2024

NSPS CONFERENCE

BOOK OF ABSTRACTS

NSPS

This book contains all the abstracts submitted for the second conference of the Nigerian Society of Physical Sciences (NSPS) - 2024

NIGERIAN SOCIETY OF PHYSICAL SCIENCES

2nd CONFERENCE OF THE NIGERIAN SOCIETY OF PHYSICAL SCIENCES KWASU, MALETE 2024

Theme: ***Physical Sciences – Current Trends and Modern Perspectives***

1st - 4th FEBRUARY 2024
Mini Convocation Arena, Kwara State University, Malete,
Kwara State

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INTRODUCTION

Physical Sciences have contributed immensely to human survival and prosperity. Physical Sciences disciplines: Physics, Chemistry, Geology, Mathematics, Statistics and Computer Sciences, continued to supply fundamental knowledge to solve myriads of human problems and tools to meet emerging needs. The second conference of the Nigerian Society of Physical Sciences focuses on "Current Trends and Modern Perspectives in the service of Physical Sciences to humanity. The conference shall start with opening speeches and a keynote lecture, to be followed by the technical sessions. The programme of event itemized the schedules and relevant information for the participants. The conference provides an excellent platform and opportunity to establish collaboration with other participants. Participants are encouraged to be open-minded, share knowledge and exchange information on relevant issues, exchange contacts, participate in discussions, interact with experts in different field, and have fun and enjoy every sessions of the programme of events.

All abstracts have been reviewed by members of the NSPS Conference organizing committee and were grouped according to disciplines. Three technical sessions will take place simultaneously and the schedules are detailed in the programme.

LIST OF ABSTRACTS

PHYSICS & GEOLOGY

T1—Physics and Geology

T1-1 **Photocatalytic Properties of Molybdenum Oxide Photoelectrode Synthesized by Spray Pyrolysis Method**

Peverga R. Jubu, Bashir Yusuf, Y. Yusof, A. A. McAsule, S. I. Aondoakaa, N. J. Tsaviv, H. F. Chahul, M. S. Shiada, A. A. Gundu, M. Erukaa

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Abstract

Hydrogen is the most promising energy vector, which can replace the existing fossil fuels due to its clean, efficient, and eco-friendly outcomes. The photoelectrocatalysis is a technique that employs semiconductor photocatalyst and sunlight to produce hydrogen fuel via water splitting. The present work reports the photoelectrocatalytic properties of pyrolyzed molybdenum oxide thin film. Microstructural analysis revealed clustered nanoaggregates. Structural analysis showed a polycrystalline α-MoO_3 phase. The crystallite size, dislocation density, microstrain, and stacking faults were found to be 41.27 nm, 5.87×10^{-4} lines/cm^2, 8.41×10^{-4} and 1.78, respectively. The optical bandgap was found to be 3.20 eV. Linear sweep voltammetry measurement in a 1 M KOH electrolyte revealed a significant photocurrent density of 992.39 μA/cm^2 at a bias of 1.2 V vs. Ag/AgCl (1.4 V vs. RHE). The reasonable performance of the device suggests that the rarely deployed spray pyrolysis method is promising for preparing photoactive α-MoO_3 films for photoelectrochemical measurement.

T1-2 **Thermal Properties of Some Selected Materials Used as Ceiling In Building**

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Abstract
Thermal properties of materials is a crucial area of interest in building construction. This study investigated the thermal properties of Polyvinyl Chloride (PVC), Plaster of Paris (POP), asbestos, and cardboard commonly used as ceiling materials. The steady state method for Lee's disc apparatus was employed to determine the thermal properties which include, thermal conductivity, thermal resistivity, thermal diffusivity, thermal absorptivity and density. The obtained results of thermal conductivity of PVC, POP and Asbestos cardboard, are 0.1083 w/mk, 0.1314 w/mk, 0.1068 w/mk and 0.0851 w/mk, respectively, and are within range of of values 0.0851-0.1314 w/mk The thermal resistivity of the cardboard, POP, Asbestos and PVC are 11.7509 $(w/mk)^{-1}$, 7.6103 $(w/mk)^{-1}$, 9.3633 $(w/mk)^{-1}$ and 9.2336 $(w/mk)^{-1}$ respectively. The results of thermal diffusivity of PVC, Asbestos, POP, and cardboard are$6.34 \times 10^{-7}\left(\frac{m^2}{s}\right)$,$6.0 \times 10^{-8}(\frac{m^2}{s})$, $1.20 \times 10^{-7}(m^2/s)$ and $8.0\times 10^{-8}(m^2/s)$respectively. The results of thermal absorptivity of card board, PVC, POP and Asbestos are 21.31 $x10^{-2}m^{-1}$, 7.57 $x10^{-2}m^{-1}$,17.40 $Xx10^{-2}m^{-1}$ and 15.07$x10^{-2}m^{-1}$ respectively. The density results of POP, PVC, Asbestos and cardboard are 79.84 kg/m^3, 203.59 kg/m^3, 824.13 kg/m^3 and 645.81 kg/m^3 respectively. The results revealed the thermal properties of some materials as a means of understanding behaviour of the materials as they interact with heat fluctuation. In comparison the results revealed that PVC and asbestos are better materials for building insulation since they have good thermal efficiency.

Keywords: Density, materials, thermal efficiency, thermal absorptivity, temperature

T1-3 Variation of ZnS deposition time on chemically prepared Cd1-xZnxS ternary compound from CdS/ZnS bilayers

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Abstract

Chemical bath deposition (CBD) was successfully used for the preparation of cadmium zinc sulphide ($Cd_{1-x}Zn_xS$) ternary alloy thin film with × composition, in the range of 0 and 1, from post annealing treatment of bilayer cadmium sulphide (CdS)/zinc sulphide (ZnS) thin film. Increasing the ZnS layer deposition time leads to an increase in the overall thickness of the bilayer with an attendant increase in zinc ion concentration. From the XRD measurement, thin film samples presented hexagonal structure, with a shift in the peaks position to higher angles coupled with a decreasing crystalline size and lattice constants as zinc ion is continuously incorporated into the $Cd_{1-x}Zn_xS$ thin films. The continuous addition of the wider band gap energy ZnS into the ternary compound as the ZnS deposition time increases constantly brought about the widening of the band gap energy from 3.62 to 3.73 eV. The band gap energy was also calculated theoretically using the composition dependent band gap energy as expressed by Vegard's law and the results obtained are the same with the experimental results. Energy dispersive spectroscopy (EDS) measurement established the presence of the major elements Cd, Zn and S. The room temperature electrical resistivity determined from the point probe measurement ranges between 2.1×10^{-3} and 1.2×10^{1} Ωm, and showed a decrease with increasing zinc ion contents. In this study, it was established that $Cd_{1-x}Zn_xS$ ternary compounds can be prepared starting with CdS/ZnS bilayer, and its post thermal annealing, with the band gap energy able to be accurately controlled by modifying the CdS/ZnS thickness ratio through variation of ZnS deposition time. The results from CdZnS thin film compounds prepared under this present condition established its superior effectiveness as a buffer layer in thin film solar cells.

T1-4 Investigation of the Effects of Atmospheric Conditions on Atmospheric Refractivity in Tropical Savannah region of Nigeria

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Abstract
In this work, the effects of Atmospheric conditions such as Relative Humidity, Atmospheric pressure, Temperature is being investigated on the Refractivity values of the savannah region of Nigeria. Gombe and Yola are used as case study for this research work. These regions have tropical climate marked by both dry and rainy seasons. Atmospheric conditions seriously affect radio wave propagation when transmitted. The need to have a study of the effects of these Atmospheric conditions on Atmospheric Refractivity (N) in the region is therefore paramount. The values of the weather conditions were gotten from NIMETS at Federal Airport Agency of Nigeria in the region for the period of three years, from January 2021 to December 2023. The obtained data were computed in a general equation used to determine the Refractivity values (298-410 N units) and plotted against each Atmospheric condition. The results show that the Refractivity values are directly proportional to Atmospheric pressure, Humidity and inversely proportional to Temperature. At minimum and maximum Temperatures, Refractivity values vary significantly. These findings are in agreement with other related works that were conducted in other regions within the country. The results of this work can be used for proper purchase and installation of telecommunication equipment's.

Key words: Atmosphere, Refractivity, Propagation, Atmospheric conditions

T1-5 Assessment of Natural Radionuclide Concentration in Some Petroleum By-Products within Oredo NPDC, Benin, Edo State, Nigeria

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Abstract

As the petroleum industry plays a pivotal role in the nation's economic development, it becomes crucial to scrutinize potential radiological implications associated with its by-products. This research work aims to contribute valuable insights into the intricate interplay between natural radionuclides and petroleum-derived substances, fostering a comprehensive understanding of the radiological landscape in this region. Assessment of activity concentration of natural radionuclides (^{238}U, ^{232}Th, ^{40}K) in petroleum by-product samples from Oredo Nigerian Petroleum Development Company (NPDC), Benin, Edo State, Nigeria was carried out using gamma-ray spectrometry. A 76 mm x 76 mm NaI(Tl) detector crystal coupled to a Canberra series 10 plus Multichannel Analyzer (MCA) through a photomultiplier tube was used for the radioactivity measurement. A total of 20 petroleum products containing sludge, scale, petrol, kerosine and diesel were analyzed. The mean value of ^{238}U, ^{232}Th and ^{40}K concentrations determined for all the by-products investigated were 33.85 ± 9.79 Bqkg^{-1}, 20.05 ± 3.93 Bqkg^{-1} and 78.01 ± 25.01 Bqkg^{-1} respectively. These values were lower than the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) permissible global values of 52.2 Bqkg^{-1}, 41.0 Bqkg^{-1} and 230.0 Bqkg^{-1} respectively. The annual effective dose, internal hazard index and the external hazard index obtained for the all the petroleum by-products were found to be lower than the UNSCEAR recommended permissible limits of 1.5 mSvy^{-1}, 1 and 1 respectively. All the petroleum by-products sample analyzed in this work met the safety criteria by UNSCEAR and hence may not pose any radiological hazards to workers, general public and the environment. This work will serve as a baseline for the interplay and distribution of natural radionuclide landscape in petroleum oil-rich region of Nigeria.

Keywords: natural radionuclides, petroleum by-products, Oredo NPDC, sludge, scale, petrol, kerosene, diesel

T1-6 **Radon Assessment of Water from Ifelodun Beryllium Mining, North-Central Nigeria**

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Abstract

Mining activities have been reported to contribute immensely to human exposure to ionizing radiation of terrestrial origin. Therefore, the Berylium minefield in Ifelodun, is believed to cause radiological impacts on the proximate communities. 24 samples of ground waters were collected within this area and analysed to assess the degree of the radon concentration and the ensuing effective doses. The ^{222}Rn activity concentration in the groundwater were analysed using a calibrated RAD7-Active Electronic detector big bottle system. The fact-findings from the mean radon concentration and the estimated annual effective doses for adults, children and infants reveal values that were mostly above the recommended limits set by regulatory bodies. The order of radiological risk follows the pattern infant > children > adult. All the estimated values of the cancer risks for the groundwater using the Monte Carlo Simulation are higher than the recommended value of 0.2 ($\times 10^{-3}$) provided by ICRP and UNSCEAR. Owing to this radiation risk, a strict and effective measures need to be put in place to safeguard the populace in the area and the workers in the mining site.

Keywords: Cancer, Radioactivity, Radon, Annual Effective Dose, Beryllium, Monte Carlo.

T1-7 **Radionuclide Intake Due to Food Drying Surfaces: Implications for Individual Ingestion Effective Dose In Ogbomoso, Southwestern Nigeria**

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Abstract
Measurement of low-level radionuclide transfer from food drying surfaces is of radiological importance in environmental protection. Especially in West Africa where farmers commonly preserve their foodstuffs by a low cost method of sun-drying on surfaces such as rock, asphalt, cement, concrete, wood, polythene sheets, metals, or roofing sheets which are reported sources of natural radionuclides. The transfer coefficient of natural radionuclides from drying surfaces into food samples is therefore a concern for dietary intake of the consumers. The radioactivity measurements of commonly used food drying surfaces (rock, asphalt and concrete) in Ogbomoso, as well as cassava flour sun-dried on these surfaces were performed via gamma-ray spectrometry. Cassava flour was sun-dried on fabric raised 1 meter above the ground to serve as control sample ($CF_{control}$). Activity concentrations of ^{40}K, ^{238}U, ^{232}Th in rock, asphalt, concrete and cassava flour dried on these surfaces were determined using a lead-shielded NaI(Ti) detector crystal. Food consumption data and the measured activity concentrations in dried cassava flour were used to estimate ingestion effective dose of radionuclide intake from cassava flour due to these drying surfaces. Annual ingestion effective doses ($mSvy^{-1}$) in cassava flour dried on concrete, rock, asphalt and fabric were estimated to be 0.72, 0.59, 0.42 and 0.26 respectively. Radionuclide addition was observed in cassava flour dried on concrete, rock and asphalt with transfer coefficient maximum in concrete surface and minimum in asphalt surface. Result of this study is useful for radiometric data analysis in the study area especially for regulations on food safety.

Keyword: *Cassava flour, Radionuclide, Ingestion effective dose, Transfer coefficient*

T1-8 **Analysis of The Variability of Solar Irradiance Across the Climatic Zones in Nigeria**

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Abstract

This work is an assessment of the variability of solar irradiance across the climatic zones in Nigeria. The thesis analysed monthly and annual solar irradiance across the five climatic zones namely: Coastal, Tropical Rainforest, Guinea Savannah, Sudan Savannah and Sahel Savannah. Within these climatic zones the following locations were used: Calabar, Benin, Oshogbo, Lokoja, Minna, Yola, Yelwa, Jos, Maiduguri and Sokoto to achieve the purpose of the study. The study used articles from journals, internet materials and data for synoptic stations across Nigeria for a period of fifteen (15) years (2001-2015) acquired from the archives of the West African Science Service Centre on Climate and Adapted Land Use (WASCAL), FUT Minna, obtained from Nigeria Metrological (NIMET)Agency, Abuja. The data was analysed using XLSTAT computer software package for descriptive statistics and Microsoft Excel was used to produce the line graphs to give the seasonal variations of solar irradiance across the selected stations of the climatic zone, the Sen's Slope and the coefficient of determination (R2) were produced to show the degree of the of variability in the solar irradiance linear regression and the non-parametric Mann- Kendall's test was applied to detect trend direction and trend significance. The results showed a monthly mean and an annual upward trend with variations in solar irradiance seasonally across all the selected locations. The result of the Mann- Kendall showed an upward monthly and annual trend for all the computed p-value>alpha value and downward monthly and annual trend for all the computed p-value<alpha. Therefore, the result generally showed that all the locations (Calabar, Benin, Oshogbo, Lokoja, Minna, Jos, Yelwa, Yola Maiduguri and Sokoto) experienced decrease in monthly solar irradiance

Keywords: Solar irradiance, variability, Mann-Kendall and Sen's Slope

T1-9 **Scalar Bosons with Gravitational Effects Near Schwarzschild's Black Hole: The Rindler Trick**

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Abstract

In this study, we explore the quantum effects in the Schwarzschild space-time for massive and massless scalar particles in the presence of an external gravitational field. The methodology involves the analytical solution of the Klein-Gordon equation for the scalar particles in the near-horizon limit of the spacetime, with the use of Rindler approximation. The results show that the quantum effects differ significantly for the massive and massless cases, they possess similar characteristics at distances very close to the event horizon. Massless bosons far from the event horizon experience less gravitational effect and have a symmetric wave function which takes the same form upon moving closer to the event horizon, but with the symmetry lost. The broken symmetry implies that the particle seeks a lower energy level and becomes unpredictable as it moves closer to the event horizon, this is consistent with the description of the behaviour of particles near the Schwarzschild horizon. The particles have energy spectrum even for extremely large values of the Schwarzschild radius, which implies that the Rindler approximation is not only valid in the near-horizon but also close enough to the event horizon. By comparing the quantum effects of the particles constrained by gravity with that of the free particle, we concluded that massive and massless scalars behave differently as a consequence of their geometric differences, since they both possess different eigenstates. Though they all seek lower energy levels at distances near enough to the event horizon.

Key Words: Scalar Bosons; Shwarzschild spacetime; Klein - Gordon equation; Rindler Approximation; Gravity.

T1-10 **Determination of Neutron Flux of Inner and Outer Irradiation Channels of Nirr-1 Leu Core**

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Abstract
This research work focused on the determination of the effective cross section and thermal neutron flux of the inner (B3) and outer (B4) irradiation channels of the Nigeria Research Reactor-1 (NIRR-1). The effective cross section for the inner (B3) and outer (B4) irradiation channels were found to be $1.85\times10^{-22}cm^2$ and $1.28\times10^{-22}cm^2$respectively. This shows that B3 has higher effective cross section than B4 which means that B3 will have more particle collision and produce more energy than B4. The thermal neutron flux for inner (B3) and outer (B4) irradiation channels were found to be $(4.78 \pm 0.22) \times 10^{11}n/cm^2s$ and $(6.86 \pm 1.86) \times 10^{11}n/cm^2s)$ respectively. This shows that outer (B4) channel is more thermalized than inner (B3) irradiation channel because the more the fission the more the thermal neutron flux produce. This signifies that B4 will produce more heat and energy than B3, Meanwhile B3 absorbed or scatter more neutrons by the materials in the reactor than B4 because B3 has lower neutron flux than B4.

Keywords: LEU, NIRR-1, High purity Germanium detector (HPGe), flux monitors, calibration sources

T1-11 **Wave function of the q-deformed hyperbolic potential: An application to quantum information theory**

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Abstract
The non-relativistic approximate eigenfunction of the deformed hyperbolic potential has been obtained via the convectional Nikiforov-Uvarov method. The wave function was obtained for arbitrary orbital quantum number and radial quantum number through the Pekeris approximation scheme. The wave function for has been applied to calculate the position and momentum space expectation values and the variances. These values where used to verify the Heisenberg uncertainty principle and the Fisher information theory for arbitrary values of the potential parameters. To check for the accuracy of the normalized wave function, we applied the Hellmann-Feynman theory to calculate the momentum mean value and found an agreement between both methods. The results obey the lowest bounds of both the Heisenberg uncertain and the Fisher information entropic products for the one-dimensional system and suggest that the uncertain inequalities are ground state phenomena.

Keywords: Fisher information theory, wave function, probability density, expectation values, Heisenberg uncertainty principle.

T1-12 **Effect of time delay on the vibrational resonance of enzyme-substrate reaction**

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Abstract
We investigated the effects of constant delay in a delayed differential equation modeling activated enzyme molecules in brain wave. The dynamical changes in the system trajectories in both the chaotic and the periodic regimes of an existing second order differential equation model are numerically examined when the delay of the biological system are modulated. Also, we examined the effect of the constant delay of vibrational resonance of the system. The simulation showed that the dynamics of the system can be altered by the delay term. In particular, the delay term can be used to control and initiate the phenomenon of vibrational resonance.
Keywords: Vibrational Resonance, Biological System, Enzyme, Brain Wave, Delayed differential equation

T1-13 **Effects of Two Parameters Foundation on Bernoulli-Euler Beam Subjected to Moving Concentrated Load With Clamped-Clamped and Clamped Free Boundary Conditions**

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Abstract

The effects of two parameters foundation on Bernoulli-Euler beam traversed by concentrated loads with clamped-clamped and clamped-free boundary conditions are investigated in this paper. The solution technique is based on the Generalized Fourier integral transform with the series representation of the Dirac-Delta function, a modification of Struble's asymptotic method and integral transformation techniques in conjunction with convolution theory. Analytical solution and numerical analysis showed that higher values of axial force N, shear modulus G and Foundation modulus K, reduced the response amplitudes of the beam when is under the action of moving concentrated loads. However, higher values of shear modulus G are required for a more noticeable effect than the values of foundation modulus K. Also, the critical speed for the system traversed by moving force is found to be smaller than that under the influence of moving mass, hence resonance is reaches earlier in the moving mass problem than that of the moving force problem.

Keywords: Shear Modulus, Foundation modulus, Concentrated Loads, Resonance, Moving Force, Moving mass, Critical Speed, Clamped-Clamped, Clamped-Free

T1-14 **New approach for obtaining the energy spectra of the wave equations under solvable potentials**

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Abstract
In this paper, a new method for obtaining the energy of a particle confined by a solvable potential function under the non-relativistic wave equation has been proposed. The method is conjectured from the Nikiforov-Uvarov and super symmetric quantum mechanics methods. Furthermore, the method is conjectured using the approximation of the orthogonal polynomial embedded in the wave function of the Nikiforov-Uvarov approach. The approximated wave function is similar to the wave function obtained via supersymmetry. After some algebraic approach, the energy can be obtained in closed-form. The method is simple and does not require solving complex integrals and laborious processes that is associated with some eigen-problem methods in existing literature.

Keywords: Schrödinger equations, Nikiforov-Uvarov method, Supersymmetry, Orthogonal functions

T1-15 **Empirical Path Loss Model for Terrestrial Broadcast Application in Uhf Band in The Federal Capital Territory, Abuja, Nigeria**

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Abstract

Path loss prediction models are an essential for proper planning, appropriate design and coverage determination in the broadcast frequency band. Propagation path loss models are very much useful mathematical tools to calculate signal attenuation and it can also be used as a controlling factor for the system performance and coverage. In this paper, the study adapted an empirical path loss model for terrestrial broadcast application in Ultra High-Frequency Band in the Federal Capital Territory, Abuja, Nigeria by quantitatively measuring the signal level of the signal. The signal levels of transmitting signal were taken along three radial routes from the transmitting station using digital signal level meter and the corresponding distances were also measured using Global positioning system. The measurement results were compared with path loss prediction of four widely used empirical path loss models. The results obtained show that Free space model gave a more accurate prediction for path loss in Abuja City after modification with the correction factor average of -48.3460 and Root Mean Square Error of 10.9356 dB. Therefore, it is important that collection of data for signal field strength used for path loss estimations should be taken in all seasons of the year in order to have accurate model that is suitable for Abuja environ.

Keywords: Propagation model, path loss, UHF, signal level, radio propagation

T1-16

A study of thermo-electric properties of the double perovskites Rb_2SeX_6(X = Br, Cl) using DFT

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Abstract

By converting heat to electric energy, thermo-electric (TE) material applications lessen dependency on traditional energy resources. For the first time, we investigated the thermo-electric characteristics of Rb_2SeX_6(X = Br, Cl). Density functional theory was used to explore the thermo-electric properties of Rb_2SeX_6(X = Br, Cl) using norm-conserving pseudo potentials in a plane wave basis set of Quantum Espresso code. The computations were carried out using Generalised Gradient Approximation of Perdew Burke Ernzerhof (GGA-PBE) and Generalised Gradient Approximation of Perdew Burke Ernzerhof adapted for Solid (GGA-PBESol) exchange correlation functionals. Electrical conductivity, thermal conductivity, seebeck coefficients, power factor and figure of merit are the thermoelectric parameters analysed in this study. Computed electrical conductivity, electronic thermal conductivity and power factor increases with temperature, while Seebeck coefficient and figure of merit are decreasing with increase in temperature. Rb_2SeBr_6 has a higher electrical conductivity value than Rb_2SeCl_6. Thermal to electrical conductivity ratios are minimal (on the order of 10^{-5}), making the studied double perovskite materials suitable for thermo-electric applications. The computed minimum values of Seebeck coefficient for Rb_2SeBr_6/Cl_6 are $0.198 \times 10^3/0.166 \times 10^3$ (m V/K) at 750 K, showing that they have p-type conduction. Both Rb_2SeBr_6 and Rb_2SeCl_6 have figure of merit values larger than one (ZT > 1) at all studied temperature ranges, indicating that they are good thermo-electric materials. The calculations' results serve as the foundation for the industrial thermoelectric application of Rb_2SeBr_6/Cl_6.

Keywords: Double perovskite, DFT, electrical conductivity, thermal conductivity, Seebeck coefficients, Figure of merit.

T1-17 Enhancing Cancer Radiotherapy in Nigeria Through Artificial Intelligence: A Promising Frontier

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Abstract

Background: Radiotherapy (radiation oncology) is a specialized area of oncology that deals with the use of radiation to control or eliminate tumour or cancer cells while minimalizing damage to surrounding healthy tissues. Even as it remains a cornerstone in the treatment and management of cancer, current developments in artificial intelligence (AI) have shown promising opportunities in this field. This study explores the concept of AI and the several applications of its techniques (machine/deep learning) in radiotherapy. The article highlights the need for Nigerian hospitals and healthcare centers to start working towards embracing and integrating AI techniques into her radiotherapy (RT) procedures for optimized cancer treatment. Also, important groundwork required to ease the integration process is discussed.

Methods: To highlight the need for Nigerian hospitals and healthcare centers to embrace and integrate AI into their radiotherapy procedures, a state-of-the-art review of accessible literatures from Scopus, PubMed, and Google Scholar was carried out. Search terms like: radiotherapy in Nigeria, artificial intelligence, machine learning and deep learning were used. Also, articles in English language published in the last ten years (2013 - 2023) met our selection criteria.

Result: Several applications of AI (machine/deep learning) techniques in radiotherapy were identified. Areas like: treatment planning, delivery, quality assurance, personalization, research, patient monitoring, and workflow efficiency were found to be candidates for optimization via AI techniques. Also, important preparations like, provision of image databanks and IT infrastructure, training of staff on AI, funding the hospitals for better equipment and staff remuneration, employment of more oncology and medical physics staff, software deployment and developing the required legal framework that supports AI and eases the use of patients' data and related matters, were equally identified.

Conclusion: The advantages of embracing and integrating AI into Nigeria's radiotherapy protocols for optimized cancer treatment are very promising. The efficiency, speed and accuracy that it brings to bear in medical practice cannot be overemphasized. Therefore, all stakeholders including government, the private sector, management and staff of Nigerian medical institutions and the general public must prepare early enough to embrace this technology in order to fight the cancer scourge to a standstill.

T1-18 Sedimentological and Weathering Signature Investigation of Claystones from Northern Bida Basin, Central Nigeria

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Abstract

In this study, selected claystone samples from northern Bida Basin, northcentral Nigeria were investigated using sedimentological, bulk geochemical (X-ray fluorescence, and inductive coupled plasma mass spectrophotometry) analyses, statistical analysis. The aim of this research is to unravel implications of the claystone as a resource potential. Two identified sub-facies (laminated and massive claystones), with color ranges from white, stained-white, brown to grey. were believed to have deposited from suspension settling of the clay-sized particles, that may have been flocculated and formed from an overbank fines architectural element within floodplain environments. Geochemical results of 10 selected samples from 5 different locations (2 samples from each), revealed the following range of compositions; SiO_2 (47.58-78.58 %), Al_2O_3 (12.17-34.35 %), and Fe_2O_3 (0.63-7.11 %), and these data are well compared with some published standard values to affirm their potentials as raw materials for ceramics and paint making, especially on wet-sieving. The statistical visualization chart identified two major oxides; SiO_2 and Al_2O_3 as the dominant variables for further characterizations. The Factor analysis (FA) identified 2 geochemical groups; i. F1-F2 (eigen values > 1.0) which suggest major contributions of SiO_2 and Al_2O_3 during weathering and depositional conditions, and, ii. F3-F5 (eigen values < 1.0) with minimal contributions. Ranges of geochemical indices values such as; Ni/Co (1.14-4.00), Cu/Zn (0.42-4.35), U/Th (0.11-0.87), V/Cr (0.04-2.15), and V/(V+Ni) – 0.73-0.95 revealed an oxic paleodepositional conditions. Also, average values of some provenance indicators like Al2O3/TiO2 (6.77-20.84), Th/Sc (0.60-4.26), Th/Cr (0.01-1.87), La/Sc (1.59-12.66), Eu/Eu* (0.57-0.78), (La/Lu)cN (4.00-57.58) with bivariate and ternary plots indicated an acidic/silicic igneous rocks as the potential provenance of the claystones. Chondrite-normalized REE pattern that shows an overall enrichment of LREE and depletion of HREE supported igneous source rocks. The calculated values of paleoweathering indices; chemical index of alteration (CIA; 88.94-99.49), chemical index of weathering (CIW; 96.72-99.94), and plagioclase index of alteration (PIA; 80.40-99.03) suggest intense weathering in the source area, which indicate non-insitu clay types. This study concludes that, the sedimentological, and geochemical investigations of the secondary clays in the northern Bida Basin, Nigeria has demonstrated their satisfactory characteristics as raw materials in ceramic, paint and brick making industries.

Keywords: Claystone, Sedimentology, Geochemical Proxies, Oxic, Paleoweathering, Provenance.

T1-19 Estimation of Hydraulic Characterization for Delineating Aquifer Distribution and Potentiality in Ikot Edem and Environs, South Eastern Nigeria

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Abstract

Geohydraulic parameters (GP) and integrated electrical conductivity (IEC) of shallow subsurface lithologic layers were determined from geoelectrical resistivity techniques to assess aquifer potentiality and protective capacity. The GP and IEC were generated from ten vertical electrical sounding (VES) locations using the Schlumberger array. The resistivity data were modelled and interpreted with the aid of WINRESIST software. Results indicate 4-5 geoelectric layers comprising of lateritic soils, sandy clay, siltstones, sands and sandstone. Layers parameters were used for the estimation of hydraulic parameters and integrated electrical conductivity (IEC) of the lithologic layers. The hydraulic parameters and IEC were further used in determining the potentiality and protective capacity of the aquifers. Non-invasive empirical/semi-empirical relationships were used in estimating hydraulic conductivity, transmissivity. Transmissivity values range from 14.6m^2/day and 39.82m^2/day indicating wide distribution of intermediate potentiality. Paucity of impermeable highly conductive layers in aquifer overburden was generally observed. Infiltration rates are generally high. Values of IEC range from 0.002 – 0.0078, revealing poor protective capacity. The area is vulnerable to external contaminant. Groundwater quality assessment is imperative before usage.

T1-20 Delination of structural features and hydrothermal alteration zones using integrated geophysical data of part of North-central Nigeria

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Abstract

Delination of possible structural features in part of Nigeria Northcentral region has been performed using high-resolution aeromagnetic and aero radiometric data. The objectives of this work are to identify and harness the factors responsible for alteration zones which can serve as a potential mineralized source for exploration purpose in the area. To achieve this purpose, mathematical techniques such as First Vertical Derivative, Analytic Signal, Euler deconvolution and Centre for Exploration Targeting (CET) grid were performed on the aeromagnetic data analysis and interpretation; in addition, ratios of radio elements and Radiogenic heat production (RHP) were obtained to support the mapping process. The results obtained showed that the area is dominated by structures trending Northeast-Southwest, Northwest, Northeast, Eastwest and Northsouth directions, although the structures trending Northeast-Southwest were found to be most predominant and considered as orientations of mineral deposits in the area. Also, aero radiometric analysis based on the concentrations of Potassium, Uranium, Thorium, their ratios and radiogenic heat revealed lithological units, hydrothermal alterations and radiogenic heat anomaly of the complex. However, this study concluded that the value of radiogenic heat obtained is sufficient for mineral maturation and exploration.

Keywords: Structural features, aeromagnetic data, aero radiometric data, lineaments, RHP, CET.

T1-21 Application of Euler And Werner Deconvolution Techniques in Delineating Tin Deposit in Okeso Area, Southwestern, Nigeria

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Abstract

The Okeso pegmatites field was evaluated using aeromagnetic method within abandoned mine site close to Ojoku area. The aim of the study was to delineate, identify geological boundaries and determine depth of tin deposits using magnetics method. The ore bearing pegmatite within the basement rocks have magnetic susceptibilities of ≤ 24.84 nT. Five magnetic profiles were selected and carried out on the residual anomalies around the abandoned mine site at Okeso with three of the profile lines were in the NW-SE direction and two in the N-S direction. Results from profiles of Werner deconvolution identified some shallow tectonic structures like fractures and faults which are capable of hosting metallic tin deposits. The depth to the magnetic source varies from a minimum to a maximum of 400 m to 800 m below the subsurface in all selected profiles, suggesting the shallow nature of the magnetic source in the area. Additionally, the dip angle ranges from 5.60 to 81.20, potentially attributed to Pan-African shallow structures according to the contact model.vSolutions obtained from the structural index of contact and dyke reveals the presence of dyke formation and boundaries which separate rocks from one another. The trend of the lineaments/ fractures which were likely established during the Pan-African orogeny is dominant in the NE-SW direction, conforms with the trends obtained for basement structures in previous studies. Depth range produced by 3D Euler deconvolution is from 10 - 1000 m for all the lineaments. This gives an insight of approximate depth range of all the lineaments/ fractures across the whole map in the study area unlike, Werner deconvolution which is profile biased. The identical signature from all profiles implies that the tin deposit is relatively uniform, extending to a great depth in the area. This represents economically viable quantity and makes it a worthy target for investors.

Keywords: Okeso pegmatite, aeromagnetic, Euler deconvolution, Werner deconvolution, fractures.

T1-22 **The Rock Pegmatite A Hidden Gem: A Review**

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Abstract

This is review paper is on pegmatite. Pegmatite is an important rock whose usefulness cannot be expressed in light terms. Pegmatite has found its utilization in cell phones and in our present day in lithium batteries. This review is a discussion on the rock pegmatite, what it is, its occurrence and distribution especially in Nigeria, its classification, chemistry, age and geotectonic settings. Pegmatite serves as host to various minerals of economic value, understanding the characterization as described above will provide information on its exploration, exploitation and industrial application

T1-23 **Application of the B3Y-Fetal interaction to alpha decay study**

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Abstract

This study explores, for the first time, the application of the B3Y-Fetal interaction to alpha decay study. To calculate alpha decay half-lives, the choice of the nuclear potential is important. The Michigan-3-Yukawa (M3Y) nucleon-nucleon (NN) effective interactions is often used within the double folding model to obtain the nucleus-nucleus potential. Recently the interaction derived from relativistic mean-field model (termed R3Y) was also successfully employed. In this study, we wish to explore the application of the icroscopically deduced B3Y-Fetal effective interactions that stems from the lowest order constrained variational approach (LOCV) in alpha decay study. We also investigate the use of different density-dependent parametrizations of the model on alpha decay half-lives. The B3Y-Fetal interaction was found to satisfactorily predict the alpha decay half-lives. It is also found that the density-dependent parametrization BDB3Y0-Fetal gives the best description of the alpha decay half-lives. It is therefore concluded that the B3Y-Fetal interaction can successfully be employed in alpha decay study.

Keywords: Alpha decay, B3Y-Fetal, Double folding model

T1-24 Sedimentological and Weathering Signature Investigation of Claystones from Northern Bida Basin, Central Nigeria

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Abstract

In this study, selected claystone samples from northern Bida Basin, northcentral Nigeria were investigated using sedimentological, bulk geochemical (X-ray fluorescence, and inductive coupled plasma mass spectrophotometry) analyses, statistical analysis. The aim of this research is to unravel implications of the claystone as a resource potential. Two identified sub-facies (laminated and massive claystones), with color ranges from white, stained-white, brown to grey. were believed to have deposited from suspension settling of the clay-sized particles, that may have been flocculated and formed from an overbank fines architectural element within floodplain environments. Geochemical results of 10 selected samples from 5 different locations (2 samples from each), revealed the following range of compositions; SiO2 (47.58-78.58 %), Al2O3 (12.17-34.35 %), and Fe2O3 (0.63-7.11 %), and these data are well compared with some published standard values to affirm their potentials as raw materials for ceramics and paint making, especially on wet-sieving. The statistical visualization chart identified two major oxides; SiO2 and Al2O3 as the dominant variables for further characterizations. The Factor analysis (FA) identified 2 geochemical groups; i. F1-F2 (eigen values > 1.0) which suggest major contributions of SiO2 and Al2O3 during weathering and depositional conditions, and, ii. F3-F5 (eigen values < 1.0) with minimal contributions. Ranges of geochemical indices values such as; Ni/Co (1.14-4.00), Cu/Zn (0.42-4.35), U/Th (0.11-0.87), V/Cr (0.04-2.15), and V/(V+Ni) – 0.73-0.95 revealed an oxic paleodepositional conditions. Also, average values of some provenance indicators like Al2O3/TiO2 (6.77-20.84), Th/Sc (0.60-4.26), Th/Cr (0.01-1.87), La/Sc (1.59-12.66), Eu/Eu* (0.57-0.78), (La/Lu)cN (4.00-57.58) with bivariate and ternary plots indicated an acidic/silicic igneous rocks as the potential provenance of the claystones. Chondrite-normalized REE pattern that shows an overall enrichment of LREE and depletion of HREE supported igneous source rocks. The calculated values of paleoweathering indices; chemical index of alteration (CIA; 88.94-99.49), chemical index of weathering (CIW; 96.72-99.94), and plagioclase index of alteration (PIA; 80.40-99.03) suggest intense weathering in the source area, which indicate non-insitu clay types. This study concludes that, the sedimentological, and geochemical investigations of the secondary clays in the northern Bida Basin, Nigeria has demonstrated their satisfactory characteristics as raw materials in ceramic, paint and brick making industries.

Keywords: Claystone, Sedimentology, Geochemical Proxies, Oxic, Paleoweathering, Provenance.

T1-25 First-Principles Calculation of the Phonon and Thermoelectric Properties of NiZrSn Half Heusler Alloy

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Abstract

The search for viable thermoelectric materials is on the front burner for researchers in material science due to the world energy crisis. Several materials have proved to be promising at both high and low-temperature regimes; however, to correctly predict the thermoelectric properties of a material, the relationship among the parameters of the dimensionless figure of merit needs to be understood and correctly analysed. In this work, we have adopted a first-principles method to investigate the structural, electronic, phonon, and transport properties of NiZrSn based on the density functional theory using the generalized gradient approximation implemented in the quantum espresso suite. The band gap, lattice constant and other structural and electronic property results obtained in this work compare well with experimental and theoretical results from previous work. Furthermore, we studied the phonon and transport properties of the alloy. The phonon dispersion and phonon density of states prove that NiZrSn is stable. The LO-TO splitting in the acoustic and optical phonon branches supports covalent and ionic bonding in the alloy. The thermoelectric properties with hole and electron doping and carrier concentrations suggest that NiZrSn will be a better thermoelectric material as an n-type semiconductor.

T1-26 **Geoelectric Assessment of Groundwater Potential in Erin-Ile, Basement complex region of Southwestern Nigeria**

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Abstract
This study presents a geoelectric evaluation of groundwater potential in Erin-Ile, situated in the basement complex terrain, utilizing Vertical Electrical Sounding (VES) to delineate lithological layers and assess aquifer characteristics. The study area relies entirely on groundwater for daily water supply, leading to challenges such as low borehole yields and increased water demand due to population growth and infrastructure development. The resistivity and thickness parameters obtained from VES profiles were systematically analyzed to understand the subsurface hydrogeological structure. Notably, the study employs H-type and KH-type curves to categorize lithological layers as lateritic soil, weathered basement, and fractured/fresh basement. Groundwater potential analysis considers aquifer resistivity, thickness, hydraulic conductivity, and transmissivity. The results indicate varying groundwater potential across the study area, with 74% classified as having moderate potential, 24% as having low potential, and 2% as having negligible potential. No locations were identified with high/good groundwater potential. The southwestern part of the study area is predominantly characterized by moderate groundwater potential. This research contributes valuable insights into the hydrogeology of Erin-Ile, offering a foundation for sustainable groundwater resource management. The findings underscore the significance of geoelectric methods in assessing groundwater potential and highlight areas for potential improvement in water supply infrastructure.

Keywords: Geoelectric Assessment, Groundwater Potential, Aquifer Characterization, Hydrogeological Exploration, Water Resource Managem

T1-27 Tunning the electronic and metal (Na and Mg) adsorption properties of 2D SiC by defect engineering: First Principles

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ABSTRACT

In light of worries about the cost and future supply of lithium, other novel technologies have emerged as potential options for large-scale stationary energy storage. The electronic conductivity of a material and its adsorption properties are two essential parameters that influence its suitability for usage as an anode within a battery system. Here in, using density functional theory (DFT), we study the effect of the addition of stonewale defects on the electronic and adsorption properties of some selected elemental metals on 2D silicon carbide (SiC). Our results show that pristine SiC exhibits an indirect wide band gap semiconducting nature with a band gap energy of 2.53 eV. The DOS calculation indicates that the valence band is dominated by the 2p states of C, with the 2p states of Si dominating the conduction band. Consequently, the indirect nature of the band gap is maintained with the addition of the stonewale defect, with the band gap decreasing to a value of 0.78 eV, indicating a band gap closing of about 70%. Additionally, the doping with stonewale defect rarely affects the dominance character of both the 2p states of C and Si in the conduction and valence bands but rather modifies the energetics of the bands. The most favorable energetic site for the adsorption of Na and Mg was on top of Si with adsorption energy of 0.357 eV and 1.241 eV for Na and Mg respectively, indicating weak binding of the adatoms on the surface of the SiC layer. Upon introducing the defect, the energetic sites migrate to the heptagonal site, with the adsorption energy slightly decreasing to -5.617 eV, and -0.156 eV for Na and Mg respectively indicating an improved metallic affinity with the introduction of defect. Finally, the structural integrity of the defected SiC was maintained upon adatom adsorption, which shows the robust nature of the doped SiC. These findings suggest improved electronic conduction and metal adsorption affinity on stonewale defected SiC, which could be useful for electrode applications in metal batteries.

MATHEMATICS, STATISTICS, & COMPUTER SCIENCE

T2 – Mathematics, Statistics, Computer Science

T2-1 A Family of Block Methods for Directly Solving Fourth Order Boundary Value Problems of Ordinary Differential Equations

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Abstract
A new family of block methods for solving fourth-order boundary value problems of ordinary differential equations is presented in this work. The block methods are constructed directly by collocating and interpolating a power series polynomial considered as a basis function. This procedure yielded the system of algebraic equations solved to obtain the unknown coefficients. The coefficients obtained are then substituted into the approximate solution to obtain a continuous scheme. The continuous scheme, its first, second and third derivatives are evaluated at all the grid points to generate the linear multistep formulas that form the block methods. In order to estimate the order p of the schemes, Taylor series expansion was adopted. Finally, the derived methods were applied to solve fourth-order boundary value problems of ordinary differential equations arising from beams and chemical problems. The methods were shown to be Consistent and Zero stable, hence Convergent. The comparison was also made with the results of some cited methods in the literature, and it was found that the derived schemes are more accurate and efficient.
Keywords: Order; error constant; Continuous Methods; Collocation and Interpolation; convergence analysis

T2-2 **Modelling the effects of PrEP and PEP on the HIV/AIDs dynamics**

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Abstract

A seven compartmental model is developed to explore collective effect of Pre-Exposure prophylaxis (PrEP) and Post Exposure Prophylaxis (PEP) on the dynamic spread of HIV/AIDS. The study demonstrates the positivity, existence and uniqueness of solution, along with analysis of equilibrium points. the Basic Reproduction number R_v was generated, the local and global stability of the Disease Free Equilibrium (DFE) of the model was assessed, confirming their asymptotic stability if$R_0 < 1$. We established the presence of a unique Endemic Equilibrium, demonstrating its local and global asymptotic stability with the aid of quadratic Lyapunov function. The study identifies the feasible region where the model is well posed. Sensitivity analysis highlights that β (the contact rate) significantly contributes to the endemic nature of the disease. Numerical simulation indicates that the use of PrEP and PEP can substantially decrease the incidence of new infections. The effectiveness of these measures along with proper treatment, plays a crucial role in reducing HIV transmission among individuals at substantial risk or exposed, emphasizing the importance of rigorous adherence to their intake.

Keywords: Pre-Exposure prophylaxis (PrEP) and Post Exposure Prophylaxis (PEP), Stability, Adherence, Exposed

T2-3 Coincidence and Common Fixed Point Results for Generalized F-Contractive Mappings of Ciric type and Hardy-Roger type with Applications

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Abstract
The purpose of this article is to establish the existence and uniqueness of coincidence and common fixed point of discontinuous non-compatible faintly compatible pair of self maps in non-complete metric space without using containment requirement of range space of involved maps satisfying Ciric type F-contraction and Hardy-Roger type F-contraction. Some illustrative examples associated with pictographic validations are provided to demonstrate the main results and to show the genuineness of our results. We consider the application of our results to the study of two-point boundary value problem related with second order differential equation, solve two-point boundary value problem of the second order differential equation arising in electric circuit equation and also apply our results to Volterra type integral equation using Ciric type F-contraction as well as Hardy Roger type F-contraction. The presented results extend and generalized various known comparable results from the current literature.

Keywords Coincidence fixed point; common fixed point; F-contraction; faintly compatible maps

T2-4 Approximate solution of time-fractional non-linear parabolic equations arising in mathematical Physics

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Abstract
In this paper, new iterative method was employed to obtain analytic approximate solutions of the Allen-Cahn, the Newell-Whitehead and the Fishers equations. These three equations were derived from the general nonlinear dynamical wave equations when the constants therein assume certain specific values. The approach presented in this paper is effective and accurate with lesser computation rigours relative to the results obtained in the literature.

T2-5 Estimates for A Class of Analytic and Univalent Functions Connected with Quasi-subordination

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Abstract

Geometric Function Theory has gained an impressive attention from many researchers. This occurs largely because it deals with the study of geometric properties of analytic functions and many of its applications in many fields of mathematics. Notable fields of applications include conformal mappings, special functions, physics and engineering. The investigations in this paper are on a new subclass of analytic and univalent functions dened in the unit disk and denoted by Q q (m). The definition of the new class encompasses some well-known subclasses of analytic and univalent functions such as the classes of star like functions, Yamaguchi functions and Ma-Minda functions. Two key mathematical principles involved in its definition are the principles of Taylor's series and quasi subordination. The investigations on functions f 2 Q q (m) are however, the upper estimates for some initial bounds, the solution to the well-known Fekete-Szeg o problem and the upper estimate for a Hankel determinant.

T2-6 **On Cummutative Properties of Multigroups**

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Abstract
Multigroups is a generalization of group theory over a multiset. The notion of center, centralizer and normalizer were presented in this paper to capture multiset since multigroup is a generalization of group theory and it will enhance further study on multigroup theory. It was established that center and normalizer of multigroup is a normal submultigroup and is the given multigroup if it is commutative.
Keywords: Multigroups, center, centralizer and normalizer.

T2-7 **The Trajectory Correlation of Mobile Phone Applications, On Student's Psychological and Communication Behaviour of Nuhu Bamalli Polytechnic Zaria, Kaduna State**

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Abstract

Mobile phone applications (apps), has becomes very important aid were ideas and knowledge can be communicated between Lecturers-to-Students and external world-to-students, which help in improvement of academic and innovation performances within our tertiary institution. This paper is written to examine and explore the correlation of mobile phone applications on both student's psychological (thoughts and feeling) and communication (body language, facial expressions, gestures and silence) behaviour. Mobile applications have a great impact in empowering mindset towards creation, innovation, forecasting and invention among the students of the polytechnic. This study's contribution is enhancing our knowledge on student's behaviour towards mobile-phone applications in respect to educational and technological system. The total numbers of 100 questionnaires were distributed among the students of the institution to examine the correlation of the mobile applications on behaviour. Therefore, three hypotheses were derived for the study, descriptive analysis, t-testing, one –way multivariate (ANOVA), inductive and deductive content analysis were performed to characterize the trajectory correlation of mobile phone applications on both psychological and communication behaviour of the students within the polytechnic. The findings show that since students are stuck to their mobile phones, there is a need to develop and create our own educational apps, YouTube and technological website in our own national local language dialects for effect communication that will increase student academic performance.

Keywords: Mobile Phone applications, Behaviour (psychological and communication), Educational system, academic performances

T2-8 **Implementation of email alert based survelance system using ultrasonic sensor**

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Abstract
In comparison to existing widely used home security systems, this work provides a smart trespasser detection and email alert system that attempts to boost security as well as the possibility of positively identifying or stopping trespassers and intruders. This system actively assesses the level of risk that an individual or animal poses on or near the home's property and notifies the owners and other designated parties, such as the appropriate security agencies, of pertinent information. The human body will block the ultrasonic transmission if an intruder enters the ultrasonic sensing area. Also, system will detect when someone enters or exits the surveillance area since the receivers won't receive any transmissions from the ultrasonic transmitter by the application of a Majority Voting Mechanism (MVM) for a sensor group. This system can be used to improve security and give prompt notifications in the event of an illegal intrusion in both home and business settings. This technology uses sophisticated data analysis and real-time notifications to provide a solid foundation for contemporary monitoring methods.
Keywords: Security, Email-alert, Surveillance, Ultrasonic sensor

T2-9 **Predicting long-term deposit customers using convolutional neural network and data conversion technique**

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Abstract

The banking industry is the foundation of any nation's economy, and bank deposits are its primary source of profitability. Bank deposits play a significant role in determining a nation's saving rate. Globalization has resulted in substantial technological changes, business strategy, and customer service across many industries, including the financial services sector. Globalization has had a massive impact on the banking industry, resulting in a revolution in how it provides cutting-edge technology. This study proposes a deep learning model using RESNET architectural design and transfer learning on a Portuguese banking institution containing 40,811 training data, with 36,202 belonging to label 0 and 4639 belonging to label 1. Clearly, this shows a significant level of bias between the two labels. Hence, a SMOTE method of class balancing was applied. This dataset, which was in comma-separated value (CSV), was converted into images coupled with the weight transfer from the residual network trained on ImageNet, our fully connected layer was built and trained with the image files. The highest performance reached by the conventional machine learning models, Random Forest (RF), is 90.78% for accuracy, 59.37% precision, 96.78% recall, and 85.28% F1 score which was tested on 412 test samples. However, our proposed methodology achieves an outstanding result with an accuracy of 93.00%, 97.00% precision, 90.00% recall, 93.00% F1 score, and 94.00% ROC, with test samples of size 5601.

T2-10 **Predictive Modeling through Machine Learning in Statistics**

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Abstract

This abstract explores the application of machine learning in statistics, focusing on predictive modeling. It delves into the integration of advanced algorithms to analyze and interpret data, aiming to enhance predictive accuracy. The study investigates various machine learning techniques within a statistical framework, illustrating their potential to uncover patterns, make predictions, and contribute to the evolving landscape of data-driven decision-making.

Keywords: Predictive Modeling, Statistics, Machine Learning, Algorithms, Data-driven Decision-making

T2-11 **Logical equivalence of data and electrical networks**

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Abstract

System Modeling has proven to be a useful technique for solving problems that would otherwise have been impossible. In modeling, it is not out of place to perform analysis and draw conclusions on a system that is too difficult or sometimes impossible to analyze by comparing it with another similar system that is relatively easier to analyze. This approach is commonly used in proffering solution to mechanical system problems by analyzing similar electrical systems and is the reason for the popular term "equivalent systems". In this paper, the term Logical equivalence (referring to systems that are logically the same) which is based on the same concept as equivalent systems is introduced to connote a logical comparism between systems (in this case a data network and an electrical network). It is mainly concerned with showing how a data network can be logically represented as the two main classifications of electrical networks (series and parallel networks) and leaving out how computational analysis can be done to determine network parameters for further research.

Keywords: systems, modeling, logical equivalence, data network, electrical network

T2-12 **Medical Image Compression using Stem Cell Optimization Algorithm**

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Abstract

Medical image compression is a vital technique aimed at reducing storage requirements and transmission bandwidth while preserving diagnostic information. This study introduces a novel approach to medical image compression using the Stem Cell Optimization Algorithm (SCOA). Inspired by the self-renewal and differentiation abilities of stem cells, SCOA proves to be well-suited for addressing complex optimization problems. The proposed method combines SCOA's power with advanced image processing techniques to achieve high-quality compression results. Leveraging stem cell behavior, the algorithm dynamically adapts compression parameters to ensure optimal compression ratios while upholding image fidelity. To assess the performance of this approach, experiments were conducted on a diverse set of medical images, including X-rays, MRIs, and CT scans. The results demonstrate that the SCOA-based compression method outperforms traditional compression techniques like JPEG and JPEG2000 in both compression efficiency and visual quality. Moreover, this approach exhibits robustness against noise and artifacts commonly found in medical images, making it suitable for real-world medical applications. The promising results obtained from this research open up possibilities for further exploring the potential of SCOA in medical image compression and related fields.

Keywords: Medical Image Compression, Stem Cell Optimization Algorithm, Image Processing, Compression Efficiency, Image Fidelity, X-rays, MRIs, CT Scans.

T2-13 **Characterization of Quasi Idempotent in Semigroups of Full Contraction Mappings of a Finite Chain**

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Abstract

Let Tn be the semigroup of full transformation of a finite set and let Xn = {1, 2, · · · , n}. A transformation β : Domβ ⊂ Xn → Im(β) ⊂ Xn is said to be full or total transformation if Domβ = Xn. A transformation β ∈ CTn is said to be full contraction mapping if ∀ x, y ∈ Domβ, |xβ − yβ| ≤ |x − y| ∀ x, y ∈ Domβ. Let CTn be the semigroup of full contraction transformation and let QCTn be its quasi-idempotent of Xn. We characterized quasi-idempotent elements into matching blocks, non-matching blocks and self-matching blocks of CTn and also quasi-idempotent of type one was also established.

T2-14 Application of Shifted Vieta-Lucas Polynomials for The Numerical Treatment of Volterra-Integro Differential Equations

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Abstract
In this research, the numerical solution of the Volterra-Integro differential equations was obtained by applying the variational iteration strategy with the Shifted Vieta-Lucas polynomials. The suggested method builds the Shifted Vieta-Lucas polynomials for the supplied Volterra-Integro differential equation, which are then utilized as basis functions for the approximation. Also, numerical examples were provided to demonstrate the effectiveness and dependability of the suggested approach. Calculations were performed using maple 2022 software.

T2-15 **Fixed Point Theorems of a Bi-Symmetry Geraghty-Type Map in b-Metric Space**

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Abstract
In this paper, we introduce a bi-symmetry Geraghty-type map for examining the well-posedness of nonlinear Picard-type problems. We establish and prove the existence theorem as well as the stability of operators satisfying the bi-symmetry condition. Finally, we consider numerical examples to validate and illustrate the general applicability of the condition.
Keywords: bi-symmetry Geraghty-type map, well-posedness, Picard-type problem.

CHEMISTRY & INDUSTRIAL CHEMISTRY

T3 – Chemistry & Industrial Chemistry

T3-1 Chemical Analysis of Sand from Kaltungo Deposit Gombe State Nigeria for Industrial Applications

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Abstract

Silica sand is a mineral asset with a wide assortment of uses; glass industry, development and foundry are the most well-known models thereof. The motivation behind this examination work is to dissect the reasonableness of sand stores for optical glass making in Kaltungo Gombe State Nigeria. The materials utilized were: sets of strainers, sifter shaker, XRF machine, Recepticles, Weighing balance, Plastic compartments, HCl and refined water. The sand tests were gotten by hand digging with digger and were gathered from five distinct areas in the site. They were blended completely; the examples were washed with faucet water until a reasonable water begin streaming. Undiluted HCl corrosive was filled the example, while, half by half HCl and refined water, the combinations were mixed at the same time. After 25 minutes, the blends were emptied and the example was completely washed with refined water, then, at that point, the example was permitted to dry. Molecule size not entirely set in stone by going the material through a progression of strainers stacked with dynamically more modest openings start to finish and gauging the material held on each sifter. X-Beam Fluorescence (XRF) Examination was utilized to do the synthetic investigation of the example and the outcome was acquired and organized. The outcomes show that the sand stores are appropriate for optical glass making because of their high SiO_2, barium oxide content and low Fe_2O_3 content combined with reasonable grain size circulation divisions.

Keywords: Silica Sand, Optical Glass, Chemical Analysis, Particle Size Distribution.

T3-2 Preparation, Functionalization and Characterization of Multi-Walled Carbon Nanotubes (MWCNTs)

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Abstract

Multi-walled Carbon Nanotubes (MWCNTs) are cylindrical structures composed of rolled-up graphene sheets with diameters of a few nanometres and lengths up to several hundred micrometres. The unique properties of MWCNTs, including their high electrical and thermal conductivity, strong mechanical strength and chemical stability make them attractive in various applications. This study functionalized the MWCNTs via chemical methods using concentrated nitric and sulphuric acids under reflux condition for 6 hrs each. The material was washed thoroughly with hot deionized water until neutral pH was obtained. The powdered sample was characterized by Scanning Electron Microscopy (SEM), Elemental Dispersive X-ray (EDX), Fourier Infrared Spectroscopy (FT-IR), Brunauer Emmett-Teller (BET) and X-ray Diffraction (XRD) respectively. The morphological study was carried out using (SEM) which confirmed large cavities and sparsely web shape while (EDX) gave atomic distribution of the material and revealed carbon and oxygen as major elements, sodium and sulphur are minor elements present in the MWCNTs. The BET surface area result of the novel material indicated higher surface area with 865.66 m2/g. The (FT-IR) result of the MWCNTs spectra showed broad band peaks at 3448.84 cm-1 and 3414 cm-1 which corresponds to O-H stretching mode of hydroxyl groups on the surface of the nanotube. The material could be used for removal of aqueous solution from pollutants.

Keywords: Carbon, Characterization, Functionalization, Nanotube

T3-3 Synthesis and optimization of ethyleneglycol-based biolubricant from castor (ricinus communis) seed oil

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Abstract

Extensive use of petroleum-based lubricants has led to significant environmental harm, necessitating the development of eco-friendly alternatives. This work focuses on synthesizing and optimizing an ethylene glycol-based biolubricant from castor (Ricinus communis) seed oil to address environmental concerns associated with conventional lubricants. The castor oil extraction, physicochemical analysis, and two-step transesterification processes produced a biodegradable and non-toxic castor oil-based biolubricant. Response surface methodology (RSM) utilizing a Box-Behnken Design (BBD) optimized the second esterification process, investigating the effects of input variables of temperature, mole ratio, and reaction time on the yield of biolubricant. Castor oil is rich in unsaturated fatty acids, with ricinoleic acid being the predominant component. The ANOVA and model fittings showed the quadratic regression polynomial model is effective in optimizing the biolubricant yield, demonstrating the effectiveness of the model. The optimization process, guided by a quadratic statistical model, identifies optimal reaction conditions of 80 °C, 90 minutes of reaction time, a molar ratio of 3:1, and a fixed catalyst dosage of 1.0%. The predicted (85.96%) and experimental (86.23%) were aligned closely. The most crucial factor, according to the data, was the molar ratio. The synthesized castor oil-based biolubricant meets the requirements of International Organization for Standardization (ISO) Viscosity Grades 32 (ISO VG 32) and 46 (ISO VG 46), affirming its quality and potential for industrial applications.

Keywords: biolubricant; castor oil, optimization, ethylene glycol; transesterification

T3-4 A Multifunctional Luminescent Zn-terephthalate Coordination Polymer for Selective Detection of Cr^{3+} and Acetone

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Abstract

Fluorescent chemosensors are becoming attractive due to their unique features of sensitivity and selective detection of analytes in the aqueous phase. The coordination polymer $[Zn(BDC)(H_2O)]_n$.DMF 1 (where H2BDC = 1,4-Benzenedicarboxylic acid) was synthesized by stirring at ambient temperature. This was characterized using elemental analysis, Fourier transform infrared (FTIR) spectroscopy, thermogravimetric analysis (TGA) and Single Crystal X-ray diffraction (SC-XRD) techniques. Compound 1 revealed a 2D sheet polymeric structure with a guest DMF molecule in its pore. The geometry around the Zn^{2+} metal centre is distorted square pyramid. The compound was found to be thermally stable up to 356 ^{o}C. Compounds 1 shows excellent fluorescent properties with maximum emission band at 421 nm. This is attributed to ligand to metal charge transfer (LMCT) arising from the π-electron rich backbone of the free ligands. The compound was further studied for detection of metal cations and volatile organic compounds. Results show selective recognition of Cr^{3+} and acetone by drastic quenching of fluorescent intensity. High Stern Volmer constants and low limits of detection obtained makes the compound a desirable sensor material.

T3-5 Microbial-Assisted Biogenic Synthesis of TiO_2 Nanoparticles: A Green Approach for Enhanced Methylene Blue Removal from Aqueous Solutions

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Abstract

This study investigates the synthesis, characterisation, and application of titanium dioxide nanoparticles (TiO_2 NPs) as an adsorbent for the effective removal of Methylene Blue (MB) dye from aqueous solutions. The TiO_2 nanoparticles were synthesized through a biogenic route using Pseudomonas aeruginosa as a bio-reducing and stabilizing agent. The synthesized nanoparticles were characterized using various analytical techniques, including X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), transition electron microscopy (TEM) and energy-dispersive X-ray spectroscopy (EDX). The UV-visible spectrophotometer was used to monitor the nanoparticle formation at 393 nm wavelength. From the results, XRD informed the nanostructured and amorphous nature of TiO_2 NPs, SEM-EDX analysis indicated a coarse and rough surface of the nanoparticles, TEM analysis highlighted their uniform spherical morphology, FTIR spectroscopy unveiled the presence of O-H, C-O, and N-H functional groups responsible for MB adsorption. The adsorption experiments investigated factors such as initial dye concentration, adsorbent dosage, contact time, solution pH, and temperature via the batch adsorption method. The adsorption kinetics were carefully explored, revealing that the pseudo-second-order model accurately described the intricate dynamics of the adsorption process. The Langmuir isotherm model emerged as the optimal fit for the experimental data, shedding light on the monolayer adsorption behaviour on the TiO_2 NP surface. The thermodynamic studies elucidate the energetics of the adsorption process. The positive ΔH (12.75 kJ) indicated an endothermic nature, while the positive ΔS (62.27 J/mol) signified an increase in disorderliness between the adsorbent and adsorbate. Negative values of ΔG (-8.522 and -13.967 kJ/mol) underscored the feasibility and spontaneity of the adsorption system, suggesting a robust affinity for MB. Highlights from this study are the excellent potential of green-synthesized TiO_2 NPs as a promising adsorbent for efficient MB dye removal from aqueous solution and possible use for other types of wastewater treatment.

T3-6 New Manganese (II) complexes of the Non-steroidal Anti-Inflammatory Drug (Sodium diclofenac) and various nitrogen-based ligands: Synthesis, characterization and antioxidant efficacy

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Abstract

A series of complexes of Mn(II), $[Mn(NaD)_2(AMP)_2]$ (1), $[Mn(NaD)_2(APD)_2]$ (2), [Mn(NaD)2(HPY)$_2$] (3), $[Mn(NaD)_2(BPY)]$ (4), $[Mn(NaD)(AMP)Cl_2]$ (5), $[Mn(NaD)(APD)Cl_2]$ (6), Mn(NaD)(HPY) (7) (NaD = Sodium diclofenac, AMP = 2-aminophenol, APD = 2-aminopyridine, HPY = 2-hydroxypyridine, BPY = 2,2-bipyridine) were synthesized and characterized using FTIR, UV-Vis spectroscopic techniques in order to examine their binding coordination modes. The antioxidant property of metal complexes was determined using DPPH (1,1-diphenyl-2-picrylhydrazyl) and ABTS (2,2-Azino-Bis-3-Ethylbenzothiazoline-6-Sulfonic Acid) assay with Ascorbic acid as control. The spectroscopic data revealed ligands coordinated to the metal ion through hydroxyl oxygen of carboxylate of Sodium diclofenac; amino group of 2-aminophenol and pyridine-nitrogen atom of 2-aminopyridine, 2-hydroxypyridine and 2,2-bipyridine respectively. The antioxidant evaluation results revealed that the IC_{50} of Ascorbic acid used as a control for DPPH is 1777 and ABTS is 1645 µg/mL. The IC_{50} values of all the metal complexes for both DPPH and ABTS were found to be lower than that of ascorbic acid signaling that the synthesized metal complexes are promising antioxidant agents. However, the antioxidant results showed that complexes 5,6 and 7 have a better antioxidant property than complexes 1,2,3 and 4.

Keywords: Manganese (II) complexes, Non-steroidal Anti-Inflammatory Drug, Sodium diclofenac, Nitrogen-based ligands, Antioxidant efficacy, Ascorbic acid..

T3-7 **The effect of a binder on the physical properties of groundnut shells briquettes**

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Abstract
Groundnut shells are found left to litter the environment as waste in most houses, industries, markets, walk ways and gardens of the groundnut processing and producing places. Aliero town been one of the groundnut producing town of the state and processing activities are taken place. The groundnut shells are seen abundant as waste. In this study the groundnut shell are used to produce briquette for cooking. The effect of binder on the physical properties of groundnut shells briquettes using two different binders: Cassava Starch and Tree Gum were studied. The briquettes samples were prepared using different groundnut shell – binder ratio (90:10, 85:15, and 80:20 respectively) using a manual press briquetting machine. The result of a water resistance measurement shows that sample of briquettes with 90:10% of Starch have the highest value of 5.17 minutes water resistance and the lowest was the sample of the briquette of 80:20% of tree gum with the value of 3.15 minutes water resistances. The compressed density shows that sample of briquettes with 90:10% of Starch have the lowest value of 0.3717 kg/m^3 compressed densities and the highest was the sample of the briquette of 80:20% of tree gum with the value of 0.6589 kg/m^3 compressed density. The result of a dimensional stability shows that the sample of briquettes of 85:15% and the 80:20% of tree gum as a binder have the highest value of 350 m. The result of a relaxation ratio shows that the sample of briquettes 80:20% of a tree gum have the highest value of 1.7427 relaxation ratio, while the lowest is the sample of briquettes 90:10% of cassava starch as a binder with the value of 0.9557 relaxation ratio. Based on the results obtained, it conclude that the briquette from groundnut shell with tree gum as binders can be used as a substitute for firewood as cooking fuel.
Key words: briquette, bind Department of Physics,er, groundnut shell, cassava starch, tree gum

T3-8 Redefining Proton Affinity for Complex Heteronuclear Molecular Species: A Quantum Chemical Approach

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Abstract

Experimental techniques for measuring proton affinity (PA) are plagued with the inability to perform site-specific protonation. Thus, for heteronuclear molecular species with two or more protonation sites, the experimental PA measurement only provides a single value of the PA for each molecular species without any information regarding the protonation site. In this study, different heteronuclear molecular species (with known experimental proton affinity values) having two to four protonation sites were subjected to site-specific protonation using different quantum chemical calculation methods with the aim of characterizing the trends of the PA corresponding to the experimentally measured PA values for each heteronuclear molecular species. Beyond the common assumption that during protonation, the proton is goes to the site of highest electron density, the results revealed other trends corresponding to the measured PA values; Where the proton goes to the site of the less electron density, The different trends observed strongly suggest the need to redefine proton affinity for heteronuclear molecular species. In addition to these observed trends, we also observed some molecular species with marked deviations between the calculated (with the different methods used) and the experimental PA values pointing to the possibility of errors in the reported experimental values. These observations will be presented and discussed.

T3-9 **Transformation of a Nigerian Montebrasite ore by Hydrochloric Acid Leaching**

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Abstract
The new energy industry has caused a significant increase in the demand and price of lithium, resulting in a shortage of lithium ores. This has led to a focus on alternate sources, such as montebrasite, a phosphate mineral that can contain over 10% Li_2O. This study examines how Nigerian montebrasite ore can be transformed by leaching it with hydrochloric acid at different acid concentrations, leaching temperatures, and particle sizes. The shrinking core model (SCM) was used to analyze the reaction between the ore particles and the leaching agent. The products before and after leaching were characterized using XRD, SEM, and EDS. The leaching study, which varied acid concentrations, leaching temperatures, and particle sizes, achieved about 31% ore dissolution. The SCM showed that the reaction rate-controlling step was diffusion-controlled, with an activation energy of 18.1 kJ/mol. However, at optimal leaching conditions, only partial dissolution of montebrasite was achieved, indicating that the majority of the major insoluble residue phases remained constant during the dissolution process. Therefore, the process was not very efficient in obtaining a significant dissolution of the ore, but it did transform the montebrasite from its non-penetrable phase.

T3-10 **The Metal Anthocyanin Interactions: An Overview**

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Abstract
Anthocyanin is one of the phenolic compounds found mainly in some parts of plants, its study has become an area of scientific exploration due to reports gathered on its reactivity, bioactive properties and usefulness as pharmaceutical ingredients in the treatment of diabetes, cancer, obesity and cardiovascular diseases. This study investigated recently characterized anthocyanins with the aim of identifying variations based on plant, plant parts and the ligand characteristics of the isolated anthocyanin. The in – vivo and in - vitro Metal Anthocyanin Complexes (MAC) was also investigated with a view of expanding isolation, synthesis, characterization, and study probable kinetics involving new MAC and its applications. The data reviewed were obtained from research reports found on Web from 2014 to 2022. Results of reviewed studies indicates anthocyanins had been isolated and characterized from different plants and from all parts of plants – leave, pulp, seed, peel, stem and root. The anthocyanidins (aglycone), undergo hydroxylation, methylation, glycosylation, and acylation producing over 800 forms of anthocyanin characterized to date. Chelation of anthocyanin in - vitro had been studied with several metals and metalloids, using the outcome in some cases to monitor and re – produced compounds formed in – vivo. Several applications had been found and are still under investigations on anthocyanins and MAC.
Key words: Anthacyanin, Metal – Anthocyanin Complexes (MAC), in - vivo, in - vitro.

T3-11 Effect of Time of Harvest on the Chemical Composition and Insecticidal Activity of Rind Essential Oils of Nigerian Grown Citrus reticulata

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Abstract
Cowpeas infested with Callosobruchus maculatus have lower protein quality compared to uninfected cowpeas. The affected cowpeas are usually treated using synthetic insecticides which are expensive and hazardous to man. Essential oils were reported to possess insecticidal property with no side effects on the users. The property is determined by the type of chemical compounds in the oils. In this study, the chemical composition and insecticidal property of essential oils from rinds of Citrus reticulata harvested in the morning and afternoon were investigated. Hydrodistillation of the pulverized (500 g each) rinds of the plant from morning and afternoon harvests afforded 0.56% and 0.38% (w/w) of essential oils respectively. GC-MS was used to characterize the oils and the characterization showed an abundance of D-Limonene (51.7% and 63.1%), linalool (12.5% and 18.9%), terpinen-4-ol (4.7% and 3.9%), nerol (7.9% and 4.0%) and α-terpineol (5.0% and 4.5%) in the oils. The insecticidal property of the oils was tested against bean weevils using fumigant toxicity bioassay. The activity of the oils differs significantly and increased with concentration and exposure period with LT50 [lower and upper fiducial limits] of 1.967 [1.796 and 2.239] hours and 1.297 [1.00 and 2.05] hours for the oils from the peels of the fruits collected at 7.00 am and 2.00 pm respectively. The oil from the afternoon harvest is therefore more potent and may be recommended as a safer insecticide against stored product insect pest, C. maculatus.
Key words: Callosobruchus maculatus, D-limonene, linalool, insecticide

T3-12 The Anti-Anaemic Effect of Quail Egg Consumption in Phenylhydrazine-Induced Anaemia in Wistar Albino Rats

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Abstract

Anaemia is a prevalent blood disorder that affects a significant number of people globally. It is characterized by a decrease in the number of red blood cells or haemoglobin, impairing oxygen delivery to the body's tissues. Various factors can cause anaemia, including nutritional deficiencies, infections, genetic disorders, or exposure to toxic substances. One such substance is phenylhydrazine (PHZ), which induces haemolytic anaemia by oxidizing and damaging red blood cells. PHZ-induced anaemia serves as a valuable model for studying the pathophysiology and treatment of anaemia. Quail eggs, produced by the Japanese quail, have been consumed for centuries in various cultures due to their nutritional and medicinal properties. They are rich in protein, fat, minerals, vitamins, and antioxidants and have been reported to have beneficial effects on various health conditions. Quail eggs have also been claimed to have anti-anaemic effects by increasing haemoglobin levels and removing toxins and heavy metals from the blood. This study aimed to evaluate the effect of quail egg consumption on haematological parameters in PHZ-induced anaemia in Wistar albino rats. Eighteen male rats were randomly divided into six groups. Anaemia was induced in the rats by administering PHZ, after which they were treated with different doses of quail egg, a standard drug for anaemia, or water for 14 days. Blood samples were collected from the rats before and after the treatment and analysed for various haematological parameters. The results showed that PHZ administration significantly reduced the haematological parameters, indicating the induction of anaemia. However, treatment with quail egg significantly increased these parameters, indicating the reversal of anaemia. The highest dose of quail egg showed the most significant improvement in the haematological parameters, comparable to the standard drug treatment. These findings suggest that quail egg consumption has a potential anti-anaemic effect in PHZ-induced anaemia in rats, possibly due to its high nutritional and antioxidant content. Quail egg may serve as a natural and alternative therapy for anaemia, especially for individuals who have limited access to conventional drugs or experience adverse reactions to them. Further studies are needed to elucidate the mechanism of action and the optimal dose of quail egg for anaemia treatment.

Keywords: Anaemia, Quail Eggs, Phenylhydrazine, Hematological Parameters

T3-13 GC-MS Profile of Phytochemical Constituents and Antioxidant Potentials of Croton tiglium Seeds Oil

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Abstract
Plant-based phytochemicals play a pivotal role as bioorganic molecules, exhibiting a diverse array of biological properties such as antimalarial, antimicrobial, anticancer, and antidiabetic activities. These compounds serve as valuable templates for the development of new pharmacophores due to their unique structural arrangements. In this study, the Croton tiglium seeds oil was extracted in n-hexane using Soxhlet extraction method and the oil obtained was evaluated for its antioxidant potential against DPPH, ABTS, and H2O2 radicals, with ascorbic acid employed as a reference standard. The phytochemical constituents of the seed oil were identified and profiled using GC-MS. The result of this study demonstrated that the extracted oil exhibited potent antioxidant properties against various radicals, comparable to the effects of the standard drug. GC-MS analysis revealed a total of 14 compounds, with 10,13-Octadecadienoic acid, methyl ester (38.42%), 11-Octadecenoic acid, methyl ester (24.37%), and cis-11-Eicosenoic acid, methyl ester (12.57%) being the most abundant constituents, respectively. In conclusion, Croton tiglium seed oil exhibits potent antioxidant properties comparable to ascorbic acid. More so, diverse bioactive compounds were also identified. These findings accentuate the potential of Croton tiglium seed oil for therapeutic development and contribute to plant-derived bioorganic knowledge.
Key words: Phytochemicals, Croton tiglium, GC-MS seeds oil

T3-14 Phytochemical Profiles, Enzymes Inhibitory and Antioxidant Potentials of Methanol Extract Melanoleuca melaleuca

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Abstract

Throughout history, mushrooms have been an integral component of the dietary traditions of numerous cultures. These fungi are recognized as abundant source of essential phytonutrients like polysaccharides, dietary fibers, and various micronutrients. Moreover, they contain vital amino acids, the foundational elements of essential proteins. In a general sense, mushrooms provide a wide array of health advantages, containing and encompassing a diverse spectrum of bioactive compounds like phenols, flavonoids, steroids, terpenoids and alkaloids with pharmacological attributes, including their potential as antidiabetic, antioxidative, antiviral, antibacterial, osteoprotective, nephroprotective, and hepatoprotective agents, among others. In this study, crude methanol extract of Melanoleuca melaleuca was analysed for the presence of phytochemicals such as alkaloids, flavonoids, terpenoids, steroids, phenols. Furthermore, the phytoconstituents of M. melaleuca were identified using gas chromatography mass spectrometry (GC-MS). More so, the crude extract was investigated for its antioxidant potential against DPPH, ABTS and FRAP and antihyperglycemic potential against α-amylase and glucosidase enzymes. The result of phytochemical screening revealed the presence of flavonoids, phenols in trace amount and alkaloids, terpenoids and steroids in large quantities. A total of twenty-six distinct phytochemicals were identified in the methanol extract of M.melaleuca representing its entire chemical composition. These compounds spanned a wide range of chemical classes with esters and terpenoids being the most prevalent compound. Predominant phytochemicals included 9,12-Octadecadienoic acid (Z-Z), Squalene, and 9-Octadecenal (Z), contributing significantly to the phytochemical composition of M.melaleuca. The result of antiradical scavenging potential demonstrated that the extract showed high antioxidant potential, particularly in the FRAP assay with an IC_{50} value of 29.0 µg/mL compared to standard. In the ABTS assay, the extract exhibited comparable potency to the FRAP assay, with an IC_{50} of 26.9 µg/mL, emphasizing its antioxidative capabilities. While the extract's performance in the DPPH assay (IC_{50} 64.13 µg/mL) was slightly lower, it maintained significant antiradical activity, albeit slightly less potent than vitamin C. The result of enzyme inhibitory assays revealed the M. melaleuca in inhibiting α-glucosidase, a pivotal enzyme in blood sugar regulation, with IC_{50} value of 19.54 µg/mL Although its inhibitory activity against α-amylase (IC_{50} = 36.78 µg/mL) was slightly lower compared to standard drug acarbose. In conclusion, this study provides valuable insights into the phytochemical compositions and potential health-related properties of the M.melaleuca extract, suggesting its significance as a source of antioxidants and potential antidiabetic compounds, though further research is warranted to explore its full therapeutic potential.

Key words: phytochemicals, antioxidants, α-amylase, α-glucosidase enzyme, Melanoleuca melaleuca

T3-15 Gas Chromatography – Mass Spectrometry Identification of Bioactive Compounds and in vitro Antihyperglycemic Potential of Methanol Root-bark Extract of Securidaca longipendiculata (Fresen)

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Abstract

Phytochemicals, bioorganic molecules with significant biological properties, accumulate in various parts of medicinal plants and serve as crucial lead compounds in drug design and discovery programs. S.longipendiculata, a medicinal plant in Nigeria traditionally used for treating diverse human diseases, was the focus of this study. The root bark of S.longipendiculata was extracted in methanol, and its phytochemical constituents were identified through gas chromatography mass spectroscopy (GCMS). The GCMS analysis revealed twenty-four compounds, with methyl salicylate as the major phytochemical, and other identified compounds including Benzeneacetic acid methyl ester, methyl2-hydroxy-4-methoxybenzoate, 2-hydroxy-6-methoxybenzoic acid, and 4-methyl-3-nitrosalicylic acid. Furthermore, the methanol extract exhibited promising antihyperglycemic potential by demonstrating inhibitory action against α-amylase and α-glucosidase, with IC_{50} values of 10.5 and 25.30 µg/mL, respectively, compared to acarbose (28.9 and 36.65 µg/mL). In conclusion, the analysis results accentuate S.longipendiculata as a rich source of important bioactive compounds, contributing to its antihyperglycemic properties.

Key words: Bioactive compounds, GCMS analysis, S.longipendiculata, antihyperglycemic

T3-16 Synthesis and Cytotoxic Properties of Pentacyclic Triterpenoids Derivatives via Copper-Catalyzed 1,3-dipolar Azido-Alkyne Cycloaddition Reaction – An Updated Overview

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Abstract
Pentacyclic triterpenoids, renowned for their diverse pharmacological properties, have attracted the attention of medicinal chemists owing to their potential therapeutic applications, especially in cancer treatment. This class of compounds represents a significant category of secondary metabolites widely distributed in various parts of medicinal plants. Many bioactive compounds within this class have been isolated and identified from their respective sources. These phytochemicals include the lupane type (betulin and betulinic acid), oleanane type (oleanolic acid and glycyrrhetinic acid), and ursane type (ursolic acid). The chemical modification of functional groups at C3, C20, and C28 of these compounds provides an opportunity to design and synthesize novel derivatives. This overview comprehensively explores the synthesis and cytotoxic properties of novel pentacyclic triterpenoid derivatives obtained through a copper-catalyzed 1,3-dipolar azido-alkyne cycloaddition reaction. This synthetic approach efficiently incorporates triazole ring heterocycles into pentacyclic triterpenoids and these heterocycles are known to reduce the overall lipophilicity of triterpenoids, thereby improving their ADME parameters. Additionally, we provide insights into the cytotoxicity profiles of these synthesized compounds, revealing their promising potential as anticancer agents.

Keywords: Pentacyclic triterpenoids, 1,3-dipolar azido-alkyne cycloaddition, triazole, cytotoxicity, anticancer agents

T3-17 Kinetics, Mechanism, Isotherm and Thermodynamics of Adsorption of Lead (II) ion on Synthesized Zinc Oxide Nanoparticle

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Abstract
Lead is a highly toxic element and can cause serious damages to the health of human beings, including cancer. For these reasons, in the recent years stringent limits have been set for this element, especially regarding drinking water. Therefore, major concern has to be the focused on the removal of this toxic metal from aqueous medium. Zinc oxide nanoparticle was synthesized and characterized using Fourier Transform Infrared Spectroscopy, (FTIR), Scanning Electron Microscopy (SEM), Energy Dispersed X-ray Spectroscopy (EDX) and Transform Electron Microscopy (TEM). The removal efficiency for zinc oxide sample in the aqueous solution was carried out through batch adsorption studies. The adsorption capacity was achieved to be 96% at pH 5 and contact time was efficient at 120 minutes with adsorbent dose of 0.3 g. Langmuir, Freundlich, Temkin and Dubinin-Radushkevich adsorption isotherm were tested for the adsorption process and the experimental data were best fitted by Freundlich model. Pseudo-second order kinetic model best described the adsorption kinetics and the mechanism of adsorption revealed that intraparticle diffusion is not the only rate determining step, other step like external diffusion may be involved in the rate determining step. Thermodynamic studies indicated that the adsorption system is feasible and spontaneous. These findings further buttress that zinc oxide nanoparticle can be harnessed for the decontamination of metal pollution in water/wastewater.

Keywords: Adsorption, lead (II) ion, zinc oxide, nanoparticle

T3-18 **Isotherms, Kinetics and Thermodynamic Sorption of p-Nitroaniline On Cocos Nucifera Shell Activated Carbon@TiO_2 Composite**

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Abstract

The need to create a more efficient, readily available and cost-effective adsorbent, comparable to commercially available adsorbents, has garnered considerable interest as a promising option for wastewater treatment. A comparative study was conducted on the adsorption capacity of Cocos nucifera shell activated carbon (CNSA) and Cocos nucifera shell activated carbon@TiO_2 composite (CNSA-TiO_2) for para-nitroaniline (p-NA) in an aqueous medium. The CNSA was carbonized at 500 ºC and activated with 1 M HNO_3 while the CNSA-TiO_2 composite was prepared by wet impregnation method. The prepared adsorbents were characterized through Brunauer-Emmett-Teller (BET), Energy dispersive x-ray (EDX) spectroscopy, Fourier-transform infra-red (FTIR) spectroscopy and Scanning electron microscope (SEM). The BET-surface area of CNSA-TiO_2 (748.96 m^2/g) was established to be larger than CNSA (574.21 m^2/g), however both materials are mesoporous. The effect of several operating parameters, such as initial p-NA concentration, pH, adsorbent dosage, contact time and temperature were studied for both adsorbents. The results showed that the adsorption operating parameters influenced the adsorption process except for temperature. Freundlich, Langmuir, Temkin and Dubinin-Radushkevich isotherms were tested on the adsorption data, and the adsorption process of both adsorbents followed the Freundlich isotherm model (R2 > 0.988). Among the kinetic models investigated were pseudo first-order, pseudo second-order, Elovich, and intra-particle diffusion. The pseudo second-order model (R^2=1) best described both processes. The thermodynamic parameters such as ΔG^o, ΔH^o and ΔS^o were calculated. The process was exothermic, feasible and spontaneous.

Keywords: Adsorption, Cocos nucifera shell activated carbon, p-nitroaniline, TiO_2, Isotherm

T3-19 Assessment of Heavy Metal Contamination in Vegetables Grown in Waste Water-Irrigated Soils: A Case Study of Ita-Nmo in Ilorin, Nigeria

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Abstract

The investigation herein aimed to ascertain the concentrations of various heavy metals in wastewater, soil, and selected vegetable species (Amaranthus, Spinach, and Corchorus). The potential risks associated with human health stemming from the consumption of vegetables grown in soil irrigated with wastewater were systematically assessed. The analysis encompassed the determination of Cu, Pb, Zn, and Cd concentrations in wastewater, soil, and vegetable samples. Additionally, data obtained from the analysis were employed to calculate transfer factors, daily intake rates, and target hazard quotients for the plants. Results indicated that the concentrations of heavy metals in irrigation water were 0.01± 0.01 mg/l for Cu, 0.11± 0.02 mg/l for Pb, 0.02± 0.01 mg/l for Zn, and Cd was found to be below the detection limit. Soil samples exhibited varying levels of heavy metal concentrations, ranging from 2.0± 0.01 to 6.0± 0.02 mg/kg for Cu, 9.5± 0.01 to 28.7 ± 0.03 mg/kg for Pb, 11.0 ± 0.01 to 18.5± 0.01 mg/kg for Zn, and 0.00± 0.01 to 0.01± 0.01 mg/kg for Cd. Vegetable samples revealed heavy metal concentrations ranging from 0.01± 0.00 to 2.70± 0.02 mg/kg across all tested varieties. Importantly, all analyzed samples fell within the safety limits set by the World Health Organization (WHO) and Food and Agriculture Organization (FAO) in 1999, indicating no immediate threat to human health. However, caution is advised against excessive consumption of these vegetables, as prolonged intake may lead to the accumulation of metals, potentially resulting in toxic effects on consumers.

Key words: Heavy metals, wastewater irrigation, soil contamination, vegetable safety, environmental health

T3-20 Determination of the Sources of Heavy Metals Pollution Using Neem Tree (Azadirachta indica) Stem Barks in Maiduguri, Borno State, Nigeria

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Abstract

Determining the sources of heavy metals pollution in the environment is very important in other to provide solution to the problem. Plants are important indicators of heavy metals in Environmental Pollution. Neem trees is used for shade lining the streets or in most people's back yards in Maiduguri. This study was aimed at determining the concentration (µg/g) of Mn, Ni, Co, Cr, Cd, Cu, Fe, Zn and Pb in barks of Neem tree at various distances away from the main roads of Maiduguri Metropolitan council, Borno State, Nigeria. Samples (stem barks) were collected monthly for three months from three different locations (Bama station, Bulumkutu and Post office areas designated as S1, S2 and S3 respectively) at distances of 50m and 100m each from the main roads, and 250m to serve as control. The samples were collected monthly from the designated and control points for a period of three months. The concentrations of heavy metals in the samples were determined using Perkin-Elmer Analyst 200 Atomic Absorption Spectroscopy (AAS). The results showed that the mean concentrations (µg/g) of the heavy metals in the various locations varied for Zn (0.115±0.007 - 0.719 ± 0.003), Mn (0.234±0.07 - 1.413 ± 0.134), Cu (0.013±0.001 - 0.151 ± 0.003), Co (0.010±0.004 - 0.043 ± 0.013), Fe (1.412±0.028 - 7.681 ± 0.123) and Pb (0.003±0.003 - 0.245 ± 0.147). Analysis of Variance (ANOVA) confirmed significant differences ($p<0.05$) among the levels of the heavy metals from the three locations. Generally, the concentrations of the heavy metals decrease with increase in distance from 50 m to 100 m and then decrease at 250 m (control) from the main roads at locations S1 and S2. However, the concentrations of the heavy metals increase with increase in distance from 50 m to 100 m and then increase at 250 m (control) from the main roads at locations S1. Hence, the pollution in S1 (bama station area) and S2 (Bulumkutu area) are due to both vehicular traffic and other anthropogenic activities while the pollution in S3 (Post office area) is due vehicular traffic activities. Therefore, the Neem tree bark can be used to determine the sources of heavy metals pollution in Maiduguri.

Keywords: Pollution Sources, Heavy Metals, Stem bark, Neem, Maiduguri

T3-21 Ecological Risk Profiles of Heavy Metals and Polycyclic Aromatic Hydrocarbon in Soil Around Industries in Ilorin, Nigeria

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Abstract
Ecological risk profiles of heavy metals and Polycyclic Aromatic Hydrocarbons were assessed in soil from selected occupational workplaces in Ilorin, Nigeria. Soil samples from nine (9) occupational workplaces, - automobile workshops, wood and furniture, and metal & steel industries sites were collected randomly, composited and digested. Cadmium, Copper, Chromium, Iron and Lead were analyzed using Atomic Absorption Spectrometer. The pollution status and ecological risk parameters were determined using standard models (Contamination Factor, Enrichment Factor, Geo-accumulation Index, Ecological Risk Index and Potential Ecological Risk Index. For the determination of PAHs, soil samples were extracted using QUECHERS method. The cleaned extracts were analyzed for the presence of 16 EPA priority PAHs using Gas chromatography mass spectrometer (GC-MS). The results showed that Iron concentration ranged between (480,720 ± 23.15 mg/kg -12031. ± 40.21 mg/kg) in soil samples from the nine (9) selected study areas which were higher than the World Health Permissible limit of (445 mg/kg). The concentration of the other heavy metals from the nine (9) selected study areas ranged between Cadmium (1.15±0.40 mg/kg - 1.93±0.46 mg/kg), chromium (15.0±1.52 mg/kg -142.30±50.55 mg/kg), Copper (17.85±4.60 mg/kg – 85.20±13.80mg/kg) and Lead (5.8±4.20mg/kg – 27.0±10.24 mg/kg) accordingly. The standard models showed that the study area is moderately contaminated and polluted with heavy metals. The GC-MS result revealed that (0.53%) anthracene was detected in Egbejila automobile workshop. Aliphatic chain compounds such as (Dibutylpthalate, Di-n-octylpthalate and Bis (2-ethyl hexylpthalate) which could be traced to plastic products and automobile upholstery were also detected.
Keywords: Heavy metals, Polycyclic Aromatic Hydrocarbons, Wood & Furniture industries, Automobile Workshop, Metal & Steel industries

T3-22 **Assessment of Aquaculture Wastewater Impact on Osun River, Ede, Nigeria**

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Abstract

A study was conducted to determine the impact of aquaculture wastewater discharged from Alhaji Aagberi Fish Farms' fish pond in Ede, Osun State. Samples were collected from four different points around the pond and subjected to physicochemical and metal content analyses aimed to determine the heavy metal levels. The physicochemical tests included pH, temperature, colour, electrical conductivity, chloride, dissolved oxygen, nitrate, phosphate, and turbidity. Biological tests such as fecal coliform, heterotrophic plate count, and adenosine triphosphate tests were also performed. The results showed that the samples had acceptable pH, temperature, and electrical conductivity levels. The colours of the samples ranged from light greenish, greenish, and light brown to no colour. Some samples gave off a fish-like odour, while others had no odour at all. The samples had an average chloride content ranging from 99.4 ± 0.2 mg/L to 149.9 ± 0.2 mg/L, dissolved oxygen from 1.94 ± 0.01 mg/L to 2.31 ± 0.02 mg/L, nitrate content from 2.99 ± 0.01 mg/L to 3.12 ± 0.01 mg/L, and turbidity from 2.44 ± 0.01 mg/L to 2.97 ± 0 mg/L. All of these values were within the regulatory limits. The metal content analyses showed that zinc, lead, mercury, and chromium were within acceptable limits. The bacterial counts ranged from 1.5 x 102 CFU/mL to 4.5 x 102 CFU/mL, leading to four genera of gram-negative and gram-positive bacteria, respectively. Aspergillus spp., Mucor, and Penicillum were the fungal isolates obtained from the samples. Therefore, to prevent harmful bacteria from the fish pond, the microbial load should be reduced by regulating and monitoring the water supplied and discharged from the pond ensuring it is free from harmful bacteria.

T3-23 Adsorptive removal of methylene blue dye from aqueous solution using ZnO_2-activated carbon composite from moringa seed-shell

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Abstract

This investigation details the synthesis and utilization of a composite material composed of ZnO_2 and acid-activated moringa seed shell (ZnO_2-AMSS) to remove methylene blue dye from aqueous solutions. The ZnO_2-AMSS composite was prepared by subjecting the moringa seed shell to acid activation, followed by the incorporation of commercially obtained ZnO_2 through a hydrothermal process. Comprehensive characterisation of the ZnO_2-AMSS composite was carried out using Scanning Electron Microscopy (SEM), Thermo Gravimetric Analysis (TGA), Fourier Transform Infrared (FTIR), and X-ray diffraction (XRD) techniques, providing detailed insights into its structural and surface properties. SEM analysis unveiled a coarse surface morphology, and XRD results suggested the amorphous nature of the composite. The FTIR spectra exhibited distinct peaks associated with O-H, C-O, and C-H functional groups, crucial for effective adsorption. Batch adsorption experiments systematically manipulated dye concentration, adsorbent dose, contact time, and pH. A 0.l-0.5 g of ZnO_2-AMSS was introduced into methylene blue solutions of varying concentrations of 5-20 mg/L. The mixtures underwent agitation at 200 rpm for specified contact times of 5-180 min, after which the adsorbent was separated, and the remaining dye concentration was quantified. The impact of adsorbent dose, contact time, pH, and initial dye concentration on removal efficiency was investigated. Optimal conditions for methylene blue removal were identified at pH 6, a contact time of 120 min, an adsorbent dosage of 0.1 g, and a dye concentration of 20 mg/L, resulting in an impressive 95% removal efficiency. The most fitting kinetic and isotherm models were the pseudo-second-order kinetic model and the Langmuir isotherm model, respectively. ZnO_2-AMSS composites have demonstrated significant potential as an effective adsorbent for methylene blue removal from aqueous solutions. The study provides valuable insights into its promising application in wastewater treatment, addressing environmental concerns related to dye contamination.

Keywords: methylene blue dye, ZnO_2-AMSS composite, adsorption, wastewater, and remediation.

END