



SPCBIC 2024

22nd – 24th April,

Minna Nigeria

**4th SCHOOL OF PHYSICAL SCIENCES BIENNIAL
INTERNATIONAL CONFERENCE
(SPSBIC 2021)**

Book of Abstracts

THEME:

**Innovative scientific research: A tool for socioeconomic
development and environmental sustainability**

**Federal University of Technology Minna,
Niger State, Nigeria**

THEME OF THE CONFERENCE

Innovative scientific research: A tool for socioeconomic development and environmental sustainability.

SUB-THEMES OF THE CONFERENCE

- Advancement in Materials Science and Technology for Sustainable Development
- Modeling, Theory and Applications
- Climate Sustainability and Sustainable Development Goals
- Science, Technology and Innovation, and the Journey to a Net Zero Energy Future for Africa

PRE-CONFERENCE WORKSHOP TITLE

Publication in Impact Factor Journal: Challenge and Breakthrough

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Two--Term President of the Nigerian Academy of Science;
Former Technology Advisor at Shell Petroleum Development Company;
Former PTDF Professional Chair.

Topic: *Science, Technology, and Innovation and the Journey to a Net Zero Energy Future for Africa*



Professor Olugbenga Solomon Bello

(BTech, Chemistry, LAUTECH, Ogbomosho I),
MSc and PhD (Physical Chemistry, University of Ibadan), MACS, MCSN, MRSC.
A Professor of Physical/ Environmental Chemistry, Department of Pure and Applied Chemistry,
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Topic: *Advancement in Material Science and Technology for Sustainable Development*



Leslie Petrik, Professor Emeritus,

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Department of Chemistry, University of the Western Cape, Belleville, South Africa

Topic: *Innovative Scientific Research: A tool for Socioeconomic Development and Environmental Sustainability*

CONFERENCE WORKSHOP FACILITATOR



Dr. Ismail Oyeleke Olarinoye

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Topic: *Publication in Impact Factor Journal: Challenge and Breakthrough*

CHEMICAL/LIFE SCIENCES

2024SPSBIC0003

Performance and Safety Evaluation of Orifice Plate in Natural Gas Pipeline using Computer Aided Engineering (CAE)¹A. G. Isah, ¹M. U. Garba & ^{**2}Sheidu Sumaila Onimisi, ²Ebhota Williams S.¹Chemical Engineering Department, Federal University of Technology Minna, Nigeria²National Engineering Design Development Institute (NEDDI) Nnewi, Nigeria^{**}Corresponding Author @: onimisi.pg2113256@st.futminna.edu.ng**Abstract**

Understanding the potential causes and consequences of orifice plate failure is essential for maintaining accurate flow measurement and preventing operational disturbances. In certain cases, Fluid Structure Interaction (FSI) problem is bound to occur overtime due to fluid pressure such as buckling failure an occur in orifice plates, leading to inaccurate flow measurements and potential safety hazards. These orifice plate had failed several times leading to partial or complete shutdown of the entire line which in some cases is a major line, leading to slow output from the industry till it is replaced with foreign one. The natural gas flows consist of three (3) lines of flows namely lines A, B and C with volumetric flow rate of 30 MMSCF/d (8.6 kg/s), 80 MMSCF/d (22.90 kg/s) and 250MMSCF/d (71.541 kg/s) respectively. The orifices were modeled with solidworks and simulated with Midas NFX using two ways FSI interface of the software. The investigation was conducted for 10,800 seconds in CFD component and 100 seconds for 60 steps in FEA component of the FSI. The validation with data from the plant show that the prediction was about 90% accurate. The buckling load factor (BLF) of the orifice plates were 1.1317, 0.5056 and 0.200 for 4 inch, 5 inch and 6 inch orifice plates respectively and a predicted service life of 501 days, 235 days and 195 days for the 4 inch, 5 inch and 6 inch orifice plate respectively.

Keywords: Orifice, Buckling, FSI, BLF, Deformation

2024SPSBIC0017

COMPARATIVE STUDY OF THE NUTRITIONAL VALUES AND FATTY ACID COMPOSITION OF SELECTED NON-CONVENTIONAL OIL SEEDS AND *Elaeis guineensis* FOUND IN NIGER STATE, NIGERIA

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Contact. Musavincent51@gmail.com. +234 703 046 1424**ABSTRACT**

The comparative study of nutritional values and fatty acid composition of selected non-conventional oil seeds and *Elaeis guineensis* found in Niger State, Nigeria. This study was carried out to extract, determine and to compare the nutritional and anti-nutritional values and fatty acid composition of *Elaeis guineensis* and non-conventional oil seeds; *Hura crepitans*, *Terminalia catappa*, *Thevetia peruviana* and *Momordica charantia*. Oil extraction was achieved using soxhlet apparatus, proximate analysis was carried out using method described by association of official analytical chemists (AOAC) and fatty acid composition were obtained using gas chromatography-mass spectrometry (GC-MC). The nutritional result revealed moisture contents (2.51 ± 0.04 to 4.24 ± 0.02 %), ash contents (1.27 ± 0.20 to 8.17 ± 0.06 %), crude fats (20.05 ± 0.00 to 64.03 ± 0.06 %) crude fibre (0.87 ± 0.06 to 10.25 ± 0.03 %), crude protein (4.85 ± 0.06 to 14.87 ± 0.01 %) and carbohydrate (8.50 ± 0.10 to 48.22 ± 0.12 %) while fatty acid composition detected palmitic acid (24.22-35.47%), linoleic acid (omega-6) (0.18 – 41.10%), gamma-Linolenic acid (omega-6) 3.59%, oleic acid (omega-9) (25.06 – 43.96 %), alpha-linolenic acid (omega-3) 0.87%, and stearic acid (0.47- 14.25 %). The result obtained from this study, when comparing *Elaeis guineensis* with non-conventional oil seed indicate *Hura crepitans*, *Terminalia catappa*, *Thevetia peruviana* and *Momordica charantia* could be a good source of oil for human consumption and nourishment of the body.

Key words: nutritional values, fatty acid, oil seeds, non-conventional and *Elaeis guineensis*

2024SPSBIC0018

EVALUATION OF NUTRIENT AND MINERAL CONTENTS OF *Leptadenia hastata* FLOWER: A TOOL FOR IMPROVING FOOD SECURITY**Yusuf Adamu Kuta¹, Adamu Amina², Buda Mohammed Kabir³, Audu Danladi Passi³**¹Department of Chemistry, Niger State College of Education, Minna, Nigeria²Department of Sciences, Federal Science and Technical College Kuta-Shiroro, Niger State, Nigeria³Department of Biology, Niger State College of Education, Minna, NigeriaCorrespondence Author: adamshakurkuta@gmail.com**Abstract**

Since antiquity wild plant products are used by humans for food and medicine. However, negligible information is available regarding their nutritional potential. The principal aim of the present study was to assess the nutritional and mineral potential of *Leptadenia hastata* flowers known as (Yadiya and Aguweto) in Hausa and Gbagyi Languages respectively. Standard methods of (AOAC, 2006) were employed for the proximate analysis. The mineral contents (calcium, magnesium and iron) were determined using AAS. Sodium and potassium were determined using atomic emission spectrometry and phosphorus was determined by colorimetry. The results of proximate analysis indicated that carbohydrate content was the highest with (38.64 %) followed by crude protein with (15.75 %) while crude fat had the lowest content with (9.60%), crude fibre content (12.40 %), moisture content (13.65%) and ash content (9.96%). The results of Mineral Analysis (mg/100g) were: potassium (694.28), sodium (24.36), calcium (254.12), iron (9.28), magnesium (58.75) and phosphorus (188.75). The results obtained from this study suggest that the *Leptadenia hastata* flowers have the potentials to be used as sources of nutrients in alleviating macro and micro- nutrient deficiencies. Domestication of this plant can improve the health status of humans and lower animals, since it contains reasonable amount of carbohydrates, proteins and trace amount of other classes of food plus some vital amount of macro minerals especially calcium and potassium.

Keywords: *Leptadenia hastata*, nutrients, proximate, malnutrition and mineral content.

2024SPSBIC0021

CRITICAL REVIEW AND CHARACTERISATION OF AMINE-GRAFTED POROUS ALUMINIUM FOAMS**Muhammad Abubakar Abubakar^{1*}, Abdulrazak Jinadu Oturu², Olalekan David Adeniyi³, Rabi Isa O⁴, Ibrahim Abuhuraira Otto⁵**^{1,3,4}Department of Chemical Engineering, Federal University of Technology Minna, Minna, Nigeria²Chemical Engineering Department, King Faisal University, Kingdom of Saudi Arabia.⁵Department of Chemical Engineering, Federal polytechnic, Nasarawa,, Nigeria.Corresponding author email: abubakar.muhammad@futminna.org.ng**ABSTRACT**

As global warming and climate change pose significant threats, carbon dioxide (CO₂) is becoming increasingly important to capture, as it is one of the major causes of global warming. A variety of materials and methods have been reported for CO₂ capture, including adsorption onto zeolites, porous membranes, and absorption in amine solutions. These methods require high energy input, possess corrosive properties, and are expensive. In analogous research, Metal Organic Frameworks (MOFs) have also been developed as excellent porous carbon dioxide-capturing materials with high selectivity and thermal stability. Amine-functionalized porous materials exhibit superior CO₂ adsorption and regeneration efficiency due to their modified pore sizes, surface areas, and morphologies, resulting in enhanced CO₂ uptake performance. As the energy throughput required to desorb the adsorbed CO₂ for the functionalized MOFs is quite high, other thermally stable and self-supporting porous materials should be explored for capturing atmospheric carbon. This technical report examines CO₂ capture and functionalization methods using different amines grafted onto porous aluminum foams produced by replication casting.

KEYWORDS: Porous Metal foams, Aluminium foam, Amine-functionlization, Greenhouse gases emissions, carbon capture.

2024SPSBIC0024

Effect of season and fertility on the expression patterns of selected male specific region-Y genes (tex261, cct8 and hsfy2) in white Fulani bulls

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ABSTRACT

The study implemented On-field Animal Research (OFAR) at three different locations within the Southern Guinea Savannah Agro ecological Zone of Niger State Nigeria in two seasons (dry and wet seasons). The experimental animals investigated were White Fulani bulls (n=1131) kept under smallholder production system. The age was determined using the dentition, the body weight of each bull was determined using Shaeffer's formula; the scrotal circumference and testicular length were measured. Testicular biometric measurements were used to categorize bulls into high and low fertile bulls. Twenty-four (24) testicular biopsy samples of the bulls in the established category (low and high fertile) for the three locations for the two seasons were collected and evaluated for the expression of selected male specific region-Y genes including Heat Shocked transcription Factor Y-linked 2 (HSFY2), Chaperonin Containing TCP1 subunit 8 (CCT8), and Testis Expressed 261 (TEX261). The results showed that season had significant effect on live weight, scrotal circumference and testis length of the bulls ($p < 0.05$). Bull's live weight was significantly ($p < 0.05$) higher during wet season (426.78 ± 5.67 kg) compared to dry season (397.10 ± 6.20 kg). Scrotal circumferences were significantly ($p < 0.05$) higher during the wet season (30.03 ± 0.16 cm) compared to the dry season (23.59 ± 0.14 cm). Testicular lengths were significantly ($p < 0.05$) smaller during the dry season (20.98 ± 0.18 cm) compared with the wet season (30.46 ± 0.16 cm). The results also indicates that TEX261 gene showed a significant ($p < 0.05$) increase in expression during wet season in low fertile White Fulani bulls in contrast to CCT8 and HSFY2 genes that showed significant ($p < 0.05$) expression during dry season in high fertile bulls. These findings will contribute to our understanding of the potential involvement of these genes in fertility regulation in White Fulani bulls. These genes (TEX261, CCT8 and HSFY2) could be used as genetic markers for field-level fertility markings in bull's selection in order to facilitate earlier prediction of fertility. Scrotal circumference was positively correlated with the selected fertility genes (TEX261, CCT8 and HSFY2) as genes in the testes of White Fulani bulls were influenced by fertility status and seasons.

2024SPSBIC0025

PREPARATION AND CHARACTERIZATION OF BIOSYNTHESIZED TiO₂ NANOPARTICLES AS POTENTIAL NANOCoATING FOR ANTIBACTERIAL ACTIVITIES

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Abstract

In this study, the preparation and characterization of eco-friendly TiO₂ nanoparticles were investigated. The phytochemical composition of aqueous extracts from peppermint, CATNIP, and Neem leaves were determined using AOAC (Association of Official Analytical Chemists) standard methods. The ecofriendly TiO₂ nanoparticles were synthesized using the extracts. The green synthesized TiO₂ nanoparticles were characterized using UV-visible spectroscopy, and Brunauer-Emmett-Teller (BET). The peppermint exhibited the highest phenol, flavonoid, and tannin content, while neem contains the

highest concentration of saponins and alkaloids UV-vis spectra of TiO₂ nanoparticles synthesized using these extracts demonstrate successful reduction of titanium isopropoxide. Peppermint-based green synthesized TiO₂ nanoparticles showed a bandgap of 3.38 eV, while CATNIP-based green synthesized TiO₂ nanoparticles offer enhanced properties with a bandgap of 3.78 eV, and neem-based TiO₂ nanoparticles fell between the two with a bandgap of 3.48 eV. BET analysis indicated a high surface area and mesoporous characteristics in peppermint+Neem+TiO₂ nanocomposites, suggesting potential applications in adsorption or catalysis. This could serve as potential antimicrobial agent against various microorganisms. The study concluded that the combination of plant extracts for the synthesis of TiO₂ nanoparticles and holds promise for developing applications with dual functionality – mosquito repellency and antimicrobial effects.

Keywords: Titanium (IV) oxide, ecofriendly, bandgap, plant extracts

2024SPSBIC0028

Quantitative Analysis and use of Silver Nanoparticles in Removal of Total Aflatoxins in Selected Food Samples

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ABSTRACT

Aflatoxins are cancerous secondary metabolites produced primarily by *Aspergillus flavus* and *Aspergillus parasiticus* in agricultural foodstuff such as peanuts, maize grains, cereals, and animal feeds. Six out of 18 different types of aflatoxins that have been identified are considered important and are designated as B1, B2, G1, G2, M1, and M2. Elimination of aflatoxins after serious contamination has proved difficult if not impossible. The rapid development of emerging nanotechnology provides rare opportunities for greatly improving the performances of detection and remediation methods. Thus, this work aim to quantitatively analyze the level of total aflatoxins and remedying of the aflatoxins by using silver nanoparticles in direct application to food samples [maize grains (Yellow maize) and cassava (Sweet cassava – TME 419)]. In this research, the total aflatoxins were analyzed using the ELISA reader while the synthesized nanoparticles were characterized using UV-visible spectrophotometer. Preliminary analysis of 4 samples, C_A, C_I, M_A, M_I shows test results of 1.2ppb, 0.2ppb, 3.4ppb and 3.4ppb respectively which are all below the permitted NAFDAC limit of 10ppb. Sample M_I was measured in lumps (5g) and mixed with AgNPs. Sample C_A was measured (5g) and directly mixed with the AgNPs. Sample M_A was mixed with the solution of AgNPs (1g/200ml of distilled water). Each of these were left for 70hours at room temperature. After application, sample C_A has 16.66% decrease in the total aflatoxin, sample M_A has 14.71% increase in the total aflatoxin, sample M_I has 5.88% increase in the total aflatoxin. Optimization test analysis was carried out on the maize sample (M_A) with a pretest total aflatoxin of 3.9ppb, directly mixed with AgNP. There was 5.13% decrease in the toxin after 7days and 20.51% decrease after 14days. In conclusion, the direct mixture (sample and AgNPs) method of removal proves effective.

KEYWORDS: total aflatoxins, silver nanoparticles, food, ELISA

2024SPSBIC0029

Assessing the Feasibility of Bioplastic Manufacturing Using Cassava Peels and Analysing its Biodegradation

Sunday Aborishade

Abstract:

This study aimed to evaluate the viability of producing bioplastic from cassava peel waste and assess its biodegradability. Through a series of experiments, cassava peel starch was extracted and processed

into bioplastic using environmentally friendly methods. The resulting bioplastic samples were characterized for their physical, chemical, and mechanical properties. Furthermore, the biodegradability of the bioplastic was investigated through controlled degradation tests in simulated soil environments. The findings revealed that bioplastic produced from cassava peels exhibited promising properties comparable to traditional petroleum-based plastics, indicating its potential as a sustainable alternative. Moreover, the bioplastic demonstrated notable biodegradability, suggesting its potential to mitigate environmental pollution associated with plastic waste. This research contributes to the ongoing efforts in utilizing agricultural waste for the production of eco-friendly materials, offering insights into sustainable practices in the plastics industry.

2024SPSBIC0033

CARBON DIOXIDE CAPTURE USING MIXED AMINE FUNCTIONALIZED ACTIVATED CARBON FROM NIGERIA SUB BITUMINOUS COAL

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ABSTRACT

A CO₂ sorbent containing a mixture of Mono ethanol Amine (MEA) and Tri ethanol amine (TEA), immobilized on activated carbon was prepared from Nigerian sub-bituminous coal. The prepared adsorbent was characterized before and after amine modification with X-ray Diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR), BET, Scanned Electron Microscope (SEM), and thermogravimetric analysis (TGA) technique. Raw coal sample from Onyeama coal was grinded to particle size of 212µm, which undergo Proximate and ultimate analysis. Coal Sample was subjected to pyrolysis at temperature of 450 o C, 550 o C, 650 o C after acidic activation with hydrochloric acid. The textural properties of the activated carbon showed that activated carbon at 650 o C with a BET specific surface area of 1065m²/g, pore volume of 0.675cm³/g and pore size of 4.8nm was used in wet impregnation with mixed amine, to avoid the blockage of the pore after functionalization with amine. Thermal stability and CO₂ adsorption desorption experiment was conducted in a TGA at a feed flow rate of 50mL/min, under simulated flue gas component of 15 vol.% CO₂ /85 vol.% N₂, 30 vol.% CO₂ /70 vol.% N₂ and 50 vol.% CO₂ 50vol.% N₂ at temperature of 25 o C, 50 o C and 75 o C respectively. The adsorption capacity was observed to increase at lower temperature range of 25 o C – 50 o C. Further increase in temperature above 50oC and above, leads to decrease in adsorption capacity. Adsorbent, AC-50vol.% MEA 50vol.% TEA was chosen to test the regenerability of the adsorbent over Ten adsorption-desorption cycles over temperature range of 25 o C – 75 o C (Adsorption), to 100 o C (desorption). AC-50 vol.% MEA 50vol.% TEA showed a maximum CO₂ adsorption capacity of 64mg CO₂/g-sorbent at 50 o C and exhibited a good regenerability and thermal stability. Adsorption Isotherm was observed to be similar Langmuir isotherm model. This result shows that combination of the two different amines, can further improve the adsorption capacity of CO₂ sorbent.

Key Word: Carbon capture., Mixed amines. Activated carbon. TGA.

2024SPSBIC0037

Phytochemical Screening, Nutritive and Anti- Nutritive Components of Ethanolic Extract of Senna Obtusifolia Leaf and Seeds

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Abstract

Diabetes is a chronic metabolic disease that is characterized by elevated levels of blood glucose (blood sugar). This study was aimed at evaluating the phytochemical, proximate and anti-nutritive components of senna obtusifolia leaves and seeds. Normal standards were used to attain the proximate and anti-nutritive components of the leaves and seeds respectively. The proximate composition in percentage of senna obtusifolia seeds are: moisture content 20.16, ash 23.75, crude fat 3.90, crude protein 28.00 and carbohydrate 24.19. high proximate composition was recorded in crude protein, carbohydrate and ash content. While for the leaves, moisture content 24.86, ash 19.34, crude fat 5.11, crude protein 38.5 and carbohydrate 12.19. high proximate composition was seen in crude protein, moisture content and ash. Some of the values were within the expected range according to FAO 2019. The anti-nutrient composition in senna obtusifolia leaves and seeds reads 205.95 and 271.62 in phytate, 163.00 and 145.00 in Oxalate, 0.07 and 0.03 in cyanide, 849.54 and 655.09 in Saponins and same value of 928.57 in both leaves and seeds for Tannins respectively. Some of the values shown here too are in accordance with the FAO 2019. Hence the result of the analysis shows that both the leaves and seeds of senna obtusifolia could serve as a good laxative, medicinal and therapeutic values for man if further processes are done to remove the inherent toxicants in the leaves and seeds.

Keywords: Seeds, Diabetes, Extract, Leaves, Senna obtusifolia

2024SPSBIC0038**Physiochemical Properties and Heavy Metals Analysis of Effluent Water from Selected Tannery Sites in Kano and Zaria.**

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ABSTRACT

The study was aimed to determine the physiochemical properties and heavy metal of effluent water sourced from tannery sites within Kano and Zaria metropolis. Effluent samples were taken from four different tannery sites: Kano and Zaria. Each sample was collected in plastic containers that were carefully rinsed with deionized water after being previously cleaned with detergents and 10% HNO₃ acid. All of the samples were brought to the laboratory for analysis using standard methodology. The Results revealed pH (3.55-9.35), Electrical Conductivity (EC)(21410-224µs/cm), Total Suspended Solids(TSS) (2150-3546.60 mg/L) and Total Dissolved Solids(TDS) (1468-8260 mg/L) across the sites. Parameters such as EC, TSS and TDS were not in conformity with the WHO Standard except pH (9.35±3.55) for site1 from Kano metropolis. Heavy metal such as Cr (3.52-4.93 mg/L), Pb (1.35-2.7 mg/L), and Cu (1.24-1.82 mg/L) were not in tandem with WHO standard across the sampling sites except for Fe (4.64-8.32 mg/L) that conformed. The studied effluent water showed significant deviation from WHO standard and as such monitoring to treat/determine the safety level should be promoted.

Keywords: Physiochemical, Heavy metals, Effluent water, Tannery, Kano and Zaria Metropolis

2024SPSBIC0046**Gas chromatography-Mass spectrometry method for authentication of raw and branded essential oils**

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Abstract

Grape seed oil (GSO) is renowned due to its diverse health promoting properties and potential application in various industries, however there are report of adulteration of GSO, this study aims to provide GC-MS chromatographic fingerprint of GSO for the purpose of authenticating the oil based on

the chemical composition. In this research, four different brands of grape seed oil were used three are commercial brands and one laboratory extracted. The commercial samples were obtained from Kure market Minna, Suleja market, both from Niger state and Dutse market in Abuja while the laboratory sample was obtained from Debmak farm Kaduna, Kaduna state. The samples were subjected to GC-MS analysis for identification of individual components. The GC-MS analysis reveals that nineteen characteristics or markers peaks were present in all of the grape seed oil. Among the nineteen characteristics or marker peaks, the most prominent peaks are; Linoleic acid (26.93-31.84%), Elaidic acid (11.70-27.71%), Palmitic acid (9.55-11.07%), Stearic acid (4.64-12.35%), Ethyl linolate (1.29-3.24%), Oleic acid (1.18-6.88%) alpha.-Pinene (0.63-3.504%) and Menthol (0.68-1.24%) .Grape seed oil is rich in fatty acids, such as linoleic acid, oleic acid, elaidic acid and palmitic acid, along with other volatile compounds which help in alleviating symptoms associated with inflammatory condition such as rheumatoid arthritis and asthma. Furthermore, Grape seed oil is also used in the formulation of various cosmetic product including lotions, creams and make-up due to its moisturizing and skin-conditioning/protection properties. This study has shown that both the laboratory extracted GSO and the three commercial brand of GSO shows high degree of similarities, therefore the commercial GSO analyzed in this study are not adulterated.

2024SPSBIC0047

Metallophilic Interactive Effect of Selected Heavy Metals on the Plant Height of Lowland Rice (*Oryza sativa* L.) cultivated under Induced Iron Toxicity

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Abstract

The metallophilic interaction of heavy metals is a promising aspect of chemistry that can provide an understanding of the behavior of heavy metals interacting with each other in soil, thus providing possible remediation for their translocation in plants. In this study, the permissible concentrations of Cu, Co, Ni, and As, in soils, 36, 50, 35, and 20 mg/kg were each applied to lowland rice planted on 8 kg potted soils with 0, 100, 200, 300 and 400 mg/kg of Fe applied in triplicates. The heights of the rice were taken before treatment, 17 days after transplanting (DAT), and after treatment, at tillering, 30 and 44 DAT, and panicle initiation stages, 62 DAT. The data collected were summarized using descriptive statistics and the different treatments for each level of iron applied were compared using a one-way analysis of variance; significant means were separated using Duncan's multiple range test. The result obtained showed that there is likely little or no interaction between Co and Ni with Fe in the soils used in the cultivation of lowland rice but synergistic interaction is likely with Cu and antagonistic interaction with As is possible. It is therefore suggested that iron toxicity should not be considered in isolation in paddy fields but the concentration of copper should also be considered as copper increased the severity of iron toxicity in lowland rice. Also, the application of iron to paddy soil contaminated with As could be a remedy for As toxicity in rice.

Keywords: Iron toxicity. Metallophilic interaction, iron, copper, cobalt, nickel, arsenic

2024SPSBIC0052

Synthesis of Iron Oxide/Activated Carbon Nanocomposite for the Removal of Cr(VI) and Pd(II) ions from Tannery Wastewater

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ABSTRACT

In this study, activated carbon obtained from *Neocarya Macrophylla* seeds and iron(III) Oxide prepared from co-precipitation method were composited for the removal of Pd(II) and Cr(VI) ions from tannery wastewater. The activated carbon was prepared using acid and base as activating agents. The prepared activated carbon and synthesized iron(III) oxide/activated carbon were characterized using X-ray diffraction spectroscopy (XRD) and Fourier transform infrared spectroscopy (FTIR). The base activated carbon had a higher yield than the acid activated carbon. The XRD patterns of the acid and base-activated carbon revealed the diffraction peaks of 28° and 51.26° at reflection planes of (002) and (101), respectively. The FTIR spectra of the activated carbons indicated the presence of various functional groups like OH groups, carbonyl groups, C=C stretching vibrations, C-C stretching vibrations and Si-O-Si symmetric stretching vibrations. The XRD pattern of based activated carbon/iron oxide nanocomposite indicated the 2θ values of iron at 33.2°, 35.5° and 54.5° corresponding to miller indices of (104), (110) and (116), respectively. A diffraction peak at 28° which signified the reflection of (002) carbon plane was also observed in the nanocomposite. The FTIR of the nanocomposite indicated the presence of 1580 and 1150 cm⁻¹ which correspond to the C-C and C-O stretching vibrations, respectively. These absorption bands are attributed to the activated carbon used as support in the nanocomposite. The effect of adsorbent dosage, contact time and temperature on the adsorption process was employed using the batch process techniques. The synthesized nanocomposite demonstrated highest efficiency of Pd(II) and Cr(VI) ions removal of tannery wastewater compared to activated carbon and iron oxide nanoparticles. The experimental data of the adsorption process was studied using kinetic models (pseudo-first-order and pseudo-second-order models) and isotherm models (Langmuir and Freundlich models). The studies followed the pseudo-second-order and Freundlich models for the adsorbents. The efficacy of the synthesized nanocomposite depends on the presence of multifunctional groups which were responsible for the removal of these metal ions from tannery wastewater.

Keywords: *Neocarya Macrophylla*, activated, adsorbent, carbon, isotherm, kinetics.

2024SPSBIC0053

Effect of Synthesised Reduced Graphene Oxide as a Hole Transport Layer in the Efficiency and Stability of Poly (Methyl Methacrylate) Encapsulated Perovskite Solar Cell

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Abstract

The quest for graphene-based hole transport material for perovskite solar cells has assumed a growing demand due to high stability and other favourable properties associated with graphene. Graphene-based hole transport material. Consequently, graphene oxide (GO) was synthesised from graphite via a modified Hummer's method, followed by thermal reduction in hydrazine vapour to form reduced graphene oxide (RGO) samples at various temperatures. A suite of characterisation techniques including Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), Energy-Dispersive X-ray Spectroscopy (EDS), UV-visible spectroscopy, X-ray Diffraction (XRD), and Hall effect measurements were employed to assess the structural, morphological, optical, and electrical properties of the samples. FTIR analysis confirmed the successful functionalisation of graphite to GO and the subsequent reduction to reduced graphene oxide, with peak intensities decreasing as the annealing temperature increased. UV-visible spectroscopy of GO showed maximum absorption at 235 nm which confirmed the synthesis of GO, the reduction of GO is confirmed by a notable red shift in

absorption peaks with increasing annealing temperature, and which also signified a reduction in the bandgap. The X-ray diffraction (XRD) analysis of GO showed diffraction at $2\theta = 10.74^\circ$ which revealed a fully oxidised GO with oxygen-containing functional groups, and hence an increase in interlayer spacing (d_{002}) from 3.341 Å (graphite) to 8.228 Å (GO). Upon reduction, there is a gradual decrease in d_{002} from 8.228 Å (GO) to 3.387 Å (HRGO300), suggesting the gradual removal of intercalated oxygen molecules, and hence the gradual restoration of sp^2 hybridisation in graphene. The EDS analysis revealed an increase in the carbon-to-oxygen (C/O) ratio from 1.78 in GO to 2.76 in HRGO300 as the annealing temperature for the reduction process increased which further confirmed the removal of oxygen functional groups. The Hall effect data showed hole mobility of 4.634×10^1 (GO), 4.831×10^1 (HRGO200), and 5.462×10^0 cm²/Vs (HRGO300) with conductivities of 8.985×10^{-5} (GO), 1.087×10^0 (HRGO200) and 1.791×10^1 S/cm (HRGO300), suggesting an increase in conductivity as the annealing temperature increased as revealed in the EDS. Out of the three samples identified as hole transport materials, the sample HRGO300 with the highest C/O ratio of 2.76 has the highest conductivity, and hence most suitable for application as a hole transport layer (HTL) in perovskite solar cells. The perovskite solar cells incorporating HRGO@300°C as an HTL demonstrated significantly enhanced power conversion efficiency (PCE) and stability compared to the cells without HTL. Furthermore, encapsulation with PMMA further bolstered stability, with the top-performing cell achieving a PCE of 8.33% at 95% stability after 1,440 hours of endurance testing in the dark at a relative humidity of 35-50% at ambient conditions. Therefore, this study underscores the potential of reduced graphene oxide as an efficient and stable HTL for perovskite solar cells, highlighting substantial advancements over traditional materials.

2024SPSBIC0057

Concrete Strength Containing Rice Husk Ash in an Aggressive Environment

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ABSTRACT

The study investigates the Influence of Rice Husk Ash (RHA) on concrete strength in aggressive environments. Various ratios of RHA were incorporated into the concrete mix, and the compressive strength of resulting concrete cubes was assessed after curing in water and aggressive environment stimulants. RHA, sourced from a local rice mill and processed to acquire pozzolanic properties, served as a partial replacement for cement. Three concrete specimens designed for a strength of 25N/mm² were prepared with RHA replacing cement at levels of 0%, 1.75%, 3.5%, and 5%. Concrete cubes (150mm x 150mm x 150mm) were cast and evaluated for densities and compressive strengths after 3, 7, and 28 days of curing in water and aggressive environment stimulants like temperature variation, chloride water, and sulphuric acid. Results revealed significant performance variations between RHA concrete exposed to water versus aggressive environment stimulants, with unexposed RHA concrete exhibiting notable increases in compressive strength as the replacement level increased. The utilization of RHA not only enhances concrete's mechanical properties but also promotes sustainability by repurposing waste by-products, thereby bolstering the resilience and longevity of concrete structures in aggressive environments.

Keywords: Concrete, Rice Husk Ash, Supplementary Cementitious Materials, Aggressive Environments, Durability

2024SPSBIC0060

Physicochemical Properties of *M. hederacea* seed oil

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ABSTRACT

The growing need to harness underutilised plant as alternative for the production vegetable oil with less competitiveness for consumption has become necessary. *Merremia hederacea* is a plant with oil rich seed. The aim of this study is to find an alternative vegetable oil that is less competitive, safe and ecofriendly. This study investigated the physicochemical properties of *M. hederacea* seed oil. 500g of pulverised *M. hederacea* seed was extracted with petroleum ether. The extract obtained was subjected to column fractionation. The physicochemical properties of the oil from the n-hexane fraction were determined using standard analytical methods. The percentage oil yield was 36%. The specific gravity, viscosity, density, moisture, saponification, iodine and peroxide values were 0.87, 4.70, 0.87, 0.02, 198.74, 133.52 and 6.50 respectively. While the refractive index, flash, pour, cloud points and cetane number recorded were 1.50, 76.50, 12.50, 17.00 and 43.73 respectively. The physicochemical properties *M. hederacea* oil has revealed, the seed oil are good edible oil having a range of acceptable physicochemical parameters in relation to health and safety. This oil could also have industrial applications in oil paint and ink production, cosmetic industry, biodiesel production and oil-based ice cream in food industry.

Keyword: vegetable oil, *M. hederacea*, seed, cetane number, refractive index.

2024SPSBIC0066

Evaluation of Growth and Yiled Responses of Bird Eye Peper to Deficit Irrigation and Water Quality in Minna, Nigeria.

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Abstract:

This study deals with the evaluation of the growth and yield responses of Bird eye pepper to deficit irrigation and water quality. A pot-based experiment was carried out in Bosso Local Government area of Niger State, North Central Nigeria. Three water qualities, groundwater, wastewater and a mix of both were applied in four irrigation scenarios which targeted soil moisture content (SMC) maintaining at 70%, 80%, 90% and 100% of field capacity (FC). Results showed that both DI and WQ had significant effects on crop development, yield and water productivity. The highest values of plant height (2566.0 ± 0.58 cm) and stem diameter (13.40 ± 0.02 mm) were found at 100% FC (control). Total yield ranged from 5.33 ± 0.03 kg/plant (70% FC) to 8.05 ± 0.06 kg/plant (control). However, mild water stress showed a positive effect on irrigation water use efficiency (IWUE) without significant yield reduction compared to control. Irrigation water quality efficiency was at its maximum (41.77 ± 0.49 kg/m³) at 90% FC. A deficit irrigation regime based on 90% FC could be an efficient irrigation strategy particularly in water-limiting condition. Recycled wastewater was best among the three water qualities having achieving a better crop growth, yield and water productivity.

Keywords: bird eye pepper; deficit irrigation; water quality; water use efficiency

2024SPSBIC0068

DETERMINATION OF CROP WATER USE FOR LAEYF VEGETABLES IN MOKWA, NIGERIA USING WEIGHING LYSIMETER

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ABSTRACT

A low cost weighing lysimeter was designed and constructed and used to investigate the crop water requirement of *Corchorus olitorius*, and *Amarathus cruentus*. Readily available materials like plastic container which serve as lysimeter tank and inner tyre tubes filled with water connected to a glass U- tube manometer for the weighing system were used for the construction. Daily displacement of water in the glass manometer as a result of change in weight of lysimeter was translated to crop water use. The results showed that the average daily water use of the Spinach increased from 0.17 mm/day at the early crop growth stages to 6.13 mm/day at mid-season and declined to 2.02 mm/day at the late season of the crop. Jute mallow shows that averagedaily water use increased from 0.21mm/day at the early growth stage of the crop to 4.94 mm/day during the mid-season and declined to 1.17 mm/day at the late season. The potential crop water use estimated for the two vegetables showed lysimeter is applicable in measuring crop water requirements and results obtained herein can be used as a guide by farmers to quantify the amount and frequency of water to be used for irrigation of vegetables.

Keyword: vegetables, crop water use and lysimeter

2024SPSBIC0069

Investigating the Potentials of a Novel Nanocomposite from Multi-Walled Carbon Nanotubes (Mwcnts) and Magnetite (Fe₃O₄) Nanoparticles (Mnps) to Immobilized & Enhance Microbes' Performance in the Remediation of Petroleum Polluted Soil

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Abstract:

The Study titled “Investigating The Potentials Of A Novel Nanocomposite From Multi Walled Carbon Nanotubes (MWCNTs) And Magnetite (Fe₃O₄) Nanoparticles (MNPs) To Immobilized & Enhance Microbes' Performance In The Remediation Of Petroleum Polluted Soil” was carried out by optimizing the production of multi-walled carbon nanotubes and that of Magnetite nanoparticles using a 2factorial design, taking advantage of the upper and lower limits of their production parameters by Catalytic chemical Vapour deposition (CCVD) Method and Green synthesis for MWCNTs and MNPs respectively. The Novel Multi-Functional Nanocomposite Adsorbent was formulated using solids state reaction method with a calcination temperature of 400 °C for three hours in a (1:1, 1:2 & 2:1) for Magnetite (Fe₃O₄) and Multi-walled Carbon nanotubes respectively (this conference Paper is an extract from a PhD ongoing research work. The microbes were isolated and cultured using serial dilution method. Those microbes isolated are: *Aspergillus Niger*, *Escherichia Coli*, *Bacillus Subtilis* and *Pseudomonas Aeruginosa* and were immobilized on the nanocomposite for petroleum polluted soil remediation. The extracts and the Multi-walled, Magnetite Nanomaterials were Characterized using the following techniques: proximate methods, UV-visible spectroscopy, Dynamic Light Scattering (DLS), X-ray diffraction (XRD), nitrogen gas adsorption-desorption Brunauer-Emmett-Teller (BET), Fourier transform infrared (FTIR), High-Resolution Scanning, Electron Microscopy (HRSEM), and Energy Dispersive X-ray spectroscopy (EDX). The results of the optimization of the production of multi-walled

carbon nanotubes and magnetite nanoparticles indicate that out of the forty runs, run twenty (20) with a flowrate of acetylene of 290 ml/min and Argon 289 ml/min at a temperature of 800 C with the mass of catalyst 0.75 g with production time of 52.5 minutes, has the highest yield of 247 % with a mass of catalyst/product of 2.6 g. the synthesis of magnetite nanoparticles was carried by first of all examining five different plants for their phytochemicals (Phenols, Flavonoids, Saponin, Alkaloids and Tannins) contents. The plants that were extracted are: moringa Alfera leaves, almond leaves, onion peels, Cashew leaves and Sodom Apples leaves. The results show that, Cashew leaves extract was better than other four plants with 43.06mg/100g, 14.66 mg/100g, 8.19 mg/100g, 10.27 mg/100g and 2.04 mg/100g for Phenols, Flavonoids, Tannins, Saponins and Alkaloids respectively. The DLS showed that cashew has the smallest average particles size of 35.38 nm, followed by Onion Peels with average particle size of 59.63 nm and almond leaves extract with 96.71 nm of their particles. UV-visible spectroscopy indicated a peak at 293.50 nm with a corresponding bandgap energy of 4.64 eV for magnetite nanoparticles. XRD patterns showed crystallite size and crystallinity of 3.31 nm and 98.11% for magnetite nanoparticles, and 7.20 nm and 99.99% for MWCNTs. BET result indicated surface areas of 51.90 m²/g for MWCNTs and 54.49 m²/g for magnetite nanoparticles. The BET results of the MNPs & MWCNTs of Novel and facile nanocomposite shows surface area increase in the order of 1:2 (19.88 m²/g) > 1:1 (15.11 m²/g) > 2:1 (8.95 m²/g) respectively. XRD/HRSEM analysis results revealed the formation of patterned or uniformly, irregular, spherical and aggregated distribution of smooth but tubular arrangement for Magnetite nanoparticles and multi-walled carbon nanotubes. The EDX analysis clearly confirmed the presence of dominants elements in the Facile nanocomposites as-synthesized by solid state reaction method without regard to their mixing ratios. The research showed that varying the quantities of elements added to the composites during formation affects both the surface area, particles sizes porosity, crystallinity and consequently, the adsorption capacities of the said novel and facile Nanocomposites. Application of the nanocomposite after a period of ten days shows a drastically decrease in the concentration of hydrocarbons from 0.682mg/l to 0.033mg/l, 0.769mg/l to 0.036mg/l, 0.537mg/l to 0.029mg/l, 0.537mg/l to 0.029mg/l, 0.410mg/l to 0.021mg/l and from 0.519mg/l to 0.025mg/l for magnetite, unpurified CNTs, purified CNT, 1:1 MNPS/CNT 1:2, MNGS/CNTs and 2:1 MNPS/ CNTs indicating that the composites and individuals substances has enhancing capacity to improve the degrading capacities of microbes in the soil.

2024SPSBIC0075

THE SYNTHESIS AND CHARACTERIZATION OF TITANIUM DIOXIDE (TiO₂) @ TUNGSTEN TRIOXIDE (WO₃) @ MULTI-WALLED CARBON NANOTUBES (MWCNTS) NANOCOMPOSITE

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Abstract

The synthesis and characterization of titanium dioxide (TiO₂) @ tungsten trioxide (WO₃) @ multiwalled carbon nanotubes (MWCNTs) nanocomposite signify a significant advancement in nanomaterial research, offering a versatile platform with wide-ranging applications. This composite material leverages the distinctive properties of TiO₂ nanoparticles, WO₃ nanoparticles, and MWCNTs to create a multifunctional nanocomposite with enhanced attributes, paving the way for innovation and the enhancement of existing products. In this study, the synthesis and characterization of different ratios of TiO₂@WO₃@MWCNTs nanocomposite were examined. TiO₂ and WO₃ nanoparticles prepared by green synthesis and the effects of pH value, stirring time, volume of extracts and concentration of precursor on the yield and particle size were investigated. While the effects of operating parameters such as mass of the Iron-Cobalt catalyst, flowrate of acetylene, reaction temperature, and the reaction time on the yield of multi-walled carbon nanotubes based on response surface methodology (RSM) using Box-Behnken approach were studied. Different mixing ratios (1:1:1, 1:2:1, 1:1:2, 2:1:1) of TiO₂@WO₃@MWCNTs nanocomposites were prepared using solid state reaction methods. The prepared adsorbents were characterized using UV-visible spectroscopy, Dynamic Light Scattering

(DLS), X-ray diffraction (XRD), nitrogen gas adsorption-desorption Brunauer-Emmett-Teller (BET), Fourier transform infrared (FTIR), High Resolution Scanning Electron Microscopy (HRSEM), Energy Dispersive X-ray spectroscopy (EDX), High Resolution Transmission Electron Microscopy (HRTEM), and Selected Area Electron Diffraction (SAED). The UV-visible spectra showed a maximum wavelength of 298.2 nm with a corresponding bandgap energy of 3.19 eV for TiO₂ nanoparticles, 373 nm and 3.23 eV for WO₃ nanoparticles. The Dynamic Light Scattering revealed the minimum particle diameter (Z-average) of 29.16 nm and 37.6 nm for TiO₂ and WO₃ nanoparticles respectively. XRD patterns showed that the crystallite size and percentage crystallinity of the synthesized anatase phase TiO₂ at pH 10, stirring time of 1 h, 50 mL volume of extract and calcined at 450°C was 5.023 nm and 91.34 %. It revealed that the crystallite size and percentage crystallinity of the synthesized monoclinic phase WO₃ at pH 2, stirring time of 1 h, 50 mL volume of extract and calcined at 550°C for 2 h was 3.44 nm and 96.12 % respectively. It also showed the crystallite size and percentage crystallinity of multi-walled carbon nanotubes as 3.13 nm and 67.71 %. At different ratios the crystallite size and degree of crystallinity were found to be 29.47 nm and 90.07 % for the ratio 1:1:1, 33.57 nm and 84.27 % for the ratio 1:2:1, 22.55 nm and 94.27 % for ratio 1:1:2, 15.76 nm and 77.18 % respectively. XRD/HRSEM/HRTEM analysis demonstrated the formation of anatase (tetragonal), monoclinic (spherical), uniformly distributed smooth (tubular) for titanium dioxide, tungsten trioxide nanoparticles and multi-walled carbon nanotubes. The BET results of the TiO₂@WO₃@MWCNTs nanocomposite increased in the order of 2:1:1 (41.64 m²/g) > 1:1:1 (27.58 m²/g) > 1:2:1 (24.06 m²/g) > 1:1:2 (20.16 m²/g) respectively. The EDX analysis also established the presence of the dominant elements in the nanocomposites prepared by solid state reaction method irrespective of the mixing ratios. The selected area electron diffraction (SAED) patterns revealed bright spots and rings suggest that the nanocomposites are polycrystalline in nature. The study demonstrated variation in the amounts of elements added to the composite altered the surface area and crystallite size of the material.

2024SPSBIC0076

THE SYNTHESIS AND CHARACTERIZATION OF MAGNETITE @ MULTIWALLED CARBON NANOTUBES (MWCNTS) NANOCOMPOSITE.

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Abstract

The synthesis and characterization of composite of magnetite (Fe₃O₄) nanoparticles @ multiwalled carbon nanotubes (MWCNTs) represents a magnetic nanomaterial merging the magnetic properties of magnetite (Fe₃O₄) nanoparticles and the mechanical strength, high electrical conductivity, and large specific surface area of multi-walled carbon nanotubes (MWCNTs), and thereby being suitable for multiple fields of applications. This composite material was recently recognized in medicine, especially for its abilities towards targeted drug release and chemotherapy, and in the area of obtaining clean water by removing pollutants from wastewater. In this study, the synthesis and characterization of various mixing ratios (1:1, 1:2, and 2:1) of Fe₃O₄ @ MWCNTs nanocomposites were conducted. The effects of pH value, stirring time, volume of extracts, and precursor concentration on the yield and particle size of magnetite nanoparticles prepared via green synthesis method were examined, while optimization of operating parameters for MWCNTs involved the mass of Iron-Cobalt catalyst, acetylene flow rate, reaction temperature, and time using response surface methodology (RSM) based on the Box-Behnken approach. Nanocomposites with mixing ratios (1:1, 1:2, and 2:1) of magnetite nanoparticles and MWCNTs were prepared using solid-state reaction methods. Characterization techniques including UV-visible spectroscopy, Dynamic Light Scattering (DLS), X-ray diffraction (XRD), nitrogen gas adsorption-desorption Brunauer-Emmett-Teller (BET), Fourier transform infrared (FTIR), High-Resolution Scanning Electron Microscopy (HRSEM), and Energy Dispersive X-ray spectroscopy (EDX) were employed. Results revealed various properties such as extinction coefficient, particle size, morphology, phase identification, and surface area. UV-visible spectroscopy indicated a peak at 293.50 nm with a corresponding bandgap energy of 4.64 eV for magnetite nanoparticles. XRD patterns showed crystallite size and crystallinity of 3.31 nm and 98.11% for magnetite nanoparticles, and 7.20 nm and

99.99% for MWCNTs. BET analysis indicated surface areas of 51.90 m² /g for MWCNTs and 54.49 m² /g for magnetite nanoparticles. The BET results of the Magnetite @MWCNTs nanocomposite increased in the order of 1:2 (19.88 m² /g) > 1:1 (15.11 m² /g) > 2:1 (8.95 m² /g) respectively. XRD/HRSEM analysis demonstrated the formation of irregular spherical and aggregating, uniformly distributed smooth (tubular) for Magnetite nanoparticles and multi-walled carbon nanotubes. The EDX analysis also established the presence of the dominants elements in the nanocomposites prepared by solid state reaction method irrespective of the mixing ratios. The research showed that changing the amounts of elements added to the composite affected both the surface area and the size of its crystallites.

2024SPSBIC0078

Physicochemical, analysis of water from selected auto mechanic workshops, within Minna, Niger State

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ABSTRACT

Water contaminants .present a threat to the existence of man, plant and animals. They occur in various degrees, forms and quantity. Some of these contaminants include used oils which are generally seen in mechanic workshops, where automobiles and various car parts are serviced and repaired. Indiscriminate disposal of used engine oil in the environment is considered one of the most significant sources of environmental pollution. The study focused on the investigation of some physicochemical parameters of water and performance evaluation from selected auto repair workshops in Minna. Water samples from three auto repair workshops (Keteren Gwari, Western by-pass and Eastern by-pass) were collected. Conventional analytical methods were employed to determine the physico-chemical properties. The result obtained. Gave the following ranges of the parameters; (pH) 5.94 to 7.36, Total hardness (TH) 58 to 250, Total alkalinity (TA) ranges from 31 to 150. The temperature range from 24.04 to 26.3, dissolved oxygen (DO) range from 5.0 to 7.0, Chemical oxygen demand (COD) range from 28 to 64, and Biochemical oxygen demand(BOD) range from 1.2 to 2.5. Other parametres such as Electrical conductivity (EC) range from 48.3 to 685, Phosphate(PO₄³⁻) range from 0.22 to 0.78, and the (NO₃) range from 0.56 to 3.36. Concentration of exchangeable bases (K⁺) was between 0.08 and 1.65,(Na⁺)ranged from 0.85 to 6.74, (Ca²⁺) range from 5.88 to 82.00, while Mg²⁺was between 0.10 to 0.22 and the Cl⁻ ranges from 13.87 to 77.66.The result indicated that the water is polluted.

Keywords: physicochemical, evaluation, pollution, Contamination, auto-mechanics, water.

2024SPSBIC0080

Characterization of green synthesized silver nanoparticles and its potential in wastewater treatment

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Abstract

Green chemistry is significant because it has led to the development of novel techniques for synthesizing silver nanoparticles from plant extracts. This research work focused on the optimized green synthesis of silver nanoparticles using the stem of Ugu plant extract as reducing and capping agent. The synthesized nanoparticles was analysed for crystallinity, elemental composition and morphology using X-ray diffraction (XRD), Energy Dispersive X-ray (EDX) and Transmission Electron Microcopy (TEM). Under the experimental conditions of stirring time (30 minutes), conc. (0.002 M) and pH 9;

time (60 minutes), conc. (0.002 M) and pH 9. The XRD result for both conditions showed four distinct peaks at angles of 44.57, 51.91 and 76.47 degrees which is related to planes of (111), (200) and (202) with designated phase structure of face centered cubic (FCC) and crystal size of 36.18nm and 32.43nm respectively. The elemental compositions also showed a separate peak of silver to be (Ag, 3 keV) for both the conditions. While the surface morphology for the experimental condition of stirring time (30 minutes), conc. (0.002 M) and pH 9 showed spherical shape and mostly were roughly circular in shape with smooth edges with average size of 29.23 nm while time (60 minutes), conc. (0.002 M) and pH 9 showed agglomerated spherical shape and less distribution of particle size with average particle size 37 nm. This results suggest that silver nanoparticles due to its unique properties can be used as a nanoadsorbent to remove heavy metals from wastewater.

Keywords: Green, silver, nanoparticles, crystallinity, morphology

2024SPSBIC0082

COMPARATIVE REVIEW OF MECHANIZED AND TRADITIONAL RICE HARVESTING PRACTICES IN NIGERIA

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Abstract

Rice production in Nigeria has experienced significant growth in recent years, driven by government interventions and increased investment in agricultural technology. Mechanized rice harvesting has emerged as a promising alternative to traditional methods, promising higher efficiency and productivity. This comparative review aims to assess the benefits and challenges associated with mechanized and traditional rice harvesting practices in Nigeria. The study examines various factors including labour requirements, cost-effectiveness, yield, environmental impact, and socio-economic implications. It explores the mechanized rice harvesting technologies adopted in Nigeria. Furthermore, the review considers the implications of mechanization on employment dynamics, particularly in rural areas where agriculture is a primary source of livelihood. It discusses the potential socio-economic impacts of transitioning from traditional to mechanized harvesting practices. Through a comparative analysis of mechanized and traditional rice harvesting practices, this review aims to provide insights into the opportunities and challenges facing rice farmers in Nigeria.

Keywords: *Environmental impact, Harvesters, Mechanized rice harvesting, Rice production, Traditional rice harvesting*

2024SPSBIC0083

Gc-MS Fingerprint Profiling Combined with Chemometrics for the Quality Evaluation and Authentication of Raw and Branded Palm Oils Consumed in Minna

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ABSTRACT

The consumption of palm oils in Minna, Nigeria, is widespread, but the quality and authenticity of these oils remain a concern due to potential adulteration, mislabelling and poor processing practices. A total of 5 samples including Crude extract of palm fruits and four corresponding oil brands were analysed using GC-MS combined with chemometric techniques of PCA and HCA. Two essential fatty acids were found. They are predominantly Hexadecanoic acid methyl ester (12.17% - 45.21%), 9-octadecenoic acid methyl ester (18.75% - 45.65%), palmitic acid (C16:0), Oleic acid (C18:1), were the dominant

saturated and unsaturated fatty acids observed. The PCA plots classified P1 and P2 samples according to the similarity of their chemical component, revealed P3 as the un-usual sample with an exceptionally high and low content of some fatty acids compared to other samples studied, Dodecanoic acid methyl ester is the signature compound eluted between the retention time 11 – 12 minutes. HCA revealed the pair of crude palm oil (labelled P1) and palm oil brand (labelled P4) to be the closest neighbourhood based on variance weighted at (± 1.62 % PA difference). The compounds describe the variance and similarities among the studied samples, this is required for authentication and quality assurance purposes of the oil. The oils are considered safe for human consumption, as the P/S ratios were above 0.4.

Keywords: palm oil, quality, authentication, chemometrics, GC-MS fingerprint, PCA, HCA.

2024SPSBIC0084

Development of recirculatory aquaponics system for the treatment of fish pond wastewater

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Abstract

The level of ammonia in pond wastewater is high; using the recirculatory aquaponic system to treat fish pond water is understudied in Minna. Because of this, the research developed a recirculatory aquaponics system to treat fish pond water. Standard formulas were utilised to design and fabricate the RAS and its filter. The NFT had the length, width and depth of 50cm, 12cm, and 5cm, respectively. At the same time, the media bed and deep water had length, width, and depth of 50cm, 30cm, and 41cm; 50cm, 30 cm, and 41cm, respectively. The filtration rate of the drum filter was 4.43 m/h, and its solid rate was designed to be $0.0008715 \text{ kgm}^{-2} \text{ min}^{-1}$. RAS was set up with ten (10) catfishes and vegetables raised from the nursery and used to test the system. After filtration, water samples were collected from the fish pond and the holding tank. Four water quality parameters (ammonia, nitrite, total suspended solids, and pH) were analysed using a Micro-Kjedahl distillation assembly, a spectrometer, filter paper, and a weighing balance. The results indicated a significant reduction in the levels of ammonia (74.40%), nitrite (65%), and pH (4%). The RAS and its filter showed a high filtration efficiency (64%). Future studies should use this RAS to raise catfish, vegetables, and monitor total suspended solids, ammonia, nitrate, and pH levels weekly.

2024SPSBIC0088

Synthesis and Characterisation of Graphene Oxide Nanoparticle

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Abstract

Graphene oxide is a carbon nanomaterial with two dimensional structure with excellent electronic, optical, mechanical and thermal properties and finds application in biomedicine, electronic devices, energy storage devices, supercapacitors, biosensors and water purification. The study focused on the synthesis and characterisation of graphene oxide (GO). Herein, GO was synthesised from graphite powder using the improve Hummers method. Characterisation of the synthesised GO was done using Ultra violet-visible (UV-Vis) spectroscopy, Fourier Transform Infra-red Spectroscopy (FTIR), High Resolution Scanning Electron Microscopy-Energy Dispersive Spectroscopy (HRSEM-EDS), and X-

ray Diffraction analysis (XRD). The UV-visible spectrum shows absorption peak at maximum wavelength of 228.5 nm. FTIR result shows the presence of functional groups such as O-H, C=O, C-O-C and C-O. HRSEM micrograph reveal the formation of flake-like network having C/O ratio of 1.41. XRD spectrum demonstrated the appearance of a wide diffraction peak at 2θ value of 11.6° with crystallite size of 18.1 nm. All the characterisation results confirm the successful synthesis of high quality graphene oxide which can be useful in wastewater treatment.

Keywords: Graphene oxide, graphite powder, improve Hummers method, characterisation.

2024SPSBIC0089

Measurements of Seasonal Variations of Elemental Contents of Soils around Rivers Niger, Benue and their Confluence in Lokoja, Kogi State, Nigeria Using Neutron Activation Analysis

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Abstract

The study determined the levels of trace elements and heavy metals in riverside soil of River Benue, River Niger and their confluence in Lokoja, Kogi State, Nigeria. Riverside soil samples were collected from three different sampling spots 10 m away from one another along the rivers and at the confluence. The samples were prepared in the laboratory according to standard methods and Instrumental Neutron Activation Analysis (INAA) was adopted for the elemental analysis using Nigeria Research Reactor – 1 (NIRR -1). Various concentrations of the following elements; As, La, Na, Ba, Br, Tm, Nd, K, Yb, U, Cr, Zn, Fe, Co, Rb, Eu, Lu, Hf, Sc, Ta, Sm and Th were obtained. This result shows that the concentration of sodium increased during the periods of February, 2021 and September, 2021 along the banks of Rivers Niger and Benue and their confluence which may be attributable to the use of mineral fertilizers during farming activities and, of course, those elements from weathering rocks. On the other hand, the concentrations of K, As, Cr, Ba, Yb, La, Sm, Eu, Ta Rb, and Br decreased within the sampling period. On the other hand the concentrations of Fe, U, Hf, Th, Sc, Co, Nd, Tm and Lu in all the samples fluctuated. Comparing the data with the World Health Organization (WHO) acceptable environmental concentration limits, the research shows that the following elements (Mean Values $\pm$ SD in ppm): Na (8610.643 $\pm$ 643), K (27471.429 $\pm$ 658), As (1.276286 $\pm$ 0.145), Ba (859.136 $\pm$ 37.14), Fe (30.135 $\pm$ 270.304), La (57.178 $\pm$ 0.269), Eu (1.5236 $\pm$ 0.118), and Hf (23.641 $\pm$ 0.358) were present in the soil samples in concentrations above the WHO acceptable limits. However, Yb (4.058 $\pm$ 0.164), Sm (12.0536 $\pm$ 0.0492), Zn (57.2143 $\pm$ 5.96), and Ta (1.5207 $\pm$ 0.152), were in concentrations below the WHO acceptable limits. The concentration of thorium (18.973 $\pm$ 0.244 ppm) was found to be within the WHO acceptable limit while that of uranium (17.876 $\pm$ 1.31 ppm) whose permissible limits in soils are inconclusive generally suggest that caution is seriously needed in polluting the river-side soils of these areas. It is also suggested that the pathways through which uranium soil contamination can impact human health be thoroughly studied in order to avoid uranium enrichment.

KEY WORDS: Confluence, Concentration, Seasonal Changes, Neutron Activation Analysis Heavy Metals

2024SPSBIC0094

Physicochemical Evaluation of Virgin Olive Oil Brands Marketed in Minna, Nigeria

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ABSTRACT

Studies have reported inconsistency in quality standards and the lack of information available to consumers and stakeholders regarding the true quality of olive oil brands available in the market. This study aimed to assess the quality of commonly consumed olive oil brands declared as "Virgin Olive Oil" sold in Minna Market, Niger State, Nigeria. Six locally rebranded and eight foreign brands, totaling fourteen samples, were collected and analyzed for various physicochemical parameters including pH, free fatty acid content, iodine value, peroxide value, and refractive index. The results revealed that the pH values of local brands ranged from 4.7 to 5.5, while foreign brands ranged from 4.1 to 4.7, meeting the IOOC standard of ≤ 4.7 for quality virgin olive oil. However, local brands consistently exceeded the specified standard of 0.8% for free fatty acid content, with mean values ranging from 0.8% to 1.5%, whereas all foreign brands demonstrated fatty acid content within the acceptable limit of $\leq 0.8\%$. Additionally, while iodine values varied among brands, all fell within the set limit of 75-94 g/100g. Peroxide values for all samples met the IOOC limit of ≤ 20 meq O₂/kg, indicating acceptable quality. More so, only one local brand sample fell within the refractive index standard range of 1.4677-1.4705, while all foreign brand samples showed higher refractive index values. The foreign brands generally met the quality standards for parameters analyzed, which indicates higher quality compared to local brands. This study offers valuable insights into olive oil quality in Minna market, facilitating informed decisions for consumers and stakeholders regarding olive oil selection and consumption.

Keywords: Physicochemical, virgin olive oil, brands, analytical techniques, quality, variability

2024SPSBIC0095

**Synthesis and Characterisation of Silver-Zinc Oxide-Kaolinite Clay
nanocomposites**

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Abstract

This study focused on the synthesis and characterization of Ag@ZnO@kaolinite clay nanocomposite. The kaolin (clay) material was first beneficiated via a sedimentation method in deionized water for 48 h to yield a slurry, which was subsequently sun-dried, pulverized, and sieved using a mesh size < 150 μm , and calcinated at 750°C. Ag and ZnO nanoparticles were prepared through green synthesis, and the influences of pH value, stirring time, and volume of extracts on the yield and particle size were explored using response surface methodology (RSM) via the Box-Behnken approach. Various mixing ratios (1:1:1, 1:2:1, 1:1:2, 2:1:1) of Ag@ZnO@kaolinite clay nanocomposite were synthesized using solid-state reaction methods. Characterization of the prepared nanomaterials were conducted through UV-visible spectroscopy, Dynamic Light Scattering (DLS), X-ray diffraction (XRD), Fourier transform infrared (FTIR), High-Resolution Scanning Electron Microscopy (HRSEM), Energy Dispersive X-ray Spectroscopy (EDX), High-Resolution Transmission Electron Microscopy (HRTEM), Selected Area Electron Diffraction (SAED) and Brunauer-Emmett-Teller (BET). UV-visible spectra indicated maximum wavelengths of 434.4 nm and 303.6 nm, corresponding to bandgap energies of 2.22 eV for Ag nanoparticles and 2.76 eV for ZnO nanoparticles, respectively. Dynamic Light Scattering revealed minimum particle diameters (Z-average) of 48.55 nm and 82.08 nm for Ag and ZnO nanoparticles, respectively. XRD patterns indicated crystallite sizes of 6.16 nm for the synthesized Ag nanoparticles and 3.64 nm for the synthesized wurtzite phase ZnO. Moreover, the crystallite size of the kaolinite clay was determined to be 6.71 nm. Varying ratios of Ag@ZnO@kaolinite yielded different crystallite sizes: 4.25 nm for the ratio 1:1:1, 7.78 nm for the ratio 1:2:1, 8.57 nm for the ratio 1:1:2, and 9.46 nm, respectively. The BET analysis of the kaolin@Ag@ZnO nanocomposite increased in the order of 1:2:1 (20.05 m²/g) > 1:1:2 (15.71 m²/g) > 1:1:1 (12.03 m²/g) > 2:1:1 (9.39 m²/g) respectively. XRD/HRSEM/HRTEM analyses confirmed the formation of metakaolinite (irregular) for meta-kaolin, wurtzite phase (spherical) for ZnO nanoparticles, and cubic (spherical) for Ag nanoparticles. SAED

patterns exhibited bright spots, suggesting the polycrystalline nature of the nanocomposites. This study illustrated that varying the amounts of elements added to the composite altered the surface area and crystallite size of the material.

2024SPSBIC0099

EFFECT OF WET TORREFACTION PROCESS PARAMETERS FOR THE UPGRADING OF SUGARCANE BAGASSE BIOMASS

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ABSTRACT

Hydrothermal carbonization of sugarcane bagasse using wet torrefaction is studied. The biomass is torrefied in water and hydrothermal autoclave and furnace are employed to heat the solutions. Where the reaction temperature starts from (180 – 240°C and 10-30min). The effects of water, heating time and solid-to liquid ratio on the performance of wet torrefaction are investigate. The calorific value of bagasse can be increased up to 20.3% from wet torrefaction. With the same improvement in calorific value, the temperature of wet torrefaction is lower than that of dry torrefaction around 100°C, revealing that wet torrefaction is a promising method to upgrade biomass as fuel. The calorific value of torrefied biomass can be predicted well based on proximate and ultimate analysis, and the last one gives the best estimation.

Keywords: Hydrothermal carbonization, biomass, sugarcane bagasse.

2024SPSBIC0124

Synthesis and Characterization of Carbon Nanotubes/Iron Tungstate Composite: Structural analysis and synergistic properties

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Abstract

In the study, carbon nanotubes (CNTs), iron tungstate (Fe₂(WO₄)₃), and CNTs/Fe₂(WO₄)₃ composite were synthesized using catalytic vapour deposition, precipitation, and wet-impregnation methods, respectively. The nanomaterials were analyzed using X-ray diffraction spectroscopy (XRD), high-resolution electron microscopy (HRSEM), high-resolution transmission electron microscopy coupled with energy dispersive spectroscopy (HRTEM/EDX), selective area electron diffraction (SAED), and Brunauer-Emmett-Teller (BET). The XRD confirmed the tubular-like shape of CNTs and the monoclinic crystal form of Fe₂(WO₄)₃. The introduction of CNTs altered peak intensities, suggesting structural changes. The HRSEM image of Fe₂(WO₄)₃ nanoparticles exhibited spherical morphology with uniform sizes and strong agglomeration due to polarity and electrostatic attraction. The synthesized composite displayed spherical-like Fe₂(WO₄)₃ morphology and tubular-like CNT structures, indicating well-distributed incorporation and potential synergistic properties. The HRTEM image and SAED pattern of Fe₂(WO₄)₃ revealed well-defined lattice fringes and diffraction rings, respectively,

confirming its crystalline nature. In the CNTs/ Fe₂(WO₄)₃ composite, both nanoparticles and CNTs are observed, with preserved lattice fringes indicating minimal distortion. The SAED pattern of the composite showed overlapping diffraction rings from both components. The EDX analysis of Fe₂(WO₄)₃ showed Fe, W, and O peaks, confirming their presence. CNTs/ Fe₂(WO₄)₃ displayed Fe, W, O, and C peaks, confirming CNTs integration into the composite. The BET surface areas of Fe₂(WO₄)₃ and its composite with CNTs were 19.47 and 26.31 m²/g, respectively. The addition of CNTs in the resultant composite increased the surface area, suggesting the potential applications of the synthesized composite in adsorption and photocatalysis.

Keywords: Nanomaterials, monoclinic crystal, lattice fringes, diffraction rings, integration

2024SPSBIC0126

VALIDATION OF HPLC METHOD FOR THE ASSESSMENT OF CO-OCCURRENCE OF AFLATOXINS, OCHRATOXIN A AND ZEARALENONE IN TIGER NUT DRINKS CONSUMED IN LAGOS, NIGERIA

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ABSTRACT

Mycotoxins contamination of food is of great concern as it poses severe health hazards such as liver and kidney diseases, immune suppression and cancer. Tiger nuts (*Cyperus esculentus*) which are highly susceptible to fungal attack and as such could have high mycotoxins level in its drinks. This present study uses validated HPLC methods for determination and quantification of Aflatoxins, Zearalenone and Ochratoxin A in tiger nut drink consumed in six Local Government Areas in Lagos State. The HPLC methods involve extraction with appropriate solvent, clean up using an immunoaffinity column, elution and subsequent injection into the HPLC system. The methods were validated for parameters such as linearity, precision, trueness, limit of detection, limit of quantitation and expanded measurement uncertainty. The results of the performance characteristics were in good agreement with the criteria mentioned in CODEX guidelines and Commission Regulation (EC) No. 401/2006. A total of thirty samples were collected. Concentration range of 0.17 – 8.01 µg/kg, 0.01 – 3.43 µg/kg, 0.24 – 0.54 µg/kg, 0 µg/kg, (total value), 0.39 – 8.83 µg/kg, 1.06 – 25.23 µg/kg were obtained for AFB1, AFB2, AFG1, AFG2, Total Aflatoxins, OTA and ZEA respectively. The obtained result indicated that 26.7%, 30%, 367% and 40 % of the sampled tiger nut drink were positive for AFB1, Total Aflatoxins, OTA and ZEA respectively. Meanwhile, only 3 % for AFB1 and Total Aflatoxins, 6.7 % for OTA and none for ZEA were above the permissible level set by NAFDAC/EU. 13% of tiger nut drink had a simultaneous occurrence of ZEA, OTA and AFs while 23%, 10% and 6% of the sample had ZEA and AFs, OTA and ZEA, and AFs and OTA co-occurring respectively. This is the first report on the occurrence of ZEA in tiger nut drink and the simultaneous occurrence of AFs, OTA and ZEA.

2024SPSBIC0126

ASSESSMENT OF MYCOTOXIGENIC FUNGI, MYCOTOXINS IN RICE GRAINS (OFADA RICE, NIGERIA LOCAL RICE AND FOREIGN RICE) MARKETING IN SOUTH WESTERN REGION OF NIGERIA

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ABSTRACT

Mycotoxins are the most widely studied chemical toxins, which contaminate foods at very low concentrations and their metabolites can cause severe acute poisoning, which can result in death, as well as long-term negative health effects, such as cancer and immune-suppressive disorders in living beings (animals and humans). This assessment describes the analytical techniques and methods that have been used to successfully detect and identify important mycotoxins in the rice samples collected with the aid of analytical techniques which include ELISA and liquid chromatography with various detectors, as well as various cleanup and extraction methods. Outcome of this analysis reveals *Aspergillus* species as the dominant fungus on the samples in all three states, a notable feature is also the prevalence of OTA and ZEA in the samples with the highest respective concentrations coming from: Ofada rice samples, amounting to 162.87 µg/Kg of OTA and foreign rice samples amounting to 45.69 µg/Kg of ZEA which is above and below the European Union Acceptable Limit respectively. Our objective is to provide a consolidated information on the mycotoxin present in rice (Ofada, local and foreign) samples sold in some selected markets in Southwest Nigeria.

Keywords: Mycotoxins, Rice, Analytical, Detection, Ochratoxin, Zearalenone, *Aspergillus* spp

EARTH SCIENCES

2024SPSBIC0008

Delineation of Solid Mineral Potential Zones using Aeromagnetic Data over Part of Zamfara State and its Environs, North Western Nigeria

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Abstract

Migmatite Gneiss Complex (MGC) and the Schist Belts (Metasedimentary and Metavolcanic rocks) of north-western part of Nigeria cover the study area with small exposed sedimentary sequences of Sokoto basin. Several structurally controlled pegmatites mineralization and hydrothermal alteration zones have long been known in the study area. Despite these enormous amounts of mineral deposit, inadequate geophysical works hinders the explorational to be carried out in a large industrial scale. Consequently, unveiling the subsurface geologic structures and mineral conduits through extensive geophysical exploration will improve the output capacity of the mining exploration and mitigate abandon mines. Aeromagnetic was used for mapping of structural elements and hydrothermal alteration zones related to solid minerals. By aeromagnetic data interpretation, the structural complexity, lineaments, and porphyry intrusions density maps have been effectively constructed. Different filtration processes such as Enhanced Center for Exploration Targeting (CET) techniques, Derivative map, Analytic signal were used in this research. The resultants maps were overlain, compared and or plotted on RTP residual aeromagnetic intensity map and or geological map and interpreted in relation to the surface geological map. Major shear zones along with NNE, NC, SS and SE are the main trends controlling mineralization in the area. The discussed techniques in the current research can be adopted as a direct indicator for structural mapping and detecting the alteration zones related to solid minerals mineralization elsewhere.

2024SPSBIC0009

EVALUATION OF THICKNESS OF SEDIMENTARY FORMATION IN FOUR LGA OF DELTA STATE, NIGERIA

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Abstract

The present study focuses on the sedimentary characterisation of part of Niger-Delta area within the south-south region of Nigeria. Four aeromagnetic data sheets covering approximately 12,100 km², bounded by longitude 5.5 to 6.5 E and latitude 5.0 to 6.0 N were used. Analysis of the airborne magnetic data for depth probing was targeted at understanding the depth estimates and geologically layered strata which could be used to infer the maturation and accumulation of hydrocarbon resources within the sedimentary region. The airborne magnetic data was subjected to spectral depth analysis and source parameter imaging (SPI) for subsurface depth profiling. The results of the spectral depth analysis revealed depth to the top of magnetic basement ranging from 2.21 to 5.01 km. Deeper depths in the range of 3.70 to 4.20 km were recorded at the center and southwestern regions of study area. Depth values below 3.00 km were observed at the northwest and north eastern regions. The estimated depth range is a reflection of the thick sedimentation associated with the basin terrane. A depth range of 85 to 5.48 km was recorded from the source parameter imaging (SPI) analysis. The depth values from SPI indicated a deeper cover of sedimentation at the southern region of study area. Both analysis show a good correlation of depth values and regions of thick sedimentation. Results from both methods also

infer that a sedimentary cover of over 5 km within the southern region of study area could be sufficient for the maturation and accumulation of hydrocarbon resources.

Key words: Aeromagnetic data, source parameter imaging, spectral depth, sedimentary thickness.

2024SPSBIC0010

ASSESSMENT OF GEOTECHNICAL PROPERTIES OF SUBSOIL OF PART OF GWAGWALADA, ABUJA FOR FOUNDATION DESIGN AND CONSTRUCTION

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Abstract

Geotechnical data acquired through soil geotechnical analysis is a rich source of information to better understand foundation design and construction. In this study, the geotechnical assessment of geotechnical properties of subsoil in part of Gwagwalada, Abuja for foundation design and construction was carried out. The report of the geotechnical investigation conducted in Gwagwalada gives the site conditions, subsurface stratification, soil parameters, analysis and interpretation of all tests results and soil parameters needed for the design and construction of the structures. The geotechnical investigation involved soil sampling, trial pitting and general laboratory soil testing. The geology of the area revealed that the area is underlain entirely by granite gneiss characterized by quartz and pegmatite veins with majorly NE-SW structural trends and a minor of NW-SE in direction. The result from the laboratory analysis revealed that the particle size distribution shows two different soil type which are; sand > clay + silt > gravel and clay + silt > sand > gravel. The natural moisture content of the soil samples has lowest value of 4.3 % and highest value of 18.8 % with a mean of 8.1 %. The specific gravity ranges from 2.63 to 2.74 with a mean of 2.68 which is within the specific gravity of a normal soil devoid of humus and heavy minerals. The Atterberg limit to determine the liquid and plastic limits shows that the LL ranges from 25 % to 63 % with a mean of 38.6 %, the PL ranges from 14 % to 31 % with a mean of 17.5 % and the PI ranges from 14 % to 43 % with a mean of 20.1 %. The soil samples maximum dry density (MDD) from proctor compaction ranges from 1.41 g/cm³ to 1.80 g/cm³ with a mean of 1.56 g/cm³, while the optimum moisture content (OMC) ranges from 6.0 % to 13.0 %. Similarly, the California bearing ratio (CBR) of the soil samples yielded soaked CBR in the range of 16.0 % to 34.0 % with a mean of 19.0 %, while that of unsoaked samples yielded CBR value in the range 42 % to 59 % with average of 49 %. Furthermore, the triaxial compression test gives the soil cohesion (C) to be in the range of 22.31 kPa to 29.91 kPa with a mean of 26.56 kPa and the angle of shear resistance to range (ϕ) from 11.65° to 18.36° with a mean of 15.56°. The consolidation (oedometer) test gives coefficient of consolidation (C_v) of the range of 1.4 x 10⁻¹ m²/yr. to 4.9 x 10⁻¹ m²/yr. and a mean of 2.7 x 10⁻¹ m²/yr.; the coefficient of volume compressibility (M_v) gives the range of 2.0 x 10⁻⁵ m²/kN to 6.8 x 10⁻⁵ m²/kN with a mean of 3.9 x 10⁻⁵ m²/kN; and the compression index (C_c) of the range of 0.08 to 0.30 with a mean of 0.20. The above information from the soil samples analyses were used to compute the allowable bearing pressure of any foundation and at a depth and width of 1 m, the allowable bearing pressure is 145.74 kN/m² and for a depth and width of 3 m, the allowable bearing pressure is 209.51 kN/m². Equally, the computed immediate settlement for any foundation at a depth of 1 m is 8.58 mm and at a depth of 3 m is 11.79 mm and the consolidation settlement on cohesive strata is 19.36 mm which is within the 25 mm of settlement for footing (AASHTO, 1993). The subsoil formation encountered within the locations is of moderate excavatability, as some of the soil layer shows the presence of very coarse material and gravels from the laboratory analysis. It is recommended that for non-load bearing/light structures, shallow foundations of either strip or pad footing placed at the depth of 1.0 m to 1.50 m below natural ground level, considering the nature of soil and bearing pressure at the study area. For structures that are of moderate loading combinations, the foundation base should be pad footing or ground beams at depth of 1.0 m and above 1.5 m below natural ground level considering the strength of the subsoil at various test locations.

2024SPSBIC0032

Estimation of Geochemical Thresholds for a Suite of Elements in Soil from Tsofon Birnin-Gwari area, Nigeria: Implication for Exploration and Environmental Studies*Nuhu Musa Waziri^{1,2}, Isah Aliyu Goro¹, Idris-Nda Abdullahi¹ & Salome Hephzibah Waziri¹¹Department of Geology, School of Physical Sciences, Federal University of Technology, Minna,²Department of Geology, Faculty of Earth and Environmental Sciences, Bayero University, Kano,

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Abstract

The geochemical threshold values for a suite of elements in residual soil of the Tsofon Birnin-Gwari area, NW Nigeria were computed using two statistical methods. This area is within the Nigerian Schist Belts and is famous for artisanal and small-scale gold mining. The concentration of 17 trace elements in 32 samples was determined using wavelength dispersive X-ray fluorescence spectrometry (WD-XRF). The data was subsequently used to compute threshold concentrations for each of the elements using (i) mean+2SD and (ii) median+2MAD methods. Before the treatments, the data was smoothened by using $\frac{1}{2}$ DL for samples with element concentration below the detection limit. The results show that for all the elements, the mean + SD method provided higher threshold values compared to the median+2MAD approach. This may be attributed to the fact that the mean is likely to be influenced by a few positively skewed data points compared with the median. The standard deviation was generally high for all the elements, indicating wide dispersion around the mean. Accordingly, the threshold values from the first method show that nearly all element concentrations are at the background level, without anomalous values. However, based on the second method, some of the elements were found to have concentrations significantly above the upper limit of background fluctuation. For practical applications in exploration and environmental studies, it is concluded that the median+2MAD approach is more robust at estimating threshold values. However, other methods such as graphical and fractal analysis may be considered as potential alternatives for this purpose.

Keywords: Geochemistry, Geostatistics, Environmental Geochemistry, Prospecting, Background

2024SPSBIC0035

Palynological, Paleoenvironmental and Paleoclimate Analyses of Emi-5-Well, Offshore Niger Delta, Nigeria

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ABSTRACT

Palynological investigation was carried out on the sedimentary successions penetrated by Emi-5-Well, offshore Niger Delta basin, Nigeria. The interval of investigation ranges from 5079 – 8465 ft and the study aim to determine the palynological zones, relative age, paleoenvironment of deposition and paleoclimate of the sedimentary succession. The standard acid palynological methods of sample administration for palynofacies, paleoenvironmental and paleoclimatic conditions were employed. The analysis yielded low to moderate palynomorph species dominated by pollen and spores of low to moderate diversity. The lithologic, textural, and wire line log data analyses indicated that the entire studied interval belong to the Agbada Formation. The interval is dated middle Miocene to late Miocene based on the recovered age diagnostic marker species such as *Multiaerolites formosus*, *Verrutricolporites rotundiporus*, *Crassoretitritiles vanraadshoveni* and *Racemonocolpites hians*. Three interval range zones were established using the international stratigraphic guide for the establishment of biozones. They include: *Stereisporites* sp – *Verrutricolporites rotundiporus*; *Verrutricolporites rotundiporus* – *Gemmemonoporites* sp. and *Retistephanocolpites gracilis* – *Pachydermites diderixi* Zones. Coastal-deltaic environment of deposition is inferred for the studied interval on the bases of the palynofacies association and palynomorphs/palyno-ecological abundance. The paleoclimate indicated wet climatic zone based on the identified palyno-ecological groups. This study suggests that the

integration of palynological analysis with lithologic and wireline log data analyses is very useful for paleogeographic reconstruction of Niger Delta sedimentary units.

Key words: Niger Delta, Emi-5-Well, Palynological zones, Paleoenvironment, Paleoclimate

2024SPSBIC0040

DELINEATION OF MINERALIZATION POTENTIAL AREAS IN PARTS OF ZUNGERU SHEET 163NE, NIGERIA USING AEROMAGNETIC DATA AND GEOCHEMICAL ANALYSES OF ROCKS AND SOILS

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Abstract

The Gidan-Kwano Campus of Federal University of Technology in Minna, Nigeria was mapped to delineate potential mineralization areas using aeromagnetic data and litho-and-soil geochemical assay data. Rock samples were collected from outcrops and soil samples were collected at B-horizon and panned to obtain concentrate. Thin section analysis of the rocks were performed and the soil samples were digested and analysed using Instrumental Neutron Activation Analysis (INAA), Inductively Coupled Plasma – Mass Spectroscopy (ICP-MS) and Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES) respectively at Activation Laboratories Limited (ActLab) in Ontario, Canada for multi-elements. The detailed geology of the study area from the mapping exercise and the thin section petrography reveals the major lithological unit to be granodiorite, diorite and medium to coarse-grained granitic rocks that have experienced multiple orogeny at different past geological time. From the assay geochemical data of the rock and soil samples for gold (Au), silver (Ag), copper (Cu), mercury (Hg), lithium (Li), manganese (Mn), nickel (Ni), lead (Pb), tungsten (W) and zinc (Zn), the mean concentration of the results indicate that there is enrichment of Au, Ag, Cu, Hg, Pb and W in the rock and soil samples with only Pb not enriched in the soil samples with the other elements not enriched since they are below the continental crustal abundance. They vary in concentration as Au > Hg > Ag > W > Pb > Cu for the rock samples and Au > Ag > Hg > W > Cu for the soil samples respectively. It is recommended that further detailed analysis of the geo-materials should be tailored towards determining the reserves for possible exploitation.

Keywords: Delineation, Mineralization, Aeromagnetic, Geochemical data, Crustal abundance

2024SPSBIC0041

ASSESSMENT OF GROUNDWATER PARAMETERS IN PARTS OF MINNA SHEET 164 SW, NORTH CENTRAL NIGERIA

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Abstract

Groundwater is the most abundant source of fresh water available for use by man. It is however used in excess of its rate of replenishment. Hence, the monitoring of this scarce resources cannot be overemphasized. The geology and hydrogeology of parts of Minna was carried out with aim of assessing groundwater parameters and to determine the geological conditions controlling groundwater flow and storage. Geological mapping was conducted on a scale of 1:12,500; surface fracture orientations were mapped to determine the principal joint direction. Hydrological mapping was conducted on existing hand dug wells. The area is basically underlain by rocks of the basement complex comprising of granites and schist. A total of 117 hand dug wells were mapped using the gridding method. About 80% of which

were stoned pitched and 20% were concrete lined. The coordinates of each well the elevation, the depth of well, depth of water and well column were adequately observe and noted. This information was use to plot the water elevation map, and hence groundwater flow direction and other parameters such as recharge and discharge areas were determined. The groundwater in the area occurs within the weathered and fractured basement with an overburden thickness between 0.5-1m as observed in the hand dug wells that were mapped. The water level contour map revealed two groundwater flow direction; major flow in the direction of NE-SW and minor flow in N-S direction and also identified areas of groundwater recharge. The recharge areas were found to be around Tundun Fulani and Maitunbi and discharge area was identified to be Kpakungu and environs. Water level in the area ranges from 0.9-10.3m, water column ranges from 0-4.8m and well depth from 1.6-10.6m. The research has buttressed for the protection of groundwater from contamination by proper urban planning and management. Keywords: Geological mapping, recharge, discharge, hand-dug wells, hydrogeological data, water level map

2024SPSBIC0042

CRITICAL REVIEW AND CHARACTERISATION OF AMINE-GRAFTED POROUS ALUMINIUM FOAMS

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ABSTRACT

As global warming and climate change pose significant threats, carbon dioxide (CO₂) is becoming increasingly important to capture, as it is one of the major causes of global warming. A variety of materials and methods have been reported for CO₂ capture, including adsorption onto zeolites, porous membranes, and absorption in amine solutions. These methods require high energy input, possess corrosive properties, and are expensive. In analogous research, Metal Organic Frameworks (MOFs) have also been developed as excellent porous carbon dioxide-capturing materials with high selectivity and thermal stability. Amine-functionalized porous materials exhibit superior CO₂ adsorption and regeneration efficiency due to their modified pore sizes, surface areas, and morphologies, resulting in enhanced CO₂ uptake performance. As the energy throughput required to desorb the adsorbed CO₂ for the functionalized MOFs is quite high, other thermally stable and self-supporting porous materials should be explored for capturing atmospheric carbon. This technical report examines CO₂ capture and functionalization methods using different amines grafted onto porous aluminum foams produced by replication casting.

KEYWORDS: Porous Metal foams, Aluminium foam, Amine-functionlization, Greenhouse gases emissions, carbon capture.

2024SPSBIC0044

Delineating the bedrock topography of Bugaji Area, Kano, using Electrical Resistivity and Audio-Magnetotellurics (ADMT): Implication for groundwater detection

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Abstract

The Bugaji Area, Kano, lies within the Malumfashi Schist Belt of northwestern Nigeria. The sparse distribution and intense weathering of outcrops have hindered efforts to effectively delineate the geology of this basement complex area. Understanding the geology of the area is important in order to determine potential aquifer zones and identify structures that could impact the environment. Thus,

geological field campaign and geophysical investigations were performed in the study area. The fieldwork identified the presence of the following metasediments: quartzofeldspathic schist, phyllitic schist/pelitic phyllite and gneiss. The rocks were highly fractured and jointed, with folds observed in some areas, which indicates the impact of tectonics. Also the overturning and vertical alignment of the schists was observed, which explained the disruption of the metamorphic prograding trend in the area. The electrical resistivity method and audio-magnetotellurics (ADMT) were employed to map the basement topography and identify aquifer zones. The electrical resistivity method utilized the vertical electrical sounding approach, where both Schlumberger and Wenner arrays were employed. At a depth of 100 m, the VES curve types delineated from the geoelectric models is a QH type, which implies an initially relatively high resistivity followed by a steep decline for the next 7m and subsequent rise in resistivity to form a bowl shape. The constant separation technique achieved using the Wenner array identified 3 to 4 layers, which correspond to the residual overburden (topsoil/indurated lateritic layer), clayey saturated layer, weathered layer/porous weathered metamorphic surface, and fresh basement. The Schlumberger array delineated the indurated lateritic overburden, clayey layer, underlying schistose basement, saturated fractured basement aquifer at depths of about 14 m and the fresh basement. The ADMT 2D profile showed similar subsurface geology, but at a larger depth of 300 m. The ADMT showed the possible presence of an intrusive layer at a depth of 150 m. In general, while complementing each other, both geophysical techniques were able to delineate subsurface geological variations in the area and identify the presence of both shallow and deep aquifers.

Key words: Electrical resistivity, Vertical electrical sounding (VES), audiomagnetotelluric (ADMT), Bugaji Area, aquifer

2024SPSBIC0048

GROUNDWATER QUALITY ASSESSMENT WITHIN MASAKA, NASARAWA STATE, NORTH CENTRAL NIGERIA

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Abstract

Accessibility to safe and inexpensive drinking water is an elementary human need and a fundamental right. Out of all water resource, groundwater is one of the important water resources worlds over, and hence the need to ascertain its suitability for intended purposes. The groundwater quality assessment within Masaka, Nasarawa State, North Central Nigeria, is a crucial study aimed at evaluating the quality of groundwater in this area. Fifteen (15) groundwater samples were taken and their physico-chemical and bacteriological parameters were analysed using standard laboratory methods of analysis. The results show the mean concentrations of the physical parameters were found to be within the threshold of Nigeria Standard for Drinking Water Quality (NSDWQ) and World Health Organisation (WHO) but there are contaminations in a number of the locations. The mean concentrations of magnesium at 25.67mg/L, fluoride at 3.86mg/L and cadmium at 0.016 mg/L are above the 20mg/L, 1.5mg/L and 0.003mg/L threshold respectively, but other analysed chemical parameters of potassium, sodium, chloride, sulphate, bicarbonate, chromium, arsenic, manganese, lead, zinc and copper are within the threshold. Generally, large amounts of Total coliform and *E. coli* with mean of 24.2 cfu/100mL and 12.67 cfu/100mL were recorded in all the water samples which is above 10 and 0 cfu/100mL, indicating contamination by human wastes. The water quality classification based on WQI value of 321.08 is >300 which is unsuitable for drinking. It is recommended that there should be consistent monitoring of the water quality and eradication of unhealthy safe disposal and sanitary practices in the area thereby contributing to the development of sustainable water management strategies in the area.

Keywords: groundwater, quality, physic-chemical, bacteriological, Masaka.

2024SPSBIC0049

ASSESSMENT OF THE EFFECTS OF AGROCHEMICALS ON GROUNDWATER QUALITY IN PARTS OF WURNO, SOKOTO, NORTH-EASTERN NIGERIA**Alayande, A.O. and Waziri, S.H.**

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Abstract

The effects of agrochemicals on groundwater quality were evaluated in parts of Wurno, Sokoto, north-eastern Nigeria. A total of twenty-five groundwater samples were collected from the study area in one liter plastic bottles and analyzed for chemical compositions. The chemistry of the major ions concentration was verified using photometry and titrimetry while that of the Heavy metal concentration was achieved through the Atomic Absorption Spectrometer (AAS). The geological mapping indicates that the extreme north-western part about 15% is part of Dange Formation and the rest of the study area (85%) is part of the Wurno Formation of Sokoto Basin. The physico-chemical results show that pH average concentration is 5.65 mg/L for the area indicating acidic concentration. Magnesium (Mg^{+}) concentration is above the acceptable limit in all the sample location but other cations (Na^{+} , Ca^{2+} and K^{+}) are within the limits. Generally, there is contamination by nitrite (NO_3), ammonium (NH_4) and phosphate (PO_4) in all the sampled locations. The analyzed heavy metals concentration revealed that cadmium (Cd), chromium (Cr), lead (Pb) and iron (Fe) exceed the standards. The mean HPI of 537 indicates pollution by heavy metals. The concentration factor (CF) status shows very high CF for lead (Pb) and iron (Fe), moderate CF for Cd and Cr and low CF for N which are above critical index value. These concentration values tend to have high effect on drinking water quality. Thus, the study concludes that, there is considerable risk of metal toxicity from the sampled wells in the area.

Keywords: Agrochemicals, groundwater quality, concentration, Wurno, Dange

2024SPSBIC0050

Outcrop and petrographic lithofacies analyses of the Kanawa Member of Pindiga Formation, Northern Benue Trough, Nigeria: Implications for environment of deposition

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Understanding the depositional history of carbonate rocks is key to successful resource exploration and exploitation. The Kanawa Member of Pindiga Formation in the Gongola sub-basin of the northern Benue trough is a limestone-shale succession which has been a subject of research especially on the macro and micro fossil contents based on which the open marine environment of deposition has been inferred. However, the existing literature lacks clarity on the nature of the carbonate platform upon which the Kanawa Member was deposited. There are two primary aims of this study: 1) To investigate the macro (outcrop) and micro (thin-section) facies and 2) To ascertain depositional environment based on integrated macro and micro facies analyses. The method employed is detailed outcrop studies combined with thin-section microfacies analyses of the Ashaka quarry and Pindiga stream sections. Results reveal the presence of dark grey to black, fissile mudstone facies and limestone facies. The limestone facies is in turn divisible into three sub-facies including mudstone-wackestone, wackestone-packstone and packstone microfacies. The lithofacies are organised into two associations, namely 1) outer ramp and mid-ramp facies associations. The facies architecture depicted by these associations suggests deposition in homoclinal carbonate ramp setting. This study demonstrates that the

combination of detailed outcrop and microfacies analyses leads to a better understanding of paleogeography of carbonate rocks which is relevant to resource exploration and exploitation.

Keywords: Benue trough, Gongola basin, Kanawa Member, Pindiga Formation, Carbonate ramp

2024SPSBIC0064

Field Mapping and Mineralogical studies of rocks in parts of Zungeru sheet 163 SE using Thin Section Petrography and X-Ray Diffraction Method

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Abstract

Mineralogical studies of rocks were carried out in parts of Gidan Kwano with an aim of investigating the mineralogical composition of the rocks using thin section petrography and X-Ray Diffraction method. The study area lies between latitudes 9°30'10"N - 9°31'50"N and longitudes 6°26'10"E - 6°27'50"E covering an aerial extent of 3.24km². Geological mapping of the area was first carried out to reveal the rock types which was then followed by preparation of thin sections of carefully selected representative samples of rocks in the study area. X-Ray Diffraction was carried out on the same selected samples to reveal geochemically the mineral contents of the rock. The geological mapping revealed that the area is underlain by granites of medium to coarse grain; with color varying from leucocratic to melanocratic. The minerals that could be identified in hand specimen are mica, quartz and feldspar and structures such as joints, faults, quartz veins and pegmatitic veins were observed on the outcrops. The thin section petrographic revealed that the rocks contained all the minerals that were observed in hand specimen with high modal percentage of quartz and orthoclase. The results from the XRD revealed the presence of the following minerals in varying proportions; muscovite, quartz, orthoclase, plagioclase, amblygonite and albite. Amblygonite is one of the few major lithium ores and was found to be present in the sample taken from the pegmatite vein. Lithium sourced from amblygonite could be used to produce aluminum products, batteries, ceramics, glazes and glass. Further geological, geophysical and geochemical prospecting is recommended to be carried out in the study area to determine the economic prospect of this mineral.

2024SPSBIC0065

Groundwater Potential Investigation of Part of Zungeru Sheet 163 NW, Gidan Kwano Area, Minna, North Central Nigeria.

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Abstract

Groundwater exploration was carried out in part of Gidan Kwano Minna in order to characterize the aquifer and locate viable points for siting of productive boreholes. The Electrical Resistivity method using the Schlumberger array was employed for the subsurface geophysical investigation. A total of 8 vertical electrical soundings was carried out across the study area to a maximum AB/2 of 90m. HA, H and HK curve types were observed in the study area. VES points 1,3,6,7,8 have no prospect for groundwater as no fracture was within the subsurface to the depth of investigation and the overburden is also not thick and productive. However, VES points 2,4 and 5 have a good potential for groundwater as fractures were observed below a depth 80m and also the overburden thickness is also appreciable to yield substantial water.

Boreholes drilled to the depth of 90m and above around VES locations 2,4 and 5 would have a good yield while other areas would have to prospect for deep seated aquifers or find alternate means of water supply either through water tankers, rainwater harvesting, and public water supply through the water board. More research should be carried out in the study area using other geophysical methods such as the Electromagnetic method, induced polarization method, and Remote sensing method in other to locate the deep-seated aquifers.

2024SPSBIC0071

ELECTRICAL RESISTIVITY INVESTIGATION FOR AQUIFER POTENTIALS AT PROPOSED IBRAHIM BADAMASI BABANGIDA UNIVERSITY TEACHING HOSPITAL, LAPAI, NIGER STATE, NIGERIA

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Abstract

Electrical resistivity investigation for aquifer potentials has been carried out at the proposed Ibrahim Badamasi Babangida University Teaching Hospital, Lapai Niger State, Nigeria. The area is bounded by latitude $09^{\circ} 02' 21''$ N to $09^{\circ} 13' 45''$ N and longitude $06^{\circ} 29' 57''$ E to $06^{\circ} 36' 12''$ E. The survey was carried out with the aim of delineating the aquifer potential of the area for groundwater development. A total of 500m by 500m was covered with VES points. Schlumberger configuration array was used for data collection with half-current electrode (AB/2) ranging from 1-100m. The WinResist Computer software package was used for the data analysis. The depth sounding interpretation result was used to produce geoelectric sections. The geologic sections of the area as well as geoelectric maps were produced, revealing three subsurface geologic layers. These layers comprise of topsoil/laterite, weathered/fractured basement and fresh basement. Overburden thickness map was generated to indicate depth to basement. From the map, relatively thick overburden between 32m and 38m was observed at north eastern part, 30m to 36m thickness was revealed at southeastern portion, while thin thickness was seen at northwestern part (6m-12m) and moderate thickness is observed at central portion of the area (24m – 26m). From the VES curves generated, having consider the resistivity values and depth of the weathered/fractured layers, the following VES stations were delineated as aquifer potentials B₁, B₃, C₂, C₃, C₆, D₃ and E₃ having resistivity range between 426.0 Ω m and 554.71 Ω m. The depth ranging between 16.1m and 34.2m.

2024SPSBIC0073

GEOLOGY AND GEOCHEMICAL EVALUATION OF MARBLE OCCURRENCE IN GAUBI AREA ABUJA, NIGERIA

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Abstract

Marble is formed as a result of the recrystallization of limestone, pure marble which is also known as high calcium marble, is primarily composed of the mineral's calcite or aragonite, with a total CaCO₃ content ranging from 97 % to 99 %. In Nigeria, there are two types of carbonate mineralization: unmetamorphosed limestones found in Cretaceous to Recent sediments, and metamorphosed crystalline limestone (marbles) found in Pre-Cambrian metasediments. In Gaubi area, three main groups of rocks occur. These include rocks of the granite, migmatite-gneiss and marble. Field occurrence shows that The Gaubi marble is located in Kuje FCT Abuja, north central Nigeria are well exposed at active and

abundant quarry pits where the over burden has been removed. Two marble varieties were distinguished on the basis of color and texture, these are the white and grey varieties. The major element composition (using the X – Ray Fluorescence Spectrometer) of the marble deposit shows it is a dolomitic marble with an average chemical composition of CaO (34.14 %), MgO (20.30 %), SiO₂ (4.07 %), K₂O (0.005 %), Na₂O (0.005 %), Al₂O₃ (0.005 %), Fe₂O₃ (0.33 %), P₂O₅ (0.024 %), TiO₂ (0.021 %) and Loss on Ignition - L.O.I (41.9 %). Comparing the chemical constituents of Gaubi marble among typical dolomitic and calcitic marbles in Nigeria; the Gaubi marble compares favorably with distinctive dolomitic marbles from diverse locations within the basement complex of Nigeria. On the basis of chemical composition only, the marble occurrence in Gaubi is suitable for the manufacture of agricultural use (manufacture of poultry feed) and refractory lime.

Key words: Gaubi, Marble, dolomitic,

2024SPSBIC102

ASSESSMENT OF EFFECTS OF WASTE DUMPS AND SOAKAWAY ON GROUNDWATER IN KEFFI METROPOLIS NORTHCENTRAL NIGERIA

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ABSTRACT

This research assesses the effects of waste dumps and soakaway on groundwater in Keffi metropolis. The methodology adopted involved field geological mapping, insitu measurement of physical parameters of water samples, measurement of distance between groundwater sources (hand dug wells and boreholes) and sources of pollution (soakaway and waste dumping site) and collection of water samples. Twenty (20) water samples were selected and analysed for major anions, cations, trace elements and bacteriological contents. The geology of the area consists of crystalline basement rocks such as gneiss, amphibolitic schist and pegmatites with fractures having dominant NE-SW trends. The physical parameters of the groundwater varied as follows; pH varied from 3.60 – 7.40, electrical conductivity varies from 478 - 1254µS/cm, TDS varies from 68 - 108mg/L and temperature varies from 26.0 – 28.0°C. Average concentrations of major anions, cations and trace elements in all water samples are within the permissible limit of WHO and NSDWQ. Total coliform count and total fecal coliform contents of all the water samples are above the permissible limits with ranges from 45 – 238cfu/100m and 28 – 168cfu/100m respectively. The distance between the sources of groundwater and the sources of the pollution ranges from 3 m to 12 m. It was observed that water from hand dug wells have higher bacteriological content than that of the water from boreholes within similar range of distance with the dump site and soakaway. It was also observed that the amount of the bacteria decreases with increasing distance away from the dumpsite and soakaway.

Keywords: Groundwater, soakaway, waste dump, bacteriological

2024SPSBIC105

Enhancing Groundwater Exploration in Crystalline Basement of Areas of North-Central Nigeria Using Machine Learning Techniques

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Abstract

Groundwater serves as a lifeline for communities and economic activity, particularly in regions underlain by crystalline basement rocks. However, escalating water demands, climate change impacts, pollution, and limited data pose significant challenges to effective exploration and management. This study presents a novel approach that leverages the power of machine learning to unlock hidden aquifers and improve groundwater potential mapping in these challenging terrains. A comprehensive methodology involving a diverse set of twenty machine learning classifiers has been employed. The dataset used for training and validation was structured to ensure optimal model performance. Following in-depth data exploration, relevant features were selected to guide the machine learning process. This exploration also informed the selection of a wide range of classifiers, including decision trees, Support Vector Machines, Neural Networks, and Decision Tree ensembles. Rigorous cross-validation schemes were implemented to ensure robust model evaluation and minimize overfitting. Furthermore, automated hyperparameter tuning was implemented to expedite the search for the optimal classification model tailored to the specific dataset. Once trained, the models were exported to MATLAB® code for future application and reproducibility. To enhance the reliability of the results beyond standard machine learning metrics, a multi-pronged approach, incorporating pumping test data for calibration and conducting analysis of Vertical Electrical Sounding (VES) data was implemented. This comprehensive approach yielded valuable insights, identifying the southern and central parts of the study area as particularly promising zones for groundwater exploration, which aligns well with the region's geological and climatic setting. The study culminates in several key takeaways with significant implications for sustainable groundwater resource management in crystalline basement areas. This study has shown that diverse machine learning classifiers surpass traditional methods in groundwater potential mapping. Combining hydrogeological data and rigorous pre-processing techniques enhances accuracy and reduces expert bias. These findings enable more effective, data-driven groundwater exploration for sustainable resource management in challenging environments.

Keywords: Groundwater exploration, Machine Learning, Crystalline Basement, Sustainable Management, Hydrogeological Data.

2024SPSBIC106

Assessment of the Effects of Agrochemicals on Soil and Water Quality of Parts of Baddegi and Environs, North Central Nigeria

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ABSTRACT

Assessment of the effects of agrochemicals on soil and water quality of parts of Baddegi and Environs, Central Bida Basin, Nigeria has been investigated. A total of 15 soil samples and 15 water samples: comprising five samples from hand-dug wells and ten (10) samples from river were collected. The analyses of the heavy metals, major cations and anions were conducted using standard water analyses procedures. The results of the soil analysis shows that the pH ranges from 2.7 to 7.5 indicating that the soil in some of the area is highly acidic. Soil sample SS6 is highly acidic and samples SS1, SS4, SS8, SS9 and SS15 are slightly acidic. All the major cations analysed for the soil are within the WHO (1996) acceptable limits. On the other hand, bicarbonate, nitrite and phosphate have concentrations which are slightly higher than the standard. The contamination factor for the analysed heavy metals of Fe, Cr, Pb, Zn and Cd are in the order Fe < Cr < Pb < Zn < Cd which is low, medium, medium, very high and very high contamination factor. Other pollution indices of Igeo is unpolluted, Enrichment Factor is no enrichment, and Ecological Risk is low risk. Similarly, the physical parameters of the water samples are within the acceptable limits of NSDWQ (2015) and WHO (2017). The cation analysis shows that there is contamination by potassium in the area. The outcome of the pollution indices for each of the analysed heavy metals for the water samples shows that Fe is unpolluted and Zn, Pb, Cr and Cd are seriously polluted in the area. Two hydrochemical facies, namely, earth alkaline and alkaline water type

predominated by bicarbonate and sulphate were recognized. Overall, the water quality in Badeggi and its environs has not been adversely affected by anthropogenic factors. However, continued monitoring is recommended as a means of protecting these flood plain aquifers from potential contamination.

2024SPSBIC110

SANDSTONE COMPOSITION AND PROVENANCE ANALYSIS OF PART OF BIDA FORMATION, NORTHERN BIDA BASIN, NIGERIA

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ABSTRACT

Provenance studies is important for the sandstones of Bida basin in order to more accurately decipher paleogeography and for assessment of the sandstone's aquifer and reservoir properties. Geochemical methods were used by earlier researchers but thin section petrography was not used for provenance studies in the basin. This project integrates outcrop studies and thin section mineralogical composition to determine the source lithology, plate tectonic setting and paleoclimatic conditions of part of Bida Formation exposed around Doko-Jima Junction in Northern Bida basin, Nigeria. Thin section mineralogy reveals quartz content to be averagely 63% while the feldspar content is less than 1% and the lithic fragment is 37% which classifies the sandstones as litharenites. Matrix was generally absent in the sandstones and the identified cements were mainly iron oxide. The sandstones display angular to subangular shapes which suggest short transportation of the sediments before deposition in fluvial environments. Plots of modal compositions of the sandstones on triangular QFL discrimination diagrams suggest that the paleo-plate tectonic setting was recycled orogens, while the source lithology was metamorphic and the climate was humid. These interpretations were supported by the lack of feldspar, abundant quartz and abundant lithic fragments composed of sedimentary and metasedimentary rock fragments such as chert and quartzite. This project has shown that the integration of field and thin section analyses is vital to sandstone provenance studies.

Keywords: Bida Basin, Bida Formation, Sandstone Composition, Sandstone Provenance, Doko

2024SPSBIC111

Geology, Geochemistry and Value Chain Analysis of Anje Clay Resources, Ikiri Sheet 322, north central Nigeria

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ABSTRACT.

Clays are the most important and widely distributed industrial minerals in abundance. Their applications in various industries are dependent on their mineralogy. This study, report the geology, geochemistry and value chain analysis of Kanje Clay resources in north central Nigeria. To achieved this study; Field work was carried out to collect eight (8) clay-soil samples on a spread of 500-600 meters interval from three different pits from 0-1, 1-2, -3 meters below elevation. Elemental composition of the samples was determined by X-ray Fluorescence (XRF) and identification of constituent mineral was also carried out by X-ray Diffraction (XRD). Result of chemical analysis indicated that the clay are composed of silica ranging from (SiO₂: 24.85%–65.47%), alumina (Al₂O₃, 6.0% –26.5%), MnO (0.13%-854%) with a significant amount of iron oxides (Fe₂O₃, 0.03%–19%). Other oxides such as (P₂O₃, SO₃, CaO, K₂O, MgO and TiO₂) were in moderate to high concentration. The chemical analysis suggests that the clay deposit is mainly made of kaolinite and free quartz. Mineralogically, quartz (24–82 %) and muscovite

(31–69 %) were the most abundant minerals in these raw clay materials, other mineral included are nacrite, Kaoline, Phenegite, Lazurite, magnetite, Bornite, Albite, chlorite, Akagoneite and PON.

2024SPSBIC0120

RESISTIVITY SURVEY FOR GROUND WATER AT THE SCHOOL OF PHYSICAL SCIENCE, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGER STATE, NIGERIA

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ABSTRACT

Geoelectrical Investigation was carried out to evaluate the viability and to determine the subsurface lithology, depth to bedrocks for ground water potential at the School of Physical Science, Federal University of Technology, Gidan Kwano Campus Minna, Niger State, Nigeria. The area is located at the Basement Complex of Nigeria which comprises of Migmatites-Gneiss Complex, the Schist Belt, the older granites and unreformed acidic/basic dykes. Vertical Electrical Sounding (VES) Surveys were conducted using a resistivity meter along six (6) profiles at 100 m interval from each sounding point and a total of 36 VES measurement were made. Schlumberger electrode configuration was adopted with maximum current electrode spacing (AB/2) of 100 m. The results of the VES is made up of three (3) distinctive lithologies; the first layer is Top Soil/Lateritic Particles with resistivity value between 4.8 and 147.5 Ωm its thickness is between 0.2 m and 1.3 m. The second layer is a weathered/fractured basement with resistivity values between 22.9 to 5457 Ωm its thickness ranges between 0.7 m to 36.3 m and the third layer is fresh basement with resistivity values from 22.1 and 43665 Ωm . The stimulated result from the field data shows 3-4 layers resistivity model. The layers are characterised by A, H, K, HA and KH curve types. The area was categorised into high, medium and low groundwater potential zones. Borehole should be drilled on the following VES points; A1, A3, B3, B4, C1, C2, D2, D3, E3, E4, F2 and F1, these VES points depicts zones of good fractures.

Key words: Gidan Kwano, Groundwater potential, Subsurface, Geoelectrical

2024SPSBIC122

GEOLOGY AND GEOCHEMISTRY OF ROCKS AND STREAM SEDIMENTS FROM PART OF ZUNGERU SHEET 164NE, NORTH CENTRAL NIGERIA AND THEIR IMPLICATIONS FOR MINERALIZATION POTENTIAL

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Abstract

Lithogeochemistry and sediment sampling and analysis were carried out after field geological mapping of the Gidan Kwanu campus, Federal University of Technology Minna. The area is part of Zungeru Sheet 164NE. Grab samples were collected during the field mapping on the exposed outcrops, and stream sediments were randomly collected across the drainage systems of the area. The aim was to delineate potential geochemical anomalies for gold (Au) and associated economic deposits. Petrographic studies of the rocks show the rocks were mainly made up of quartz, feldspars, and micas in the percentage proportions of 35%, 45% and 10% respectively. Other accessory minerals include 6% opaque minerals and 3% amphiboles. Results of geochemical analysis of the rock and stream sediments using Instrumental Neutron Activation Analysis (INAA), Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS), and Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES) were superimposed on the aeromagnetic interpretation of the area to define the anomalous areas. The major lithology in the area is granite and granite-gneiss of medium- to coarse-grained texture. The rocks were intruded by pegmatites of different widths and orientations at various locations, showcasing the

deformation history of the area. Microfolds also characterize the surfaces of the outcrops, and exfoliations were also observed in most of the locations visited. The interpreted geochemical data revealed the enrichment of Au, Ag, Cu, Hg, Pb, and W in the concentration order of $Au > Hg > Ag > W > Pb > Cu$ and $Au > Ag > Hg > W > Cu$, respectively, for the rocks and soils. Systematic sampling at intervals narrowed to anomalous areas and pitting and trenching to estimate the reserves are warranted.

Keywords: Geological Mapping, Geochemistry, Mineralization, Aeromagnetic

MATHEMATICAL/ICT

2024SPSBIC0002

STATISTICAL ANALYSIS ON FACTORS RESPONSIBLE FOR STUDENT'S ACADEMIC PERFORMANCES IN THE POLYTECHNIC INSTITUTION:

CASE STUDY: THE POLYTECHNIC, IBADAN STUDENTS.

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ABSTRACT

Students' Academic Performance is vital for assessing a student's final result within The Polytechnic Ibadan. It makes it possible for academic staff, educational administrators, and decision-makers to precisely evaluate students taking various courses throughout a semester. The general purpose of the study is to determine the main factors (student's factors, family factors, school factors, peer factors, finance and economy factors) affecting poor/good students' academic performances in The Polytechnic Ibadan. This research tends to cover all the faculties (using samples size of 1% in each faculty) and selection will be done using simple random sampling. This research will be conducted using questionnaire method via Statistical Package for the Social Science (SPSS) to run the analysis. Statistical analysis such as descriptive statistics, cross tabulation, chi – square, and multinomial logistic regression were used to obtain reliable results. The results of the analysis revealed that, studying only when there is test or examination has the strongest impact on academic performance, with a significance level of 0.00, while other factors (copying assignments given by colleagues, refusing to attend lectures, playing games, chatting rather than studying, having brilliant people as friends, receiving orientation on how grades are calculated, attending classes, feeding allowances, and lecturers coming to classes regularly) have a fairly significant impact on the performance of students at The Polytechnic of Ibadan. The likelihood ratio test indicates that, the lecturers' expertise, and parent's/guardian's level of education are statistically significant predictors in the multinomial regression model. However, we recommend that Students should prepare adequately before the tests and examinations for an outstanding Academic Performance.

Keywords: The Polytechnic of Ibadan, Chi-square Test, Multinomial logistic regression, Descriptive Statistics, Cross tabulation.

2024SPSBIC0004

THE APPLICATION OF LINEAR ALGEBRA IN MACHINE LEARNING

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Abstract

In the realm of machine learning, incorporating linear algebraic methods has become indispensable, serving as a foundational element in developing and refining various algorithms. This study explores the significant impact of linear algebra on machine learning applications, highlighting its fundamental principles and practical implications. It delves into key concepts such as vector spaces, matrices, eigenvalues, and eigenvectors, which form the mathematical basis of well-established machine learning models. The research provides a comprehensive overview of how linear algebra contributes to tasks such as classification, regression analysis, and dimensionality reduction. It also investigates how linear algebra simplifies data representation and processing, enabling effective handling of large datasets and identification of meaningful patterns. Additionally, the study explores specific machine learning

applications like Word/Vector Embedding, Image Compression, and Movie Recommendation systems, demonstrating the critical role of linear algebra. Through case studies and practical examples, the study illustrates how a deep understanding of linear algebra empowers machine learning practitioners to develop robust and scalable solutions. Beyond theoretical frameworks, this research has practical implications for practitioners, researchers, and educators seeking a deeper understanding of the relationship between machine learning and linear algebra. By elucidating these connections, the study contributes to ongoing efforts to improve the efficacy and efficiency of machine learning applications.

KEYWORDS: Linear Algebra, Machine Learning Applications, Mathematical Underpinnings, Data Representation, Model performance.

2024SPSBIC0005

A Panel vector Autoregressive (PVAR) Analysis of impact of Renewable Energy and financial Development on Co2 Emission and Economic growth in west African Region, Abstract Presentation

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Abstract

In contrast to prior research in the energy-environment domain, this study utilizes the panel vector autoregressive (PVAR) model developed by Love and Zicchino (2006) to explore the influences of renewable energy and financial development on carbon dioxide (CO₂) emissions and economic growth across selected West African countries (Senegal, Ghana, Nigeria, Guinea, Burkina Faso, Mali, and Togo). Employing both vector autoregressive and panel vector autoregressive models, we delve into the reactions of CO₂ emissions and economic growth (measured by GDP) to renewable energy and financial development variables, considering their interdependencies. Additionally, variance decomposition of the dependent variables concludes the analysis for the period spanning 1990 to 2020 across the seven West African countries. The results uncover intricate dynamics among CO₂, GDP, and lagged variables, with the first lag of CO₂ and GDP consistently driving significant changes in their current levels. The second lag of CO₂ demonstrates a notable negative impact in both models. Noteworthy is the marginal influence of the credit to the private sector variable on both CO₂ and GDP in the Panel VAR model. These findings contribute nuanced insights to the temporal relationships among these variables, enriching our understanding of their interactions over time.

2024SPSBIC0006

The Dynamics of Controlling Malaria Infection: A Mathematical Modelling Approach

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Abstract

An integrated mathematical model was constructed to analyze the transmission dynamics and control of malaria, incorporating key interventions such as vaccination, standard incidence function, mass treatment, and insecticide treatment. The effective reproduction number (R) was calculated to assess the impact of different control strategies on disease transmission. Utilizing demographic data from Nigeria, numerical simulations were conducted to evaluate the effectiveness of various control measures. The results indicated that implementing a vaccination rate of 50%, an insecticide control rate of 25%, and a mass treatment control rate of 75% resulted in a significant reduction in morbidity among vaccinated individuals, with a transition to the disease-free equilibrium occurring within 10 days. Non-vaccinated individuals showed a decline in infection levels, reaching the disease-free equilibrium within the first 60 days. These findings underscore the importance of comprehensive control strategies involving multiple interventions to effectively curb malaria transmission. Based on the findings of this

study, a major recommendation is to prioritize the implementation of a comprehensive control strategy that combines vaccination, insecticide treatment, and mass treatment interventions.

Keywords: Disease-free equilibrium, effective reproduction number, vaccination

2024SPSBIC0007

STABILITY ANALYSIS OF TOBACCO SMOKING MODEL: THE CASE OF BACTERIAL INFECTION

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Abstract

In this paper, we describe a tobacco smoking epidemic model with ten (10) compartments and used ordinary differential equations to describe the dynamics. The effective reproduction number was obtained and used as a threshold for the spread of bacterial infection through tobacco smoking. It was found that whenever, the tobacco smoking-free equilibrium of the model is globally asymptotically stable (GAS) and the endemic equilibrium is stable if otherwise.

Keywords: Tobacco smoking, Stability, Tobacco smoking-free equilibrium, Effective reproduction number

2024SPSBIC0011

A Four-step block hybrid backward differentiation formulae (BHBDF) for the solution of general second order ordinary differential equation

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ABSTRACT

In this paper, the block hybrid Backward Differentiation formulae (BHBDF) for the step number $k=4$ was developed. For this purpose, power series was employed as the basis function for the development of the schemes in a collocation and interpolation techniques at some selected grid and off- grid points which gave rise to continuous schemes and were further evaluated at those points to produce discrete schemes combined together to form block methods. Analysis of the basic properties of the discrete schemes investigated showed consistency, zero stability and convergence of the proposed block methods. Test problems were solved to examine the efficiency and accuracy of the proposed method. The results showed that the proposed methods with relatively small errors performed favorably in comparison with the existing methods.

Keywords: Block, hybrid, Stiff ODEs, Backward Differentiation Formula, Ordinary differential equation.

2024SPSBIC0012

OPTIMIZING ARTIFICIAL INTELLIGENCE FOR ENHANCING SOCIOECONOMIC DEVELOPMENT IN NIGERIA: OPPORTUNITIES AND CHALLENGES

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ABSTRACT

As Nigeria strives for sustainable socioeconomic development, the integration of Artificial Intelligence (AI) presents unprecedented opportunities to address longstanding challenges and unlock new pathways for growth. This abstract delineates the potential applications of AI in various sectors of Nigeria's economy and highlights key considerations for maximizing its impact on socioeconomic development. AI holds immense promise in revolutionizing sectors such as healthcare, agriculture, education, finance,

and governance in Nigeria. By leveraging AI-driven solutions, policymakers and stakeholders can enhance efficiency, productivity, and inclusivity across these sectors, thereby fostering economic growth, job creation, and social empowerment. Key areas of AI application for socioeconomic development in Nigeria include: Healthcare, Agriculture, Education, Finance, and Governance. Despite the transformative potential of AI, several challenges must be addressed to ensure equitable and sustainable socioeconomic development in Nigeria. These challenges include the digital divide, data privacy concerns, ethical considerations, regulatory frameworks, and skill gaps in AI adoption and implementation. To harness the full benefits of AI for socioeconomic development, concerted efforts are needed from government, industry, academia, and civil society to: Foster digital infrastructure development and broadband connectivity. Promote data literacy and capacity building in AI technologies. Establish regulatory frameworks to safeguard data privacy and ethical AI usage. Facilitate public-private partnerships and innovation ecosystems to drive AI research, development, and deployment. By adopting a holistic and inclusive approach to AI integration, Nigeria can leverage this transformative technology to build a more resilient, inclusive, and prosperous society, advancing the nation's socioeconomic development agenda in the 21st century.

Keywords: Artificial, intelligence, socioeconomic, development, governance, digital transformation.

2024SPSBIC0013

DEVELOPMENT AND VALIDATION OF AN INSTRUMENT TO ASSESS COGNITIVE PRODUCT OF STUDENTS IN DEMAND AND SUPPLY IN ECONOMICS IN NASARAWA STATE, NIGERIA

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ABSTRACT

This study focuses on the development and validation of an instrument to assess cognitive product of students in demand and supply in economics in Nasarawa state, Nigeria. The study used instrumentation research design. The population of this study consist 1541 SS II Economics students in 6 senior secondary schools in Keffi LGA. The sample for the study is 200 respondents from 3 schools using simple random sampling technique. From each of the sampled schools, all the SSII students that are offering Economics were used for the study. For the purpose of this study, one instrument developed by the researchers used for the data collection, namely: Economics Cognitive Product Achievement Test (ECOPAT). Also, the ECOPAT is made up of two sections. Section 'A' captures the instructions and Section 'B' contains 30 items. The ECOPAT developed considers senior secondary school (SSII) in both first, second and third term scheme of works. Again, table of specification is designed to cover items raised from each topic. Students' responses to the items were scored using a marking scheme that is prepared. Content validity was ensured for developing a test blueprint or table of specifications based on the Benjamin Bloom's taxonomy of educational objectives in the cognitive domains and the researchers then obtained the logical or concessional validity indices of the instruments via 0.85 and 0.82 indices. The researchers used Kuder-Richardson (K-R21) Method for ECOPAT. K-R to calculate the internal consistency of the Economics Cognitive Product Achievement Test which yielded 0.87 index. t-test was used to determine how well the Economics Cognitive Product Achievement Test (ECOPAT) at 0.05 level of significance. In order to provide answers to the stated research questions and test the formulated hypotheses, data was collected from the respondents via the instrument. The findings indicate high content validity for the instrument, as evidenced by content validity index (CVI) scores not less than 0.85 for the assessment of cognitive product among economics students. This suggests that the instrument's items effectively capture the intended construct of cognitive product, aligning with expert judgments and existing

research in the field. The reliability analysis revealed that the instrument demonstrates high internal consistency, with reliability coefficients not less than 0.87 for both cognitive product and product variables. This indicates that the instrument produces consistent and stable measurements of student performance in economics education, supporting its reliability for use in assessment contexts. It recommend among others that educators, researchers, and policymakers in Nasarawa State can effectively leverage the validated instrument to assess cognitive product among economics students, ultimately enhancing the quality of economics education and promoting student success.

Keywords: Development, validation, instrument, cognitive, product

2024SPSBIC0014

EVALUATION OF THE INDICATORS OF STAFF DEVELOPMENT PROGRAMME AND PRODUCTIVITY IN NASARAWA STATE TERTIARY INSTITUTIONS, NIGERIA

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ABSTRACT

In this twenty first century, the indicators of staff development program play a crucial role in enhancing the productivity and effectiveness of personnel within tertiary institutions. This study evaluates the impact of staff development programs on productivity within Nasarawa State tertiary institutions in Nigeria. A descriptive survey research design was used. Population of the study constitutes 3785 respondents in the study area. Multistage random sampling technique was adopted to sample 367 respondents. The research employs a mixed-methods approach, combining quantitative survey and qualitative interview to gather comprehensive data. The quantitative aspect involves administering structured questionnaires to academic and non-academic staff members across various departments within the tertiary institutions. The questionnaire focuses on assessing the participation levels, perceived effectiveness, and impact of staff development programs on individual performance and institutional productivity. Complementing the quantitative analysis, qualitative interviews are conducted with key stakeholders, including administrators, faculty members, and human resource personnel. These interviews delve deeper into understanding the nuances of staff development initiatives, identifying challenges, and exploring potential improvements. Validity index of 0.89 with the reliability index of 0.84 using content validity and Cronbach's alpha were used. Person product moment correlation was used for the data analysis. Findings from the study shows that indicators of staff development programs contribute to increased morale and engagement among employees. When staff members feel supported in their professional growth and see opportunities for advancement, they are likely to be more motivated and committed to their work. Another possible finding is that indicators of staff development program lead to enhanced skills and knowledge among employees. Training sessions, workshops, and other development activities may equip staff with the competencies needed to perform their roles more effectively, leading to improved productivity. The study aims to provide insights into the effectiveness of existing staff development programs in Nasarawa State tertiary institutions and to identify areas for enhancement. By examining the relationship between staff development and productivity, the research seeks to inform policy recommendations and strategic interventions aimed at optimizing workforce performance and institutional outcomes.

Keywords: Evaluation, staff development, Programs, Productivity

2024SPSBIC0015

TECHNOLOGY AS AN INSTRUMENT TO TRANSFORM ECONOMICS ASSESSMENT PRACTICES IN NIGERIAN UNIVERSITIES

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ABSTRACT

In Nigerian universities educational system, the field of economics plays a pivotal role in shaping future leaders and decision-makers. However, traditional assessment methods in economics education often struggle to capture the dynamic nature of the discipline and adequately prepare students for real-world challenges. This paper delves into the potential of technology as a catalyst for improving economics assessment practices in Nigerian universities. Technological advancements offer a plethora of tools and platforms that can revolutionize the assessment landscape in economics. From online simulations and data analysis software to interactive economics models and virtual case studies, technology provides avenues for more practical, immersive, and engaging assessment experiences. Through leveraging such tools, educators can create assessments that mirror real-world economic scenarios, fostering critical thinking, problem-solving, and analytical skills among students. Moreover, technology facilitates the integration of real-time data and multimedia resources into economics assessments, enabling students to explore economic phenomena with greater depth and breadth. Interactive graphs, dynamic visualizations, and multimedia presentations enhance students' understanding and retention of economics concepts, fostering a deeper connection with the subject matter. Furthermore, technology-driven assessments offer opportunities for personalized and adaptive learning experiences in economics. Intelligent algorithms and analytics empower educators to tailor assessments to individual student needs, providing targeted feedback and interventions to enhance learning outcomes. Additionally, technology enables the implementation of peer-to-peer assessment and collaborative projects, promoting teamwork, communication, and interpersonal skills among students. However, the effective integration of technology into economics assessment practices requires careful planning, investment, and support. Nigerian universities must prioritize the development of digital infrastructure, provide comprehensive training for faculty members, and ensure ongoing technical support to maximize the benefits of technology-enhanced assessments. In conclusion, technology holds immense promise for transforming economics assessment practices in Nigerian universities. By embracing innovative tools and methodologies, institutions can create more relevant, engaging, and effective assessments that prepare students for success in the dynamic field of economics and beyond.

Keywords: Technology, instrument, transform, economics assessment, practices.

2024SPSBIC0016

INFORMATION AND COMMUNICATION TECHNOLOGY AS AN ENABLER FOR ENHANCING COUNSELING ASSESSMENT AND EVALUATION PRACTICES IN NIGERIA

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ABSTRACT

Counseling assessment and evaluation play a crucial role in promoting the mental health and well-being of individuals in Nigeria. However, traditional methods of assessment and evaluation in counseling often face challenges such as limited reach, lack of standardization, and insufficient resources. This

paper explores the potential of Information and Communication Technology (ICT) as a transformative tool for improving counseling assessment and evaluation practices in Nigeria. ICT offers a wide range of tools and platforms that can revolutionize counseling assessment and evaluation. From online surveys and self-assessment quizzes to virtual counseling sessions and data analytics software, ICT provides opportunities for more comprehensive, accessible, and data-driven assessment experiences. By leveraging ICT, counselors can gather a wealth of information about clients' needs, preferences, and progress, enabling them to tailor interventions more effectively. Moreover, ICT facilitates the implementation of standardized assessment protocols and outcome measures, ensuring consistency and reliability across different counseling settings. Digital platforms and databases enable counselors to collect, store and analyze data efficiently, leading to more evidence-based decision-making and continuous improvement in counseling practices. Additionally, ICT enhances the accessibility and reach of counseling services, particularly in remote or underserved areas of Nigeria. Tele-counseling platforms, mobile applications, and online support groups provide avenues for individuals to seek help and support regardless of their geographical location or physical limitations. Furthermore, ICT enables counselors to collaborate and consult with colleagues and experts across various disciplines, enriching the quality and effectiveness of their interventions. However, the successful integration of ICT into counseling assessment and evaluation practices requires careful consideration of ethical, privacy, and security concerns. Counselors must ensure the confidentiality and integrity of client data, adhere to professional guidelines and standards, and provide adequate training and support for both counselors and clients in using ICT tools responsibly. In conclusion, ICT holds immense promise for enhancing counseling assessment and evaluation practices in Nigeria. Through embracing innovative technologies and methodologies, counselors can improve the accessibility, effectiveness, and efficiency of their services, ultimately contributing to the overall well-being and resilience of individuals and communities across the country.

Keywords: Information, communication, technology, counseling, assessment, evaluation

2024SPSBIC0019

Comparison of Analysis of Variance and Multivariate Analysis of Variance Techniques in the Study of Yield and Growth Performance of Beniseed

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Abstract

Analysis of Variance (ANOVA) is the most widely used statistical technique for assessing the significance of the effects of more than two treatments on a single response variable at a time. However, most experiments (especially in agriculture and biology) involves more than one response variables, which are correlated, and an appropriate technique for analyzing multiple responses simultaneously is the Multivariate Analysis of Variance (MANOVA). This study compares the performance of ANOVA and MANOVA techniques in assessing the significance of the effects of farm site location and variety on the yield and growth parameters of Beniseed. The data for the study are on yield and growth performance of thirteen (13) different varieties of Beniseed from three (3) different farm site locations. These yield and growth parameters are made up of ten (10) response variables. Correlation matrix was computed for these responses, which revealed the Pearson correlation (r) values for each pair of the responses and classified as very weak (0.01), weak (0.20), medium (0.40), strong (0.60)... , very strong (1.0). For each of the pairs of the responses with r value in the above range, MANOVA was carried out and significance of the main effects of each of the factors and their interaction under each of the four multivariate test statistics (Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root) were investigated. Then separate ANOVA was performed for each of the pairs of the responses with a given r value and the significance of the main effects of each of the factors and their interaction were investigated. Then for each pair of the responses with r value, the significance of the main effects and that of the interaction effect from the separate ANOVA tests for each of the correlated responses are compared with that of each of the multivariate test results for the joint response variables. The results

revealed that, for two response variables (capsule length and height of lowest capsule) with very weak correlation ($r = 0.1861$), each of the main effects and interaction effect from all the multivariate tests possesses a highly significant effect on the joint response variables with p-values below 0.001 ($p < 0.001$). The corresponding separate univariate ANOVAs for each responses reveals that the variety main effect and location x variety interaction effect possess a highly significant effect on each of the responses as in MANOVA, while the location effect was insignificant on the capsule length with p-value ($p = 0.089$) and highly significant on the height of the lowest capsule. This indicates that when two responses are correlated (even weak correlation), ANOVA results will sometimes be misleading in terms of investigating the significance of the main and interaction effects.

Keywords: Analysis of Variance, Multivariate Analysis of Variance, Comparison, Correlation, Test Statistics.

2024SPSBIC0020

APPROXIMATE SOLUTIONS TO STIFF PROBLEMS OF THREE-STEP LINEAR MULTISTEP METHOD USING HERMIT POLYNOMIALS.

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Abstract

In this paper, formulation of an efficient numerical schemes for the approximation second-order initial value problems (IVPs) of ordinary differential equations (ODE) is presented. The method is a block scheme for 3-step linear multi-step methods using the Hermite Polynomials as the basis function. The continuous and discrete linear multi-step methods (LMM) are formulated through the technique of collocation and interpolation. Numerical examples of ODE have been examined and results obtained show that the proposed scheme can be efficient in solving initial value problems of second order ODE.

Keywords: linear multi-step method, ordinary differential equations, initial value problems, Hermite polynomials

2024SPSBIC0022

Machine Learning Approach for the Classification of Short Message Service Spam

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Abstract

The unwanted advertisements sent with Short Message Services (SMS) significantly interferes the normal communication among customers, which should have been guaranteed by the mobile service providers. Such trends have attracted many phishing and spamming attacks using SMS messages. The issue with SMS spam classification lies in its direct impact on user security, privacy, communication experience, technological advancements, and the broader social and economic landscape. It plays a crucial role in fostering a safer and more efficient digital environment for users. They can unknowingly access suspect websites and be at risk of phishing attacks or malware downloads. The study embarked on an extensive exploration of SMS spam classification techniques, aiming to distinguish between legitimate messages (ham) and unsolicited or unwanted messages (spam). Kaggle database provided us the dataset “SMS Spam Collection” which is made up of over 10,000 records of Ham and Spam messages. The “SMS Spam Collection” dataset is a public set of SMS labelled messages that have been collected for mobile phone spam research. The dataset was splitted into 70% training set and 30% testing set. The performance was evaluated based on Accuracy, Precision, Recall and F1-Score. Based on the analysis of the experimental results of the NB-SVM hybridized model, the Accuracy of 0.98 (98%), 0.99 and 0.91 Precisions for HAM and SPAM respectively, 0.99 and 0.93 Recall for HAM and SPAM respectively, and 0.99 and 0.92 F1-Score for HAM and SPAM respectively.

Keywords: Short Message Service, SMS SPAM Detection, Mobile SMS, Machine Learning, SPAM Filtering

2024SPSBIC0023

Application of Structural Equation Modelling of Students Academic Performance in Tertiary Institution

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ABSTRACT

Learning is the process of gaining knowledge. The learning process can take place at school, campus or informal institutions. There are many methods for transferring knowledge from lecturers to students and there are many source of learning that can be accessed by students. This study investigated the application of structural equation modelling on student's performance in tertiary institution. The study was conducted within a causal research design. Academic performance data for the school of physical science students were collected from the academic office Federal university of technology, Minna Niger State. The research considered data on the student's joint admission and matriculation board (JAMB) score, sex of students, mode of entry to higher institution, number of credit passed in O-level, school attended (Private/public), grade point average (GPA) and cumulative grade point (CGPA). Data were analysed through structural equation modelling (SEM). According to the result from structural models obtained, the result shows that sex of the students, type of school attended, JAMB score and mode of entry have significant influence on the academic performance of the sampled students in the university. And the result of correlation analysis show that student's mode of entry, School type (public or private secondary school) and Jamb score has strong positive correlation with academic performance (GPA and CGPAS) with $r = 0.866, 0.7402$ and 0.8310 respectively. The fit index values obtained from the analysis were observed to be $\chi^2 = 41.82$ with Prob (χ^2) = 0.0000 which infers good fit. The study recommends structural equation model as one of the best model for modelling academic performance, since it can explore complex relationships among variables such as direct, indirect, spurious, hierarchical and non-hierarchical.

2024SPSBIC0026

Improving convergence rate of the Accelerated Overrelaxation (AOR) method¹Ibrahim Suleiman, ²Abdulrahman Ndanusa and ³Aliyu Umar Mustapha^{1,2}Department of Mathematics, Federal University of Technology, Minna, Nigeria³Department of Mathematical Sciences, Federal Polytechnic Offa, Nigeria**ABSTRACT**

This study is an attempt at enhancing the rate of convergence of the well-known two-parameter Accelerated Overrelaxation (AOR) iterative method for the solution of linear algebraic systems $Ax = b$, where A is the coefficient matrix, b is a column vector and x is the vector of unknowns. A new parameter α , which is dependent on the two parameters, r and ω , is brought in to make the difference. Convergence of the iteration matrix is established for irreducible matrix with weak diagonal dominance and $L -$ matrix. Results of numerical experiments revealed the superiority of the improved version over the classical AOR as well as similar versions in literature.

Keywords: coefficient matrix, AOR, L -matrix, linear system, irreducible matrix, diagonally dominant matrix, convergence

2024SPSBIC0027

NONLINEAR REGRESSION MODELLING OF RELATIONSHIPS AMONG GROWTH PARAMETERS OF TILAPIA (*Oreochromis niloticus*)

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ABSTRACT:

Nile tilapia, *Oreochromis niloticus*, is a widely distributed and economically most important fish species in the world. Effective management is essential to sustain their benefits for the local communities. Fish performance in artificial ponds is greatly limited by certain physiochemical factors like temperature, dissolved oxygen, pH, etc., which operates separately and/or jointly to affect the fish physiological and metabolic processes negatively and thereby reducing survival and growth rates of species. This work makes use of data on growth parameters (total length, standard length and weight) of fish samples, which were collected weekly from three different ponds, each subjected to four different water temperatures (control, 28C, 30C, and 32C) for a period of twelve weeks. The study models the relationship between the fish total length and weight and between the fish standard length and weight under each of the four water temperatures using nonlinear regression technique and examines the effects of weeks and water temperature on tilapia growth. The fitted nonlinear regression models were then compared using F-test statistic to determine the best model. It was observed that the week, water temperature, as well as their interaction have a highly significant effect on the weight of the fish with a p-value less than 0.0001 ($p < 0.0001$). Among the fitted nonlinear regression models under each of the four water temperatures, model three appears to be the best model for both the total length x weight and the standard length x weight relationships with the smallest residual sum of square of 3137.143 and 3099.227 and mean square error of 8.7629 and 8.657 respectively. The estimated marginal means plot shows that mean weight for each of the water temperatures (treatments) continues to increase with the age of the fish. The regression model connecting the fish total length with the standard length explains about 96% of the total variability in the total length data indicating that the model fits the data well. The fishery managers and scientists who wish to manage and further explore the tilapia stock will find usefulness in the results of this study.

Keywords: Length-weight Relationship, Nonlinear Regression Modeling, Tilapia fish Growth parameters, Univariate Analysis of Variance.

2024SPSBIC0030

PERFORMANCE EVALUATION OF MACHINE LEARNING APPROACHES FOR CLASSIFICATION OF DDOS ATTACKS IN SOFTWARE DEFINED

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Abstract.

Enhancing network management and centralized network control is the goal of software-defined network. It separates the data plane from the control plane. Pros of SDN include its programmability, flexibility, and manageability to accommodate network users' ever-increasing demands. SDN is known to be a strong and safe defense against malicious network activity, but it is also susceptible to attacks like distributed denial-of-service attacks. This is as a result of its centralized control features. To defend against this threat, a number of machine learning strategies have been employed. This study evaluated the performance of five Machine learning (ML) Algorithm (Naive Bayes, K-nearest neighbour, Random Forest, support vector machine, Logistic regression) for classification of traffic dataset as either normal or DDOS attacks in SDN. The study adopted 10-fold cross validation on each of the ML Algorithms and the result showed Random forest has the highest performance compared with other machine learning model while Naive Bayes had the lowest training time.

Keywords: DDOS Attack, Software defined Network, Machine learning, Support Vector Machine, Detection

2024SPSBIC0031

MACHINE LEARNING PREDICTION OF GAS-HYDRATES FORMATION AND BLOCKING RISK IN NATURAL GAS PIPELINES IN OFFSHORE NIGER DELTA.

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ABSTRACT

This study investigates hydrate-blocking risks within offshore gas systems, particularly focusing on the Niger Delta region, utilizing multiphase simulations conducted via OLGA software. The research extends to developing machine learning (ML) models to predict hydrate-blocking risks in Niger Delta risers and flowlines. The findings highlight the presence of hydrate jamming risks during natural gas transportation, emphasizing the necessity for effective hydrate management strategies. At around 750 meters from the wellhead, the formation of hydrate began due to the fluid temperature dropping below the temperature of hydrate formation. As the pipeline lengthened to 2971 meters, the volume of hydrate suddenly increased, peaking at 3022 meters with a maximum fraction of 0.54. Beyond 3022 meters, the rate of hydrate development started to decrease, while the temperature remained relatively constant. However, the pressure continued to decrease. Eventually, the volume of hydrate dropped to zero around 3600 meters from the wellhead. ML models, particularly Random Forest, demonstrated superior accuracy in predicting hydrate blocking risk compared to other models. The Simple Logistic model also stands out for its interpretability, offering valuable insights for future predictions and management strategies. Further analysis revealed distinct correlations between hydrate volume fraction, pipeline length, fluid temperature, water cut and mixture velocity, indicating varying levels of hydrate blocking risk. Notably, increasing some of these variables can amplify intermediate and high plugging risks, while decreasing others such as hydrate volume fraction may mitigate these risks. Overall, the ML models perform commendably in identifying hydrate jamming risks, with Random Forest emerging as the most accurate predictor. This research underscores the significance of integrating multiphase simulations and ML predictions in managing hydrate-related risks within offshore gas systems, with Random Forest and Simple Logistic models emerging as promising tools for hydrate risk estimation and management in natural gas pipelines. These findings not only contribute to enhancing current approaches for management of hydrate but also pave the way for advanced strategies in gas transportation systems.

Keywords: Hydrates, Machine Learning, Models, Prediction, Niger Delta

2024SPSBIC0034

Analytical Investigation of Thermal Stratification in the Flow of Fluid in a Cylindrical Pipe

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Abstract

Thermal stratification is a phenomenon where a hot layer of fluid flows over a cold layer of fluid due to density difference. This research work investigates the effect of thermal stratification on fluid flow in a horizontal circular pipe. The transient behaviours of fluid flow, velocity and temperature distribution in the pipe were analysed using Olayiwola's generalized polynomial approximation method (OGPAM). It was found that Grashof's number increases the velocity of the fluid. It was also observed that Peclet number, Biot number and Eckert number decrease the temperature of the fluid and at later time increase as the values of these parameters increase. The results also show that the thermal stratification parameter reduces the temperature profile.

Keywords: Thermal, OGPAM, cylindrical pipe, stratification, Biot number.

2024SPSBIC0043

Developing Machine Learning Models to Forecast Covid-19 Cases in Nigeria

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Abstract

This research focuses on developing accurate models to forecast COVID-19 trends in Nigeria. Given the gravity of the pandemic, having reliable predictive tools is crucial. The study assesses three forecasting methods—AutoRegressive Integrated Moving Average (ARIMA), Seasonal AutoRegressive Integrated Moving Average (SARIMA), and Long Short-Term Memory (LSTM)—to gauge their effectiveness in anticipating ‘Recovered,’ ‘Death,’ and ‘Confirmed’ COVID-19 cases. The global impact of COVID-19 pandemic stresses the urgency of precise forecasting for informed public health decisions. Data was obtained through web scraping reputable sources like the Nigeria Center for Disease Control (NCDC) and the World Health Organization (WHO). The selected algorithms include ARIMA, SARIMA, and LSTM, as these models have been chosen for their proven track record in time series forecasting. On the applicability of these models to COVID-19 time series data, results revealed that LSTM consistently outperforms the other models, especially for predicting confirmed and death cases in Nigeria. Another interesting finding show that an efficacy of the ARIMA model, which indicate a better prediction score in term of Root Mean Squared Error of 0.001 for recovered cases. This prompts scrutiny into the ARIMA model’s potential overfitting and the need for further investigation.

Key words COVID-19 Data, ARIMA Model, Long Short-Term Memory (LSTM) model and Prediction error

2024SPSBIC0045

Hierarchical Models of Fish Abundance and Occurrences in Southern Basin of Kainji, Nigeria

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Abstract

Fish abundance and occurrence refer to the population size and distribution of fish species within a particular ecosystem or geographical area. These terms are commonly used in the field of ecology and fisheries science to describe the number of fish individuals present in a given habitat and how frequently they are encountered. The study will adopt a hierarchical approach wherein prior distributions for abundance or detection will be used to specify stochastic dependence among the five sample locations. The aim of the study is to carry out the hierarchical models of fish abundance and occurrence in southern basin of Kainji Lake, Nigeria. This study aim would be achieved through the following objectives (i) Evaluating fish abundance and occurrences using abundance formulae and their diversity index. (ii) Fitting hierarchical models to modeled fish abundance and occurrence in southern basin of Kainji Lake, Nigeria. The study evaluates the variability of fish abundance and occurrences in different fishing locations and also identifies the effect of location specific area environmental factors on fish population in the study sites. The study estimated the fish abundance and diversity index, and it also developed hierarchical models such as multinomial distribution model, product binomial model and logistic regression and compare the performance of the models to determine the best model for the data under consideration In conclusion, the study estimated the fish abundance and occurrences at each fishing community and our approach can enhance the water resources management in Nigeria.

Keywords: Fish abundance and occurrence, diversity index, multinomial distribution, product binomial, logistic regression, and Bayesian analysis.

2024SPSBIC0051**A Study of the Effects of Variety, Transplanting age, and Nitrogen fertilizer rates on Growth Components of Rice (*Oriza Sativa*): Split-Split Plot Design Approach**

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Abstract

The age of rice seedling at transplanting and application of nitrogen fertilizer are important husbandry practices for improved rice growth. The split-split plot design is often suited for a three- factor experiment where three different levels of precision are desired for the various effects. In this work, effects of variety, seedling transplanting age and nitrogen fertilizer rates on growth of rice were investigated for agronomic field trial conducted during 2020 and 2021 planting seasons at National Cereals Research Institute, Badeggi farms, in which the treatments were laid out as split-split plot arrangement fitted into Randomized Complete Block Design (RCBD) with five replications. The treatments for the trial consist of five rice varieties (FARO 44, FARO 52, FARO 59, FARO 63, FARO 64), four seedling transplanting dates (7, 14, 21 and 28 days after planting, DAP) and five inorganic Nitrogen fertilizer rates (0, 60, 120, 180 and 240 kg N ha⁻¹). The Rice varieties were allocated to the main plot while seedling transplanting age and nitrogen fertilizer rates constitute the sub plot and sub-sub plot factors, respectively. The response variables consist of plant height, number of tillers and leaf area index, each measured at 30 and 45 days after transplanting (DAT) during the two planting seasons. The goodness-of-fit of the fitted split-split plot model was first investigated, then the significance of the effect of each of the fixed factors in the model on the response variables was assessed using the Analysis of Variance technique. Then the contribution of each of the random components of the model to the total variability in each of the responses was investigated. It was observed that the fitted model accounted for about 86% of the total variability in the data and that the effect of each of the three fixed factors is highly significant with a very small probability value (P-value < 0.0001). Among the random components of the model, it was observed that the residual (error (3)) contributed about 93.8% of the total variability in the response data, which is the highest.

Keywords: Split-split plot design, Growth Components, Fixed Factors, Random Components, Variance Components.

2024SPSBIC0054**SECURE IMAGE STEGANOGRAPHY USING LEAST SIGNIFICANT BIT AND EDWARD-CURVE DIGITAL SIGNATURE ALGORITHM**

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ABSTRACT

Image steganography is the process of incorporating text into photos so that the Human Visual System (HVS) cannot detect it and that only the sender and recipient are aware of its presence. There has been numerous works done on image steganography, however some of the challenges outlined by most of the work include low Peak Signal-to-Noise Ratio (PSNR) and low compression rate. This research proposes a model for image steganography that makes use of Edward-Curve Digital Signature Algorithm (EdDSA), Least Significant Bit (LSB), and Diffie-Hellman algorithm. The information to be hidden in the image is first of all encrypted and signed using EdDSA and then the encrypted message is then encrypted using the Diffie-Hellman algorithm to deal with the issue of key exchange. The encrypted message is then embedded in the image using LSB method which is one of the most used steganographic methods. In order to strengthen the security of the information, the model not only conceals information in a picture but also encrypts it and offers a hash. Both subjective and objective analysis are used to assess the aforementioned technique. The experimental results were evaluated based on PSNR and Space Saving and the proposed method outperforms a number of other methods by having

higher Peak Signal-to-Noise Ratio (PSNR) values and a high a compression rate. The result of the study was tremendous having a PSNR values of 96.21415, 99.76348, 88.85138, 98.15750 for Baboon, House, Pepper, Dog stego images respectively. The result also had a compression rate of 90%, 42%, 95% and 83% for Baboon, House, Pepper, and Dog respectively. The proposed image steganography model, integrating EdDSA, LSB, and the Diffie-Hellman algorithm, not only effectively conceals information within images but also enhances security through encryption and hashing. The achieved superior performance in terms of higher PSNR values and substantial compression rates, as validated through comprehensive analyses, underscores the efficacy and robustness of the proposed method in safeguarding sensitive information during transmission.

Keywords: Steganography, Cryptography, LSB, RGB, PSNR, JPEG, DCT, TIFF, BMP, SHA, MD5, PNG, ECDSA, EdDSA

2024SPSBIC0056

ORTHOGONAL FACTOR MODELS WITH ITS' APPLICATION IN FINANCIAL MARKET

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ABSTRACT

The exchange rate is the value of a Nation's currency in terms of the currency of another nation or economic zone. The study aimed to evaluate the efficiency of conditional covariance with application in financial market, using monthly data from 2004 to 2022. The research employs Constant Conditional Correlation (CCC), Dynamic conditional correlation (DCC) and Diagonal Vector Error Correction Heteroskedasticity (DVECH) components of the Multivariate Generalized Autoregressive Conditional Heteroskedasticity (MGARCH) model. Johansson test of cointegration was also used to determine the short or long run relationship between the variables. Akaike information criterion (AIC), Bayes information criterion (BIC), and Log likelihood were employed to select the best model. The result from summary statistics reveal that GB Pound sterling has highest exchange rate to Nigeria naira; followed by Euro with an average of 291.894 and 240.599 Billion respectively during the period studied. The Johansson cointegration test reveals that the variables are not cointegrated which suggest that the exchange rates have short term relation with shares. The DVECH, DCC and CCC components of the MGARCH model were observed to exhibit similar behaviour, showing a significant influence of Exchange Rate on Shares in Nigeria. The DVECH component of the model was observed to have a better estimate with AIC, BIC and Log-likelihood values of 71.7056, 74.8652 and -4131.958 respectively, less than the AIC, BIC and Log-likelihood values from DCC and CCC models. Thus the criteria estimate of the DVECH component of the MGARCH model is better and therefore recommended as the best model for modeling the conditional covariance with application in financial market and its influence on shares in Nigeria.

Keywords: MGARCH models financial market, orthogonal factor models, Heteroschedasticity.

2024SPSBIC0058

Application of linear dynamic model of autoregressive distributed lag (ARDL) model to evaluate the impact of cashless policies on economic growth of five West African countries

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Abstract

Cashless economy is an economy where transaction can be done without necessarily carrying physical cash as a means of exchange of transaction but rather with the use of credit or debit card payment for

goods and services. Gross domestic product is most often used by the government of a single country to measure its economic health. The study investigated the effect of cashless policy on economic growth in five selected west African countries (Nigeria, Ghana, Gambia, Liberia and Sierra Leone), using annually time series data spanning through the period of 2012 to 2022 data sourced from World Bank development indicators report. The study applied a linear dynamic model of Autoregressive Distributed Lag (ARDL) cointegration technique to analyse the short-run dynamics and long-run relationship of the cashless policies on economic growth of the selected countries. Diagnostic test such as serial correlation, heteroskedasticity and Breusch-Godfrey Serial Correlation LM Test were conducted. Phillip-Peron and Kwiatkowski-PhillipsSchmidt-Shin (KPSS) were used to carry out unit root test on the variables. The findings revealed a significant relationship between mobile money transactions (Internet banking) and automated teller machines (ATM) with the Gross Domestic Product while. The estimation results from ARDL error correction regression indicate that the negative coefficient value of Coint Eq(-1)* = -0.628624 with p-value = 0.0000 signifies a long run co-integrating relationship among the variables studied. The result of the Breusch-Godfrey Serial Correlation from the selected ARDL (4, 3, 3, 2, 3, 4) model with P-value = 0.9732 greater than 0.05 significance level shows that the model is not serially correlated. And the result from trend analysis, shows that there is an upward trend of the studied variable within the studied period. The study concludes that cashless policy influences economic growth in Nigeria and other four selected west African countries studied with their P-values = 0.0247, 0.0324 less than 0.05 and therefore suggests that the Central Bank of Nigeria should encourage Banks to offer quality ATM services to their customers. This is expected to boost the adoption of alternative payment system which is amongst the rationale for introducing the cashless policy.

2024SPSBIC0061

Application of Diffusion Magnetic Resonance Equation in the Detection of Tracheomalacia

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Abstract

This research examines the application of Magnetic Resonance Equation in the detection of a disease called Tracheomalacia. The mathematical model applied evolved from the fundamental Bloch equations and was transformed into general flow equations. With appropriate boundary conditions, the method of separation of variables was used to obtain the solutions in two cases: Case 1 – free flow situation and Case 2 – diseased situation. The solution obtained was graphically plotted. From the graphs, the values of magnetization exhibited by the free flow demonstrated free induction decay (FID) with a range of value of 1.26026E-05 to 0.18 while those exhibited by the diseased situation manifest a deformity with a range of value of 1.26026E-05 to 1.5. As shown mathematically from the work, MRI has become an important tool in non-invasive methods of diagnosis and treatment in humans.

Keywords: Bronchoscopy, Magnetization, Relaxation Time, Spine, Tracheomalacia.

2024SPSBIC0074

A MATHEMATICAL MODEL OF THE EFFECTS OF IRRIGATION AND NITROGEN FOR UPLANDRICE DURING DRY SEASON IN BADEGGI ENVIRONMENT

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ABSTRACT

Mathematical model was used to analysis the effects of irrigation and nitrogen fertilizer on the upland rice during dry season in Badeggi environment, this is as a result of the demand for rice in Nigeria that has exceeded the production, due to ever increasing population and hike in the price of the rice. The mathematical model was used to analysis and to obtain optimal yield in upland rice production. The method of least square, R² (coefficient of determinat) and root mean square error (RMSE) was used to evaluate the rate of nitrogen (30, 60, 90, 120 kgNha⁻¹) and (7, 14, 21days). The result showed that the models were adequate and significant at 5%. The results also indicated that application of 90-120kgNha⁻¹ and 7days interval of irrigation enhanced upland rice yield during the dry season. It was also known that there was an increase in yield when there is frequent irrigation combined with application of nitrogen fertilizer (90-120kgNha⁻¹) Analysis of variance (ANOVA) was used for the data collected form National Cereal Research Institute Badeggi, Niger State, and computation of the data was adequate with R² above 50% and root mean square error (RMSE) was very small.

Keyword: Irrigation, Nitrogen fertilizer, significant at 5%, least square and root mean square error (RMSE)

2024SPSBIC0077

**A SYSTEMATIC LITERATURE REVIEW OF DIGITAL FORENSIC INVESTIGATION
METHODOLOGIES: TRENDS, FRAMEWORKS, TECHNIQUES, CHALLENGES,
SOLUTIONS AND OPEN ISSUES**

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Abstract

Digital forensics, pivotal in cyber security, garners attention from researchers and practitioners due to the escalating complexity of modern cyber-attacks. The need for multiple technologies in evidence acquisition amplifies this sophistication. Existing surveys delve into specific digital forensics domains, providing insights into individual advances. However, a global perspective is lacking. Addressing this, we conducted a qualitative review, synthesizing key topics and challenges from relevant digital forensics reviews. While diverse in topics and methods, common issues, primarily centered on evidence acquisition and pre-processing complexities, persist across domains. Our study extends beyond technical hurdles, shedding light on procedural concerns like readiness, reporting, presentation, and ethical considerations. This comprehensive analysis encourages collaboration among researchers and practitioners in various digital forensics domains. This systematic literature review utilizes the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method to thoroughly investigate Digital Forensic Investigation Methodologies. The exploration covers prominent journal libraries, including IEEE, ACM Library, Elsevier, Google Scholar, Research Gate, Science Direct, and Springer Link, with a focus on trends, frameworks, techniques, challenges, solutions, and open issues. Starting with an initial dataset of 505 papers, a rigorous application of the PRISMA method led to the meticulous selection of 60 papers deemed most pertinent for the review.

Keyword: Digital forensic, IoT, cyber, cybercrime, evidence, forensics

2024SPSBIC0085

Forecasting Monthly Air Traffic Passengers in Nigeria Using Seasonal Autoregressive Integrated Moving Average Models Approach

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Abstract

Air Transport has substantially impacted eco-tourism and trade facilitation in Nigeria economy, and with the rest of other world economies by promoting socio-economic interactions among people, cultures and nations. The study aims at developing time series modeling and forecasting for air traffic passengers in Nigeria using the data 'collected from the radio station of the Arik Air at the Nnamdi Azikiwe International Airport (NAIA), Abuja from 2006 to 2018. Seasonal Autoregressive Moving Average (SARIMA) models was proposed for the monthly passenger flows in Nigeria in order to understand to the patterns of air traffic flows and general eco-tourism potentials of the country. The study fitted twelve SARIMA models and 2 neural network models. From the formulated models, it was concluded that the best model for the data at hand was SARIMA model of order (3) denoted as SARIMA (1, 1, 3) (1, 1, 3) 12. The model performance was evaluated using Akaike Information Criteria (AIC), mean average percentage error (MAPE), mean absolute deviation (MAD) and mean standard deviation (MSD) we conclude SARIMA (1, 1, 3) (1, 1, 3) 12 is the best model over than ARIMA model for the data under study. The best model was used to forecast for 24 months ahead.

2024SPSBIC0090

Modelling of Diabetic Patients' Treatment Compliance and Their Survival Patterns in Nigeria: A Survival Analysis Approach

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Abstract

This study investigates the Diabetic Patients' Treatment Compliance and their Survival Patterns in Nigeria using secondary data from the University of Ilorin Teaching Hospital, Ilorin, Kwara State, Nigeria, spanning the years 2020 to 2023. Employing a comprehensive analysis, the study assessed parametric, semi-parametric, and nonparametric approaches, with time to recovery from diabetes infection as the primary outcome variable. Four covariates including gender, age, years of admission, and categories of diabetes were considered in the analysis. Model selection criteria relied on the Akaike and Bayesian Information Criteria (AIC and BIC). Results indicate that age, years of admission and categories of diabetes significantly contribute to the patients' treatment compliance and their survival patterns, as evidenced by the estimated survival rates. Additionally, the log-rank test was employed to compare survival curves across different values of the variables. Significant statistical differences were observed at a 0.05 level of significance among various age groups, years of admission and categories of diabetes. The study further underscores the significant influence of age, years of admission and categories of diabetes on patients' survival patterns, with age, years of admission and categories of diabetes revealed a significant role in all models (Cox, exponential and Weibul models). Notably, parametric models consistently identified age, years of admission and categories of diabetes as significant covariates, while the Cox model highlighted age and years of admission as the significant covariates. Based on the findings, early hospital intervention and treatment compliance are recommended for diabetic patients to ensure optimal care, particularly considering the critical role of the categories of diabetes. Moreover, the study recommends the Exponential model as the most suitable fit for diabetes data, irrespective of sample size, and emphasizes the parametric models' approach as the preferred strategy for analyzing diabetes data.

KEYWORDS: Survival Analysis, Diabetes, Cox proportional Regression, Kaplan-Meire Estimator, Nigeria.

2024SPSBIC0096

A mathematical model and analysis of cholera endemic with emphasis on control interventions

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Abstract

Acute gastrointestinal infections and watery diseases like cholera are still a major global health concern and are still emerging in developing nations. In this work, we develop a mathematical model that encapsulates some of the key dynamics of cholera transmission, including treatment, immunization, public health campaigns, and sanitation as control measures to contain the disease. To evaluate the potential advantages to the community, the reproduction numbers with single and combined controls are computed and compared. Numerical simulation demonstrates that in a novel control plan, vaccination and sanitation come last, then treatment produces the best outcomes, followed by an awareness campaign. Additionally, we observed that using multiple strategies greatly improves cholera control; in two controls, the outcomes outperformed those of a single strategy, and in three control strategies, the outcomes outperformed those of two control strategies. Subsequent simulations utilizing all four interventions yielded the best outcomes of all previously achieved combinations. To ascertain the relative significance of each critical parameter for illness transmission and prevalence, we conducted sensitivity analysis on the main factors influencing the dynamics of the disease.

Key words: education, treatment, vaccination, modeling, sensitivity, sanitation, and epidemiology

2024SPSBIC0097

Application of Queuing Theory to Optimize Waiting-Time in Hospital Operations

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ABSTRACT

Waiting time is inherent to the healthcare service sectors in Nigeria and a major challenge faced by almost every big hospital is queuing. Long waiting time can be a reflection of inefficiency in hospital operations. The out-patient department (OPD) has the biggest queue as compared to other departments in hospital operations. This study comprises of in-depth analysis of OPD from different dimensions. Like in many big hospitals across Nigeria, the OPD of General Hospital in Minna Niger State, Nigeria is managed using experience and rule of thumb rather than strategic research-based techniques such as queuing theory. The General Hospital in Minna Niger State, receives a large number of patients each day which results in longer waiting time for patients due to long queues. To address the challenge, queueing model was design to identify the bottlenecks in service operations and potential areas for improvement in the system, with the objective of optimizing patients waiting time, thereby allowing a higher flow of patients in OPD using queuing model. The result from the multi-server model (m/m/s) shows that the probability of having zero patients in the queue at the OPD unit in the clinic is 0.71 (71%). This infers that the clinic experience constant queue each day. The average time spent in the system (Wq) per patients is 30minute to 35 minute and the average service time in the system before leaving the clinic was estimated to be between 31minute to 40 minutes each day. The study recommends to the government authority to look into the factors that result in long queue and delay of patients at the OPD unit so as to resolve the increasing rate of queue and delay patients experience in the clinic before being attended to.

Keywords: queuing theory, OPD, arrival time, waiting time, service time, hospital operations

2024SPSBIC0098**A Comprehensive Review on Techniques, Tools and Open Issue in Blockchain and Smart Contract Development**Hafiz O. Haruna , Ismaila Idris , Joseph Ojeniyi , Abdulkadir O. Isah, and Sikiru O. Subaiyru⁵

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Increasingly popular are blockchain platforms and programming languages for creating smart contracts. However, the development of smart contracts and blockchain applications follows non-standard software life cycles. This means that updating delivered applications or fixing bugs through new software versions is challenging. This literature review in software engineering aims to highlight current problems and potential solutions in smart contract and blockchain application development. Examining 98 articles from 2016 to 2023, we focus on addressing challenges specific to software engineering in the development, testing, and security assessment of blockchain-oriented software. The review covers four key topics: smart contract testing, smart contract code analysis, smart contract metrics, and blockchain applications. The research identify open challenges for further research in each of these areas, beyond reviewing proposed techniques, tools, and approaches in the literature.

Keywords – Blockchain, Smart contracts, software, Ethereum Virtual Machine, Solidity

2024SPSBIC0103**Modelling of Diabetic Patients' Treatment Compliance and Their Survival Patterns in Nigeria: A Survival Analysis Approach**

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Department of Statistics, Federal University of Technology Minna.

Corresponding Author Email Address: * azeezsule76@gmail.com**Abstract**

This study investigates the Diabetic Patients' Treatment Compliance and their Survival Patterns in Nigeria using secondary data from the University of Ilorin Teaching Hospital, Ilorin, Kwara State, Nigeria, spanning the years 2020 to 2023. Employing a comprehensive analysis, the study assessed parametric, semi-parametric, and nonparametric approaches, with time to recovery from diabetes infection as the primary outcome variable. Four covariates including gender, age, years of admission, and categories of diabetes were considered in the analysis. Model selection criteria relied on the Akaike and Bayesian Information Criteria (AIC and BIC). Results indicate that age, years of admission and categories of diabetes significantly contribute to the patients' treatment compliance and their survival patterns, as evidenced by the estimated survival rates. Additionally, the log-rank test was employed to compare survival curves across different values of the variables. Significant statistical differences were observed at a 0.05 level of significance among various age groups, years of admission and categories of diabetes. The study further underscores the significant influence of age, years of admission and categories of diabetes on patients' survival patterns, with age, years of admission and categories of diabetes revealed a significant role in all models (Cox, exponential and Weibul models). Notably, parametric models consistently identified age, years of admission and categories of diabetes as significant covariates, while the Cox model highlighted age and years of admission as the significant covariates. Based on the findings, early hospital intervention and treatment compliance are recommended for diabetic patients to ensure optimal care, particularly considering the critical role of the categories of diabetes. Moreover, the study recommends the Exponential model as the most suitable fit for diabetes data, irrespective of sample size, and emphasizes the parametric models' approach as the preferred strategy for analyzing diabetes data.

KEYWORDS: Survival Analysis, Diabetes, Cox proportional Regression, Kaplan-Meire Estimator, Nigeria.

2024SPSBIC0108

Analysis of chlorophyll “a” and “b” in randomly selected varieties of Sugar cane leaves using multivariate analysis of variance

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Abstract:

An experiment was conducted at the experimental farm and laboratory of physiology and sugar chemistry Division of Niger state, National Cereal and Research Institute (NCRI) Badegi. Multivariate data needed to make rigorous probability statements about the effect of factors and their interaction in experiments. Chlorophyll “a” and “b” are indeed essential for the growth and development of sugarcane stalk. This paper presents multivariate analysis of variance of the chlorophyll contents of the randomly selected varieties of sugarcane leaves. The data set obtained from a study conducted at National Cereal Research Institute (NCRI) Badegi, Niger state Nigeria. The results show that there are statistical significant differences in both the seasons of the sugarcane leaves in the chlorophyll contents.

Keywords: chlorophyll contents in randomly, selected varieties of sugarcane leaves, growth, development sugarcane stalk.

2024SPSBIC0109

Mathematical Analysis on the Transmission Dynamics of Leptospirosis in Human and Animal populations

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ABSTRACT

Leptospirosis infection, is a contractable disease which is caused by bacteria known as *Leptospira*, it can lead to serious complications and can pose serious health challenge if not treated promptly and effectively. The complex interplay between reservoir hosts, environmental factors, and human activities complicates efforts to curb the spread of the disease. Consequently, this paper presents a deterministic mathematical model for the transmission dynamics of leptospirosis within the intertwined human and animal populations. A comprehensive examination of the model revealed that the disease-free equilibrium is locally and globally asymptotically stable when the basic reproduction number is below one. The basic reproductive number was obtained and we conducted a sensitivity analysis on the basic reproduction number of Leptospirosis to identify parameters that contribute positively to the disease's spread. Furthermore, we validated our Leptospirosis model by fitting it with confirmed cases reported in Kerala State, India, covering the period from January 2021 to December 2022. This calibration process ensures the model accuracy and reliability in reflecting the real world epidemiological dynamics within the specified region and time frame. The solution was solved numerically using Adomian Decomposition method. Results obtained from numerical solutions indicate that the clearance of the bacteria from the environment as a standalone control strategy has discernible effect on the number of infected humans or the bacteria population.

Keywords: Leptospirosis, Basic reproduction number, Stability, Sensitivity analysis, Adomian decomposition method

2024SPSBIC0107**Behavior of Contaminant in a Flow due to Variations in the Cross-Flow dispersion under a Dirichlet Boundary Conditions.**

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Abstract

The advection-dispersion equation (ADE) is mostly adopted in evaluating solute migration in a flow. This study presents the behavior of contaminant in a flow due to variations in the cross-flow dispersion under a Dirichlet boundary conditions. The analytical solution of a two-dimensional advection-dispersion equation for evaluating groundwater contamination in a homogeneous finite medium which is initially assumed not contaminant free was obtained. In deriving the model equation, it was assumed that there was a constant point-source concentration at the origin and a Dirichlet type boundary condition at the exit boundary. The cross-flow dispersion coefficients, velocities and decay terms are time-dependent. The modeled equation was transformed using some space and time variables and solved by parameter expanding and Eigen-functions expansion method. Graphs were plotted to study the behavior of the contaminant in the flow. The results showed that increase in the cross-flow coefficient decline the concentration of the contaminant with respect to increase in time, vertical distance and horizontal distance in different patterns.

Keyword: contaminant, cross-flow dispersion, advection, dispersion, decay parameter, Eigen-function, parameter expanding method.

2024SPSBIC0120**An order (K+5) Block Hybrid Backward Differentiation Formula for Solution of Fourth Order Ordinary Differential Equations**

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Department of Mathematics, Federal University of Technology, Minna

E-mail: r.muhd@futminna.edu.ng**Abstract**

This paper covers the derivation and implementation of the 4-step linear multistep method of block hybrid backward differentiation formula (BHBDF) for solving nonlinear fourth-order initial value problems in ordinary differential equations. In the derivation of the proposed numerical method, the utilization of collocation and interpolation points was adopted with the legendary polynomial serving as the fundamental basis function. The 4-step BHBDF developed to solve fourth-order IVPs has higher order of accuracy $p = 9$. Furthermore, the proposed numerical block methods are employed to directly solve fourth-order ordinary differential equations. In comparison to some existing methods examined in the prior studies, the proposed method has a robust implementation strategy and demonstrates higher level of accuracy.

Keywords: Backward Differentiation Formula, Block method, Collocation, Hybrid method, Interpolation methods and linear multistep methods

2024SPSBIC0123

Covariate Effect as an offset in Spatio-temporal Disease Mapping Modelling

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Abstract

This paper focuses on extending spatio-temporal model in disease mapping. The objective is to incorporate covariate variable as an offset to analyse rea-life data across state and health care areas. The method of generalized linear mixed model (GLMM) that followed a Poisson distribution and built within a Bayesian approach was used. Model fitting and inference were carried out using integrated nested Laplace approximations (INLA), while deviance information criteria (DIC) were used to choose the best performing model. The performance of the proposed model compared to existing model was assessed using female breast cancer mortality data. Result revealed that the proposed model has the lowest DIC value of 1514.053 as against DIC value of 1514.407 for the existing model. The proposed model overcomes the usual model as measured by DIC for a difference of 0.354 (35%) which showed a significant improvement in the proposed model, The proposed model has yielded a classical methodology for assessing the risk variations in the state areas and their influence in health care areas on disease outcome. The study recommended that covariate variable such as age should be included as an offset in a spatio-temporal disease mapping modelling.

Key words: Covariate effect, health care areas, deviance information criteria, relative risks, standardized mortality ratios

2024SPSBIC0128

Effect of Cashless Policy on Gross Domestic Products in Nigeria: A Vector Autoregressive Model (VAR) Approach¹ OKEMMIRI Hillary Uche, ² Jibrin Abdullahi Yafu ³ Usman Abdullahi and ⁴ S.M. Oguche

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ABSTRACT

The study undertakes an econometric research to analyze the cashless policy and its effectiveness on Gross Domestic Products in Nigeria using quarterly data of 2019 to 2022. The vector Autoregressive model (VAR) was adopted to examine how automated teller machine (ATM), Point of sale (POS) and Internet banking (IB) had impacted on Nigeria GDP. Unit root test was carried out on each of the variables to determine their level of stationarity. They were however found stationary after first difference with the p-values less than 0.05 and then used for the regression analysis. And a Johanso test of cointegration was used to examine the short or long term influence of the cashless policies on GDP. In the VAR model result, the activities on automated teller machine (ATM) and point of sales (POS) has significant influence on Nigeria economic growth with their respective p-values less than 0.05 and R-Squares = 0.99. The result from the Johanson test of cointegration show that there is on cointegrating factor which infers a short-term influence. The study recommends that the use of ATM and POS should be much more encouraged in Nigeria, with proper awareness on its benefit. Also effective policy needs to be developed by the government through the CBN to ensure the effectiveness and efficiency of ATM and POS.

Keywords: Automated teller machine (ATM), Point of sale (POS), Internet banking (IB), Vector Autoregressive model (VAR)

Physical/Climate Sciences

2024SPSBIC0001

THERMAL NEUTRON FLUX ESTIMATION IN THE INNER AND OUTER IRRADIATION CHANNELS OF NIRR-1 LEU COREAnas M. S ¹, Muhammad Taha Umar ¹ and J. A Yusuf ²¹ Physics Department Ahmadu Bello University, Zaria-Nigeria² Centre for Energy Research and Training, Ahmadu Bello University, Zaria-Nigeria**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 $1.85 \times 10^{-22} \text{ cm}^2$ and $1.28 \times 10^{-22} \text{ cm}^2$ 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 and 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 and 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.

2024SPSBIC0039

A REVIEW ON RENEWABLE ENERGY POWER SUPPLY SOURCES AS AN OPTION FOR TECHNICAL INSTITUTION*¹ Muhammad Sadiq, ² Ezenwora Joel Aghabgunam, ² Ibrahim Aku Godwin and² Kingsley Chidozie Igwe¹ Physics with Electronics Department, Federal University Birnin Kebbi, Kebbi State, Nigeria² Department of Physics, Federal University of Technology Minna.

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ABSTRACT

Education is an essential tool to maintain steady development and strengthen human resources in any country. The development of any nation depends largely on her technical prowess and capabilities. The need for energy to satisfy the country technical training institution for the avoidance of unemployed graduate and unplanned production of irrelevant skilled should be a priority for effective national building as majority of the institution are having unreliable power supply. Implementing renewable energy policy intensely in this institution will aid to achieve the workforce for the purpose of initiating, facilitating and implementing technological development of a nation. The study examined opportunities associated with renewable energy resources and challenges to meet electricity demands in Nigeria technical Institution. The findings revealed that if solar, wind, biomass and small hydro power resources are integrated and fully harnessed it would help to achieve the goal of renewable energy by providing sustainable and reliable power, reduce emission and offer clean energy.

2024SPSBIC0055

LAND USE AND LAND COVER MAPPING OF KUTA USING REMOTE SENSING AND GIS TECHNIQUES

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ABSTRACT

Mapping land use land cover (LULC) analysis of Kuta using remote sensing and GIS techniques is an area of interest that has been attracting increasing attention. The main objective of this study was to identify and analyze the land use change of Kuta using remote sensing. The images were classified using Maximum Likelihood classification method. This study revealed that in 2000, built-up area occupies about 227.07 hectares (Ha) of the land area constituting 8.85%, farmland occupying 863.73 hectare (Ha) which is 33.66%, vegetation occupying 1270.62 hectare (Ha) which is 49.51%, bare ground occupying 204.93 hectare (Ha) which is 7.99%. In 2010 built up covers 473.67 hectares (Ha) of the land area constituting 18.46%, farmland occupying 1192.68 hectare (Ha) which is 46.47%, vegetation occupying 636.84 hectare (Ha) which is 24.82%, bare ground occupying 263.16 hectare (Ha) which is 10.25%. In 2020, built up covers 765.18 hectares (Ha) which is 29.82%, farmland occupying 1072.53 hectare (Ha) which is 41.79%, vegetation occupying 433.98 hectare (Ha) which is 16.91%, bare ground occupying 294.66 hectare (Ha) which is 11.48%. The result also shows 12.82% increase in farmland between 2010/2000 and -4.68% decreases between 2020/2010. All this leading to a cumulative change trend with built up having 20.97%, farmland having 14%, vegetation having -32.60% and bare ground having 3.50%. By implication, there is growth in population and increase in demand. There is a need for appropriate land management scheme and allocation of resources for sustainable land use in Kuta.

Keywords: Kuta, Remote Sensing, GIS, Land use and Land cover

2024SPSBIC0059

Climate Change Trend and its Effects on Reference Evapotranspiration at Irepodun and Adavi Local Governments Areas, North Central States, Nigeria.

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Abstract

Irepodun and Adavi Local Government Areas in North Central Nigeria are experiencing water shortages in wet and dry seasons. Because of this, the research analysed climate change trend and its effects on reference evapotranspiration (RET) in the study area. The observed data spanned from 1980 to 2020, while it's projected ranged between 1951 and 2100. The Penman-Monteith (FAO 56 PM) and Hargreaves (HS) methods were used to compute RET. Standard formulae were used to calculate sensitivity analysis. The results indicated that the higher solar radiation in Adavi (25.10 W m^{-2}) and Irepodun (24.68 W m^{-2}), respectively, for FAO-56PM, is responsible for causing reference evapotranspiration. The results of Mann-Kendall showed that RET (FAO 56PM) had a negative trend in October (-2.03^*) and had a positive November, December and January with corresponding Z-values of 1.74^+ , 2.56^* and 1.91^+ , respectively, at different significance levels. The RET in Irepodun also experienced a downward trend in May (1.81) and June (2.30) at 10% and 5% levels of significance, indicating an increasing trend of RET (FAO 56PM). However, there was no trend of RET in Irepodun ($P < 0.05$). On a seasonal and annual basis, the RET (FAO 56PM) had a significant downward trend (-

2.30*) in wetness at Irepodun. At the same time, the HS used to compute RET showed a positive and upward trend in the annual season at Adavi in the observed RET, indicating that the two models have different patterns of trends and also indicate potential variations in water resource dynamics between Irepodun and Adavi. The RET under RCPs 4.5 and 8.5 showed the upward trend ($P < 0.001$) in wet, dry and annual seasons.

2024SPSBIC0062

Multi-Response Optimisation of Cutting Parameters in Turning of AISI 1020 Mild Steel using Formulated Neem Seed Oil Based Cutting Fluid.

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Abstract:

One of the requirements for minimal surface roughness, cutting temperature, tool wear and optimal material removal rate coupled with improved machinability and productivity in general is the cutting fluid as one of the input parameters. The evaluation of the optimal factors of surface roughness, material removal rate, cutting temperature and tool wear in the turning of AISI Mild Steel with the use of eco-friendly fluids which is the Neem seed oil based cutting fluid. There has been global concern about the non - biodegradability and non-recyclability of the conventional fluids in the metal cutting industry. This prompted the research interest in replacing the conventional petroleum based fluids with eco-friendly cutting fluid such as neem seed oil based cutting fluid (NBCF). The physicochemical properties as well as its fatty acid composition (FAC) of the locally sourced neem seed oil was investigated for its effectiveness as based metal cutting fluid. The cutting fluid was formulated using ratio 1:9 of oil with additives to distilled water and then characterized. In turning of AISI 1020 Mild Steel, the evaluation of surface roughness, material removal rate, cutting temperature and tool wear under the NBCF compared to the mineral oil based cutting fluid (MBCF) were carried out using Taguchi experimental design and Grey Relational Analysis (GRA) for multi-response optimization. The formulated cutting fluid showed pH value of 8.35, viscosity of 0.896 mm²/s, good resistance to corrosion, good stability and milkfish in colour. From the GRA, the multi-response optimal factor combination under the NBCF is (1250 rev/min) spindle speed, (0.6 mm/rev) feed rate and (1.0 mm) depth of cut, all at level 3 while under the MBCF, it also shows (1250 rev/min) spindle speed, (0.6 mm/rev) feed rate and (1.0 mm) depth of cut all at level 3. This has contributed and improves the science of machining as the parameters from Taguchi and GRA results are in agreement with results from other vegetable oil based cutting fluids.

Keywords: Turning, Neem Seed Oil, Cutting temperature, Material removal rate, Surface roughness, Tool wear, Taguchi, Multi-objective optimization, GRA.

2024SPSBIC0063

CHARACTERISATION OF BIOMASS AND POLYETHYLENE WASTE BRIQUETTES PRODUCED USING TAGUCHI BASED DESIGN OF EXPERIMENT

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Abstract

Fuel for preparing food in many homes in sub-Saharan Africa are from wood sources in form of firewood or charcoal and this is depleting forest reserve quickly. Alternative to fuelwood are being developed from available agricultural wastes residues and other high calorific combustible materials in waste stream, by transforming them into solid briquettes to overcome the drawbacks in the direct

utilisation of these biomass residues as fuel. It is important to characterise briquettes produced, to determine their performance and the elemental makeup of the solid fuel, which gives an idea of the amount of heat energy they can produce and the product of combustion that will be released during burning. In this research, 27 Experimental runs was designed using Taguchi based design of experiment from Minitab 17 software, four factors were varied in the design: Moulding temperature varied between 250 to 290 °C, Moulding Pressure varied between 46 to 66 MPa, Composition of Polyethylene varied between 10 to 30% and Dwell Time varied between 60 to 300 seconds. Briquettes were produced from combination of biomasses and polyethylene wastes, produced briquettes were then characterised. From the characterisation results obtained, 26.3162 MJ/kg was the highest Calorific value, and from the ultimate analysis, highest carbon percent was 46.9817, while 4.6595, 0.06, 30.3253 and 0.11 were the least percentage values of hydrogen, nitrogen, oxygen and sulphur respectively from the produced briquettes. The characterisation results showed that high calorific value fuel can be produced with good combustion properties, from the combination of biomass and polyethylene wastes.

Key words: Biomass waste residues, polyethylene waste, fuelwood, briquettes, calorific value, ultimate analysis

2024SPSBIC0067

Assessment of Flood Vulnerability in Suleja Local Government

Area of Niger State, Nigeria

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Abstract

This study examined the flood vulnerability in Suleja Local Government Area of Niger State. The objectives of the study are to assess the land use land cover change for 15 years as well as to delineate flood vulnerable areas in Suleja L.G.A. Primary data was collected using a handheld GPS to obtained coordinates data of the areas where flood has previously occurred while the secondary data that were used includes the coordinate data, shape-file, landsat images for 2010, 2015, 2020, digital elevation model (DEM), and the administrative map of Suleja L.G.A. The maximum likelihood algorithm of supervised classification in ArcMap software was adopted to classify the land use in Suleja into different classes. The DEM was used to show the elevation of the area. The result from the analysis of land use and land cover satellite imageries revealed that vegetation cover have decreases and built-up area have been on the increase as a result of the influx of people. Interms of vulnerability areas, the western and south western part of Suleja are more vulnerable to flooding because they are located on low elevation while Ranfi Sanyi, Bakin-Iku, Ibo, Kwamba, Kuchiko, Maji, Numbwa and Tunga Shano are less vulnerable because they are higher elevation areas. Interms of flood occurrences, Ranfi Sanyi and Bakin-Iku usually have flood events every year and the major factors leading to this flood is due to haphazard erection of buildings along water ways rather than natural factors (heavy rainfall and elevation). The study therefore recommends that stiffer measures should be put in place by the relevant law enforcement agencies to check the problem of indiscriminate waste disposals and constructions along the drainage and water ways.

Keywords: flood, vulnerability, delineate, land use and land cover change

2024SPSBIC0070

EFFECT OF CUTTING PARAMETERS AND NOSE RADIUS ON SURFACE ROUGHNESS AND TEMPERATURE OF AISI 304 ALLOY STEEL DURING TURNING PROCESS

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ABSTRACT

In this study, the contribution and effect of cutting parameters (cutting speed, feed rate and depth of cut) and tool nose radius on surface roughness, and cutting temperature during turning of AISI 304 alloy steel using design of experiment via Taguchi method was investigated. Coated carbide inserts of varying nose radius of 0.4mm, 0.8mm and 1.2mm were used. No cutting fluid was used during the turning experiments. Surface roughness was measured with a digital surface roughness tester and cutting temperature measured with an infrared thermometer. Minitab 2017 was used to analyse the results. Analysis of variance shows that cutting speed with a contribution of 38.573% has the most significant effect on surface roughness while depth of cut with a contribution of 58.90% has the most significant effect on cutting temperature.

Keywords: Cutting speed, feed rate, depth of cut, nose radius, surface roughness and temperature.

2024SPSBIC0072

DEVELOPMENT OF A RICE HUSK–ASH–CONTAINING GEOPOLYMER CONCRETE SUBJECTED TO ELEVATED TEMPERATURE APPLICATION

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ABSTRACT

The research identifies the challenges faced by bakers who use traditional clay ovens. To address these challenges, geopolymer concrete (GPC) was produced using rice husk ash (RHA), ordinary Portland cement (OPC), and metakaolin (MK). The physical properties of the concrete were then tested to determine its effectiveness. During the testing process, RHA was replaced with OPC at different percentages (0%, 10%, 30%, and 50%), while MK was kept constant at 10%. After the concrete was hardened, it was cured for 7, 14, and 28 days at ambient temperature, and then subjected to thermal resistance tests at varying temperatures (450, 500, 600, 700, and 800 degrees centigrade) for 30, 60, and 120 minutes. The results showed that GPC specimens containing 50% RHA/OPC and 100% RHA produced compressive strength of 55 N/mm² and 31N/mm² before thermal application respectively. However, after thermal application, the compressive strength of GPC specimens containing 50% RHA/OPC reduced to 0 N/mm², while that of 100% RHA GPC was 21.56 N/mm² at a temperature of 800 degrees centigrade for 120 minutes. This indicates that 100% RHA GPC is better suited for structures that require elevated temperature resistance such as traditional clay ovens.

Keywords: Traditional clay oven, Geopolymer concrete, Thermal resistance, Elevated temperature application

2024SPSBIC0079

Development of a Vertical Oil Palm Digester

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aliemeke@yahoo.com, iyoreaisosa@gmail.com)‡aliemeke@yahoo.com, +2348030648051**Abstract**

A mobile vertical oil palm digester was designed, fabricated and tested. The developed palm oil digester was conceptualized and designed using scientific formulae and detailed graphical modeling. The machine consist of a main frame mounted with cylindrical vessel fitted with rotary shaft bearing six beater arms, an internal combustion engine, bearing, pulleys, belt and a discharge chute. The shaft geometry consist of beater arms arranged and welded horizontally on the solid shaft at various distances in order to impact centrifugal force on the boiled palm fruits. The development of the vertical oil palm digester was significantly carried out to eliminate the crude form of oil production which in the past was prevalent in African communities. The developed machine had a volume of digester chamber of 0.65m³ that accommodated oil palm of 200kg/m³. The machine developed a torque of 214.70Nm from a ruptured force of 275.26N. A designed shaft diameter of 29mm was powered with an internal combustion engine which developed a capacity of 1865.76Watts. The developed machine macerated 7kg out of the 9kg of boiled oil palm in 5minutes yielding an efficiency of 77.8%.

Keywords: Development, Digester, Oil palm, Vertical and Technology

2024SPSBIC0081

**ANALYZING THE SPATIO-TEMPORAL PATTERNS OF RAINFALL AND
TEMPERATURE: A COMPARATIVE STUDY OF GUINEA AND SUDANO-SAHELIAN
AGRO-ECOLOGICAL ZONES IN NIGERIA**

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ABSTRACT

Climate change, a global issue spurred by various anthropogenic activities, induced shifts in hydro-climatic variables such as rainfall and temperature. This study analyzes the long-term spatio-temporal trends of rainfall and temperature in the Guinea and Sudano-Sahelian Agro-ecological Zones of Nigeria from 1981 to 2021 using satellite grid-based reanalysis datasets. The Mann-Kendall statistical test, Thiel Sen's slope estimator, Linear Regression, Sequential Mann-Kendal Trend Test, and inverse distance weighing interpolation techniques were used to detect trends, assess magnitude, mutations, and spatial distribution of rainfall and temperature. Results of the rainfall indicates a non-significant decreasing trend of 1.9mm/year and 0.39mm/year over the Guinea Savannah and the entire study area, with low variability of 3%. Conversely, Sudan and Sahel Savannahs exhibits a non-significant increasing trend of 0.78mm/year and 1.2mm/year, with 0.9% and 3.1% variability respectively. Mean annual temperature shows an increasing trends across all zones, with rates of 0.020°C per year in the Guinea Savannah, 0.021°C per year in the Sudan Savannah, and 0.018°C per year in the Sahel Savannah accounting for 42%, 35%, and 27% of the variability. Moreover, the overall study area demonstrates an increase of 0.020°C per year, representing 39% of the variability. Given the observed trends, proactive measures should be adopted to mitigate the impacts of climate change, including sustainable land management practices, water conservation strategies, and policy interventions aimed at reducing greenhouse gas emissions.

Keywords: Climate Change, Spatio-temporal trends, Rainfall, Temperature, Nigeria.

2024SPSBIC0086

Performance metrics and impedance spectroscopy of a surface-modified stainless-steel mesh and carbon-felt electrodes in a terrestrial microbial fuel cell for micro-power production^aImologie M. Simeon*, ^bAmarachi C. Alaka, P. Daniel^a, ^cOlalekan D. Adeniyi.^aDepartment of Agricultural and Bioresources Engineering,
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Federal University of Technology, Minna, Nigeria.*Correspondence email: s.imologie@futminna.edu.ng**Abstract**

Terrestrial Microbial Fuel Cells (MFCs) represent a promising avenue for sustainable energy production, leveraging microbial metabolism to convert organic matter in the soil into electricity. Crucial to MFC performance is the selection of electrode materials, which directly interface with electroactive microbes for electron transfer. This study conducts a comparative analysis of surface-modified stainless-steel mesh (SMS) and carbon felt (CF) electrodes in terrestrial MFCs, evaluating their performance metrics and impedance spectroscopy. The SMS electrode which was fabricated using the pasting and reinforcement process demonstrated superior performance with maximum power of 859 μ W compared 234 μ W power of the commercially available CF electrode. This better performance of the SMS electrode was attributed to its pseudocapacitive behavior, enhancing internal charge storage capacity and overall MFC efficiency. Electrochemical impedance spectroscopy revealed a substantially higher charge transfer resistance (R_{ct}) in the CF electrode, impeding electron transfer processes. Conversely, the SMS electrode exhibited lower charge R_{ct} and improved diffusion characteristics, facilitating efficient electron transfer and mass transport. Notably, the R_{ct} of the CF electrode was over 40 times higher, while its diffusion coefficient was approximately 6 times greater compared to the SMS electrode. These findings underscore the significance of tailored electrode materials in optimizing MFC performance and emphasize the utility of impedance spectroscopy in elucidating complex electrochemical processes within MFC systems, thus guiding future advancements in sustainable power production in terrestrial MFCs.

Keywords: Impedance, microbial fuel cell, modified stainless-steel mesh, electrode, carbon-felt, performance

2024SPSBIC0087

Prediction of Compaction Parameters of Lateritic Soil Stabilized with Fly Ash and Limestone Powder Subjected to Three Energy Levels

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alaladeabayommy@gmail.com**Abstract**

This study adopted the multi-variate linear regression modelling technique to derive equations for compaction parameters (MDD and OMC) for lateritic soil stabilized with fly ash at varying percentages (3%, 6%, 9%, 12%, and 15%) and limestone powder at a constant percentage of 6%. Soil mixture containing 6% Limestone content was the control for the experiment. Three energy levels: British Standard Heavy (BSH), West Africa Standard (WAS), and British Standard Light (BSL) were adopted in this study. Regression modeling tools in MATLAB software was deployed to derive the equations for Maximum Dry Density (MDD) and Optimum Moisture Content (OMC). The MDD and OMC equations were modeled on admixture content and compactive effort. The model for MDD had an R² value of 0.899 and a p-value of 6.24e-07. The model for OMC had an R² value of 0.766 and a p-value of 0.000108. Based on the Analysis of Variance (ANOVA) results of laboratory and model data of

MDD and OMC, the model equations for the compaction parameters (MDD and OMC) are adequate. The models developed in this study will reduce time and efforts involved in determining MDD and OMC through laboratory procedures.

Keywords: Compaction; Lateritic soil; Linear regression; Maximum Dry Density; Optimum Moisture

2024SPSBIC0091

EXAMINING FLOOD TRIGGERING MECHANISMS AND CAUSAL FACTORS INFLUENCING FLOOD OCCURRENCES IN LOWER BENUE BASIN, NORTH CENTRAL NIGERIA

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Abstract

In the lower Benue Basin of North Central Nigeria, the annual occurrence of devastating floods poses significant threats to lives and properties due to the region's low terrain and proximity to the Benue River, Nigeria's second-largest river. This study aims to analyze the triggering mechanisms and causal factors influencing flood occurrences in this area using remotely sensed data and geospatial techniques. Utilizing Digital Elevation Modeling (DEM) and gridded climatic data within ArcGIS 10.8 software, the study classified the region into five vulnerability classes: very high, high, medium, low, and no risk areas. Results indicate that the Benue valley and plain terrain, classified as "very highly vulnerable" and "highly vulnerable," collectively cover 98.52% of the study area whereas the medium, low and no risk areas covers a combined area of 814.06 km² (1.49%). Specific localities such as Makurdi, Guma, and others are identified as highly susceptible to flooding. Furthermore, areas along rivers like Katsina-Ala, Buruku, and Okpokwu Local Government Areas (LGAs) face increased vulnerability due to their proximity to water bodies. Recommendations include leveraging remotely sensed data and GIS techniques for flood disaster preparedness, community relocation from high-risk areas, and public awareness campaigns for early flood warning adherence. Additionally, proactive measures for sustainable urban floodplain development are crucial for enhancing resilience to urban floods amidst increasing human settlement in flood-prone regions.

Keywords: DEM, Flood disaster, Floodplains, GIS, Terrain analysis

2024SPSBIC0092

Synthesis and Characterization of Fe-doped ZnSe nanocrystal for high density memory applications

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Abstract

The X-ray diffraction pattern of Fe-doped ZnSe nanocrystal milled at 5hours, 15hours and 20hours revealed a cubic phase structure that become more stable after 5hours milling time. The Xrd peaks were broadened with increasing milling time suggesting decrease in crystallite size of 4.2nm after 20hours milling evaluated by Scherrer's formula. High-resolution transmission electron microscopy (HR-TEM) showed well-defined lattice fringes with interplanar spacing of about 0.38 nm. The thermal properties of the milled powder was characterized using differential scanning callometry (DSC), that revealed an endothermic peak at 210 °C associated with the melting of C-Se phase. The second peak at 459 0C corresponds to glass transition after 20 hours of milling.

Keywords: Nanocrystal, Xrd , HR-TEM and DSC characterization

2024SPSBIC0093**ASSESSMENT OF PHOTOPROTECTIVE PROPERTIES OF CRUDE SHEA BUTTER, WHITE SEED MELON AND SESAME OILS***¹Vatsa, M.A., ¹Tsadu, M. F., ¹Bello, I.A., ¹Garba, N.N., ²Soje, A. A and ³Girigisu, S.¹Department of Physics, Ahmadu Bello University, Zaria, Nigeria.²Department of Basic Sciences, Niger State College of Agriculture, Mokwa, Nigeria.²Department of Physics, Federal College of Education (Technical), Gusau, Nigeria.*Corresponding author: vatsaaa.eshiii@gmail.com or mvabdullahi@abu.edu.ng; +2348038890035**ABSTRACT**

The study evaluated the photoprotective properties of crude shea butter, white seed melon, and sesame seed oils using various analytical techniques. The pH values of the oils were determined, and bioactive compound contents were analyzed using a UV-visible spectrophotometer. The absorbance of the samples at wavelengths between 290-320nm was measured, and sun protection factors were calculated using the Mansur equation. Different samples were identified using sample IDs – Crude shea butter (SB), white seed melon (WS), and sesame oil (SS). The results showed pH values of 3.96 for sample SS, 6.85 for sample SB and 3.84 for sample WS. The highest flavonoid content was in sample SB with 370.7 ± 0.006 followed by WS with 106.2 ± 0.006 and then SS with $98.90.003$. Sample WS has ($EC_{50} = 133.0 \times 10^{-6} \mu\text{g/ml}$) followed by sample SS having ($EC_{50} = 211.7 \times 10^{-6} \mu\text{g/ml}$) and sample SB having ($EC_{50} = 291.7 \times 10^{-6} \mu\text{g/ml}$). Sample WS showed high absorbance values ranged between 4.726 ± 0.027 and 0.609 ± 0.000 at 290-320nm followed by sample SB with absorbance range of 4.059 ± 0.005 and 0.026 ± 0.000 then sample SS with absorbance range of 3.704 ± 0.005 and 0.037 ± 0.000 . The determined SPF values were 18.51 for sample SS, 15.71 for sample SB and 29.82 for sample WS. Overall, the findings demonstrate the potential of these oils as natural photoprotective agents, with white seed melon oil showing promising attributes in UV protection. The study provides valuable insights into the photoprotective properties of these oils, paving the way for further exploration in skincare and sunscreen formulations.

Keywords: Seed based oils, Flavonoid, Photoprotective, UV-radiation, sunscreen formulation**2024SPSBIC0100****Pt-MWCNT as Counter Electrode for Dye Sensitised Solar Cell**F. M. Abdullahi¹, M. I. Kimpa¹, S. O. Ibrahim¹, A. A. Abubakar¹, H. Isah^{1,2}, A. S. Gene^{1,3}, and K. U. Isah¹¹Department of Physics, Federal University of Technology Minna.²Department of Physical Sciences, Niger State Polytechnic Zungeru.³Department of Physics, Ibrahim Badamasi Babangida University, LapaiCorresponding Authors: fabdul0001@gmail.com (+234-81-69362792)**ABSTRACT**

The study presents the synthesis and functionalization of multi-walled carbon nanotubes (MWCNT) decorated with platinum nanoparticles (Pt-Np) and their potential application as a counter electrode (CE) in dye-sensitized solar cells (DSSCs). The catalytic chemical vapour deposition (CVD) method was employed for MWCNT synthesis using Fe-Co/CaCO₃ as the catalyst. Subsequent functionalization and purification were achieved through treatment with sulfuric acid solution, and the MWCNTs were then decorated with Pt-Np using a wet impregnation method. Characterization techniques including UV-Vis spectrophotometry, SEM, TEM, EDX, XRD, and TGA were employed to analyse the Pt-MWCNTs. The UV-Vis analysis confirmed the concentration of deposited Pt on the MWCNTs based on absorbance. The morphological analysis revealed entangled tubular nanostructures with different average diameters. The elemental analysis by EDX confirmed the presence of carbon and Platinum, while XRD analysis indicated the successful formation of Pt-MWCNT with high degree of crystallinity.

Additionally, TGA analysis showed a high degradation temperature, indicating potential suitability for solar cell applications. Despite the promising aspects of Pt-MWCNTs as a low-cost and high catalytic counter electrode for DSSCs, the study noted the poor photovoltaic performance of the developed DSSCs, attributing it to the choice of sintering temperature. However, the observation of room for improvement in the fill factor (FF) value suggests opportunities for enhancing the efficiency of DSSCs with Pt-MWCNTs. In conclusion, the findings suggest that MWCNTs decorated with Pt-Np hold potential as an alternative to pure Pt in the development of efficient and cost-effective CEs for DSSCs, with further research recommended to optimize the photovoltaic performance of Pt-MWCNT-based DSSCs.

2024SPSBIC0101

SYNTHESIS AND CHARACTERISATION OF ZnO AND ZnO/Ag NANOCOMPOSITE FOR APPLICATION IN OPTOELECTRONICS

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ABSTRACT

ZnO nanoparticles are of significant interest as they provide many practical applications worldwide. Its wide energy bandgap makes it a good photocatalyst material for optoelectronic devices. However, one drawback of using ZnO is that it has some structural defects, such as Zn/oxygen vacancies and therefore have many mid-gap trap states, which through recombination reduces its photocatalyst performance. In this study, ZnO nanoparticles (NPs) was synthesised using hydrothermal method. The synthesised ZnO was doped with Ag plasmonic nanoparticles by the reduction of AgNO₃ via a simple chemical reduction method in order to enhance its light absorbance. XRD and UV visible spectroscopic analysis were used to investigate the structural and optical properties of the synthesised ZnO and Ag doped ZnO. Structural analysis revealed that ZnO NPs had a wurtzite hexagonal structure evidenced by the three major wurtzite peaks. Two other additional peaks reveals the presence of Ag in the ZnO oxide lattice. The spectra exhibit the absorption band which is a characteristics of wurtzite crystal ZnO. The pure ZnO had its absorption peak at 263 nm while for ZnO/Ag1 (0.1mmol of AgNO₃), ZnO/Ag2 (0.2mmol of AgNO₃) and ZnO/Ag3 (0.1mmol of AgNO₃) the peaks are at 264, 270 and 286 nm respectively. These shows that there was a shift in absorption peak to higher wavelength. ZnO/Ag composite had the highest absorption in both UV and visible spectrum. Bandgap reduction as obtained from Tauc's plot revealed energy below the conduction band making the Ag doped ZnO a god material for application in optoelectronics.

2024SPSBIC0104

Natural Radioactivity and Radiological Risk Assessment of Cassava (*Manihot esculenta*) Cultivated and Consumed in Wukari Metropolis Taraba State Nigeria.

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Abstract

Contamination of the human food chain can occur through various means, such as direct deposition of radionuclides, absorption from radionuclide-contaminated soil and water by plant roots, or ingestion of polluted plants, soil, or water by animals. Activity concentrations of ²³⁸U, ²³²Th and ⁴⁰K in soil and Cassava (*Manihot esculenta*) cultivated and consumed in the Wukari metropolis of Taraba State, North East Nigeria, were measured using gamma spectrometric technique, which employs ³NaI (TI) detector. The population's degree of radiation exposure was also assessed through computed radiological parameters. The results show that the activity concentration of ²³⁸U in Cassava ranged

from 0.04 ± 0.01 Bq/kg to 0.45 ± 0.18 Bq/kg with an average of 0.24 ± 0.07 Bq/kg, ^{232}Th ranged from 0.15 ± 0.08 Bq/kg to 1.26 ± 0.46 Bq/kg with an average of 0.73 ± 0.16 Bq/kg and ^{40}K ranged from 9.58 ± 0.57 Bq/kg to 30.73 ± 6.66 , with a mean value of 18.77 ± 2.51 . Similarly, for the soil sample, mean activity concentrations of ^{238}U , ^{232}Th and ^{40}K are 4.70 ± 0.64 Bq/kg, 8.41 ± 1.44 Bq/kg and 395.85 ± 28.04 Bq/kg, respectively. These values are below the respective safety limits of 32 Bq/kg, 40 Bq/kg and 420 Bq/kg for ^{238}U , ^{232}Th and ^{40}K set by the United Nations Scientific Committee on the Effect of Atomic Radiation. The computed mean absorbed dose rate for Cassava is 1.33 nGy/h with the corresponding annual effective dose of 0.0016 mSv/y, which is also less than the world safety threshold. The computed excess lifetime cancer risk due to cassava consumption is 0.0057×10^{-3} . Soil-to-cassava transfer factors are found to be 0.05, 0.09 and 0.05, respectively, for ^{238}U , ^{232}Th and ^{40}K , which are less than unity. The Cassava are, therefore, fit not just for consumption but also for export to other nations from a radiological point of view.

Keywords: Radioactivity, Radiological Risk Assessment, Transfer Factor, Cassava

2024SPSBIC0112

Evaluation of the Physico-Chemical Properties of Briquettes Produced from Rice Husks and Palm Kernel Shells for Solid Fuel Application

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Abstract

In this study, composite briquettes as solid fuel were produced from agricultural waste (rice husks and palm kernel shells). The sample of rice husks and palm kernel shells were ground into powder using a grinding machine and sieved using a 1 mm sieve mesh. The mixtures of rice husk to palm kernel shell were prepared at various weight ratios (90:10, 80:20, 70:30, 60:40, 50:50, 100:0, and 0:100) with 25% of the binder from cassava starch. Subsequently, the rice husk (RH) and palm kernel shell (PKS) samples were thoroughly mixed to achieve a uniform and homogeneous mixture. In each case, the mixture was hand-fed into the briquetting machine and compacted using a manually operated 20-tonne air hydraulic piston press with a pressure gauge to obtain the compressive pressure at room temperature and relative humidity. The proximate and calorific values of the briquettes were determined. The experimental results of the proximate analysis of the briquettes revealed that the moisture content, ash content, volatile matter, and fixed carbon percentages ranged from 4.18 to 5.57%, 12.48 to 19.32%, 74.39 to 81.38%, and 0.05 to 2.11%, respectively. The calorific value ranged from 18.63 to 19.38 MJ/kg, which compared favorably with the American Society for Testing and Materials (ASTM) standards. Notably, the briquettes with a 90:10 ratio of rice husk to palm kernel shell recorded the highest calorific value of 19.38 MJ/kg, suggesting superior heating efficiency and recommended as an alternative fuel source to compete with conventional fuels such as charcoal and firewood.

Keywords: Briquettes, Rice Husks, Palm Kernel Shells, Proximate Analysis, Calorific Value, Solid Fuel, Physico-Chemical Properties.

2024SPSBIC0112

COMPUTATION OF ELECTRICAL LOAD ANALYSIS FOR A PROPOSED SOLAR POWERED ELECTRIC VEHICLE

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Abstract

In order to provide a viable alternative to cars that run on petrol, this article describes the entire design and simulation process of a solar-powered vehicle. A totally emission-free vehicle powered by solar power is not dependent on fossil fuels. In contrast to the earlier solar cars that were produced, which were not much workable, costly, and only had one seat for the driver, the study suggested method that will create a solar electric power system that can be used to power electric car that is viable not only for personal use but also from a business standpoint. To determine how much electrical power is needed to propel the car to the desired speed of 60 km/h, the mass of the structure and the passengers were considered.

In order to charge a bank of 48v and 200 Ah lithium ion batteries for 6 hours per day, 320 W of parallel solar panels are connected as a photovoltaic array. An efficient commercial prototype of a solar car is promised by the testing of the design and simulation using MATLAB/Simulink

Keywords: Solar photovoltaic panel, Battery charger, Battery bank, Speed controllers, Brushless motor, internal combustion engine, chases DC fan, Head light fog light.

2024SPSBIC0125

Impacts of Urbanization on the Land Use and Land Cover Dynamics of Gombe State, Nigeria¹ Deborah Ishaku, ¹ Emmanuel Umaru, ² Adebayo A. Abel, ³ Lowner Ralf, ¹ A. A. Okhimamhe

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ABSTRACT

Land use and cover changes if not carefully managed can consequently result in environmental degradation, such as distortions of ecosystem health, environmental pollution, deforestation, erosion and change in stream flow. Anthropogenic activities without adequate consideration for the environment have led to the incessant loss of land cover and natural resources in many parts of the world; This study analyses the land use and land cover Changes in Gombe State, Nigeria with a view of classifying the various land use and land cover types in the State; this is done by examination of land use and land cover changes between 1991 and 2001; Landsat TM satellite image of 2011, Landsat OLI of 2021, were used; Data was sourced from from US geological survey agency website. Supervised classification method was adopted to classify the Landsat imageries using Idrisi Terrset 20 and GIS software. Data generated were analyzed through digital image processing, image classification, and descriptive statistics. Results revealed that built-up areas increased from 2.56% in 1991 to 15.03% in 2021. The changes in land cover features resulting from uncontrolled human development, and the increasing population in the study area have shifted the land use from the natural use as forest to the artificial use as buildings for accommodation and commercial activities as well as farmlands to feed the growing numbers. The implications of the spatial pattern of land use and land cover in the area are accelerated socioeconomic activities and the prevalence of drought. The study concluded that there is a need for a balance between human development and land use planning to ensure sustainable development in the study area.

Keywords: Land use/land cover, Idrisi Terrset Geographic information system, Remote Sensing.