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The Members of the Trustee/Governing Council of the Nigerian Society of Physical Sciences sincerely thank all participants for attending the 3rd International Conference of the Nigerian Society of Physical Sciences, held at the Federal University Oye-Ekiti, Ekiti State, Nigeria.

BOOK OF ABSTRACTS

NIGERIAN SOCIETY OF PHYSICAL SCIENCES
In Collaboration with the
FEDERAL UNIVERSITY OYE-EKITI
Ekiti State Nigeria

3RD INTERNATIONAL CONFERENCE
OF NIGERIA SOCIETY OF PHYSICAL SCIENCES

BOOK OF ABSTRACTS

3RD- 6TH FEB. 2025

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3RD INTERNATIONAL CONFERENCE OF NIGERIA SOCIETY OF PHYSICAL SCIENCES

In collaboration with

FACULTY OF SCIENCE, FEDERAL UNIVERSITY OYE-EKITI

THEME: PHYSICAL SCIENCES FOR A SUSTAINABLE AND EQUITABLE FUTURE: ADDRESSING GLOBAL CHALLENGES

Date: Monday 3rd –Thursday 6th February 2025

Venue: New Faculty of Science Auditorium (NFSA), Phase II, Federal University Oye-Ekiti, Ekiti State, Nigeria

Chief Host: Prof. Abayomi Sunday Fasina, The Vice Chancellor, Federal University Oye-Ekiti

Host: Prof. Abiodun Akeen Ajiboye, Dean, Faculty of Science

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INTRODUCTION

The Physical Sciences have long served as a cornerstone of human advancement, laying the foundation for discoveries and technological breakthroughs that continue to redefine our world. From unraveling the mysteries of the universe through Physics and Astronomy to pioneering transformative innovations in Chemistry, Earth Sciences, Mathematics, Statistics, and Computer Sciences, these disciplines collectively illuminate the path toward a brighter, more sustainable future. Their impact transcends national borders, fostering global collaboration and interdisciplinary synergy that drive progress.

The theme of this third international conference of the Nigerian Society of Physical Sciences, **"Physical Sciences for a Sustainable and Equitable Future: Addressing Global Challenges,"** underscores the urgency and promise of this era. It challenges us to explore the potential of Physical Sciences in solving the most pressing global issues, including climate change mitigation, energy sustainability, equitable access to technology, food security, and global health. The dynamic interplay of these challenges necessitates bold ideas, innovative methodologies, and collaborative efforts that transcend traditional academic and industrial boundaries.

With participants from 14 countries—Nigeria, Malaysia, South Africa, Spain, China, Canada, the United Kingdom, Australia, India, Germany, the United States of America, the United Arab Emirates, Saudi Arabia, and Italy—this conference represents a confluence of diverse perspectives and expertise. The inclusion of leading researchers and scholars from these nations enriches the discourse, broadens the scope of knowledge-sharing, and fosters international partnerships aimed at addressing contemporary scientific and societal challenges.

This conference is meticulously structured to provide a platform for stimulating dialogue and meaningful engagement. It begins with inspiring keynote addresses by eminent scholars and industry experts, setting the stage for dynamic technical sessions that showcase pioneering research and groundbreaking innovations. Attendees will have the opportunity to engage in thought-provoking discussions, share expertise, and forge new collaborative ventures through networking sessions and interactive panel discussions.

The comprehensive programme of events has been designed to balance intellectual rigor with collegial interactions, ensuring a stimulating and enriching experience for all participants. Each abstract has undergone rigorous peer review by the NSPS Conference Organizing Committee and is categorized into five thematic streams aligned with the core disciplines of Physical Sciences. The parallel technical sessions offer an extensive array of presentations,

providing attendees with the opportunity to explore cutting-edge research tailored to their areas of interest.

Beyond being an academic symposium, this third international conference is a celebration of the role of Physical Sciences in shaping a sustainable and equitable future. It embodies a commitment to knowledge exchange, scientific excellence, and collaborative innovation on a global scale. We encourage every participant to embrace this opportunity to connect, innovate, and embark on a transformative journey of discovery that will inspire new perspectives and drive impactful solutions for the challenges of our time.

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GROUP A: CHEMISTRY- NSPS-FUOYE-CH

NSPS-FUOYE-CH-001

Catalytic dehydrogenation of ethanol to produce acetaldehyde using Kankara clay as catalysts

Effi M.E., Tuagha S. and Owabor, C. N*

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Abstract

This study investigated the catalytic dehydrogenation of ethanol to produce acetaldehyde using different functionalized kankara clay samples as catalysts. The research work which was carried out using this locally sourced material was with a view to replacing imported catalysts thereby promoting Nigeria's local content policy and boosting the economy. The raw and beneficiated (calcined, acid, and alkaline treated) kankara clay samples were characterized using X-ray fluorescence (XRF), X-ray diffraction (XRD), and Fourier-transform infrared (FTIR). The morphologies were examined using scanning electron microscopy (SEM). The result of the chemical composition analysis showed that kankara clay was rich in oxides of silica (SiO_3) and aluminum (Al_2O_3) with other oxides in trace amounts. The overall experimental analysis confirmed the presence of kaolinite with occasional illite as a major mineral and the main non-clay mineral as quartz. The clay sample was siliceous and of alumino-silicate with appreciable and reasonable values of the refractory properties that are comparable to standards. The results of the dehydrogenation process showed that the yield of acetaldehyde was progressive for all the different kankara clay samples used as catalysts in the reaction. The acid-functionalized kankara clay catalyst gave the highest percentage yield of 38.18 mol% of acetaldehyde at 100^{o}C and exhibited superior activity when compared to others (raw and alkaline treated). The experimental results validated kankara clay as a catalyst for dehydrogenation of ethanol to produce acetaldehyde.

NSPS-FUOYE-CH-002

GREEN SYNTHESIS OF ZNO NANOPARTICLES DERIVED FROM SECURIDACA LONGIPEDUNCULATA

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ABSTRACT

ZnO nanoparticles were synthesized with glycerol – water extract of *Securidaca longipedunculata*. Phytochemical analysis of the extract showed the presence of alkaloids, tannins, flavonoids, saponins, cardia glycosides and reducing sugars. Chelating functional groups, which include –OH, C=O, C-OH, and C=C were identified in the synthesized nanoparticles. The results of antioxidant assay of the nanoparticles showed significant activities compared to the ascorbic acid standard. The sunscreen activity test indicated promising results of the efficacy potential of the nanoparticles as sunscreen agent. The result of this research work indicates the potential application of the synthesized nanoparticles in the formulation of cosmetics products.

NSPS-FUOYE-CH-003

VANADOCENE COMPLEXES SUPPORTED ON POROUS SILICA NANOSYSTEMS FOR ANTICANCER APPLICATIONS

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ABSTRACT

Nanoscale materials hold great promise in anticancer therapy by optimizing their functionalization and physicochemical properties. This study presents the synthesis of novel silica-based nanomaterials incorporating vanadocene with four sulfur-containing amino acids (penicillamine, methionine, captopril, and cysteine) and various fluorophores (rhodamine B, coumarin 343, Alexa Fluor™ 647). Characterization was performed using solid-state spectroscopic techniques, including FTIR, diffuse reflectance spectroscopy, ^{13}C and ^{51}V solid-state NMR, XRD, XRF, thermogravimetry, and TEM. Functionalization predominantly occurred within the silica pores, confirmed by reduced peak intensities in the diffractograms. Solid-state ^{51}V NMR suggested a four-coordinated local symmetry around vanadium in the final materials (S1–S4). Nanostructured silicas containing cysteine and captopril exhibited high cytotoxicity and selectivity against triple-negative breast cancer cells, positioning them as promising antineoplastic drug candidates. Biological results indicated that vanadium activity was enhanced by its incorporation through amino acids, improving cytotoxicity by increasing cancer cell internalization. These materials hold significant potential for mesoporous silica-supported metallodrugs, balancing strong cytotoxic effects with low metal loading. Additionally, their optical properties, enhanced by rhodamine B, coumarin 343, or Alexa Fluor™ 647, suggest potential theranostic applications.

NSPS-FUOYE-CH-004

SUSTAINABLE REMOVAL OF CONGO RED DYE FROM THE AQUEOUS SOLUTION BY COAGULATION-FLOCCULATION TECHNIQUE USING PLANT-BASED MATERIALS

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ABSTRACT

Contamination of water and wastewater with hazardous dyes is a major global concern, posing a considerable public health and environmental challenge. The coagulation-flocculation technique is one of the most efficient methods of removing dyes from water and wastewater. However, the use of synthetic chemical coagulants/flocculants limits its usage due to their toxicity, high cost, and generation of harmful sludge. Biocoagulants and bioflocculants from plants offer alternatives to chemical coagulants and flocculants. In this study, the removal performance of *Moringa oleofera* seed (biocoagulant) and *Opuntia ficus indica* leaves (bioflocculant) was evaluated to remove Congo red (CR) dye from the aqueous solutions using the Jar-test method and their performances compared with the chemical coagulants/flocculants. The experiment was monitored using UV-Vis spectroscopy, and biocoagulants and bioflocculants were characterized by Fourier transform infrared spectroscopy (FT-IR). Moreover, the experiment was optimized to study the effects of pH, biocoagulant and bioflocculant dosages, CR concentration, agitation time, agitation rates, and settling time. The findings of the study revealed 97.8% of CR dye was successfully removed at the end of the coagulation-flocculation experiment at optimal conditions of 1.2 g of *M. oleofera* biocoagulants and 0.7 g of *O. ficus indica* bioflocculant at agitation rates of 160 rpm and 40 rpm and stirring times of 5 min and 25 min for coagulation and flocculation, respectively, at an initial CR dye concentration of 50 mg/L after the settling time of 40 min. pH had no significant effect on the CR removal rate. The FT-IR analysis identified COOH, OH, and C═O groups as the major functional groups associated with the biocoagulants and bioflocculants, with charge neutralization, adsorption, and bridging as plausible mechanisms. Thus, *M. oleofera* and *O. indica* are found to be efficient, cost-effective, and environmentally sustainable substitutes for conventional chemical coagulants and flocculants.

NSPS-FUOYE-CH-005

EXPLORATION OF BIOACTIVE COMPOUNDS IN *VERNONIA AMYGDALINA* ROOT EXTRACTS FOR POTENTIAL ALPHA-GLUCOSIDASE INHIBITION

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ABSTRACT

The multipurpose medicinal plant, *V. amygdalina,* known as 'Eworo' in Yoruba, is indigenous to Africa and Asia and has been traditionally utilized in Western Nigeria for treating ailments like diabetes, stomachaches, and gastrointestinal issues. This research aims to validate the purported anti-diabetic properties of *V. amygdalina* sourced from the ACHRI farm at the University of Ilorin, Nigeria. Samples were meticulously processed, including drying, pulverization, and sequential cold extraction with n-hexane, ethyl acetate, methanol, and water. Further fractionation of the extracts was conducted through column chromatography, yielding pure compounds isolated via PTLC and re-ce (normal phase) column techniques. Biological assays, focusing on the root extracts of *V. amygdalina* and the isolated compounds, were conducted. Structural elucidation was based on data obtained from H and C nuclear magnetic resonance spectroscopies, aligned with existing literature. Vitro antidiabetic activity was evaluated via alpha glycosidase denaturation assay, with diclofenac as a control drug. Three compounds were isolated: Vernoniamyoside B (VARCIEI), Vernonioside A4 (VARCII), and a proposed compound (VARC2HH3). These compounds exhibited inhibition, with half-maximal inhibition concentration (IC50) values of 179.5, 249.6, and 253.5 µg/mL, respectively. Although their IC values were higher than that of diclofenac (27.92 µg/mL), indicating reduced anti-diabetic potential, this study suggests that these compounds may contribute to the overall anti-diabetic efficacy of the plant.

NSPS-FUOYE-CH-006

In Vivo Analgesic Activity, Elemental Profiling and Sub-Acute Toxicity of Root Extracts of Aristolochia Albida

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ABSTRACT

Aalbida root extracts are widely used by communities in North Central Nigeria to manage stomach ailments, pain, and snakebites, yet scientific data on their safety and efficacy remain scarce. This study evaluated the analgesic activities, elemental composition, and subacute toxicity of A. albida root extracts. Hexane, ethyl acetate, ethanol, and water extracts were prepared by cold maceration, and their safety was assessed in Wistar rats following OECD (2008) guidelines. Analgesic activity was investigated using the acetic acid-induced writhing test in mice. All extracts demonstrated significant analgesic effects at doses of 250, 500, and 1000 mg/kg body weight (bw) compared to pentazocine (20 mg/kg bw), the reference drug. At 250 mg/kg bw, the hexane extract provided maximum inhibition (58.62%), followed by ethyl acetate (30.60%). At 500 mg/kg bw, water and hexane extracts showed potent inhibition of 69.83% and 58.53%, respectively. At 1000 mg/kg bw, hexane extract achieved 85.78% inhibition, while the water extract recorded 83.62%, slightly lower than pentazocine. Analgesic effects were dose-dependent across all extracts. Elemental profiling revealed the presence of eight elements, with magnesium (21.13 µg/g) being the most abundant. Copper, zinc, iron, manganese, lead, arsenic, and chromium were detected in smaller amounts. Hepatic and renal function tests indicated dose-dependent decreases in serum total protein levels. While serum alanine transaminase (ALT), aspartate transaminase (AST), and alkaline phosphatase (ALP) levels increased marginally at all doses, significant changes were observed in other liver function markers. This study highlights the potential analgesic properties of A. albida root extracts and provides insight into their safety profile. However, further research is recommended to explore their long-term effects and therapeutic applications.

NSPS-FUOYE-CH-007

SYNTHESIS OF HETEROGENEOUS CATALYST OBTAINED FROM SNAIL SHELL FOR BIODIESEL PRODUCTION

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ABSTRACT

The increasing demand for renewable energy sources has prompted the exploration of sustainable biodiesel production methods. This study presents a comprehensive physicochemical analysis of biodiesel produced from glycine max (soybean) utilizing a heterogeneous catalyst synthesized from snail shell which was used as a source of calcium oxide (CaO) calcined at 750 ^{o}C for 4h. The investigation focuses on evaluating the properties of the biodiesel, including Saponification value, acid value, specific gravity, density, iodine value and fatty acid composition, inaccordance with international biodiesel standards. The catalyst's performance is assessed through various transesterification reaction parameters such as catalyst loading (1 wt %), reaction temperature (60 ^{o}C), reaction time (2h) and methanol to oil ratio (5:1) these optimized conditions resulted in an optimum yield of 78.10%. Characterization of the produced biodiesel is conducted using techniques like gas chromatography-mass spectrometry (GC-MS) to determine fatty acid properties and Fourier transform infrared spectroscopy (FTIR) for functional group identification. Results indicated that the biodiesel produced with snail shell-derived catalyst exhibits favourable physicochemical properties, making it a viable alternative to conventional biodiesel.

NSPS-FUOYE-CH-008

ASSESSMENT OF $ZnCl_2$ ACTIVATED COCOA POD HUSK CHARCOAL EFFICIENCY ON THE REMOVAL OF Cu^{2+}, Cd^{2+}, AND Pb^{2+} IONS FROM AQUEOUS SOLUTION

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ABSTRACT

The efficiency of $ZnCl_2$-activated cocoa pod husk charcoal (ACPHC) in removing Pb(II), Cu(II) and Cd(II) ions from aqueous solution was investigated under different conditions of shaking speed, contact time, adsorbent dose, adsorbate concentration, pH, and temperature with a view to widening the applications of the husk. Adsorption equilibrium, kinetics and desorption studies were conducted. Activated carbon produced at 650 °C was found to give the best desired properties. The optimum shaking time and pH value were 45 min and 6. The shaking speed of 700 rpm gave maximum removal efficiency (mean ± sd) 97.02 ± 0.34%, 96.24 ± 0.19%, and 96.85 ± 0.01% for Pb(II), Cu(II), and Cd(II) ions at the optimum pH, 25 °C, and 0.1 g adsorbent/25 ml solution with adsorption capacities of 2.426, 2.406, and 2.421 mg/g, respectively. While the average capacity at the optimum contact time was 2.290 mg/g. Non-linear Temkin and Redlich–Peterson and linear Langmuir isotherm models gave the best description of the adsorption equilibrium of the metal ions onto ACPHC surface, while pseudo-second order kinetics model gave the best description of the adsorption kinetics. The rate of removal of the metal ions was in the order Pb(II) > Cu(II) > Cd(II). The regeneration of the spent adsorbent was efficient with respect to the considered metal ions. The recovery values were 96.72 ± 0.43%, 92.76 ± 0.49%, and 91.66 ± 0.34% for Pb(II), Cu(II), and Cd(II) ions, respectively. Thus ACPHC was found to be an efficient low-cost material for the removal of the studied metal ions from aqueous solution.

NSPS-FUOYE-CH-009

COMPARATIVE STUDY OF THE COLLECTION METHOD OF BIOGAS GENERATION USING CHICKEN DROPPINGS

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ABSTRACT

The study determines the anaerobic digestion in the production of biogas as a renewable energy from the digestion of chicken droppings which has high content of lignin and lignocellulose biofibers using two different method of collection such as collection over lime and collection over water. Sample of the substrate was obtained from Batagarawa metropolis and initially, processed (dried, and ground to powder) before preparing slurry in a specialize bioreactor that was constructed using a 5 L gallon. The gas generated was allowed only one passage via a tube and collected by downward delivery. The result shows that the collection over lime has the highest cumulative biogas generation of 80.30 cm^3 with retention time of 22 days, followed by the collection over water which produces a total volume of 75.00 cm^3 with retention time of 22 days and a pH range of 4.6-6.6. It was found that, the chicken droppings which naturally have been dumped carelessly as domestic waste can provide an alternative substrate for efficient biogas production. The study recommends that biogas is not just a renewable energy source but also an appropriate way of managing waste, 3R (reduced, reuse and recycle) of waste materials, having potentials to replace fossils fuel.

NSPS-FUOYE-CH-010

ZINC OXIDE AS A CORROSION INHIBITOR UPON MILD STEEL IN 0.5 M HCL SOLUTION

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ABSTRACT

Corrosion remains a significant barrier to metal components' durability and structural integrity, especially under harsh conditions such as hydrochloric acid (HCl) exposure. This research investigates how varying concentrations of zinc oxide (ZnO) inhibitors—50, 100, 150, and 200 ppm—impact the corrosion rate of mild steel in 0.5M HCl at temperatures ranging from 30°C to 60°C. Electrochemical techniques, including potentiodynamic polarisation and linear sweep voltammetry (LSV) via open-circuit potential (OCP) measurements, were employed to evaluate the effectiveness of ZnO in reducing the corrosion rate. Results showed a notable reduction in corrosion rate as ZnO concentrations increased across all temperature conditions. Specifically, at 30°C, the corrosion rate of mild steel decreased by as much as 89.21% at the highest ZnO concentration, highlighting ZnO's efficacy in mitigating corrosion. Adding ZnO also led to higher polarisation resistance, suggesting enhanced corrosion resistance. OCP results showed a shift towards more positive potentials, indicating effective inhibition of both anodic and cathodic reactions. This suggests that ZnO promotes the formation of a protective layer on the steel surface, which reduces the overall corrosion process. The study demonstrates ZnO's potential as an effective corrosion inhibitor in aggressive environments. Its ability to reduce corrosion rates and increase polarisation resistance indicates promise for extending the lifespan of metallic structures in corrosive settings. Positive enthalpy values (ΔH) imply an endothermic adsorption process, while negative entropy values (ΔSo) indicate a more structured arrangement of inhibitor molecules on the steel surface. Activation energy ranged from 9,972.41 J/mol without ZnO to 16,532.79 J/mol with ZnO, suggesting that the bond formation between ZnO and steel surface primarily involves physical adsorption.

NSPS-FUOYE-CH-011

Mass Transfer Effect in the Treatment of Water Polluted by Polycyclic Aromatic Hydrocarbons (Naphthalene, Anthracene, Phenanthrene and Quinoline)

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ABSTRACT

The transfer of naphthalene, anthracene, phenanthrene, and quinoline was investigated through batch kinetic experiments using zeolite as an adsorbent. Various mass transfer models, including particle diffusion, film diffusion, external diffusion, and Smith and Furusawa models, were employed to identify the rate-limiting step. External mass transfer coefficients ranged from 1.20×10^{-3} m/s to 1.66×10^{-3} m/s for naphthalene, 5.20×10^{-2} m/s to 5.40×10^{-2} m/s for anthracene, 3.35×10^{-4} m/s to 3.56×10^{-4} m/s for phenanthrene, and 5.60×10^{-6} m/s to 5.71×10^{-6} m/s for quinoline. Particle diffusion coefficients were similarly estimated. The average particle diffusion times for naphthalene, anthracene, phenanthrene, and quinoline were 0.00221 min, 2.968 min, 0.0155 min, and 0.00435 min, respectively, while average external diffusion times were 3.788 min, 3.757 min, 1.562 min, and 1.011 min, respectively. These findings suggest that external mass transfer is the slowest step in the sorption process. Biot numbers (25.00–57.11) confirmed that film diffusion dominated, ensuring uniform mass distribution during sorption. The concentration gradient served as the primary driving force, validating the Fickian diffusion condition. Overall, the study revealed particle diffusion as the fastest step and film diffusion as the governing mechanism for naphthalene, anthracene, phenanthrene, and quinoline, which exhibited similar mass transfer behavior regarding diffusion mode and the correlation between concentration and diffusion rate.

NSPS-FUOYE-CH-012

COMPARATIVE ANALYSIS FOR CORROSION INHIBITION ON MILD STEEL BY PARTS OF *ANOGEISUSS LEIOCARPUS* IN ACDIC MEDIUM

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ABSTRACT

This research work was investigated to compare corrosion inhibition by parts of *Anogeisuss leiocarpus* on mild steel in 0.5 M H_2SO_4 under temperature conditions of 30 -60 ℃ and exposure time of 3, 6 and 9 hours using weight loss, and PDP. The inhibition efficiencies of the parts follow the trend: root (88.80 %) and leaf (82.52 %). Increase in the concentration (0.2 g, 0.4 g, 0.6 g and 0.8 g) of the methanolic extracts resulted in IE % increase but decreased with temperature increase thus, increase in corrosion rate. The phytochemical result suggest that metabolites like saponinns, tannins, flavonoids, carbohydrates, steroids, terpenes and cardiac glycosides is responsible for inhibition.

NSPS-FUOYE-CH-013

COMPARATIVE STUDY OF IODINE VALUE FOR TWO DIFFERENT SIZES OF ACTIVATED CARBON FROM COCOA POD WASTE

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ABSTRACT

The most valuable application of iodine value is to determine the amount of unsaturation contained in fatty acids. The unsaturation is in the form of double bonds which react with iodine compounds. The higher the iodine value, the more unsaturated fatty acid bonds are present in it. five grams of Carbon from cocoa pod was activated with H3PO4 in the ratios of 1:1, 1:2, 1:3 as well as 2:1 and 3:1 at 100^{o}C, 200^{o}C, and 300^{o}C for both 325um and 600um sizes respectively, (CS: H3PO4) and (CS:KOH). The mixture was agitated until both components were homogeneous before being allowed to react for 72 hours at room temperature, distilled water was used to wash AS until the pH was balanced. Once the mass change became constant, washed Activated samples were dried at 100°C, 200°C, and 300°C for 3, 2, and 1 hour, respectively. The final volume of sodium thiosulfate for size 325um at ratio 1:1 for 300^{o}C is 43.2ml while the final volume for size 600µm at ratio 1:3 for 300°C is 41.7ml. The Iodine values for activated carbon of size 325µm and 600µm are 63.96mg/g and 104.84mg/g respectively. This implies that the sample size 325µm has the double bonds which has the highest saturation element that can be used for adsorption capacity of cocoa pod.

NSPS-FUOYE-CH-014

INVESTIGATION AND STUDIES OF KINETICS, THERMODYNAMICS, AND ISOTHERM PROPERTIES ON THE BINARY METAL IONS (LEAD & SILVER) FROM AQUEOUS SOLUTION USING TEA LEAF AND TEA FIBER

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ABSTRACT

The growing human population and industrial demands increase heavy metal contamination, posing health risks. This research explores sustainable methods for heavy metal removal using tea leaves and tea fiber, examining adsorption capacity and effects of time, temperature, dosage, and initial metal concentrations. Two adsorption isotherms, namely Langmuir and Freundlich, were employed to analyze the data after investigating the thermodynamics and kinetics of the sorption process. FTIR spectroscopy was used to confirm the presence of active functional groups like C-O, N-H, and C-N in the tea leaves and fibers. The Langmuir isotherm presents correlation coefficient (R^2) of 0.3791 and 0.0092 for the biosorption of silver and 0.0379 and 0.1708 for the biosorption of lead by tea leaves and tea fiber respectively. On silver, the Freundlich isotherm shows R^2 values for tea leaves and tea fiber as 0.5218 and 0.1392, respectively, and on lead, it yields R^2 values of 0.0308 and 0.1771, respectively. The kinetic analysis utilized first-order and second-order kinetics, with the second-order fitting well for experimental results of the sorption process of tea leaves and tea fiber on silver and lead. Thermodynamic studies suggest a spontaneous, endothermic, and practical adsorption process. This study suggested that tea leaves (Camellia sinensis) are a more suitable low-cost adsorbent for effective Pb (II) and Ag removal from industrial effluent and wastewater than tea fiber.

NSPS-FUOYE-CH-015

COMPARATIVE ANALYSIS OF WATER QUALITY IN COVERED AND UNCOVERED HAND-DUG WELLS IN OYE-EKITI

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ABSTRACT

Access to safe and clean drinking water is critical to sustainable development. It remains a significant public health issue, particularly in rural and peri-urban areas of third-world countries like Nigeria, where hand-dug wells are common among drinking water sources. This preliminary research investigated the water quality of covered and uncovered hand-dug wells in Oye-Ekiti, Nigeria, to inform sustainable well water management practices. Using judgmental sampling and standard analytical methods, water samples from two wells (covered and uncovered) were collected and analysed for physical, chemical, and microbiological parameters. The results indicated that covered well water generally has better quality, with lower concentrations of suspended solids, dissolved solids, and total hardness (80, 50, 31.5 mg/L, respectively) than uncovered well (330, 80, 59 mg/L, respectively). However, heavy metals (Cd, Cr, & Pb) and coliform counts in both wells exceeded WHO limits except for Cu and Zn. Notably, E. coli was absent in both wells, but the presence of coliforms (3 MPN/100 mL) signals potential vulnerabilities in the water safety, specifically the uncovered water (5 MPN/100 mL). The research findings corroborated the protective role of covering wells in reducing contamination. However, additional measures, including regular maintenance, improved construction, and monitoring, are recommended to ensure water quality. This pilot research provides a foundation for larger-scale investigations to support evidence-based policies for improved public health and to achieve Sustainable Development Goal 6 on clean water and sanitation by 2030.

NSPS-FUOYE-CH-016

MIXED LIGAND METAL COMPLEXES WITH THEOPHYLLINE AND DIIMINE OR DICARBOXYLIC ACID LIGANDS: SYNTHESIS, STRUCTURAL ELUCIDATION AND APPLICATIONS

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ABSTRACT

This presentation highlights the synthesis and structural characterization of metal complexes of theophylline, a methylxanthine with a diimine or dicarboxylic acid ligand as ancillary ligand. Copper and manganese complexes of theophylline (theo) with a diimine (e,g, 2.2'-bipyridine, bpy, and 1,10-phenanthroline, phen) or dicarboxylic acid (oxalic acid, succinic acid, isophthalic acid and terephthalic acid) were synthesized and exploited for therapeutic applications. Sodium complex of theophylline was serendipitously obtained in an attempt to synthesize oxovanadium complex of theophylline. The compounds were characterized by Single Crystal X-ray diffraction (SC-XRD), UV–Vis diffuse reflectance spectroscopy (UV–Vis-DRS), Fourier-transform infrared spectroscopy (FT-IR) and Thermogravimetry-Differential Scanning Calorimetry (TGA-DSC). In all complexes, theophylline behaves as a bidentate ligand coordinating with two N atoms while copper and manganese complexes exhibit square pyramidal and octahedral complexes respectively. While sodium complex of theophylline inhibited the growth of Gram-positive (Staphylococcus epidermidis) and Gram-negative (Acinetobacter baumannii, Escherichia coli and Klebsiella pneumoniae) bacteria as well as fungi (Candida *albicans* and Candida *tropicalis*), copper complex **3** with theophylline and phenanthroline ($Cu(theo)_2phen(H2O).5H_2O$) proves to be a promising lead anticancer agent by showing superior and broad spectrum antitumor activity compared to other complexes, with IC_{50} values below 5 µM. The preliminary evaluation of complex 3 indicated that it does not cause necrotic cell death, which is advantageous in the development of new cancer drugs. The data obtained indicates that complex 3 is worthy of further evaluation as a potential anticancer agent. Also, $Cu(theo)_2phen(H_2O).5H2O$ (CTP) is the most promising candidate against Candida species due to its broad-spectrum activity and low toxicity. Further investigations on the manganese complexes and dicarboxylic acid complexes with theophylline and copper are ongoing.

NSPS-FUOYE-CH-017

GREEN CHEMISTRY APPROACH TO REMOVE CHROMIUM FROM CONTAMINATED SOIL

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ABSTRACT

This study was driven by the need to remove Chromium (Cr) a toxic element from the environment. Pot experiments using amendments like biochar (BC), compost (CP) and sewage sludge (SS) were performed to study their effect on the uptake of Cr. Five plants, *K. senegalensis, E. citridora, J. curcas, S. occidentalis and S. tora* were grown on amended soil and control in a glass house at USTC, China. The influence of the amendments on soil properties, bioavailability, and Cr accumulation in tissues were examined and compared to unamended soil. ICP-MS was used to assess the levels of Cr in the soil and plant tissues. Results revealed that, *S. occidentalis* in compost amended soil (17.60 ± 0.99) and *S. tora in sewage sludge amended soil* (13.99 ± 0.55mg kg^{-1}) show high retention of Cr in the root tissue than the shoots while *S.tora* showed highest Cr levels in shoots (8.48 ± 0.31) than the others, suggesting both *S. occidentalis and S. tora* for the phytostabilization of Cr contaminated soils.

NSPS-FUOYE-CH-018

Optimizing Cadmium (II) Adsorption on HKUST-1: A Comparative Study of RSM and ANN

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ABSTRACT

This study investigates the optimization of cadmium (II) adsorption onto HKUST-1, a metal-organic framework. Response surface methodology (RSM) and artificial neural network (ANN) were employed to model and optimize the adsorption process. 30 experimental runs were conducted using a central composite design (CCD) to evaluate the influence of three (3) independent variables:[Initial Cd (II) concentration, adsorbent dosage and contact time] on cadmium (II) removal efficiency. The quadratic model of the RSM was used to develop predictive models and identify optimal conditions. ANN models with 7 hidden layers and 10 neurons were also developed and their predictive capabilities were compared with RSM. The maximum cadmium (II) removal efficiency of 96.12 % was achieved at an optimal condition of 47.7 mg/L initial cadmium concentration, 19.7 mg HKUST-1 dosage and 44 minutes. Based on the findings, ANN models exhibit higher accuracy and predictive power compared to RSM models, with a lower root mean square error (RMSE) of 0.169671 for ANN and 0.785905 for RSM and average absolute e deviation (AAD) of 2.734 for ANN and 8.31144 for RSM. These findings demonstrate the effectiveness of both RSM and ANN in optimizing cadmium (II) adsorption onto HKUST-1. However, ANN exhibited superior predictive capabilities, making it a valuable tool for optimizing and scaling up cadmium (II) removal processes using MOF adsorbents.

NSPS-FUOYE-CH-019

ASSESSMENT OF PHYSICOCHEMICAL PROPERTIES OF LARFARGE CEMENT TOWARDS ACHIEVING A SUSTAINABLE SOCIETY

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ABSTRACT

Conducive shelter is one of the basic needs of life, and in this modern society, large numbers of livable structures are made of cement. The number of cases of collapsed structures/buildings in Nigeria has been on the increase in recent times, reported in cities like Lagos, Ibadan, Abuja, Port Harcourt, etc. There is an urgent need to find lasting solutions to tackle structural/building challenges arising from the use of cement. Since the production of cement is a continuous process, there is a need for continuous monitoring of the quality of Ordinary Portland Cement, as recommended by the Standard Organization of Nigeria (SON). The study assessed the physicochemical properties of four brands of Larfarge cement named (Standard Sample 52.5 GRADE, 32.5 GRADE Elephant Classic), 42.5 GRADE (Supaset), and 52.5 GRADE (Powermax) using standard procedures. The cement analysis reveals that the SiO_2 content increases with the grade of cement, with the highest value of 20.46% in 52.5-grade cement. Similarly, higher grades of cement demonstrate greater values in Al_2O_3, Fe_2O_3, and MgO, indicating enhanced material composition for higher strength applications. Most of the parameters analyzed fall within SON and ASTM C 150. It can be concluded that building failure due to the use of these cements could be linked to the use of nonprofessional builders, other fake materials, and corruption by contractors.

NSPS-FUOYE-CH-020

EVALUATION OF CHLORINATED PESTICIDE POLLUTION IN RIVER GALMA USING PASSIVE SAMPLING

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ABSTRACT

Chlorinated pesticides pose a significant environmental threat due to their persistence and toxicity. This study assessed contamination in River Galma sediments, Zaria-Nigeria, by measuring freely dissolved concentrations (Cfree) of chlorinated pesticides using 50 µm low-density polyethylene (LDPE) passive samplers. These samplers provided time-integrated, bioavailability-focused data across ten locations (P1–P10). Sediment-pore water equilibrium was achieved under controlled conditions, and pesticides were quantified using Gas Chromatography with Electron Capture Detection (GC-ECD), with detection limits as low as 1.5 ng/L. The Cfree data revealed significant spatial variability in contamination. Hotspots at P3 and P6 showed Lindane concentrations up to 1651.12 ng/L, p,p'-DDT at 11.17 ng/L, and hexachlorobenzene at 92.08 ng/L, attributed to agricultural runoff and localized sources. Degradation ratios (e.g., DDT/(DDE+DDD)) indicated substantial transformation of DDT into its derivatives, though the persistence of p,p'-DDT suggested ongoing contamination. Principal component analysis (PCA) identified distinct contamination profiles, with HCH isomers dominant in agricultural zones and chlordane-related compounds prevalent in urban-industrial areas. Toxic Unit (TU) analysis revealed that most locations exceeded ecological risk thresholds (TU > 1), indicating significant environmental risks. This study underscores the effectiveness of passive sampling in assessing bioavailable pollutants and informing risk management strategies.

NSPS-FUOYE-CH-021

PRODUCTION OF CLAY- BASED WATER FILTER USING BIOMASS OF *BACILLUS SUBTILLIS*, SAWDUST, ACTIVATED CHARCOAL, PERIWINKLE AND SNAIL SHELL AS ADDITIVES

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ABSTRACT

Ceramic water filters were prepared by combining clay minerals with additives. Sawdust was used as a burnout material to enhance the rate of filtration. Silver nitrate, charcoal, periwinkle shell, snail shell, and biomass of *Bacillus Subtilis* were used as additives accordingly. The body composition was formulated to remove microbes and treat heavy metals by adsorption process. The formulated bodies were fired at a temperature range of (700˚C - 900˚C) and water was allowed to run through the filter. Characterization, physiochemical tests and Microbial test were conducted on the ceramic material and water, antimicrobial test was carried out on the biomass of *Bacillus subtilis*. Mineralogical (XRD) and elemental analysis of the clay and snail shell, periwinkle shell showed serpentine, plagioclase, mixture of feldspar minerals albite (sodium aluminosilicate - $NaAlSi_3O_8$), anorthite calcium aluminosilicate- $CaA_{l2}Si_2O_8$) and Calcium (70-97 %composition) respectively. The results showed large proportion of silicon, indicating the material is silicate. Filtration rate of the clay-based filter was estimated as 1.125 L/hr. The result shows ceramic filter has 96.72%, 99.26% and 66.67% colony removal efficiency for heterotrophic bacteria, coliform and fungi respectively. The filter showed about 70% to 96% affinity for physico-chemicals in household water purification.

NSPS-FUOYE-CH-022

PHYTOCHEMICALS AND ANTIOXIDANT ACTIVITY OF AMBLYGONOCARPUS ANDONGENSIS LEAF EXTRACTS

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ABSTRACT

Amblygonocarpus andongensis is a vascular plant native to tropical regions of Africa used in traditional medicine. Ethnomedicinal studies have revealed the use of its leaf extract in the treatment of stomach-ache and other challenges without scientific validations. The aim of this work was to carryout phytochemical screening and investigate antioxidant activity of *Amblygonocarpus andongensis* leaf extracts. The plant material was percolated in methanol, extracted and dried to yield a green coloured crude extract which was later fractionated. Phytochemical screening of the crude extract was carried out using standard methods. Antioxidant activity of the extracts was evaluated in DPPH radical scavenging assay using quercetin and ascorbic acid as positive controls. Phytochemical screening of the crude extract revealed the presence of carbohydrates, reducing sugars, tannins, flavonoids, phenolics, proteins and amino acids whereas alkaloid was found to be absent. The crude, n-hexane, dichlomethane and ethyl acetate extracts demonstrated antioxidant activity of IC_{50} value 29.545, 57.352, 20.357 and 15.962 µg/ml respectively relative to quercetin (IC_{50} value 2.717 µg/ml) and ascorbic acid (IC_{50} value 9.303 µg/ml). The lower the IC_{50} value the higher the activity and vice-versa. This research for the first time suggests the phytochemicals and antioxidant activity of *Amblygonocarpus andongensis* leaf methanolic extracts. The research also validates the traditional use of the plant leaf extract in the treatment of diseases and challenges associated with oxidative stress.

NSPS-FUOYE-CH-023

KINETICS AND RESPONSE SURFACE METHODS IN THE OPTIMIZATION OF PHOTODEGRADATION OF RHODAMINE B USING N-CeO_2/ZnO NANOCATALYST

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ABSTRACT

The study addresses the severe threat caused by wastewater containing toxic and non-biodegradable organic dyes like rhodamine B (RhB) to the biota, by producing an efficient nanocatalyst, N-CeO_2/ZnO, with tremendous removal of RhB using the hydrothermal method. The characterization of the nanocatalyst is explored by TEM, SEM/EDX, XRD, BET, DRS, and FTIR. The response surface method was used to evaluate the process's operational parameters, including pH, initial RhB dye concentration, time, and dosage. The produced N-CeO_2/ZnO nanocatalyst exhibits a lower band gap energy of 3.1 eV compared to the precursors, with an improved BET-surface area of 41.78 m^2/g, which is mesoporous. And a crystallite size of 58.30 nm and a particle size of 56.74 nm. The photodegradation performance of N-CeO_2/ZnO nanocatalyst (93.21%) on RhB dye is higher than that of CeO_2/ZnO, CeO_2, and ZnO alone, influenced by all the operational parameters. The quadratic model of BBD-RSM efficiently predicts the optimum conditions (pH 4, C_o = 20 mg/L, 90 and 0.3 g nanocatalyst dosage) for the degradation process. The photocatalytic degradation kinetics data fit best into the first-order model with a rate constant of 0.007 min^{-1}. N-CeO_2/ZnO nanocatalyst has promising potential for removing RhB dye from wastewater.

NSPS-FUOYE-CH-024

SYNTHESIS AND CHARACTERIZATION OF Cu (II) COMPLEX WITH SCHIFF BASE DERIVED FROM PYRROLE-2-CARBOXALDEHYDE AND THIOSEMICARBAZIDE

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ABSTRACT

A Schiff base was synthesized from the condensation reaction of thiosemicarbazide and 1H-pyrrole-2-carboxaldehyde. The corresponding Cu (II) complex was obtained by refluxing the chloride of the metal with the prepared Schiff base in an ethanolic solution. The Schiff base and its complex were characterized and analysed using Fourier Transform Infrared (FT-IR), UV-visible, magnetic susceptibility, conductivity measurement, melting point/decomposition temperature and solubility test. The Infrared spectral data of the Schiff base showed absorption band at 1585 cm^{-1} which is attributed to v(C=N) stretching. However, this band was shifted to a higher frequency of 1598 cm^{-1} indicating the formation of Cu-N band in the complex. The melting point of the schiff base was found to be 179 °C while the decomposition temperature of the complex was found at 205 °C indicating the stability of the complex. The molar conductance value of Cu (II) complex was observed at 24.20 ohm^{-1} cm^2 mol^{-1} which indicates non-electrolytic nature of the complex. The results of solubility test revealed that the complex was soluble in most organic solvent and insoluble in water.

NSPS-FUOYE-CH-025

ADSORPTIVE REMOVAL OF CONGO RED DYE FROM AQUEOUS SOLUTION USING ACTIVATED CARBON PRODUCED FROM AFRICAN EBONY SEEDS (*DIOSPYROSMESPILIFORMIS*)

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ABSTRACT

Activated carbon derived from African ebony seeds (*Diospyrosmespiliformis)* via chemical activation using phosphoric acid have been utilized for the removal of congo red dye from aqueous solution. The activated carbon was characterized using some physicochemical parameters and Fourier transform infrared (FTIR) technique to ascertain its structural and surface functional groups. The results of Physicochemical properties showed that the ash content, moisture content, pH and bulk density of the activated carbon were 8±0.5567%, 12.9±0.1528%, 2.4±0.03431 and 7.3±0.0577g/cm^3 respectively. The FTIR analysis revealed that, the surface of the adsorbent contains hydroxyl, phosphate ester and unsaturated groups. Batch adsorption experiments were conducted to evaluate the adsorption capacity of the activated carbon for the removal of dye from aqueous solution. The results of the batch adsorption studies indicated that congo red dye was adsorbed at initial concentration (500 ppm), contact time (30 minutes), pH (2.0) and adsorbent dosage (0.01g) with corresponding adsorption capacities of 1018, 1083, 969 and 975 mg/g respectively.

NSPS-FUOYE-CH-026

DEVELOPING BIODEGRADABLE ADSORBENTS FOR HEAVY METAL REMOVAL FROM CONTAMINATED WATER: RENEWABLE RESOURCES SOLUTIONS FOR SUSTAINABLE WATER TREATMENT

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ABSTRACT

Access to clean water is a major global problem, especially in areas affected by pollution from industries and mining, which can lead to heavy metal contamination. This research aimed to create biodegradable materials from natural sources that can effectively remove heavy metals, such as lead, cadmium, and mercury, from polluted water. By using materials like chitosan and agricultural waste, we hope to offer an eco-friendly alternative to traditional water treatment methods that often use harmful chemicals. This study were categories into stages: first stage tested how well these biodegradable materials can remove heavy metals under different conditions, such as contact time and pH levels; while the second stage, evaluated their environmental impact compared to regular adsorbents. Laboratory-scale experiments were conducted to understand the effectiveness of these materials in cleaning water. The results obtained shown that both chitosan and activated carbon are effective in removing heavy metals, with activated carbon demonstrating superior performance. In conclusion, this research highlights the potential of biodegradable adsorbents as effective tool for addressing heavy metal pollution in water. It is recommended that future research focus on pilot scale application to validate laboratory findings, explore regeneration techniques for absorbents to enhance economic viability, and investigate broader contaminant spectra beyond this research.

NSPS-FUOYE-CH-027

UTILIZING BACTERIA-MEDIATED SILVER/TITANIUM DIOXIDE NANOPARTICLES FOR THE PHYSICOCHEMICAL CHARACTERIZATION AND REMEDIATION OF OIL-POLLUTED WATER

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ABSTRACT

Oil pollution is a serious threat to the environment and water quality, necessitating an efficient technique for remediation. Oil-polluted water samples are prepared and subjected to a thorough physicochemical analysis to simulate environmental contamination. Standard procedures and analytical tools, such as UV-visible and atomic absorption spectrophotometers, were used to assess parameters like pH, temperature, turbidity, chemical oxygen demand (COD), biological oxygen demand (BOD), total dissolved solids (TDS), total suspended solids (TSS), nitrates, sulfates, chlorides, total nitrogen, phosphates, heavy metals, and oil-related hydrocarbons. Bacteria mediated-silver/TiO2 nanoparticles synthesized via a green approach were used as adsorbents to treat the laboratory-simulated oil-polluted water. The optimized conditions of contact time, pH, adsorbent dosage, and water-to-oil ratio derived from our previous study were applied to the adsorption process for efficiency. After six hours of treatment via adsorption, physicochemical parameters such as pH, turbidity, COD, BOD, and heavy metal concentrations were reduced in multifolds to levels within or below permissible standards set by the Standard Organization of Nigeria (SON) and National Environmental Standards and Regulations Enforcement Agency (NESREA). This included significant drops in the amount of oil and grease as well as drops in the concentrations of nitrate, sulfate, and chloride. The findings demonstrate how effectively oil-polluted water can be treated using bacteria-mediated-silver/TiO2 nanoparticles by adsorption, offering a sustainable solution to mitigating the environmental and public health risks associated with oil spills.

NSPS-FUOYE-CH-028

SYNTHESIS AND ANTIMICROBIAL STUDIES OF BIDENTATE SCHIFF BASE TRANSITION METAL COMPLEXES DERIVED FROM 4-((2-HYDROXYPHENYLIMINO)METHYL) BENZALDEHYDE

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ABSTRACT

The solvent-based synthesis of a bidentate Schiff base ligand (SB) derived from terephthalaldehyde (TPA) and 2-aminophenol (AMP) in equimolar ratio was accomplished via conventional method. Transition metal complexes were prepared by complexing the Schiff base ligand with Mn (II), Co (II), Ni (II), Cu (II) and Zn (II) metal ions. The ligand and complexes were characterized using physicochemical techniques - melting point, solubility, conductivity and spectroscopic parameters - FTIR and UV-Visible. FTIR data showed that the ligand coordinated to the metal ions through an azomethine N-atom with coordinated water of crystallization. Square planar geometry was proposed for all metal complexes based on the available spectroscopic data obtained. The antimicrobial results showed that both the ligands and the metal complexes inhibited bacterial and fungi growth, with the metal complexes showing higher antibacterial activity than the Schiff base ligand and some of the standard drugs. While the ligand showed higher antifungal properties than the complexes.

NSPS-FUOYE-CH-029

CONDUCTION BAND SHIFT AND INTERFACIAL CHARGE TRANSFER TRANSITION BY ADSORBED 4-TERIARY BUTYL PYRIDINE ANALOGUES ON TIO2: A DENSITY FUNCTIONAL THEORY STUDY

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ABSTRACT

Additives are regular components in dye sensitized solar cell (DSSC) electrolyte preparations. 4-teriary butyl pyridine (4-TBP) is one of the most common additives in DSSC electrolytes. The role of 4-TBP at enhancing the open circuit voltage via negative shift of the conduction band edge of TiO2 is widely recognised, however, its capability for interfacial charge transfer transition (ICTT) is unknown. In this contribution we use DFT to examine adsorption of 4-TBP and its analogues on TiO2. The results show that 4-TBP is capable of ICTT in the UV region. Analogues bearing electron donating groups display ICTT in the visible region. While analogues bearing electron withdrawing groups may display no ICTT and cationic analogue displayed reversed ICTT. The results provide insights on the effect substituents on the negative shift of the conduction band edge of TiO2. The results also revealed wider scope for selection of additives for enhancing the performance of DSSCs.

GROUP B: EARTH SCIENCES-NSPS-FUOYE-ES

NSPS-FUOYE-ES-001

WATERSHED DELINIATION AND STREAM ORDER MAXIMIZATION USING DIGITAL ELEVATION MODEL FOR EFFECTIVE NATURAL HAZARD MANAGEMENT

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ABSTRACT

Watershed delineation is a fundamental requirement of hydrological studies, natural hazard management, and any type of water management including water supply, flood or erosion management. This study tensions the Shuttle Radar Topography Mission, where it operates in maximizing stream order using SRTM 30m DEMs along with utilization of Digital Elevation Models (DEMs) and Remote Sensing data to demarcate watersheds. The study region lies in Jigawa State, Nigeria and spans an area of 6867km2 including two major geological units which are Basement Complex and Chad Sedimentary formations. The research also incorporates the use of Pour Point and geometric automatic watershed delineation methods for the purpose of improving hydrological analyses. The flow direction, flow accumulation and sink area filling infer operations used to approximate the surface runoff were done and the stream orders which were the final output after combining all the parameters in an ArcGIS were varied. The study demonstrates that the geographical information system (GIS) technology coupled with remote sensing methodologies for watershed delimitation is advantageous most especially in addressing issues of erosion scour, gully development and water management issues. Delineation of accurate watershed boundaries is very important not only for hydrological analysis but also for ensuring that water related problems are managed effectively. This would in ensuring that modern day approach to water issues is adopted and resulting in effective resolution of water related problems.

NSPS-FUOYE-ES-002

AIR POLLUTION MODELLING IN KANO STATE USING ARTIFICIAL INTELLIGENCE AND ENVIRONMETRICS

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ABSTRACT

Assessment of air pollution is essential to determine explicit control strategies that mitigate against environmental degradation and health impact. This study aim to apply artificial intelligence and environmetric models for prediction and source apportionment of PM_{10}, $PM_{2.5}$, O_3, NO_2, and SO_4. Data were collected during the wet season (Jun –September) and dry season (October-February) to understand the seasonal variability, source emission and concentration using principal component analysis. Artificial neural network (ANN) model was used with ten hidden neurons in order to learn the pattern of the data set for effective prediction. The data were divided into 60% training, 20% testing and 20% validation. The ANN model show reliable prediction of R^2 0.969 (training), R^2adj 0.942 (validation) and RMSE 0.416. The results indicate high pollution level during the dry season compared to the wet season. The major contributory source profiles were attributed to the suspended dust particles from roads and construction sites, smoke from fire, emission from automobiles exhaust and industries. This study provide evidence of possible health implications and poor environmental wellness of Kano State.

NSPS-FUOYE-ES-003

CHEMOSTRATIGRAPHY AND PALEOENVIRONMENTAL ANALYSIS OF SAND-SHALE FORMATIONS USING CORE GEOCHEMICAL SPECTROSCOPY TOOLS

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ABSTRACT

Contemporary investigations into spectral gamma-ray (SGR) logs, are progressing, but remain inadequate in some situations. Its advancement in geoscience has enabled the use of potassium (K), uranium (U), and thorium (Th) to identify clay minerals, allow chemostratigraphic correlations, and reconstruct paleoenvironments. In the Tak-1 well, Niger Delta Basin, spectroscopic analysis of a 106 m interval of sand and shale was conducted to evaluate clay mineral types and signatures. Sandstones consist of heavy minerals, feldspars, micas, and glauconite, while mudrocks are enriched in uranium and thorium. Th/K ratio cross-plots differentiated clay minerals into smectite, illite, kaolinite, and chlorite. Low Th/K values indicated potassium-rich minerals like illite, mica, or feldspar, while thorium-rich clays were classified as kaolinite and mixed-layer smectite. Sandstones also contained potassium-bearing minerals such as feldspars, micas, or glauconite. Low Th/U ratios and high Uranium values of 10–15 ppm signified organic matter and source rocks formed in anoxic, reducing environments. Extremely low potassium values (<2%) indicated terrestrial sandstone deposits rich in feldspar. The mineralogical characteristics revealed transitional depositional settings, with sediments influenced by both terrestrial and marginal marine environments. This geochemical and mineralogical characterization has improved the predictability of reservoir quality and hydrocarbon prospectivity in the study area.

NSPS-FUOYE-ES-004

INVESTIGATION OF FAULT ZONE FOR MINERALIZATION PROSPECT IN ILORIN, NORTH CENTRAL, NIGERIA

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ABSTRACT

In the quest for economic advancement, Nigeria is curiously searching for availability of mineral resources. This study therefore investigated and identified the fault zone in Ilorin for mineralization prospect. For this purpose, high resolution aeromagnetic data of Ilorin, obtained from Nigerian Geological Survey Agency were processed and interpreted using Geosoft Oasis Montaj 6.4.2 data processing and analysis software package. The Reduced to Equator (RTE)-Residual Magnetic Anomaly (RMA) maps were obtained from step by step filtering of magnetic intensity maps, then subjected to depth continuation process to obtain localized fault zones. The Upward continuation process employed, conspicuously showed the region of consistent high magnetic amplitude or increasing amplitude on the upward depth continued map of the study area as region of deep depth to magnetic sources, indicating intrusion. The minor or localized faults were captured with decreasing magnetic amplitude at UC height of 5000 m at the depth of 2,500m in the area under study. These identified localized faults within the study area could serve as conduit pipe or storage for certain minerals to be trapped and be useful for human needs.

NSPS-FUOYE-ES-005

EVALUATING THE VOLUMETRIC STORAGE POTENTIAL OF CRYSTALLINE AQUIFERS USING MACHINE LEARNING

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ABSTRACT

Comprehensive estimate of Total Groundwater Storage of a region is a prerequisite for the sustainable management of groundwater resources. While success has been recorded in estimating groundwater storage in sedimentary aquifers, reliable estimates of groundwater storage in crystalline aquifers remains a critical challenge. To address this challenge, six machine learning protocols namely Decision Tree, Deep Feed forward Neural Network, Linear Regression, Support Vector Machine, Random Forest, and Simple Feed Forward Neural Network models were built and trained for assessing volumetric groundwater storage in Moonset Field, Sub-Saharan Africa using seven thematic aquifer parameters. The entire machine learning process was optimised using iterative parameters normalisation, training-testing loss curves, and three correlation techniques. The machine predicted groundwater storage maps were validated by the groundwater storage map obtained from borehole pumping tests. The best machine-predicted groundwater storage maps under the three tested scenarios showed that groundwater volume range from 3.46 to 52.86 m^3, 9.56 to 46.14 m^3, and 3.46 to 51.44 m^3, respectively while the actual volumetric groundwater storage values derived from borehole pumping test range from 2.56 to 54.0 m^3. The highest groundwater storage volumes correspond to the central and southern spots of the moonset field. Of the twenty-four hydro-geophysical parameters derived from the geophysical data, the most effective predictors of groundwater storage were found to be transmissivity, hydraulic conductivity, fracture contrast, overburden thickness, thickness of the weathered aquifer, combined aquifer thickness, and resistivity of the aquifer. The study concluded that Random Forest, Linear Regression, and Simple Feed Forward Neural Network are the best three machine learning models for predicting volumetric groundwater storage in crystalline aquifers.

NSPS-FUOYE-ES-006

A Comparative Study of Ensemble Learning Models for Predicting Apparent Resistivity Distribution in Cemetery Sites: A case study of Ejigbo Osun State

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Abstract

This study aims at the performance evaluation of three ensemble-learning models for predicting the apparent resistivity (AR) values of the subsurface of the study area to replace the conventional method (CM) of acquiring AR that are labour-intensive, expensive, and time-consuming. Ten vertical electrical soundings (VES) using the Schlumberger configuration were carried out on the four sides of a cemetery in Ejigbo town located on the latitude 7° 53' 4.809" N and longitude 4° 19' 58.367" E, at 10-meter intervals from the wall. The three ensemble models were trained using a total of 890 data, including geometric factor (K), apparent resistivity (AR), current electrode spacing (AB/2), potential electrode spacing (MN/2), and the corresponding latitude and longitude of all 40 VES points in the area surrounding the cemetery. Using geophysical software (WinResist), the results of the field data AR and the predicted AR were examined. The analysis revealed that the research site is composed of five layers: topsoil (lateritic), clayey sand (second layer), weathered layer (third layer), fractured/fresh basement (fourth layer) and basement complex (fifth layer). The performance evaluation of the 3-models indicated that Hybrid Ensemble Model (HEM) has the lowest mean absolute error (MAE) of 6.83 and highest coefficient of correlation of 99.94%, Extreme Gradient Boost (XGBoost) and Random Forest (RF) have MAE of 31.92 & 40.61 and coefficient of correlation of 98.71% & 97.48% respectively. Hence, HEM outperformed other two ensemble models and will be more reliable for prediction of spatial apparent resistivity in the selected cemetery.

NSPS-FUOYE-ES-007

INVESTIGATING HYDROTHERMAL ALTERATION ASSOCIATED TO GOLD MINERALIZATION IN BIRNIN-GWARI USING AERO-RADIOMETRIC DATA

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ABSTRACT

Gold mining is a significant driver of wealth, serving as a reliable store of value against currency decline and a favoured hedge against inflation. Regions with hydrothermal alteration are key indicators of gold mineralization, and certain mapping techniques have proven effective for identifying these zones. However, these techniques have not yet been applied within the Birnin Gwari Schist Belt. This study uses these established techniques to examine the spectrometric data from a known gold mine within this belt. The findings reveal that the gold mine area shows moderate potassium levels with low thorium and uranium readings, indicating hydrothermal alteration. Additionally, a region northwest of the mine may have undergone a similar alteration, suggesting a potential gold mine (PGM). The ternary map indicates the location of both the gold mine and PGM has high potassium concentrations. Both sites also record high Kd and low Kn values, consistent with potassic alteration. The computed parameter value for the gold mine and PGM is around 0.589 suggesting their rock formations have undergone moderate alteration.

NSPS-FUOYE-ES-008

DELINEATE COPPER ALTERATION IN AZARA USING LANDSAT8 REMOTE SENSING IMAGERY

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ABSTRACT

The rise in demand for copper, driven by the growth of electric vehicles, has intensified the search for new copper deposits. Although Nigeria is known to have several metallic minerals, reports of copper occurrences are scarce. Landsat 8 has proven effective worldwide for mapping copper-related alterations, and this study uses its band ratio, colour composite, and principal component analysis techniques to analyze the reported Azara copper mineralization area. To enhance interpretation, a digital elevation model (DEM) and Google maps of the area were generated to compare the responses of Landsat 8 techniques with the region's landforms. The DEM shows that the copper-rich area has a hilly terrain, with Google Maps revealing sparse vegetation on these hills. Additionally, the DEM highlights prominent lineaments trending northeast within the copper-bearing hills. The Landsat 8 analysis, including band ratios (4:2, 5:7, 6:7, and 7:6), colour composites (combinations of Bands 6, 4, and 2; Bands 7, 6, and 2; Bands 10, 7, and 2; and other combinations), and PCA analysis, effectively delineates the hilly, sparsely vegetated terrain of the copper mineralization zone. Notably, the band ratios (5:7 and 6:7) and colour composite (Bands 4:2, 6:7, 5) show anomalies that align with the reported copper deposit in Azara, consistent with global findings. These results indicate that copper mineralization follows a northwest-trending linear structure

NSPS-FUOYE-ES-009

INVESTIGATING POSSIBLE CONNECTIVITY OF GESHERE AND RISHIWA YOUNGER GRANITE USING AERO-RADIOMETRIC DATA

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ABSTRACT

Geshere and Rishiwa Younger Granites (YGs) are physically two separate bodies, but believed to be either from the same source or one is an extension of the other. Previous work suggests they are connected at the subsurface, but the radiometric data will provide a unique perspective as it is a reflection of the geochemical formation of rocks. This work focused on identifying possible connection between the two YGs based on the variation of the radioelements in the study area. The result shows the values of potassium, thorium, and uranium range from 0.1 to 4.9 %, 11.9 to 61.2 ppm, and 1.4 to 10.3 ppm respectively. The average potassium concentration around Geshere and Rishiwa is high (4.5 and 4.1 % respectively), thorium is low (13.1 and 14.9 ppm respectively), and uranium is low around Geshere and south of Rishiwa YGs, but high at north of Rishiwa YG. The result of the composite maps of the three radioelements and the potassium reveal the extent of the YGs. However, the composite maps of thorium, and uranium revealed the south of Rishiwa and Geshere share similar geochemistry. It was also observed that the fault system could have served as the conduit of connectivity for the two YGs.

NSPS-FUOYE-ES-010

MAPPING OF THE SHALLOW-TO-DEEP SUBSURFACE STRUCTURAL ELEMENTS TO DETERMINE THE THERMAL REGION AND HYDROCARBON POTENTIAL OF GONGOLA BASIN, NE NIGERIA

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ABSTRACT

This study explores the sub-crustal and thermal structures of the Gongola Basin, NE Nigeria, using airborne magnetic and gamma-ray spectrometric data for hydrocarbon prospecting. The reduced-to-equator total magnetic field (TMI-RTE) data underwent enhancement techniques and depth estimation methods, including first and second vertical derivatives (FVD, SVD), rose diagrams (RD), source parameter imaging (SPI), and 2D magnetic depth modeling. These analyses mapped subsurface geologic structures, basement architecture, and depths to the magnetic basement. Radiogenic heat production (RHP) and favorable hydrocarbon maturation zones were determined via thorium normalization techniques (TNT) based on concentrations of radioactive elements (K, eTh, and eU). The FVD, SVD, and RD revealed NE-SW, NNE-SSW, and NW-SE trending structures that may act as hydrocarbon migration pathways or traps. SPI and 2D modeling showed sediment thickness varying between >1000 m and >5000 m, with depths of 3000–5000 m concentrated in areas such as Alkaleri, Akko, Gombe, and Futuk, ideal for hydrocarbon maturation. Positive DRAD values highlighted zones of hydrocarbon potential, while total RHP rates ranged from 289.4 to 1477.6 ρW kg^{-1}. Higher RHP values (e.g., 797.87 ρW kg^{-1}) in formations like Yolde, Pindiga, and Keri-Keri align with the moderate RHP window (750–1500 ρW kg^{-1}), confirming hydrocarbon prospectivity.

NSPS-FUOYE-ES-011

MUNICIPAL WASTE DUMPSITE: IMPACT ON SOIL PROPERTIES, HEAVY METAL CONCENTRATIONS AND CONTAMINATION OF UNDERGROUND WATER, KUJE AREA COUNCIL, ABUJA, NIGERIA

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ABSTRACT

In Nigeria, there is a widespread use of soils from rural and urban dumpsites for agricultural purposes, particularly for growing vegetables. However, many individuals are unaware of the risks associated with heavy metal uptake by plants. Therefore, assessing heavy metal contamination is a critical aspect of risk evaluation at waste dumpsites. This study was conducted in the Kuje area to determine the risks of heavy metal pollution and the physicochemical properties of soils at a waste dump site. Soil samples were collected from a depth of 0–30 cm in two designated zones, the top site and Dump-site, with ten samples collected (two from each zone). The physicochemical properties and concentrations of heavy metals, including lead (Pb), zinc (Zn), and cadmium (Cd), were analyzed. The results indicated significant differences ($p < 0.05$) in soil chemical properties, with levels ranked as dump-site > top-site. The concentration of metals at the dumpsite was ranked as follows: Fe > Pb > As > Zn > Cd, with iron (Fe) showing levels exceeding 30 mg kg−1, while the other heavy metals (As, Cd, Pb, and Zn) were below 0.55 mg kg−1. Significantly, the levels of heavy metal contamination across various sampling locations were within the permissible limits established by FAO/WHO. This study shows the necessity for regular monitoring and remediation of the dumpsite to ensure its safety for agricultural use.

NSPS-FUOYE-ES-012

PILOT STUDY OF SATELLITE-BASED AUGMENTATION SYSTEM IMPLEMENTATION IN THE WEST AFRICA SUB-SAHARAN REGION

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ABSTRACT

The ionosphere poses significant challenges to the accuracy and reliability of Global Navigation Satellite Systems (GNSS) and regional augmentation systems such as the Satellite-Based Augmentation System (SBAS), especially in safety-critical applications. These challenges are amplified in the Equatorial Ionization Anomaly (EIA) region, where phenomena like the fountain effect, steep ionospheric gradients, electron density crests, plasma bubbles, and diurnal and seasonal variability severely degrade system performance. Such disturbances often result in reduced accuracy and degraded service quality, particularly during heightened ionospheric activity. Current SBAS systems are not operational in the sub-Saharan region and face substantial limitations in addressing its unique ionospheric conditions. This study evaluates the potential of SBAS in the region by assessing ionospheric models, including the modified planar fit and Kriging methods, and employing advanced techniques such as the Modified Kriging multi-shell algorithms. The multi-shell Kriging model, with different weights, demonstrates superior capability in capturing the dynamic behaviour of the EIA region, accommodating diurnal and seasonal variations, and bounding residual errors effectively. The findings stress the potential of the multi-shell Kriging approach for SBAS applications in West Africa. This method significantly reduces errors, enhances service availability, and shows promise for safety-critical applications such as CAT-I civil aviation landing systems, making it a key step toward addressing the ionospheric challenges in the region.

NSPS-FUOYE-ES-013

INVESTIGATION OF THE GEOMAGNETIC STORMS' IMPACT ON LOW-LATITUDE IONOSPHERE: CASE STUDIES OF OCTOBER 2003 AND MARCH 2015 EVENTS

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ABSTRACT

Geomagnetic storms can significantly impact the Earth's upper atmosphere known as the ionosphere used for communication and navigation, particularly at low latitudes. This study examines the effects of two major geomagnetic storms on the low-latitude ionosphere that occurred during October 2003 and March 2015. In the analysis of the two events, data from NASA Space Physics data resources, Omni web, were analysed. Our analysis of the electron density, temperature, and ion composition data reveals significant disturbances in the ionosphere during both storms. The October 2003 storm caused a decrease in electron density and an increase in temperature, while the March 2015 storm had a more moderate impact. Our results highlight the importance of understanding geomagnetic storms' effects on the low-latitude ionosphere, particularly for mitigating their impacts on radio communication, navigation, and satellite operations. This study contributes to our understanding of geomagnetic storms' effects on the ionosphere and provides valuable insights for future research and applications.

NSPS-FUOYE-ES-014

DEVELOPMENT OF A PORTABLE SEISMOGRAPH FOR MONITORING BLAST INDUCED GROUND VIBRATION IN QUARRY SITES

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ABSTRACT

A seismograph is a device used to detect and record ground vibration in different occurrences of ground motion such as blasts from quarry. Buildings near quarry sites are being damaged due to their closeness to the quarry. It is also known as a ground motion detecting sensor, and a recording system make up a seismograph, a device for monitoring the movement of the earth. The development of a portable seismograph for monitoring blast-induced ground vibration in quarry is essential to calculate a safe distance from the shot. The developed seismograph was calibrated using a standard ABEM seismograph. It was tested and was able to detect the ground vibration in form of Peak Particle Velocity (PPV). It was deployed to the neighborhoods of IBM Impex Quarry at Afao – Ekiti, Ekiti State, Nigeria for data acquisition. It was positioned at a distance of 500m, 700m, 900m and 1000m from the point of the shot. The data were stored in the SD Card in Excel format for further analysis. The seismograph recorded the PPV components. The PPV measurements for the horizontal, vertical, and transverse axes were as follows: 86.883 mm/s, 86.843 mm/s, and 86.092 mm/s at 500 m; 65.872 mm/s, 65.193 mm/s, and 65.194 mm/s at 700 m; 30.356 mm/s, 30.378 mm/s, and 30.128mm/s at 900 and 22.666 mm/s, 22.578 mm/s and 22.668 mm/s at 1000m respectively. The results showed that, from 700m down to 500m and lower is not safe for residents because their PPV surpassed the acceptable threshold set out by the United States Bureau of Mines, which is 50.8mm/s. The PPV from 900m and above are lesser than the standard. This shows that the vicinity is safe. The developed seismograph is relatively cheap compare to the standard one and it is capable of acquiring horizontal, vertical, and transverse axes data at once.

NSPS-FUOYE-ES-015

ANALYSIS OF RADIONUCLIDE CONCENTRATION IN AKIRI ROCK, PLATEAU STATE, NIGERIA

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ABSTRACT

This research examines the concentration of radionuclides in Akiri Rock, situated in Plateau State, Nigeria. The study involved the collection of rock samples from Akiri Rock, which were then analyzed using gamma-ray spectroscopy to determine the activity concentrations of naturally occurring radionuclides such as uranium-238 (^{238}U), thorium-232 (^{232}Th), and potassium-40 (^{40}K). The results revealed that the activity concentrations of ^{238}U, ^{232}Th, and ^{40}K in Akiri Rock ranged from 40.76 ± 2.1 to 61.75 ± 3.5 Bq/kg, 48.72 ± 2.5 to 75.52 ± 4.2 Bq/kg, and 125.20 ± 20.5 to 657.30 ± 30.2 Bq/kg, respectively. Additionally, calculations were performed to determine the radium equivalent activity, absorbed dose rate, and annual effective dose to evaluate the potential radiation hazard associated with Akiri Rock. The findings suggest that the radiation levels in Akiri Rock fall within safe limits, indicating that the rock does not pose a significant radiation hazard to the environment or human health. Nevertheless, regular monitoring of radiation levels is recommended to ensure ongoing safety and protection of public health.

NSPS-FUOYE-ES-016

SEASONAL VARIATION IN THE CONCENTRATIONS OF RADIONUCLIDES IN SOME TIN MINING AREAS OF BARKIN LADI AREA OF PLATEAU STATE, NIGERIA

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ABSTRACT

Radionuclides are ubiquitous in the Earth's crust, emanating from natural radioactive series such as ^{238}U and ^{232}Th. Barkin Ladi Local Government Area, Plateau State, Nigeria, is a prominent tin and columbite mining zone, located on rugged terrain within the Younger Granites. Soil samples were collected in February (dry season) and July (wet season) to assess seasonal variations in radionuclide concentrations and analyzed using gamma-ray spectrometry. In February, the radionuclide concentrations were: ^{40}K (209.99±0.27 to 271.40±0.54 Bq/kg), ^{226}Ra (69.39±0.16 to 98.07±0.88 Bq/kg), and ^{232}Th (78.10±0.86 to 97.47±0.31 Bq/kg). In July, the concentrations decreased to: ^{40}K (184.74±0.36 to 208.07±0.08 Bq/kg), ^{226}Ra (65.96±0.40 to 78.42±0.76 Bq/kg), and ^{232}Th (75.64±0.98 to 86.46±0.94 Bq/kg), with average reductions of 11.40% (^{40}K) and 10.30% (^{232}Th). The ^{40}K levels were below the recommended limit of 412 Bq/kg, but ^{226}Ra and ^{232}Th exceeded the global averages of 33 Bq/kg and 45 Bq/kg, respectively. Soil pH, electrical conductivity (EC), and organic carbon (OC) ranged from 4.20–5.81, 397.07–697 µS/cm, and 0.69–1.21% in the dry season, and 5.55–6.42, 302.16–489 µS/cm, and 0.43–0.86% in the wet season. Elevated ^{226}Ra and ^{232}Th levels indicate pollution, particularly during the dry season, posing long-term cancer risks from accumulated radiation exposure. The area is radiologically unsafe for habitation.

NSPS-FUOYE-ES-017

RADIOMETRIC EVALUATION OF NATURALLY OCCURRING RADIONUCLIDES IN WATER BODIES AROUND DELTA STEEL COMPANY (DSC) AND ITS ADJOINING COMMUNITIES IN DELTA STATE, NIGERIA

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ABSTRACT

The radiometric evaluation of naturally occurring radionuclides in water bodies (river, drainage paths, and dredging sites) around Delta Steel Company has been carried out. The average activity concentration of (^{238}U, ^{40}K and ^{232}Th) in water samples collected from the three communities, are 3.64±0.82 Bql^{-1}, 59.04±3.96 Bql^{-1} and 1.44±0.10 Bql^{-1} respectively. Except for ^{238}U whose value is below the world's average value of 10 Bql^{-1}, the average activity concentration of the other radionuclides (^{40}K and ^{232}Th) is above the recommended values of 10 Bql^{-1} and 1Bql^{-1} respectively. This elevated values of ^{40}K and ^{232}Th, is attributed to leaching of steel wastes in the soil, carried by rain washouts into drainage paths and dredging pits within and around the company. The Radium equivalent (10.34 Bql^{-1}); External and Internal hazard index (0.027 $mSvy^{-1}$ and 0.038 $mSvy^{-1}$ respectively); Absorbed dose rate (5.06 $nGyh^{-1}$); Annual Effective Dose Equivalent (AEDE) (outdoor)(0.006 $mSvy^{-1}$) and Excess Life time Cancer Risk (ELCR) (0.022 $mSvy^{-1}$), are below their permissible limits recommended by UNSCEAR and ICRP). Therefore, the activity concentration of the naturally occurring radionuclides present in the water samples obtained have not been enhanced by the activities of the steel company and no immediate health risk is incurred on the populace.

NSPS-FUOYE-ES-018

ASSESSMENT OF THE LEVELS OF SOME POTENTIALLY TOXIC METALS IN ORGANIC MANURES FROM MAJOR REFUSE DUMPSITES IN PANKSHIN L.G.A OF PLATEAU STATE, NIGERIA

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ABSTRACT

This study assessed the physicochemical properties and concentration of heavy metals namely, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Cd and Pb in five (5) refuse dumpsite site manures in Pankshin Metropolis. Samples were collected using standard sampling methods and analysed using ICP-OES. Organic Carbon (OC) and Organic Matter (OM) were analysed using Walkley-Black method (revised in 2018), while the pH and electrical conductivity (EC) were determined using standard methods. The results obtained shows that Cd range from 187.77±0.00 to 333.46±0.00 mg/kg, Cr, from 450.97±0.04 mg/kg to 165.92±0.04 mg/kg, Ni form 67.56±0.02 to 2.71±0.06 mg/kg, Zn, form 721.17±0.01 to 3437.31±0.07 mg/kg, Mn from 1152.71±0.03 to 3458.83±0.15 mg/kg, Fe from 78891.00±1.74 to 163361.70±6.47 mg/kg, Cu from 111.08±0.02 to 442.98±0.05 mg/kg and As, from 10.62±0.07 to 27.80±0.06 mg/kg. The concentration of Pb ranged from 199.75±0.04 to 93.42±0.01 mg/kg while that of Co was 22.83±0.02 to 50.64±0.00 mg/kg. The risk assessment of the metals such as contamination factor (CF), pollution load index (PLI), Geo accumulation index (I-geo), Ecological risk factor (ErF) and Potential ecological risk factor (RI) of the metals, show a moderate to extremely contaminated soil. The results of the physicochemical parameters obtained were within the permissible limits specified by Food and Agricultural Organization and world health organisation (FAO & WHO, 2008), while the heavy metals content were above the limits specified by World Health Organization (WHO) and FAO for agricultural soils. The manures from these dumpsites are thus considered to be polluted with the heavy metalls suggestively emanating from a variety of sources ranging from metal scraps, plastics, pesticides, insecticides, automobile oils, paint containers, sewage effluents, combustion e.t.c. It is therefore recommended that the manure from these dumpsites should not be used for the cultivation of crops.

NSPS-FUOYE-ES-19

AIR QUALITY ASSESSMENT OF INDOOR AND OUTDOOR ENVIRONMENTS IN JALINGO METROPOLIS, NORTH-EASTERN NIGERIA

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ABSTRACT

This study assessed the air quality in Jalingo metropolis by measuring indoor and outdoor levels of carbon dioxide (CO_2) and carbon monoxide (CO) in various environments, including residential apartments, schools, offices, hotels, and churches. A Lutron Air Quality Meter was used for air quality measurements, with locations identified via GPS. The findings revealed the following mean concentrations of CO_2 and CO across different times of day: indoors, the morning levels averaged 502.73 ppm for CO_2 and 5.88 ppm for CO, while afternoon levels were 491.32 ppm and 4.69 ppm, and evening levels were 470.72 ppm and 4.07 ppm. Outdoors, the morning levels averaged 466.17 ppm for CO_2 and 3.65 ppm for CO, with afternoon levels at 455.41 ppm and 3.17 ppm, and evening levels at 446.05 ppm and 3.73 ppm, respectively. These values were evaluated against the acceptable limits recommended by the World Health Organization (WHO), which are 600 ppm for CO_2 and a range of 1-70 ppm for CO. While CO levels were within acceptable limits, recommendations for improving indoor air quality include regular cleaning and maintenance of air-conditioning systems. Public awareness campaigns are also suggested to enhance community understanding of air pollution risks and mitigation practices.

NSPS-FUOYE-ES-20

THE INTEGRATION OF 2D AND 3D ELECTRICAL RESISTIVITY TOMOGRAPHY FOR LITHOLOGICAL VARIATION FORMATION IN EKHOR COMMUNITY, EDO STATE, NIGERIA

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ABSTRACT

One of the geophysical methods that is widely employed to investigate the complexity of the subsurface structures or features in sedimentary terrain is electrical resistivity method, this research employed integration of 2D and 3D electrical imaging models with the aim to map out geologic variations which includes the subsurface lithology formation in Ekhor communityarea of Edo state. This research is necessary to evaluate subsurface geological characteristics so as to forestall any future collapse via engineering infrastructure failures in the community. Ten 2D geolectrical resistivity traverses acquired in the study area generated ten 2D resistivity models using Earth Imager 2D software, which were used to delineate the geometry for both lateral and vertical variations using Wenner array with electrodes spread of 200m. A 3-D block inverted model showing top and bottom view and five horizontal and vertical depths slice layers were also generated to delineate the subsurface stratification. These models were possible through the compilation of 2D dataset into a 3D data set and inverted using Res3Dinv software and Voxler 4.0 programs. All ten traverses of the 2D resistivity imaging revealed almost the same geo-electric layers from the top soil down to the depth of 29.9m. This suggested to be lateritic in nature due to its high resistivity values (between 450 Ωm and 1300 Ωm) and below this depth is the signature of low resistivity value which is denoted by the black cycle and this is corresponds to the conductive parts which are the anomaly points in the study area. The 3D model, horizontal and vertical depth slice generated revealed more detail of the five lithological layers with different resistivities values within the study area. However, the integration of 2D and 3D ERT models has successfully revealed the lithological variation within the subsurface in the study area.

GROUP C: COMPUTER SCIENCES-NSPS-FUOYE-CS

NSPS-FUOYE-CS-001

ENHANCED MACHINE LEARNING MODEL FOR CLASSIFICATION OF THE IMPACT OF TECHNOSTRESS IN COVID AND POST COVID ERA

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ABSTRACT

The global crisis caused by the coronavirus outbreak and other diseases has brought many changes to people's daily lives, work, office, school, etc., forcing people and organizations to adapt to their different developments in the dynamic of virtuality. These devices lead to reactive disease induced by the inability to deal with information in a healthy way with computer technologies. This study seeks to model a system that uses a Random Forest Algorithm for prediction and classification using age, gender, hours spent, and technological experiences of an individual as its parameters the system should classify stress based on high, moderate, and low stress. Segmented our data collection into two sections, the first is through the questionnaire to carry out a proper analysis of technostress, based on the impact or stress that is incurred while using technology during COVID-19 and post-COVID era. To obtain a sample of respondents knowledgeable on the subject and to be able to respond to the questionnaire; a non-probabilistic sample was used. In classifying the impact of technostress, RF is classified accurately. The emphasis was on determining how well the prediction and classification will be if a user has low or high stress. The work applies RF to classify gender based on the dataset and the technology in each case, the accuracy of the classification was 90%, which implies that RF is efficient in the classification process. Nevertheless, an interactive user interface was developed to aid the evaluations of the impact of technostress on technology use and hours spent on technology.

NSPS-FUOYE-CS-002

SMART COMMUNITIES: ENHANCING LOCAL PROCESSES THROUGH ARTIFICIAL INTELLIGENCE AND QUALITY OF LIFE

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ABSTRACT

The rapid growth of urban populations necessitates innovative solutions to address urban challenges. Smart Community is one of the innovative solutions in which local processes could be enhanced through the potential of AI because, it can optimize the resource allocation, improve citizen engagement, and foster sustainable development. This study explores the transformative potential of Artificial Intelligence (AI) in enhancing local processes and quality of life in Smart Communities. A mixed-methods approach, combining surveys, case studies, and interviews are used to investigating the AI's impact on the quality of life indicators, citizen participation, and local process efficiency. The paper looks into the integration of AI-driven solutions in transportation, public safety, energy management and healthcare in the smart communities. The findings reveal that there are significant improvements in crime reduction, transportation efficiency, and energy consumption, highlighting the critical role of community engagement and effective data management. This research contributes to the development of a comprehensive framework for AI-driven Smart Community development, informing policymakers, urban planners, and community leaders on the use of AI in creating more liveable, sustainable, and responsive cities.

NSPS-FUOYE-CS-003

A GRID-BASED SECTORING FOR ENERGY-EFFICIENT WIRELESS SENSOR NETWORKS

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ABSTRACT

Extending the network lifetime of Wireless Sensor Networks (WSNs) while meeting user needs is crucial, given the limited energy capacity of nodes and their tendency to deplete energy quickly. Clustering is an effective strategy for prolonging network lifetime by reducing energy overhead in data transmission. In this approach, sensor nodes are organized into clusters to minimize energy consumption and prevent signal attenuation. Within each cluster, non-cluster head nodes send data to the cluster head (CH), which then forwards the information to the sink. However, selecting CHs poses a challenge; an inadequate randomization process can lead to uneven energy consumption across the network. This research addresses this issue by grouping nodes into square grid clusters based on data volume and employing a routing algorithm to randomize CH selection. MATLAB 2023a was used to design the network and implement the algorithm. Results indicate that the proposed method enhances network lifetime and balances energy consumption across clusters, with increased transmission rounds contributing to improved performance.

NSPS-FUOYE-CS-004

Enhanced Priority-Based Congestion Detection and Avoidance (E-PCDA) Algorithm for Wireless Sensor Networks: Design, Implementation, and Performance Evaluation

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ABSTRACT

Congestion in Wireless Sensor Networks (WSNs) occurs when the traffic load offered to a node exceeds its capacity, leading to increased packet drop rates, higher delays, and reduced throughput. This congestion problem adversely affects the Quality of Service (QoS) in WSNs, necessitating effective congestion management to ensure optimal performance. Current research reveals significant differences in congestion detection, notification, and control mechanisms, highlighting a need for more effective solutions. This paper addresses these challenges by proposing an Enhanced Priority-based Congestion Detection and Avoidance (E-PCDA) algorithm. The E-PCDA algorithm introduces a novel approach to congestion control by leveraging queue-based congestion detection and prioritization strategies. The primary aim of this algorithm is to minimize performance degradation during congestion events and to maximize the successful delivery of priority packets (Hp) to the sink. To evaluate the effectiveness of the E-PCDA algorithm, we employed a comprehensive simulation and queueing modeling methodology using the NS-2 network simulator. Our research includes the implementation and comparative evaluation of the E-PCDA algorithm against existing congestion control protocols. Simulation results demonstrate that the E-PCDA algorithm significantly outperforms traditional methods in key performance metrics, including throughput, end-to-end delay, and residual energy. The findings underscore the effectiveness of the E-PCDA algorithm in improving network performance and QoS in WSNs. By enhancing congestion detection and prioritizing packet delivery, the proposed algorithm provides a robust solution to the congestion challenges faced in modern wireless sensor networks. Future work will focus on further refining the algorithm and exploring its application in diverse network scenarios.

NSPS-FUOYE-CS-005

IMPACT OF HYBRID RECOMMENDATION SYSTEM ON E-COMMERCE

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ABSTRACT

Recommender system is an artificial intelligence algorithm usually associated with machine learning that uses big Data to suggest products to consumers. Hybrid recommendation system which combines the strength of different traditional recommendation systems have emerged a promising solution to overcome the limitations of the traditional systems. This research paper explores the impact of hybrid recommendation system on e-commerce, focusing on the different techniques and approaches used. We also highlight the advantages and challenges of using hybrid recommender systems in e-commerce. Furthermore, we discuss the evaluation metrics used for measuring the performance of hybrid recommendation system and identify the research gap and future directions in this field.

NSPS-FUOYE-CS-006

ENHANCING LOCAL PRODUCTIONS THROUGH SMART MANUFACTURING AND INDUSTRY FOR SUSTAINABLE AND EQUITABLE FUTURE IN NIGERIA

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ABSTRACT

This paper explores how smart manufacturing, driven by technologies like AI, IoT, cloud computing, and cybersecurity, can transform Nigeria's industrial sector. AI enables predictive maintenance and data-driven decision-making, boosting efficiency and reducing downtime. IoT enhances real-time monitoring and connectivity, while cloud computing provides affordable, scalable data infrastructure for small and medium-sized enterprises. Cybersecurity ensures data protection in increasingly interconnected environments. Together, these technologies can increase local production competitiveness, reduce reliance on imports, and promote self-sufficiency. Additionally, smart manufacturing supports sustainable development by reducing waste, lowering carbon emissions, and creating inclusive job opportunities. The paper argues that adopting these innovations is crucial for a sustainable, resilient, and equitable future for Nigeria's industry.

NSPS-FUOYE-CS-007

ADAPTIVE HYBRID OPTIMIZATION TECHNIQUES FOR ENHANCED BACKPROPAGATION NEURAL NETWORKS IN IMAGE CLASSIFICATION

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ABSTRACT

This study enhances Backpropagation Neural Networks (BPNNs) for image classification by integrating adaptive learning rates with novel optimization techniques like AdaGrad and Particle Swarm Optimization (PSO). Traditional BPNNs often struggle with slow convergence and local minima; our hybrid algorithm addresses these challenges by dynamically adjusting learning rates based on accumulated gradients, thus improving convergence speed and model accuracy. We implement a comprehensive framework, including data preparation, chaotic weight initialization, and gradient calculations, to evaluate the model using accuracy, precision, recall, and F1 score. Preliminary results suggest our model exceeds 95% accuracy and shows faster convergence and superior generalization compared to baseline models. This research contributes to optimizing BPNNs, enhancing their utility in fields like computer vision and autonomous systems by developing more efficient training methodologies.

NSPS-FUOYE-CS-008

DETECTION OF BRAIN TUMORS FROM A COMPUTED TOMOGRAPHIC (CT) - MAGNETIC RESONANCE IMAGERY (MRI) USING SEGMENTATION DEEP LEARNING TECHNIQUE

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ABSTRACT

The leading cause of cancer death in children and adults under 40 is brain tumor. A primary brain tumor affects more than 12,000 individuals a year, including 500 children and teenagers; that's 33 people every day. Brain imaging technology continues to be at the forefront of developments in both comprehension of the brain and the capacity to identify and treat brain diseases and illnesses. The automated triage of imaging scans using computer algorithms has the potential to identify brain tumors earlier with high degree of precision and accuracy thereby improving therapeutic outcomes. In this study, we propose the use of hybrid segmentation model known as SegUnet which has the capacity to address the issue of small size tumors getting lost during down sampling to train an MRI-CT cross modality dataset. In addition to this, we research on the effectiveness of filter size in the segmentation of medical images. However, we implemented three different SegUnet model with modification on filter size. We employed size 2, 3 and 4 to test the efficiency of filter on medical image segmentation. The report of the result shows that the model with filter size of 2 and size of 3 almost have the same evaluation results in terms of mean pixel accuracy, global accuracy, IOU and frequency weighted IU while model with filter size of 4 is relatively lesser in metrics compared to the others. Also, looking closely at the training and loss plot of the respective filters it could be noted that the model of filter size 3 loss plot was stable and decreases steadily while the others are in zig-zag pattern or better put as unstable. Thus, we conclude that our model with filter size of 3 performed better compared to the other two models and model in terms of generalization as we used two different image modalities for the training of our model.

NSPS-FUOYE-CS-009

CLASSIFICATION OF STUDENT ASSESSMENT MODE FROM LEARNING ATTRIBUTES USING MACHINE LEARNING

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ABSTRACT

The growing need to apply machine learning methods in educational data analysis in institutions has created a dimension for understanding student academic performance and effectively utilizing best assessment strategies. The research x-rayed multi-class classification of learners course assessment modes which includes, assignments, examinations, projects, quiz and group work based on learning characteristics which consist of participation in class, Grade Point Average, Age and study hours. The study determined the performance of machine learning classifiers: decision trees, random forests, Support Vector Machines, Logistic regression, AdaBoost, Gradient Boosting, and Multinomial Naïve Bayes are evaluated for effectiveness in student course assessment modes with respect to their learning attributes. Decision tree and random forest out-performed all other classifiers. The classifiers were evaluated specifically based on the following evaluation metrics: accuracy, precision, recall and F1-score. Decision tree and random forest achieved same result given as: accuracy 0.91, F1-score 0.93, precision 0.95 and recall 0.90. Gradient Boost got accuracy 0.77, F1-score 0.79, precision 0.88 and recall 0.71. K-Nearest neighbor achieved accuracy of 0.70, F1-score 0.76, precision 0.76 and recall 0.76. Support Vector Classifier had accuracy 0.34, F1-score 0.47, precision 0.62 and recall 0.38. Logistic Regression achieved accuracy 0.34, F1-score 0.36, precision 0.71 and recall 0.24. While Multinomial Naïve Bayes attained accuracy 0.30, F1-score 0.17, precision 0.67 and recall 0.10. Gaussian Naïve Bayes got the poorest output with accuracy 0.09, F1-score 0.00, precision 0.00 and recall 0.00. From the result it shows that decision tree and random forest classifiers are robust and reliable in multi-class classification tasks.

NSPS-FUOYE-CS-010

WEATHER PREDICTION USING MACHINE LEARNING: A COMPARATIVE STUDY OF XGBOOST, CNN, LSTM, AND RNN MODELS

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ABSTRACT

Accurate weather prediction is fundamental to innumerable sectors, from farming to emergency management, from power management to regular activities. This research focused on the effectiveness of eXtreme Gradient Boosting (XGBoost), Convolutional Neural Network (CNNs), Long Short-Term Memory (LSTMs), and Recurrent Neural Network (RNNs) in accomplishing high precision weather prediction tasks. Using a dataset with eight meteorological variables, models were trained and tested against standard performance metrics which included temperature values (mean, maximum and minimum), humidity, cloudiness, precipitation, global solar irradiation and sunshine. The XGBoost ensemble model and CNN model performed the best with an accuracy of 97% each, followed by LSTM and RNN which both performed at (96%). While XGBoost was relatively balanced on both precision and recall, overtaking others, this made it the best candidate for imbalanced datasets. The most crucial predictors of weather patterns are temperature and precipitation, according to feature importance analysis. Correlation analysis suggests that global radiation, sunshine, and temperature are closely related features, and that they are extremely important variables in weather forecasting. The confusion matrices for all models indicate that all models obtained high true positive rates. This research exemplifies that DL approaches are effective for weather forecasting. While deep learning models like LSTM and CNN leverage their ability to capture temporal dependencies and spatial features, XGBoost's model approach balances computational efficiency and accuracy, making it an excellent choice for this application. Future modeling studies may look at hybrid models that unify the features of these models to further extend their application.

NSPS-FUOYE-CS-011

CHALLENGES OF SECURING ARTIFICIAL INTELLIGENCE-POWERED SYSTEMS FROM CYBER THREATS : CASE STUDY OF AUTONOMOUS VEHICLES

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ABSTRACT

The Integration of Artificial intelligence (AI) into various sectors including transportation has a significant impact on human endeavors, in addition to eco-friendly advantages. One of the most promising areas of AI-powered systems is the manufacture of Autonomous Vehicles (AVs). These self-driving cars, also known as driverless are intelligent vehicles that can operate without human aid or support. AVs are equipped with sophisticated AI-powered technologies such as sensors, radars, Global Positioning System (GPS) and advanced algorithms that can transmit information and navigate the environment using analyzed data. These driverless cars have the potential of revolutionizing the transport sector by improving efficiency, reducing road accidents, improving flexibility and decreasing congestion. However, AI in AV applications poses some risks and challenges associated with securing systems from cybersecurity threats and attacks. This paper explores the dangers and difficulties of securing AI systems from cyber threats, highlighting various detection and prevention mechanisms. The ethical and legal implications, including strategies to address these challenges proactively are also discussed. It is believed that the challenges in the automotive industry can be mitigated through collaboration among stakeholders, manufacturers, researchers, IT professionals, and policymakers by implementing robust security measures, conducting regular vulnerability assessments, and leveraging the expertise of software security specialists. Collaboration between industry and cybersecurity professionals is essential to safeguarding public safety.

NSPS-FUOYE-CS-012

Optimizing Energy Efficiency in IoT Networks for Sustainable Smart Cities: A Focus on Advanced Protocols

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ABSTRACT

As the development of smart cities progresses, there is an increasing need for IoT networks that are efficient, scalable, and sustainable. The challenges of energy consumption associated with IoT devices and their communication infrastructure becomes more pronounced as the number of connected devices rises. This study investigates sophisticated energy-efficient protocols aimed at enhancing the performance and sustainability of IoT networks within smart cities. It analyzes various categories of protocols, including network-layer, MAC-layer, and cross-layer protocols, emphasizing their capabilities for energy conservation. Notable protocols such as Low-Energy Adaptive Clustering Hierarchy (LEACH), Routing Protocol for Low-Power and Lossy Networks (RPL), and Constrained Application Protocol (CoAP) are examined for their effectiveness in minimizing energy usage while ensuring the operational efficiency of IoT systems. The paper also identifies the significance of advanced protocols in fulfilling the sustainable development objectives in smart cities. In conclusion, the paper delves into various emerging technologies like AI-driven optimization, edge computing, energy harvesting and their potential to further improve energy efficiency were discussed.

NSPS-FUOYE-CS-013

MITIGATING MAC FLOODING ATTACKS USING PORT SECURITY TECHNIQUES

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ABSTRACT

In today's interconnected digital landscape, network security is paramount, particularly for Local Area Networks (LANs) that are increasingly vulnerable to MAC flooding attacks. These attacks exploit vulnerabilities in network switches, compromising network integrity and privacy. This study aims to explore the effectiveness of port security mechanisms in mitigating MAC flooding threats through a practical simulation using Packet Tracer. The simulation setup includes a switch, two authorized computers, and one unauthorized computer, with a strict limit of one MAC address allowed per port. Shutdown violation is set whenever the switch port learn more than 1 MAC address to avoid MAC flooding. The findings reveal that the implementation of MAC address limiting effectively prevents the learning of additional MAC addresses, thereby safeguarding the network from potential flooding attacks. When the maximum MAC address limit is reached, the port is shutdown as set in the violation mode. This research underscores the critical importance of proactive security measures in maintaining network integrity and provides valuable insights for network administrators seeking to enhance their security protocols.

NSPS-FUOYE-CS-014

ADAPTIVE DEFENCE MECHANISMS FOR DYNAMIC ADVERSARIAL ENVIRONMENTS: A MULTI-AGENT SIMULATION STUDY

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Abstract

As cyber-attacks advance with more sophistication, conventional static security methods become increasingly insufficient. This paper introduces an innovative approach for examining adaptive defensive mechanisms in dynamic adversarial settings using multi-agent simulation. We provide a detailed simulation environment that replicates intricate interactions between advanced defensive systems and developing attack techniques. The system integrates reinforcement learning-based defenders who perpetually adjust their methods according to observed adversarial patterns, while concurrently simulating attackers that modify their tactics in reaction to defensive actions. Our research reveals that adaptive defensive mechanisms attain a 27% superior threat detection rate and a 34% reduced false positive rate relative to conventional static defences when confronted with fresh attack patterns. Our findings also indicate the emergence of defensive techniques that demonstrate significant resilience against novel attack vectors. The simulation framework yields significant insights into the dynamics of attacker-defender interactions and serves as a testbed for enhancing security systems. These findings have substantial implications for the development of next-generation cybersecurity systems, especially in contexts where threats rapidly adapt and conventional signature-based methods are inadequate.

NSPS-FUOYE-CS-015

AN ANDROID MALWARE DETECTION USING RANDOM FOREST ALGORITHM

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ABSTRACT

The proliferation of mobile devices and their dependence on the Android OS has made them prime targets for cybercriminals, leading to an escalating threat of malware. This study addresses the growing need for effective malware detection methods by exploring the application of machine learning (ML) techniques to enhance the security of Android devices. Specifically, the research investigates the performance of various ML algorithms, with a focus on Random Forest, in detecting malware on the Android platform. Through comprehensive analysis and experimentation, the study demonstrates significant improvements in detection accuracy, achieving a near-perfect 0.99 across key performance metrics, including accuracy, recall, precision, and F1-Score. These results highlight the potential of ML to revolutionize Android OS malware detection, offering robust, real-time protection against evolving threats while minimizing the impact on device performance. The findings contribute valuable insights for cyber security practitioners, mobile app developers, and researchers, paving the way for more secure mobile environments and advanced malware detection systems.

Keywords: Android, Random Forest, Malware, Mobile Device, Detection

GROUP D: PHYSICS AND ASTRONOMY-NSPS-FUOYE-PA

NSPS-FUOYE-PA-001

ESTIMATING THE THERMODYNAMIC PROPERTIES OF SOME DIMERS USING THE SHIFTED STATIC SCREENED COULOMB POTENTIAL

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ABSTRACT

We were able to solve the Schrodinger equation which contain a shifted static screened Coulomb potential (SSSCP) analytically by applying the Nikiforov-Uvarov technique by utilizing a fitting approximation technique to facilitate molecular motion. Molecular data of some dimers (I_2, H_2, N_2, O_2), were used in order to obtain energy spectral corresponding to *n* and *l* quantum numbers. The dimers' energy eigenvalues are dependent on quantum numbers. A unique case of Yukawa potential and Coulomb potential were derived. likewise way, the partition function, along with thermodynamic properties including vibrational mean U, specific heat C, free energy F, and entropy S, was determined within the acceptable classical limits of energy eigenvalues. The results obtained are temperature dependent.

NSPS-FUOYE-PA-002

A DFT STUDY OF ELECTRONIC AND OPTICAL PROPERTIES OF Rb2SeX6 (X = Cl, Br) DOUBLE PEROVSKITES UNDER HYDROSTATIC PRESSURE

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ABSTRACT

Double perovskites are used in a variety of applications and at different pressures. Electronic and optical properties of Rb_2SeX_6 (X=Cl, Br) double perovskites were studied under hydrostatic pressure (0 - 8 GPa) using a plane wave basis set of Quantum ESPRESSO algorithm. The exchange correlation functional used was Perdew-Burke-Ernzerhof for Solids (PBE-Sol) with generalised gradient approximation (GGA). The materials' band gap values drop under hydrostatic pressure. Rb_2SeCl_6 has a band gap of 2.44 eV at 0 GPa and 2.21 eV at 2 GPa. Above 2 GPa, Rb_2SeCl_6 is metallic in character. Rb_2SeBr_6 has a band gap value of 1.56 eV at 0 GPa, but has a metallic character under hydrostatic pressure (2 – 8 Gpa). The static values of refractive index and reflectivity are found to increase with increase in hydrostatic pressure. Also, values of optical conductivity, absorption, reflectivity and refractive index increases with increase in hydrostatic pressure. The optical characteristics results indicate that the materials have maximum absorption, high reflectivity, low optical loss in the visible and ultraviolet ranges, good optical conductivity, and a refractive index appropriate for opto-electronic applications.

NSPS-FUOYE-PA-003

Di-layers Satellite Electronic Shielding System (DiLSES): Fabrication and Characterisation

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ABSTRACT

Satellites in space are vulnerable to high-energy electrons above 1 MeV that can damage their electronic systems. To combat this issue, we introduce the Di-layer Satellite Electronic Shielding System (DiLSES), featuring an innovative di-layered composite material made from L/(DF-H) in LH and HL configurations. This advanced material showcases exceptional toughness with impact strength of 0.6498 J/mm, a hardness of 75.4 Hv, and a tensile strength of 23.5 MPa, making it highly resistant to launch vibrations and debris. It remains stable at high temperatures, enduring up to 300°C and gradually decomposing between 400°C and 500°C. For radiation shielding, it effectively reduces gamma radiation by 17.71% for Co-60 and 8.74% for Cs-137, with the LH configuration offering superior protection. Impressively, it attenuates high-energy electrons and photons by over 93%, achieving a remarkable 98.24% reduction at 10 MeV. This innovative material has the potential to vastly improve satellite durability and reliability while providing lightweight, cost-effective shielding solutions.

NSPS-FUOYE-PA-004

SEISMIC FEATURES AND THEIR CLASSIFICATION IN DETECTING RESERVOIR CHARACTERIZATION IN AN ACQUIRED SEIMIC REFLECTION DATA

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ABSTRACT

The concept of seismic features or attributes usually derived from seismic reflection data in order to give a clearer picture and images of subsurface occurrences. The various attributes computed from the original seismic section including Signal envelope, instantaneous phase, instantaneous frequency, semblance, coherence, dip features, curvature, relative & absolute impedance inversion, have been discussed together with illustrative sections showing what each attribute depicts. Unlike the application of the conventional method which is acoustic impedance to derive quantitative reservoir characterization is associated with missing low-frequency band during the computation. This study has revealed the combination of the concept of Meta-Attributes with a number of seismic attributes to detect faults, fractures, & gas chimneys, and also by combining the predicting power of the various inputs attributes using artificial neural network (ANN). Also, the study has explained why relative impedance inversion is the best features used practically for reservoir characterization and how it has able to overcome missing low-frequency band, however, the application of an integration of Meta-attribute with multi-attributes using an artificial neural network (ANN) has able to provide conclusive definitive information about the occurrence in any reservoir that can be investigated in the Niger-Delta.

NSPS-FUOYE-PA-005

EFFECT OF DEFORMATION ON ALPHA DECAY OF SUPER-HEAVY NUCLEI WITHIN A WOODS-SAXON MODEL

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ABSTRACT

In this research, alpha decay study of super-heavy nuclei have been carried out by employing the Woods-Saxon model potential. The spherical and deformed Woods-Saxon model have been employed to investigate the effect of deformation on the super-heavy nuclei via alpha decay. When compared with experimental data, the two models are found to perform very well in describing the experimental half-life data. Moreover, results obtained by considering deformation is found to give better agreement with the experimental data than the results using spherical configuration. This is mainly because the super-heavy nuclei have non-zero deformation parameter. The study concludes that deformation should be considered when studying super-heavy nuclei, and that the deformed Woods-Saxon model is more complete in describing the interaction between the alpha decay and the daughter nuclei.

NSPS-FUOYE-PA-006

WIRELESS MULTI-HOP QUANTUM TELEPORTATION UTILIZING A 4-QUBIT CLUSTER STATE

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ABSTRACT

This paper proposes a quantum routing protocol using multi-hop teleportation for wireless mesh backbone networks. After analyzing the quantum multi-hop protocol, a four-qubit cluster state is selected as the quantum channel for the protocol. The quantum channel between intermediate nodes is established through entanglement swapping, utilizing the four-qubit cluster state. Additionally, both classical and quantum routes are created in a distributed manner. It has been demonstrated that quantum information can be teleported hop-by-hop from the source node to the destination node. Successful quantum teleportation occurs when the sender performs Bell state measurements (BSM), while the receiver introduces auxiliary particles, applies a positive operator-valued measure (POVM), and uses a corresponding unitary transformation to recover the transmitted state. The success probability of quantum state transfer has been analyzed. It was discovered that the optimal success probability is achieved when $\tau_{2|1} = \frac{1}{\sqrt{2}}$. The numerical results show the susceptibility of P_{suc} to the number of hops N. These findings indicate that multi-hop teleportation using distributed wireless quantum networks with a four-qubit cluster state is feasible.

NSPS-FUOYE-PA-007

URBAN HEAT ISLAND AND CLIMATE VARIABILITY IN LAFIA AND ITS ENVIRON: SATELLITE IMAGERY APPROACH

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ABSTRACT

This study investigates the urban heat island (UHI) effect in Lafia, a tropical city located at latitude 8.50°N and longitude 8.49°E, using remote sensing techniques. The UHI phenomenon, characterized by increased temperatures in urban areas compared to their rural surroundings, was analyzed through land surface temperature (LST) variations derived from Landsat satellite images. Landsat 8 images from 2013 to 2023 were employed to evaluate temporal changes in LST and detect spatial patterns of heat concentration across the city. The thermal infrared spectral bands were used to calculate LST, and Normalized Difference Vegetation Index (NDVI) and Normalized Difference Water Index (NDWI) were calculated using the near-infrared and shortwave infrared bands. The study found significant variations in temperature between urban and rural areas, with urban zones exhibiting higher LST due to factors such as decreased vegetation and increased built-up surfaces. The NDVI analysis revealed areas with sparse vegetation contributing to elevated heat levels, while NDWI analysis highlighted the role of water bodies in mitigating temperature increases. The results confirm the presence of an urban heat island effect in Lafia, with clear implications for urban planning and sustainability. The research underscores the importance of incorporating green spaces and water bodies to reduce the UHI effect and improve urban climate resilience in tropical cities like Lafia.

NSPS-FUOYE-PA-008

ENHANCING SIGNAL LOSS PREDICTION IN URBAN MACRO ENVIRONMENTS: A HYBRID APPROACH INTEGRATING EXPONENTIAL FUNCTIONS AND LSTM MODELS

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ABSTRACT

In this paper, a novel hybrid model is proposed for signal loss prediction in Urban Macro (UMa) environments. The model combines the strengths of Long Short-Term Memory (LSTM) networks and exponential functions (EXP) to address limitations in both approaches. The exponential function captures the general trend of signal loss in UMa environments, while the LSTM network learns complex underlying temporal patterns in the data. The proposed hybrid model is evaluated using real-world data collected from drive tests in Port Harcourt, Nigeria. The results show significant improvements over the standalone EXP and LSTM models, achieving a 48% reduction in Mean Squared Error (MSE) compared to the EXP model and a 73% reduction compared to the LSTM model on unseen testing data. This underscores the strength and superiority of the hybrid approach over conventional signal loss models in UMa environments.

NSPS-FUOYE-PA-009

STUDYING THE INFLUENCE OF CHITOSAN SURFACE COATING ON THE CHARACTERISTICS OF ZINC-FERRITE NANOSTRUCTURES PREPARED USING SOL-GEL AUTO COMBUSTION METHOD FOR BIOMEDICAL PURPOSES

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ABSTRACT

The sol-gel auto combustion technique was used to process zinc ferrite nanoparticles in this research, with chitosan serving as the capping material. To confirm the physicochemical properties of the materials, various techniques were employed to characterize the obtained nanoparticles. By employing X-ray diffraction microscopy, the materials' crystallinity was established. The size of the crystallites obtained is in the range of nanometers. The materials' micrograph was determined by SEM. By utilizing FTIR, the functional groups in the materials were identified. UV-visible spectroscopy was employed to measure the material's absorbance and detect a Surface Plasmon Resonance (SPR) peak within the 250-380 nm range. By employing a vibrating sample magnetometer, the magnetic properties were determined. The transition from paramagnetic to superparamagnetic behavior was observed, allowing for potential use in biomedical applications. It is noteworthy that the obtained properties are highly enhanced for biomedical applications.

NSPS-FUOYE-PA-010

RADON: A BENEFICIAL RADIOACTIVE GAS IN THE FIELD OF GEOSCIENCES

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ABSTRACT

Radon, a naturally occurring radioactive gas, has long been known for its health risks in enclosed environments, particularly as a contributor to lung cancer. However, in the field of geoscience, radon has gained attention for its significant benefits in various applications. This paper explores the beneficial uses of radon in geoscience, focusing on its role in understanding geological processes, earthquake prediction, groundwater exploration, and soil gas studies. Although the health risks of radon are well documented, its positive impacts on environmental science and geotechnical investigations are becoming more prominent.

NSPS-FUOYE-PA-011

QUASIPARTICLE BAND STRUCTURE OF GERMANENE/ZNO HETEROSTRUCTURE FOR NEAR INFRARED PHOTODETECTOR AND SOLAR CELL APPLICATIONS: A G0W0 CALCULATION

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ABSTRACT

In this paper, highly accurate first-principles many-body perturbation theory method was used to evaluate the structural and electronic properties of novel germanene/ZnO heterostructure. The results demonstrate that the lattice constants of the Germanene/ZnO heterostructure are in good agreement with previous findings. According to the energy analysis of the germanene/ZnO heterostructure, the configuration with the Zn or O atom of ZnO facing germanene above the germanene hole center is the most stable. Also, the stability of Germanene/ZnO with an interlayer distance of 3.0 Å is greater than that of the other germanene/ZnO heterostructures with similar construction. The predicted GW band gap of the ZnO monolayer was found to be 3.79 eV, which is consistent with the experimental result of 3.80 eV. The quasiparticle (QP) band gaps of germanene/ZnO heterojunction were found to be 0.0, 0.60, 0.59, 0.4 and 0.1 eV for interlayer distances of 2.0, 3.0, 3.5, 4.0, and 4.5 Å respectively. These findings gave a tremendous impact since a noticeable energy ban gap in germanene was created in the presence of ZnO sheet and this consequently leads to the pathways of assembling a variety of applications with the semiconductor-like properties of germanene. Our results suggested that germanene/ZnO heterostructure could be a promising candidate for near infrared photodetector and solar cell applications.

NSPS-FUOYE-PA-012

APPLICATION AND IMPACT OF NANOTECHNOLOGY IN SOLAR CELLS FOR HUMAN DEVELOPMENT

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ABSTRACT

Energy is a fundamental demand for humankind. With increases in technological advances, the demand for energy is rapidly increasing, new renewable energy technologies in a variety of shapes and forms are developing daily. Nanotechnology has the potential to significantly extend the lifespan and capacity of sunlight-based energy sources while also helping to address current efficiency challenges. A variety of real cycles that can be applied to the management and transfer of solar energy have been mapped out at the nanoscale. A further era of better execution items has been made possible by the application of nanotechnology in sun-oriented cells. In light of the intensifying competition for sustainable energy options, a range of different approaches have been investigated in order to expand the options. In the areas of sun-oriented cell age, multi-age, range adjustment, thermo-photoelectric cells, hot transporter, centre band, and many other techniques, new standards have been researched. It has been demonstrated that nanoparticles and nanostructures can improve. For the purpose of producing significant amounts of power on a wide scale, today's solar cells are just too expensive to manufacture and too inefficient. On the other hand, possible developments in nanotechnology might make it possible to produce solar cells that are somehow more efficient and less expensive. In the solar industry, nanotechnology has already demonstrated enormous advancements. They are an entirely different kind of solar cell from anything you could have imagined. While solar cell performance may be improved via nanotechnology, which can be the most promising use to the environment.

NSPS-FUOYE-PA-013

APPLICATION OF NANOTECHNOLOGY IN RENEWABLE ENERGY

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ABSTRACT

The great technological challenges in 21st century is the development of renewable energy technologies due to serious problems related with the generation and use of energy. Nanotechnologies area of research considered nowadays as one of the most recommended choices to solve this problem. The aim of this review is to introduce several significant applications of nanotechnology in renewable energy systems. Papers reviewed were Desk (theoretical) research works only related with nanotechnology applications in solar, hydro, wind, biomass, and geothermal. A lot of literatures were reviewed and summarized carefully in a useful tables to give an overview about the role of nanotechnology in improving the various sources of renewable energies. This paper can be considered as an important bridge between nanotechnology and all available kinds of renewable energies. From the other side, these researches study the effect of nanotechnology to enhance the renewable energy industry especially in solar, hydro, wind, biomass, and geothermal.

NSPS-FUOYE-PA-014

RECEPTOR MODELING OF SIZE-SEGREGATED PARTICULATE MATTER IN A SMELTING FACTORY ENVIRONMENT IN ILE-IFE, SOUTHWESTERN NIGERIA

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ABSTRACT

The samples of $PM_{2.5}$ and $PM_{2.5-10}$ particles were collected around smelting factory and analyzed for the elemental and black carbon content using x-ray fluorescence spectrometer and optical transmissometer. The average mass concentrations were 216.26 μg/m^3 for $PM_{2.5}$ and μg/m^3 for $PM_{2.5-10}$. The same data set were used as input for the Positive Matrix Factorization (PMF), receptor modeling in order to identify the possible sources of particulate matter and their contribution. The PMF resolved four sources with their respective contributions were metal processing (33 %), e-waste (33 %), diesel emission (22 %) and soil (12 %) for $PM_{2.5}$, and coking (50 %), soil (29 %), metal processing (16 %) and diesel combustion (5 %) for $PM_{2.5-10}$. The study concluded that metal processing and e-waste are the major sources contributing to the fine fraction while coking and soil contributed to the coarse fraction within the factory environment, and this posed a great hazard to the atmospheric environment and likewise on human receptors in the study areas.

NSPS-FUOYE-PA-015

NON-CONVENTIONAL SOURCES OF ENERGY FOR ACHIEVING A SUSTAINABLE ECONOMIC DEVELOPMENT IN NIGERIA

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ABSTRACT

It is a clear fact that having access to a healthy, clean, less cost as well as modern energy services is an enormous challenge facing the African continent because energy is fundamental for socioeconomic development and poverty eradication. Today, 60% to 70% of the Nigerian population does not have access to electricity. There is no doubt that the present power crisis afflicting Nigeria will persist unless the government diversifies the energy sources in domestic, commercial, and industrial sectors and adopts new available technologies to reduce energy wastages and to save cost. The paper focuses on ways of generating electricity with renewable source of energy for economic development in Nigeria. Specifically, the Nigeria's energy background, renewable energy potentials and barriers, as well as various national energy policies were analyzed and areas that require attention to achieve sustainable provision of non-conventional energy were also highlighted. Overall, achieving sustainable development in Nigeria lies in addressing the imminent energy crisis facing the country, With current energy problems Nigeria is facing which encompasses gradual decrease in the availability of wood fuel in the rural areas as well as in the urban areas and the problems attributed to the use of it for cooking purposes, irregular availability of fossil fuels (like kerosene, methane gas etc.) and lack of steady supply of electricity to use electric stoves for cooking and other domestic and commercial purposes so also its creation of a number of environmental problems with use of fossil fuels; the obvious alternative is the use of the non-conventional energy sources in order for Nigeria to meet its needs for climate protection, poverty reduction, electricity and technological progress.

NSPS-FUOYE-PA-016

CANONICAL ENSEMBLE THERMODYNAMICS OF MASSLESS SCALAR BOSONS IN SCHWARZSCHILD'S BLACK HOLE

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Abstract

Through the use of analytical methods, we have obtained an approximate solution for the Klein-Gordon equation in the Schwarzschild spacetime. Our analysis allowed us to determine the corresponding eigenstate and energy eigenvalue, revealing a symmetry in the eigenstates for S-waves but not for other l-states. This suggests that particles prefer lower energy states in pursuit of stability and orderliness. Our study also involved calculating various thermodynamic properties of the scalar boson, including vibrational internal energy, Gibbs free energy, specific heat capacity, and entropy. By utilizing a statistical approach with the partition function as the link between the micro-state and the macro-state, we found that maintaining a distance from the event horizon ensures thermodynamic stability. This was deduced from 1 the positive heat capacities and entropies for all l-states.

NSPS-FUOYE-PA-017

ENTROPY PRODUCTION RATE IN HYBRID QUANTUM SYSTEMS

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ABSTRACT

We present the irreversibility generated by a stationary cavity magnomechanical system. In this system, the magnons are coupled to the cavity photon mode via magnetic dipole interaction and to the phonon mode via magnetostrictive force (optomechanical-like). We employ the quantum phase-space formulation to evaluate the steady-state entropy production rate and associated quantum correlation in the system. We find that the behavior of the entropy flow between the cavity photon mode and the phonon mode is determined by the magnon-photon coupling and the cavity photon dissipation rate. Interestingly, the entropy production rate can increase/decrease depending on the strength of the magnon-photon coupling and the detuning parameters. We further show that the amount of correlations between the magnon and phonon modes is linked to the irreversibility generated in the system for small magnon-photon coupling. Our results demonstrate the possibility of exploring irreversibility in driven magnon-based hybrid quantum systems and open a promising route for quantum thermal applications.

NSPS-FUOYE-PA-018

HIGH PERFORMANCE MULTILAYER SATELLITE ELECTRONIC SHIELDING SYSTEM (MULSES)

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Abstract

Space satellites are exposed to a variety of hostile radiation environments. High-energy beta particles in these environments could lead to the destruction or malfunction of onboard electronic components. We proposed MULSES as an efficient shielding system for satellites, designed to protect electronic components from high-energy beta particles (>1 MeV) encountered in low Earth orbit. Three layers of biomass-reinforced HDPE combined with synthesized materials, UL1 and UL2, were optimized concerning thermal stability and radiation attenuation. Mechanical characterization showed a tensile strength of 25MPa, hardness of 85.7Hv, and impact absorption of 23.721J confirming its resistance. Thermal analysis presented stability up to 600°C. The radiation tests presented beta attenuation efficiency higher than 97% for energies up to 9 MeV and 94.74% for 15MeV energy. Gamma radiation shielding tests by means of Co-60 and Cs-137 sources presented better results for middle-energy sources, reaching an attenuation of 17.51%. The results pointed out MULSES as a promising material for shielding satellite electronics from thermal and radiological challenges in space.

NSPS-FUOYE-PA-019

TOPOLOGICAL DEFECTS NN THERMODYNAMIC FUNCTIONS OF DIATOMIC MOLECULES UNDER AB FLUX FIELD

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ABSTRACT

Topological defect influence on molecular potential models has been significantly proven to shape the behaviour and interactions of different constituent quantum systems. Based on this fact, we employ the Nikiforov-Uvarov functional analysis method to solve the Schrodinger equation with modified Kratzer plus generalized Morse potential, embedded with Aharonov-Bohm flux field and point-like monopole defect. Rotation-vibrational energies of selected diatomic molecules have been presented numerically and graphically for various quantum states, flux field and topological defect values. In addition, vibrational energy expression of the combined molecular potential considered is used to obtain some thermodynamic functions of carbon monoxide, using Poisson summation formula. Graphical studies of these thermodynamic functions show high dependence on temperature, flux field and topological defect parameters considered. Conventional results of this study in Minkowski space are realized as the topological defect parameter approaches unity, and their special cases results agree with available results in literature. The results in this study also point relatively to some physical phenomena in chemical and molecular physics.

NSPS-FUOYE-PA-020

NOVEL APPROACH TO FLEXIBLE DYE-SENSITIZED SOLAR CELLS: INNOVATIVE SUBSTRATE AND ELECTROLYTE DESIGN FOR IMPROVED PERFORMANCE

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ABSTRACT

Flexible dye-sensitized solar cells (DSSCs) can be a promising alternative to established rigid photovoltaic technologies. They offer potential solutions for lightweight, adaptable, and sustainable energy harvesting systems because they are flexible, non-toxic and relatively cheap to fabricate. Despite the possible advantage of flexible DSSCs, enhancing the performance and durability of these solar cells has proved challenging. This work investigates a novel approach to improving the performance and durability of flexible DSSCs through innovative substrate engineering and electrolyte composition optimisation. We developed a flexible DSSC utilising a polyethylene terephthalate (PET) substrate modified with a hierarchical titanium dioxide (TiO_2) nanostructured electrode with a 10-20 mm electrode layer thickness and a 65% porosity. The nanostructure was synthesised using a controlled hydrothermal method to ensure precise morphology control and cost-effective processing. This method achieves enhanced surface area and improved electron transport characteristics. A custom-developed 1-ethyl-3-methylimidazolium iodide and Na-Y zeolite organic-inorganic hybrid electrolyte system was implemented to address traditional limitations in ionic conductivity and long-term stability. Experimental results demonstrated a power conversion efficiency of 8.4%, with remarkable mechanical flexibility allowing repeated bending cycles without significant performance degradation. Electrochemical characterisation revealed improved charge transfer kinetics and reduced electron recombination compared to conventional DSSC architectures.

NSPS-FUOYE-PA-021

PHOTOCATALYTIC APPLICATION OF OXIDE COATING FORMED BY PLASMA ELECTROLYTIC OXIDATION ON NB

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ABSTRACT

The unsustainable reliance on fossil fuels has driven the search for alternative methods to mitigate environmental pollution, particularly through innovative material science approaches. This study explores the photocatalytic potential of oxide coatings formed on niobium via Plasma Electrolytic Oxidation (PEO). Niobium samples were coated in a sodium phosphate electrolyte, with and without sodium aluminate, under varying concentrations to evaluate their efficiency in degrading organic pollutants. The resulting oxide coatings were characterized using scanning electron microscopy (SEM), X-ray diffraction (XRD), photoluminescence (PL), and UV-Vis spectroscopy. The findings reveal that the addition of sodium aluminate enhances the intensity of micro-discharges, leading to the formation of $AlNbO_4$ coatings with improved photocatalytic activity compared to TT-Nb_2O_5. $AlNbO_4$ coatings exhibited a high degradation efficiency of methyl orange, reaching 81% after 8 hours of irradiation. This superior performance is attributed to increased oxygen vacancies and defects inhibiting electron-hole recombination. While both coatings demonstrated strong ultraviolet absorption, their limited ability to harness sunlight underscores the need for further optimization. These results highlight the potential of niobium-based oxide coatings for environmental remediation and pave the way for advancements in photocatalytic material design.

NSPS-FUOYE-PA-022

IMPACT OF HIGH-DOSE GAMMA IRRADIATION ON THE STRUCTURAL, MECHANICAL AND THERMAL PROPERTIES OF DOUM FIBER-REINFORCED HIGH-DENSITY POLYETHYLENE COMPOSITES

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ABSTRACT

This study investigates the impact of Doum fiber reinforcement and gamma irradiation on the mechanical and thermal properties of high-density polyethylene (HDPE) composites. The materials tested included pure HDPE (control), a composite with 20% Doum fiber (sample B), and with 40% Doum fiber (sample D). Mechanical testing revealed that Doum fiber reinforcement significantly enhanced tensile strength, hardness, and impact resistance. Sample B, with 20% fiber, showed the highest tensile strength (19.59 MPa) and hardness (60.67), and attributed to effective fiber dispersion and stress transfer. Conversely, sample D demonstrated reduced mechanical performance due to excessive fiber content, causing clumping and weaker stress distribution. Thermal stability was analyzed using Thermogravimetric Analysis (TGA) and Differential Thermal Analysis (DTA). All samples exhibited comparable stability pre-irradiation, with degradation starting around 380°C. After 100Gy irradiation, thermal stability remained largely unchanged. However, at 150Gy, thermal degradation accelerated, with sample D showing the earliest onset of degradation (350°C) due to radiation-induced chain scission. Fourier Transform Infrared (FTIR) spectroscopy identified chemical changes post-irradiation, including increased formation of hydroxyl and carbonyl groups, indicating oxidative degradation. Changes in the fingerprint region also suggested polymer chain scission and rearrangements. The extent of degradation increased with both fiber content and irradiation dose, with sample D experiencing the most significant structural changes. The study demonstrates that adding 20% Doum fiber optimally improves HDPE's mechanical properties without compromising thermal stability under moderate irradiation. In contrast, higher fiber content and irradiation doses diminish performance, underscoring the need to balance these factors in composite design. These findings provide valuable insights into the development of fiber-reinforced HDPE materials for applications requiring mechanical robustness and moderate radiation resistance.

NSPS-FUOYE-PA-023

Analytical determination of molar entropy and Gibbs free energy for some molecules

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Abstract

A symmetric trigonometric Rosen Morse potential is described by parameters of non-physical definition, hence, this potential lack ability to discuss molecular systems. In this study, the potential is combined with a certain type of Pöschl-Teller potential and their parameters are transformed to a form of spectroscopic constants suitable for molecular discussion. The transformed potential is used to study Thermodynamic properties such as the molar entropy and molar Gibbs free energy of some molecules via partition function. The partition function is calculated using the Poisson summation formula. The calculated results are found to be in perfect agreement with the experimental data obtained from National Institute of Standards and Technology (NIST) for the molecules studied. The calculated results are found to be closer to the experimental values at lower temperatures. The study enhances the theoretical understanding of coupled potentials and provides foundation for useful applications in multicomponent systems. The results also provides the effects of a combined potential on the thermodynamic stability.

NSPS-FUOYE-PA-024

ASSESSMENT OF ^{222}Rn IN GROUNDWATER AND ITS RADIOLOGICAL IMPACT ACROSS AGE GRADES IN OYE-EKITI, NIGERIA

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ABSTRACT

^{222}Rn, a naturally occurring radioactive gas, is a significant contributor to ionizing radiation exposure from groundwater sources. In this study, ^{222}Rn concentrations was assessed in groundwater sources (confined and opened) across different locations in Oye-Ekiti, Nigeria, and their health implications for different age groups, from infants to adults was evaluated. Forty groundwater samples were collected from open and confined sources, and measurements were conducted using the RAD7 detector coupled with RAD7-H_20 accessories. The results indicate significant variations in radon levels between confined and open water, with open-source water ranging from 18.47 – 339.01(μSv/y), 9.24 – 169.5(μSv/y) and 6.37 – 116.7 (μSv/y) for infants, children and Adult respectively while for confined water sources it ranges from 0.42 -120.4 (μSv/y), 4.27 – 1223.8 (μSv/y) and 2.13 – 611.03(μSv/y) for infant, children and adult respectively. The results show some confined sources exceeded WHO, ICRP and IAEA recommended safety levels. This poses health concern risks especially for infants and children. The estimated ingestion doses, inhalation doses, total doses, and excess lifetime cancer risks (ELCR) in open source for each age group were 14.43 μSv/y , 14.23 μSv/y , 28.66 μSv/y and 10.03 and in confined sources are 46.67 μSv/y, 46.03 μSv/y, 92.71 μSv/y and 32.45 respectively. These radiological estimations are well within safety limits of 1mSv/y recommended by ICRP and WHO. The study recommends more exposure of water sources and continue monitoring of water sources from the study area.

NSPS-FUOYE-PA-025

IMPACT OF TEMPERATURE VARIATION ON THE PHYSICAL PROPERTIES OF ZR-DOPED CUSE NANOCRYSTALS

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ABSTRACT

This research investigates the impact of temperature variation on the physical properties of zirconium-doped copper selenide (CuSe) nanocrystal films via Electrodeposition techniques. The optical, structural, morphological, elemental composition and electrical properties of the synthesized films were explored using UV-Vis spectroscopy, X-ray diffractometry, scanning electron microscopy, energy dispersive X-ray spectroscopy and four point probe technique respectively. The optical analysis showed that the optical band gap value for the Zr-doped CuSe films increases from 1.21 eV to 1.70 eV as the deposition temperature increases. The Zr doped CuSe samples deposited at higher temperature displayed lower value of absorbance in the Vis and NIR region of the spectrum. XRD results showed the shift in the diffraction peaks toward larger angles as the value of the deposition temperature increases. The crystallite sizes were found to increase from 0.69nm to 0.99nm as the value of the deposition temperature increases. SEM results revealed grains of different sizes and shaped were randomly distributed and densely packed at higher deposition temperature.

NSPS-FUOYE-PA-026

POTENTIAL ASSOCIATION BETWEEN RADIATION EXPOSURE TO KOGI STATE RADIOLOGISTS AND PHYSIOLOGICAL PARAMETERS OF HEALTH IMPORTANCE

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ABSTRACT

The radiation exposure produced by medical imaging techniques and its health implications cannot be over emphasized. In this study, the levels of exposure to x-radiation from different x-ray equipment in the laboratories of twelve selected hospitals and nearby offices were determined using Thermo fisher survey meter at different distances from the sources (1 m - 5 m) and at different energy levels (70 KeV 20 mA – 90 KeV 20 mA) in Kogi State. The link between radiation exposure and some physiological parameters of health importance such as blood pressure, weight, Height, body temperature and BMI was also investigated. Using Thermoluminescence Dosimeter, the skin and deep dose (s) of the subjects were also measured. The results indicated that the indoor and outdoor effective dose ranged from 0.188 – 0.396 μSv hr^{-1}. At different energy levels (70 – 90 KeV), the indoor and outdoor effective dose also ranged from 0.20 – 0.46 mSv yr^{-1}. In most diagnostic laboratories, the indoor and outdoor annual effective dose (0.396 – 1.656 mSv yr^{-1}) were above the ICRP recommended limits. The skin and deep dose of the subjects differ significantly on the basis of BMI and at different energy levels. No significant correlation (at 0.01 and 0.05) was established between the levels of exposure and any of the physiological parameters. Findings from this study established the effects of dose accumulation over a period of time.

NSPS-FUOYE-PA-027

Optical and Structural Properties of TiO_2 and $CuAlSe_2$ doped with Carbon for Optical Devices

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Abstract

The preparation and characterization of copper aluminum diselenide ($CuAlSe_2$) and Titanium dioxide (TiO_2)-doped with carbon based graphene nanocomposite thin films were conducted. The temperature, deposition time, and pH of the medium was varied by spin coating method. The samples were characterized by X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM) and energy dispersive x-ray (EDX) and UV visible spectroscopy techniques for the crystalline, structural, morphological, compositional features and photo response for photovoltaic devices. The optical property revealed that $CuAlSe_2$ films have energy band gaps range 2.22-5.80 and 2.10-2.14 eV at room and peak temperature. X-ray diffraction study showed, the $CuAlSe_2$ films were polycrystalline with orientation along the (112) plane. XRD pattern of C: $CuAlSe_2$ and TiO_2 flakes were perfectly crystallized and the inter-planar spacing of ~0.0535 nm. FESEM analysis indicated smooth, and uniform structures. The graphene-TiO_2 displayed glistering surfaces due to less density of electronic trap states and improved absorption in the UV region. The results indicated that the average electron mobility depends on the probability of the electrons in the conduction band (CB) and as the quasi-Fermi level approaches the CB, a higher current, power supply and lower resistivity level.

NSPS-FUOYE-PA-028

MODELING TRANSMISSION AND REFLECTION LOSSES IN HETEROJUNCTION SOLAR CELLS

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ABSTRACT

It is certain that solar power can tackle the world energy crisis if properly harnessed and majority of the radiations coming from the sun are used efficiently. In this study, determining optical losses in heterojunction thin films solar cell is theoretically modelled to improve the photovoltaic (PV) activities. In the absence of non-radiative recombination, the Shockley-Queisser limit for a single p-n junction solar cell with energy band gap between 1.1 and 1.4 eV is ~33%. It implies that ~67% of energy coming from the sun does not contribute to the generation of solar electricity. The integration of carbon in designing PVs improved efficiency, life time and minimized optical losses. They optimize photo-generated electrons, carbon molecules can absorb light energy in the UV-visible region at different wavelength. The study addressed the major drawbacks of PSCs-based thin films SCs due to low electron mobility with a high density of electronic trap states, instability under UV light, hysteresis, and limited operational life-time due to excessive energy loss by transmission of photons and thermalization of hot carriers.

NSPS-FUOYE-PA-029

COMPUTATIONAL STUDY OF CALCIUM AND MAGNESIUM OXIDE FOR ENHANCED ENERGY CONVERSION AND STORAGE

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ABSTRACT

Energy demand for sustainable electrical power, and for domestic and industrial activities are on the rise. Silicon based solar cells have reached theoretical upper limit. They are not only expensive but require significant energy for purification and processing thereby limiting the cost-effectiveness and scalability of silicon-based PVCs. In this study, computational study of Calcium and Magnesium Oxide for enhanced energy conversion and storage using first principle method is presented. The impact of doping CaO and MgO on its structural, electronic, and optical properties were analyzed. A wide band gap of 7.0-8.0 eV which decrease with doping is noted for the samples. It showed that the 2p states valence, and 4s conduction band, and density of state peaks indicated regions where electronic states were densely packed. It changes due to thermal agitation and transfer of electrons to the conduction band. The study recommends TiO_2 nanoparticles, and nanotube in MgO and CaO matrix to optimize PV conversion, storage and efficiency due to radiation absorption in the UV range and it eases fabricating efficient devices and reducing the dependence on depleting fossil fuels.

NSPS-FUOYE-PA-030

EDGE DETECTION AND DEPTH DETERMINATION TECHNIQUE AS A POTENTIAL TOOL IN DELINEATING THE STRUCTURAL FRAMEWORK OF PARTS OF CENTRAL AND NORTH-EASTERN NIGERIA

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Abstract

High resolution aeromagnetic data covering parts of central and north-eastern Nigeria were interpreted in order to delineating the general structural framework of the sub-surface of the study area, geologic lineaments and estimate the depth to magnetic sources. Results of the first and second vertical derivatives, the tilt angle derivative and its total horizontal derivative, the analytic signal as well as 3D-Euler deconvolution filters applied on the residual magnetic intensity data reveal that the study area contains highly magnetic materials suspected to be hematite and magnetite in the basement rocks. There is a positive correlation between the lithological map, geological map, the aeromagnetic map and the lineament map. Further analysis of the results shows that iron mineralization (Ferric and Ferrous types) is present in various degrees in the study area. The Euler depth solution has estimated the geological source bodies to be within a depth (<400- >5000m). This is evidence that the study area was accompanied by series of intense shearing activities or deformation during the orogenic process.

NSPS-FUOYE-PA-031

EFFECT OF COMPACTIBILIZER ADDITION ON THE MECHANICAL PROPERTIES OF DOUM FIBER REINFORCED POLYESTER COMPOSITE

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ABSTRACT

Natural fibers such as doum, jute, and hemp are emerging as alternatives to glass fibers for reinforcing polymer composites. However, the hydrophilic nature of natural fibers often leads to poor adhesion with hydrophobic polymer matrices. This results in inferior mechanical properties of the composites. The aim of this study was to investigate the effect of incorporating maleic anhydride (MA) as a compatibilizer on the hardness and tensile properties of doum fiber reinforced unsaturated polyester (UP) composites. Dom fibers were manually extracted and treated with 5% NaOH solution. UP resin was reinforced with 0.3-2.7 wt% untreated doum fibers and 0.3-2.7 wt% MA was added as the compatibilizer. The components were mixed thoroughly and cured by hand layup technique. Hardness was evaluated using Vickers hardness tester. Tensile tests were performed on electronic universal testing machine to determine the tensile strength, elastic modulus and elongation at break. Three (3) samples were tested for each composition and the results averaged. Incorporating MA led to significant increase of the hardness, tensile strength and modulus compared to the control. This indicates poor interfacial bonding between the hydrophilic doum fibers and hydrophobic UP resin.

NSPS-FUOYE-PA-032

PREDICTION OF PRECIPITABLE WATER VAPOUR OVER WEST AFRICAN SUB-SAHARAN REGION USING GNSS MEASUREMENTS

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ABSTRACT

The ability to precisely and accurately model precipitable water vapour (PWV) is essential for global navigation satellite system (GNSS) and meteorological applications. In order to address this challenge, this study develops a multiparametric regression model that utilized the zenith tropospheric delay (ZTD) extracted from RINEX files to predict the PWV of the study stations. In this work, data from seven Global Navigation Satellite System (GNSS) ground-based receiver stations within West African sub-Saharan region for the year 2009 to 2019, together with those from surface meteorological stations, have been used to estimate the ZTD and empirically determine PWV for all the studied stations. The GNSS data were analyzed using GNSS Laboratory (gLab) and Matlab software. The performance metric results of coefficient of determination (R2) between the predicted and experimental PWV ranges between 0.9793 - 0.9983 for BJCO, 0.5962 - 0.8332 for CGGN, 0.8397 - 0.8766 for DAKR, 0.7788 - 0.9912 for NKLG, 0.6078 – 0.7288 for OUAG, 0.5402 - 0.5756 for BJNA, and 0.8851 – 0.9036 for YKRO. The model performed outstandingly and agrees very well with the PWV experimental data, with residual error of -0.003 – 0.01m for BJCO, 0.02 – 0.036m for CGGN, -0.04 – 0.002m for DAKR, -0.01 – 0.011m for NKLG, -0.002 – 0.02m for OUAG, -0.002 – 0.022m for BJNA and 0.002 – 0.01m for YKRO. This study provides a useful alternative for PWV predictions and also in the event the West African sub-Saharan GNSS stations' PWV data are unavailable for the GNSS users. The spatiotemporal variation observed in the annual trend of PWV of the study area would be useful for the farmers and network providers in making informed decisions.

NSPS-FUOYE-PA-033

THERMOPHYSICAL AND DYNAMICAL PROPERTIES OF FERROMANGANESE (FEMN) USING FLORY QUASI-LATTICE MODEL AND MOLECULAR DYNAMIC SIMULATION

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ABSTRACT

A study of thermophysical and dynamical properties of FeMn alloys at different temperatures have been made within the frame of the Quasi-Lattice Theory (QLT) using the Flory's model. The order energy parameters as temperature dependent were computed on the basis of the Flory's theory, other thermodynamic quantities as free energy of mixing, enthalpy of mixing, entropy of mixing and activity coefficient of the alloy have been calculated for the liquid alloys FeMn at 1450k and the result compared with experimental values. The study reveals that the order energy parameter ω is negative for the alloys indicating indicates that there is a tendency for short-range order of atoms in liquid Fe–Mn alloys and compound formation. The calculated and experimental values for the free energy of mixing, enthalpy of mixing is in good agreement. Molecular dynamic simulation was used to evaluate other the different properties for temperatures were no experimental values existed. The result of the molecular dynamic simulation at 1450k are in good agreement with the experimental value.
Keywords: Thermophysical, Flory Model, Free Energy of Mixing, Enthalpy of Mixing, Molecular Dynamic Simulation.

NSPS-FUOYE-PA-034

COMPARATIVE STUDIES FOR DETERMINING THE OPTICAL BAND GAP ENERGY OF CUSE THIN FILMS

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ABSTRACT

In the present study, copper selenide (CuSe) metal chalcogenide thin films have been fabricated from Se/Cu bilayer deposited using two-step procedure involving thermal evaporation and dip coating, and its subsequent thermal annealing. The thickness of the thermally evaporated Se layer was maintained at 40 nm while the dip coated layer of copper was carried out for varying time of 40 and 80 min. The prepared CuSe thin film was studied by structural and optical properties. The x-ray diffraction spectra revealed post thermal inter-diffusion of the two layers and the production of CuSe thin film exhibiting hexagonal crystal structure. The optical transmission measurements were recorded within the wavelength range of 300 to 1000 nm. Four different methods were employed in ascertaining the direct band gap energies of the prepared CuSe thin films and the results were compared with the famous Tauc's relation. The results from the study confirmed that the fabricated thin films possess wide band gap energy, making them a candidate for window layer in many solar cell applications.

NSPS-FUOYE-PA-035

OPTOELECTRONIC PROPERTY OF POLYMER-DERIVED SICN/C CERAMICS

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ABSTRACT

Polymer-derived silicon carbonitride (SiCN) ceramics have emerged as promising materials for various high-temperature applications owing to their exceptional thermal stability and electronic properties. This study investigates the correlation between the optoelectronic property in SiCN ceramics corresponding to the levels of free carbon (C) incorporation and pyrolysis temperature. The carbon-rich SiCN nanocomposites (SiCN/C) were developed via a single-source precursor (SSP) technique that involved a tailored combination of divinylbenzene (DVB) to the polysilazane preceramic precursor. This was done corresponding to pyrolysis temperatures of 1100 oC, 1400 oC, and 1600 oC in an argon atmosphere. The developed SiCN/C nanocomposites were characterized using SEM, XRD, TGA, Raman spectroscopy, carbon analyzer, EDX, and UV-vis spectroscopy. Both the content and ordering of the carbon influenced bandgap reduction in the developed SiCN/C nanocomposites. Progressively decreased bandgap energies from 5.04 eV to 4.63 eV in the SiCN/C nanocomposites with increases in the free carbon content was observed. Further decrease in the bandgap energies was achieved from 4.63 eV to 4.55 eV, and 4.46 eV, as the pyrolysis temperature increased from 1100 °C to 1400 oC, and 1600 °C, respectively. The quality and output of this study has implication on bandgap engineering, design, and development of semiconducting free carbon-rich SiCN-based sensors for applications in high temperature environments.

NSPS-FUOYE-PA-036

Optimization of Preparative Parameters of Optoelectronics Properties of Electrodeposited FTO/MoS_2-Based Solar Cells Aided SCAPS 3201

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ABSTRACT

P-type molybdenum disulfide (MoS_2) was synthesized via electrodeposition using ammonium molybdate as the molybdenum source and sodium thiosulfate as the sulfur source. The material's appeal lies in its potential applications in mechanical, electrical, and optical devices. Despite its multifunctionality, further studies are needed to determine its electrical conductivity type and key electrical properties for high-efficiency solar cells. MoS_2 is typically n-type due to sulfur's electron accommodation. This study characterized the material's electrical conductivity type using photoelectrochemical cell measurements. Additionally, analytical and numerical (SCAPS) methods were employed to extract electrical parameters critical for optimizing MoS_2-based optoelectronic devices. The research also investigated the influence of substrate temperature on material properties and electrical performance, deviating from conventional analysis methods by integrating SCAPS simulations. Results revealed a decrease in energy band gap from 2.17 eV to 1.87 eV with increasing deposition time, likely due to quantum confinement effects. These findings confirm the successful synthesis of scalable MoS_2 materials with enhanced properties for optoelectronic applications.

NSPS-FUOYE-PA-037

ENHANCING SUPERCAPACITOR PERFORMANCE WITH NITROGEN ION IMPLANTATION: ELECTROCHEMICAL ENGINEERING OF A Ti3C2Tx/GRAPHENE/NiO ELECTRODE

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ABSTRACT

This study used an in situ precipitation method with 0.3g of (Ti2CTx), 0.3g of graphene, and 0.4g of NiCl2.6H2O. The implantation process involved using 50 keV nitrogen ions at doses of 1×1015, 1×1016, and 1×1017 ions/cm2, with a separate un-implanted film used for characterization. The electrochemical properties of the electrode were assessed using three electrodes. Tests were conducted for performance evaluation using a 2M potassium hydroxide electrolyte and varying scan speeds (10-50 mVs-1). The specific capacitances at different scan rates were estimated to be 625, 312, 208.33, 156.25, and 125 F/g. The specific capacitance of un-implanted MXene/Graphene/NiO decreases with increasing scan rate. The specific capacitance of MXene/Graphene/NiO material was estimated to be 677 F/g at 10 mV/s, 338 F/g at 20 mV/s, 225.69 F/g at 30 mV/s, 169.27 F/g at 40 mV/s, and 135.41 F/g at 50 mV/s after implanting it with nitrogen ions of 1x1015 ions/cm2 and varying the scan rates. The XRD pattern of the MGN material demonstrates that the addition of nitrogen ions enhances its crystallite properties, creating vacancies that make it well-suited for super-capacitance applications. The unirradiated bandgap is 1.73 eV, while the nitrogen-irradiated bandgaps are 1.51 eV, 1.39 eV, and 1.35 eV for different ion densities.

GROUP E : MATHEMATICS AND STATISTICS-NSPS-FUOYE-MS

NSPS-FUOYE-MS-001

A NEW HYBRID CONJUGATE GRADIENT METHOD FOR SOLVING UNCONSTRAINED OPTIMIZATION PROBLEMS WITH APPLICATION

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ABSTRACT

In this work, we presented a new hybrid conjugate gradient (CG) method using a MKMAR parameter based on an inexact line search for solving unconstrained optimization problems. The global convergence properties are established using some assumptions. Various standard benchmark problems were used to generate the numerical results. The result shows that the new approach is effective when compared with other CG methods. In addition, the performance of the new approach was shown to be efficient when solving the COVID-19 model using multilayered neural network.

NSPS-FUOYE-MS-002

ONE-STEP DIRECT BLOCK METHOD AND ITS APPLICATIONS TO SBVPS OF DYNAMICAL SYSTEMS

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ABSTRACT

The study of the dynamical system is an area where hybrid block method has not found enough of its applications. Therefore, this work presents a one-step direct block method and its application to solve some singular boundary value problems of ordinary differential equations. The method was constructed directly by adopting the concept of collocating and interpolation to a block method, and power series polynomial as the trial solution. This is important to obtain a method that is numerically stable and suitable for simulating both linear and nonlinear third-order ordinary differential equations. A comparative study between the new method and some methods in literatures is presented. The results demonstrate the reliability and efficiency of the proposed method.

NSPS-FUOYE-MS-003

ON SOLVING LINEAR FREDHOLM INTEGRO-DIFFERENTIAL EQUATION VIA FINITE DIFFERENCE-SIMPSON'S

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ABSTRACT

In this paper, a hybrid of Finite Difference-Simpson's approach was applied to solve Linear Fredholm integro-differential equations of second kind. The method works efficiently great by reducing the problem into a system of linear algebraic equations. The numerical results show the simplicity and effectiveness of the method when compared with some existing method in the literature, error estimation of the method is provided.

NSPS-FUOYE-MS-004

MATHEMATICAL MODELING TO ANALYZE NUTRIENTS IN EDIBLE MUSHROOMS

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ABSTRACT

Edible mushrooms are a rich source of essential nutrients like proteins, vitamins, minerals, and fibers, whose content is influenced by species, substrate composition, and environmental conditions. This paper presents a mathematical model analyzing nutrient absorption, retention, and degradation in edible mushrooms, focusing on optimizing growth conditions to maximize nutrient content. The model uses differential equations and empirical data from controlled growth experiments, demonstrating its accuracy and potential applications in agriculture and nutritional science.

NSPS-FUOYE-MS-005

FIXED POINT THEOREMS OF A CONDENSED KANNAN-TYPE MAP IN G-METRIC SPACES

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ABSTRACT

The paper introduces a new type of contraction map called a condensed Kannan-type contraction in G-metric spaces. It establishes and proves fixed-point theorems for operators that satisfy this new condensed map. To evaluate the efficacy of this condition, the paper defines a new criterion in G-metric spaces to assess the effectiveness and dynamicity of this new condition. We demonstrate the dominance of the new map using practical examples, by showing its generality compared to existing Kannan-type maps in G-metric spaces.

NSPS-FUOYE-MS-006

ON SOME PROPERTIES OF PARTIAL SOFT SEPARATION AXIOMS AND SOFT COMPACT SPACES

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ABSTRACT

In this work, using the newly introduced p-soft spaces we give a relationship between soft Hausdorff and new soft regular spaces by removing the restriction on the shape of soft open sets. Furthermore, we introduced new separation axioms and investigate some of their properties using newly defined partial belong and total non belong relations. Finally, we show that p-soft T_i- spaces are stronger than soft T_i- spaces for i=0,1,4. We also point out that p-soft regular is weaker than soft regular and verify that a p-soft regular condition is sufficient for the equivalent among p-soft T_i- spaces, for i=0,1,2.

NSPS-FUOYE-MS-007

SET-BASED ORDERING ON SIMPLE MULTISETS OF INCOMPARABLE OBJECTS

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ABSTRACT

It is convincing that there exists an ordering on simple multisets of incomparable objects by means of the Jouannaud Lascanne set-based multiset ordering. A successful attempt to show that a singleton multiset is dominated by a simple pair multiset despite the incomparability of their objects is made with respect to the ordering. Furthermore, an existence of the ordering among simple multisets of higher cardinalities where the cardinality of the preceding multiset is a unit or more less than that of the succeeding multiset is observed. Thus, we obtain an extension of the ordering to simple multisets of incomparable objects. No stronger set-based multiset ordering may be found to exist.

NSPS-FUOYE-MS-008

EFFECT OF VISCOUS DISSIPATION ON STEADY PRESSURE DRIVEN FLOW IN HORIZONTAL POROUS CHANNEL

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ABSTRACT

The study investigates the effect of Viscous Dissipation on steady pressure driven flow in a horizontal porous channel. The research explored the impact of Viscous Dissipation, a phenomenon arising from the conversion of mechanical energy into heat within a fluid, on the characteristics of flow within a porous channel subjected to a constant pressure gradient. Asymmetric thermal boundary conditions are applied to the channel walls. The resulting governing dimensionless equations were solved analytically. Closed form expressions for the velocity field, temperature field, skin friction and the rate of heat transfer in terms of Nusselt number were obtained. MATLAB programs were written to compute the numerical value from the analytical solutions. The effect of the flow parameter Prandtl number(Pr), Suction/Injection parameter(S) and the dimensionless Brinkman number(Br) on the velocity field, temperature field, skin friction and the rate of heat transfer in terms of Nusselt number was investigated. During the course of investigation, it was seen that the rate of heat transfer on the boundary surfaces was enhanced by increased in Brinkman number(Br) which invariably increase the mass flow rate in the channel. However, the rate of heat transfer deteriorates with a growing Prandtl number(Pr) while it accelerates with growing Suction(S).

NSPS-FUOYE-MS-009

THE COMBINED EFFECTS OF VISCOUS AND DARCY DISSIPATION ON FORCED CONVECTION FLOW THROUGH A PERMEABLE HORIZONTAL CHANNEL

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ABSTRACT

This study investigates the combined effects of viscous and Darcy dissipation on the hydrodynamic and thermal behavior of a laminar forced convection fully developed flow in a horizontal porous channel subject to a constant pressure. Asymmetric thermal boundary conditions are applied to the channel walls. The flow formation inside the porous medium is modelled using Darcy-Brinkman model. The resulting governing equations were rendered in dimensionless form and solved analytically by method of undetermined coefficient. Closed form expression for the velocity field, skin friction and the rate of heat transfer in terms of Nusselt number were obtained. MATLAB programs were written to compute the numerical value from the analytical solutions. In order to see the effect of the governing parameters on the thermal and hydrodynamic behavior of the fluid flow, the results are depicted pictorially for variations in the different governing parameter. It is interesting to point out that growing the Darcy number as well the suction S accelerate the fluid motion. whereas increasing the Brinkman number increases the temperature profile. The result is validated by existing analytical work when Darcy number is large.

NSPS-FUOYE-MS-010

A Comprehensive Analysis of a Fractional-Order Mathematical Model for Monkeypox Using the Atangana-Baleanu Operator

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ABSTRACT

Monkeypox remains a significant global health challenge, characterized by periodic outbreaks and complex transmission dynamics. Traditional Monkeypox models often overlook reinfection and the advantages of fractional-order systems, limiting their accuracy in capturing real-world disease progression. This study addresses these gaps by utilizing the Atangana-Baleanu-Caputo (ABC) fractional derivative with the Mittag-Leffler kernel to model the transmission dynamics of Monkeypox. The Picard–Lindelöf method is employed to establish the existence and uniqueness of solutions, ensuring the mathematical soundness of the proposed model. Numerical simulations are conducted to evaluate the long-term behavior of the disease, focusing on the impact of secondary infection rate, the effectiveness of treatment and quarantine interventions. Sensitivity analysis highlights the critical parameters influencing disease spread, providing key insights into targeted control strategies. Our findings demonstrate that quarantine and treatment, when combined with public health measures such as personal protective equipment, contact tracing, and vaccination, significantly reduce the spread of Monkeypox. Moreover, the fractional-order model's memory effect offers a more accurate representation of disease dynamics compared to classical integer-order models, capturing the impact of past states on current disease progression. Recommendations for enhancing future preparedness and strategies to mitigate the risk of future infectious disease outbreaks were made.

NSPS-FUOYE-MS-011

BINOMIAL EXPANSION – A SIMPLE COMPARATIVE ANALYSIS AND TIME COMPLEXITY OF CONVENTIONAL AND ALTERNATIVE METHODS

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ABSTRACT

Alternative (or computer-ready) approach of learning Mathematics is exemplified and compared to the conventional methods using binomial expansion as a sample subtopic. The approach uses the tabular system for obtaining the terms of a binomial expansion. Three groups of randomly selected 100 level students are tested using one method for each group. We present a comparative analysis of the data obtained. Some advantages of the alternative method were observed. It can go a long way to enhance students' understanding of the concept. Moreover, it enables the programming of binomial expansion for computer aided solutions to problems whose solutions require binomial expansion as can be deduced from the time complexity of the methods.

NSPS-FUOYE-MS-012

ON UNSTEADY DEAN FLOW OF DUSTY FLUIDS BETWEEN TWO OSCILLATING CYLINDERS

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ABSTRACT

This study investigates the unsteady Dean flow of dusty, viscous, incompressible fluids confined between two oscillating concentric horizontal cylinders under a semi-analytical framework based on Laplace transformation and its numerical inverse known as Riemann-sum approximation (RSA). The problem is modeled using the momentum and continuity equations for both fluid and particulate phases, incorporating the effects of azimuthal pressure gradients and oscillatory boundary conditions. The semi-analytical framework is employed to derive the velocity profiles, skin frictions, and vorticity in Laplace domain, which are then inverted to obtain time-dependent solutions. Steady-state solutions for the velocity, skin frictions, and vorticity (for cases of oscillating with different frequency, non-oscillating case, and oscillating with the same frequency) are obtained in closed forms for the validation of the method employed at large values of time. Key dimensionless parameters such as the mass concentration of dust particles, relaxation time, dimensionless time, and angular velocities are explored to assess their impact on the flow dynamics. Results reveal the interplay between particle relaxation time and fluid velocity in achieving equilibrium flow states. This work provides insights into dusty fluid mechanics, applicable to industrial and environmental systems involving particulate-laden flows, offering a benchmark for further computational and experimental studies.

NSPS-FUOYE-MS-013

MATHEMATICAL ANALYSIS OF FRACTIONAL-ORDER TREATMENT MODEL OF TUBERCULOSIS

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ABSTRACT

Tuberculosis (TB) remains one of the deadliest infectious diseases globally, claiming millions of lives annually, particularly in regions with limited healthcare access. Caused by *Mycobacterium tuberculosis* and transmitted through the air, TB poses a significant threat, especially to vulnerable populations such as those with weakened immune systems, including individuals living with HIV. In this study, we developed a deterministic compartmental model to analyze the transmission dynamics of TB, incorporating six distinct classes: susceptible humans, exposed humans, acutely infected humans, chronically infected humans, treated humans, and recovered individuals. To better understand the complex nature of TB transmission and enhance control strategies, we incorporated Adams-Bashforth method alongside fractional-order derivatives. This combination allowed for effective integration of memory effects, capturing nuanced behaviors of TB transmission dynamics. Sensitivity analysis revealed that promoting high treatment rate led to increased recovery rate among infected individuals. Through simulations, we explored various strategies, such as improving treatment access, reducing diagnostic delays, and addressing non-linear behaviors, all of which demonstrated significant potential in reducing TB transmission and controlling its spread.

NSPS-FUOYE-MS-014

ANALYSIS OF A FRACTIONAL-ORDER MATHEMATICAL MODEL FOR MONKEYPOX USING THE ATANGANA-BALEANU OPERATOR

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ABSTRACT

Monkeypox remains a significant global health challenge, characterized by periodic outbreaks and complex transmission dynamics. Traditional Monkeypox models often overlook reinfection and the advantages of fractional-order systems, limiting their accuracy in capturing real-world disease progression. This study addresses these gaps by utilizing the Atangana-Baleanu-Caputo (ABC) fractional derivative with the Mittag-Leffler kernel to model the transmission dynamics of Monkeypox. The Picard–Lindelöf method is employed to establish the existence and uniqueness of solutions, ensuring the mathematical soundness of the proposed model. Numerical simulations are conducted to evaluate the long-term behavior of the disease, focusing on the impact of secondary infection rate, the effectiveness of treatment and quarantine interventions. Sensitivity analysis highlights the critical parameters influencing disease spread, providing key insights into targeted control strategies. Our findings demonstrate that quarantine and treatment, when combined with public health measures such as personal protective equipment, contact tracing, and vaccination, significantly reduce the spread of Monkeypox. Moreover, the fractional-order model's memory effect offers a more accurate representation of disease dynamics compared to classical integer-order models, capturing the impact of past states on current disease progression. Recommendations for enhancing future preparedness and strategies to mitigate the risk of future infectious disease outbreaks were made.

NSPS-FUOYE-MS-015

HYBRID REGRESSION MODELS FOR SOLVING HETEROGENEITY PROBLEMS

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ABSTRACT

The linear regression is critical for data modelling especially for scientists. Nevertheless, with the plenty of high-dimensional data, there are data with more explanatory variables than the number of observations. In such circumstances, traditional approaches fail. This paper proposes a modified sparse regression model that solves the problem of heterogeneity using seaweed data. The modified heterogeneity models for ridge, LASSO and Elastic net were used to model the data. Robust estimation M Bi- Square, M Hampel, M Huber, MM and S were used. Based on the results, the hybrid model of sparse regression for before, after, and modified heterogeneity robust regression with the 45 highest ranking variables with a 2- sigma limit can be used efficiently and effectively to reduce the outliers. The hybrid model of the modified sparse LASSO with M Bi- Square estimator for the 45 high ranking parameters performed better. According to the eight selection criteria (8SC), random forest with the 15, 25, 35 and 45 highest important variables have the lowest 8SC, this represents the efficient model generated.

NSPS-FUOYE-MS-016

MULTISTEP BLOCK METHOD AND ITS APPLICATION IN FLUID DYNAMICS MODELS

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ABSTRACT

Numerical methods are known to provide an approximate solution when differential equation models without exact solutions are encountered. This situation of being unable to obtain an exact solution arises in various fluid dynamics models and researchers result in adopting suitable numerical approaches. Block methods are among the numerical approaches existing in literature, with the advantage of providing more accurate solutions than conventional approaches. This article showcases a multistep block method being applied to two types of models arising in fluid dynamics. The results obtained are in good agreement with previous studies. Hence, justifying the usability of block methods when solving various mathematical models especially those in fluid dynamics.

NSPS-FUOYE-MS-017

THE NON-LINEAR MODIFIED LANGUMIR AND VAN DER POL DIFFERENTIAL EQUATIONS: A LINEAR APPROXIMATION THROUGH THE USE OF THE GENERALIZED SUNDMAN TRANSFORMATION

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ABSTRACT

Analytical solutions to the nonlinear ordinary differential equations Langumir and Van der Pol are difficult. To make these nonlinear equations easier to solve, the aim of this effort is to transform them into linear form. They are given in the proper linearizable formats, ensuring that the coefficients of the two equations satisfied the linearizability conditions. Once this was accomplished, the equations were linearized using the generalized Sundman transformation. The generalized Sundman transformation (GST) is a non-point transformation defined by the formulas $u(t) = F(x, y)$, $dt = G(x, y)dx$, $F_y G \neq 0$. When the GST was applied, basic solutions for the two equations were found. The linear equations that resulted from the linearization process were solved using the traditional method of variation of parameters.

Keywords: Linearization, Modified Langumir, Differential Equation, Van der Pol, Generalized Sundman Transformation

NSPS-FUOYE-MS-018

MODELLING MALARIA DYNAMICS WITH EFFICIENCY AND ECONOMIC ANALYSES OF INTERVENTION STRATEGIES

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ABSTRACT

In this study, a nonlinear mathematical model for the transmission dynamics of malaria incorporating recrudescence, relapse, and reinfection is presented and analysed. The basic properties of the model are established through the theory of positivity and boundedness of solutions with Lipschitz condition. The model was shown to exhibit backward bifurcation property in the presence of reinfection. In addition, the influence of model parameters on the basic reproduction number is investigated using the normalized forward sensitivity index. Consequently, four time-dependent control interventions are considered to mitigate the spread dynamics of malaria in the population. Efficiency and economic analyses of the intervention strategies are explored to identify the most efficient and most cost-effective intervention that best avert highest number of malaria cases in the population when limited resources are provided.

NSPS-FUOYE-MS-019

FORMULATION, ANALYSIS AND NUMERICAL SOLUTION OF SECOND-ORDER PARTIAL DIFFERENTIAL EQUATIONS USING NOVEL BLOCK MULTISTEP FORMULAS

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ABSTRACT

This paper presents formulation, analysis and implementation of a novel block multistep formulas (NBMF) for second-order PDEs. The NBMF was proposed to numerically solve second-order partial differential equations which describes diffusion, convection and nonlinear reaction–diffusion processes. The novel formulas are formulated through interpolation and collocation approach using power series as the basis function. The basis function is interpolated at some selected points and collocated at all points within the interval of integration. The resulting novel block multistep formulas was formed by combining the discrete scheme and its t derivatives. The central difference implicit scheme is used for discretization, resulting in a semi-implicit system. The formulas, termed NBMF, was investigated for its basic properties and found to be convergent and p-stable. Numerical experiments demonstrate that the computed solutions are in good agreement with exact solutions and comparable to existing methods, highlighting the NBMF's accuracy.

NSPS-FUOYE-MS-020

TRANSIENT DEAN FLOW OF DUSTY FLUID: RIEMANN-SUM APPROXIMATION APPROACH

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ABSTRACT

This study investigates the transient Dean flow of a Newtonian fluid containing dust particles between two concentric annuli, characterized by constant viscosity. The fluid flow is driven by an azimuthal pressure gradient and adheres to no-slip boundary conditions. The governing equations for both the fluid and dust phases are derived based on the principles of continuity and momentum equations. The equations are made dimensionless and solved using Laplace integral transformation with Riemann-sum approximation (RSA) to derive analytical solutions in Laplace domain for the velocity profiles, skin friction, and vorticity, which are then converted to the time domain using RSA. To validate the accuracy of this method, the steady-state solutions for the velocity, skin friction, and vorticity of the fluids are obtained independently. Additionally, solutions for limiting cases, including scenarios with fluids of (mass concentration $l = 0$, relaxation time parameters $\tau \to \infty$), and its steady-state solutions are provided. The analysis of the results consistently shows that the vorticity in the fluid exceeds shear stress, with the highest values found near the outer cylindrical walls, where shear stress is most pronounced, as illustrated in Tables 2-4. Further insights are stated in the results and discussion, and conclusion section respectively.

NSPS-FUOYE-MS-021

CUMULATIVE INCIDENCE FUNCTION IN COMPETING RISKS: A CASE STUDY OF PRIMARY BILIARY CIRRHOSIS IN LIVER DISEASE

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ABSTRACT

Competing risks are critical in survival analysis, particularly in chronic diseases where multiple mutually exclusive outcomes can occur. This study examines the competing risks of death and liver transplantation in primary biliary cirrhosis (PBC) using data from the Mayo Clinic trial. We employ the cumulative incidence function (CIF) and Fine-Gray sub-distribution hazard models to estimate event probabilities and assess the impact of D-penicillamine treatment versus placebo. Our findings reveal that mortality is the dominant event, while transplantation occurs less frequently. Although the treatment group shows marginally lower mortality and higher transplantation rates, these differences are not statistically significant. Key risk factors for event occurrence include age, ascites, disease stage, and platelet count, whereas sex, bilirubin, and albumin do not exhibit significant associations. Variance analysis indicates greater precision in transplantation estimates, suggesting possible limitations in mortality-related data accuracy. These findings underscore the importance of integrating competing risks in survival analysis to improve treatment evaluation and clinical decision-making. Further research should explore more effective therapeutic strategies for PBC management.

Keywords: D-penicillamine, Cox's PH, placebo, mortality.

NSPS-FUOYE-MS-022

MODELLING THE EFFECT OF VACCINATION ON THE DYNAMICS OF TUBERCULOSIS IN AN AGE-STRUCTURED POPULATION

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ABSTRACT

Despite several efforts, Tuberculosis (TB) is still a global leading cause of death. This paper proposed an age-structured deterministic model governing the transmission dynamics and control of TB in the presence of vaccination integrated into the eligible population. Qualitative analysis of the model was carried out to obtain the disease-free equilibrium point of it. The effective reproduction number, R_e of the model was calculated using the next-generation matrix method, which offered a numerical indicator of the potential for TB transmission in the age-structured population. Based on the R_e, sensitivity analysis of the model parameters was conducted to determine which of the model parameters had a positive and which had a negative effect on the spread of TB in the population. Numerical analysis further offers some insightful information about how the key sensitive parameters and the vaccination rate influence the transmission dynamics and control of TB in an age-structured population setting.