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Niğde Ömer Halisdemir University Environmental Engineering Department

ABSTRACT BOOK

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organized by

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ABSTRACT BOOK OF THE 2ND INTERNATIONAL CONFERENCE ON ENVIRONMENT, TECHNOLOGY AND MANAGEMENT (ICETEM)

13-15 October, 2022

Niğde, Türkiye

Edited by

Research Assistant Kemal ULUSOY

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PREFACE

Dear Colleagues,

We have the pleasure for sharing state-of-the-art knowledge, science and technology with you in the "2nd International Conference on Environment, Technology and Management (ICETEM)" which will be held between 13-15 October, 2022 in Niğde (one of the cities of Cappodoccia), Türkiye.

2nd ICETEM is organized by Environmental Engineering Department of Niğde Ömer Halisdemir University (Niğde/Türkiye). This conference will provide not only the opportunity to bring experts from all around the World and different disciplines and but also the ideal academic platform for researchers to present the latest research findings. We believe this interaction is a unique platform to come together to discuss critically recent research and to intensify new collaborations and scientific research in environment, technology and management.

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ALTERNATIVE ENERGY SOURCES FOR CARGO PORTS: TURKISH PORTS PERSPECTIVE

Tanzer Satır[1*], Neslihan Doğan-Sağlamtimur[2], Natalia Borisovna Tiron-Vorobiova[3]

[1] *Department of Maritime Transportation and Management Engineering, Istanbul Technical University, Turkey*
[2] *Department of Environmental Engineering, Nigde Omer Halisdemir University, Turkey*
[3] *Odessa Maritime Academy, Danube Institute of National University, Ukraine*
** Corresponding author: e-mail: tsatir@itu.edu.tr*

Abstract

Carbon dioxide (CO_2) released from fossil fuels used due to economic growth, industrialisation, population growth, increasing energy demand, and consumption in our developing world has been the most important anthropogenic greenhouse gas causing climate change and global warming. Although the maritime sector and shipping is the greenest mode of transportation compared to other modes of transportation and emits the lowest CO_2 emissions per kilometre, alternative fuels, reduction of cruising speed, total fleet management, development of existing technologies, improved ship hull design, more efficient engines and propulsion systems, low-carbon fuel types, and even integrated, intermodal, and green logistics methods, which are renewed logistics methods, have a severe potential for fewer CO_2 emissions. A Green (Eco) port is an approach that aims to minimize the adverse effects on the environment and ecosystem. While the ports continue their activities to achieve this goal, it aims to use systems that use energy resources efficiently and effectively while meeting energy needs and having the least negligible impact on the ecosystem. The equipment that maintains port operations, port equipment, and ships berthing in the port are energy-consuming elements.

In this study, the authors focus on alternative (renewable) energy sources for commercial ports. Turkish ports are selected to give a perspective on suitable energy sources.

Keywords: Carbon dioxide, Energy, Environment, Green (Eco) Port, Maritime industry

THE ENVIRONMENTAL EFFECT ON THE AQUATIC ECOSYSTEMS OF THE PORT

Ali Murad Khan[1*], Mesut Selamoglu[2]

[1]Anatomy & Histology Department, University of Veterinary & Animal Sciences, Lahore, Pakistan*
2Logistics Programme, Department of Management and Organization, Bahce Vocational School, Osmaniye Kortut Ata University, Osmaniye, Türkiye Corresponding author: Ali Murad Khan
e-mail: aligamk@gmail.com

Abstract

Marine environments have many factor of disturbance that can be viewed as a pollution agent. Using our basic knowledge about information on abundance and distribution of pollution factors, we developed an index that impacts on the native species, the communities, different habitats and different ecosystem functioning of marine life. Another problem on port related to fuels of vessels that can be dangerous for the ecosystem of that area. The International Maritime Organization (IMO) sets limit sulphur content in fuels for marine transportation system. However, vessels still continue to use the residual high-sulphur fuels in combination with the exhaust gas cleaning systems (EGCS or scrubbers). Here with relation to the scrubbers another problem form which is scrubbers, exhaust gases are sprayed with water in order to prevent SOx, which in result of acidic wash water with elevated contaminant concentrations discharged in the aquatic ecosystem causing high problems.

Keywords: Aquatic ecosystem, Aquatic pollution, Environment, Marine ecosystem, Port system.

TRANSPORT TRENDS AND POLLUTION FACTORS IN POULTRY PRODUCTION

Ali Murad Khan[1*], Mesut Selamoglu[2]

[1]Anatomy & Histology Department, University of Veterinary & Animal Sciences, Lahore, Pakistan*
[2]Logistics Programme, Department of Management and Organization, Bahce Vocational School, Osmaniye Kortut Ata University, Osmaniye, Türkiye Corresponding author: Ali Murad Khan
e-mail: aligamk@gmail.com

Abstract

This paper will shows the current situation of the poultry sector and future its trends, and discusses the challenges and difficulties in this sector, with particular emphasis on four areas: food security, social challenges that is poverty alleviation and equity, health related to animal and human and environment as natural resources and climate change. Poultry makes a substantial contribution into food chain, its security and nutrition, providing energy, protein, and essential micro-nutrients to humans as a daily food product, with short production cycles and the ability to convert a whole wide range of agricultural food by-products and wastes, into meat and eggs which edible by humans. Poultry knowns as the fastest growing agricultural sub-sector, globally in developing countries. The poultry sector is expected to continue to grow as demand for meat and eggs, rising incomes and urbanization. In this context, the sector is facing unprecedented challenges related to environmental changes badly. Particularly for small holders and the poor, both in rural and urban areas. Poultry is a major source and key to poverty alleviation, providing income and market participation on small and large scale. Birds can be sold in times of crisis and act as household insurance or little income. But the growing market is essentially benefiting large scale operations as access to market is critical for small holders.

Keywords: Farming, Poultry production, Poultry management, Poultry farming, Poultry transportation.

ASSESSMENT OF THE QUALITY OF GROUNDWATER RESOURCES IN THE TARKWA NSUAEM MUNICIPALITY, WESTERN REGION, GHANA: A REVIEW

Daniel Senne[1*], Belinda Bentum[1], Fosu Yaw[1], Solomon Agyire[1], Joshua Nkansah[1], Gloria Baidoo[1]

[1]Department of Geological Engineering, Faculty of Geosciences and Environmental Studies, University of Mines and Technology, P.O. Box 237, Tarkwa, Ghana

**Corresponding author email: sennedaniel01@gmail.com*

Abstract

Groundwater is the major source of drinking water across the globe. However, geogenic and anthropogenic activities are adversely affecting the quality of groundwater, which calls for a great deal of attention. The Tarkwa Nsuaem Municipality (TNM) is the only municipality in West Africa with the highest number of mining companies. The mining activities as well as agricultural activities are threatening the quality of groundwater in this municipality. Arsenic contamination of groundwater is a major challenge in the area. The arsenic mobilization in groundwater is attributed to weathering, dissolution and hydromorphic dispersion of arsenic-rich ore minerals in the area. This poses health related problems in the municipality since groundwater is the major source of drinking water. Although there are research works on the quality of groundwater in most parts of the TNM, there is no comprehensive study across the entire municipality that documents the quality of groundwater to help stakeholders easily identify parts that have quality problems. Therefore, this review assesses the groundwater chemistry, major pollutants, pollution sources and the associated health problems. This is done by synthesizing previous studies in the TNM and then discussing the quality of the groundwater resource in the municipality from the previously published works in various parts of the municipality. Recommendations have been made to serve as a guide for policy making to safeguard the quality of groundwater resources in the municipality.

Keywords: Arsenic contamination, Groundwater, Health problems, Mining, Tarkwa Nsuaem Municipality

EPILITHIC DIATOMS OF TAHAR STREAM, TUNCELI-TURKIYE

Rzgar Farooq Rashid[1*], Metin Caglar[2], Zeliha Selamoglu[3]

[1]*Department of Medical Laboratory Science, College of Science, Knowledge University, Erbil 44001, Iraq*
[2]*Department of Fundamental Science, Faculty of Fisheries, Firat University, Elazig, Türkiye*
[3]*Department of Medical Biology, Faculty of Medicine, Nigde Ömer Halisdemir University, Nigde, Türkiye*
** Corresponding author: e-mail: rzgar.faruq@knu.edu.iq*

Abstract

In this study, the epilithic diatoms of Tahar Stream, which is 135 km away from Tunceli and feeds from the Kırklar Creek originating from the Kırklar Mountain, and discharges into the Keban Dam Lake from the west of the Çemişgezek district, were investigated. For this purpose, the samples taken from two stations between March 2021 and November 2021 were examined in terms of epilithic diatoms. In addition, water temperature, dissolved oxygen and pH values were also measured at the sampling areas. During the study, 26 taxa were recorded at Station 1 and 33 taxa were recorded at Station 2.

Keywords: Epilithic Diatoms, Taxa, Tahar Stream, Türkiye.

STRUCTURAL, DIELECTRIC AND MAGNETIC OF STUDY OF YTTERBIUM SUBSTITUTED COBALT-ZINC SPINEL FERRITES

Qaisar Khan[1], Maaz Khan[2], Gaffar Ali[2], Iftikhar Ahmad[3,4] and Rashid Ahmad[1*]

[1]Department of Chemistry, University of Malakand, Chakdara, Pakistan
[2]Physics Division, Pakistan Institute of Nuclear Science and Technology, Nilore, Islamabad
[3]Department of Physics, University of Malakand, Chakdara, Pakistan
[4]Centre for Computational Material Science, University of Malakand, Chakdara, Pakistan
**Corresponding author E-mail: rashmad@gmail.com*

Abstract

Yb^{+3} doped Co-Zn based spinel ferrites composition $Co_{0.5}Zn_{0.5}Yb_xFe_{2-x}O_4$ are synthesized via sol-gel method and characterized by XRD, FTIR, SEM, Impedance Analyzer and VSM. The phase analysis revealed a cubic spinel structure having a single phase. Similarly, XRD peaks became less intense and their width became larger with Yb^{+3} substitution due to the larger ionic radius of Yb^{3+} (0.99 Å), comparative with the ionic radius of Fe^{+2} (0.645 Å). The M-O vibrations at octahedral and tetrahedral sites are confirmed by FTIR spectra. Dielectric parameters are carried out using impedance analyzer within frequency range 60 Hz-110 MHz at room temperature. Dielectric constant is significantly affected with Yb^{3+} and attained 2903 value at 36 MHz for $Co_{0.5}Zn_{0.5}Fe_{1.948}Yb_{0.052}O_4$. Furthermore, $Co_{0.5}Zn_{0.5}Fe_{1.948}Yb_{0.052}O_4$ showed dielectric loss of -1802 at 36.1 MHz. The saturation magnetization, remanence, and coercivity confirmed the soft magnetic nature of the material. Excellent dielectric and magnetic properties of material suggested that they are best for high-frequency devices, super-capacitors, sensing, isolators, data storage and energy storage devices.

Keywords: Dielectric constant, FTIR, Spinel ferrites, Sol-gel, XRD.

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EVALUATION OF MAJOR SUBGRADE SOIL PROPERTIES AFFECTING PAVEMENT STABILITY USING A COMBINATION OF CORRELATION AND MULTIVARIATE STATISTICS IN NORTH-CENTRAL NIGERIA

Moroof Oloruntola[1], Daniel Obasaju[2*], Sunday Oladele[1], Victor Ojekunle[1], Olateju Bayewu[3], Christopher Baiyegunhi[4] and Ganiyu Mosuro[3]

[1]Department of Geosciences, University of Lagos, [2]Department of Earth Sciences, Kogi State University
[3]Department of Earth Sciences, Olabisi Onabanjo University, [4] Department of Geology, University of Limpopo, South Africa
**Corresponding Author: e-mail: obasajudaniel@gmail.com*

Abstract

The knowledge of the relationships between various subgrade soil properties and the contribution of each property to the stability of a highway is paramount in evaluating the causes of the failure of an existing highway and future rehabilitation or construction exercise. Subgrade soils (within depth ≤ 1 m) of failed and stable segments of a major highway in North-central Nigeria were evaluated for the purpose of understanding the contributions of subgrade properties to highway stability. Several subgrade properties (grain size distribution, liquid limits, compaction, California bearing ratio and mineralogy) were determined. These were complemented with geophysical data (resistivity, shear and compressional wave velocity) and subjected to correlation and multivariate analyses. Results showed that the soils have resistivity (10 – 272 Ohms-m), compressional wave velocity (358 – 1417 m/s), shear wave velocity (183 – 440 m/s), fines (20 – 64%), sand (36 – 80%), liquid limit (23.2 – 58. 0), plasticity index (0.4 – 38.8%), optimum moisture content (9.62 – 18.7%), maximum dry density (1.7 – 2.69 g/cm^3), unsoaked California Bearing Ratio, CBR (4 – 17%), Soaked CBR (2 – 10%), Unconfined Compressive Strength, UCS (24.5 – 46.2 kN/m^2), kaolinite (0 -20.6%), Illite (0 – 58.8%), smectite (0 – 15%), vermiculite (0 – 21.7%), quartz (5.2 – 68.5%). Correlation analysis showed that CBR increased with increased resistivity, compressional wave velocity, shear wave velocity, sand, maximum dry density, quartz and kaolinite but decreased with increased liquid limit, plasticity index, optimum moisture content, smectite, vermiculite, illite and fines. Two Principal components relating to soil matrix (grain size distribution, resistivity, shear and compressional wave velocity, CBR and UCS) and water content (liquid limit and optimum moisture content) had 68.86% and 14.58% respective contributions toward the subgrade properties. The study revealed that the evaluated subgrade properties accounted for 83.44% variability in the stability of the investigated highway. The study, therefore, showed the importance of geological considerations in the construction and rehabilitation of highways.

Keywords: California bearing ratio, Grain size distribution, Mineralogy, Resistivity, Subgrade soils.

GENOTOXIC AND PHYSIO-CHEMICAL DETERIORATION OF *EICHHORNIA CRASSIPES* (MART.) SOLM GROWING IN PAPER MILL EFFLUENTS

Harma[1*], Muhammad Umer Farooq Awan[1], Ali Hasnain[1], Maryam Iqbal[1], Binyameen[1], Rida Hayat[1], Muhammad Naveed Anjum[1], Mubashara Inam[2], Maham Batool[2], Warda Fatima[2]

[1] *Laboratory of Genotoxicity, Department of Botany, Government College University, Lahore, Pakistan*
[2] *Department of Biotechnology, Kinnaird College for Women, Lahore, Pakistan. 5400*
** Corresponding author: e-mail: harmashah9@gmail.com*

Abstract

Eichhornia crassipes (Mart.) Solms is a freely floating and ubiquitous invasive aquatic weed. There is tremendous trouble of water pollution worldwide due to anthropogenic activities in which increment of industrialism is a major contributor. For treating industrial effluent that contain potentially toxic elements, before disposal, several physical and chemical protocols have been applied that are highly expensive and cannot be practiced regularly. Cost-effective and eco-friendly techniques are bioremediation and phytoremediation. Solms is a menace but a promising phytoremediator. It is renowned for its potential of rectifying wastewater and eloquent tolerance against heavy metals. Despite of its competence, pollutants impart deleterious impacts on it. While recycling polluted water, heavy metals culminate phytotoxicity. The present study aims to determine genotoxicity and physiochemical deterioration in water hyacinth that grows in paper mill effluents. Water analysis of polluted site showed acidic pH, high electrical conductivity (1.857 ± 0.73456S/m), turbidity (339 ± 43.4319NTU), salinity > 0.5 (1.03 ± 0.35119ppt), TDS (1.343 ± 0.40869g/L) to dangerous level. Soil analysis revealed metals Cu, Ni, Pb in order Cu>Ni>Pb 3.577>1.336>-0.786mg/L respectively. Reduction in leaves' number, leaf area, roots length and relative water content were observed. Biochemical profile of water hyacinth growing in adulterated aqueous ecosystem manifested inauspicious ramifications on total chlorophyll content up to 0.03836 ± 0.05 mg/g. Toxins curtailed optimum cellular pH. Ascorbic acid elevated (0.014 ± 0.05mg/g, 0.032 ± 0.05mg/g, 0.0127 ± 0.05mg/g). Lead, Cadmium and Nickel were detected in wastewater plants in order Cd>Ni>Pb. Mean of Cd and Ni was (-0.0057 ± 0.00153ppm), (0.005ppm) respectively and Pb was absent. Molecular analysis was done to determine genotoxicity, DNA was extracted by a modified CTAB. İndustrial effluents effect the physiochemical nature and genomorphic characteristics of *Eichhornia crassipes* (Mart.) Solms.

Keywords: Bioremediation, Genotoxicity, Heavy metals, Phytoremediation, Wastewater.

MOLECULAR ASSESSMENT OF AIR POLLUTION IMPACT ON GENOMORPHIC CHARACTERISTICS OF *MIMUSOPS ELENGI* L. PLANTED ALONG THE ROAD SIDE OF LAHORE, PAKISTAN

Ali Hasnain[*1], Muhammad Umar Farooq Awan[1], Harma[1], Ayesha Iqbal[1], Khadija Bari[1], Muhammad Usama Aziz[1], Arooba John[1], Binyameen[1], Maryam Iqbal[1], Muhammad Naveed Anjum[1], Rida Hayat, Zahid Mehmood[1], Mubashara Inam[2], Maham Batool[2], Warda Fatima[2]

[1]*Laboratory of Genotoxicity, Department of Botany, Government College University, Lahore, Pakistan*
[2] *Department of Biotechnology, Kinnaird College for Women, Lahore, Pakistan. 5400*
** Corresponding author: e-mail: imalichoudhary@gmail.com*

Abstract

Mimusops elengi L.is an evergreen, ornamental plant that is famous for its medicinal values. It is planted along the road side of Lahore city to provide the shade, due to its vast canopy. Automobile exhaust releases different types of pollutants such as carbon-monooxide, sulfer oxide, nitrogen oxides, hydrocarbons, and particulate matters that effect the physiochemical nature and genomorphic characteristics of this plant. In the present study, we compared the physiochemical and genomorphic characteristics of *Mimusops elengi* L. that is planted along the road side of Lahore with control, where the vehicular exhaust are less. The physiochemical analysis of both sites were performed to determine the air pollution tolerance index. For molecular analysis, CTAB method is used for DNA extraction. PCR product was analyzed by using the primers of GRF5 genes. The result showed that higher values of APTI were seen in Canal Road samples then in Mall Road. Normal values of APTI were seen in experimental site. The molecular analysis showed that the expression of GRF5 genes in experimental sites are recessive as compared to control site which can negatively affect the development and normal growth of plants. Automobile exhaust, constructional projects, planned or unplanned industrialization and urbanization causes combine effect in production of air pollution. The activity of man, careless technology, lack of awareness and casual attitude may lead to air pollution. The plants in city of gardens are facing tremendous stress of environmental pollution. The plantation of higher tolerant plant on road side has great importance to execute the reduction in air pollutions.

Keywords: Automobile exhaust, CTAB, *Mimusops elengi* L., Molecular analysis, GRF5 gene.

HEAVY METALS CHARACTERIZATION OF WASTES DUMP SOIL IN OKENE METROPOLIS, NORTH CENTRAL NIGERIA

Yomi B. Gideon[1], Ayuba, R.[1], Felix B. Fatoye[2] and Joseph I. Omada[3]

[1]Department of Earth Sciences, Kogi State University, Anyigba
[2]Department of Mineral and Petroleum Resources Engineering, Kogi State Polytechnic, Lokoja
[3]National Open University of Nigeria, Lokoja
Corresponding E-mail: yommex76@yahoo.co.uk

Abstract

Sixteen major and active dump sites were identified within Okene metropolis. At each site, four soil samples were collected from 0 to 10cm depth using stainless hand-auger and later composited into one. The wastes dump soil and a control soil sample were subjected to geochemical analysis using Energy Dispersion X-Ray Fluorescence Spectrophotometer at Centre for Nanotechnology, Engineering and Material Development Institute, Akure-Ondo State, Nigeria. The average concentrations of As, Cd, Cr, Cu, Fe, Ni, Pb and Zn in the dump soil are 42.10 ppm, 4.74 ppm, 261.00 ppm, 2561.40 ppm, 105310.85 ppm, 1340.15 ppm, 495.33 ppm and 3409.20 ppm, respectively. These values are relatively higher than the contents in the control soil sample which revealed 0.05ppm As, 0.03 ppm Cd, 35.80 ppm Cr, 293.00 ppm Cu, 40471.50 ppm Fe, 297.00 ppm Ni, 62.00 ppm Pb and 476.00 ppm Zn, indicating enrichments by the decomposed substances. Anthropogenic factor indicator showed that all the measured metals were mainly derived from non-geogenic materials. Indices of enrichments indicated that the dump soil have minimal enrichment of Fe, but highly enriched with As and Cd, significantly enriched with Cr and moderately enriched with Cu, Ni, Pb and Zn. Based on geo-accumulation index, the dump soils are unpolluted with Fe, but very highly polluted with As and Cd, moderately polluted with Cr, Cu, Ni, Pb and Zn. Correlation analysis at $P < 0.01$ significance level and R-mode varimax rotated component analysis revealed some positive relationships where r is greater than 0.87 between As and Pb, Cu and Ni, and Pb and Zn, indicating similarities in geochemical processes and pathways of the pairs of the metals into the dump soil. Q-mode hierarchical cluster analysis revealed 95% similarity in composition of wastes dump soil in the metropolis. However, the contents of all the metals are above maximum values permissible in soils within residential area by WHO standards.

Keywords: Geochemical analysis, Heavy metals, Pollution**,** Wastes dump soils, WHO.

BIOSORPTION EFFICIENCY OF KENAF FIBRES AND MORINGA SEEDS COMBINATIONS IN TURBID WATER TREATMENT

Grace O. Oluwasanya[1&2], Enovwo E. Odjegba[2*], Adebayo Y. Sadıq[3], Abayomi O. Bankole[4] and Olufiropo S. Awokola[2]

[1]*United Nations University, Institute of Water, Environment and Health, Hamilton, Ontario, Canada*
[2]*Federal University of Agriculture, Abeokuta (FUNAAB), P.M.B 2240, Ogun State, Southwest Nigeria*
[3]*Kent State University, Kent, Ohio, USA*
[4]*Universidade Estadual Paulita (UNESP), Sao Paulo, Brazil*
[*]*Corresponding author: odjegbaee@funaab.edu.ng*

Abstract

Inadequate access to potable water supply influence reliance on water from rivers, streams, lakes, and ponds, that become increasingly turbid, especially, during the intense rainy season. The study focused on developing household nature-based water treatment technique from agricultural byproducts. The kenaf fibres were pre-treated with sodium hypochlorite (household bleach) and water, mixed in the ratio 1 part bleach to 20 parts water to sanitize the fibres and remove dirt/discolouration. The fibres were then sun dried and stored prior to use. The moringa seeds was pulverized using a grinding machine. Stock solution was prepared using the pulverized moringa seeds. The experiment contained four (4) levels of treatments-raw (turbid) water with moringa seed powder treatment only, kenaf fibres treatment alone, Kenaf-moringa treatment combinations and Moringa-kenaf treatment combinations. Aluminum sulphate and activated carbon combination was used as control. The water samples were tested for pH, electrical conductivity, total dissolved solids, turbidity, magnesium, calcium, nitrate, chloride, and biological (Total Bacterial Count, *Staphylococcus spp.* and *Enterobacter spp*.) The post-treatment concentrations of the assessed water quality parameters were compared with the World Health Organization (WHO) Guidelines for Drinking Water Quality (2017). Combination of Moringa and Kenaf treatment had the best performance efficiency on the pH, turbidity, hardness, magnesium, calcium, and microbial parameters. Moringa is the major factor in the reduction of pH. Increase in chloride concentration was observed in all treatment with highest concentration in moringa-kenaf and kenaf-moringa. Chlorine is a disinfectant in water treatment, hence, the addition of natural chloride to the water may make the addition of sodium hypochlorite unnecessary. Moringa-kenaf combination had a 100% removal efficiency of *Staphylococcus spp.* and *Enterobacter spp*. Moringa-kenaf combination yielded a better result relative to the kenaf-moringa treatment. The study shows the effectiveness of the combination of 'kenaf fibres and moringa seed powder' in high turbid water treatment.

Keywords: Biosorption efficiency, Kenaf fibres, Moringa seeds, Water quality, Water treatment technology.

Acknowledgment: National Water Resources Institute (NWRI), Kaduna, Nigeria and FUNAAB/NWRI Southwest Regional Centre for National Water Resources Capacity Building Network (NWRCBNET).

THERMAL CONDUCTIVITY OF DUSTY PLASMAS UNDER INFLUENCE OF POLARIZATION

Aamir Shahzad[1*], Aadil Mahboob[1], Muhammad Kashif[1] and Maogang HE[2]

[1]Modeling and Simulation Laboratory, department of Physics, Government College University Faisalabad (GCUF), Allama Iqbal Road, Faisalabad 38040, Pakistan

[2]Key Laboratory of Thermo-Fluid Science and Engineering of Ministry of Education (MOE), Xi'an Jiaotong University, Xi'an 710049, P. R. China

**Corresponding author: e-mail: aamirshahzad_8@hotmail.com; aamir.awan@gcuf.edu.pk*

Abstract

Thermophysical properties have played a fundamental role in system design and optimization, and have diverse applications in many process industries. The major outcome is to minimize operating and developmental cost in designing new systems in terms of shortening the time and reducing the uncertainty in going from process innovation at the small scale to industrial scale commercialization.

Thermal transport is significant and difficult properties of complex materials. Thermal conductivity of two-dimensional (2D) complex dusty plasmas (CDPs), under influenced of polarization, is investigated through molecular dynamics (MD) simulations. The normalized thermal conductivity of 2D strongly coupled CDPs is measured for a wide range of plasma parameters (Γ, κ), system sizes and varying polarization values. The universal temperature scaling law has been employed for polarized thermal conductivity. The obtained thermal conductivity is well matched with earlier numerical, theoretical and experimental available data. It has been shown that the present results are more précised and current method has better performance as compared to earlier numerical techniques.

Keywords: Thermal transport, Complex materials, Molecular dynamics, Universal temperature.

Acknowledgment: The authors thank Khurram Shahzad (Project Director), TEVTA-MIDC, Sialkot, for providing facilities to test and run our Experiment. This work was partially supported by the industrial collaborative work between Government College University Faisalabad (GCUF) and Metal Industries Development Complex (MIDC) Sialkot, TEVTA, Govt. of Punjab, Pakistan, as a position of Consultant in a proposed project

DIFFUSION COEFFICIENTS OF WATER IN SINGLE WALLED CARBON NANOTUBE

Aamir Shahzad[1*], Ama Tul Zahra[1], Muhammad Zubair[1], Adil Loya[2] and Maogang HE[3]

[11]Modeling and Simulation Laboratory, department of Physics, Government College University Faisalabad (GCUF), Allama Iqbal Road, Faisalabad 38040, Pakistan

[2]Department of Mechanical Engineering, National University of Sciences and Technology, H-12 Islamabad, Pakistan

[2]Key Laboratory of Thermo-Fluid Science and Engineering of Ministry of Education (MOE), Xi'an Jiaotong University, Xi'an 710049, P. R. China

**Corresponding author: e-mail: aamirshahzad_8@hotmail.com; aamir.awan@gcuf.edu.pk*

Abstract

Among nano structured materials, Carbon nanotubes are considered to be extraordinary capable candidate for energy storage, membrane separations, water and air filtration, applications in thermal materials and bio medics along with high constancy both chemically and mechanically because of distinctive composition, structure and configurations benefitting economically. Carbon nanotubes are proficient in purifying the water at a very low cost and energy by removing biological, organic and inorganic pollutants.

Single walled Carbon Nanotubes have appeared to be excellent candidate to use as nanochannel because of its flawless structure and outstanding physio chemical properties. So, we thoroughly examined the diffusion coefficient of Armchair Single walled Carbon Nanotubes by implementing Equilibrium molecular dynamics when water passes through it. In order to precisely investigate the energy, temperature, pressure and diffusive parameter by varying temperature (280k, 290k, 300k, 310k and 320k), computer software LAMMPS is used. Ovito is employed to visualize the interaction of water molecules with nanotube and closely guard their movement thoroughly. How variation in temperature effects the diffusion coefficient (calculated by velocity autocorrelation function) while considering dynamical and structural properties of restricted water. Our results can also be very helpful to develop devices for drug delivery.

Keywords: Autocorrelation function, Carbon Nanotubes, Diffusion coefficient, Molecular dynamics, LAMMPS.

PREVENTIVE MEDICINE PRACTICES AND SUSTAINABILITY IN PRIMARY PREVENTION OF DISEASES

Betul Ozdemir[1*], Zeliha Selamoglu[2]

[1]*Department of Cardiology, Faculty of Medicine, Nigde Ömer Halisdemir University, Campus, Nigde, Türkiye*
[2]*Department of Medical Biology, Faculty of Medicine, Nigde Ömer Halisdemir University, Campus, Nigde, Türkiye*
**Correspondance Author: e-mail: betulozaltun@ohu.edu.tr*

Abstract

The preventive medicine includes all measures which limit progression of disease at any stage of its course. Sustainability of the preventive medicine is an important issue of attention for the public at large, for governments, and for the healthcare system. Primary prevention comprises the manipulation of man's environment, his water supply, the air breatlhes, and also the manipulation of man himself by such measures as immunization against infectious disease.

Preventive medicine can be practised by governmental agencies, primary care physicians and the individual himself. The dividing line between preventive medicine and public health practice is far from distinct, as is that between prevention and treatment. The fields of preventive medicine and public health share the objectives of promoting general health, preventing disease, and applying epidemiologic techniques to these goals. There is also challenge conventional sustainability practices in the healthcare sector and remind managers of their responsibility not only to follow best practices but also to manage environmental and economic impact for the benefit of the larger community. There is a multitude of public health policies that, if implemented, could contribute greatly to preventing disease. Further research is necessary to both sustainability and update the tools of the medical model of preventive medicine and to evaluate the effectiveness of this model compared with other approaches to primary prevention.

Keywords: Healthcare, Primary prevention, Preventive medicine, Sustainability.

EFFECTS OF ELECTRIC FIELD ON STRUCTURAL BEHAVIOR OF COMPLEX PLASMAS USING MOLECULAR DYNAMICS SIMULATIONS

Aamir Shahzad[1*], Fazeelat Hanif[1], Muhammad Asif Shakoori[2] and Maogang HE[3]

[1]Modeling and Simulation Laboratory, department of Physics, Government College University Faisalabad (GCUF), Allama Iqbal Road, Faisalabad 38040, Pakistan

[2]Department of Mechanical Engineering, National University of Sciences and Technology, H-12 Islamabad, Pakistan

[2]Key Laboratory of Thermo-Fluid Science and Engineering of Ministry of Education (MOE), Xi'an Jiaotong University, Xi'an 710049, P. R. China

**Corresponding author: e-mail: aamirshahzad_8@hotmail.com; aamir.awan@gcuf.edu.pk*

Abstract

Equilibrium molecular dynamics (EMD) simulation has been used to investigate structural behaviors (order-disorder structures) of three-dimensional (3D) complex (dusty) plasmas (CDPs). The Yukawa (screened coulomb) potential and periodic boundary conditions have been used in the CDPs algorithm. Two factors have been used to analyze the structural behavior of CDP which are radial distribution function (RDF), and lattice correlation (LC). Moreover, diffusion coefficient and energies also have been computed. The results for these factors have been calculated in a canonical (*NVT*) ensemble with varying electric field strengths (E^*) from 0.005 to 1 for a complete series of different plasma conditions of Coulomb coupling (Γ) and Debye screening parameters (κ). The results of RDF and LC have shown that the 3D CDP structure moves from disordered or moderate to completely order conditions with increasing E^* and κ, and the long-range order moves to high Γ with an increase of κ. In these simulations, the system size also has been tested to check how it is influencing the structural behavior of the CDP. The measures indicated that when the 3D CDPs remain in the ordered state (strongly coupled regime) the potential energy is maximum and it is minimum in the disordered state (nonideal gas range) and there is an opposite trend for kinetic energy.

Keywords: Equilibrium molecular dynamics, Complex (dusty) plasmas, Radial distribution function, Lattice correlation, Coulomb coupling

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COMPARATIVE ANALYSIS OF CLASSIFICATION ALGORITHMS IN ARCGIS AND QGIS: AN EMERGING EVIDENCE IN GROUNDWATER POTENTIAL ASSESSMENT

Prosper Kpiebaya[1,2,3,*], Kwartema Osei Mensah[6], Ebenezer Ebo Yahans Amuah[5], Abdul-Ganiyu Shaibu[2] (Ph.D), Bernard N. Baatuuwie[3] (Ph.D), Vincent K. Avornyo1 (Ph.D), Benjamin Wullobayi Dekongmen[4] (Ph.D), Precious Kwaku Blege[7] (Ph.D), David Sogfaa[7]

[1]Department of Soil Science. Faculty of Agriculture, Food and Consumer Sciences, University for Development Studies. P. o. Box TL 1882, Ghana
[2]Department of Agricultural Engineering, School of Engineering, University for Development Studies. P. o. Box TL 1882, Ghana
[3]Department of Ge-Information Sciences, Faculty of Renewable Natural Resources and Environment, University for Development Studies, P. o. Box TL 1882. Ghana
[4]Department of Agricultural Engineering, Ho Technical University, Post Office Box HP217, Ho, Ghana
[5]Department of Environmental Science. Kwame Nkrumah University of Science and Technology. P. o. Box 1279, Kumasi, Ghana
[6]Faculty of Geosciences, Geoengineering and Mining, Technische Universität Bergakademie Freiberg
[7]West African Center for Water, Irrigation and Sustainable Agriculture (WACWISA). University for Development Studies, P. o. Box TL 1882. Ghana
Corresponding author: email: Kpiebayaprosper@gmail.com, prosperkp1926@uds.edu.gh

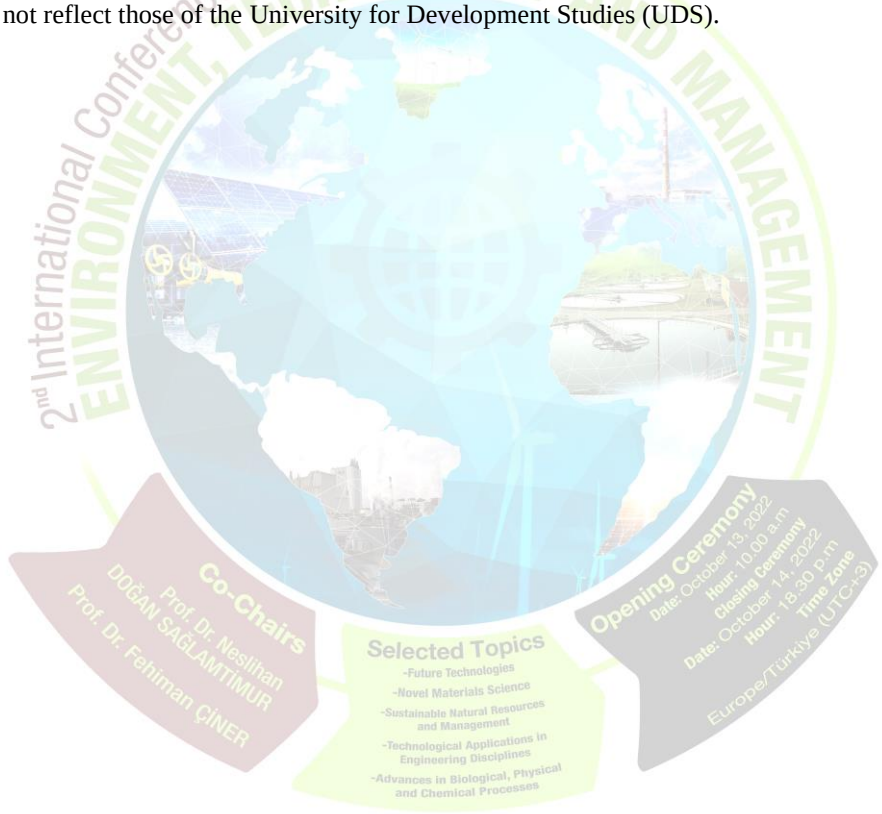
Abstract

Groundwater is the most important natural resource in many parts of the world that requires advanced and new technologies for monitoring and control. This study presents a comparative analysis of different classification algorithms (in ArcGIS and QGIS) used in the estimation of groundwater potential. The study focuses on the performance, merits, and demerits of these tools using empirical groundwater data (lithology, soil, slope, drainage, lineament, vegetation, and rainfall) from the Sawla-Tuna-Kalba and Nandom districts of Ghana. The study employed ArcGIS and QGIS with Analytical Hierarchical Process (AHP) to assess groundwater availability in the two districts. The algorithms that were evaluated include; Random Forest (RF), Support Vector Machine (SVM), Gaussain Mixture Model (GMM), and Iterative Self-organizing Data Analysis (ISODATA). Findings from this work showed that in Nandom the overall accuracies of RF yield (96.16%), SVM (92.61%), GMM (87.03%), ISODATA (67.22%) whereas Sawla-Tuna-Kalba showed RF (94.70%), SVM (91.20%), GMM (85.70%), ISODATA (65.90%). The groundwater potential was classified into three classes namely; low, moderate, and high class. The study found that in the Nandom district low groundwater potential zones was 177.16km^2 using RF and 202.89km^2 using ISODATA whereas, in the Sawla-Tuna-Kalba was 1402.87km^2 using RF and 1940.11km^2 using ISODATA. The difference in the groundwater potential zones varied acrossed the other classes and this may be

partly attributed to the low accuracies in the LULC map because the other thematic layers remained constant. The cross-validation reveal that the RF had an r^2 = 0.67 while ISODATA had r^2 = 0.23 indicating that the use of RF is a better-performing algorithm in predicting groundwater potential areas. It can be conclusion that to enhance groundwater potential outputs, it is recommended that researchers employ better-performing algorithms.

Keywords: Algorithms, ArcGIS, Groundwater potential, LULC, QGIS.

Acknowledgment: This study is part of an MPhil and ongoing PhD thesis of the first and Second author. We would like to thank the organizers of this conference for this opportunity to present our study. The views expressed in this paper do not reflect those of the University for Development Studies (UDS).



AN OVERVIEW OF SOLUTIONS AGAINST WATER EUTROPHICATION

Kinga Korniejenko[1*], Beata Figiela[1], Piotr Dynowski[2], Thomas Grab[3]

[1] *Faculty of Material Engineering and Physics, Cracow University of Technology, Poland*
[2] *Faculty of Geoengineering, University of Warmia and Mazury in Olsztyn, Poland*
[3] *Scientific Diving Center of the TU Bergakademie Freiberg, Germany*
** Corresponding author: e-mail: kinga.korniejenko@pk.edu.pl*

Abstract

The eutrophication of lakes under natural conditions is very slow due to the accumulation of allochthonous and indigenous matter. It is accompanied by an increase in the content of various elements, including the so-called nutrients, including N and P. However, more and more often this process is induced artificially, the main reason is the introduction of fertilizers used in agriculture and sewage related to human living and management to surface waters. Nowadays, according to the UNEP (United Nation Environmental Protection) estimates that between 30% and 40% of the lakes and reservoirs have been affected by eutrophication of the water caused by human activity, throughout the world. Excessive eutrophication causes a number of unfavorable phenomena in water bodies, including: changes in the structure of hydrobionts (including excessive growth of algae, the retreat of submerged vegetation from the lake), reduction of species diversity (including: deterioration of spawning and breeding conditions for fish, decrease in oxygen content in the deeper zones of the lake), and limiting the economic use of water (including: water blooms, presence of hydrogen sulphide in the lake bottom zone). The main aim of the article is to present the possible solution against water eutrophication and analyze it. Today on the market there are some water treatment systems that counteract the eutrophication process of lakes, but most of them have significant disadvantages connected mainly with the negative impact on environmental aspects. Due to this, a new solution for water treatment systems counteracting the eutrophication process is required.

Keywords: Clean water, Eutrophication, Nutrient, Sorbent, Water treatment system.

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FLOODS AND DROUGHTS IN EASTERN MEDITERRANEAN

Anastasia Katsoulea[1*], Antigoni Zafeirakou[1]

[1] Department of Civil Engineering, Aristotle University of Thessaloniki, Greece
** Corresponding author: e-mail: akatsoul@civil.auth.gr*

Abstract

In the recent years, an increase in the frequency and intensity of extreme weather events, such as prolonged dry weather conditions, droughts and floods, has been noted. There have been numerous scientific studies linking this phenomenon with human-induced climate change and the overall increase in the planet's temperature. This paper focuses on extreme weather events such as floods and droughts in the Eastern Mediterranean and more specifically in Greece and Türkiye. The Global Disaster Alert and Coordination System GDACS platform was used to enumerate the extreme weather events that occurred in the past decade in these two countries. The KNMI Climate Change Model was run for several parameters such as precipitation, moisture content of soil layer, temperature, and net water flux for the Mediterranean Sea area, using relative changes and different emissions scenarios, with the predictions of the resulting maps being alarming, especially combined with the recent extreme drought that affected more than half of the European continent during the summer of 2022. It is now, more than ever, imperative to take a more proactive approach to these extreme events instead of a reactive one and intensify the efforts of, not so much prevention any longer, but mitigation of their effects.

Keywords: Droughts, Eastern Mediterranean, Floods, GDACS, KNMI.

COMPARISON OF REMOVAL EFFICIENCY OF 5-CHLORO-1H-BENZOTRIAZOLE IN SBR WITH FLOCCULATED AND GRANULAR ACTIVATED SLUDGE

Joanna Struk-Sokołowska[1*], Aleksandra Dobkowska[1], Urszula Kotowska[2]

[1]Białystok University of Technology, Faculty of Civil Engineering and Environmental Sciences, Wiejska 45A, 15-351 Białystok, Poland

[2]University of Bialystok, Faculty of Chemistry, Ciołkowskiego 1K, 15-245 Białystok, Poland

** Corresponding author: e-mail: j.struk@pb.edu.pl*

Abstract

Research into the identification of micropollutants, including those of the benzotriazoles group, in various elements of the environment, their toxicity and elimination is currently a very important aspect of scientists' work. While the simplest forms of benzotriazoles, i.e. 1H-benzotriazole and 4(5)-methyl-benzothiazoles, are increasingly well described in the literature, little information is available on 5-chloro-1H-benzotriazole (5Cl-BTR). This compound is used as a corrosion inhibitor, to improve photographic image quality and to stabilise UV radiation in plastics. The presence of 5Cl-BTR has been confirmed in surface water, groundwater, drinking water, urban road rainwaters (after rainfall and snowmelt), raw and treated wastewater.

The aim of this study was to compare the removal efficiency of 5Cl- BTR (concentration 100 - 1000 µg/l) from wastewater, in successive process phases of a sequencing batch reactor (SBR) with flocculated and granular activated sludge. The object of the research was 4 independent model SBRs with an active volume of 16 dm^3. For the isolation and determination of 5Cl-BTR in samples the previously developed method was used based on ultrasound-assisted emulsification microextraction (USAEME) and gas chromatography-mass spectrometry (GC-MS). It should be noted that the presence of 5 Cl-BTR was found in the model wastewater, without the added standard dose of this micropollutant. This may indicate the presence of this compound in detergents for washing glassware and laboratory apparatus, tap water or in containers used to hold chemical reagents for the preparation of synthetic wastewater.

The wastewater treatment process in the SBR with flocculated and granular activated sludge, resulted in the removal of 5Cl-BTR from the wastewater with varying efficiency. The removal efficiency of 5Cl-BTR in individual process phases, as well as over the entire SBR operation cycle, depended on the concentration of the micropollutant in the raw wastewater and on the type of activated sludge in the SBR.

Keywords: Benzotriazole, Flocculated activated sludge, Granular activated sludge, Micropollutant.

EFFECT OF SURFACTANTS OVER THE SOLUBILITY OF NON-STEROIDAL ANTI-INFLAMMATORY DRUGS

Muhammad Mustaqeem[1]

[1] *Institute of Chemistry, University of Sargodha, Pakistan*

Abstract

Non-Steroidal Anti-inflammatory Drugs (NSAID's) are widely used for relief of pain in patients suffering from rheumatic diseases, migraine, sore throat and primary dysmenorrhea. However, its aqueous solubility is very low and hinders the skin permeation. Thus, it is imperative to develop such a drug delivery systems which can improve its aqueous solubility and hence improve the skin permeation and therapeutic compliance. Surfactants have been also proven to increase the cutaneous absorption of lipophilic drugs as compared to conventional vehicles. Surfactants have the capacity to 'hide/solubilize' water-insoluble molecules within a continuous oil phase. Surfactants like ionic, non-ionic and Zwitter ionic were used as a solubility media. It has been concluded that the product was more soluble than the parent compound. The biological activities of these were also investigated. The outcome was very promising and the product was more active than the parent compound. It therefore concluded that in this way we can not only enhance the solubility of the drug, increase its bioactivity but also reduces the risk of stomach cancer.

A COMPARATIVE ASSESSMENT OF THE NOVEL WATER POLLUTION INDEX AND THE WATER QUALITY INDEX USING EMPIRICAL DATA: IMPROVING WATER QUALITY EVALUATION

Ebenezer Ebo Yahans Amuah[1*], Prosper Kpiebaya[2], Raymond Webrah Kazapoe[3], Benjamin Wullobayi Dekongmen[4]

[1]Department of Environmental Science, Kwame Nkrumah University of Science and Technology, PMB, Kumasi, Ghana

[2]Department of Soil Science. Faculty of Agriculture, Food and Consumer Sciences, University for Development Studies. P. O. Box TL 1882, Ghana

[3] Department of Geological Engineering, School of Engineering, University for Development Studies, P. O. Box TL 1882, Ghana

[3]Department of Agricultural Engineering, Ho Technical University, Post Office Box HP217, Ho, Ghana

** Corresponding author: amuahyahans@gmail.com*

Abstract

Different water assessment indices have been employed in the evaluation of water quality for human use. However, these methods have their peculiar drawbacks. This study applied the novel water pollution index (WPI) against the water quality index using empirical data (packaged and groundwater sources) from some parts of Ghana. The study showed that the WPI method is flexible and easy to compute compared to WQI. In this study area, WPI ranged from 0.22–0.31 and 0.23–0.32 for packaged water obtained from production and vending sites respectively. However, the WQI outputs were 0.12–0.36 (production site) and 0.27–0.42 (vending sites). Though the water samples from both sources were excellent for drinking, the wide variation in the WQI suggests the biases resulting from the selection of the weighting factors for the various parameters. Considering the groundwater sources applied in this study, 74% as against 93% and 19% as against 5% of the samples were excellent and good water sources based on the WPI and WQI respectively. These disparities are largely attributed to the biases posed by the quality rating and weighting factors which are researcher-described.

Keywords: Water Pollution Index, Water Quality Index, Merits and demerits, Water quality assessment.

CAUSES OF CLIMATE CHANGE AND GLOBAL WARMING & URGENT SOLUTIONS REQUIRED TO MINIMISE THE IMPACTS

Najib Altawell[1*]

[1] *Department of Energy Management*
Coventry University
6 Mitre Passage, Greenwich, SE10 0ER
United Kingdom
[*]*Corresponding author: Email: ad4103@coventry.ac.uk*

Abstract

Global warming and climate change recognised today as one of the main dangers facing us all, i.e. major impacts on our natural environment and our lives throughout the world.
Even though there are natural phenomena which may accelerate or bring about major changes to our planet atmosphere and consequently to our environment, these phenomena may not happen in the same speed as that of man-made causes in changing our climate. Man-made causes and factors, such as the burning of the fossil fuels, plus, are the major factors in accelerating climate change and global warming.
In this paper, the causes of climate change and global warming discussed and analysed in detail, as well as practical solutions(s) provided, with additional recommendations to what should those in authorities, scientists, engineers, and the public should do to minimise these impacts on a global, national as well as the local scale.

Keywords: Climate Change, Global Warming, Natural Environment, Fossil Fuels, Natural Phenomena.

REVIEW OF RENEWABLE ENERGY OPTIONS SELECTION IN THE PHILIPPINES THROUGH MULTI-CRITERIA DECISION MAKING

Art Marvin Arañas[1*], Ayşe Topal[1]

[1] *Department of Business, Nigde Omer Halisdemir University, Turkey*
** Corresponding author: e-mail: artmarvin94@gmail.com*

Abstract

Since signing the Paris Climate Agreement in 2016, the Philippines despite its financial limitations has shown a strong commitment to joining other countries in addressing climate change, including the promotion of renewable energy. The country boasts a high share of renewable energy consumption with respect to final energy consumption at 47.5%, third among countries in the Asia Pacific region. Renewable energy options in the country involve geothermal, wind, solar, hydropower, and biomass sources. However, despite the abundance of these resources, around 5 million Filipinos still don't have access to electricity, while electricity prices remain at relatively high prices which hinders economic productivity.

With a high growth potential in this area, the government held a green energy auction program to promote the usage of renewable energy, wherein the cost of energy consumption per household will be significantly reduced. Moreover, partner local and international agencies are establishing a partnership to help the country accelerate the clean energy transition. With much attention given, the use of multi-criteria decision-making is essential to select which renewable energy option is the best. As previous literature suggested, these options will be analyzed in terms of cost-benefit, sustainability, availability of supply, and impact, among others.

Keywords: Climate Change, MCDM, Renewable Energy.

MIXED OXIDES NANOPARTICLES PREPARED FROM HYDROTALCITE LIKE MATERIALS FOR HYDROGEN PRODUCTION VIA NATURAL GAS VALORIZATION

Z. Abdelsadek[1, 2], O.Cherifi[2], Gonzalez-Cortes[3], Djamila Halliche[2], Patrick J. Masset[2]

[1]Institute of Electrical and Electronics Engineering, University of M'hamed-Bougara, Independence Avenue, 35000, Boumerdès, Algeria

[2]Laboratory of Chemistry and Natural Gas, Faculty of Chemistry, USTHB, B.P. 32 El-Alia, 16111 Bab-Ezzouar, Algiers, Algeria

[3]Inorganic Chemistry Laboratory, Department of Chemistry, University of Oxford, South Parks Road, Oxford OX1 3QR, UK.

[3]Warsaw University of Technology, Faculty of Materials Science and Engineering, Woloska 141, 02-507 Warsaw, Poland.

Abstract

In recent years, one of the most challenging aspects of our environment is the global warming resulting from the increase in greenhouse gases. Thus, reducing the emission of these gases via developing original processes capable of converting such by-products to useful derivatives is of prime concern to the scientific community. One of the solutions proposed is the utilization of the dry reforming of methane (DRM) reaction to produce hydrogen syngas. This process has been extensively investigated academically in the last few decades. Such approach was equally sought as a promising solution to solve the challenges of global warming. Compared to the steam reforming reaction, the DRM reaction produces syngas with lower H_2/CO ratio (= 1) **[1]**, which is more appropriate for the Fisher-Tropsch and methanol syntheses **[2]**. Hence, the DRM reaction can contribute to the simultaneous reduction of two greenhouse gases; this may render its utilization as an environmentally friendly procedure. Unfortunately, no large industry application of this process has been achieved mainly due to the sintering of the active phase and the deactivation of catalysts by carbon deposit which leads to the reactor blockage and the catalyst destruction. According to the literature, the DRM reaction is catalysed by several catalysts such as exchanged zeolite **[3]**, mixed oxides (Al_2O_3,CeO_2, etc…) used as supported catalysts **[4]** and noble metals like Ru, Rh, and Pt, which exhibit a high stability and activity and are less sensitive to coke deposition **[5]**. The drawback with noble materials is their high cost and limited availability, thus restricting their use as industrial catalysts. Other cheap transitions metals such as Ni and Co have been extensively investigated as catalysts for DRM **[6]**. Again, while tested in DRM reaction, their rapid deactivation by coke deposition and/or disaggregation of the metallic phase is still a critical issue for their industrialisation. Therefore, alternative options have been undertaken to solve these problems. For example, the dispersion of the active metallic phase is very important since it can influence the catalytic activity behaviour. An innovative way for increasing the metal dispersion on the catalysts is to introduce the active phase in a well-defined structure. The alkaline anionic clay type hydrotalcite (HT) is

widely used as catalyst with minimal carbon formation; this is due to its basic properties as well as the cations (Ni^{2+}, Mg^{2+}, Co^{2+}, Al^{3+}, Ce^{3+}…) being homogeneously distributed within the brucite type sheets **[7]**.Their structure is based on a mixture of divalent and trivalent metal cations occupying randomly the centres of coplanar edge-sharing $M(OH)_6$ octahedra, and forming sheets similar to those in the brucite, $Mg(OH)_2.[M_{1-x}^{2+} M_x^{3+} (OH)_2]^{x+}[A^{n-}_{x/n}].m\ H_2O$ is the general formula of hydrotalcite where M^{2+}, M^{3+}, A^{n-} and n^- represent, the divalent and trivalent metals occupying octahedral positions, interlayer anions (CO_3^{2-}, NO_3^-, Cl^-, OH^-) or organic anions and a the charge of the interlayer ion; x and m being the fraction constants, respectively. This new class of materials is characterized by their low density and high specific surface. The thermal decomposition temperature of HT, leading to the loss of HT structure, starts at temperatures ranging from 250 to 400 °C and induces the dehydration, dehydroxylation and loss of compensation inter-anions **[7, 8]**. The oxides derived from HT exhibit small particle sizes, large specific surfaces, homogenous inter-dispersion of metallic phase and a better resistance to sintering compared to the supported catalysts. Furthermore, the mixed oxides-hydrotalcite have high basic properties, which lead to a higher affinity for the CO_2 acid molecule resulting in enhanced potential capacity storage and adsorption which in turn is favourable for the DRM process. In this work, we investigated different catalyst compositions: NiAl, NiMgAl, CoAl, CoMgAl, and NiCoMgAl. These samples were prepared by coprecipetation at constant basic pH and calcined at 450°C. The catalysts obtained were characterized by AAS method, XRD, FTIR, BET, TPR, TGA/DTA, and SEM/TEM analysis. The data obtained from chemical analysis of the calcined catalysts confirmed that $(M^{+2})/n(M^{+3})$ ratio is close to the intend value of 2. The XRD patterns exhibit the characteristic diffractions of hydrotalcite-like layered double hydroxide materials for all samples. The catalysts were tested for methane dry reforming reaction versus time on stream (20 h) at 700°C. It was found that performances of catalysts after 10h of reaction within this period were kept and no deactivation took place (except for CoMgAl-catalyst which did not show any catalytic activity. The catalytic performances of investigated catalysts showed the following sequence: NiMgAl-HTc-R > NiAl> NiCoMgAl-HTc-R>> CoAl-HTc-R>>>> CoMgAl-HTc-R.

Keywords:(Ni, Co) catalysts, Green house effect, Hydrotalcite, Hydrogen, Natural gaz valorization,

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EFFECTS OF PRENATAL METHAMPHETAMINE EXPOSURE ON SPATIAL COGNITION AND HIPPOCAMPAL SYNAPTIC PLASTICITY IN ADOLESCENT RATS

Razieh Aghazadeh[1], Shiva Roshan-Milani[2], Leila Drafshpour[2]*, Samaneh Ahmadian-Moghaddam[3], Ehsan Saboory[3]*

[1]Department of Physiology, Faculty of Medicine, Urmia University of Medical Sciences, Urmia, Iran
[2]Neurophysiology Research Center, Cellular and Molecular Medicine Institute, Urmia University of Medical Sciences, Urmia, Iran
[3] Department of addiction studies, school of medicine, Zanjan University of Medical Sciences, Zanjan, Iran;
** Corresponding author: Prof. Ehsan Saboory, e-mail: saboory@zums.ac.ir*

Abstract

Global rise in methamphetamine (MA) abuse during pregnancy has placed a large number of children at risk for the adverse consequences of prenatal methamphetamine exposure (PME). While behavioral and neurocognitive deficits of PME have been extensively studied in humans and adult rodents, far less is known regarding the sex- and dose-dependent effects of PME as well as the underlying mechanisms. Adolescence in nonhuman primates is also a less explored territory. In the present study, PME was inducted by oral treatment to pregnant rats on gestational days 15-19 with either low-dose (0.1 mg/ml) or high-dose (0.6 mg/ml)) of MA. The cognitive effects of PME were then evaluated in two adolescence age-intervals: early adolescent (started on postnatal day (PND) 21) and mid adolescent (started on PND 33), among male and female rat offspring using Morris water maze (MWM) test. Alterations in hippocampal synaptic plasticity in Schaffer collaterals-CA1 pathway were also measured in vitro. Results of behavioral test showed that PME led to serious deficits of learning and memory abilities in both male and female rat offspring. PME also depressed LTP in most of the PME subgroups. Moreover, 21-day-old rats were more sensitive to PME-induced cognitive impairment in MWM tasks, but not in hippocampal synaptic plasticity, than 33-day-old rats. No sex-dependent effects of PME were found on the cognitive function and synaptic plasticity. These findings confirmed that PME impacted negatively on cognitive performance in prepubertal male and female rats, and the impairment of hippocampal synaptic functions might partly play a significant role in these effects.

Keywords: Addiction, Cognitive function, Environmental factors, Methamphetamine, Prenatal exposure.

ADVERSE EFFECTS OF PROPRANOLOL UPON RODENT MODEL

Javaria Shaheen[1], Ammara Riaz[2]*

[1] *Department of Zoology, University of the Punjab, Quaid-e-Azam Campus, Lahore 54590, Pakistan.*
[2]*Department of Life Sciences, Khwaja Fareed University of Engineering & Information Technology, Rahimyar Khan 64200, Pakistan*
** Corresponding author: e-mail: ammarach21@gmail.com*

Abstract

The objective of this study is to determine the teratological effects of propranolol on tissues including kidneys, heart and testis. The experiment was designed in order to observe and the study teratological effects of propranolol on different body tissues. Swisso albino mice, aged above 6 months were taken as experimental models. They were divided into 4 groups (control, low, medium, high) with the dosage values of propranolol measured at 15µg/g, 30µg/g, 60µg/g of their body weight, respectively. Mice were fed orally with butterfly needle for 30 days, and their body weights were measured on daily basis. At last mice were slaughtered and the teratological effects of propranolol were observed by Morphometric, Morphological, and Histological analysis. At the end of study it was noticed that increasing the dose of propranolol results in the increased tubular degeneration and vacculation. The highest dose of propranolol (60µg/g of the body weight) caused enlarged amyloid body because of the poor and degenerated tubular formation. Likewise, high doses of propranolol caused necrosis and vacculation in liver. High doses of propranolol damage striated strips in heart tissues, medium doses have water accumulation in between the heart tissues and low doses have tissues damage i.e. damaged striated strips and irregular arrangement of nuclei were observed. It was concluded that treatment with this antihypertensive and anti-anxiety drug propranolol (pregnancy category C) causes changes in the serum hormones and histology of the treated mice.

Keywords: Angina pectoris, Antihypertensive, Antianxietic, CNS, β_blocker.

ECO-CHEMICAL STUDY OF WATER AND BOTTOM SEDIMENT SAMPLES TAKEN FROM KHOJASAN LAKE

Islam Mustafayev, Sevinj Hajiyeva, Tarana Aliyeva

Institute of Radiation Problems of ANAS, Azerbaijan
Baku State University, Azerbaijan
Corresponding author: e-mail: tarana_chem@mail.ru

Abstract

In order to conduct an eco-chemical study of Khojahasan lake, samples were taken from the lake water, bottom sediments, and the soil around the lake, and the amount of organic matter was determined.

Liquid extraction method was used to prepare water samples taken from Khojahasan lake. 0.5 liters of water samples were extracted 3 times with 30 ml of dichloromethane, dried with anhydrous sodium sulfate and concentrated in a rotor evaporator until the volume remained 1 ml. Deuterated naphthalene and phenanthrene were used as internal standards. Determination of organic compounds in the samples was carried out on a mass spectrometer gas-chromatography device (GC-MS (Agilent, USA) HP6890 in one-dimensional and two-dimensional mode. Ionization energy is 70 eV. Capillary silicon column RTX-5MS (30 m), temperature mode: 400^0C (2 min.)-200^0C /min.-3000^0C (10 min.).

In the same way, samples of bottom sediments (1.4 and 1.6 g) were taken from the lake, extracted 3 times with 30 ml of dichloromethane, dried with anhydrous sodium sulfate, and concentrated in a rotor evaporator until the volume was 1 ml. Deuterated naphthalene and phenanthrene were used as internal standards. Determination of organic compounds in the samples was carried out on a mass spectrometer gas-chromatography device (GC-MS (Agilent, USA) HP6890 in one-dimensional and two-dimensional mode. Ionization energy is 70 eV. Capillary silicon column RTX-5MS (30 m), temperature mode: 400^0C (2 min.)-200^0C /min.-3000^0C (10 min.).

In soil samples taken from the vicinity of Khojahasan lake, there was: benzene<0.04 μg/kg, toluene 0.156 μg/kg, p-xylene<0.036, ethylbenzene and m-xylene<0.04 μg/kg.

In the bottom sediment samples of Khojahasan Lake, there was: benzene is 0.99 μg/kg, toluene is 7.01 μg/kg, p-xylene is 13.74, ethylbenzene is 0.325 μg/kg, and m-xylene is 0.75 μg/kg.

Table 1. The amount of organic substances in bottom sediments of Khojahasan Lake

Sampling stations / Organic substances	Unit of measurement	S1
Benzene	µg/kg gm	8,53
Toluene	µg/kg gm	16,43
Ethylbenzene	µg/kg gm	0,31
p-xylene	µg/kg gm	3,83

As can be seen from the table, the amount of organic matter in the bottom sediments exceeds the limit.

Table 2. Determination of PAHs in water samples taken from Khojahasan Lake

Sampling stations / PAHs	Unit	S25	S26
Naphthalene 0.02	µg /l	0,02	0,025
Acenaphthalene 0.006	µg /l	0,02	0,024
Anthracene 0.001	µg /l	0,02	0,02
Fluoranthene 0.02	µg /l	0,02	0,02
Fluorene0.006	µg /l	0,02	0,02
Phenanthrene0.006	µg /l	0,02	0,067
Benzaprene0.001	µg /l	<0,02	0,02
Chrysene 0.003	µg /l	<0,02	0,02
Pyrene 0.02	µg /l	0,02	<0,02
Benzanthracene 0.006	µg /l	0,02	0,02

Keywords: Bottom sediments, Khojahasan Lake, Organic substances, Soil samples, Water samples.

FUTURE TECHNOLOGIES: MATERIALS IMITATING LUNAR REGOLITH

Barbara Kozub[1*], Kinga Pławecka[1], Kinga Korniejenko[1]

[1] Department of Materials Engineering, Faculty of Materials Engineering and Physics, Cracow University of Technology, Cracow

** Corresponding author: e-mail: barbara.kozub@pk.edu.pl*

Abstract

Lunar regolith is a layer of fine-grained material covering the lunar surface, which physical properties are mainly a result of mechanical disintegration of basaltic and anorthositic rocks that occurred as a result of constant meteorite impacts and bombardment by charged solar and interstellar atomic particles on the surface of the Moon over billions of years. The National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA) have announced that they hope to secure the possibility of permanent human settlement in so-called habitats on the Moon and Mars by 2040. Regardless of the time frame, the realization of this idea requires the development of materials and implementation concepts for the lunar habitat. Based on a literature review, an attempt has been made to synthesize a ceramic-based powder with a composition similar to lunar regolith, which will be suitable for 3D printing (Binder Jetting) technology applications in non-standard environments and extreme conditions, including space. Both the oxide composition and particle size of the substrates used were taken into account during the synthesis. Tests, which included the analysis of the content of individual phases by XRD diffractometry, the analysis of the particle size distribution, and the observation on the scanning electron microscope (SEM) of the individual components used as substrates during the preparation of the mixtures (i.e. fly ash, volcanic tuff, olivine, silica, quartz river sand, granite flour, basalt flour) were carried out. The prepared mixtures, differing in the proportion of each component, were observed on a scanning electron microscope, and the oxide composition was analyzed by energy dispersive spectroscopy (EDS), which made it possible to select a mixture with an oxide composition most similar to the lunar regolith.

Keywords: Binder Jetting, Lunar regolith simulant, Oxide composition, 3D printing.

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ECO-FRIENDLY MATERIALS: GEOPOLYMERS BASED ON FLY ASH FROM DIFFERENT COMBUSTION PROCESSES

Kinga Pławecka[1*], Kinga Korniejenko[1], Michał Łach[1]

[1] *Faculty of Material Engineering and Physics Cracow University of Technology, Poland*
** Corresponding author: kinga.plawecka@pk.edu.pl*

Abstract

The main objective of the study was to evaluate various fly ashes as raw materials for the production of geopolymer materials. Three different fly ashes were investigated: conventional fly ash from a coal-fired power plant in Skawina, ultra-fine fly ash from a power plant in China, and fly ash that was a waste product obtained after incineration at an incineration plant in Bialystok. The precursors used were tested for their elemental and chemical content. In addition, the particle size of the base materials was analyzed using laser particle size testing. Tests of geopolymer materials based on these three fly ashes are also presented. The materials based on the precursors used were subjected to strength evaluation - compressive and flexural strength - and microstructure analysis by scanning electron microscopy (SEM). The results obtained indicate that the fly ash-based materials had similar compressive strengths (about 60 MPa), while significant differences were observed during the bending test from 0.1 to 5.3 MPa. Ultra-fine fly ash had lower flexural strength compared to conventional fly ash. The study showed the need for, among other things. process optimization for materials based on the precursor from the waste incinerator.

Keywords: Fly ashes, Waste incineration product, Geopolymers, Mechanical strength.

Acknowledgment: The works presented were carried out as part of the project: "Geopolymer foams with low thermal conductivity produced on the basis of industrial waste as an innovative material for the circular economy", which is financed by the National Center for Research and Development under the LIDER X program. Grant No.: LIDER/31/0168/L-10/18/NCBR/2019

SUSTAINABILITY APPROACH IN TOURISM INDUSTRY

Erhan Ergin[1*], Ayşe Topal[1]

[1]Department of Business Administration, Nigde Omer Halisdemir University, Turkey
** Corresponding author: e-mail: erhanergin51@hotmail.com*

Abstract

Tourism is an industry that has been on the rise in our country's economy recently. For this reason, with the aim of spreading tourism to every day of the year, a trend towards different types of tourism from mass tourism has begun. In this way, the interest in developing alternative tourism types has increased and these types of tourism have started to be evaluated within the framework of sustainability.

Sustainable tourism has become a subject that is discussed more intensely with each passing day. For this reason, it is necessary for all businesses to adopt a human and environment-oriented sustainability approach in order to maintain their existence and profit in an increasingly competitive environment, and thus to ensure the continuity of production. This approach, whose main issues are environmental, economic, social and cultural sustainability, not only plays a cost-reducing role for businesses, but also facilitates making strategic decisions for the future.

The implementation of sustainability principles for the tourism sector, which has an important place in the world economy, helps to reduce the negative effects of tourism on the environment, to protect the social and cultural values of the local people, and to the economic development of all stakeholders of tourism in that country.

It is important for Turkey, located in the Mediterranean region, which is an important location for world tourism, to apply the sustainability approach in order to increase its share in tourism and participate in global competition.

Keywords: Environment, Sustainability, Sustainable Tourism, Tourism.

EVALUATION OF CHEMICAL INDICATORS OF ARAZ RIVER WATER QUALITY

Sevinj Hajiyeva, Nazim Shamilov, Tarana Aliyeva, Madina Nabiyeva

Baku State University, Azerbaijan

Corresponding author: e-mail: nabiyevamadina@gmail.com

Abstract

The national monitoring department of the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan has been conducting regular observations on the state of the waters of Araz and small rivers for many years, and it is known that as a result of the discharge of a number of enterprises and domestic sewage into the Araz River, its water has a high concentration of pollutants. Thus, according to the average statistical results, the amount of phenols exceeds the permissible concentration limit by 5 times, metals by 4 times, and oil products by 2 times. At the mouth of the Araz River, the amount of phenols exceeds the permissible concentration limit by 11 times, metals by 6 times, and oil products by 4 times.

Micronutrients in the Araz River and its tributaries are not equally distributed and not fully studied. These elements include iron (Fe^{3+}), aluminum (Al^{3+}), copper (Cu^{3+}), arsenic (As^{3+}), manganese (Mn^{2+}), zinc (Zn^{2+}), titanium (Ti^{3+}), iodine (J^{-}), bromine (Br^{-}), mercury (Hg^{2+}), chromium (Cr^{3+}), molybdenum (Mo^{2+}), etc. During the dry season of the year, the microelements accumulated in the soil are washed away and enter the river waters as a result of strong soil moisture. Many municipal wastewater treatment plants receive industrial wastewater containing heavy metals. Microelements cause a serious problem in both chemical, physical and microbiological indicators of river water quality in the studied areas. During irrigation, heavy metals and radionuclides in river water can easily migrate from soil to agricultural plants. Currently, agricultural products are grown in such areas, and the problem of food security of the population is still relevant, because the only source of water used by the population of the villages located along the Araz River is the water of this river and water from artesian wells.The river is polluted with copper and zinc mainly due to opencast mining and mine waters, electrochemical industry, ore refining factories and household waters. The excess of copper and zinc in river water weakens the process of purifying water from organic substances. In water bodies used for sanitary and domestic purposes, copper compounds should not exceed 0.0001 μg/l, and zinc should not exceed 0.001 μg/l, while in water bodies used for fishing purposes, the permissible concentration limit for both elements should not be more than 10 μg/l.

Keywords: Araz River, Chemical indicators, Heavy metals, Permissible concentration limit.

OPERATING PROBLEMS AND SOLUTIONS IN SMALL SCALE WASTEWATER TREATMENT FACILITIES: THE CASE OF KAYSERİ

Ali Kemal Egül*[1], Fehiman Çiner[1]

[1] *Department of Environmental Engineering, Nigde Omer Halisdemir University, Turkey*
[1] *Department of Environmental Engineering, Nigde Omer Halisdemir University, Turkey*
** Corresponding author: e-mail: alikemal.ergul@mail.ohu.edu.tr*

Abstract

With the development of consumption habits in the globalizing world, the number of production-oriented institutions and organizations is also increasing. Organized Industries have an important place in meeting this production need. However, it is a well-known fact that all production activities carried out away from the concept of sustainable development will cause serious damage to the environment, especially our water resources. In this mean, wastewater treatment facilities in organized ındustrıal zones have an ımortant place.

In this study, 2-hour composite samples were taken from the entrance and exit of the Mimarsinan OSB wastewater treatment plant in Kayseri in 2020, and analyzes of AKM, COD, Cr+6, total Fe, Pb, total Fe, Zn, total CN-. The treatment efficiencies of AKM, COD, total Cr, Pb, and total Fe were investigated. The efficiency of the treatment plant was found to be 95.77% for AKM, 93.24% for COD, 63.5% for total Cr, 48.2% for Pb and 61% for total fe.

The operational problems encountered in the physico-chemical biological treatment plant were defined, and alternative solutions were presented. It has been determined that knowing the wastewater characterization and choosing the appropriate operating parameters play an important role in the solution of operational problems.

As a result of the study; It has been concluded that the amount of inlet flow in parallel with the pollution concentration in wastewater treatment is an important parameter both in operating standards and in treatment efficiency.

Keywords: Waste water treatment, Business issues, Sustainable design.

Acknowledgment: Water pollution and control

AN APPROACH TO EVALUATING FOOD SAFETY IN TERMS OF TOXIC ELEMENTS IN MEDICINAL PLANTS IN THE WORLD AND EXAMINING DIFFERENT ASSESSMENT METHODS

Ebrahim Alinia-Ahandani[1*], Zahra Alizadeh-Terepoei[2], Zeliha Selamoglu[3]

[1] *Department of Biochemistry`, Payame Noor University, Tehran, Iran*
[2] *Department of Biology, Faculty of Basic Sciences, University of Gilan, Iran*
[3] *Department of Medical Biology Faculty of Medicine, Nigde Omer Halisdemir University, Nigde, Turkey*
** Corresponding author: e-mail: ebi.alinia@gmail.com*

Abstract

We must have a broad approach to the investigation of toxic elements in medicinal plants in the world, and as we know, knowing the appropriate evaluation methods and sources that cause the production of toxic elements in food is one of the most important issues today. In this research, the necessary data and related phrases or words (such as "recent researches on medicinal plants and toxic elements, herbs and toxic elements, new methods of assessment of toxic elements in herbs and foods, etc.) were gathered from databases such as Google Scholar, ScienceDirect, Scopus, SID, PubMed, Elsevier, Springer, etc. Then we concentrated on exact researches related to toxic elements and herbs and negative effects of toxic elements on body organ. At first, we tried to take a general look at this important issue and discuss the ways of entering toxic elements into biological cycles, and then by examining some important phrases and key phrases in recent researches around the world that are related to the issue of toxic elements and medicinal plants, and a proper collection related to subject and at the end, by introducing some important methods of evaluation and analysis of toxic elements, as well as the various effects of the accumulation of toxic elements in medicinal plants and diseases were examined. By identifying species and correct use of safe medicinal plants, as well as effective and followable methods, including identifying contaminated areas, using soil stabilizers, and preventing the cultivation of plants and raising animals in contaminated fields and farms, and identifying the correct and more accurate methods of toxic elements was presented.

Keywords: Animals, Medicinal plants, Methods, Research, Toxic elements.

IMPACT OF NOISE ON PHYSICAL AND MENTAL HEALTH DURING LOCKDOWN: A CONCEPTUAL ANALYSIS

Sunpreet Kaur Sahni[1*]

[1] *Associate Professor, Department of Business Management, India*
** Corresponding author: e-mail: sunpreetkaursahni@gmail.com*

Abstract

The paper highlights the impact of reduced noise pollution on the human health during the lockdown. The Mother Nature was revived owing to the standstill in the commotion of the automobiles, besides, social, economic and industrial activity. This led to radical decline of the noise pollution, resulting to pronounced relief to the human population throughout the globe. Noise in technical terms, can be expressed as a mechanized quiver produced from air and water. Sirens; loud music in the surroundings; home alarms; traffic on the road, sea and the air are the various sources generating noise pollution. The perspective of the study is to address the determinants that are triggered owing to increased noise levels that not only have a detrimental impact and create health issues, but also hamper the productiveness and efficiency. The first objective of the paper is to unify the documented work by classifying under different segments based on physiological health and psychological health, substantiated by the extant literature, focusing on the dimensions and its outcomes. The second objective will extend its outlook by developing a conceptual model, where the dimensions explored in the prior objective will be aligned to structure a path model, which has not been looked at earlier and has not been researched in totality, in theoretical and empirical studies, till date. The paper depicts the magnitude of the noise that can have damaging implications on the physical and psychological wellness, by framing a conceptual model. The paper explores theoretically, how physical consequences of noise effluence can have a direct bearing on the person's health, augmenting loss of hearing, cardiovascular disorders, high blood pressure, sleep disorders, to name a few. Besides, argumentativeness, changes in the mood, loss of concentration and anxiety causing psychological effect. Further, the paper substantiates that the reduction of noise not only decreases the threat of sound-related health issues, but has an impact on quality of life, resulting to efficiency and productivity.

Keywords: Lifestyle, Noise levels, Physiological health, Productivity, Psychological wellness.

ABATEMENT OF AZO DYE, ACID BLACK 234 BY COAL BASED ACTIVATED CARBON FROM THE WASTEWATER OF LEATHER INDUSTRY IN PAKISTAN

Saeed Ullah Jan[†1], Saad Melhi[2], Nadia[3], Anam Nisar[3], Sohail Khan[3], Sana Faryal[3], Nabeela[3], Tahira[3]

[1]Department of Chemistry, Chakdara Lower Dir, 18800, University of Malakand, Pakistan
[2]Department of Chemistry, College of Science, University of Bisha, Bisha, 61922, Saudi Arabia
[3]Department of Chemistry, GPGC Timergara Lower Dir, 18800, Pakistan
Corresponding Author: e-mail: saeedsimmab@gmail.com

Abstract

The high-risk organic pollutants produced by industries are of growing concern. The highly porous coal based activated carbon (AC) with a specific surface area of 3470 m^2g^{-1} is used for the removal of azo dye, acid black 234 from wastewater of leather industry in Pakistan. The sorbent is characterized by BET, SEM, TEM, XRD, FT-IR, TGA, and zeta potential. The sorbent exhibits -18.7 mV surface charge, which is high enough for making suspension. The maximum dye uptake of 333mg g^{-1} is observed in sorbent under acidic medium. The thermodynamics parameters like ΔG, ΔH, ΔS are found to be -12.40 $kJmol^{-1}$, 39.65 $kJmol^{-1}$ and 174.55 $kJmol^{-1}K^{-1}$ respectively, revealing that the adsorption process is spontaneous, endothermic and feasible. The experimental results follow the Langmuir and D-R models. The adsorption follows pseudo second-order kinetics.

Keywords: Adsorption, Anionic dyes, Activated carbon, Kinetics, Thermodynamics, DFT.

MAJOR DETERMINANTS OF NOISE POLLUTION: AN ANALYSIS OF ITS IMPACT ON EMPLOYEE PRODUCTIVITY AT SHARED WORKSPACES

Sunpreet Kaur Sahni[1], Amrit Kaur[2*]

[1] *Associate Professor (Marketing), India*
[2] *Research Scholar, IKG Punjab Technical University, India*
** Corresponding author: e-mail: amritkaur15150@gmail.com*

Abstract

Today's work environment is characterized by complex work structures with multiple employees interacting and working in shared workspaces. While working in such workspaces, the significant contaminant influencing their work is exposure to noise pollution. Noise or noise pollution refers to a phenomenon that causes auditory sensations which are unpleasant, undesirable, and annoying. It comprises workspace conversations, sounds from technological gadgets, the noise produced in the normal course of work (opening door, ticking clock, pushing chair), etc., and it may range from acceptable, bearable to unbearable sounds. However, all the employees don't have the same level of acceptance of the same type of noise. Therefore, while continuously working in a noisy work environment, they generally face many adverse impacts which hamper their work performance, efficiency, and productivity. However, chronic exposure to a high level of noise pollution can hamper physical (hearing loss, ischemic heart disease, high blood pressure, etc.); emotional (stress, burnout and mental health issues, etc.); and psychological (impair cognitive abilities, impairment of concentration, etc.) well-being. Therefore, the current paper will investigate the determinants present in shared workplaces that stimulate and influence noise pollution. Further, the paper will also analyze the impact of noise pollution on the physical, emotional, and mental health of employees through the development of a conceptual model identifying how the determinants of noise pollution influence the employees' physical and mental health that in turn impact employee performance, productivity, and efficiency at work. The paper will be based on secondary data collected from peer-reviewed research journals and scholarly articles. Besides aligning the research questions with the outcomes, the paper will also shed light on policies and strategies that employers can implement to reduce noise pollution in shared workspaces in order to improve employee health and develop opportunities for employees to enhance their performance and productivity.

Keywords: Noise Pollution, Shared workspace, Employee wellbeing, Mental health, Productivity.

FOUR TRITERPENE GLYCOSIDES ISOLATED FROM *HEDERA HELIX* L. GROWING IN AZERBAIJAN

Akberova Saida[1], Iskenderov Gaibverdi[1]

[1]*Department of Pharmaceutical Toxicology and Chemistry, Azerbaijan Medical University, Azerbaijan*

Abstract

Hedera helix L. has been used in folk medicine since antiquity. Its various medicines are also used, mainly against coughs. The therapeutic effect of the plant and the corresponding preparations is associated with the content of triterpene glycosides in them. The aim of this study is to isolate four individual triterpene glycosides from ivy berries and study them chemically. Dried and crushed ivy berries, which grow in Azerbaijan, were used as raw materials. To determine the number of triterpene glycosides and sapogenins, thin layer chromatography was used. Various solvent systems were used as the mobile phase for TLC. The chromatogram was developed with 25% alcohol solution of phosphotungstic acid. Monosaccharides and methyl derivatives were detected on the chromatogram with aniline phthalate. The melting point of the substances was determined using a Kofler device, and the specific rotation was measured using a P-161 polarimeter. IR spectra of triterpene saponins were recorded on an Agilent Cary 630 FTIR spectrometer from Agilent Technologies in the range of 600-4000 cm^{-1}.

From the defatted raw material polar glycosides C and D were extracted first with 50% ethanol, then low-polarity glycosides A and B with 80% ethanol. The results of experimental studies on the chemical study of the above triterpene glycosides showed that glycoside A has the chemical structure: oleanolic acid 3-O-alpha-L-rhamnopyranosyl-(1→2)-O-alpha-L-arabinopyranoside. Glycoside B is also a bioside, but contains hederagenin as an aglycone. The carbohydrate chain of this glycoside has a similar set and sequence of monosaccharides, as in glycoside A. As shown by the results of a chemical study of glycoside C, it is an oleanolic acid pentaoside, the composition of the carbohydrate chain of the molecule of which includes one molecule of L-rhamnose, D-glucose, D-galactose and two molecules of L-arabinose. Moreover, all monosaccharides are interconnected, forming one carbohydrate chain at the hydroxyl in position 3 of the oleanolic acid molecule. It was proved that glycoside C is a new compound for the genus *Hedera helix* L. Glycoside D has a similar carbohydrate chain composition to that of glycoside C, with the only difference that the aglycone is hederagenin.

Keywords: *Hedera helix L.*, Triterpene glycosides, Oleanolic acid, Hederagenin.

3D PRINTING OF ALUMINUM POWDER BY BINDER JETTING TECHNOLOGY

Joanna Marczyk[1], Marek Hebda[1*]

[1] *Faculty of Materials Engineering and Physics, Cracow University of Technology, Poland*
** Corresponding author: e-mail: mhebda@pk.edu.pl*

Abstract

Additive manufacturing, also known as 3D printing, is a method for which there has been significant development in recent years. Binder Jetting technology can be distinguished among the 3D printing methods belonging to the powder bed techniques. This technique allows the production of high-quality components with complex shapes. The Binder Jetting method uses a powdered material, which is spread layer by layer and joined with a liquid binding agent. As a result, a three-dimensional part with the desired shape is obtained. Subsequently, curing processes are carried out to remove the volatile solvents of the binder and to strengthen the parts. The next step is depowdering, during which a part is separated from the unbound powder. The final step is the sintering process in high-temperature furnaces. This stage aims to compact the printed parts.

The aim of the research was to optimize 3D printing parameters in the Binder Jetting technology in order to produce aluminum parts. Due to the fact that there are no reports of the use of aluminum powder in the Binder Jetting technology in the literature, irregular aluminum powder was selected as the printing material. During the printing process, variable parameters of binder saturation, roller traverse speed and layer thickness were used. Physical properties, such as the determination of density and porosity, were carried out on the sintered parts. The dimensional changes after sintering were appointed and the surface roughness was determined.
It is known that the use of manufacturing technology based on Binder Jetting allows us to provide innovative solutions that can be used in many industries. Optimizing the parameters of the 3D printing process will allow the development of a technology that will enable the production of high-quality parts in a relatively short time and at low costs.

Keywords: 3D printing, Additive Manufacturing, Aluminum, Binder Jetting.

GREEN EXTRACTION AND SYSTEMATICAL CHARACTERIZATION OF SELECTED PLANT BIOACTIVES

Farooq Anwar[1*]

[1] *Institute of Chemistry, University of Sargodha, Sargodha- Pakistan*
[*] *Corresponding Autor e-mail: fqanwar@yahoo.com*

Abstract

The recovery and extraction of high-value bioactives such as phenolics, volatiles and lipids from different food and medicinal plants is infact a challenging task due to multiple reasons such as varying concentration and constituent resources, diverse structural features/chemical nature of compounds, choice of extration solvent and technique as well as processing conditions etc. Due to growing demand from functional food and nutra-pharmaceutical sector, now a days food researchers and natural product chemists are keenly focussing on the discovery/design and use of green routes for an efficient extraction of high-value plant bioactives. The main focus of this lecture is to present an an overview of some important green extraction techniques that are applicable for efficient recovery/isolation of selected plant bioactives/ functional components from different food and medicinal plants. In this direction, methodological developments made by our research team involving efficient green extraction such as enzyme-assisted extraction, ultrasound-assisted extraction, and supercritical carbon dioxide extration of high-value components (plant oils and phenolics) are covered. Moreover, analytical characterization of these bioactives using state-of-the-art chromatographic techniques is also presented.

PROPERTIES OF WASTE GLASS-REINFORCED GEOPOLYMER COMPOSITES

Celina Ziejewska[1*], Agnieszka Grela[2], Marek Hebda[1*]

[1] *Faculty of Materials Engineering and Physics, Cracow University of Technology, Jana Pawła II 37, 31-864 Cracow, Poland*

[2] *Faculty of Environmental and Power Engineering, Cracow University of Technology, Warszawska 24, 30-155 Cracow, Poland*

** Corresponding author: e-mail: celina.ziejewska@doktorant.pk.edu.pl, mhebda@pk.edu.pl*

Abstract

In recent years, with the rapidly growing population and intensified urbanization process, the construction industry has been evolving dynamically. Due to this fact concrete is one of the most popular materials nowadays all over the world, and consequently, the Ordinary Portland Cement (OPC), is increasingly used. However, OPC production has a highly harmful impact on the environment owing to the carbon dioxide emission, high energy consumption as well as the use of natural resources.

Geopolymer is an inorganic amorphous polymer, which is obtained from aluminosilicate materials and alkaline activators in the geopolymerisation process. Moreover, geopolymers are becoming an increasingly popular alternative to concrete material, particularly in the construction industry, due to their properties as well as their environmentally friendly and energy-saving nature. In addition, geopolymer technology enables the use of waste and by-product materials. Despite all these factors, geopolymers are not commonly applied, and there is still a need for their development.

In this study, the application of unwashed waste glass as an addition to fly ash-based geopolymer was investigated. The liquid-to-solid ratio in all produced samples was fixed at 0.4. The consistency of fresh geopolymers, mechanical properties, durability and microstructure of manufactured samples were evaluated.

Keywords: Composite, Fly ash, Geopolymer, Waste glass.

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DICLOFENAC REMOVAL BY ANODIC OXIDATION METHOD USING BORON DOPED DIAMOND ANODE

Mahmut Soylu[1], Ömür Gökkuş[2*], Amina Othmani[3]

[1] *Department of vocational health services high school, Iğdır University, Turkey*
[2] *Department of Environmental Engineering, Erciyes University, Turkey*
[3] *Department of Chemistry, University of Monastir, Tunisia*
** Corresponding author: e-mail: omurgokkus@erciyes.edu.tr*

Abstract

Many studies conducted today show that there is a significant increase in the types and amounts of drugs used in both prevention and treatment processes due to population growth and the diversity of existing diseases. Drugs, which are quite complex and resistant due to their chemical structure, are in the class of micropollutants. Micropollutants that reach the sewerage system via urea and from there to the treatment plants via collectors tend to remain in the effluent in conventional treatment systems without being treated at all. Micropollutants have the potential to cause irreversible damage to the ecosystem and human health even at low concentrations, and advanced treatment processes are required for their effective treatment.

In this study, the removal of diclofenac sodium, which is the most used drug in the anti-inflammatory drug group, by anodic oxidation process was investigated. Diclofenac sodium is a non-steroidal anti-inflammatory drug used to reduce inflammation and relieve pain and for acute injuries. In the anodic oxidation process, boron doped diamond electrode (BDD) is employed as the anode material and stainless-steel (SS-316) is used as the cathode. Operational parameters for the anodic oxidation experiments were investigated. In the study, each experiment was performed at 80 minutes, and the spectrophotometric analyzes of the samples were carried out at 276 nm wavelength for the samples taken from the electrochemical cell at each 10-minute periods. As a result, 97.5% drug removal was achieved at the initial drug concentration of 10 µM, applied current of 50 mA with the background electrolyte concentration of 125 mM.

Keywords: Boron Doped Diamond, Anodic Oxidation, Diclofenac Sodium, Micropollutant, Active ingredients.

Acknowledgement: This work was supported by Scientific Research Unit of Erciyes University with the project number of FDK-2021-11069.

ENVIRONMENTAL EFFECT OF SOME INSECTICIDES TO AGAINST WEEVILS ON SUNFLOWER IN THE SOUTH-EAST OF KAZAKHSTAN

A.S. Zhunussova[1], M.K. Alimkulova[1], M.K. Kanatova[1*]

[1] *Kazakh National Agrarian Research University*
050010, Almaty, Kazakhstan
[*] *Corresponding Autor e-mail: jmarikoza@mail.ru, moldir.a@mail.ru*

Abstract

The article presents the results of the biological and economic efficiency of the insecticide Aliot emulsion concentrate. (malathion, 570 g/l) against weevils in sunflower crops. The death of overwintered adult gray weevils from this insecticide 7 days after treatment was 83.3-90.0%, and 14 days after treatment was 85.7-92.9%. Sunflower yield increased by 112.0-116.9%, i.e. the crop yield increase was 2.7-3.8 centners/ha.

Keywords: Aliot, Efficiency, Insecticide, Productivity, Sunflower.

THE EFFECT OF TALK ADDITION ON THE MECHANICAL PROPERTIES OF THE POLYMER MATRIX

Uliana Pidkovynska[1], Vera Savchenko[2]

[1] Ph.D student of the National University "Zaporizhzhya Polytechnic", Zaporizhzhya, Ukraine
[2] Ph.D., Associate Professor, Dean of the National University "Zaporizhzhya Polytechnic", Zaporizhzhya, Ukraine

Abstract

An overview of the literature shows that the use of polymer matrices based on epoxy resins is now a very modern and widely used method. Matrices based on epoxy resins are now a very modern and applicable type of polymer composite material. To increase their mechanical and functional properties it is necessary to focus special attention on dispersion-strengthened polymer composite matrices, which were modified with finely dispersed or nano-sized talc particles.

In this work, the investigation of polymer modification with talc nanoparticles was done within the range from 0.75% to 2.0% and from 12.5% to 20.0 % mass fraction.

At the investigation of the talc content from 0.75%...2.0%, it was observed the strength of the composite increased from 4.69 MPa to 12.74 MPa. In samples with 1.0% and 1.5% talc content, active foaming of the polymer sample was observed. This can be explained by the fact that talc acts as a nucleator. This property of the polymer matrix can be further used to make sandwich structures for the cladding helicopters, as it will significantly reduce the weight and cost of the product.

The increase in the content of talc from 12.5% to 20.0% in the composition of the polymer matrix almost linearly decreases the ultimate tensile strength, as the polymeric matrix at rupture is more sensitive to the structures of mineral fillers, which can serve as centers of formation of defects during the mechanical action on them. Therefore, the strength in such composites decreases in comparison with the unmodified sample.

Keywords: Epoxy, Talc, Composite, Materials, Matrix.

THE EFFECT OF MICROCLIMATE ON THE DETERIORATION OF FACING STONES: THE CASE OF NIĞDE ÖMER HALISDEMIR UNIVERSITY MAIN CAMPUS

Mustafa Korkanç[1,2*]

[1] *Department of Geological Engineering, Niğde Ömer Halisdemir University, Turkey*

[2] *Disaster Education and Management Application and Research Center, Niğde Ömer Halisdemir University, Turkey*

** Corresponding author: e-mail: mkorkanc@ohu.edu.tr*

Abstract

Atmospheric effects play an important role in the deterioration of natural stones. In particular, the intensity of solar radiation and wind speed to which the building stones are exposed directly affects the type and degree of deterioration. The variable microclimatic characteristics of the area where the structures built using natural stone are located play an important role in the development of the negative effects of atmospheric processes. It is very important to know the aspect, solar radiation, wind effect, soil type and water content in determining the deterioration due to microclimatic effects that occur in the usage areas of the building stones. In this study, it was aimed to determine the deterioration of andesite, ignimbrite, basalt, limestone and travertine used as paving stones in the campus area, where degradation due to microclimatic environment effects caused by the effect of aspect and wind is observed. According to observational studies, solar radiation and prevailing wind direction on different facades of buildings caused variability, especially in capillary levels, and significantly affected the type of weathering and its intensity. Among the stones used in the main settlement, the most weathering due to microclimatic effects was observed in ignimbrites. The results of the research reveal that microclimate effects should be considered in the selection of construction materials.

Keywords: Deterioration, Facing stones, Ingimbrite, Solar radiation, Wind direction.

A COMPREHENSIVE BIBLIOMETRIC OVERVIEW OF THE TOXICITY OF TEXTILE DYES

Büşra Salman[1], V. Zülal Sönmez[1*], Ceyhun Akarsu[1], Nüket Sivri[1]

[1] *Department of Environmental Engineering, İstanbul University-Cerrahpaşa, Turkey*
** Corresponding author: e-mail: zulal.sonmez@iuc.edu.tr*

Abstract

The textile industry is globally prevalent and rapidly expanding. The most noticeable characteristics of textile sector effluent are high organic and inorganic pollutants and vivid color content. The dyestuffs and auxiliary chemicals employed in this industry significantly contribute to pollution. There is growing literature on the toxicity and carcinogenic effects of dyestuffs in wastewater on aquatic life, and an increasing effort to quantify and predict alternate treatment strategies.

The purpose of this study is to evaluate the bibliometric analysis of the toxicity of dyes to identify research trends, track research hotspots, and determine future research directions in the last 5 years. Bibliometric indicators and visualization maps were utilized to analyze the retrieved data quantitatively and qualitatively. The following parameters were used to compile a summary of textile effluent toxicity studies from 2017 to 2021: dye type, acute/chronic toxicity, environmental sensitivity, article keywords, country, and keyword co-occurrence analysis. The results indicate that the majority of investigations were conducted using laboratory-prepared wastewater at a rate of 75%. It was also found that research on the acute toxicity of textile wastewater is mainly carried out in effluent treatment plants, with an emphasis on human health and sustainable color manufacturing. *Environmental Science and Pollution Research* and *Ecotoxicology* published the most studies, while India and Brazil ranked first and second in the number of articles published.

In recent years, there has also been a strong focus on sustainable development goals. Additionally, the current regulations and procedures for wastewater treatment were examined, and several potential future study paths for academics were suggested. The findings show that bibliometric analysis is a practical approach to measuring research hotspots and trends both qualitatively and statistically. It can also be broadly applied to assist new researchers in analyzing the body of literature on a particular study topic.

Keywords: Acute/chronic toxicity, Bibliometric analysis, Textile dye, Textile industry, VOSviewer.

PHASE BALANCE IN YTTRIA-STABILIZED ZIRCONIA DEPENDING ON THE CONTENT OF THE STABILIZING ADDITIVE AND SINTERING TEMPERATURE

Valentyna Vavrukh[1*], Marek Hebda[2], Pavlo Lyutyy[1]

[1]Department of Materials Science and Engineering, Lviv Politechnic National University, 12 S.Bandera str., Lviv 79000, Ukraine

[2] Department of Materials Engineering, Cracow University of Technology, Warszawska 24, 31-155 Kraków, Poland

** Corresponding author: e-mail: vavrukh.valentyna@gmail.com*

Abstract

The wide use of yttria-stabilized zirconia ceramics in dentistry, orthopedics, and in mechanical engineering is due to a particular set of properties, namely a combination of high strength, wear resistance, corrosion resistance with high fracture toughness. Such properties are related to the microstructure and phase composition of the ceramics, which in turn depend on the alloying and sintering mode. The optimal choice of these parameters to ensure the necessary operational properties is a task that needs to be solved.

Alloying of zirconia ceramic by Y_2O_3 additive allows obtaining not only a monoclinic phase but also a tetragonal and cubic phase in the structure at ambient temperature. Depending on the sintering temperature, these phases are distributed in different ratios. Achieving the maximum content of the tetragonal phase provides high-performance characteristics of ceramics.
The aim of the work was to investigate changes in the phase state of ceramics depending on the sintering temperature and the content of the stabilizing additive. XRD analysis was carried out and the phase composition of yttria-stabilized zirconia ceramics with different contents of yttria was investigated, namely: 3 mol. % Y_2O_3 (3YSZ), 4 mol. % Y_2O_3 (4YSZ), 5 mol. % Y_2O_3 (5YSZ) and 6 mol% Y_2O_3 (6YSZ). For each series of samples, the following sintering temperatures were used: 1450 °C, 1500 °C, and 1550 °C. Correlational dependences were established between the content of the Y_2O_3 additive, the sintering temperature, and changes in the structure and phase balance of the investigated ceramics.

Keywords: Alloying, Ceramic, Sintering temperature, Tetragonal, Yttria-stabilized zirconia.

THE EFFECTS OF DIFFERENT MULCH MATERIAL APPLICATIONS ON SOME HYDROLOGICAL PARAMETERS IN LABORATORY CONDITIONS

Selma Yaşar Korkanç[1*], Halil Şahin[2]

[1] *Niğde Ömer Halisdemir University, Engineering Faculty, Department of Environmental Engineering, Niğde, Turkey*

[2] *Niğde Ömer Halisdemir University, Graduate School of Natural and Applied Sciences, Department of Environmental Engineering, Niğde, Turkey*

** Corresponding author e-mail: sykorkanc@ohu.edu.tr*

Abstract

Mulches are materials that have the potential to be effective in reducing runoff and soil loss. However, knowing which mulch material and in what amount to use is important in terms of efficiency and economy. In this study three mulch rates (2, 4, 6 t/ha) and three mulch types (straw, dry weed and peanut hay) were applied onto experimental plots and the effects of different mulch materials and dose applications on some hydrological behaviors were investigated under simulated rainfall conditions. Simulated rainfall was applied along an hour. The rainfall intensity was 97 mm/h. The slope of experimental plots was 9%. The runoff water formed during the application was collected 10 minutes intervals. Runoff coefficient, time to ponding, time to runoff and drainage coefficient properties were determined. The results of the study showed that the runoff coefficient decreased in all mulched plots compared to the control plots. It has been revealed that the most effective mulch application in delaying time to ponding and time to runoff is 4 tons/ha of straw mulch.

Keywords: Hydrological Response, Mulching, Runoff Coefficient Time to Ponding

ASSESSMENT OF THE INFLUENCE OF BOREHOLE DRILL DEPTHS ON THE CONCENTRATION OF HYDROCHEMICAL PARAMETERS IN GROUNDWATER AT THE VEA CATCHMENT, GHANA, UPPER EAST REGION: A GUIDE TO WATER WELL DRILLERS

Richard Obeng[1*], Emmanuel Daanoba Sunkari[1,2]

[1] *Department of Geological Engineering, University of Mines and Technology, Ghana*
[2] *Department of Geological Engineering, Nigde Omer Halisdemir University, Turkey*
**Corresponding author: e-mail: ri.obeng02@gmail.com*

Abstract

Harnessing groundwater hosted in aquifers entails drilling boreholes to a specific depth to pump/hoist quality groundwater. Aquifers formed at varying depths at the earth's subsurface have varied hydrochemical characteristics, resulting in variations in groundwater quality. However, limited studies have been carried out on the effect of borehole drill depths on the concentration of high F^- levels and other hydrochemical parameters in the Vea Catchment of the Upper East Region, Ghana. Therefore, this study seeks to determine the effect of borehole drill depths on the concentration of hydrochemical parameters in groundwater in the Vea Catchment. For geochemical investigation, 53 groundwater samples were collected from several settlements within the Vea Catchment. The borehole drill depths varied from 17.0 to 70.0 m with an average of 42.8 m, implying mostly shallow wells. Fluoride (F^-) concentrations in the groundwater range from 0.35 to 3.95 mg/L with an average of 1.58 mg/L, higher than the maximum tolerance limit of 1.5 mg/L. Using bivariate scatter plot analysis, the correlation coefficient *(r)* of the graphs was computed. The highest *r* value obtained was 0.37 less than 0.5, indicating a very weak and poor correlation between borehole drill depth and the concentration of hydrochemical parameters in groundwater in the Vea Catchment. The relationship between F^- concentration and other groundwater hydrochemical parameters against borehole depths in the study area is very weak, hence the elevated fluoride concentration in groundwater is not dependent on the depth (shallow or deep) of boreholes in the study area.

Keywords: Borehole Drill Depth, Fluoride Contamination, Groundwater, Vea Catchment, Technology

Acknowledgment: This research is part of the undergraduate project work of the first author at the University of Mines and Technology, Tarkwa, Ghana.

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GEOCHEMICAL CHARACTERISATION AND ASSESSMENT OF THE SOURCES OF GROUNDWATER CONSTITUENTS IN THE GARU-TEMPANE DISTRICT, GHANA

Awura Adwoa Akyeama Ankomah[1*], Emmanuel Daanoba Sunkari[1, 2], Edmund Nana Asare[1], Enoch Ofosu[3]

[1] *Department of Geological Engineering, University of Mines and Technology, Ghana*
[2] *Department of Geological Engineering, Nigde Omer Halisdemir University, Turkey*
[3] *School of Environmental Sciences, University of Guelph, Canada*
**Corresponding author: e-mail: adwoaakyeama@gmail.com*

Abstract

Garu-Tempane lies within the Precambrian basement complex and the Voltaian Supergroup, mainly composed of volcanic and sedimentary rocks. The study involved the hydrochemical characterisation of the groundwater to ascertain its chemistry, quality and sources. A total of sixty-six (66) samples were collected from boreholes in the area. The study revealed that the major cations and anions vary in the order: $Na^+ > Mg^{2+} > Ca^{2+} > K^+$ and $HCO_3^- > Cl^- > SO_4^{2-} > F^-$, respectively. The dominant water type in the area is Na-HCO3 with other mixed water types. This reflects the local geology, which is composed of carbonate and silicate rocks. Five principal components with eigenvalues >1.0 explaining for a total variance of 76.8% of the hydrogeochemical data were obtained from Factor Analysis indicating that geogenic and anthropogenic sources contribute to the groundwater chemistry. The dominant geogenic sources of groundwater constituents in the district are water-rock interaction, silicate mineral weathering, carbonate mineral dissolution, and ion exchange reactions, whereas the anthropogenic sources include leachate from domestic sewage, runoff from farmlands and agrochemical application on farms. Geochemical modelling revealed that the groundwater is undersaturated with respect to dolomite, calcite, aragonite, and fluorite. It is recommended that periodic assessment of the water in the district must be done to prevent the outbreak of water-borne diseases.

Keywords: Geochemical modelling, Groundwater, Hydrogeochemistry, Precambrian basement, Voltaian supergroup

Acknowledgment: This research is part of the undergraduate project work of the first author at the University of Mines and Technology, Tarkwa, Ghana.

OCCURRENCE, CONTROLLING FACTORS AND HEALTH HAZARDS OF NITRATE-ENRICHED GROUNDWATER IN SOME BIRIMIAN AQUIFERS IN THE UPPER WEST REGION, GHANA

Samuel Yamoah Nyamekye[1*], Emmanuel Daanoba Sunkari[2], Musah Saeed Zango[3]

[1] *Department of Geological Engineering, University of Mines and Technology, Ghana*
[2] *Department of Geological Engineering, Nigde Omer Halisdemir University, Turkey*
[3] *Department of Geological Engineering, University for Development Studies, Ghana*
**Corresponding author: e-mail: samuelnyamekye67@gmail.com*

Abstract

High nitrate (NO_3^-) consumption poses serious health risk to consumers. Therefore, this study seeks to document the nitrate levels in groundwater, the potential sources of nitrate in the groundwater and health risks associated with nitrate contaminated groundwater in the Upper West Region. A total of 108 samples were collected from active boreholes in the region for hydrochemical analysis. The results obtained were interpreted using hydrochemical graphing, geochemical modelling and multivariate statistics. The order of the dominant major cations is: $Ca^{2+} > Mg^{2+} > Na^+ > K^+$ while the dominant major anions vary in the order: $HCO_3^- > SO_4^{2-} > Cl^-$. The concentration of NO_3^- ranges from 0.00 to 719.82 mg/L with 91.79 mg/L as the average value. The dominant water type in the study area is Ca-Mg-Na-HCO3 (31.2%) with other mixed water types. Five principal components with eigen values > 1.0 were extracted from Factor Analysis using Principal Component Analysis as the extraction criterion. The factors accounted for a total variance of 82.03%. NO_3^- associated with component one can be attributed to the elevation of high nitrate in groundwater from agricultural inputs. The USEPA, human health risk assessment model was used in the health risk assessment. Children were identified as the age group among the population with the highest estimated daily intake of the nitrate-contaminated groundwater. For the Hazard Quotient, children were also vulnerable to detrimental health risks associated with high nitrate concentration in the groundwater and thus, are considered to be the hypersensitive among the age groups. It is recommended that, water distillers eliminate nitrate from small batches at a time and public education programmes could be organised to emphasise on the effects of the excessive application of nitrate fertilizers in relation to groundwater.

Keywords: Birimian Aquifer, Groundwater, Health Risk Assessment, Hydrogeochemistry, Nitrate Contamination

Acknowledgment: This research is part of the undergraduate project work of the first author at the University of Mines and Technology, Tarkwa, Ghana.

ASSESSMENT OF GEOCHEMICAL CONTROLS ON GROUNDWATER QUALITY IN THE BAWKU WEST DISTRICT, GHANA: IMPLICATIONS FOR DRINKING AND IRRIGATION PURPOSES

Sulleyman Kwaw Haruna[1*], Emmanuel Daanoba Sunkari[1, 2], Jamel Seidu[1], Enoch Ofosu[3]

[1] Department of Geological Engineering, University of Mines and Technology, Ghana
[2] Department of Geological Engineering, Nigde Omer Halisdemir University, Turkey
[3] School of Environmental Sciences, University of Guelph, Canada
**Corresponding author: e-mail: harunacyrrill@gmail.com*

Abstract

This study aims at determining the hydrogeochemical controls on groundwater quality in the Bawku West District and the suitability of the groundwater for drinking and irrigation purposes. The assessment was conducted using hydrochemical graphing, multivariate statistical analysis, and generation of spatial maps. A total of 69 borehole samples from the district were used for this study. The concentration levels of the major cations and anions are in the decreasing order $Na^+ > K^+ > Mg^{2+} > Ca^{2+}$ and $HCO_3^- > SO_4^{2-} > Cl^-$, respectively. The dominant groundwater type in the area is Na-HCO3 (39.13%) and the next dominant water type is K-HCO3 (11.59%), which could be attributed to carbonate dissolution and feldspathic rock weathering. Multivariate statistical analyses reveal rock weathering and ion exchange reactions as well as anthropogenic activities as the factors that control the hydrochemistry of groundwater in the district. Generally, the groundwater is suitable for drinking per the guideline values of the World Health Organization but unsuitable for irrigation purposes since most areas have high sodium percent (Na%) ranging between 33.37 to 99.7% with a mean value of 85.22%, and magnesium ratio ranging from 2.7 to 99.9 with a mean of 75.1, above the guideline values. Therefore, groundwater from the affected boreholes must be treated prior to usage as irrigation water for farms or water with less Na% and MR should be mixed with water from the affected boreholes.

Keywords: Groundwater Chemistry, Groundwater Quality, Irrigation Water Quality, Multivariate Statistical Analysis, Geogenic Sources

Acknowledgment: This research is part of the undergraduate project work of the first author at the University of Mines and Technology, Tarkwa, Ghana.

MICROTUBULAR SOLID OXIDE FUEL CELLS WITH MIXED CONDUCTOR INFILTRATED ELECTRODES

Cigdem Timurkutluk[1,2*]

[1] *Department of Energy Science and Technologies, Nigde Omer Halisdemir University, Türkiye*
[2] *Nigde Omer Halisdemir University, Prof. Dr. T. Nejat Veziroglu Clean Energy Research Center, 51240, Nigde, Türkiye*
** Corresponding author: e-mail: cigdemtimurkutluk@ohu.edu.tr*

Abstract

To improve the electrochemical performance of microtubular solid oxide fuel cells, both anode and cathode electrodes are decorated with nanosized GDC (gadolinium doped ceria) particle by infiltration method. For this purpose, a solution composed of cerium and gadolinium nitrate is prepared to form the desired GDC phase around the main electrode structures. The complete cell is dipped into this solution for various dwelling times and infiltrated by capillary action. The amount of GDC loading is found to increase with the dwelling time. On the other hand, the cell performance tends to increase up to a dwelling time of 45 min, at which almost doubled performance is achieved compared to that of the cell without infiltration. The improvement in the cell performance is attributed to the increased number of electrochemical reaction regions due to nanostructured GDC formed in both electrodes as confirmed by microstructural investigations via scanning electrode microscope. After 45 min dwelling time, the cell performance shows a sharp decrease. This can be explained by excessive GDC loading resulting in decreased porosity as well as reduced electrochemical reaction zones.

Keywords: GDC infiltration, Microtubular, Solid oxide fuel cells.

DEVELOPMENT OF NICKEL INFILTRATED ANODE ELECTRODES FOR SOLID OXIDE FUEL CELLS

Fuat Yildirim[1, 2*], Bora Timurkutluk[1,2]

[1] Nigde Omer Halisdemir University, Mechanical Engineering Department, 51240, Nigde, Türkiye
[2] Nigde Omer Halisdemir University, Prof. Dr. T. Nejat Veziroglu Clean Energy Research Center, 51240, Nigde, Türkiye
** Corresponding author: e-mail: b.fuatyildirim@gmail.com*

Abstract

In this study, nanostructured anode electrodes are produced by infiltrating anode catalyst into porous electrolyte skeleton to enhance the cell performance of solid oxide fuel cells. In this respect, YSZ (yttria stabilized zirconia) electrolyte supports with porous and dense layers are fabricated by tape casting. A solution with a concentration of 0.5 M containing the Ni catalyst in nitrate form is prepared and infiltrated into porous YSZ electrolyte backbone. Different numbers of loadings (1-20) are applied to determine the suitable amount of Ni content. The infiltrates are also sintered at various temperatures (800-1000ºC) to investigate the effect of sintering temperature. The electrochemical performances of the cells with identical LSM (lanthanum strontium manganite)-YSZ cathodes manufactured by screen printing are measured at 700-800ºC operating temperatures. Impedance measurements are also carried out at these temperatures. In addition, microstructural analyses by SEM and characterizations via XRD methods are performed. The results reveal that infiltration is a very effective method to improve the cell performance by providing increased number of electrochemical reaction zones within the electrode due to nanostructured catalyst formed around the main phase.

Keywords: Infiltration, Nanostructured anode electrode, Nickel catalyst, Solid oxide fuel cell.

OBTAINING SOIL-IMPROVING COMPOST FROM FOOD PREPARATION WASTES AND PRUNING WASTES: CHARACTERIZATION AND EVALUATION OF ITS EFFECTS ON PLANT GROWTH

Yağmur Uysal[1*], Zeynep Görkem Doğaroğlu[1]

[1] *Department of Environmental Engineering, Mersin University, Turkey*
** Corresponding author: e-mail: yuysal@mersin.edu.tr*

Abstract

Today, the need for green space is more than ever due to the increase in the industrialization and the resulting greenhouse effect. However, the disposal of garden wastes such as bark, dry and green leaves, pruning wastes, grass clippings etc. from these areas poses an environmental problem. Sending these wastes to landfills causes the formation of high amounts of methane and carbon dioxide gas as a result of both the increase in the waste volume and the storage together with domestic wastes, and these gases cause great environmental problems that cannot be avoided due to the greenhouse effect. From an environmental point of view, composting is recognized as one of the most viable alternatives to manage and treat organic solid waste. By recycling nutrients, composting ensures the reuse of the organic fraction of waste by plants and soil microorganisms, and thus helps to reduce environmental pollution by reducing the amount of organic waste. In this study, it was aimed to produce and characterize compost fertilizer from garden wastes after harvesting from Mersin University Central Campus and food wastes from cafeterias. With the compost unit established for this purpose, food and garden wastes (green wastes such as grass, etc. were composted. The effects of produced compost material on plant growth were also investigated on wheat plants.

Keywords: Compost, Fertilizer, Organic removal, Plant growth, Pruning wastes, Recycle, Wheat

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SYNTHESIS, SWELLING PROPERTIES AND EFFECTS ON SEED GERMINATION PROCESS OF OLIVE STONE BIOCHAR-BASED PVA/SA HYDROGEL

Zeynep Görkem Doğaroğlu[1], Yağmur Uysal[1*]

[1] *Department of Environmental Engineering, Mersin University, Turkey*

** Corresponding author: e-mail: yuysal@mersin.edu.tr*

Abstract

Global freshwater scarcity caused by climate change and wild agricultural irrigation has recently become a crisis for all ecosystems, especially agricultural production systems. For this purpose, the production of cross-linked hydrogels has become widespread in recent years to help improve the water holding capacity of plants and soil by using different polymer chemicals. Polyvinyl alcohol, sodium alginate etc. water-absorbent hydrogels produced using synthetic polymers without harming the plants or polluting the soil environment are attracting attention as a promising solution because they increase the resistance of the soil-plant system against drought. Different additive materials can be added to hydrogels to increase the swelling capacities of hydrogels or to improve soil-plant health. For this purpose, one of the most widely used additive is biochar. In this study, the olive stone biochar (OSB) was produced with slow pyrolysis method at 650 ^{o}C. The chemical analysis of the obtained biochar (pH, electrical conductivity, ash content) and elemental analysis (C, H, N) were determined. Then the hydrogels containing olive stone biochar at different concentration (0-0.1%-0.4%-0.8%) were synthesized. Non-toxic polyvinyl alcohol and sodium alginate polymers and calcium chloride were used in hydrogel synthesis. The swelling capacity and swelling kinetics of hydrogels, and the effects of these hydrogels on lettuce and wheat seed germination were determined.

Keywords: Biochar, Hydrogel, Lettuce, Olive, Seed germination, Wheat

MODIFICATION OF POLYVINYL ALCOHOL FOR BIODEGRADABLE PLASTIC BAGS

Asylzat Iskalieva[*1], Yerzhanov Yerbolat[2], Negim Attia El-Sayed[3], M.N. Mohamad Ibrahim[4]

[1] *School of Chemical Engineering, Kazakh-British Technical University, 59 Tole bi St., 050000, Almaty, Kazakhstan*

[2] *School of Chemical Engineering, Kazakh-British Technical University, 59 Tole bi St., 050000, Almaty, Kazakhstan*

[3]*Laboratory of Advanced Materials and Technology, Kazakh-British Technical University, 59 Tole bi St., 050000, Almaty, Kazakhstan*

[4]*School of Chemical Science, Universiti Sains Malaysia, 11800 Penang, Malaysia*

** Corresponding author: e-mail: A_iskalieva@kbtu.kz*

Abstract

The blending polymers were synthesized. Potassium persulfate was used as an initiator. The blend copolymer (PVA/S) was prepared by blending poly (vinyl alcohol) (PVA) with starch (S) with ratio 2:1 of materials at the first stage. The next stage was grafting polymers with blend copolymer. The obtained polymers (PVA/S/PEGMA) were characterized by FT-IR spectroscopy for analyzing the interaction of hydrogen bonds between PVA, starch and PEGMA in the mixtures. PVA/S/PEGMA blend films were tested for biodegradability and mechanical tests. The results showed that the mechanical properties of blend films are strongly dependent on the PEGMA. Moreover, an increase in the ratio of PEGMA in grafted polymers, tensile strength and elongation at break.

Keywords: Blend films, Polyethylene glycol methyl methacrylate, Starch, Polyvinyl alcohol, Solubility.

THE EFFECT OF FA AND GGBFS ON THE FRESH AND RHEOLOGICAL CHARACTERISTICS OF ENGINEERED GEOPOLYMER COMPOSITES

Hatice Öznur Öz[1], Muhammet Güneş[1*]

[1]*Department of Civil Engineering, Nigde Omer Halisdemir University, Turkey*

** Corresponding author: e-mail: mgunes@ohu.edu.tr*

Abstract

As a result of research studies to improve the ductility performance of conventional concrete, engineered cementitious composites (ECCs) have been developed with high strength, durability and ductility properties. Then, engineered geopolymer composites (EGCs) have been introduced by replacing the ECC matrix with geopolymer composites. The fresh and rheological characteristics can be affected by design parameters as well as the hardened characteristics. The high workability property is one of the important parameters for the homogeneity distribution of the PVA fiber.

This study aims to investigate the workability characteristics of EGCs incorporating fly ash (FA) or FA and slag (S). For this purpose, eight FA-based EGCs were produced using different alkali liquids/binder (AL/Bi) with the different content of AL+Bi. Then, in each of these mixtures, eight different EGCs incorporating FA+S were designed by using 30% S instead of FA. The mini slump flow, mini V-funnel, marsh funnel and rheological tests were performed on EGCs. FA+S-based EGCs achieved similar fresh and rheological properties in comparison with FA-based EGCs by higher water content. For similar workability, the water contents of FA+S based EGCs from increased by 15.7%, 3.7, 3.2, 11.8, 15.7, 17.6, 7.5 and 11.8, respectively. This is probably supported by the result of differences in the physical properties and chemical reactions of binders in the fresh EGCs.

Keywords: Engineered geopolymer composites, Fly ash, Fresh properties, Slag, Rheological parameters

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PHYTOBIOTICS AS AN ALTERNATIVE TO ANTIBIOTICS IN POULTRY PRODUCTION AND THEIR EFFECT ON GUT HEALTH

Muhammad Umair Asghar[1],[2]*, Mariusz Korczyński[1], Martyna Wilk[1], Sibel Canoğulları Doğan[2], Sema Yaman[2]

[1]*Wroclaw University of Environmental and Life Sciences, Faculty of Animal Science and Fisheries, Department of Animal and Feed Sciences, Poland*

[2]*Department of Animal Production and Tech., Faculty of Agricultural Sciences and Tech., Niğde Ömer Halisdemir University, Niğde, Turkey,*

**Corresponding author email: muhammad.asghar@upwr.edu.pl, umairasghar341@gmail.com*

Abstract

In poultry industry, antibiotic substances have been widely used as a growth promoters causes serious health problems regarding one health concept. Antimicrobial resistance developed due to imprudence usage of these antibiotics as growth promoters (AGPs). With the restriction or decline of the use of AGPs in broiler production, alternatives to AGP are required, particularly to maintain the balance of intestinal flora in chicken. To overcome this problem, employing biotic or natural items as antibiotic replacements, phytochemicals, phytobiotics, organic acids, probiotics, prebiotics, bacteriophages, in-feed enzymes and others such as phytobiotics (phytogenics or botanicals), has gotten a lot of interest. Phytobiotics or its components are a new class of natural herbs that have acquired appeal and acceptance among poultry sector. The use of a variety of phytobiotic additions in chicken feed has demonstrated their capacity to improve the productivity of both broilers and layers. Furthermore, phytobiotics shown high efficiency in combating pathogenic microorganisms in the intestine while preserving the community of typical resident useful microbiota. Moreover, substances like thymol, carvacrol, cinnamaldehyde and curcumin found in thyme, pepperwort and turmeric exert significant support of the innate immunity as well as antioxidant action. Phytobiotics have been found to have an immunostimulatory impact on both humoral and cellular immunity, along with antioxidant qualities. As a result, the purpose of this review paper was to focus on the use of various types of phytobiotics as chicken dietary supplements to boost productivity, decrease infectious intestinal flora, and augment the immunological response, particularly after vaccination. However, the phytochemical mechanisms of the growth promotion and action on microflora are still unclear and need further investigation to achieve the maximal effectiveness. This study summarizes the potentials and prospective mechanisms of action of several AGP replacements (referred to as nutraceuticals) in boosting the gut microbial environment, immune system, and growth performance of chicken.

Keywords: Antibiotics, Growth performance, Gut-Microbiota, Immunity, Phytobiotics.

ELECTROCHEMICAL REMOVAL OF FENOPROFEN FROM AQUEOUS SOLUTION

Mahmut Soylu[1], Ömür Gökkuş[2*], Amina Othmani[3]

[1] Department of Vocational Health Services High School, Iğdır University, Turkey
[2] Department of Environmental Engineering, Erciyes University, Turkey
[3]Department of Chemistry, University of Monastir, Tunisia
** Corresponding author: e-mail: omurgokkus@erciyes.edu.tr*

Abstract

Fenoprofen is an anti-inflammatory drug used especially after operations that require serious medical attention, such as surgery. It is reported that after the use of drugs such as fenoprofen, most of the drug active substances are excreted from the body through urea. Residues of pharmaceutical active substances reaching the treatment plants through the sewerage are almost never removed during the treatment period, and they accumulate in the water systems and endanger the aquatic ecosystem and living life. These drugs, which are considered in the micropollutant class in terms of both their size and the risks, have the potential to cause irreversible damage to the ecosystem and living things even at low concentrations. Advanced treatment processes are required for the treatment of this type of pollutants.

Electrooxidation is an advanced electrochemical treatment process based on applying current to an electrochemical cell containing anode and cathode. In the study, drug fenoprofen was removed with electrooxidation process using boron doped diamond anode (BDD) and stainless-steel cathode as electrode materials. The parameters reported to be effective on treatment efficiency were determined as applied current, initial drug concentration and background electrolyte concentration. In this study, the samples were taken at every 10 min from the electrochemical cell during the 80-min of electrolysis period, and analyzed spectrophotometrically to determine the optimum operational conditions that affect the process efficiency. After a serial of trials, a maximum removal rate was determined as 98% for fenoprofen at the applied current of 70 mA with the initial drug concentration of 75 µM, and the background electrolyte concentration (Na_2SO_4) of 100 mM.

Keywords: Active ingredients, Boron Doped Diamond, Electrochemistry, Fenoprofen, Micropollutant.

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DEVELOPMENT OF A LOW-COST HOUSEHOLD DEFLUORIDATION UNIT USING THERMALLY-ACTIVATED COW BONE: A CASE STUDY AT NORTH EAST REGION, GHANA

Charles Mensah[1*], Emmanuel Daanoba Sunkari[1, 2]

[1] *Department of Geological Engineering, University of Mines and Technology, Ghana*
[2] *Department of Geological Engineering, Nigde Omer Halisdemir University, Turkey*
** Corresponding author: e-mail: charlesmensah519@gmail.com*

Abstract

The negative impact of high fluoride concentration in drinking water poses a threat to the lives of individuals, so due to this, the search for locally available technology to defluoridate drinking water remains critical. Hence, this research seeks to investigate the potential of thermally-activated cow bone as a simple defluoridation technique and also to design the defluoridation unit as a cost-effective technology to defluoridate drinking water in the North East Region of Ghana. The experiment was conducted by drying the bones for up to 5 days and pyrolysed at a temperature of 900℃ for 2 hours. The pyrolysed products were then crushed and sieved to obtain a particle size of -2.8 mm + 1.4 mm**.** The pyrolysed products were then activated physically for 4 hours to obtain thermally-activated cow bone. Scanning Electron Microscopy analysis was conducted to check for the pore spaces present in the cow bone. The adsorbent was characterised by its percentage removal of fluoride ions from naturally fluoridated water under optimised contact time, pH, adsorbent dosage, and initial fluoride concentration in the groundwater. Contact time of 4 hours and 8 hours reduced fluoride concentration from 3.1 mg/L to 0.82 mg/L and 0.43 mg/L, respectively at constant dosage of 4.0 g**,** and at a percentage of 73.5% and 86.1**%,** respectively. Adsorbent dosages of 10.0 g and 12.0 g reduced fluoride concentration from 3.1 mg/L to 1.10 mg/L, and 0.72 mg/L at a percentage of 64.52% and 76.77% for constant time of 2 hours. This implies that when the contact time of the adsorbent increases, the percentage removal of the fluoride also increases and when more dosage is applied the adsorption capacity of the adsorbent increases. Therefore, the efficacy of the cow bone for defluoridating groundwater in the North East Region has been proven in this study.

Keywords: Cow bone, Defluoridation, Fluoride Concentration, Groundwater, Scanning Electron Microscopy.

Acknowledgment: This research is part of the undergraduate project work of the first author at the University of Mines and Technology, Tarkwa, Ghana.

ENVIRONMENTAL IMPACTS OF A DESALINATION PLANT

Aylin Bayram[1], Nilay Elginoz[2], Fatos Germirli Babuna[1*]

[1] *Istanbul Technical University, Environmental Engineering Department, Maslak 34469, Istanbul, Turkey*
[2] *IVL Swedish Environmental Research Institute, Life Cycle Management, Valhallavägen 81, 114 27 Stockholm, Sweden*
** Corresponding author: e-mail: germirliba@itu.edu.tr*

Abstract

With the rapid growth of the population and the increase in per capita water consumption, the importance of water is elevated. The aim of this study is to reveal environmental impacts of a desalination plant during production of units, installation and, operation and maintenance stages through life cycle assessment (LCA) methodology. For this purpose, GaBi 7.3 software is adopted. The desalination plant under investigation is composed of a static mixer, a multimedia filter, a cartridge filter, a reverse osmosis system, a dolomite filter, UV and chlorination units. The production of units is performed in Dilovasi, Turkey. The produced parts are then transported to Kazakhstan where installation, operation and maintenance take place. The functional unit is 1 m^3. Abiotic Depletion Potential Elements (ADP-elements), Abiotic Depletion Potential Fossil (ADP-fossil), Acidification Potential (AP), Eutrophication Potential (EP), Freshwater Aquatic Ecotoxicity Potential (FAETP), Global Warming. Potential (GWP), Human Toxicity Potential (HTP), Ozone Depletion Potential (ODP) and Terrestrial Ecotoxicity Potential (TETP) are determined as environmental impact categories.

The environmental impacts can be reduced when the transportation from Turkey to Kazakhstan is carried out by railroad and sea, not by highway.

Operation and maintenance stage dominates ATP elements, ATP fossil, AP, EP, FAETP, GWP, HTP and TETP impact categories when the whole stages are considered. On the other hand ODP arises mainly due to production of units and installation phases.

The biggest impact in the operation and maintenance is of energy origin. Using a renewable energy source such as solar or wind power instead of electricity is observed to lower the impacts.

Keywords: Desalination, Energy, Environmental impacts, Life cycle assessment, Sustainability.

SUSHY PROJECT: SUSTAINABILITY DEVELOPMENT AND COST-REDUCTION OF HYBRID RENEWABLE ENERGIES POWERED HYDROGEN STATIONS BY RISK-BASED MULTIDISCIPLINARY APPROACHES

Nicola Paltrinieri[1*]

[1] *Department of Mechanical and Industrial Engineering, Norwegian University of Science and Technology – NTNU, Trondheim, Norway*

** Corresponding author: e-mail: nicola.paltrinieri@ntnu.no*

Abstract

The SUSHy project (sustainability development and cost-reduction of hybrid renewable energies powered hydrogen stations by risk-based multidisciplinary approaches) aims to address system modelling and analysis issues in clean hydrogen production and storage, more specifically in the analysis of uncertainties that can impact social, economic, and environmental sustainability of hybrid renewable energies powered (HREP) hydrogen production and fueling facilities. Attention is paid to newly risk-based performance and degradation models for dealing with fluctuations, unexpecting events, and other complexities brought by HREP, to prevent and mitigate accidents, build organizational safety culture and procedures, better communicate with the public, and identify optimal operational modes for increasing the feasibility of HREP hydrogen stations. This cross-sectoral project includes multilateral participations of technical and social sciences from 4 European partner countries (Norway, Spain, Poland, and Turkey) and Japan. The overall aim of this project is to strengthen the cooperation between European and Japanese partners in sustainability development of hydrogen energy, create possibilities that go beyond what the countries can achieve alone, and provide outcomes of greater value for the countries' citizens. To create new knowledge, the main research objective is to develop risk-based philosophy and a new integrated approach to overall control uncertainties, and improve safety, public acceptance, and economic sustainability of HREP hydrogen production and fueling stations. By establishing a research network, a common risk-based framework is explored for covering technical, organizational, social, and economic topics to build a better society in a context of hydrogen technologies.

Keywords: Hydrogen fueling station, Multidisciplinary approach, Risk, Sustainability development, Uncertainty.

HYDROCHEMICAL ASSESSMENT OF NITRATE CONTAMINATION IN GROUNDWATER OF THE MALUWE BASIN, SAVANNAH REGION, GHANA: IMPLICATIONS FOR HUMAN HEALTH RISK ASSESSMENT

Okai Caleb Okaitei[1*], Emmanuel Daanoba Sunkari[1,2], Musah Saeed Zango[3]

[1] *Department of Geological Engineering, University of Mines and Technology, Ghana*
[2] *Department of Geological Engineering, Nigde Omer Halisdemir University, Turkey*
[3] *Department of Geological Engineering, University for Development Studies, Ghana*
**Corresponding author: e-mail: niikaleb@gmail.com*

Abstract

Nitrate (NO_3^-) is a minor ion that can be present in groundwater, affects its quality when in higher quantity and leads to health problems when consumed. Therefore, forty-eight (48) water samples were collected from active boreholes in the Savannah Region of Ghana for hydrogeochemical analysis and interpreted using hydrochemical plots and multivariate statistical analysis to understand the sources and mechanisms of NO_3^- in groundwater. It was observed that the major cations and anions follow in the order: $Ca^{2+} > Na^+ > Mg^{2+} > K^+$ and $HCO_3^- > NO_3^- > Cl^- > SO_4^{2-}$, respectively. Ca-Mg-Na-HCO3 was the dominant water type due to silicate weathering, ion exchange reactions and mineral dissolution with other mixed water types. NO_3^- concentrations ranged from 0.08 to 188.04 mg/L with an average of 29.5 mg/L. Hierarchical Cluster Analysis indicated that both geogenic processes and anthropogenic activities influence the chemistry of the groundwater. Gibbs plot indicated that the groundwater is greatly controlled by water-rock interaction. Non-carcinogenic health risk assessment associated with the intake of water containing high concentrations of NO_3^- was assessed using the USEPA, human health risk assessment model in this study, which revealed that children are more vulnerable to the health implications. It is recommended that good agricultural practices such as the reduction in the application of nitrate fertilizers should be encouraged and to protect recharge zones from anthropogenic activities such as improper sewage disposal, a comprehensive geochemical study of the watershed should also be encouraged.

Keywords: Maluwe Basin, Groundwater, Health Risk Assessment, Hydrogeochemistry, Nitrate Contamination

Acknowledgement: This research is part of the undergraduate project work of the first author at the University of Mines and Technology, Tarkwa, Ghana.

ADDITIVE MANUFACTURING IN THE CONSTRUCTION INDUSTRY - DEVELOPMENT OF AN ENVIRONMENTALLY FRIENDLY MIXTURE DEDICATED TO 3D PRINTING

Magdalena Rudziewicz[1*]

[1] *Faculty of Materials Science and Physics, Cracow University of Technology, Poland*

** Corresponding author: e-mail: magdalena.rudziewicz@atmat.pl*

Abstract

The challenge for ecological construction and a sustainable economy is to design, build and maintain the construction process in such a way as to use as little energy as possible, produce a minimum of pollution, and minimize cost while increasing the comfort and safety of people living in the constructed facilities. The subject of the investigation will be focused on the ideology of the design going towards a zero-waste technology dedicated to 3D printing. Moreover, waste materials will be used to produce elements with specific properties.

One of the main potential advantages of 3D printing with concrete is an increase in productivity and cost reduction. In addition, the possibility of the process personalization is often mentioned in relation to e.g. climate and place, and moreover, in situ production has a positive impact on a significant reduction in transport costs for both raw materials and components. Furthermore, the proposed solution is highly appreciated due to its unique features, such as construction without formwork, less human involvement (labor costs reduced by 50-80%), minimal waste of building materials, and reduced CO_2 emissions. A sustainable alternative to the widely used cement is geopolymers, the production of which requires less energy and can also reduce the consumption of natural resources. Geopolymers have good mechanical properties and are also resistant to high temperatures. However it is necessary to conduct research focused on the verification of the possibility of using such material in the 3D printing process. Another important aspect will be the analysis of the durability of the manufactured objects, due to both the type of raw material used and the production technology.

Keywords: 3D printing, Cirqular economy, Concrete, Product lifecycle, Recycling.

ENVIRONMENTAL SUSTAINABLITY THROUGH GREEN CHEMISTRY

Subramanian Ravichandran[1*]

[1] *Professor in Chemistry, Lovely Professional University, Jalandhar-144411, Punjab, India*
[*] *Corresponding Autor e-mail: ravichandran.23324@lpu.co.in*

Abstract

Green chemistry represents the pillars that hold up our sustainable future. It is clear that many industries and research of many academics recognize the significance of green chemistry. In the practice of green chemistry a set of principles that reduces or eliminates the use of hazardous substance in the design, manufacture and applications of chemical products are utilized. Chemistry is really very helpful to us as its applications are used worldwide for several purposes. We cannot really imagine a world without chemistry and its applications. However, we should now concentrate on green chemistry, or sustainable chemistry, which refers to reducing or stopping the damage done to the environment around us. Hence, green chemistry could include anything from reducing waste to even disposing of waste in the correct manner. Chemical derivatives must be avoided as far as possible in any type of application as they often prove to be harmful. All chemical wastes should be disposed off in the best possible manner without causing any damage to the environment and living beings. Green chemistry and sustainability essentially go hand in hand. Sustainable development is meeting the needs of the present generation without compromising the ability of future generations to meet their own needs. We need greener chemistry—chemistry that efficiently use renewable raw materials, eliminates waste and avoids the use of toxic and or hazardous solvents and reagents in order to achieve this noble goal. Green chemistry is one of the most fundamental and powerful tools to use on the path to sustainability. In fact, without green chemistry and green engineering, there is no path to sustainability.

A NEW APPROACH ON THE CONNECTIONS THAT MIGHT EXIST BETWEEN THE ENVIRONMENTAL NEUROTOXICITY AND MOST OF THE NEUROPSYCHIATRIC DISORDERS

Gabriela Savastre[1], Alin Ciobica[1,2,3], Gabriel-Ionut Plavan[1*]

[1]Department of Biology, Faculty of Biology, Alexandru Ioan Cuza University, B dul Carol I, No 11, 700506 Iasi, Romania

[2]Center of Biomedical Research, Romanian Academy, B dul Carol I, No 8, 700506 Iasi, Romania

[3]Academy of Romanian Scientists, Splaiul Independentei nr. 54, Sector 5, 050094 Bucuresti, Romania

** Corresponding author: e-mail: gabriel.plavan@uaic.ro*

Abstract

Lately there is a growing interest in understanding the relevance of pesticide exposure in most of the neuropsychiatric disorders**.** Thus, we are describing here the current connections between environmental neurotoxicity and psychiatry, in a new original perspective, by mainly focusing on aspects such as the environmental pollutants, neurotoxicity and the environmental neurotoxicity vs. eco-neurotoxicity. In this way, based on the fact that the exposure to these chemicals can affect all the levels of cellular anatomy and physiology of the body we will also discuss the blood-brain barrier, the vulnerability of the nervous system to chemical toxicants, as well as on the biological markers in risk assessment and finally, of course, the neurotoxicity and psychiatric disorders associated with it.

Keywords: Chemicals, Eco-neurotoxicity, Neuropsychiatric disorders, Pesticides, Psychiatry.

EXTENDED PRODUCER RESPONSIBILITY IN THE FRAMEWORK OF THE CIRCULAR ECONOMY ACTION PLAN

Halime Sezer[1], Özgecan Madenli[1], Ece Ümmü Deveci[1*]

[1] *Department of Environmental Engineering, Nigde Omer Halisdemir University, Turkey*
** Corresponding author: e-mail: eudeveci@ohu.edu.tr*

Abstract

The circular economy action plan is a plan that aims at the absolute recycling of products, which are indispensable in our daily life, from their design, use, and after completing their useful life, in line to protect the environment throughout their entire life cycle. The main theme of the circular economy can be shown as the production of sustainable and durable products and the full participation of the stakeholders in the whole life cycle of the products in the circular economy. It can be said that the most effective way to combat environmental problems is to design products in an environmentally friendly, reusable, and fully recyclable manner, as well as to change consumption habits and raise awareness and information effectively. At this stage, the biggest responsibility lies with the producers. To ensure the durability and reusability of the products they produce, to take necessary measures to reduce hazardous chemicals, to increase energy and resource efficiency, to enable remanufacturing and high-quality recycling by using high-recycling content in products, to reduce carbon and environmental footprints, single-use limiting and providing longevity and reuse. Extended producer responsibility in EU Directive 2008/98/EC is a waste reduction strategy in circular economy. Extended producer responsibility, which is also included in Turkish legislation, targets the recovery, reuse, shredding, and recycling of the products with the aim of efficient use of resources without compromising the free circulation of the products in the market. Some product groups within this scope can be counted as electrical and electronic goods, packaging, vehicles, batteries, and accumulators. It has specific legislation for the product groups in question, and the manufacturers are responsible for the regulations. This study will give information about the studies carried out within the scope of producer responsibility in the EU and our country and the steps to be taken.

Keywords: Circular economy, Producer responsibility, Waste minimization,

BIODIVERSITY AND GUILD STRUCTURE OF SPIDERS (ARANAE: ARACHNIDA) IN THE SUGARCANE FIELDS

Samina Malik, Tahira Jabeen[1*]

[1] *Department of Zoology, University of Sindh, Jamshoro- 76080 Pakistan*
[*] *Corresponding Autor e-mail: tjchandio65@gmail.com*

Abstract

Species richness, diversity and availability of spiders clearly indicating that the environmental factors and farming practices have positive impact on the fluctuations of sugarcane spider fauna. Most of the specimens were collected during early stages of the crop. Number of the specimens decrease in the last stage. The decline in the diversity was due to the crop age, non-availability of the prey also when the crop reaches to its full maturity stage it was difficult to collect the spiders.it is clearly indicating that area of agriculture sites are more rich in spider fauna and during study it was observed that sugarcane fields in sugarcane areas well as in other area were not treated with insecticides and pesticides. Because use of insecticides, pesticides have effect on not only on pest but also on predators such as spiders. Spiders have top-down effect and reduce pest densities in agricultural fields. Research demonstrated that a variety of spider's species consume analogous resources (food, shelter, mating etc) in a diverse ways and structures in an assemblage (Guilds) in an ecosystem. In the same way it was also found that not only diverse spider species are linked by means of special guilds in sugarcane crops even their work of art were also diverges. The presence of meticulous spider fauna in sugarcane crops is showing its effect on the especial features of the environment because surroundings arrangement sustains a variety of the spider species. In sugarcane crops of 2 two agriculture districts of province Sindh Pakistan ten families Lycosidae, Sparassidae, Salticidae, Thomisidae, Araneidae, Tetrgnathidae Clubionidae, Gnaphosidae Oxyopidae and Pholcidae, were deeply studied and recognized four new records and two spider guilds clusters i.e wandering spiders and web builder spiders are reported first time from above area. Out of nine families the wandering families are seven and two are web builder spiders. Wandering spiders built most rich guild structure whereas web builders built least rich one. Hence Wandering spiders dominated over wed builder 59%, 40.58%, correspondingly. The guilds structure not only found in adults but also witnessed between immature spiders. Further family Lycosidae was most diverse and found in abundance in the sugar cane while Oxyopidae was least diverse family. The author spectator four sub sites in sugarcane crop which build according to the age of crop these sub sites are 1 bottom, 2 middle and foliage 3 foliage to top while 4 leaf litter are hence interchangeable with the terms of sugarcane and thus both numerical and dominant of the family. Metaphors which point toward the hierarchical come together in studies two districts scrutiny is formed a dendrogram which was used to construct spider guilds (tables 1, 2). The

collapse of succeeding groups of spiders come into sight were based first and foremost on web use, web-type, and microhabitat, resulting in two clusters of spider families that have been eyewitnesses could be measured as spiders guilds or spiders foraging habits. The spiders are predators feed upon a variety of pests hence can be used as biological control agents.

This research is the baseline study especially for particular crop spider guilds and provides more than enough evidence that spiders can be used in a better way in IPM strategies. In this study author observed spiders as one of the important group of the predators' reason is their high abundance and preference of insects as their food. They can claim the status of farmer friendly as well as environmental friendly arthropods. There are several factors which minimize the spider population such as habitat loss, increase use of the fertilizers, pesticides, degradation, and loss of field boundary and burning of remaining sugarcane residues and reason for reduction in the diversity of spiders in the sugarcane fields. These factors were observed during the study due to rain fall in 2017 habitat loss seem to be the reason of reduction in the collection size. Also due to unawareness and illiteracy farmers used pesticides without any protocol. It causes severe damage to the diversity of spiders but also diversity of other farmer friendly insects. Burning of the remaining sugarcane plant residue is common practices among the sugarcane growers. It has been observed in few study areas, but fortunately some of the sugarcane growers use the sugarcane leaves as fodder to their cattle and it had been noticed that the remaining foliage and litter of sugarcane crop send to paper mills for making chipboard sheets. Spiders react in two ways when the pest population increases in the fields. One is increase in their own density (Numerical Response NR) other is increase in prey consumption (Functional Response FR). The results of this research match with the research work of Marc as he stated that the functional response is more important in the pest control. During present study in the sugarcane fields, it was observed that the consumption of prey was higher especially in the sugarcane fields. Overall both responses were observed in the spider fauna of sugarcane fields of both the districts.

Keywords: Biological control, Guild structure fauna spider, Predator and pest management.

THE LIFE CYCLE ASSESSMENT FOR THE ENVIRONMENTAL AND ECONOMIC IMPACT OF WASHING MACHINE PROGRAMS AND SELECTION BEST PROGRAM WITH MOORA

Fatma Şener Fidan[1*], Emel Kızılkaya Aydoğan[2], Niğmet Uzal[3]

[1] Department of Technology Transfer Office, Abdullah Gul University, Kayseri, 38170, Turkey
[2] Department of Industrial Engineering, Erciyes University, Kayseri, 38060, Turkey
[3]Department of Civil Engineering, Abdullah Gul University, Kayseri, 38170, Turkey
** Corresponding author: e-mail: fatmasener@gmail.com, fatma.senerfidan@agu.edu.tr*

Abstract

Today, there are various habits developed by consumers at home to keep their clothes clean. These habits include many different issues from the choice of the temperature of the washing machine to the detergent used by the consumers. Every choice made by the consumer affects the emissions originating in the use phase of the garments. Studies carried out for the life cycle of garments in the literature characterize the use phase as the second most important emission source after raw material consumption. Similarly, the energy spent for the maintenance phase of the garments is 65% of that consumed in the entire life cycle. This study aimed to evaluate the emissions of the programs provided by the washing machine manufacturers in terms of life cycle assessment methodology and programs consumption costs. For this reason, the scenarios created were evaluated on the basis of both environmental and economic dimensions, and finally the best scenario was chosen by applying MOORA, which is a state of art multi-criteria decision-making method. According to the results obtained, Scenario 3, which is the best scenario, was selected. These results provided important information about environmental and economic effects to both washing machine manufacturers and consumers by examining the washing machine programs that have not been included in the literature until today in multiple dimensions.

Keywords: Environmental impacts, Laundry, LCA, MOORA, Washing machine programs.

DETERMINING THE EFFECT OF LAKE SUĞLA ON REGIONAL CLIMATE BY TREND ANALYSIS

Hasan Çağatay Çiftçi[1*], Kutalmış Gümüş[1]

[1] *Department of Geomatics Engineering, Nigde Omer Halisdemir University, Turkey*
** Corresponding author: hcagatayciftci@gmail.com*

Abstract

Large catchment areas have various effects on climate. In this study, trend analyzes were applied to the climate time series in order to determine the effect of the 40 km^2 Suğla Lake, which is located in the southwestern part of the Konya province of Turkey, was completed in June 2003 and has been serving as an irrigation dam since that year, on the regional climate. Normality and homogeneity tests were applied to the average temperature, average humidity, average wind and average precipitation data obtained from 4 different observation stations from the General Directorate of Meteorology. With the Mann Kendall and Mann Kendall Rank Correlation test, the status of the trend, if there is a trend, the direction and year of the trend were determined for each station as annual and seasonal. The presence and direction of the trend were also examined with the Sen's Slope and Innovative Sen tests. As a result of the studies, increases in temperature, humidity and wind values and decreases in precipitation values were observed. As a result, even a water catchment area of 40 km^2 causes changes in the climatology of the region.

Keywords: Climate change, Innovative Sen Test, Mann Kendall test, Sen's Slope, Trend analysis.

EVALUATION OF BIOGAS PLANT OUTPUTS AS BIOFERTILIZER FOR SUSTAINABLE AGRICULTURE

Sevgi Demirel[1,2], Öznur Begüm Gökçek[1,2*], Hamdi Muratçobanoğlu[1]

[1] Department of Environmental Engineering, Nigde Omer Halisdemir University, Turkey
[2] Department of Energy Science and Technologies, Nigde Omer Halisdemir University, Turkey
** Corresponding author: e-mail: begumgokcek@ohu.edu.tr*

Abstract

Fermentation processes are a well-known and widely used technology at all over the world. Organic materials are converted into biogas under anaerobic conditions with the fermentation process. All over the world the energy demand is increasing rapidly, energy production from biomass is considered as an important alternative energy source with a sustainable approach. In recent years, the linear economy giving its place to the circular economy, this situation becomes with the "can other outputs/components of biogas plants be brought into the economy?" question. Among these outputs, there are research subjects such as the recovery of CO_2 in the biogas content, which has an important place, and the evaluation of the process effluent (digestate) as solid and liquid fertilizers. In this study, current data on the use of digestate as solid and liquid fertilizer were compiled and the results were discussed in detail.

Fertilization has an important place in agricultural applications and studies. Fertilizers containing nitrogen, phosphorus and potassium are used to obtain more efficiency from the unit area. The most important problem in fertilization in our country is the usage of fertilizers by farmers without any soil analysis. Consumption of chemical fertilizers more than the demand of the soil and the plant can cause pollution of water and soil resources in the long period. It may possible to reduce the contamination potential by obtaining a biodegradable structure with the use of digestate as a fertilizer. There are many studies describing the positive effects of digestate on soil quality. The most important factor determining the quality in the use of digestate as solid or liquid biofertilizer is the type of organic waste used in biogas production and the anaerobic process operating conditions. Research in this field is very important for more effective use of digestate as fertilizer. Studies are needed to determine the optimum process operating conditions that will improve digestate quality and to develop new generation "digestate dewatering and processing technologies" that will facilitate the transport of digestate to agricultural areas.

Keywords: Biogas, Digestat, Biofertilizer, Sustainable Agriculture.

BIOHYDROGEN PRODUCTION VIA MICROBIAL ELECTROLYSIS CELL: ELECTRODE AND SUBSTRATE TYPE

Fatma Muratçobanoğlu[1*], Merve Oğuz[1], Sevgi Demirel[2]

[1] Department of Environmental Engineering, Erciyes University, Turkey
[2] Department of Environmental Engineering, Nigde Omer Halisdemir University, Turkey
** Corresponding author: e-mail: fatosmuratcobanoglu@gmail.com*

Abstract

Hydrogen has an important place as a sustainable energy source and is currently seen as the versatile fuel of the future with the potential to replace fossil fuels. In particular, biohydrogen production enables both waste disposal and renewable energy production from organic wastes. There are various processes involved in the production of biohydrogen. These can be listed under three main headings as fermentation, biophotolysis and bio-electrochemical. Microbial electrolysis cell (MEC), a bio-electrochemical process, is among the highly efficient processes that can be integrated with agricultural and industrial activities or waste treatment plants, providing biohydrogen production and wastewater treatment. MEC is a reactor system in which electrochemically active microorganisms on the anode break down organic compounds, releasing protons and electrons, and hydrogen (H_2) is produced on the cathode. Compared to other H_2 generating processes, MEC is a highly developed process that achieves high yields from various organic compounds at low voltage values (<1.0V). Another advantage is the absence of expensive catalysts required at the anode and the potential for simultaneous waste removal. In this study, the effects of electrode types used in MEC process and various wastewater/waste used as substrate on biohydrogen production were compiled.

Keywords: Biohydrogen, MEC, Renewable energy, Waste to energy.

PROMOTING SUSTAINABILITY AND SOCIAL WELL-BEING THROUGH EXCELLENCE IN OCCUPATIONAL HEALTH

-Challenges and Role of IT in Sustainable waste management –

Marina Rovira Puig[1*], Júlia Seco[2], Luís Mazón[3], Rosa M. Orriols[4]

[1]*OiMAlba Advisors, Barcelona*
[2]*Hospital del Mar, Barcelona*
[3]*Hospital de Fuentlabrada, Madrid*
[4]*Chair Scientific Commitee Industrial Hygiene, Hospital Universitari de Bellvitge, Barcelona*
** Corresponding author: e-mail: marinarovira2@gmail.com*

Abstract

Exponential transformation and just sustainability transitions are now increasingly in the spotlight. Before we can come close to achieving the Agenda 2030, concrete pathways, policies, behavioral and system changes are required. The new framework urges us to develop new adaptation and mitigation measures towards achieving the 17 sustainable development goals and build our path towards Net Zero. This implies better organization, long-term planning, and the will to do things differently.

Bellvitge Hospital is committed to caring for the environment and people by placing occupational and environmental health at the core of its activities. Hospitals need to reconsider and change their practices both inside and outside of the working spaces. The hospital is committed to take responsibility and work towards a new sustainable healthcare model. The new model establishes concrete actions for the reevaluation of the hospital's group II waste. This model leads to a new sustainable waste management strategy based in circular economy around waste that allows not only to reevaluate the waste but also to reduce the hospital waste budget.

Moreover, a new system has also been developed for ensuring proper handling and storage of group IV toxic waste. The system is based on the utilization of low temperature containers provided with a photocatalytic filter. Data shows that the new containers not only allow prevention of micro exposure to cytotoxic materials but also reduce the equipment and resources used in traditional management systems.

Keywords: Environmental health, Circular economy, Sustainable waste management, Hospital waste.

INVESTIGATION OF THE MECHANICAL PROPERTIES OF CEMENT BASED GROUTS INCORPORATED WITH DIFFERENT TYPES OF FLY ASH IN JET-GROUTING PROCESS

Fatih Çelik[1*], Çağrı Atasever[1]

[1] *Department of Civil Engineering, Nigde Ömer Halisdemir University, Turkey*
** Corresponding author: e-mail: fatihcelik@ohu.edu.tr*

Abstract

As jet grouting method is frequently used in the improvement of problematic soils encountered in geotechnical engineering. Within the scope of this study, grout mixtures were obtained by substituting 4 different fly ash in different ratios to cement-based grout mixtures used in jet grout injection. Within the scope of the experimental study, 4 different fly ash (FA-1, FA-2, FA-3 and FA-4) and fly ash in various proportions (0%, 5%, 10%, 15% and 20%) were used in cement. A total of 180 cylindrical samples were prepared, with 3 mixtures each for 3,7- and 28-days curing periods from 20 different grout mixtures prepared by substituting them. Curing process was applied to all prepared cylindrical mixtures in a water tank at room temperature conditions for 3, 7 and 28 days. To determine the mechanical properties after the curing processes, the mixtures; unconfined compressive strength test (UCS), Ultrasonic Pulse Velocity (UPV) measurement and bleeding test were performed. Test results showed that fly ash type and amount in the mixture are dominant factors that directly affect the mechanical features of the grouts.

Keywords: Fly ash, Grout injection, UPV, Unconfined compressive strength (UCS).

THE USAGE OF *Bacillus* sp. FOR REMOVAL OF POLYVINYL ALCOHOL (PVA)

Tuba Artan Onat[1], Abdulrahman Zeyno[1]

[1] *Department of Biotechnology, Nigde Omer Halisdemir University, Turkey*
** Corresponding author: e-mail: tubaartan@ohu.edu.tr*

Abstract

Plastics are long-chain polymeric molecules that have many positive properties such as strength, flexibility, extreme durability, low weight and easy and inexpensive production. Its usage and applications have been increasing steadily over the past 150 years, with plastic production worldwide increasing approximately 250 times from 1950 to 2018. Plastics also enter the soil through sewage sludge and effluent used as fertilizer, and are widely used in agriculture as protective covers (e.g. greenhouses, low tunnels and other uses), as fertilizers, pesticides, hormones and seed coatings, and as packaging materials. Until recently, plastic pollution in the environment has been considered solely an aesthetic nuisance. However, recent research has identified concerns about the potential adverse effects of plastics on biota and human health.

In the study, the PVA removal capacity of four different species of Bacillus sp. (B. megaterium, B. subtilis, B. cereus, B. thuringiensis) at different pH values and in two different media (mineral and nutrient broth media) were determined to their potential for use in the removal of polyvinyl alcohol (PVA), which is used as a plastic monomer.

Bacillus strains were noted to be unable to grow in mineral media due to heterotrophic bacteria and to use PVA as a carbon source. The removal experiments were performed with 100 mg/L initial concentration PVA with Bacillus strains at different pH values in Nutrient Broth medium. At the end of the seven-day incubation period, B. megaterium, B. cereus, B. subtilis were showed highest removal rate at pH 5, and the highest removal rate at pH 9 has been achieved with B. thuringiensis. The PVA concentration removal experiments were carried out with these selected pH values. Therefore, it was determined that the highest removal was obtained with the B. thuringiensis, B. cereus, and B. thuringiensis strains at 25 mg/L, 50 mg/L, and 75 mg/L, respectively.

Keywords: *Bacillus subtilis, Bacillus cereus, Bacillus thuringiensis, Bacillus megaterium,* Polyvinyl alcohol.

INVESTIGATION OF LOCALIZED DEFORMATION AND DISLOCATION STRENGTHENING MECHANISM OF THE VT8 ALLOY AFTER CRACK RESISTANCE TESTING

Filimonov Oleksii[1*], Marek Hebda[2], Valentyna Vavrukh [1]

[1] Department of Materials Science and Materials Engineering, Lviv Polytechnic National University, 12 S.Bandera str., Lviv 79000, Ukraine

[2] Department of Materials Engineering, Cracow University of Technology, Warszawska 24, 31-155 Kraków, Poland

** Corresponding author: e-mail: oleksii.s.filimonov@lpnu.ua*

Abstract

Samples of VT8 titanium alloy, which are used for the manufacture of gas turbine engine elements, were studied in the initial state and after crack resistance testing using transmission electron microscopy. The JEM-200CX microscope identified peculiarities of the microstructure, the nature of the phases distribution, defects in the crystal structure, the formation of dislocation inhomogeneities and local concentrators of the internal stresses. The scalar density of dislocations was determined by the secant method.

It is shown that investigated samples of the VT8 titanium alloy are characterized by a two-phase (α+β) microstructure in the form of α-phase large plates, interspersed with a small amount of thin-plate β-phase.

Based on the scalar densities of dislocations, the level of local internal stresses near dislocations clusters was estimated. Dispersed particles of secondary phases, characterized by different sizes and different morphology of the structure, also were identified.

The calculated density of dislocations and an average estimated distance over which they move during deformation was the basis for creating a statistical localized deformation level map for the structural components and for the fracture surface. This map shows that levels of localized deformation (ε_L) for the structural components of the base metal and of the fracture are approximately the same and does not exceed 22%, which is associated with the substructure refinement around the fracture zone. The quantitative assessment of dislocation hardening ($\Delta\sigma_d$) represented that the general increase in the dislocations density, as a result of the deformation effect, increases the rate of dislocation hardening in the metal structure by an average of 38%.

Keywords: Dislocation hardening, Internal stresses, Localized deformation level, VT8 titanium alloy.

AN INTERPRETABLE UNSUPERVISED MACHINE LEARNING APPROACH FOR CLASSIFYING HYDROTHERMAL SYSTEMS IN WESTERN ANATOLIA BASED ON HYDROGEOCHEMISTRY

Bemah Ibrahim[1*], John Owusu Konduah[2], Isaac Ahenkorah[3] Albert Kafui Klu[4]

[1,2,4] *Department of Geological Engineering, University of Mines and Technology, Ghana*
[3] *Department of Civil Engineering, University of South Australia, UniSA STEM, SA, 5000, Australia*
** Corresponding author: e-mail: bemah.aki@gmail.com*

Abstract

The classification of geothermal resources is an important step in the characterization, assessment, and development of geothermal energy. Supervised machine learning algorithms have aided and demonstrated superiority (in terms of accuracy) over existing classical solute geothermometers in this regard. The accuracy of the target labels, which are typically derived from classical geothermometric equations, is always critical to their performance. If conventional geothermeters provide suboptimal readings in these situations, the effect trickles down to the ML models built with these datasets. Therefore, this study presents an unsupervised interpretable approach based on Principal component analysis, Gaussian mixture models, and SHapley Additive exPlanations to cluster geothermal systems in western Anatolia into similar groups (based on hydrogeochemistry) and investigate the relationship between hydrogeochemical parameters and derived clusters. The findings of the study revealed that, Geothermal systems in Western Anatolia can be optimally clustered into two types; high and low temperatures. Na was the most influential variable followed (in decreasing importance) by K, EC, B, SiO_2, Cl and pH. High temperature geothermal systems are characterized by high Na content (> 650 mg/l) and vice versa. The explainability of the proposed approach led to the development of a simple but efficient 2D and 3D graphical models based on Na, K and EC for classifying geothermal systems in western Anatolia. The proposed method could be used as a guide for understanding the hydrogeochemical dynamics of other geothermal systems around the world, as well as a necessary step in the development of new machine learning-informed classification diagrams.

Keywords: Explainability, Geothermal, Hydrogeochemistry, Reservoir temperature, Unsupervised learning.

USAGE OF ZINC WASTE IN PRODUCTION OF GEOPOLYMER CONCRETE

Ahmet Bilgil[1*], Hamdi Can Özmen[1]

[1] *Department of Civil Engineering, Nigde Omer Halisdemir University, Turkey*
** Corresponding author: e-mail: abilgil@ohu.edu.tr*

Abstract

It is aimed to produce geopolymer concrete in order to convert zinc waste, which creates an environmental problem, into a product and make it usable in the construction industry. In the production process; filling material, Kayseri İpek Furniture A.Ş. it was obtained from the Çinkom. Zinc process waste is granulated waste (approximately 40 000 tons per year) formed at the furnace exit in the form of iron calcium silicate after zinc production. Sodium Hydroxide (NaOH) was used as alkali activator. In the mixture, 20, 30 and 40% (12 Mol) NaOH activator by weight of zinc waste was used and samples with dimensions of 40*40*160 mm were produced. In order to determine the best curing temperature of each sample mixture group, they were subjected to curing temperature at 75, 100, 125 and 150 ^{0}C for 48 hours. No deformation was observed in the visual inspection on the products. The unit volume weight was obtained as 0.87 g/cm^3 for the samples cured at 75 ^{0}C with the lowest 20% activator, as 1.87 g/cm^3 for the samples cured at 100 ^{0}C with the highest 40% activator. The bending-tensile stress was measured as 0.5 MPa in the samples cured at 75 ^{0}C with the lowest 30% activator, and 7.5 MPa in the samples cured at 100 ^{0}C with the highest 40% activator. The axial compressive stress values of the samples were measured as 2.0 MPa in the samples cured at 75 ^{0}C with the lowest 20% activator, and 22.84 MPa in the samples cured at 100 ^{0}C with the highest 40% activator. According to the curing temperatures, the lowest mechanical stress values were observed at 75 ^{0}C, the best value was reached at 100 ^{0}C, an average of 37% decrease from the best value at 125 ^{0}C and 62% at 150 ^{0}C. As a result, it was seen that geopolymer concrete with 30% NaOH activator, 100 ^{0}C curing temperature can be produced with zinc waste.

Keywords: Geopolymer concrete, Zinc waste, Zinc waste with NaOH activator.

AN ANALYSIS OF GHG MITIGATION OPTIONS IN THE LAND USE SECTOR OF TURKIYE

Yusuf Serengil [1*], Stavros Papageorgiou[2]

[1] *Istanbul University Cerrahpaşa Istanbul/Turkiye*
[2] *World Bank, Washington-USA*
** Corresponding author: e-mail: serengil@istanbul.edu.tr*

Abstract

Turkiye ratified the Paris Agreement in 2021 and plans to submit its Nationally Determined Contribution (NDC) to the United Nations Framework Convention of Climate Change (UNFCCC) in late 2022. Turkiye also prepares a Long-Term Strategy (LTS) to reach net zero emission by 2053. In this framework, we try to put forward the mitigation options in the Land Use sector (LULUCF), the second largest sector in the GHG inventory of Turkey, following Energy. It had around 10-20 percent offset capacity of the total national GHG emissions for the last decade. The forest management (FL-FL) and Harvested Wood Products (HWP) categories contribute to almost 100 percent of the LULUCF sector removals. Other categories (i.e. Croplands, Grasslands, Settlements, Wetlands, and Other lands) are all sources of emissions constituting less than 1 percent of the sector GHG budget. Therefore, the assessment mainly focuses on the sub-activities of these two key categories. Still, a more comprehensive range of land-based mitigation options has been considered for establishing Business as Usual (BAU) and Mitigation scenarios up to 2053, the target year set by the Government of Turkey (GoT) for achieving net zero emissions. The mitigation options we have analyzed were; forest restoration, harvest, range restoration, and avoided deforestation.

This paper provides an overview of the Land Sector, employs mitigation options, and analyzes their impacts on land-based GHG emissions.

Keywords: Climate Change Mitigation, Land Use Sector, GHG Removals.

Acknowledgment: The data and assessments in this paper are based on the Climate Change and Development Report (CCDR) of Turkiye 2022.

ADVANCES IN LIGHT-RESPONSIVE DRUGS FOR THERAPY

Khatereh Khorsandi[1,2*]

[1]*Department of Photodynamic, Medical Laser Research Center, Yara Institute, ACECR, Tehran, Iran*
[2]*Department of Biochemistry and Molecular Medicine, School of Medicine and Health Sciences, The George Washington University, Washington, DC 20037, USA*
**Corresponding Autor e-mail: hselcuk@iuc.edu.tr*

Abstract

There are many drug-related problems that are of a major concern to society. Poor drug selectivity can result in toxicity-related side effects, but less obvious complications are frequent also, such as drug resistance. Poor drug selectivity stems from a drug's affinity for targets other than that intended. This limitation is perhaps unsurprising when one considers that drugs interact with processes embedded in complex signaling and metabolic pathways to overcome these side effects, substantial efforts have been devoted to the development of targeted therapy, but selectivity remains a major hurdle. Another major issue in modern pharmacotherapy is drug Resistance. In particular, the use of antibacterial agents is under pressure because of the emergence of many resistant bacterial strains.

Light offers unparalleled opportunities as a non-invasive regulatory element for biological applications. Current studies are rich in novel directions in which light plays a key role as a tool for controlling cell activity. Also, light allows drug selectivity to be increased by controlling activity. Light-responsive agents are bioactive molecules modified with photoswitches, that is, moieties that change their structure upon irradiation with light. The photo induced changes in their structure allow the use of light to regulate their therapeutic action. Light-responsive drugs can be consider as alternative ways for treatment of cancers and resistant microbial organisms.

Keywords: Light-Responsive Drugs, Light Therapy, Photoswitching, Targeted Therapy

IMBALANCE AS INDISPENSABLE CONDITION OF MELT FORMATION

Reihaniyyih Ismulla kyzy Kassimova[1*], Roland Nikolaevich Sobolev[2]

[1] *Department of Geology, Lomonosov Moscow State University, Russia*
[2] *Department of Geology, Lomonosov Moscow State University, Russia*
** Corresponding author: e-mail: fizza@mail.ru*

Abstract

Melt's formation is a long complex non-equilibrium irreversible multi-stage process. Its duration determined by physical properties of melt and minerals, as well as by thermodynamic and kinetic parameters. During the process of heating the system's internal energy increases and this is the reason for the fact the amplitude and oscillation frequency atoms increase. The result of this process is lattice loosening what means weakening bonds in it. At the same time vacancies, defects and dislocations number increases. This process is more intense in a crystal peripheral part in comparison with its inner part. Impurity also disorders crystalline lattice and make it unstable. Bonds between atoms in the crystal border part are not as strong as the inner part in it. Therefore the transfer atoms from the border part of the crystal in the melt need less energy and so this process happens takes place at a lower temperature in comparison with the same process for atoms from the cystal inner part. While a particle, situated on the crystal surface, reaches necessary energy, it breaks bonds ties with lattice and moves to the melt. Atoms situated on different elements of crystal surfaces (vertex, edge, facet) have different amount of bonds with lattice. This fact determines the sequence of atom transfer to melt: the less bonds the atom has, the sooner it goes to the melt.

Correspondingly, in order to detach the atom with a less number of bonds, the less amount of energy is required, and, correspondingly, the lower temperature too. The process of this kind of melting is typical only for the atom situated on the crystal vertex. As this melt has formed, the process of transfer the other atoms to melt takes place as a complex operation: an independent separation the atom from lattice and realization of this process with the support of existing melt, both of these processes take place simultaneously. Total temperature interval of a practice transfer from the crystal surface to the melt (superficial melting) is different for different substances. It varies from tens up to hundreds centigrade degrees for different crystals.

The process of melt formation of the crystal consists of two stages phases: the first stage phase is superficial melting and the second – a volumetric melting.

Keywords: Experiment, Granite, Imbalance, Melt, Process.

THE REUSABILITY OF RAINWATER AND GREY WATER WITHIN THE SCOPE OF SUSTAINABLE WATER MANAGEMENT AND COST ANALYSIS

Meltem Sarıoglu Cebeci[1*], Burcu Şahan[2]

[1] *Department of Environmental Engineering, Sivas Cumhuriyet University, Turkey*
[2] *Environmental Engineering, Turkey*
** Corresponding author: e-mail: sarioglu@cumhuriyet.edu.tr*

Abstract

Today, when natural water resources are gradually decreasing, it is very important to prefer alternative methods for water conservation, water saving and water reuse. Sufficient water for future generations, preserving its quality; It changes depending on how it is managed in the face of factors such as rapid population growth, industrialization, and rapid growth of cities. In a sustainable water management, it is important to reuse rain water and grey water, bring it into the economy, and save energy. In this context, the ecological and economic analysis of grey water, grey water resources and their characterization, the amount of grey water formed and its reuse after treatment were made. In the same way, the contribution of the use of rain water to sustainability, the amount of rain water, the characterization of the rain water and the economic analysis of the systems that make it suitable for use were determined. When we evaluate the water savings that occur when we reuse rain water and grey water according to the state of today's natural resources, we see that its use has become a necessity. Membrane bioreactor (MBR) was used to treat grey water in the selected project area.

Keywords: Grey water, Rainwater, Reuse, Sustainability, Water saving,

ENVIRONMENTAL EFFECTS ON THE BASIS OF ENERGY SOURCES DURING CHARGING OF ELECTRIC VEHICLES

Ahmet Gökalp Girayhan[1*], Gamze Yücel Işıldar[2*]

[1]Deparment of Enviromental Sciences, Gazi University, Turkey
[2]Department Of Urban And Regional Planning, Gazi University, Turkey
** Corresponding author: e-mail: gokalp93@gmail.com*

Abstract

The transportation sector ranks 4th in terms of CO_2 emissions and its impact on climate change with the ratio of 14.3% in 2019. Nowadays, more than 95% of the energy consumed for transportation on a global scale is due to the high dependence of internal combustion engine vehicles on fossil fuels. Fortunately, electrical vehicles (EV) are getting importance and increase in number in all over the world as in our country. However, as EV usage increase, the energy sources used for charging of vehicle batteries getting importance and should be taken into account. Along this line, it is aimed to compare the amounts of CO_2 emissions from 'renewable' and 'non-renewable' energy sources used during the charging of electric vehicle batteries. To this purpose; Norway, Finland, France and Italy were chosen due to the high percentages of renewable energy production/consumption and number of EVs, while Turkey, Germany, the Netherlands and Poland were chosen due to the low percentages mentioned. As a methodology; the maximum and minimum amounts of gCO_2/km s were calculated for a single EV on a country basis and for the total of all EVs in that country. Then, findings are correlated in terms of 'energy sources used for electricity production', 'no of EVs' and 'amount of carbon dioxide' emitted.

As a result of this analysis, statistically significant correlation ($p=0.006$ and $p=0.001$ respectively for CO_2 emitted by unit EV and for total) has been found between electricity production and carbon dioxide amounts. As a result, it could be said that; use of renewable energy sources for charging EV batteries should be preferred.

Keywords: Electric Vehicles, Energy Sources, CO_2 emission.

ANAEROBIC CO-DIGESTION OF ORGANIC WASTES: EXAMPLE OF FOOD WASTE, MANURE AND SLUDGE

Meltem Sarıoglu Cebeci[1*], Turgay Bişgin[2]

[1] *Department of Environmental Engineering, Sivas Cumhuriyet University, Turkey*
[2] *Sivas Municipality director of water and sewage works (SİBESKİ), Turkey*
** Corresponding author: e-mail: sarioglu@cumhuriyet.edu.tr*

Abstract

Anaerobic digestion (AD) has been successfully established as technology to treat and reduce organic wastes and makes available a renewable energy. AD of organic solids represents a low-cost and low-technology system to supply energy for rural areas. Sewage sludge from aerobic wastewater treatment, animal manure, harvest residues, organic wastes from agriculture-related indutries, meat and fish industrial wastes, dairy wastes, food waste, collected municipal organic solid waste from markets and households and energy crops are the substrates commonly used for feeding anaerobic digesters to produce biogas.

Various materials such as urban wastes, agricultural residues and industrial effluents can be used as a potential cosubstrate to increase methane production from wastewater treatment plant sludge in anaerobic codigestion. In this study, the use of wastewater treatment plant return waste activated sludge as the primary substrate, together with the anaerobic digestion of urban organic wastes, the use of Refectory Vegetable Waste (VW) and Cattle Manure (CM) as an cosubstrate was examined. As a result, according to the characterization of the sludge from the wastewater treatment plant, it is recommended that the sludge be dried and evaluated as well as the integrated management of the treatment sludge with organic waste (vegetable waste and manure).For this purpose, in the anaerobic process established at the laboratory scale, the effects of mixing of sludge with different organic substances on methane gas formation and / or composting were investigated and it was found that adding vegetable waste had positive effect on process efficiency.

Keywords: Anaerobic co-digestion, Biogas, Organic wastes, Waste treatment sludge, Wastewater treatment plant.

EVALUATION OF ION-EXCHANGE RESIN PROCESS AS A PRETREATMENT METHOD FOR BIPOLAR MEMBRANE ELECTRODIALYSIS PROCESS

Burak Yuzer[1,2*], Ragad F. Alshebli[2], Nadira Salsabila[2], Huseyin Selcuk[2], Yusuf Bicer[2]

[1] Department of Environmental Engineering, Engineering Faculty, Istanbul University-Cerrahpasa, Istanbul, Turkiye

[2] Division of Sustainable Development, College of Science and Engineering, Hamad Bin Khalifa University, Qatar Foundation, Doha, Qatar

** Corresponding author: e-mail: byuzer@hbku.edu.qa*

Abstract

The bipolar membrane electrodialysis (BPMED) process is used for acid-base production from salt solutions, acid recovery from acidic waste solutions, and acid and base stabilization in food production. BPMED system desalinates saline water with high efficiency, while the produced acid and base provide additional valuable chemical recovery. However, a pretreatment process is needed so that the pollutants in the wastewater do not clog the ion exchange membranes. In this study, anionic ion-exchange resins are used as a pretreatment method to remove the color from the textile wastewater for the BPMED system. The effects of this process on the BPMED system are evaluated by examining parameters such as inlet wastewater pH and current density. Initially, 12 L of textile wastewater is treated with 100 mL of ion-exchange resin while 66% of the chemical oxygen demand (COD) removal and 95% of color removal efficiencies are achieved. Then, the pH values of the pretreated wastewater are adjusted to 8, 7, 5, and 3 to monitor the effect of the wastewater's initial pH value on the BPMED process. Maximum desalination efficiency is achieved as 90% at pH 8. The organic matter in the wastewater causes clogging of the ion exchange membranes, resulting in increased electrical resistance of the membranes and increased energy consumption in the system. The COD removal by the ion-exchange resins helps to prevent membrane clogging in the BPMED process. Finally, 18.7 mM HCl and 11.7 mM NaOH are produced during the 1-hour operation of the BPMED process with an energy consumption of 45.4 kJ/L of wastewater. As a result, it is seen that color and organic matter removal with anionic ion-exchange resins increase the desalination efficiency of the BPMED process, and it is a critical pretreatment method for this process.

Keywords: Bipolar membrane electrodialysis, Color removal, Ion-Exchange, Resin textile wastewater.

AIR POLLUTION RESEARCH: COMPARISON OF PM_{10} AND SO_2 CONCENTRATIONS OF NIĞDE (TURKEY) WITH NORTHERN NEIGHBORING PROVINCES

Zinnur Yılmaz[*1], Mustafa Bünyamin Karagözoğlu[1]

[1] *Department of Environmental Engineering, Sivas Cumhuriyet University, Turkey*

** Corresponding author: e-mail: zinnuryilmaz@cumhuriyet.edu.tr*

Abstract

The development of technology, high demand for traditional resources, unplanned urbanization and rapid population growth are some of the most important reasons for the increase in particulate matter (PM) and sulfur dioxide (SO_2) in Turkey in the last 20 years. In this study, it is aimed to evaluate the PM_{10} and SO_2 air pollution levels of Niğde province and neighboring provinces in the north of Aksaray, Nevşehir and Kayseri between 2010 and 2021. Between 2010 and 2021, the mean PM_{10} concentrations calculated at Niğde, Nevşehir, Kayseri-Hürriyet Kayseri-OSB and Aksaray air quality stations (AQS) were 67.43, 46.28, 79.47, 66.84,$^{(-)}$µg m^{-3} and SO_2 concentrations were 9.96, 12.59, 11.13, 10.36 and 11.97 µg m^{-3}, respectively. In addition, it was compared with the limit values in the Turkish Air Quality Assessment and Management Regulation. The limit values allowed by the regulation between 2010-2021 were calculated for PM_{10} with 2645 days (228.66 days $year^{-1}$) in Niğde, 1401 days in Nevşehir (120.01 days $year^{-1}$), Hürriyet 2710 days (226.61 days $year^{-1}$) and OSB 2295 days (196.68 days $year^{-1}$) in Kayseri, for SO_2 it exceeded 0 days at Niğde and Kayseri OSB, 7 days in Nevşehir (0.58 days $year^{-1}$), 14 days in Aksaray (1.20 days $year^{-1}$), and 2 days (0.17 days $year^{-1}$) in Kayseri Hürriyet AQS. As a result of the ANOVA analysis performed after the descriptive statistics, the means of both PM_{10} and SO_2 pollutants in Niğde and Kayseri OSB AQS were statistically equal ($p>0.05$) and differences were found between Niğde and Nevşehir, Aksaray and Kayseri Hürriyet AQSs ($p<0.05$). In general, it has been found that SO_2 concentrations are well below the regulations and that the majority of air pollution in Niğde and its neighboring provinces is caused by PM_{10}. According to the results obtained in this study, it is recommended to make more efforts throughout the year in the months when the concentration is high in order to reduce PM_{10} emissions.

Keywords: Air quality, Cappadocia, Particulate matter, Sulfur dioxide, Turkey.

METAL RECOVERY FROM OXIDIZED ORE TAILINGS WITH ORGANIC ACID

Emine Yoğurtcuoğlu[1*]

[1]*Faculty of Engineering, Department of Mining Engineering, Niğde Ömer Halisdemir University, 51240, Niğde, Turkey*
[*]*Corresponding Autor e-mail: eyogurtcuoglu@ohu.edu.tr*

Abstract

Kayseri-Yahyalı region is a region of high importance in terms of oxidized lead-zinc minerals. In general, the mining study applied to these ores is the flotation process for lead. Therefore, the remaining wastes contain high amounts of zinc minerals. In this study, NaCl leaching with organic acid was applied to the flotation wastes taken from the region. Oxide/carbonate mineral contents such as dolomite, goethite, quartz, smithsonite, and hydrozincite were determined in the mineralogical studies of these wastes. The grain size of the ore wastes ground in the flotation process (d80=78.1 mm) was sufficient for the experiments applied in the study, and it was an important advantage in terms of not requiring grinding costs. The lead and zinc grades of the waste sample are 2.49% and 5.51%, respectively. The parameters examined in the study are citric acid concentration (0.125-1M), sodium chloride concentration (50-300g/L), leaching time (15-120 minutes), temperature (25-95 C), solid ratio (5-40%w). As a result of the study, optimum conditions of multi-metal recovery efficiencies were determined.

Keywords: Lead, Nacl leaching, Organic acid, Oxidized, Zinc.

LET'S PRINT AN ECOLOGY IN 3D

Magdalena Szechyńska-Hebda[1*], Marek Hebda[2], Neslihan Doğan-Sağlamtimur[3]

[1] The Plant Breeding and Acclimatization Institute - National Research Institute, Poland
[2] Institute of Materials Engineering, Cracow University of Technology, Poland
[3] Department of Environmental Engineering, Nigde Omer Halisdemir University, Turkey
** Corresponding author: e-mail: szechynska@wp.pl*

Abstract

Ecology refers to multiple aspects of the interaction between living organisms, their environment, and nonliving factors around them. Currently, the most urgent is finding solutions for ecosystems that function during increased 'unecological' human activities around the world. Climate change, wasted natural resources, plastic pollution, and poverty are the biggest and most tightly interconnected problems influencing the state of ecosystems and environment today. The lecture attempts to indicate whether 3D printing technologies can be included, at least in a small range, in a set of solutions that will support ecology. A brief overview of the development in 3D printing and adoption of the processes of joining materials layer upon layer, to make objects from 3D model data will be provided. It was estimated, that additive manufacturing could save up to 90% of the raw material during manufacturing (according to a European Commission); slash waste by nearly 90%, and cut energy use by 50% (the U.S. Department of Energy). However, both, the positive impact on the environment and the disadvantages of 3D technologies will be discussed; at least for industrial sectors, health, consumer goods, energy, and construction. Particularly, attention will be paid to the lifetime cost to society, the environment, and the economy of plastic production, which is set to double in 2050 (US$ ~8.5 trillion). We have calculated that with the world population projected to increase from 7.5 billion in 2017 to 9.8 billion in 2050, the next generation (within 33 years) will produce 12,000–13,000 Mt plastic, while the yearly consumption will reach 37–40 kilos of plastic per person worldwide. Therefore, 3D-printed alternatives to substitute plastic will be presented. Additionally, the significance of the reduction of other technologies imposing negative impacts on people and the environment will be underlined. Finally, a brief discussion will be provided to compare myriad advantages with many legal implications involved in the implementation and extension of 3D printing technology.

Keywords: 3D printing technology, Ecology, Environment, Plastic.

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DEVELOPMENT OF 3D PRINTING TECHNOLOGY FOR ECO-FRIENDLY CONSTRUCTION

Marek Hebda[1*], Joanna Marczyk[1], Celina Ziejewska[1], Kinga Korniejenko[1], Magdalena Szechyńska-Hebda[2], Mateusz Góra[1]

[1] *Faculty of Materials Engineering and Physics, Cracow University of Technology, Poland*
[2] *The Plant Breeding and Acclimatization Institute - National Research Institute, Poland*
** Corresponding author: e-mail: marek.hebda@pk.edu.pl*

Abstract

Nowadays, concrete is one of the most commonly used substances all over the world and a key product in many developing countries. Global industrialization and the huge demand for construction materials have generated an increased interest in cementitious materials. However, we cannot forget about the harmful influence of this material on the environment. The annual greenhouse gas emission caused by the Ordinary Portland Cement (OPC) production industry was estimated to be 1.35 billion tons per year, which represents approximately 7% to 9% of the total greenhouse gas emissions. Furthermore, the intensity of carbon dioxide has increased by approximately 31.7% in the past 58 years. Therefore, there is an urgent need to develop new sustainable materials to avert the worst effects of climate change. An attractive and more sustainable alternative to OPC can be a geopolymer.

In addition, the use of technologies that save time and production costs, while at the same time producing parts that have specific properties and allowing the creation of complex geometries is a very desirable solution. Therefore in recent years, 3D concrete printing technology has been developed dynamically. However, intensive research has still required the development of material compositions dedicated to this technology as well as the innovative designs of 3D concrete printers.

Keywords: 3D printing, Additive Manufacturing, Geopolymers

Acknowledgment: This work has been supported by the Growth Operational Programme 2014–2020, IV Increasing the research potential, 4.1.4: 'Application projects', funded by the National Centre for Research and Development in Poland, within the framework of the grant: "Development of 3D printing technology for construction and facade prefabricated elements made of concrete composites and geopolymers", grant no. POIR 04.01.04-00-0096/18-00.

AN EVALUATION OF THE BIOLOGICAL ACTIVITIES OF *ROSA CANINA* L.

Falah Saleh Mohammed[1*], İmran Uysal[1], Zeliha Selamoğlu[3], Mustafa Sevindik[2]

[1] *Department of Biology, Faculty of Science, Zakho University, Iraq*
[2] *Department of Food Processing, Bahçe Vocational School of Higher Education, Osmaniye Korkut Ata University, Turkey*
[3] *Department of Medicinal Biology, Faculty of Medicine, Nigde Omer Halisdemir University, Nigde, Turkey.*
** Corresponding author: e-mail: falah.sindy@uoz.edu.krd*

Abstract

Traditional medicine is a set of systems based on empirical knowledge used by the public as well as modern medicine. Many natural products are used in traditional medicine. Especially plants are important medicinal natural resources used in this context. Plants are unique natural materials that contain many biologically active compounds. These compounds have different properties and are non-nutritive, but have high biological activities. In this study, previous biological activity studies of *Rosa canina* L. plant in the literature were mentioned. In this context, many researchers around the world have reported that *R. canina* plant has different activities such as antioxidant, antimicrobial, antiinflammatory, cytotoxic, DNA cleavage, anticancer, antidiabetic, antiobesity, hepatoprotective, antidiarrheal, antimutagenic, antiproliferative, acetylcholinesterase. In this context, it has been determined that the *R. canina* plant is responsible for many biological activities. As a result, it has been determined that the plant is an important natural material that can be used in traditional medicine.

Keywords: Anticancer, Antioxidant, Rosehip, Traditional medicine.

BIOLOGICAL ACTIVITIES OF LEMNA SPECIES

Falah Saleh Mohammed[1*], İmran Uysal[1], Zeliha Selamoğlu[3], Mustafa Sevindik[2]

[1] *Department of Biology, Faculty of Science, Zakho University, Iraq*
[2] *Department of Food Processing, Bahçe Vocational School of Higher Education, Osmaniye Korkut Ata University, Turkey*
[3] *Department of Medicinal Biology, Faculty of Medicine, Nigde Omer Halisdemir University, Nigde, Turkey.*
** Corresponding author: e-mail: falah.sindy@uoz.edu.krd*

Abstract

Plants contain many bioactive compounds. These bioactive compounds are responsible for many different biological activities. The use of plants in complementary medicine is becoming increasingly common. The bioactive compounds in it highlight the use of plants in complementary medicine as a natural product. Many studies have shown that plants have many activities such as antioxidant and antimicrobial. In this study, the biological activities of species of the genus *Lemna* were investigated. Previous studies have been identified in the literature. As a result of the literature research, 6 *Lemna* species were identified as Lemna aequinoctialis Welw., *Lemna disperma* Hegelm., *L. japonica* Landolt., *L. gibba* L., *L. minor* L., *L. minuta* Kunth and *L. perpusilla* Torr. species have been determined to have biological activities. Studies have shown that 6 species have insecticidal, antioxidant and antimicrobial activities. As a result, it was determined that the members of the *Lemna* genus had biological activities.

Keywords: Antimicrobial, Antioxidant, Lemna, Traditional medicine.

ZERO WASTE APPROACH OF VOCATIONAL SCHOOL STUDENTS: CASE STUDY OF POLYMER TECHNOLOGIES

Aysun Ekinci[1*]

[1] *Department of Materials and Material Processing Technologies, Yalova Vocational School, Yalova University, Turkey.*
** Corresponding author: e-mail: aysun.ekinci@yalova.edu.tr*

Abstract

With the increase in the amount of production and consumption worldwide, wastes become a problem and cause various economic and environmental concerns. Nowadays, the reduction of waste, recycling, correct disposal and more efficient use of raw material resources are becoming the focus of academic and industrial studies. With the perspective of sustainability and waste management gained in polymer technology education, the creation of zero waste management awareness has an important place in enabling students to continue both in their business and daily lives after graduation. Adoption of zero waste behaviour for sustainable development is also promising in terms of quality education. In this study, the awareness and perception levels of the students studying in Yalova University Yalova Vocational School Polymer Technology Program about zero waste management were measured by means of a survey prepared within the framework of the Zero Waste Project. The data of the face-to-face questionnaire applied to the students were evaluated by statistical analysis. As a result, data on making zero waste management effective in increasing the knowledge and skills of polymer technology program students on waste management, prevention, reduction, reuse, recycling and disposal methods were obtained. It has been determined that education has an important place in the students' individual zero waste management.

Keywords: Environment, Quality education, Climate change, Sustainability, Zero waste.

THE ROLE OF LOCAL GOVERNMENTS IN LIFE LONG LEARNING WITHIN THE FRAMEWORK OF THE UNESCO GLOBAL NETWORK OF LEARNING CITIES

Sülün Evinç Torlak[1]*, Tancu Söyleyici [2]

[1] *Alanya HEP Üniversitesi*
[2] *Pamukkale Üniversitesi*
[*] *Corresponding Autor e-mail: etorlak@pau.edu.tr*

Abstract

Although population growth and migration to the city are shown as a cause of urbanization, globalization is an important factor in accelerating urbanization. The place of the Nation State, whose influence has weakened with globalization, is being tried to be filled by local governments. There are some difficulties in the services that local governments should provide. In order to develop solutions in the face of difficulties, cities are involved in "network-type" organizations. Global challenges can only be resolved through global cooperation. UNESCO Learning Cities Network is one of the organizations that brings local governments together. The change experienced has affected the education system closely and it has been inevitable for local governments to serve in this field. Education is one of these services. The key to urban development depends on increasing the level of knowledge among people. Individuals need to continue their learning processes due to reasons such as the inadequacy of formal education, the loss of validity of existing information in a short time, the emergence of new information, and the differentiation of needed information. In this context, Lifelong Learning is the key to reaching the information that an individual needs at every stage of his life, and to improving his skills, attitudes and behaviors. In this context, it is thought that the Learning Cities Network will contribute to lifelong learning. In the study, the Lifelong Learning contribution of the Learning Cities Network is tested within the framework of the Turkish example. In our country, 6 cities that are members of Learning Cities are discussed. "Embedded Theory Method" was used as a qualitative research method and embedded information was revealed. Based on the Learning Cities Criteria accepted with the Beijing Declaration, basic concepts were created. The frequency of transition of these concepts is measured in the Activity Reports of the member cities. It has been tried to reveal the change experienced by analyzing the cities before and after becoming a member of the Network. In addition, a "comparative analysis" of the "Awarded Cities" selected by UNESCO every two years and the member cities of our country has been made and the difference has been revealed. According to the results of the analysis, the areas where Learning Cities were successful ounsuccessful in the field of Lifelong Learning were determined. Successful examples were examined and suggestions were developed for learning cities.

Keywords: Global city networks, Learning cities, Lifelong learning.

THE EMPHASIS OF ENVIRONMENT IN NEW MEDIA MANAGEMENT

A. Cemal Saygın[1*], Mutlu Başaru[2]

[1] *Department of Private Security and Protection and Management and Organization Graduate Student, Nigde Omer Halisdemir University, Turkey*
[2] *Management and Organization Graduate Student, Nigde Omer Halisdemir University, Turkey*

Abstract

New media tools are among the issues that are given importance for corporate use as well as personal use. Institutions and organizations, like individuals, frequently have new media tools that are managed by business professionals. These new media tools differ in the context of the segment addressed by the institutions. For example, in Türkiye, while applications such as Instagram and Youtube are used as new media tools by institutions and organizations to reach the younger generation, institutions and organizations that want to appeal to the middle age and above give priority to applications such as Facebook rather than other media tools.

With the growing and globalizing world, companies have started to turn to the right marketing strategies instead of production-focused efforts and to professional public relations studies instead of customer-focused efforts. "Environment," which includes all living and non-living beings that have come into existence naturally, has become a subject where corporate companies show themselves in some way on national or international platforms by carrying out corporate social responsibility studies.

In this study, the environmental emphasis of corporate companies in the new media management process will be discussed, and it will be examined on which new media platforms they deal with, and the environmental issues with which emphasise.

Keywords: Corporate, New media, Management and Environment.

INDUSTRIAL SYMBIOSIS CONCEPT AND APPLICATIONS FROM TÜRKİYE AND DENMARK

Kemal Ulusoy[1*], Neslihan Doğan-Sağlamtimur[1], Fehiman Çiner, Andrzej Sternik[2], Paulina Magdalena Sekuła[2]

[1] *Department of Environmental Engineering, Nigde Omer Halisdemir University, Türkiye*
[2] *The Faculty of Engineering, University of Southern Denmark, Denmark*
** Corresponding author: e-mail: cmkemalulusoy@gmail.com*

Abstract

Industrial symbiosis (IS) occurs when two or more industrial operations, preferably physically close to each other and working independently, form long-term partnerships and collaborate to improve resource efficiency, environmental performance, and competitiveness. By-products or waste generated by one enterprise can be used as raw materials or resources by another, for example, in organized industrial zones, industrial parks, and so on. As a result, in addition to preventing industrial environmental problems, economic benefits can be provided. The network of IS is made up of companies and activities that have the indicated type of synergy relationship. IS benefits include: (i) improving raw material quality and lowering costs, (ii) lowering energy costs, (iii) lowering waste processing and disposal costs, (iv) developing new products, (v) lowering transportation and logistics costs, (vi) achieving a richer idea and human resource pool, (vii) producing less waste, and (viii) making compliance with environmental laws and regulations easier.

The number of Organized Industrial Zones (OIZs) in Türkiye and Denmark is also rapidly increasing. OIZs use a lot of resources (like raw materials, water, electricity, natural gas, coal, and so on) and produce a lot of solid, liquid, and gaseous waste. As a result, efforts to develop IS have become an important issue in the last decade. Several examples of synergistic networks have been reported in North and South America, Australia, Southeast Asia, and Europe. This study reviewes and evaluates four well-known IS applications from Türkiye and Denmark.

Keywords: Denmark, Environment, Industrial symbiosis, Sustainable development, Türkiye.

APPLYING CORONA DISCHARGE AS A PRETREATMENT METHOD TO SPIRULINA PLATENSIS MICROALGAE STRAIN AND INVESTIGATION OF IMPACT ON BIOGAS PRODUCTION POTENTIAL

Djaafri Mohammed[1], M. Rasit Atelge[2*], Mustafa Kaya[3], A.E. Atabani[4], Sebahattin Unalan[4]

[1] *Unité de Recherche en Energie Renouvelables en Milieu Saharien (URERMS), Centre de Développement des Energies Renouvelables (CDER), Adrar 01000, Algeria*
[2] *Siirt University, Department of Mechanical Engineering, Siirt 56100, Turkey*
[3] *Siirt University, Department of Chemical Engineering, Siirt 56100, Turkey*
[4] *Alternative Fuels Research Laboratory (AFRL), Energy Division, Department of Mechanical Engineering, Faculty of Engineering, Erciyes University, 38039 Kayseri, Turkey*
[*] *Corresponding Autor: M. Rasit ATELGE (rasitatelge@siirt.edu.tr)*

Abstract

Due to their biodegradability, renewability, and reduce carbon emissions, biofuels have become one of the key strategic self-sustaining fuel sources. Based on the raw materials and technologies utilized in their production, they are typically categorized as first, second, and third generation biofuels. First-generation biofuel production has gained the most traction. Yet, there are issues with carbon balances, environmental effects, and the conflict between food and fuel that make scientists doubtful, and it loses interest. The drawbacks of first-generation biofuels have thus been addressed by the development of second- or third-generation biofuels. Microalgae strains, which is used to produce third-generation biofuels, represents as potential of biofuel production material. Although, the production of such biofuels has some problems that must be overcome before their potential can be fully utilized. For instance, although lignocellulosic biomass is abundant around the world, its contribution to the renewable energy sector is negligible due to its complex structure consisting mainly of carbohydrate polymers and lignin that is difficult to degrade. One of the ways to produce third-generation biofuels is anaerobic digestion, and the use of lignocellulosic biomass in this process makes it almost impossible due to its stubborn nature. Therefore, pretreatment is an important step in the process of converting lignocellulosic biomass to energy. Corona discharge pretreatment is a promising method that can be applied to break lignin structure of biomass. In this study, 5 kV high voltage at 50 – 250 – 500 kHz frequency were applied as a corona discharge pretreatment for 3 – 5 minutes to Spirulina Platensis (SP) microalgae strain as biomass. The result showed that the corona discharge pretreatment is a promising method. The cumulative methane yield was calculated to be 322 mL CH4/ g VS for SP whereas it increased by 46% to 470.4 mL CH4/ g VS for SP @5kV 5dk 500F according to SP.

Keywords: Biofuels, Biogas, Corona discharge pretreatment, Microalgae, Spirulina platensis.

REDUCING THE CARBON FOOTPRINT OF THE TEXTILE INDUSTRY VIA RECYCLING AND REUSE

Huseyin Selcuk[1*]

[1] *İstanbul University-Cerrahpasa*
Environmental Engineering Department, Avcilar-İstanbul, Türkiye
[*]*Corresponding Autor e-mail: hselcuk@iuc.edu.tr*

Abstract

The carbon dioxide (CO_2) level in the atmosphere is steadily increasing and requires urgent action for the mitigation of catastrophic effects of global warming on the world. After the first Paris Agreement in 2015, almost all countries in the world have committed to control the rise in global average temperature levels. The agreement includes an approach where countries individually decide by how much they will reduce their national emissions each year. CO_2 emissions in Turkey were estimated to be around 5 metric tons per capita. In this study, the carbon footprint and power demand of cotton-synthetic textile sector was quantified and analyzed. Moreover, the results of some case studies on zero-discharge approaches in textile industry were evaluated by considering their effects on the CO_2 emission.

FOREST POLICY, THE SPEARHEAD IN DEALING THE CLIMATE CRISIS

Konstantinos Aravossis[1*]

[1]Professor, Coordinator of the "Enviromental Economics and Sustainability Unit (ESU)", School of Mechanical Engineering, National Technical University of Athens, Greece
Secretary General for Forestry, Greek Ministry of Environment and Energy
Corresponding Author e-mail: arvis@mail.ntua.gr

Abstract

The Climate Crisis is not a vague concept and a future threat. It is one of the greatest challenges in the world, which all the countries of the world must face quickly and, above all, effectively. Forests can contribute catalytically to this aim as carbon sinks but also to adapt to the effects of the Climate Crisis. Greece, through the implementation of substantial political choices to mitigate the consequences of a dangerously changing climate, is already giving a clear sample of the new perception of a different way of exercising Forest Policy. Indicative of the government's will to protect forest ecosystems and their further exploitation at the level of development planning, but also of the well-being of citizens is the recent establishment of the General Secretariat of Forests. The vision of the new General Secretariat is to maintain the sustainable management of Greek forest ecosystems and to transform them into a "Smart Forest" with the use of modern technologies and innovations for effective protection and management with emphasis on prevention. To this end: A key priority and reform are the completion of the ratification process of the Forest Maps, an emblematic infrastructure development project. By the end of October, 90% of the forest maps of the Greek Territory will have been ratified. Our big goal is the National Reforestation Plan on 165,000 hectares of degraded forest ecosystems of the country within three years with funding from the Recovery & Resilience Fund. The erosion prevention measures in the areas affected by the devastating fires of the summer of 2021 were completed with unprecedented speed, while the mountainous anti-flood works, the planned reforestations and other restoration works are progressing rapidly. Fire Protection Projects have been implemented, funded by the Recovery & Resilience Fund, in forest ecosystems throughout the country, consisting of pyrophilic species, while Fire Protection Plans are being prepared for the critical fire prone forest ecosystems of the country. The updating of the National Forest Inventory System that has already started, will provide data on the achievement of carbon neutrality, favoring the overall development of the country and the confrontation of the Climate Crisis.

Keywords: Forest policy, Forest management, Forest innovation, Forest technologies.

APPLICATION OF 3D PRINTING TECHNOLOGY FOR GREEN BUILDING MATERIALS

Mateusz Góra[1*]

[1] *Faculty of Materials Engineering and Physics, Cracow University of Technology, Poland*
**Corresponding author e-mail: mateusz.gora@atmat.pl*

Abstract

Currently, a huge problem that we face on a daily basis is the high prices of houses, which results not only from the growing demand, but also from the prices of materials and rising labor costs, supported by the lack of qualified construction workers. The use of automated building systems will reduce the costs of work and increase its precision, properties thanks to which it will be possible to 3D print construction walls and parts in shorter time, thus with ultimately a more affordable price of houses and apartments will be possible. This is the issue of particular importance as recently housing prices have increased significantly with a slight change in the purchasing power of citizens. As a result, more and more people cannot afford to buy their own apartment, which is a barrier to the economic development of society.
The use of a fully automatic machines for the building material lying (using 3D printing) will contribute also to reducing necessary amount of material, which is a significant barrier in the modern construction industry. Additive manufacturing also provides additional benefits, such as possibility to design innovative elements with built-in cable trays, ventilation ducts, water or sewage pipes and, as a result, minimizes the need for installation work. Furthermore, 3D printing allows for the production of geometries characterized by properties impossible to achieve with the use of traditional construction techniques, by enabling the design of appropriate spaces. Filling them with insulating material (acquired from recycled waste material) will contribute to the improvement of thermal insulation properties (walls, ceilings). Beforehand, many technical challenges need to be addressed and perfected to obtain reliable and efficient new construction process.

Keywords: 3D printing, Additive Manufacturing, Geopolymers

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SOURCE ROCK CHARACTERISTICS OF CHIA GARA, NAOKELEKAN, AND SARGELU FORMATIONS AT AJEEL OIL FIELD (TIKRIT, IRAQ)

Ali Müjdat Özkan[1*], Abbas Falah Gharib[2]

[1] *Department of Geological Engineering, Konya Technical University, Türkiye*

[2] *Department of Oil and Gas Economics, College of Administrative and Financial Science, Imam Ja'afar El Sadiq University, Iraq*

** Corresponding author: e-mail: amozkan@ktun.edu.tr*

Abstract

Total organic carbon and rock-eval pyrolysis analyzes were carried out to determine the organic matter content, organic matter type, and thermal maturity properties of the source rocks (Chia Bara, Naokelekan, and Sargelu Formations) in the Ajeel oilfield. 39 core and crumb samples were taken from Sargelu, Naokelekan, and Chia Gara formations in wells AJ-12 and AJ-8 in the Ajeel oil field. TOC values in rock samples of Aj-8 of the Chia Gara Formation are between 22.5%-0.5% and TOC values in rock samples from Aj-12 are between 6.85-0.75%. Considering these values of the Chia Gara Formation, it states that it is a medium to excellent source rock. The TOC values of the Naokelekan Formation in the Aj-8 well vary between 1.0-16% and in the Aj-12 well, between 15.5-11%, indicating that the formation has good and excellent source rock potential. The TOC values of the Sargelu Formation in the Aj-8 well are 2.02-10.5% and in the Aj-12 well between 1.09% and 8.38%, these values indicate that the Sargelu Formation is a good-very good source of the rock. As a result of the distribution of samples from the Sargelu, Naokelekan, and Chia Gara formations using the hydrogen index (HI) and Tmax diagram, it was determined that the Ajeel oil field has three types of kerogen (Type-II, Type-II/III, and Type-III).

Keywords: Ajeel, Petroleum, Source rock, Iraq.

INVESTIGATION OF CO-SEDIMENTATION IN THE FORENSIC-CHEMICAL ANALYSIS

Kamala Badalova[1]*, Gaibverdi Iskandarov[1]

[1]*Azerbaijan Medical University, Pharmaceutical toxicology and chemistry department, Azerbaijan, Baku, Az1022*

** Corresponding author: e-mail: kamala.badalova@mail.ru*

Abstract

It is of particular importance to investigate the mechanism of each of the reactions used in forensic chemical analysis to detect and prove any chemical substance that caused acute poisoning and death in cadaver material - internal organs, tissues and biological fluids. We have managed to scientifically substantiate the mechanism of the evidential reaction used in the forensic chemical analysis of mercury compounds. Employees of our department continued research in this direction and performed special experiments for the purpose of isolation and proof of cadmium and aluminum metal poisons from liver tissue by various methods. Further studies were directed to the issue of investigating the mechanism of evidential reactions and methods used in the forensic chemical analysis of chromium and manganese metal poisons with varying degrees of oxidation. From the point of view of the internal co-sedimentation phenomenon, the addition of chromium ions to the precipitate can be explained primarily by the mechanical capture process. The main sediment crystals contain particles of the parent solution, various mixtures, powders, etc. has the ability to catch and hold. Joining the isomorphous precipitate occurs due to the replacement of a part of the precipitate ions by the ions of the substance forming the double precipitate. This happens when the radii of the main precipitate and the double precipitate ions are very close to each other. The results of the conducted experimental studies once again show that in the chemical-toxicological analysis experiment, when heavy metal ions are isolated from biological material by the method of wet mineralization, there is a co-sedimentation event of chromium ions with the initial sediment in the mineralizate obtained under certain conditions, and the mechanism of this was investigated on the basis of known analytical regularities.

Keywords: Co-sedimentation, Mineralization, Metal, Poison.

ENERGY SAVING AND ECO-FRIENDLY UPLC METHOD FOR DETERMINATION AND VALIDATION OF DOXYCYCLINE HYCLATE AND AMBROXOL HYDROCHLORIDE IN PRESENCE OF AMBROXOL HYDROCHLORIDE IMPURITY

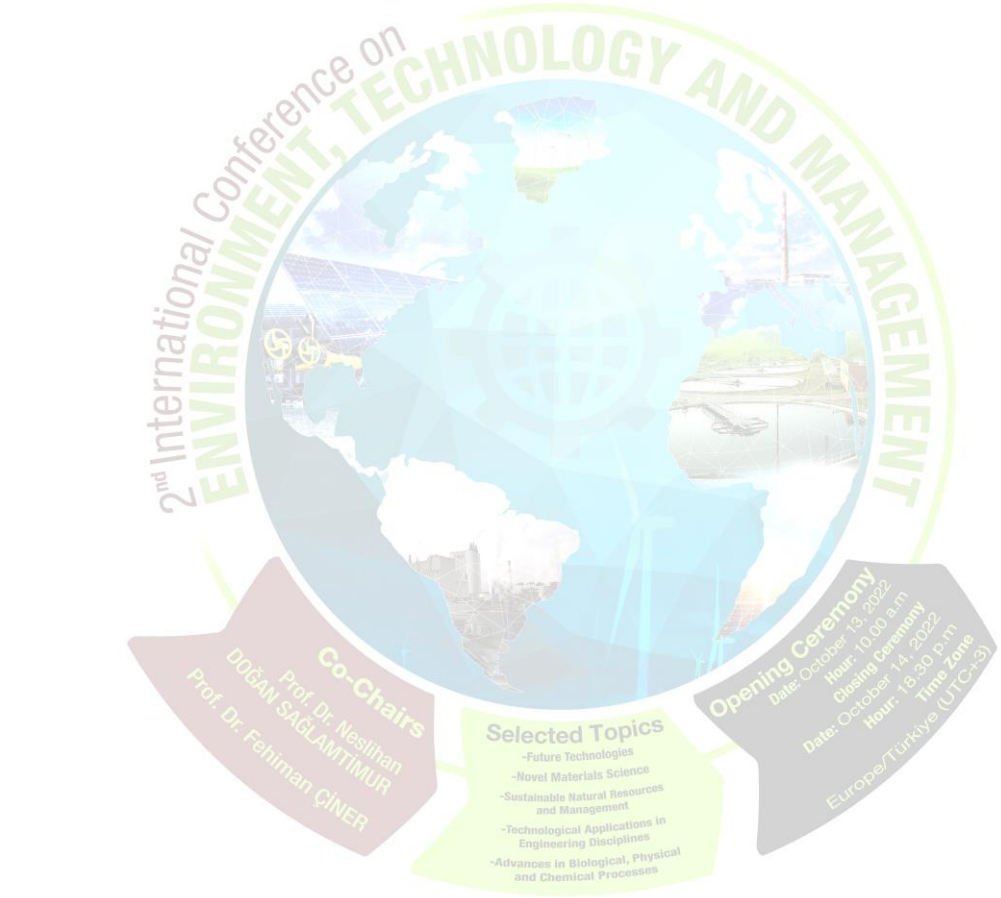
Safa'a M. Riad[1*], Hany H. Monir[1], Mohamed A. Elsayed[2], Selvia M. Adly[2]

[1]Analytical Chemistry Department, Faculty of Pharmacy, Cairo University, Egypt.
[2]Pharmaceutical Analytical Chemistry Department, Faculty of Pharmacy, Fayoum University, Egypt
[*]Corresponding Autor e-mail: safaa.riad@pharma.cu.edu.eg

Abstract

Ultra-performance liquid chromatographic method was developed for the first time to analyze doxycycline hyclate (DOX), ambroxol hydrochloride (AMB) simultaneously in presence of ambroxol synthetic precursor and process impurity (IMP). The developed method was carried out on ACQUITY UPLC BEH C18 column in isocratic mode at flow rate 0.22 ml min-1 and using mobile phase of acetonitrile: water (60: 40, v/v) and temperature was adjusted to 25 °C. The injection volume was 5 µL and the effluent was UV detected at 370 nm for DOX and 240 nm for AMB and IMP using Diode array detector. Linearity was achieved in the concentration ranges of (5-150), (5-150), and (0.5-40) µg mL-1 for DOX, AMB, and IMP, respectively. Additionally, complete separation among the studied components was obtained upon applying the developed method to synthetic mixtures.

The validation of this chromatographic method was made according to ICH guidelines and it was successfully applied for the determination of the studied drugs in their available combined pharmaceutical formulation. Also, the statistical comparison was carried out between the developed method and the reported HPLC method showing no significant difference between them concerning both accuracy and precision. The greenness outline of the developed UPLC method was carefully agreed with the requirements of the green chemistry by using five greenness techniques including; National Environmental Methods Index NEMI approach, the modified NEMI, analytical Eco-Scale, Green Analytical Procedure Index (GAPI) and analytical greenness metric (AGREE).



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