabaenopetin B (ANA-B), aeruginosin-98A (Aer-A), aeruginosin-98B (Aer-B), microginin-FR1(MG-FR1) and cylindrospermopsin (Cyl) were carried out to compare their influence on plant growth, photosynthetic pigments and oxygen production. Effects of their binary mixtures were also determined by isobole approach and calculation of the combination index (CI) that indicates type of interaction between metabolites. Microcystin-LR and anabaenopeptin-A revealed the strongest inhibition of S. polyrhiza growth while other metabolites appeared less toxic. Oxygen production was inhibited by Cyl, MC-LR, ANA-A , ANA-B, while both variants of aeruginosins and MG-FR1 did not affect this process. Photosynthetic pigments' contents decreased in S. polyrhiza exposed to ANA-A and Cyl, while MC-LR , Aer-A caused their slight increase. Car/Chl ratios changed in narrow ranges. Comparison of 96 h EC50 values showed that the growth of L. minor was more sensitive to MC-LR, ANA-A , MG-FR1 and Cyl than the growth of S. polyrhiza. Also the pigment contents were affected by MC-LR, ANA-A and MG-FR1 and Car/Chl ratio increased from 0.205 to 0.235. Synergistic effects of binary mixtures with MC-LR were observed to oxygen production while antagonistic to the growth of S. polyrhiza. Diverse effects of mixtures on different physiological processes indicate their various toxicity mechanisms.

THE EFFECT OF DISSOLVED ORGANIC MATTER (DOM) ON ABUNDANCE AND PRODUCTION OF PLANKTON IN FRESHWATER ECOSYSTEMS: A META-ANALYSIS

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Abstract

Dissolved organic matter (DOM) is a mixture of aromatic and aliphatic hydrocarbon structures with attaching various functional groups, that create heterogeneous aggregates weakly biodegradable in water. Its role in modulating the structure and function of freshwater ecosystems is equally important to this of primary production. However, due to observed global browning of lakes, worrisome effect of higher concentrations of DOM are emphasized, including decline in aquatic primary production and the dependent food webs and the development of trophically related communities utilizing organic matter as the primary source of energy mobilization. Here, the findings from the studies on the relationships between DOM and freshwater plankton characteristics are synthesized. Meta-analysis of 411 effect sizes extracted from 59 articles shows that autochtonous DOM had insignificant effect on abundance and production of freshwater plankton whereas allochthonous DOM had positive effect on bacterioplankton and insignificant effect on phytoplankton and bacterioplankton. In all the cases, effect sizes of allochthonous DOM displayed greater variance than effect sizes of autochthonous DOM. This greater variance could be explained by different sources of allochtchonous DOM. Among sources of allochthonous DOM, leaf/litter leachates and glucose/sucrose gave the most variable effects. Analyses of the influence of concentration of DOM suggest non-linear influence of DOM. For research presenting bacterioplankton responses to DOM publication bias was observed suggesting greater possibility of publishing significant results.

BIOLOGICAL EXPERIMENTS AS TOOLS FOR ACTIVE PROTECTION OF THE ENDANGERED SPECIES ALDROVANDA VESICULOSA (DROSERACEAE)

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Abstract

Conservation translocation is the controlled placement of plants into natural or semi-natural habitats with the aim of preventing the extinction of species. The selection of appropriate locations for the reintroduction of endangered plant species is an important process, because it mainly influences the success of the conservation.

The aim of this study was to select the optimal substitute habitats for Aldrovanda vesiculosa, a very rare and critically endangered aquatic carnivorous plant. In a series of experiments, we took into account the influence of physical–chemical factors (light intensity, temperature, pH, concentration of dissolved forms of nitrogen and cyanobacterial toxin microcystin-LR) on the efficiency of plant growth. Water analysis and field observations of the habitats of six lakes in Eastern Poland typified as potential substitute habitats for aldrovanda were carried out.

The results of the experiments showed that both the concentration and the form in which nitrogen compounds are present in the environment were the factors limiting the growth rate and condition of plants. Another factor that caused the inhibition of aldrovanda growth was microcystin-LR. It was found that the habitat conditions in one of the studied lakes were within the ecological tolerance of the species. The low content of mineral compounds and the available forms of nitrogen and phosphorus in the water were the most important. Such conditions can negatively affect the development of toxic cyanobacteria, which potentially inhibit the growth of A. vesiculosa.

In conclusion, both physical and chemical parameters of water together with requirements of the species, are crucial for the choice of the appropriate sites for plant translocation. However, the observations made by practitioners are also important, as they are able to recognize the problems not measurable by typical experimental methods.

HUMIC LAKES – FROM INEFFICIENT TO EFFICIENT TRANSFER OF MATTER IN PLANKTONIC FOOD WEBS

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Abstract

The humic stress and related factors are the main constraints for the development of zooplankton in humic lakes, which lead to low transfer efficiency in the food webs. The results of this study indicated that some zooplankton species could have an advantage in these conditions. We have found that the mass development of omnivorous Asplanchna priodonta could be caused by the domination of high nutritional algae like Gonyostomum semen and Botryococcus braunii. These algae are too large for most zooplankton to ingest, but A. priodonta could feed on a wide range of particles, and take benefits from this high-nutritional food. While the small cladocerans (Ceriodaphnia, Bosmina) could be favored in humic lakes when picoplankton and small algae dominated. Therefore, some zooplankton species could have an advantage and control the development of phytoplankton in humic lakes, which leads to the effective transfer of matter and energy in the planktonic food web.

NATURE-BASED SOLUTIONS FOR SAFETY ENSURANCE DURING FLOOD EVENTS

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Abstract

Flood is the most significant hydrological hazard worldwide in terms of risks to life and property and due to climate change and other factors the probability of flood events is predicted to increase in the near future. To cope with the growing flood risk, it is necessary to establish effective flood protection measures. Nature-based solutions (NBs) that involve natural processes to mutually decrease flood risk and protect natural ecosystems can be an answer to the demand for resilient flood risk management.

The research aims to investigate NBs implementation process as a potential introduction of innovation in the field of redefining, combining, and reformulating existing approaches to improve the welfare and wellbeing of individuals and communities. The potential of NBs in flood risk management and safety ensurance was assessed and a set of barriers and drivers for effective NBs implementation was formulated as a main result of the research.

THE INFLUENCE OF INTENSIVE AND ORGANIC AGRICULTURE ACTIVITY ON THE QUALITY OF GROUND AND SURFACE WATER

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Abstract

Despite the existence of important laws such as the EU Nitrates and Water Framework Directives, agriculture is still considered a major contributor to water pollution in many EU countries, and agricultural systems and on-farm activities affect freshwater resources.

The purpose is to assess the impact of intensive and ecological agricultural activities on the quality of underground and surface water.

A multiple regression analysis of the effect of anthropogenic load on the concentration of water quality indicators in basins showed that with a larger area of organic farms, the concentrations of total phosphorus and total nitrogen in water are lower; the higher the percentage of organic farms, the better the water condition according to EŽI (fish index in lakes) and according to the taxonomic composition and abundance of zoobenthos (EMI) ($p < 0.05$). The higher the concentration of from arable land, households not connected to sewage networks, municipal sewage, the larger the basin area of the water body, the area of agricultural land – the value of in water is higher; The larger the area of the basin and the area of arable land in the basin – the values of the taxonomic composition and abundance of zoobenthos in the water are lower, the water condition is worse ($p < 0.05$).

After assessing the diffusion of nutrients into the groundwater from organic and intensive farming farms, it was found that total P in the groundwater of wells drilled in all areas of organic farming farms; NO3-N; The concentrations of NH4-N and PO4-P were statistically significantly lower than in the groundwater samples of boreholes drilled in areas of intensive agricultural farms ($p < 0.05$).

ASSESSMENT OF THE VERTICAL FLOW LABYRINTH TECHNOLOGY FOR WASTEWATER TREATMENT IN SMALL LITHUANIAN SETTLEMENTS

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Abstract

The vertical flow labyrinth (VFL) is an innovative technology of wastewater treatment with high efficiency of biological removal, low investment and operation costs and reuse of the treated water.

The main objective of the paper was to determine the operational efficiency and environmental impact of small wastewater treatment plants (WWTPs), reconstructed by applying VFL technology in Lithuania.

The wastewater treatment plants of five small settlements in Ukmerge district, and three WWTPs in Silute district were selected for the study. The efficiency of these WWTPs was calculated according to the most important pollution indicators: BOD7, total nitrogen and total phosphorus. In order to evaluate the impact of wastewater treatment plants installed in Ukmerge district on the environment, their Life Cycle Assessment (LCA) was performed.

It was established that the vertical flow labyrinth technology is suitable for treatment of small amounts of wastewater not only in terms of operational efficiency, but also in terms of environmental protection.

EFFECT OF CHANGING ENVIRONMENTAL CONDITIONS ON TREE SAP FLOW AND WATER STATUS

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Abstract

Currently, there is a significant shift in the temporal and spatial distribution of atmospheric precipitation, which greatly impacts the vitality, growth, and survival of the plant kingdom, including trees. Climate change has resulted in prolonged periods during the growing season characterized by a reduced availability of soil water that vegetation requires for essential physiological processes, such as transpiration. The scarcity of soil water disrupts plant physiology and negatively affects their health, resistance, biomass formation, and ultimately their survival. Due to the influence of drought, both in the atmosphere and soil, the damage inflicted increases each year. If the adverse trend of global warming continues, these impacts are likely to intensify further.

Fluctuations in weather patterns and the availability of soil water significantly influence the water balance of trees, which can be observed through variations in sap flow intensity and daily changes in trunk circumferences. The progression of environmental conditions throughout the season directly affects tree growth. Monitoring and analyzing how trees manage available water and respond to soil drought and changing environmental conditions serve as crucial tools for investigating the effects of climate change on forest communities. Furthermore, this information can be used to predict the consequences of global warming and propose mitigation or adaptation measures in forestry.

In our study, we present the results of monitoring selected physiological processes in two types of trees under changing environmental conditions, with a particular focus on the availability of water in the soil.

ENVIRONMENTALLY-FRIENDLY JANUS BASED SEMICONDUCTING NANOCOMPOSITES FOR SUSTAINABLE ENVIRONMENTAL PROTECTION

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Abstract

Polymer nanocomposites have attracted scientific and industrial interest in the recent years, since the combination of typically inorganic nanoparticles into a polymeric matrix improves the performances of material in terms of optical, flame resistance, electrical and thermal conductivity. However, the preparation process of nanocomposites based on inorganic fillers comprises some noticeable shortcomings, such as: limited dispersibility of filler in solvent, reduced mechanical properties even at low filler contents, chemical and thermal degradation. This study is aimed at the preparation of amphiphilic and semiconducting Janus nanoparticles comprising one non-polar lobe of polystyrene (PS) and a polar lobe of 3-(triethoxysilyl)propyl-methacrilate (TSPM) and polyaniline (PANi). The environmentally-friendly Janus nanoparticles are further incorporated into a conjugated polymer matrix resulting in the development of a new type of advanced semiconducting polymer nanocomposite. A homogeneous dispersion of organic filler into the conjugated polymer matrix is expected since both the components are water dispersible.

Acknowledgments: *This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS/CCCDI–UEFISCDI, project number TE 94/17.05.2022, PN-III-P1-1.1-TE-2021-1332*

WASTEWATER TREATMENT WITH INNOVATIVE MATERIALS PRODUCED BY PICKERING EMULSION POLYMERIZATION TECHNOLOGY (PEMPTECH)

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Abstract

Presence of heavy metal ions in natural waters, mainly due to industrial and mining activities, have greatly increased the toxicity levels and pose a big threat to aquatic and living organisms, requiring rapid intervention for decontaminating the affected areas with energy efficient methods and high-performance materials. Decontaminating large volumes of water with current technologies is rather limited to intensive energy methods, because large volumes of water must be pumped through columns containing ion exchange resins. Further, in special situations, such as the Fukushima Daiichi nuclear plant disaster of 2011 in Japan, where large volume of radioactive ions, such as 137Cs and 90Sr, have entered ocean water and soil, decontamination is not even possible with standard methods but could be at least in part alleviated with advanced materials capable of quick metal absorption. Alternatively, technologies that require less energy input are being developed, such as water floating ion-imprinted polymer (IIP) films or supported liquid membranes, which can be deployed on large water surface areas with minimal human intervention and can be easily removed after the duty cycle completion. Here we present a new technology, to produce advanced materials via Pickering Emulsion Polymerization Technology (PEmPTech). PEmPTech can produce polymeric materials that are easy to handle, to deploy and to recover from the water surface after completion of the metal ion extraction cycle. Acknowledgements: This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS/CCCDI-UEFISCDI, project number PN-III-P4-PCE-2021-0306 (Contract Nr. PCE62/2022).

Keywords: *Pickering emulsions, nanoparticles, water treatment, metal ion recovery, Pickering emulsion polymerization technology*

Acknowledgements: *This work was supported by a grant of the Ministry of Research, Innovation and Digitization of Romania, CNCS/CCCDI-UEFISCDI, project number PN-III-P4-PCE-2021-0306 (Contract Nr. PCE62/2022).*

OXIDATION OF AQUEOUS PHARMACEUTICALS WITH PERSULFATE ACTIVATED BY NON-THERMAL PLASMA

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Abstract

The oxidation of antibiotic vancomycin (VAN), antidiabetic metformin (MET), and anti-inflammatory dexamethasone (DEX) was studied using a combined pulsed corona discharge (PCD) and persulfate (PS) system. The effect of the dose of persulfate on the degradation rate, the degree of mineralization, and the energy efficiency of the target pharmaceuticals oxidation was evaluated. Irrespective of the target compound studied, the addition of moderate persulfate doses resulted in a noticeable improvement in oxidation efficiency compared to non-assisted PCD process. For all pharmaceuticals examined, with minor exception for DEX showing negligible improvement, an increase of the dose of persulfate in the PCD/PS combination resulted in a substantial increase in the observed degradation rate. The findings of this study strongly suggest that the combined PCD/PS oxidation is a promising treatment technology for water purification from aqueous pharmaceutical contamination.

Keywords: *advanced oxidation process, peroxydisulfate, pulsed corona discharge, water treatment*

SUCCESSION OF PLANT COMMUNITIES IN PEAT EXTRACTION PITS BASED ON MACROFOSSILS AND CURRENT PLANT ANALYSIS

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Abstract

The small water bodies formed after peat excavation undergo spontaneous succession, and the hydrological factor plays a key role in this process. Plant organic matter deposited in the conditions of high wetness retains the structure of plant tissues; hence, it is possible to identify vegetation that forms subfossil communities and reconstruct the succession series by analysing macroscopic plant remains. The aim of the present study was to identify the sequence of the succession series in the post-excavation peat pits of the Łęczna-Włodawa Lakeland by analysis of plant macrofossils. Depending on trophy conditions and water layer thickness, various communities are responsible for initiation of the peat-forming process in the analysed objects of the Łęczna-Włodawa Lakeland. These include underwater Chara meadows (Ostrówek Podyski object), rush communities from the alliance Magnocaricion (Jelino and Krasne objects), and bryophyte communities forming a floating carpet over an open water surface (Podlaski object). The analysed post-excavation pits are currently undergoing a transitional phase of overgrowing. They have become refugia for many rare and protected plant species, e.g. Rhynchospora alba, Scheuchzeria palustris, or Menyanthes trifoliata.

Keywords: *peat extraction pits, Łęczna-Włodawa Plain, peatland's vegetation, Ellenberg index*

CHANGES IN RAINWATER QUALITY ALONG THE RAINFALL-RUNOFF PROCESS IN AN URBAN WATERSHED

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Abstract

Progressive urbanization contributes to decrease in impermeable areas, natural vegetation, and undisturbed hydrological cycle. Areas of roads, parking lots, roof tops, and other forms of sealed open space cannot effectively absorb and purify stormwater. As a result of rainfall, air deposition is and eventually end up in surface water ecosystems, mainly rivers and lakes, Runoff water collects wash away pathogens, heavy metals, sediments, and chemical pollutants and quickly transmit them downstream to streams, rivers, estuaries, or the sea through the stormwater drainage systems. The pollutants are not naturally purified unless infiltrated.

The aim of the study was to show changes in rainwater quality at multiple locations along the rainfall-runoff pathway in 14 ha urban sub-catchment in a center of the town of Olsztyn (N Poland). Sampling sites (7) included direct rainfall and runoff locations. Parameters such as pH, specific conductance, Fluorescent Dissolved Organic Matter, total dissolved solids (TDS), and turbidity, as well as heavy metal concentrations including Cu, Cr, Fe, Ni, Zn, and Pb were measured in 4 seasons. The results showed that as the rainwater runoff from urban sub-catchment has significantly higher TDS, turbidity, and heavy metal concentrations, particularly during "first flush". The highest heavy metal concentrations were found in the storm collector and surface runoff locations, indicating that urbanization and increased impermeable pavement were major sources of heavy metal pollution. This study highlights the importance of monitoring rainwater quality and heavy metal contents in urban watersheds, particularly during rainfall-runoff. Implementing solutions such as green infrastructure and stormwater management practices can help mitigate the impact of urbanization on water quality and protect the water environment. Project financially co-supported by Minister of Education and Science in the range of the program entitled "Regional Initiative of Excellence" for the years 2019-2023, Project No. 010/RID/2018/19, amount of funding 12.000.000 PLN.

Keywords: *stormwater, runoff, pollution, water quality, drainage systems, urbanisation*

GRADUAL TRANSITION TOWARDS THE LOW-CARBON POWER INDUSTRY IN THE REPUBLIC OF BELARUS

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Abstract

In the Republic of Belarus, due to limits of its own natural reserves of fossil fuels, almost 80 percent of energy consumption in real sector and social sphere is provided by the import of energy resources that significantly reduces the energy security of the country. Under these conditions, one of the priority areas for increasing stability and security of Belarusian power engineering complex is gradual replacement of imported crude oil and natural gas with local energy resources, including renewable energy and nuclear power. Both resources if properly balanced, scheduled and utilized in the National United Energy System along with gradual decommission of fossil fuel facilities should also help Belarus in meeting and strengthening the country's climate commitments. The recent developments in this area included construction and commercial operation of the Belarusian nuclear power plant and sufficient progress in extending renewable energy resources and improving energy efficiency. This allowed, since 2010, to achieve the twofold reduction of the share of hydrocarbon imports in GDP and increase the ratio of the own primary energy production to the gross consumption of fuel and energy resources from 14.0% to 22.5%. As a result, during the last ten years, the energy production facilities reduced their greenhouse gas emissions by more than 8%. The analysis of energy supply indicators, the current state and medium-term forecasts of the development of the national energy industry, in the structure of which nuclear energy begins to play a significant role, indicate about a number of achievements that include gradual elimination of threats and uncertainties for the sustainable, reliable and efficient development of the energy sector in the Republic of Belarus.

Keywords: *power engineering, fossil fuel, nuclear power plant, renewable energy, low-carbon development, energy security*

LANDSCAPE AS A DETERMINANT FACTOR IN CLIMATE CHANGE RELATED BEHAVIOUR? – THE RESULTS OF A LARGE SAMPLE SURVEY

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Abstract

The negative impact of climate change is inevitable in the future. However, the impacts are different in different territories. Hence, people living in different territories might have different approaches towards climate change, and their adaptive strategies are also different.

Research into the effects of climate change and adaptation options is not new. Questionnaires related to climate change are becoming more and more frequent and do not only provide a European overview but also focus on the regional and local level, revealing the perceptions, attitudes and strategies of either decision-makers or the population. Regional climate-related research is usually working with administrative boundaries and research conclusions are made for administrative regions. These administrative regions are not necessarily covering a homogenous landscape (like flat agricultural areas, hilly forest areas or built-in areas) where the impacts, hence strategies might be homogenous.

This paper presents the results of a large sample representative survey from Hungary, where regions are represented not by administrative boundaries but by homogenous landscapes. This paper aims to prove that – besides other factors – the landscape is a determinant factor in how one perceives the impact of climate change and how she/he builds her/his adaptation strategy.

Keywords: *climate change, landscape, pro-climate behaviour, climate-related attitude, Hungary*

CONSERVATION ZONES FOR FOREST GENETIC RESOURCES OF PINUS DEVONIANA LINDL

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Abstract

In Mexico, there are no in situ genetic conservation efforts for Pinus devoniana Lindl., guaranteeing its continuity over time in future climate scenarios. Therefore, it is necessary to define sites to preserve the genetic material within its natural distribution. The objective of this work was to define the genetic conservation units (GCU) of P. devoniana and determine the use of its genetic resources. The distribution of the species in genetic zones was determined based on the National Forest and Land Inventory (NFLI) latitude and longitude records. In contrast, the genetic conservation units were defined based on population size, management, monitoring, and ownership. Finally, for the use of the genetic resources of the species in each genetic zone, the number of trees sampled by the NFLI, the number of populations with molecular data, the number of populations with seed stands, the number of individuals selected for progeny tests, the number of provenance tests, and the number of seed orchards were taken into account. Sixteen genetic zones were identified in which the species was present, but only eleven (III.4, IX.2, X.1, X.2, X.3, XII.1, XII.2, XII.3 XII.4, XII.5, and XIV.1) satisfied the criteria for the establishment of 14 GCU (68%). Of these zones, 14.3% had existing genetic information (molecular characterization and provenance trials). For the use of forest resources, 2,277 trees were sampled, 3 and 4 populations had molecular characterization and seed stands, respectively, but only 1 provenance trial was recorded. Finally, the UCGs are expected to help maintain the target species genetic resources in situ for their future use and exploitation in forest management programs.

Keywords: *conservation efforts, genetic conservation units, genetic diversity, Mexican pine*

EVALUATION OF DÜZCE URBAN FORESTS' CLIMATE CHANGE MITIGATION POTENTIAL WITH MEASURING URBAN CARBON FOOTPRINT

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Abstract

Carbon-source and carbon-sink estimations are crucial important for carbon-emissions reduction. Although urban areas cover less than 2% of the earth's surface they are known carbon sources responsiple of 80% of the world's anthropogenic greenhouse gases (GHGs). The methodologies for carbon footprint calculations are expressed a measure used to assess the amount of anthropogenic greenhouse gas emissions based on tons of CO2 equivalent, and emerging as an important tool for greenhouse gas management. Besides increased efforts to reduce carbon footprint from cities, there is the alternative possibility to remove some atmospheric CO2 by sequestering it within forest ecosystems. Forest ecosytems can sequester and store a large amount of carbon in cities. In this study, it is focused on potentially do Duzce city greengas emissions and available sinks assessment. In the first step, it is calculated "Carbon Footprint" by using greenhouse gas emission calculator that developed by UNFCCC. Then it is identified urban carbon sources such as human respiration, industrial fossil-fuel consumption, electriciy-heating-cooling consumption, water consumption and transportation. In the second step, it is estimated potential of carbon storage forest ecosystems urban and sub urban areas by used a GIS-based approach. Although forest areas cover 50,2% of Düzce, industrial and agricultural activities and rapid urbanization, overconsumption lead to increase greenhouse gas emission and ecological balance is disturbed. The most effective way to reduce emissions is afforestation.

When evaluating in the context of climate change mitigation, sustainable afforestation studies in urban forests should be accelerated. Within the scope of the study, it is recommended for a sustainable future to give importance to industrial afforestation studies with fast-growing domestic or foreign forest tree species in forest and non-forest areas in urban areas.

Keywords: *climate change mitigation, carbon footprint, GIS-based approach, planting for future, urban forests*

EXPLOSION OF HYDROGEN-HYDROCARBON-AIR MIXTURES IN A SPHERICAL VESSEL

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Abstract

The research of flame propagation in gaseous fuel-air mixtures is important for design of domestic and industrial chemical plants and for achieving safe operating conditions of industrial processes. In the last decades, hydrogen-hydrocarbon mixtures have attracted more and more attention. Recent studies showed that hydrogen addition to various engine fuels could increase engine thermal efficiency and improve the lean burn capability of the fuel. The increase of the oxidation rate might determine also the decrease of the quenching distance and minimum ignition energy, the increase of the normal burning velocity and of the propagation speed, without major changes of the peak explosion pressure and flame temperature. The present paper reports data from an experimental study on pressure evolution during closed vessel explosions of gaseous mixtures, at various initial pressures within 0.3 – 1.0 bar and ambient initial temperature. Explosion pressures, maximum rates of pressure rise and explosion times of stoichiometric hydrogen/n-butane/air mixtures with various hydrogen/n-butane ratios were measured in a spherical vessel (Φ = 10 cm). The deflagration index of centrally ignited explosions was also calculated from maximum rates of pressure rise. It was found that both the explosion pressures and the maximum rates of pressure rise are linear functions on total initial pressure, at constant initial temperature and fuel concentration. The measured explosion pressures are examined in comparison with the adiabatic explosion pressures, computed by assuming chemical equilibrium within the flame front. The influence of initial pressure and composition on explosion pressures, maximum rates of pressure rise and explosion times are discussed for the examined systems.

INTERESTERIFICATION OF RAPESEED OIL WITH METHYL FORMATE FOR PRODUCTION OF INNOVATIVE BIODIESEL FUEL

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Abstract

During the production of biodiesel, a by-product - the glycerol phase is formed (about 10% of the obtained biodiesel). The interesterification of vegetable oil using carboxylate esters of low molecular weight does not produce glycerol, instead its compounds (mono-, di- and triformyl glycerides) are obtained in a mixture with fatty acid alkyl esters (conventional biodiesel). Such a product can be used as fuel for diesel engines. The aim of the work was to investigate the possibilities of application of methyl formate in the biotechnological production of biodiesel. The industrial enzyme preparation Lipozyme TL IM was used as a catalyst for interesterification. The influence of the amount of catalyst, the molar ratio of methyl formate to oil and the duration of the process on the yield of biodiesel was evaluated. The highest yield of rapeseed oil methyl esters was obtained under the following conditions: 14-15% of the enzyme preparation Lipozyme TL IM (based on the weight of the oil), molar ratio of methyl formate to oil - 40:1, duration - 60 h. Under these conditions, an 81.6% yield of rapeseed oil methyl esters was obtained.

Keywords: *biodiesel, methyl formate, interesterification, lipase*

THE IMPACT OF ECO DRIVING ON THE REDUCTION OF EXHAUST GAS EMISSIONS

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Abstract

In this paper, an example of the application of eco-driving in practice and the achieved effect in reducing exhaust gas emissions in a road transport company GSP in Novi Sad is given. Based on data on the age of the vehicle fleet, the type of fuel used, the type of gearbox, tire pressure, distance traveled and the driver's qualification, we obtain values that show in which cases the emission of exhaust gases into the atmosphere increases. The aim of the work is to determine under which conditions drivers can contribute to reducing fuel consumption and thus reducing exhaust gas emissions in urban areas.

CONVERTING INTERNAL COMBUSTION ENGINES' EXHAUST GASES KINETIC ENERGY TO ELECTRICAL ENERGY

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Abstract

Over time, clean and affordable energy sources are being embraced to meet the rising global energy demand. This paper reviews kinetic energy harvesting from wastes as a potential localized power supply for automobiles accessories. Multiple sustainable solutions have been developed because of the renewable resources' fast-growing importance and contribution to the field of power generation. Additionally, pollution in the atmosphere is getting worse every day, which is the largest threat to life of human. In the suggested study, waste air from the exhaust system can be used and transformed into power utilizing energy-conversion techniques. The proposed concept can be used to provide vehicles with an alternate source of electricity. The suggested design aims to convert gasses kinetic energy into a useful electrical source which can be used in energized cars' accessories like lighting system and other electronic units or as an optional stored energy source.

GLASS FOR RADIOACTIVE WASTE MANAGEMENT

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Abstract

Copper-lead based glass structure was investigated as a potential host matrix for the immobilization of High-Level Radioactive Waste due to its radiation shielding properties, flexibility, low melting temperature and short melting time processing. Thermal stability and glass forming ability of the glass system were evaluated. The effect of copper ion content on the structural property and compound distribution in the lead glass system is ample investigated using X-ray diffraction analysis, Fourier Transform Infrared and Electron Paramagnetic Resonance. The most promising glass composition was tested as a host matrix for immobilization of MoO3, as integral compounds of radioactive waste. The results revealed that copper-lead glass is suitable as a waste form in radioactive waste storage applications to improve the solubility of select radioactive waste in glass without phase separation.

Keywords: *copper-lead glass, solubility of molybdenum, radioactive waste management*

Acknowledgments: *This work is funded by the Ministry of Research, Innovation and Digitalization through: CNCS–UEFISCDI, project No: PN-III-P1-1.1-PD-2021- 0721, within PNCDI III and Programme 1 - Development of the National Research and Development System, Subprogramme 1.2 - Institutional Performance - Funding Projects for Excellence in RDI, Contract No.37PFE/30.12.2021.*

EXPLORATION OF RHENIUM CATALYST FORMULATIONS FOR GREEN HYDROGEN PRODUCTION VIA WATER GAS SHIFT REACTION: STRUCTURE AND REDUCIBILITY

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Abstract

Water gas shift (WGS) reaction (CO+H2O↔CO2+H2) is well known process for hydrogen purification and generation.

The goal is development of rhenium-promoted catalyst with novel formulations that allow efficient production of green hydrogen from renewable sources as biogas from organic substrates. Green hydrogen will be use in fuel cells as carbon-free energy source. Promoted Re/Al2O3 compositions were prepared by Exact Soaking method: bi-, tri- and four-metallic CoRe, K-CoRe, CoReMo u K-CoReMo compositions.

The research starts with analysis of structures formed in synthesized samples and its reducibility in order to elucidate the effect of reduction treatment for achievement of active catalyst structures. Several physicochemical methods were used PXRD, UV-vis DRS and H2-TPR.

At this stage of our research on WGS reaction capabilities of selected Re-formulations, we could summarize that the role of molybdenum and potassium is not only to support the achievement of higher CO conversion degrees (obtaining larger amounts of clean H2), but also to influence the structure features of the studied catalysts in the activation/reduction stage at appropriated combinations of elements.

Acknowledgments: *The authors kindly acknowledge the financial support of project № BG05M2OP001-1.002-0014 „Center of competence HITMOBIL - Technologies and systems for generation, storage and consumption of clean energy", funded by Operational Programme "Science and Education for Smart Growth" 2014-2020, co-funded by the EU from European Regional Development Fund.*

SOIL CHARACTERISTICS, CONTENT AND EXPORT OF MAIN MACRONUTRIENTS (N, P, K) WHEN GROWING MAIZE ON CALCIC CHERNOZEMS

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Abstract

Climate change put the functioning of agroecosystems at great risk and had a significant impact on the productivity of cultivated crops, especially in non-irrigated conditions. The purpose of the present study was to monitor the cultivation of maize (Zea mays, L.), by performing field phenological observations and studying the growth of the crop in different phases on Calcic Chernozems. In 2021, the development of a medium-early maize hybrid DKC 5075 (450 from the FAO group) was investigated at the Trastenik experimental field near the town of Ruse. The dynamics of changes in the agrochemical and physical properties of the soil during the growing season were assessed, the content and export of the main macroelements N, P and K in three phases of maize development were studied, grain yield at harvest were calculated. It was found that with the total biomass of maize, nitrogen export was the highest - 292 kg/ha, followed by potassium - 285 kg/ha, and phosphorus export was the lowest - 54 kg/ha. Soil-climatic conditions during the investigated period and the activities carried out created favorable conditions for development of the cultivated crop resulting in high maize yields (9845.0 kg/ha ± 793.0). The agrochemical characteristics of the soil showed that at the end of the growing season significant amounts of mineral nitrogen remained, 42.8 mg.kg-1, while the reserves of available P and K were low. The application of additional potassium fertilization will compensate the export of this element with the plant biomass. Balanced fertilization is one of the ways to improve the availability of biogenic elements, despite the good natural fertility of Calcic Chernozems.

Key words: *maize, NPK content, export, yield, Calcic Chernozems*

STABILIZED IRON NANOPARTICLES FOR ENVIRONMENTAL TECHNOLOGIES

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Abstract

Iron nanoparticles stabilized by polymers show good stability even when handled in air, when unstabilized particles oxidize rapidly and lose their reactivity necessary for use in environmental technologies. The presented study aims at stabilizing iron nanoparticles with polymers without the need for the contact of the nanoparticles with an aqueous environment causing their rapid oxidation. Thus, the nanoparticles stabilized in this way exhibit high reactivity towards pollutants in aqueous environments while being highly stable when exposed to the oxidizing environment of the surrounding atmosphere.

INTENSITY OF HAILSTORM IN KAKHETI REGION (GEORGIA)

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Abstract

Kakheti region is one of the hail risk regions in Georgia. It is particularly noteworthy that Kakheti is famous for its agricultural crops, vineyards, gardens, annual and perennial crops. In the warm period of the year, there are frequent hailstorms, which destroy the crops and thus cause great damage to both the region and the country's economy. In many cases, the intensity of hail determines the amount of damage - the greater the intensity, the greater the damage.

The purpose of the study is to determine the intensity of hail for the Kakheti region, which is the subject of our special interest, since intense hail damages this region the most. Average and maximum intensities of hail were estimated based on available data. Areas of intense hail were defined according to different intensities. Tables of average and maximum intensity of hail and corresponding geo-informational maps were compiled.

The research was carried out according to the data of 10 meteorological stations in the Kakheti region, which includes both the last century (1983-1991) and 2014-2018 data on hail.

The obtained results will contribute to the planning and implementation of anti-hail works in the Kakheti region.

Keywords: *Hail, Meteorological phenomena, Climate, Anthropogenic impact*

ACTIVE CONSORTIA OF MICROORGANISMS FOR OIL DEGRADATION IN A WIDE RANGE OF POSITIVE TEMPERATURES

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Abstract

Soil pollution with petroleum hydrocarbons has become a global problem and was a consequence of the intensification of human industrial activity. Remediation of contaminated sites using a microbiological process (bioremediation) has proven to be effective and reliable due to its environmental performance. For bioremediation of oil-contaminated ecosystems, both individual strains of microorganisms and their associations are used. It was noted that the use of consortia of hydrocarbon-oxidizing microorganisms leads to a more complete destruction of hydrocarbons. One of the main factors for the oxidation of oil hydrocarbons is the temperature regime. In this study, the selection of consortia of oil-oxidizing microorganisms capable of effectively degrading oil in a wide range of positive temperatures was carried out. Experiments were carried out on a mineral medium with oil at 10℃, 30℃ and 50℃. It is shown that the most active transformation of oil occurred at 30℃. 3 consortia were selected that utilized oil from the Zhanatalap and Dossor fields at all temperatures under study. The use of such consortia will contribute to the effective cleanup of contaminated areas throughout the growing season. This is very important in an arid climate, which is characterized by sharp seasonal and daily temperature fluctuations.

Keywords: *oil pollution, bioremediation, consortia of oil-oxidizing microorganisms, oil biodestruction, temperature*

THE LONG-TERM TREND OF APPLYING CHEMICAL AND NATURAL FERTILIZERS IN ROMANIA

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Abstract

Land improvements, in the last decades, have received a special attention, representing the whole complex of hydrotechnical works that are carried out in order to improve land, ensure soil fertility by improving its qualities in order to capitalize on agricultural land for unproductive land or improve crop development conditions, agricultural land on some poorly productive land. The five categories of fertilizers applied on agricultural lands in Romania are chemical, nitrogen, phosphate, potassium and natural. The purpose of this paper is to study the management of the application of chemical fertilizers in the analysed period and implicitly the spatial evaluation. In the last 32 years the area of land on which chemical fertilizers have been applied has increased considerably from 3,528,354 ha in 1990 to 8,400,360 ha in 2021. Phosphate fertilizers are maintained around the average of 4,364,177 ha while natural fertilizers are applied on fairly small 826,420 ha in 1990 sweeping up to 877,985 ha in 2020. If we discuss the regions at the national level, a significant difference can be observed, even from singles to doubles in the region Centru 41,941,745 ha and the Sud-Muntenia region 8,753,2752 ha.

Keywords: *chemical and natural fertilizers land improvements, eco-friendly agriculture*

ORGANISATION OCCUPATIONAL SAFETY AND HEALTH PERFORMANCE ADAPTATION FOR LIBYA CONSTRUCTION COMPANY

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Abstract

The construction industry offers employment to about one hundred eighty million people worldwide. The modern economy is based on the evolution and development of the construction industry due to the demand for urbanisation and industrialisation. Despite the significant improvement in the construction industry, this sector is considered risky then challenging; and faces the most vulnerable and hazardous work environment. The launch of Occupational Safety and Health (OSH) of ISO 45001- 2018 International Standards is inevitable for construction organisations to provide safety, healthy and preventive environment on construction sites to the labours. OSH in construction is a globally important concern, the same goes for Libya. There are several issues ranging from the lack of attention to OSH from the construction company, plus, the increasing cost and time for safety equipment and maintaining safety culture, thus leading to poor workers' performance. These factors lead to low-quality construction work. Resolving problems of OSH practices requires enhancing the requisite knowledge, skills, attributes, and a wealth of experience to lead and manage projects successfully. A study was carried out for adapting the Organisational OSH Performance Practice in Libya Construction Companies. This paper highlights a quantitative research approach to the adaptation of OSH measurement performance in a construction company. The data was collected from 75 respondents of construction practitioners in Libya using structured questionnaires. The study revealed the factors between the OSH regulation in ISO 45001-2018 and OSH organisational performance, subsequently, the intricacies of the relationship will nurture the development of a valid model and recommendations regarding the success of construction projects in Libya. In conclusion, implementing OSH can better manage and measure construction projects and improve the organisational OSH performance.

Keywords: *OSH, ISO 45001-2018, Organisational Occupational Safety and Health performance, construction safety management, international standard, Libya*

RISK ASSESSMENT TO THE SAFETY AND HEALTH OF EMPLOYEES ON CONSTRUCTION SITES AND RECOMMENDED MEASURES FOR REDUCTION

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Abstract

The largest number of workplace injuries in Serbia occur on construction sites and these injuries are often fatal. Since construction is one of the more developed industries in Serbia, as well as in other European countries, it is quite clear how important it is to pay attention to occupational safety and health on construction sites. Recognizing the importance of the topic, the authors wish to contribute to the reduction of workplace injuries for employees and other persons on construction sites through this paper, which consists of several parts. In the first of them, the number of injuries is investigated, causes and consequences are analyzed. Then, a risk assessment is carried out at the workplace and in the working environment for the most common workplaces encountered on the majority of construction sites. Places with increased risk are observed and recommendations are made for measures to reduce risk, which can be organizational, constructive, protective and others. After that, the risk is reassessed and recommendations are made for a plan of preventive measures.

NEW INSIGHTS INTO HUMAN ADENOVIRUS 36 CAUSING OBESITY, IN LIGHT OF STUDIES IN DOGS AND CATS

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Abstract

Human adenovirus 36 (HAdV-D36) is the only virus currently known to have the ability to cause obesity in both animals and humans. To date, the ability of this virus to infect animals such as monkeys, chickens, mice and rats has been confirmed. Such an unusual host range raises the question: what other animals (farmed or companion animals) could become hosts for this pathogen? In our study, we examined a group of dogs and cats from the Wrocław and surrounding areas (Poland) to analyze the presence of anti-HAdV-D36 antibodies in their blood serum. We were able to confirm the high seroprevalence of this virus among both cats and dogs. Visceral fat samples were also collected from individuals with high antibody titers, from which active HAdV-D36 viral particles were reisolated. The high seroprevalence and positive reisolation of this virus from canine and feline samples indicates that this virus is able to successfully infect and persist in these animal populations. In light of the above studies, it becomes relevant to ask whether human adenovirus 36 causing infectious obesity is a new virus with anthropozoonotic potential?

THE INFLUENCE OF CLIMATIC FACTORS ON THE PREVALENCE OF CONTAMINATION OF GREEN AREAS IN BELGRADE BY DOG PARASITES

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Abstract

The constant increase in the number of dogs represents a serious environmental problem in urban areas. Green areas and parks are the most frequent places where people hang out and have the largest number of children's playgrounds. At the same time, these are places where dog owners let their pets out, which they pollute with their feces. Dogs are the carriers and true hosts of zoonotic parasites whose eggs are eliminated by excrement into the environment, and the most dangerous and most common are the eggs of the helminths Toxocara canis, Ancylostomidae spp., Echinoccocus granulosus. Trichuris vulpis and Strongyloides stercoralis and oocysts of the protozoa Giardia intestinalis, Amoeba spp. and Cryptosporidium spp. the speed of parasite development on the microclimatic conditions prevailing in certain parts of the year. Thus, when studying this type of pollution and assessing the risk of human infections, we must be guided by the knowledge of bioclimatic conditions so that the sampling and interpretation of the results are in accordance with the actual situation on the ground. For these reasons, during our two-decade examination of the contamination of green and park areas in Belgrade, we were guided by the Uvarovo bioclimatogram in order to determine the optimal time for taking samples for examination and evaluation of the obtained results.

Keywords: *dogs, urban environment pollution, climate condition, epidemiology*

IDENTIFYING STAKEHOLDERS FOR NATURE-BASED TOURISM IN MARGINALISED MOUNTAINOUS AREAS OF TÜRKİYE

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Abstract

Türkiye's surface area consists of approximately 78% mountainous areas. Mountainous areas are generally low population density and unsuitable for settlement. The areas where the imbalances between regions in terms of development are most intense are mountainous areas. Nature-based tourism is one of the prominent sectors with the aim of proper management of mountain resources and socio-economic development of the rural people. Mountain communities can use sustainable tourism initiatives that natural resources as an outlet to create new job opportunities, develop on-site, improve infrastructure opportunities, solve environmental and social problems and reduce their effects. In line with the nature-based tourism opportunities offered by mountainous areas, plans and specific policies can be created. It is necessary to identify the groups that are affected by the plans carried out in the planning process, to classify these defined groups according to their contributions, and to identify and analyze the stakeholders on how all this information can improve the nature-based tourism activities and the wellbeing level of rural communities living in mountainous areas.

Within the scope of the study, all stakeholders that may be relevant within the framework of nature-based tourism activities in marginalized mountainous areas in Türkiye were determined on a local, regional, national, European and global scale. The interests, behaviors and intentions of each stakeholder were evaluated. Universities, research centres, and companies, SMEs, NGOs, etc. are some of the identified stakeholders in tourism activities on marginalized mountainous areas and vulnerable ecosystems.

Keywords: *Marginal areas, mountainous region, nature-based tourism, rural human wellbeing, stakeholder analysis*

THERMAL WATERS IN THE REPUBLIC OF ALBANIA AS AN OPPORTUNITY FOR THE DEVELOPMENT OF SUSTAINABLE TOURISM

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Abstract

The Republic of Albania is very rich in surface and underground water. In the territory of Albania there are thermal springs, which have been known by the inhabitants since ancient times. The thermal springs in my country are in Bilaj (Fushe Kruja), Bellova (Diber), Kozana, Hidrait (Elbasan), Dimal, Benja in the Langarica canyon (Permet), Vromoneri, Postenani (Leskovik), and Mamuras. Some of these thermal springs have been known by Albanians since the time of the Roman Empire. The geological construction of the Albanian soil plays a special role in the thermal waters, which are influenced by the properties of the rock composition of the Albanian subsoil. In addition to geological construction, relief and climatic conditions, a significant factor that guides the use of thermal waters is the way of management by man.

The purpose of the study, based on a detailed analysis of thermal water springs in Albania, is to identify the way they can be used and well-managed to serve as a development instrument in curative tourism in our country.

This article presents the curative tourism potentials, the forms and dimensions of their use so far, but also the need for drawing up strategies for sustainable development by the central and local government.

In order to carry out this study, field observations were carried out and it was used the literature of the field. Consultations with specialists (water engineers) were conducted well as interviews with doctors who work in curative centers, visitors of these centers and owners of hotels located near thermal springs. Thermal spring waters contain sulphur, magnesium, calcium and other minerals. These mineral waters have curative properties for various rheumatic diseases, skin diseases, nervous system diseases, respiratory diseases, etc.

The findings of the study will be at the service of central and local institutions, tourist operators, and interested communities, with the aim of involving all actors in making efforts for strategic intervention in areas that offer the possibility for the development of curative tourism.

Keywords: *underground water, thermal water, curative water*

THE SOUND OF THE OCEAN

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Abstract

Following the information of the Whales life and "songs", we analyze the effects of the physical properties of the water on the velocity, intensity and other parameters of the sound. What will be the effect of the sea water of the Black Sea on the phenomenon? The physical data regarding the properties of the sea or ocean water are used in order to analyse the sounds. The properties refer to velocity of the sound in the liquids (sea water), acoustic pressure, acoustic power, experimental values for some sonic parameters. Registered sound offered by the publication National Geographic will be presented. The results are analysed and some conclusions are offered.

Keywords: *sounds, whales songs, ocean, sea, acoustic properties, water properties*

OLD AGE AND AGING – A CHALLENGE FOR HEALTH CARE PROFESSIONALS

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Abstract

The modern demographic situation is characterized by an aging population due to an increase in life expectancy. The substantial increase in the relative proportion of elderly and old people poses a number of challenges for health care professionals. Nurses interact closely with health care consumers in a variety of work environments. This enables them to assess health needs broadly, track how environmental factors affect the health of patients and their families, and how people respond to different strategies and services.

Keywords: *old age, aging, nursing, medico-social issues*

DIFFERENT INFLUENCES ON SMOKING HABITS RELATED TO AN ONLINE TOBACCO PREVENTION PROGRAM

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Abstract

Tobacco control experts must concentrate their efforts to prevent smoking and to promote cessation before adolescents become addicted to nicotine. Our aim was to determine different factors associated with tobacco use among high school students. Susceptibility to smoking, defined as a lack of a firm commitment not to smoke, is therefore useful in estimating which young people can become smokers and under whose influence the status of susceptibility can change. The aim of this study is to assess the association between the susceptibility of tobacco use and psychosocial and sociodemographic factors. The current study is a repeated cross-sectional secondary analysis of data collected using a questionnaire administered in 2015 and 2018 among ninth-grade students in Chisinau, Republic of Moldova. The prevalence of susceptibility to cigarette smoking among the study participants was 38.6% in 2015 and 50.2% in 2018 (p<0,001). Our result indicates that smoking friends represent a strong predictor of high smoking susceptibility among those who have never smoked. The temptation to smoke increased significantly during the period covered by the study from 1.32 (0.67) to 1.48 (0.66) (p < 0.001). In conclusion the connection between socio-demographic factors (smoking parents or friends) and psycho-emotional factors (temptation to smoke) will increase the likelihood of smoking among adolescents.

Keywords: *smoking susceptibility, depression, smoking temptation, adolescents*