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BOOK OF ABSTRACTS

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IS CIRCULAR ECONOMY, CIRCULAR?

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Abstract

This paper is an attempt to explain the geometric metaphor, circular economy, and of its range of application. For that, reuse and recycle loops are analyzed in two situations: discrete and continuous systems, both looking for material decay along cycles or time (due to purge) and for the time evolution of its unit price (time value of money and inflation). The case of existing a make-up that compensates the purge is also analyzed. The conclusion is that the geometric metaphor in use, circular economy, corresponds to particular situations. In general, the evolution is spiral rather than circular.

Keywords: *circular economy, reuse, recycle, mass conservation*

URBAN PLANTS: NATURAL DEFENDERS AGAINST PARTICULATE MATTER, HEAVY METALS, AND MICROPLASTIC POLLUTION.

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Abstract

The rapid urbanization and expanding road networks have resulted in a plethora of air pollution challenges, particularly in densely populated regions. Particulate matter (PM) pollution, primarily stemming from the combustion of liquid fuels and household heating, has become a major concern for public health. Unfortunately, PM can carry harmful heavy metals (HM), and recent research has revealed the presence of microplastic (MP) particles as well. When pollutants are released, the only viable method of purifying the air lies in technologies, with phytoremediation taking the lead.

Phytoremediation involves the strategic cultivation of plants, acting as living filters, to capture and remove PM deposited on their surfaces. The presence of greenery varies across cities, and trees, in particular, have proven to be highly effective in cleansing the air. However, the choice of tree species and their location plays a crucial role in determining their efficiency.

The primary objective of this study was to ascertain the effectiveness of different plant species in mitigating the accumulation of PM, HM and MP within cities.

In research we focused on the most prevalent tree species found in urban environments The study aimed to measure the accumulation of PM in three different size fractions, HM and various types of MP on the leaves of these trees at the conclusion of the growing season.

Our investigation revealed notable discrepancies in the accumulation of PM among the studied locations and the different tree species. Intriguingly, all plant species examined exhibited PM deposition on both the leaf surface and within the epicuticular waxes. Furthermore, a significant presence of hazardous heavy metals was detected. Our results underscore the pivotal role of plants in mitigating air pollution within these locations.

Keywords: *air pollution, PM, plants, phytoremediation, trees*

Acknowledgment: *This research was funded by National Science Centre, Poland [Grant number: 2020/39/D/NZ9/00969].*

PLANT INVASION IS A DUAL PHENOMENON: THE ROLE OF THE PLANT AND ITS ENVIRONMENT

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Abstract

In many cases, human interventions into pristine nature have been accompanied by species invasions, which certainly hamper the effort to protect and restore habitats. Alien plant invasion affects the diversity and stability of the local community. The EU Biodiversity Strategy for 2030 has set the challenge of controlling invasive aliens that have already become widespread. Data on alien species show that plant invasions are caused by a complex combination of characteristics of invasive species (invasiveness) and characteristics of invaded environment (invasibility). The first target of invasive alien species regulation is the most aggressive invaders. Small balsam (Impatiens parviflora from Balsaminaceae) could be classified in this category. Numerous studies have focused on I. parviflora interactions with neighboring herbaceous species. Phytocenological data were mostly associated with either environmental properties of the sites or with geographical, morphological, and physiological properties of I. parviflora populations, but the relationship with molecular features has been poorly investigated. The objective of our study was to evaluate the genetic diversity of Lithuanian populations of highly invasive Impatiens parviflora by set of molecular markers and to relate molecular data to biotope features defined by employing neighboring species of herbaceous plants. In total, 138 herbaceous species were registered. Bayesian analyses of molecular data demonstrated many genetic clusters. Our results suggest multiple introductions of I. parviflora into Lithuania. The molecular diversity of populations significantly correlated with the total coverage by herbaceous plants in the sites. The variability of study sites was most related to the coverage of herbaceous plants and least related to the molecular features of I. parviflora populations.

Keywords: *IAS, invasive alien plants, Impatiens, biotic environment, populations*

EVALUATION OF THE CREMATION PROCESS BY ECOLOGICAL ASPECTS

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Abstract

Humans perform a variety of activities throughout their lives that affect nature around the world. Many of these activities are being studied and their potential impact on the environment. Very little is known about the environmental impact of human burial.

Separate issues were discussed, such as outgoing emissions during cremation, potential groundwater and soil pollution, and the rapid expansion of cemeteries. However, the overall environmental impact of burial has not been studied in great detail and is lacking in the scientific literature. The impact on the environment, be it from a service or a product, does not always have to be calculated in many decimal places, as long as critical limits of environmental pollution are protected by law when it comes to cremation.

The handling and disposal of dead bodies in many countries is organized according to traditions, religions or legal procedures that have been developed to protect human health and the local ecosystem

EXAMINATION OF SUSTAINABILITY INDICATORS IN AN ORIENTED STRAND BOARD (OSB) BUSINESS WITH SUSTAINABLE VALUE STREAM MAPPING DESIGN (SUS-VSM)

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Abstract

Sustainability in the forest products sector in Turkey depends on the sustainable management of the country's forests, but its importance has been increasing in recent years. Various practices are implemented in the sector for sustainability. However, little is known about the consequences of these practices in forest products businesses. Oriented Strand Board (OSB), an output of the forest products sector, is produced by mixing the chips obtained by chipping small-diameter round wood raw material in the longitudinal direction with glue and wax, and then pressing them under certain pressure and temperature. This study aims to examine sustainability indicators in an OSB business with Sustainable Value Stream Mapping Design (sus-VSM). The research was carried out in a business that has been producing OSB for more than 10 years in Turkey. The business has high quality efficiency (99.7%) in the economic indicator and high material efficiency (97.8%) in the environmental indicator. The safety efficiency level, one of the social indicators, is low (70%). The results showed that the business can be an exemplary business in terms of sustainable production by making improvements in the safety level. It is recommended to add efficiency regarding waste use by sector as a variable to the sus-VSM design in future studies.

Keywords: *sustainable production, sustainable value stream mapping, sustainable occupational and health and safety, board industry, forest product sector*

STATUS OF THE BALTIC SEA. FUTURE PERSPECTIVES

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Abstract

More than a third of the Baltic Sea is less than 30 meters deep, so the total volume of water is very small compared to its surface area. The only connection with the Atlantic Ocean is through the Denmark Strait. The exchange with ocean water is very slow and the influx of fresh water is high. Most of the water comes from rivers and this determines the salinity level of the water.

The poor condition of surface water is still a challenge in many countries, including Lithuania. To assess the impact of organic agricultural production on groundwater and surface water quality in Lithuania, surface water from rivers and other bodies of water are often studied, but groundwater in agricultural fields has not been extensively studied.

The status of Baltic Sea is needed to be improved. E.g. nutrient emissions induce its eutrophication; total estimated phosphorous load to Baltic Sea was about 29 000 ton and nitrogen 859 600 ton in year 2008 (Helsinki Commission, 2012). The most of the nutrient emissions (=phosphorus and nitrogen) in Baltic Sea region are derived from Poland, Sweden and Finland. From the total nutrient load the anthropogenic one is derived from e.g. by human communities and industry, even though the most of that is derived from agriculture (over 50 %).

SIZE STRUCTURE AND LENGTH-WEIGHT RELATIONSHIP OF EMPEROR FISH (LETHRINIDAE)

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Abstract

The emperor fish is a reef fish that constitutes the main catch of traditional fishermen in Wakatobi National Park (WNP). This study aimed to analyze the size structure and exploitation rate of emperor fish. The research was conducted on Kaledupa Island, WNP. The study used a survey method, identifying fishermen's catches and measuring the length and weight of the emperor fish found at the study locations. Data analysis used description analysis for measuring fish diversity; length-weight relationship (LWR) of fish; and measurement of the fish growth indicators. The results indicated that fish diversity in the two study locations (Balasuna and Tampara) was nearly identical. The species of emperor fish found were Lethrinus harak, L. ornatus, L. variegatus, L. lentjan, L. erythropterus, and L. genivittatus. Of the five types of fish found there, was L. harak (505 ind), 210 L. variegatus and 172 L. ornatus. L. harak was the longest in size at 29.5 cm, L. variegatus at 29 cm, and L. ornatus at 19 cm. Analysis of the LWR conducted on the L. harak, L. ornatus, and L. variegatus species indicated that the growth pattern of the three fish is negative allometric ($a < b$), meaning that their growth in length exceeded their growth in weight. The growth indicators (K, L_∞, t_0) of emperor fish in WNP when compared with previous research are not significantly different. In order to maintain the sustainability of fish resources, there is a need to increase fishermen's education and improve supervision of fishing activities.

Keywords: *Wakatobi, emperor fish, reef fish, exploitation*

ADVANCED 2D NANOSTRUCTURED FILMS ENGINEERED VIA LANGMUIR-BLODGETT AND PICKERING EMULSIONS FOR CU(II) ION REMOVAL IN WASTEWATER TREATMENT

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Abstract

This study presents the synthesis and application of a 2D nanostructured film comprising a self-assembled monolayer of silica nanoparticles functionalized with polyethyleneimine (PEI), fabricated through an integration of Langmuir-Blodgett (L-B) and Pickering emulsion techniques. This research addresses the critical need for efficient materials capable of removing metal ions, specifically Cu(II), from water, contributing to environmental remediation efforts. The synthesis process began with the stabilization of an oil-in-water (o/w) Pickering emulsion, where tert-butyl acrylate served as the oil phase. This emulsion was carefully spread over the L-B trough, compressed, and polymerized under UV radiation, forming an asymmetrically structured thin film. The surface functionalization of silica nanoparticles with PEI not only enabled the effective adsorption of Cu(II) ions due to the chelating action of amine groups but also contributed to the film's structural integrity and mechanical properties. The resultant films were characterized using SEM. These analyses confirmed the high degree of nanoparticle ordering and uniformity, essential for achieving the desired photonic and adsorptive functionalities. Despite the film's inherent fragility, further mechanical reinforcement was achieved by incorporating a polyvinyl alcohol/glycerol layer, enhancing its durability and making it suitable for practical environmental applications. This modification preserved the film's functional properties, such as its iridescence and adsorption capacity, while significantly improving its handling robustness. Specifically, the 2D nanostructured film demonstrated a notable adsorption capacity for Cu(II) ions, outperforming conventional nanoparticle powders and microspheres, underlining its potential for real-world environmental applications. Future research directions include optimizing the film's adsorption performance for a broader range of pollutants and exploring its potential in other applications, such as sensors and photonic devices. This study offers a novel approach to addressing the pressing challenges of water purification and environmental sustainability. 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, Langmuir-Blodgett*

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THE INTERACTION BETWEEN ALGAE, BACTERIA AND FUNGI IN BIO-BASED PLASTIC DEGRADATION

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Abstract

Plastic waste has been becoming a growing threat to the environment and society. An urgent solution to this requires innovative approaches. Bio-based plastics, made fully or partially from renewable sources, have been introduced and expected to be bio-degradable. Profound research has reported the involvement of microorganisms or enzymes in the biodegradation of synthetic plastics, leading to a possible development of biological treatment technology for plastic waste. However, a single organism has been approached, not a complex symbiosis of microbial consortiums such as algae, bacteria, and fungi. In this experiment, bacteria and fungi associated with green-algae Chlamydomonas reinhardtii, were isolated in order to understand their potency on bio-based plastic degradation. The associated microorganisms were isolated and identified using fluorescence microscopy and DNA sanger sequencing. Then the isolated microorganisms were tested respectively for their potency to degrade plastics by growing them on bio-based PET- containing agar. Moreover, their capability to produce esterase and lipase plastic degrading enzymes were detected using the spectrophotometry method. The results showed that the isolated microorganisms were Arthrobacter ruber, Aspergillus fumigatus and Alternaria alternata. They were able to grow on biobased PET-containing agar, and each of them poses esterase and lipase enzymes. Further study is needed to understand the interaction and mechanism of the microorganism on degrading bio-based plastic.

Keywords: *Chlamydomonas reinhardtii, bio-based plastic, bio-degradation, esterase, lipase, enzyme*

IMPORTANCE AND EFFECTIVENESS OF BIOLOGICALS FOR THE PRODUCTION OF ECO-FRIENDLY FOOD

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Abstract

The population of our planet may reach 15 billion people by 2100, so the priority challenge of any state is to provide the population with food. The required amount of food, its sustainability, cost-effectiveness, soil fertility and structure maintenance, and human health preservation can all be achieved by biotechnology. The extensive use of chemical pesticides has led to severe depletion of the soil and exhaustion of its beneficial inhabitants, environmental damage, increased human morbidity, and a decrease in the immunity of plants, animals and humans. Only 13% of children can now be considered completely healthy, resulting in increased costs for the construction of new hospitals, the development of drugs, the payment of sick leaves, and the loss of the labor pool. Biotechnology can significantly reduce costs and harm caused by chemical pesticides, ensure cost-effective agricultural technologies, reduce crop storage losses, increase the quality of fruits and grains, as well as maintain the beneficial properties of the soil and human health. The major biotechnological products, namely bioinsecticides, biofungicides, bioimmunomodulators and biofertilizers, both individually and in combination, are able solve these problems. Every dollar invested in a biological can return 10-13 dollars of profit. Biologicals are based on the use of microorganisms taken from soil or plants. Bioinsecticides are derived from Bacillus thuringiensis, biofungicides – from Trichoderma, immunomodulators – from endo- and exomycorrhizal fungi, and biofertilizers – from Bac. amyloliquifaciens. The vast collections of microorganisms-producers available allow producing effective and diverse biologicals and meet the above challenge.

Keywords: *biologicals, microorganisms, bioinsecticides, biofungicides, biofertilizers, environment*

GLOBAL LANDSCAPE OF SOIL POLLUTION FROM MINING ACTIVITIES

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Abstract

Although mining has played a crucial role in economic development, employment, infrastructure and the provision of essential raw materials for modern society, in recent decades, global mining activities have been associated with various environmental issues, including soil pollution. Heavy metals can persist in soils for extended periods of time, posing threats to human health and ecosystem integrity. This paper aims to provide insight into the current state of soil pollution following mining activities worldwide with a focus on soil contamination by heavy metals. Through examining case studies from different continents, this paper highlights the widespread impact of soil pollution caused by mining activities, while also addresses health risks related to exposure to specific contaminants such as cadmium, lead, arsenic, chromium and copper. By integrating existing data and research findings this work contributes to a better understanding of the problems associated to soil pollution resulting from mining activities while highlights the importance of addressing potential remedial techniques.

Keywords: *global mining pollution, soil contamination, heavy metals, heavy metal exposure health risks*

RESISTANCE AND GROWTH DYNAMICS OF LEGUME PLANTS DURING PETROLEUM HYDROCARBONS-CONTAMINATED SOIL PHYTOREMEDIATION PROCESS

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Abstract

Petroleum hydrocarbons (TPH) are the most common soil pollutants in the world. Due to the extensive and long-term use of petroleum products, there are around 2.8 million potential spots of soil pollution in Europe alone. This pollution can damage the environment and create health risks. There are various ways to decontaminate soil pollution, but biological methods are the most desirable. Leguminous plant's phytoremediation is a promising method for TPH-contaminated soil treatment because they can fix nitrogen with the help of nitrogen-fixing bacteria in their roots. This means they don't have to compete with other plants and microorganisms for nitrogen.

This study tested the resistance of three types of leguminous plants (Medicago sativa L., Melilotus albus L., Lotus corniculatus L.) to soil contaminated with heavy fuel oil (HF) and diesel. The plants were grown in soil contaminated with HF at concentrations of 2.5 and 4 g kg^{-1} and in soil contaminated with diesel at concentrations of 4.0 and 6.0 g kg^{-1} for 90 days. Plant growth and physiological parameters were measured. Diesel had a negative effect on the growth of all legumes, but only L. corniculatus and M. albus showed a reduced growth rate. The weakest inhibitory effect on shoot and root dry weight was observed in L. corniculatus in the case of HF contamination. According to the tolerance index (TI), M. sativa was the most resistant legume under the highest HF and diesel concentrations tested.

Keywords: *soil, phytoremediation, Fabaceae plants*

ANALYSIS OF LIFE CYCLE ASSESSMENT AND BIODEGRADABILITY OF MINERAL DIESEL FUEL MIXTURES CONTAINING 10 % OF BIODIESEL, OBTAINED BY SIMULTANEOUS OIL EXTRACTION AND TRANSESTERIFICATION

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Abstract

The article provides data on the environmental properties of biofuels obtained by the simultaneous extraction of oil from spoiled rapeseed and transesterification with the addition of mineral diesel to the reaction mixture. The resulting reaction product contained 10% biodiesel – fatty acid methyl, ethyl or butyl esters in mixtures with mineral diesel. Life cycle analysis has shown that mixtures of biodiesel and mineral diesel have lower negative environmental impacts compared to pure mineral diesel. The values of indicators such as abiotic depletion, acidification, global warming, ozone depletion, human toxicity for mixtures are 40% - 58% lower compared to the corresponding values for mineral diesel. The addition of biodiesel has been found to increase the rate of biodegradation of fuels. Such fuels are classified as partially biodegradable according to the OECD classification.

Keywords: *Life cycle; biodegradability; mineral diesel biodiesel mixture*

YEASTS IN THE SOILS OF THE ALYTUS REGION AFTER THE FIRE OF THE TIRE PROCESSING PLANT

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Abstract

Alytus is located by the Nemunas river, 65 km south of Kaunas and 108 km southwest of Vilnius. On October 16, 2019, a fire broke out at a tire recycling plant in the industrial district of the city of Alytus, Lithuania. About 5,000 tons of used and recycled tires were stored in the premises, and the area of the premises was 2,000 square meters. About 2,000 tons of tires burned during the fire. This fire is considered one of the biggest ecological disasters in Lithuania. The study aimed to investigate the prevalence and biodiversity of yeasts in the soil and water samples of the city and district of Alytus after a fire at a tire processing plant. 11 soil and 3 water samples were taken each year for the periods of 2019-2021. The yeast count in the soil samples ranged from 10^2 to 10^5 CFU/g. In water samples, the count of yeasts varied between 0.00-10^3 CFU/g. A total of 114 yeast isolates were isolated from the soil samples and 46 yeast species were identified. No statistically significant changes in the phyla distribution of yeast species isolated from the soil were observed during the different study periods. A total of 25 yeast isolates were isolated from the water samples and14 yeast species were identified. Statistically significant differences in the phyla distribution of yeast species isolated from water samples were observed. The obtained research data showed that the results of all chemical soil tests do not exceed the limit values specified in Lithuanian legal acts. The obtained results of the study allow us to state that the fire at the tire recycling plant did not affect the prevalence and biodiversity of soil yeasts, but the possibility that the effect will be noticed after a longer period of time cannot be ruled out.

Keywords: *yeast, prevalence, biodiversity, tire fire, pollution*

RISK OF TOXIC COMPOUNDS FROM FOOD PACKAGING MATERIALS

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Abstract

Food protection and safety requires the use of packaging. The primary objective of packaging is to prevent the food contents from microbiological, chemical, physical contamination and for preservation purposes hence the quality of substances used must be appropriate to avoid any chemical reactions. Food contact materials (FCM) they are all the materials that come into contact with food and drinks, such as containers, packaging, kitchen utensils, cutlery and dishes. They covers a wide range of materials, including plastics, paper, metal, ceramics and glass, which contain chemical substances that might migrate into food. These chemicals must not migrate into the foodstuff in quantities that could endanger human health. Chemicals like phthalates, bisphenol A (BPA), perfluoroalkylated substances (PFAs) polyvinyl chloride (PVC) have been discovered in plastic food packaging, and in canned foods comes from inner layer of cans. They can be affected with natural body hormonal pathways and can cause damage of them. These chemicals, endocrine disruptors (ED), structurally similar to natural hormones with affinity to the receptors, can damage the body natural hormone signals to block or activate natural responses. The European Food Safety Authority (EFSA) has issued fixed packaging guidelines that deals with provisions for regulating different packaging components such as plastics, glass, paper, metal and also printing inks.

In this study we focused on an overview of the materials used, the associated risks and the applicable European legislation.

Keywords: *food packing materials, migration, risk*

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MANAGEMENT OF WASTE COOKING OIL IN COMPOSITES WITH DESIRED UTABLE PROPERTIES

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Abstract

Waste cooking oil (WCO), produced by food service establishments and households, can pose health and environmental risks due to harmful compounds formed during frying. Improper disposal of WCO can release these compounds into the environment, causing ecological hazards. Strict regulations on WCO recycling and disposal have made waste management challenging. Recently, there has been a focus on recycling and reusing WCO for environmental protection.

In this study, WCO was used to create oil composites (OC) with high mechanical strength and antimicrobial properties. Salicylic acid (SA) was added in amounts of 1%, 4%, or 7% to enhance the composites' effectiveness against Gram-positive and Gram-negative bacteria. The process of OC obtaining involved mixing WCO with sulfuric acid (catalyst) and sand (0.5-1.4 mm), homogenizing the mixture, adding SA and re-homogenizing. The mixture was then transferred to aluminum molds, compacted, and heated at 190 to 210°C for 12 to 20 hours. The content of catalyzed oil was 20 or 25% and the mass ratio of catalyst to catalyzed (cat./oil$_C$) was 0.04 0.14 or 0.24.

The physicochemical properties of CO were examined. The materials were characterized by high porosity and sharp edges but varied in mechanical strength due to the different size and number of pores inside the composites. The highest splitting tensile strength of composites with salicylic acid was 4.2 MPa (composites obtained by annealing at 210°C, 18h, cat./oil$_C$=0.24).

Selected SA - composites were the most active against P. aeruginosa caused almost complete inactivation of the bacteria (inactivation level of 99%). SA-composites had a less lethal effect on S. aureus, causing a reduction in these microorganisms 20-25%.

Keywords: *composite, oil block, waste cooking oil, microbiology, salicylic acid*

THE FUTURE PERSPECTIVES OF RECEIVING RIVERS UNDER THE REVISED URBAN WASTE WATER TREATMENT DIRECTIVE

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Abstract

The updated Urban Wastewater Directive (UWWTD) represents a significant change to the European Union's strategy for managing the surface water quality.

Addressing the increasing pressures from urbanization, climate change, and industrial activities, the directive introduces stricter regulations and innovative approaches to enhance the treatment and management of wastewater. Key measures include enhanced nutrient removal processes, stricter monitoring of micro-pollutants, and the promotion of circular economy principles in the water management.

The main objective of this research is to examine the impact of the urban wastewater treatment plant on the receiving rivers, in the light of the above-mentioned new regulations. Therefore, for one year, the effect of seasonality at different water levels in the area of Veszprem city (Hungary) was investigated. The monitored water quality indicators were Nitrogen and Phosphorus based nutrients, and some specific pollutants related to heavy metal ions (such as: Cd(II), Zn(II), Cu(II) and Pb(II)) and residual traces of pharmaceuticals, which were detected especially in the spring and autumn seasons respectively, in the form of analgesics (e.g. painkillers), as an example.

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REMEDIATION OF LEAD-POLLUTED WASTEWATER USING GRAPE WASTE

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Abstract

The winemaking waste creates problems to wine producers, because the grape marc can pollute the environment and affect the nearby agricultural crops. The present research proposes a new direction for the valorization of this agro-food waste: in residual water depollution. Four biomaterials obtained from winemaking waste were tested for Pb removal: raw Merlot grape marc (MR), raw Sauvignon Blanc grape marc (SbR), Merlot grape marc biorefined (ME) and Sauvignon Blanc grape marc biorefined (SbE). The effects of sorbent and initial Pb concentrations, adsorption kinetic, equilibrium isotherms and the matrix influence from a mine effluent were assessed. Very good perspectives for the practical application in lead uptake from wastewaters arise, with better results for biorefined grape marc compared to raw material. The lead removal percentage from an initial solution containing 20 mg Pb/L, at optimum pH (5.5±0.5), is 71% - MR, 78% – SbR, 80% - ME and 97% - SbE. Langmuir model reveals very good removal capacity for ME (40 mg/g) and SbE (64 mg/g). Thus, the grape waste can turn into a low-cost and easy-to-prepare sorbent for the bioremediation of contaminated water.

Keywords: *grape marc, biomaterials, residual water depollution, lead, bioremediation*

USE OF ARTIFICIAL INTELLIGENCE METHODS IN THE IDENTIFICATION OF CHIRONOMIDAE LARVAE

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Abstract

An ongoing challenge for ecological research is the collection of adequate amounts of large-scale, precise data to detect and counteract adverse global change processes flawlessly. A major obstacle is the time-consuming and difficult process of sorting and identifying organisms, but incorporating the capabilities of artificial intelligence as a tool for observing biodiversity provides a potential solution. Among the large group of bioindicators in the aquatic environment, benthic macroinvertebrates and highly diverse insects play an important role. However, the costly and time-consuming process of species identification is one of the key obstacles to implementing the principles of next-generation biomonitoring (NGB) of aquatic ecosystems. Recently, a method has been proposed to determine, for example, Chironomidae (Diptera) larvae species based on deep learning from information in available public datasets. This method, which harnesses the power of AI, is remarkably accurate in determining the species composition of this group of insects, instilling confidence in the reliability of the results. Transfer learning was applied using a deep convolutional neural network (CNN) pre-trained on multiple larval images. This allowed for accurate determinations of the species composition of this group of insects subsequently traced to determine environmental quality. Thus, AI capabilities in classical taxonomic studies are expected to support molecular studies (barcoding and/or metabarcoding) in the assumptions of next-generation biomonitoring. This approach should gain in popularity in the years to come, especially when implementing strategies for biodiversity conservation, where accurate knowledge of the taxonomic diversity of biocoenoses at a broad spatial scale will be the basis.

RELATION BETWEEN INDOOR RADON CONCENTRATIONS AND GEOGENIC RADON POTENTIAL

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Abstract

The study presented the results of radon measurements in homes, gamma dose rate, and geogenic radon potential (GRP) in different settlements in Bulgaria. The study aims to assess the relation between measured parameters. Indoor radon measurements were carried out under the Bulgarian National Radon Plan, as follows: for the Sliven district during 2018 - 2019 and the city of Kyustendil during 2020 - 2021. The nuclear track detectors (CR-39) were used for measurements. The determination of radon concentration in soil gas, soil permeability, and gamma dose rate, were carried out under a national project by the Bulgarian National Science Fund of the Ministry of Education and Science (Contract № КП-06-Н37/22/07.12.2019 г.). Measurements of radon in soil gas were performed with a soil radon monitoring system RM 2 (Radon v.o.s, Czech Republic). Soil gas permeability was performed with a RADON-JOK system manufactured by Radon v.o.s, Czech Republic, with a range of 1.7E-14 to 5.6E-11m^2. The geogenic radon potential (GRP) is a quantity determined by the concentration of radon in soil gas and the permeability of the soil. Direct gamma dose rate measurements were performed according to standard operating procedure with a Rados-RDS 110 portable dosimetry device. Indoor radon variations range from 23 to 1314 Bq/m^3, and the maximum calculated GRP value is 192. The average outdoor gamma dose rate is 0.14 μSv/h, which is typical for the country. IBM SPSS Statistics, v. 23 was used for performing the statistical analysis. Statistical significance correlation was found between groups of results: radon in dwellings and GRP and gamma dose rate and GRP applying Spearman's rank correlation coefficient, which showed that GRP could be used for the prediction of indoor radon.

Keywords: *geogenic radon potential, dwellings, indoor radon, gamma dose rate*

GRAPHITE OXIDE SUBSTRATE FOR THE DEVELOPMENT OF WO_3/BI_2S_3 HETEROSTRUCTURE WITH PHOTOCATALYTIC APPLICATIONS

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Abstract

The diversification of pollutants type and concentration in Wastewater has underlined the importance of finding new alternatives to traditional treatment methods. Advanced oxidation processes (AOPs), among others, are considered as promising candidate to efficiently remove organic pollutants such as pharmaceutical active compounds (PhACs) from wastewater [1, 2].

The present work focuses on the development of WO_3/Bi_2S_3 heterostructure using carbon graphene oxide (GO) as nucleation sites for the metallic semiconductors. The photocatalytic activity was testes toward ampicillin and amoxycillin from wastewater. The diffraction analysis indicates the presence of crystalline structure corresponding to the heterostructure components. The samples have a porous morphology and the specific surface varies from 38.2 m^2/g for WO_3 to 247 m^2/g for WO_3/Bi_2S_3@GO.

The photocatalytic experiments were made in the presence of UV-Vis irradiation and the results indicate that WO_3/Bi_2S_3@GO is able to remove 92.4% ampicillin in 10h, comparing with WO_3/Bi_2S_3 which exhibit 73.5%. A similar behavior was observed for amoxycillin removal were the photocatalytic efficiencies attempt 94.1% for WO_3/Bi_2S_3@GO and 71.8% for WO_3/Bi_2S_3. The results indicate that the use of GO as nucleation sites serve as triple benefits: (1) homogenous surface distribution, (2) higher active surface area and (3) energy network for the charge carriers involved in oxidative species generation.

MODELING OF PHYSICO-CHEMICAL PROCESSES IN AQUATIC ECOSYSTEMS BASED ON MASS BALANCE EQUATIONS FOR MULTICOMPONENT TWO-PHASE SYSTEM

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Abstract

This study introduces a framework integrating unique mass balance equations for soluble and insoluble species from aquatic ecosystems within heterogeneous systems, focusing on "solid phase - saturated multicomponent solution" systems. It presents fundamental mass balance equations within the residual concentration method to analyze thermodynamic functions for various chemical interactions, described by the developed generalized equations, including metal ion hydrolysis, ligand protonation, and complex formation. The derived equations account for contributions from solid phases, hydroxocomplexes, and complexes with complexing agents, expressing total and residual concentrations of solid phases components in the saturated aqueous solution. The method demonstrates the ability to handle simultaneous formation of multiple chemical species, leading to specific thermodynamic relationships. It provides a comprehensive analysis of thermodynamic conditions, estimating solid phase quantities based on initial composition and pH values.

Acknowledgement: *A part of the work (IP and OS) has been carried out within the Institutional Research Program of the State University of Moldova for the period 2024-2027, subprogram "Advanced Research in Computational and Environmental Chemistry, Identification of Technological Treatment Processes, Formation of Water Quality and Quantity", code 010603.*

DEVELOPMENT OF THE PROTECTION ENGINEERING STUDY PROGRAM IN BASIC PROFESSIONAL STUDIES

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Abstract

The Higher Education Technical School of Professional Studies in Novi Sad had four accredited study programs in the field of protection. These were the study programs: Occupational Safety, Environmental Protection, Fire Protection and Civil Protection. By conducting various surveys with employers, employees and students, the needs of the labor market have been analyzed. We came to the conclusion that it is enough to accredit one degree in protection engineering for basic professional studies for several reasons. Employers in smaller companies who have the obligation to employ all three profiles of engineers do not need three people full-time. Thus, they employ one protection engineering engineer qualified to perform all three jobs. Training is additionally carried out through training programs and taking exams for licenses in the appropriate field. Also, specialist and master's studies provide the possibility of continuing improvement in each of these areas.

Therefore, the paper deals with the research of the labor market, the attitudes of employers, the opinions of employees and the students about the development of a new integrated study program for basic professional studies. After that, they are free to choose further subjects, as well as the topics that will be lectured to in each subject. The last step is the preparation of complete documentation for the seven-year accreditation of the study program at the National Entity for Accreditation and Quality Assurance in Higher Education.

GRAPHIC INDUSTRY AND ENVIRONMENT

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Abstract

The printing industry in this region, using the evaporation of chemicals which are very harmful to the environment. Flexographic processes, deep, and screen printing, using chemicals which evaporation must be minimized by using plants for air purification before discharge into the environment. For businesses to assess whether they are more profitable to switch to more modern equipment and less harmful chemicals, or to incorporate air cleaners. This paper analyzes the materials used in the printing industry by printing techniques, and fumes in the air that is because of them appear. Also, trying to find a solution to reduce harmful emissions of polluting emissions into the atmosphere by using other materials, new technology, or by installing the appropriate air purifiers. The aim is to point to air pollution, analyze the causes and find a best solution to reduce environmental pollution.

DOUBTS ABOUT RECENT ENERGETIC TRENDS

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Abstract

This paper deals with the issues besieging the traditional "service-oriented" approach to energy. The tension between the 20th and 21st century engineering approaches is almost antagonistic. What can be the long-term goal, what can ecological sustainability even mean in energy industry? The following doubts occur:

- *How good is nuclear power?*
- *How long can wind farms grow realistically, economically and ecologically?*
- *Is the temporary storage of excess energy in a battery the best solution?*
- *Where do we get the primary energy for the inefficient hydrogen economy?*
- *Are electric cars really the means of transport of the future?*
- *Is it possible to switch to a full renewable energy supply in the short term?*
- *Does complete carbon dioxide exemption guarantee long-term sustainability?*
- *Does the energy market really help and solve energy crises? – etc.*

Although we cannot propose a global and universal solution, in addition to the growing doubts, we also recommend some confident solutions stepping in the right direction, such as self-restraint, saving energy and demand side regulated energy use in parallel to energy storage.

Keywords: *energetics, engineering and energy paradigm, ecological sustainability, CO2 mitigation, Smart DSM, national energy strategy, systems' hierarchy*

POSSIBILITIES OF ENERGY EFFICIENCY IN INDIAN HIGH-RISE BUILDINGS: AN ARCHITECT'S APPROACH

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Abstract

Presently the only suitable and logical alternative left before mankind for developing habitation is to rise vertically up from land to air. The vertical growth pattern of highly developed urban areas projects further development of taller buildings. But high-rise buildings are major energy users. The artificial lighting and air handling of spaces are the major sections of energy consumption. Vertical transportation and comfortability of inmates also uses much energy. Different building services consume fair amount of energy. Distribution of energy accounts for transmission losses. This usable energy is generated from fossil fuels which are major pollutants and will not last longer. 6 present Indian mega cities have started competing with each other in verticality, with Mumbai leading with 61 stories residential tower. So, in near future tall buildings will be extensively used for all types of habitation and high-rise cities will come into existence. Use of renewable energy resources & low energy building materials will reduce the negative environmental footprint of tall buildings in one hand; smart measures will ensure efficient use of available resources on the other hand. This research identifies strategies of usage of renewable energy for development of futuristic Indian tall buildings.

Keywords: *tall buildings, alternative energy, energy management system, energy audit, low energy materials, high-rise.*

LITHUANIA CONSTRUCTION MATERIAL REUSE OPTIMISATION (SOLUTION) PORTAL

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Abstract

Over two billion tonnes of municipal solid waste are produced annually worldwide. Human activity also generates significant waste related to agriculture, building and demolition, industry and commerce, and healthcare. This waste is generated at companies, hospitals, building sites, and farms. Unregulated waste knows no boundaries. While emissions from burning and open waste dumping are deposited in terrestrial and aquatic ecosystems and the atmosphere, they are transported via waterways within and between nations (UNEP and ISWA 2024). Construction material reuse portals exist in various countries globally. By connecting waste producers to waste managers, various countries portals make it easier for the construction sector to maximise resource efficiency to the highest possible environmental standards.

During the project, we analysed various business models (circular inputs, product as a service, product use extension, resource recovery, the concept of sharing economy and others) and put forward the best options among them. The SOLUTION Portal is an open, co-creative real-time collaborative platform that gives its users—activists, businesses, citizens, consumers, innovators, policymakers—a convenient access to networks, tools and practical guidance to take action and speed up the adoption of reuse SOLUTION.

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EVALUATING RECREATIONAL INFRASTRUCTURE IN MARGINALISED MOUNTAINOUS AREAS: A CASE STUDY OF KARDÜZ UPLAND

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Abstract

Mountainous areas are multifunctional and provide several goods and services to society. One of these goods and services is forest-based recreation. Many reasons make mountainous areas attractive for recreation such as clean air, scenic beauty, wildlife, local culture, being intertwined with nature and nature sports. Recreational infrastructure and facilities highly influence destination competitiveness for marginalised areas. The aim of this study is to determine the recreational infrastructure, existing resource values, user demands and trends of Kardüz Upland, to identify existing problems and to create a recreation planning concept for the competitiveness of the study area. Kardüz Upland with an altitude of 1,830 metres above sea level is 180 hectares. Kardüz Upland, one of the highest points of Düzce, is a candidate for winter tourism. In addition to winter sports in winter; jeep safari, photo safari, mountain biking, trekking, horse riding and camping activities can be done for enthusiasts. Kardüz Upland has been determined and declared as "Culture and Tourism Protection and Development Zone" by the decision of the Council of Ministers. Mountainous area has one of the important hiking routes of Düzce. In the study, natural and cultural resource inventory (slope, aspect, elevation, topography, transportation, existing land uses, water resources, etc.) was created and analyzed in ArcGIS environment. In the analysis of the data obtained as a result of the surveys conducted on the visitors, IBM SPSS Frequency percentages were determined using the Statistics 25 package program and given in charts and graphs.

Keywords: *Nature-based Tourism, Mountainous Areas, Recreational Infrastructure, Sustainable Development*

SUBJECTIVE ASSESSMENT OF WORKING CONDITIONS ON VESSELS

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Abstract

Shipping and fishing are among the sectors of the economy which are characterised by particularly extreme environmental conditions and, as a consequence, ship crews belong to the group of workers whose health and lives are particularly vulnerable. In addition, they are a specific occupational group – for a significant part of the year, the vessel is not only their working environment, but also their living environment. This is one of the two main sources of job dissatisfaction for this professional group. The second source of this dissatisfaction is working conditions. The paper presents the results of the assessment of working conditions in workplaces on selected vessels. This assessment was based on survey results. The survey was conducted by means of a questionnaire among 300 maritime and inland navigation workers. Over half of the respondents (i.e. 51% of the workers) assessed their working conditions as good.

Keywords: *working conditions, workplace, vessel, survey research*

VIRTUAL REALITY TECHNOLOGY TO RAISE AWARENESS OF OCCUPATIONAL HAZARDS ON CONSTRUCTION SITES

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Abstract

Safety is of utmost importance to the Abu Dhabi City Municipality, particularly for those working in the construction sector. Given the high-risk and critical nature of activities in this industry, it is essential to provide proper training to increase awareness and promote safety among the workforces. This paper aims to test the hypothesis that "VR Training on Construction Sites is an effective tool to prevent accidents and undesirable events" by comparing its effectiveness to traditional training methods in terms of coaching construction workers and improving their abilities to identify and assess risks. The framework in this paper includes understanding the root causes of incidents through the analysis of historical incident data. Based on this analysis, 15 training scenarios were developed using virtual reality technology to provide workers with an engaging and interactive training experience that enables them to visualize site risks better and effectively understand safety precautions. After the VR training sessions, participants were asked to evaluate their training experience through a short questionnaire to measure the effectiveness of VR technology in safety training. In addition to the training assessment, "incident trend analysis exercises" were carried out after delivering the VR training courses to measure the effectiveness of the VR training and its impact on the safety culture, overall workers' hazard identification, and awareness of work site risks. The study showed a positive attitude among participants toward VR safety training and a tangible reduction in the number of undesirable events recorded over a certain time span. These findings suggest that VR technology can be a valuable tool for promoting safety and preventing accidents in the construction industry.

Keywords: *Virtual reality, Safety, Incident, Awareness*

NITRATES IN DRINKING WATER IN VARNA DISTRICT

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Abstract

The study determined drinking water state in Varna district, Bulgaria, with regard to presence of nitrates in it. Water supply sources of the district are studied. Nitrates presence in drinking water is investigated for period 2018-2022 in 17 critical areas and trends are determined. The highest nitrate pollution levels are found in Dobrogled (2018 – 256 mg/dm^3), Sadovo (2021 – 204 mg/dm^3) and Zdravets (2021 – 165 mg/dm^3). Drinking water in Dobrogled area is in the worst condition. Reported values are more than five times the norm. In 2018 the highest amount (256 mg/dm^3) is recorded for studied period, and lowest (206 mg/dm^3) is measured in 2021, which is more than four times exceeding the established norm (50 mg/dm^3). Measures and activities implemented by RHI-Varna and WSS - Varna are studied.

Keywords: *quality, drinking water, pollution, nitrates*

RISK FACTORS FOR INFECTIOUS DISEASES IN FLOOD-AFFECTED AREAS: THE CASE OF CENTRAL GREECE

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Abstract

Floods account for the majority of catastrophic events resulting from hydrometeorological hazards. In September 2023, Greece was confronted with the Daniel flood phenomenon that led to the need to reconstruct Central Greece. Flooding alters the natural balance of the environment and often creates a favorable habitat for the occurrence of infectious diseases. The probability of occurrence and transmission of these diseases is multiplied due to the adverse living conditions formed by the occurrence of the phenomenon. The obligation of the state to safeguard the lives of citizens makes it necessary to take prevention, preparedness and intervention measures adapted to the profile and needs of society.

Keywords: *flood, waterborne diseases, civil protection, Daniel, Greece*

A REVIEW OF RESEARCH ON MICROPLASTICS IN DRINKING WATER, SOURCES, AND IMPACTS

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Abstract

Microplastic pollution in drinking water has emerged as a pressing global health concern, necessitating extensive investigation. These tiny plastic particles have pervaded all forms of water bodies worldwide, including lakes, rivers, and oceans, as well as various drinking water sources such as tap and bottled water. This study is focused on key aspects of microplastic contamination in drinking water, including its sources, contamination levels, and impacts on human health. Understanding the sources of microplastic contamination is crucial for implementing effective mitigation strategies. Various sources contribute to this pollution, including plastic waste, synthetic textiles, and microbeads in personal care products. The contamination levels of microplastics in drinking water vary widely across different regions and water sources, highlighting the need for standardized monitoring and assessment protocols. The full extent of how microplastic ingestion affects human health remains unclear. However, research indicates that these particles can accumulate within the body, posing potential risks for long-term health problems. There is growing evidence suggesting that microplastics may influence the development of several health issues, including obesity, diabetes, cancer, infertility, and rheumatoid arthritis.

HEAVY METAL CONTAMINATION IN THE MAHONING RIVER, OH

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Abstract

Mahoning River, historically one of the most contaminated rivers in the U.S., contains heavy metals above the U.S. Environmental Protection Agency's aquatic criteria. This study identifies the contamination levels, spatial patterns, and bioavailability of heavy metals (As, Ba, Fe, Pb, Ni, Zn) in the sediment of the lower Mahoning River. The contamination factor indicated that heavy metals in sediments were moderately to highly polluted (3-15). Inverse distance weighting in sediments illustrated decreasing concentrations towards downstream for Ni, while increasing concentrations towards downstream for As, Ba, Fe, Pb, and Zn in sediment. The inverse distance weighting patterns may be associated with land use, as the river traverses the agricultural region upstream, the urbanized region downstream, and mixed-land areas in the last stretch. Speciation analysis revealed heavy metals in water and sediments were in divalent forms (HM2+), except Pb (PbOH+, PbCO3), indicating high bioavailability and potential plant uptake in the aquatic environment.