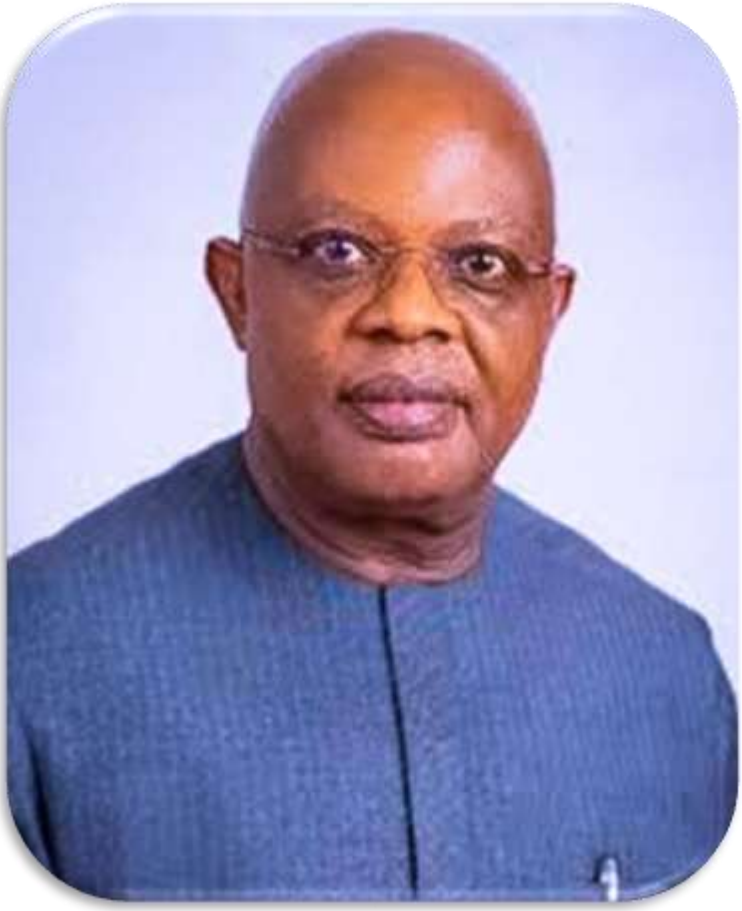
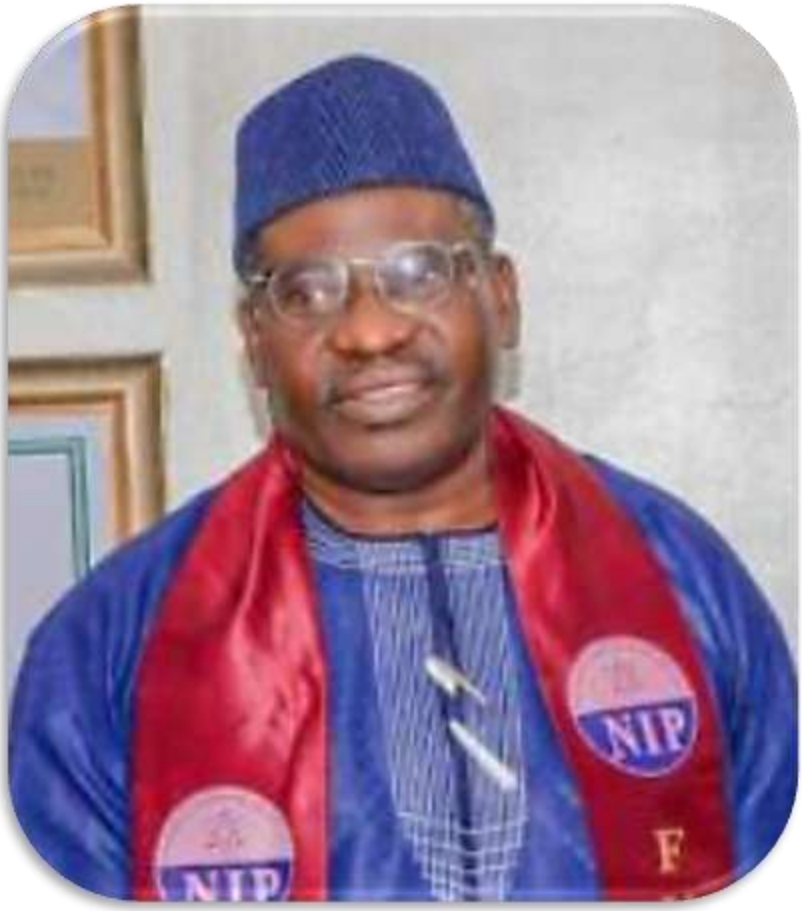
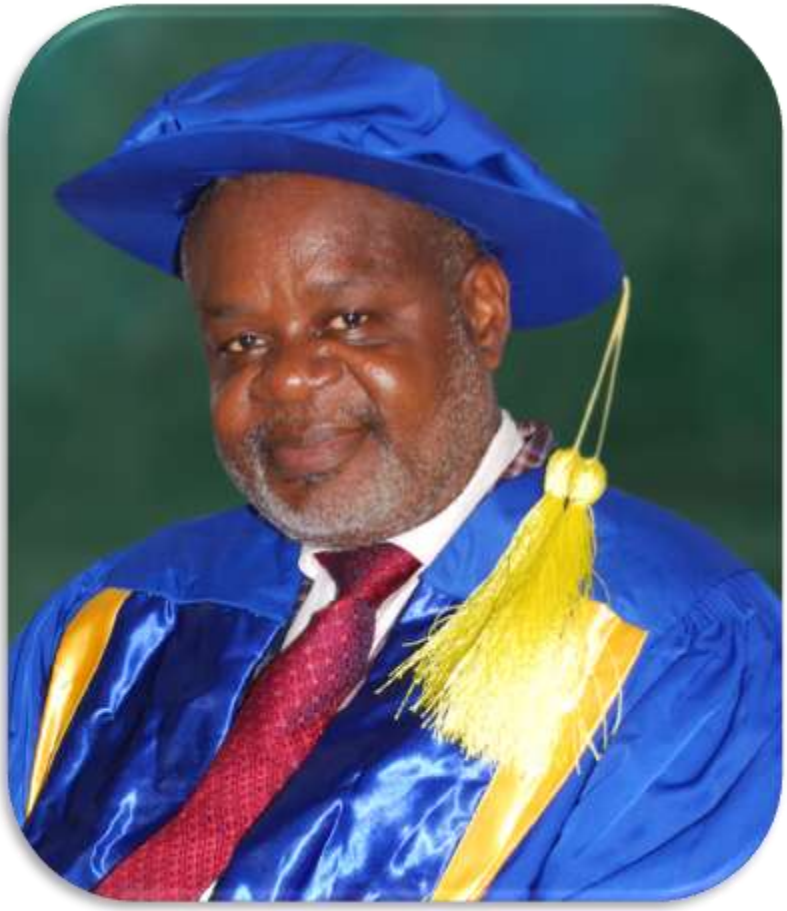


Vice Admiral Ibok-Ete Ekwe Ibas (Rtd.)
The Sole Administrator of Rivers State

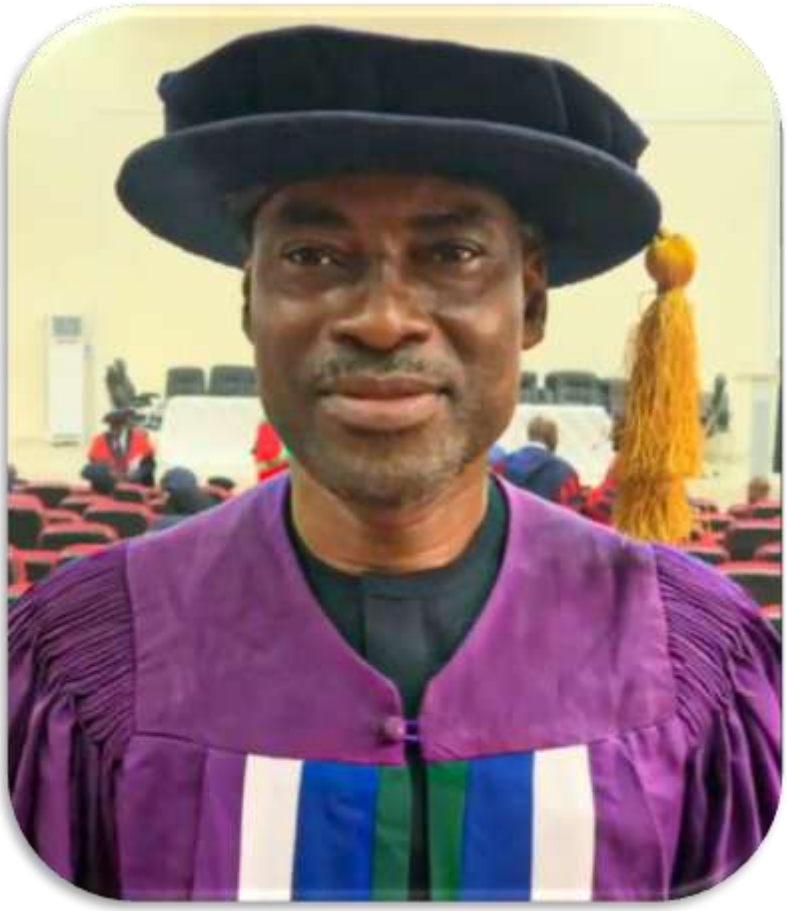
Prof. Isaac Zeb-Obipi
The Vice Chancellor
Rivers State University



Prof. Joseph Olakunle Coker (FNIP)
NIP National President



Prof. Ndokiari Boisa
The Dean, Faculty of Science
Rivers State University



Dr. Arobo R. C. Amakiri
LOC Chairman/Head of Physics Department
Rivers State University

A BRIEF HISTORY OF RIVERS STATE UNIVERSITY

Rivers State University, formerly known as the Rivers State University of Science and Technology (RSUST), is a distinguished public university located in Port Harcourt, the capital city of Rivers State, Nigeria. The institution was originally established in 1972 as the College of Science and Technology and was subsequently elevated to university status in 1979 through the enactment of the Rivers State University of Science and Technology Law. This transformation marked the official founding of Nigeria's first technological university and the first university to be sited within the Niger Delta region.

The university was conceived with a mandate to advance scientific and technological education tailored to the unique developmental needs of Rivers State and the broader Niger Delta. Over the decades, it has grown into a comprehensive institution offering a wide range of academic programs through its various faculties, including Engineering, Environmental Sciences, Agriculture, Law, Management Sciences, and Social Sciences.

In 2017, the university underwent a significant rebranding and was renamed Rivers State University to reflect its broadened academic vision and evolving role as a multidisciplinary center of learning and research. Today, Rivers State University continues to play a vital role in fostering academic excellence, innovation, and socio-economic development within and beyond its host region.

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13.	HRH Dr. Benjamin Kii	-	Member

46TH NIP Conference Programme of Activities @ a Glance

DAY	DATE	PERIOD	EVENT	VENUE
Sunday	11th May, 2025	All Day	Arrival of NIP Council Members and Conference Participants	
Monday	12th May, 2025	10:00 – 11:00	Courtesy call on VC by NIP Council Members	
		10:00 – 14:00	Quiz Competition	RSU ICTC
		11:00 – 13:00	NIP Council Meeting	
		15:00 – 16:00	Induction of New Members	RSU Amphi-Theater
		16:00 – 18:00	Conferment of New Fellowships	RSU Amphi-Theater
Tuesday	13th May, 2025	09:30 – 13:00	Opening Ceremony	Faculty of Media & Communication Studies Auditorium
		13:00 – 14:00	Tea break/Lunch	Food Vendors Stand
		14:00 – 17:00	Plenary Speakers	Faculty of Media & Communication Studies Auditorium
		18:00 – 19:30	VC's Cocktail	
Wednesday	14th May, 2025	09:00- 13:00	Technical Section 1	Physics Department Lecture halls
		13:00 – 14:00	Lunch Break	Food Vendor Stand
		14:00 – 17:00	Annual General Meeting	Faculty of Media & Communication Studies Auditorium
Thursday	15th May, 2025	09:00 – 12:00	Technical Section 2	Physics Department Lecture halls
		12:00 – 12:30	Tea/Coffee Break	Physics Department Lecture halls
		12:30 – 15:30	Technical Section 3	Physics Department Lecture halls
		15:30 – 16:30	Lunch Break	Food Vendor Stand
		16:30 – 18:00	Closing Ceremony	Faculty of Media & Communication Studies Auditorium
Friday	16th May, 2025	Excursion/Departure		Excursion Site

Programme of Activities for the Opening Ceremony
Tuesday 13th May, 2025
@ Conference room of Faculty of Media and Communication Studies, RSU

TIME	EVENT
08:00	Registration of Participants
09:00	Arrival of the Vice Chancellor and His Principal officers, Council Members, Sole Administrator, Awardees and other Distinguished Guests.
09:30 - 09:45	Introduction of the Special Guest of Honor, Guests, Host, Awardees and Members of NIP Council by the Master of Ceremony
09:45 – 09:50	Opening Prayer
09:50 – 10:00	Opening Remarks by LOC Chairman: Dr. Arobo R. C. Amakiri (MNIP)
10:00 – 10:15	Welcome address by Chief Host: Prof Isaac Zeb-Obipi, Vice Chancellor, Rivers State University
10:15 – 10:25	Address by the Host: Prof. Joseph Olakunle Coker (FNIP), President, Nigerian Institute of Physics
10:25 – 10:55	Keynote Address by Mr. Khalil Suleiman Halilu, The Executive Vice Chairman/Chief Executive Officer, National Agency for Science and Engineering Infrastructure (NASENI).
10:55 – 11:20	Award of Excellence
11:20 – 11:30	Award for National Physics Quiz
11:30 – 11:40	Response on behalf of the Awardees
11:40 – 12:30	Address by His Excellency, Vice Admiral Ibok-Ete Ekwe Ibas, the Sole Administrator of Rivers State.
12:30 – 12:35	Vote of thanks by the LOC Chairman: Dr. A. R. C. Amakiri (MNIP)
12:35 – 12:45	Closing prayer
12:45 – 12:55	Group Photographs
12:55 – 13:25	Refreshment
13:25 – 16:00	Plenary Speakers
16:00 – 17:00	Questions/Answers

Table of Contents

SECTION A

Researches in Geophysics, Oil and Gas for Economic Development (RGOG)

RGOG 001

GEOMECHANICAL CHARACTERIZATION OF A CLASTIC RESERVOIR IN PARTS OF NIGER DELTA, NIGERIA

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Abstract
In this study, a clastic reservoir located in the study area was characterized geomechanically using suits of well log to estimate its geomechanical properties. The estimated properties were cross-plotted to infer the rock strength and probable mechanical failure mechanism. The estimated values of these properties are 5.4135GPa, 1.534GPa, 6.053GPa, 0.3478, 0.653GPa^{-1} and 27.457GPa for Young's modulus, Shear modulus, Bulk modulus, Poisson's ratio, compressibility, and UCS respectively. The cross-plots of the properties colour-coded with porosity for the adopted reservoir distinguished three lithofacies: hydrocarbon sands, brine sands, and shale with varying sensitivities in the reservoir interval. The cross-plots of Poisson's ratio versus elastic moduli and UCS show that the porous hydrocarbon sands exhibit high Poisson's ratio, low elastic moduli, and low UCS, while brine sands and shale exhibit moderate Poisson's ratio and medium to high elastic moduli and UCS respectively. These suggest that the hydrocarbon sands are brittle and more prone to lateral deformation, while shale is ductile, stiffest, and the most rigid rock in the reservoir. These observations are indications that the hydrocarbon sands are friable and unconsolidated compared to the consolidated brine sands and shale. Thus, the low strength hydrocarbon sands are prone to mechanical failures and are likely to deform easily under the influence of overburden in the reservoir interval during production.

RGOG 002

DETECTION OF LITHOLOGICAL BOUNDARIES USING SECOND ORDER VERTICAL DERIVATIVES.

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Abstract
Gravity method of geophysical prospecting is very effective in delineating geologic formation of based on the formation of density data was used to delineate the boundary between two geologic formations of significant contact in the formation density. The study area is within the Hadeja arm of the contact region between the Chad sedimentary formation and crystalline basement complex in the northeastern jigawa state of northern Nigeria. Settellite gravity data which lies between latitude 110°- 130°E and latitude 80°- 140° N was obtained from Bureau Gravimetric international (BGI). The Bouguer corrections was already applied in the data. Bouguer graph was plotted using surface software sound vertical derivation graph was also plotted. Low gravity anomalies are observed in the north with its minimum value appearing in the southwestThis suggests the appearance of sedimentary rock which are low in density, since the sedimentary rock is characterised by low density value. The results shows that second vertical derivative methods is suitable for enhancing weater local anomalies, defining the edges of geologically anomalous density dissemination and identification of geologic unit.

RGOG 003

2D RESISTIVITY IMAGING OF FEDERAL COLLEGE OF EDUCATION (TECHNICAL) AKOKA GROUND FOR CONSTRUCTION PURPOSES

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Abstract
2D resistivity imaging was conducted at the Federal College of Education (Technical), Akoka, Lagos State, Southwestern Nigeria. This area is between Longitude N06º31'10" and

Longitude N06º31'30" and Latitude E3º22'55" and Latitude E3º23'5.3". The study area is a sedimentary terrain underlain by the Nigerian arm of the Dahomey Basin. A total of six Constant Separation Traverses (CST) using Wenner electrode array were carried out with PASI 16GL Terrameter and Res2DMod. Exe, a 2D forward modeling program for apparent resistivity pseudo-section to obtain a 2D subsurface model. The positions of 2D profiles were selected based on the cracks observed on the walls and tilting of buildings; the spread length of 2D profiles ranged between 60m and 120 m, based on available space. Three to four geoelectric layers were delineated across the profiles, and they were characterized by clay, sandy-clay, sand and clayey-sand. The presence of clay within the subsurface layers of the ground could be responsible for the cracks, tilting, and sinking of buildings observed within that zone. It was recommended, among others, that further geophysical surveys can be carried out using seismic reflection, well-logging, and laboratory measurement of some physical parameters.

RGOG 004

ASSESSMENT OF GROUNDWATER SUSCEPTIBILITY TO POLLUTION WITHIN PARTS OF NSUKKA, ENUGU STATE, NIGERIA

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Abstract
This study provides an integrated evaluation of groundwater vulnerability to pollution in parts of Nsukka, using a combination of geo-electrical and hydrogeological indices. Vertical Electrical Sounding (VES) surveys were conducted to map subsurface lithological variations, while key hydrogeological parameters such as porosity, hydraulic conductivity, permeability, and hydraulic resistance were measured to gain insights into groundwater flow dynamics. The VES results identified four to five geo-electric layers with varying resistivities, thicknesses, and depths, underscoring the subsurface's complexity. These layers were classified as lateritic sand, medium-coarse brownish sand, coarse sand, and fine- to medium-grained sand. Low resistivity observed in parts of the study area suggests the presence of geological structures like faults and fractures. Groundwater vulnerability indices, including the Aquifer Vulnerability Index (AVI) and GOD index, were calculated to assess pollution susceptibility. Porosity values ranged from 27.04% to 30.21%, hydraulic conductivity from 0.1417 m/s to 0.1571 m/s, permeability from 1.9840 to 2.1994, and hydraulic resistance from 93.0656 to 665.8944. The AVI classified the area into high and moderate vulnerability zones, with regions having shallow water tables showing greater vulnerability. The GOD index categorized the area into low and moderate vulnerability classes, with differences in classification stemming from the distinct criteria of each model.
Keywords: aquifer, geo-electric, AVI, GOD, vulnerability

RGOG 005

CAUSES OF ROAD PAVEMENT FAILURE ALONG KASHERE – PINDIGA ROAD

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Abstract
This research work investigates the causes of road pavement failure along the Kashere-Pindiga road, using the electrical resistivity method, specifically the Schlumberger vertical electrical sounding technique. Data were collected at five different locations from the field and processed it with ip2Win resistivity software to facilitate our analysis. The results from the resistivity measurements indicate that the areas of the road that have failed show low resistivity values of less than 200 Ωm. The geo-electric profiles identify significant near-surface geological structures extending down to about 15 m deep. These profiles suggest the presence of a conductive zone, particularly in the failed sections identified at VES points 1, 3,

and 4, where the subsurface materials include clay, sandy-clay, and limestone. These materials are known to expand when water content is high and contract when dry, leading to instability and eventual failure of the road pavement. On the other hand, the stable segments, as seen at VES points 2 and 5, show resistivity values above 500 Ωm, indicating that the geological material in these areas is lateritic soil, which is more resistant to changes in moisture. This resistance helps maintain the stability of these road segments.

Keywords: Road Pavement, Resistivity, Schlumberger, Kashere-Pindiga Road

RGOG 006

DELINEATION OF OIL – POLLUTED SITES IN EMOHUA LGA OF RIVERS STATE USING RESISTIVITY AND INDUCED POLARIZATION TECHNIQUES.

Jonathan Stephen Osita, Cyril N. Nwankwo,
University of Port Harcourt
stephenjonathan41@gmail.com

Abstract

A geophysical investigation was conducted in Emohua Local Government, Rivers State, Nigeria, to assess the impact of oil spillage on the environment. The study used vertical electrical sounding (VES) and resistivity/IP tomography to examine the extent of oil contamination in the soil and groundwater. The results showed that the study area is heavily impacted by oil spillage, with high resistivity values (up to 10,000Ω-m) indicating the presence of hydrocarbons. The contamination was found to be widespread, affecting both the soil and groundwater and originating from a possible point source along a pipeline section. The study also revealed that the aquifer in the area is unconfined, with high hydraulic conductivity values, making it vulnerable to contamination. The groundwater flow direction was found to be from NW to SE, indicating the potential direction of contaminant migration. The study recommends cleanup and remediation efforts to mitigate the environmental impact of the oil spillage. Going forward, security operatives should adopt a more robust way of handling apprehended vehicles and vessels containing illegal oil Bunkry.

Keywords: Electrical resistivity, Induced polarization, Conductivity, oil spill investigation, tomography

RGOG 007

DELINEATION OF POTENTIAL MINERAL ZONES USING INTEGRATED AEROMAGNETIC AND AEROGRAVITY DATA OVER PART OF ZAMFARA STATE, NORTH WESTERN NIGERIA.

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Abstract

In this study, acquired aeromagnetic and aerogravity data of part of Zamfara State were used to delineate structures that may host minerals in the study area. The data were subjected to reduction to equator, regional and residual separation using polynomial fitting. Residual map was further subjected to first vertical derivative and analytical signal in order to enhance the shallower effects at the expense of deeper effects and provide good amplitude response of the anomalies. Lineaments analysis was used to determine faults and fractures of the rocks within the study area. The result from this study isolated the potential mineral zones with general trending NW-SE, E-W and N-E of the study area corresponded to the Maru, Dan Gulbi, Dan Kaina, southern part of Gusau, southern part of maru as well as northern and southern part of Tsafe. Delineating mineral zones can ease mining process and create a productive environment for business opportunities, boost the nation's economy and provide raw materials for industrial uses which might in turn reduce the level of unemployment thereby minimizing poverty.

keywords: Aeromagnetic, Aerogravity, Analytical signal, First Vertical Derivative, Faults, Fractures, Lineaments analysis, Oasis Montaj, Reduction to equator.

RGOG 008

ESTIMATING GEOPHYSICAL PARAMETERS USING PETROPHYSICAL ALGORITHM TO ENHANCE HYDROCARBON RECOVERY IN LOKAKA FIELD, NIGER DELTA, NIGERIA

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Abstract

Adoption of Enhanced Oil Recovery (EOR) to boost the hydrocarbon saturation (S_h) of reservoirs has caught the interests of many researchers in Geosciences. Evidence from literature shows that both primary and secondary recovery methods have failed to account for about 60% hydrocarbon (HC) that is trapped in the reservoirs and getting to discover large productive new fields has become a herculean task. This study identified the fluid nature and boundaries of reservoirs using some relevant geophysical (petrophysical) parameters and reservoir rocks physical features such as shale volume (V_{sh}), permeability (K), water and hydrocarbon saturation (S_w & S_h). Petrophysical data were sourced from the data bank of the Department of Physics, Federal University of Health Sciences, Otukpo, Nigeria. Analysis of data was done using the PETREL 2010 and OpendTect 4.6.0 versions for quality checking, delineation of identified reservoirs, fluid contacts demarcation and fluid types' determination. The interpreted data were thereafter loaded into Microsoft Excel environment in order to adopt suitable statistical relations for the estimation of V_{sh}, K, S_w and S_h. Exploration of about 59.4% HC with NaOH, 64.5% HC with KOH, 69.5% HC with NH_4OH and 78.5% HC with LiOH were discovered after the (EOR) flooding process. Comparison of the V_{sh}, K, S_w and S_h values before EOR with the values after EOR further showed that the reservoirs produced more HC with EOR. This study concluded that more hydrocarbon saturation can be achieved from reservoirs when EOR is carried out.

RGOG 009

EXPLORATION OF GOLD MINERALIZATION ZONES USING ELECTRICAL RESISTIVITY IMAGING AND INDUCED POLARIZATION TECHNIQUES AT ITAGUNMODI AREA OF ILESHA, OSUN STATE, SOUTHWEST NIGERIA.

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Abstract

This research is aimed at investigating the potential zones of gold mineralization at Itagunmodi Area of Ilesha, Osun State. Electrical resistivity and induced polarization imaging surveys were carried out along six traverses using dipole-dipole electrode configurations with electrode separations ranging from 2.0 to 5.0 m and profile lengths ranging from 128.0 to 315.0 m. The apparent resistivity and chargeability data were inverted using RES2DINV software. The results from the 2D resistivity models along traverses 1 and 2 revealed low resistivity zones ranging from 16.3 Ωm – 669 Ωm corresponding to high chargeability zones with values ranging from 288 msec - 444 msec, which were identified at lateral distances ranging from 82.5 m – 260 m, from depths ranging from 6.76 m – 36.98 beneath the surface. These anomalous zones along these traverses are regarded as the suspected regions of gold mineralization since they can also be attributed to quartz veins and fractures that may likely be filled with conductive materials like gold and associated base metals. This research has clearly revealed the efficacy of the adopted methods in delineating the suspected regions of gold mineralization.

Keywords: Electrical resistivity imaging, Induced polarization, low resistivity, High chargeability

RGOG 010

GEO-ENVIRONMENTAL CHARACTERIZATION OF HYDROCARBON CONTAMINATED SITES FOR PLANNING REMEDIATION SCHEMES IN OGONI LAND, RIVERS STATE NIGERIA.

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Abstract
The study was conducted in in two communities in Ogoni land for planning remediation schemes. Both resistivity and geochemical methods were utilized. Resistivity methods involved vertical electrical sounding which employed the Schlumberger and Wenner array configurations. Soil total petroleum hydrocarbons were analyzed from samples obtained from borings. A total of nine VES sounding points, eight profile lines and nine boring data were acquired within the contaminated areas in both communities. Geophysical and boring data were also collected from a control site stationed 150m away from each of the contaminated sites. The acquired data were subjected to analysis using various softwares. Results of geophysical investigation revealed four geoelectric layers to a maximum depth of 22.0m across both sites. Geoelectric layers validated using actual boring logs were composed of top sandy soil, silt sandy layers underlain by coarse sands. Resistivity values ranged from 160 to 9956 Ohm.m and 789 to 3012 Ohm.m respectively for the contaminated site and the control site within the first community, and from 174 to 7668 Ohm.m and 756 to 5257 Ohm.m for the second community. Hydrocarbon contamination was identified with significant low resistivity anomalies (≤550 Ohm.m).

Keywords: Hydrocarbon, Ogoni, Geoelectric layers, Contamination, VES.

RGOG 011

GEOPHYSICAL 3-DIMENSIONAL SURVEY FOR MINERAL AT ELAWURE GRAMMA SCHOOL USEN, OVIA NORTH EAST LOCAL GOVERNMENT AREA, NIGERIA

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Abstract
An Electrical Resistivity Tomography (ERT) survey was carried out using ABEM SAS 1000 instrument at Elawure Gramma school environ at Usen, Ovia South West Local Government Area. This was done with a view to locating depositedminerals. 2D apparent resistivity data were acquired on Five (5) lines in parallel directions 60m in length using wenner schlumberger electrode configuration. The 2D data set was inverted separately using RES2DINV software producing 2D models of each line. Then the 2D data were collated into 3D data using the inversion code RES3DINV. The images were presented as 3D slices and block models. The total depth attained for this survey was 15.4m (50.82ft). The material and aggregate that fall within the resistivity range (17.8 to 5602) when compared with the standard resistivity scale are dolomite, maris, clay, alluvium, moraine, soil 40% clay, soil 20% clay, lateritic soil, sand clay/ clay sand, limonite, quartz, rock salt, lignite, syenite, basalt, schists, marble, conglomerates, and sandstone.

Keywords: Electrical Resistivity, mineral, electrode configuration, inversion code, aggregate

RGOG 012

GEOPHYSICAL INVESTIGATION OF GROUNDWATER CONTAMINATION PATHWAYS AT LOW-COST KOFAN GAYAN ZARIA USING VERY LOW FREQUENCY ELECTROMAGNETIC (VLF-EM) METHOD

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Abstract

Geophysical very low frequency electromagnetic method (VLF-EM) was used to investigate the groundwater contamination pathway at Tsauni, Waziri Low-cost Zaria dump site. Four profiles of VLF-EM readings were taken at 5m interval along the profiles. The aim is to investigate the subsurface fractures or permeable zones that serve as groundwater contamination pathway. The Microsoft excel and Fraser and Karous-Hjelt filtering software was used to interpret the result. The point of high current density were observed along the profiles with depth ranges between 7m to 15m in K-H pseudo-section profile. The point of maximum negative in both the in-phase and out-phase in profile 4 revealed a fracture in the form of dyke. The anomalous fracture/dyke was observed between 20m-40m along profile 4 of the K-H pseudo-section. The even distribution of the in-phase and out-phase plots at profile 1, 2 and 3 indicate that the area has low resistive/high conductive thick overburden soil. The low resistive/high conductive of the subsurface may be as a result of seeping of the contaminant into the ground. Also the fracture observe in profile 4 is serve as the pathway for the contaminant to seep into the groundwater. Thus, the fracture, low resistivity and sandy nature of the subsurface serve as the pathway for contaminate plume to contaminate both the surface and groundwater in the study area.

RGOG 013

GROUNDWATER CONTAMINATION INVESTIGATION IN THE QUADRUPLE HELIX MODEL FOR INNOVATIVE RESEARCH AND ECONOMIC DEVELOPMENT

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Abstract

Innovative research anchored on the quadruple helix model serves as bedrock towards a nation's economic growth and developmental indices. This study, based on the quadruple helix model, aimed at investigating groundwater contamination in the Olusoshun-Ojota Lagos dumpsite, with the objective of mapping the vertical and horizontal extent of contamination plumes induced by the waste-disposal site to the water aquifer. Sixty-four multi-electrode 2D electrical resistivity imaging was carried out on the site using the Wenner array with the ABEM SAS 1000 resistivity meter. A total of seven traverses were cut. The electrode spacing was 5 m with an inter-traverse interval of 10 m. Resistivity data analysis involved inversion using a rapid least-squares technique and construction of iso-apparent resistivity contour maps. The results, as revealed in the resistivity values of the seven tomograms ranging from 0.0306 Ωm to 1.00 Ωm, showed that the leachate from the landfill contains a high concentration of contaminant effluents, as there are no natural sources of these in the vicinity. The contaminant plumes are concentrated within the entire subsurface to an approximate depth of 33.8 m. The study demonstrated an academic-based geophysical role in a quadruple helix model for a solution of an environmental issue.

RGOG 014

HYDROGEOPHYSICAL INVESTIGATION OF GROUND WATER POTENTIALS OF GOMBE METROPOLIS AND PARTS OF AKKO LOCAL GOVERNMENT IN GOMBE STATE

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Abstract
This work was carried out to determine the groundwater potentials of Gombe metropolis and parts of Akko LGA. Seven 7 Vertical Electrical Soundings (VES) using Schlumberger array with a maximum electrode separation of AB/2 = 100 m were conducted in the study area. The data obtained were processed using ipi2win and interpex. From the result, it was found that all the VES points have six subsurface layers. VES points 1, 2 and 7 are characterized by very low values of longitudinal conductance with values far less than 0.1 in all the areas surveyed. This showed that the area surveyed has very poor aquifer protective capacity. The area also showed high values of transverse resistance which indicated high resistivity formations in the study area. While the other VES points 3, 4, 5 and 6 are characterized by moderate values of longitudinal conductance with values 0.2 to 4.9. This showed that the area surveyed has a moderate aquifer protective capacity. The area showed high values of transverse resistance which indicated high resistivity formations in the study area. The direction of groundwater flow in the area was found to be northwest-southeast, average fitting error, pH and conductivity are 5.138 percent, 7.02 and 72.16

RGOG 015

LITHOLOGY EVALUATION IN ZINO FIELD, ONSHORE NIGER DELTA FOR CARBON CAPTURE AND STORAGE

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Abstract
The study evaluated the various lithology in some depleted reservoirs around the Zino field Onshore Niger Delta. It went further to describe the Zino field as a good depleted reservoir medium for storing CO_2, which will aid in the reduction of the increasing levels of greenhouse gases. The characterization of depleted reservoirs in the Zino field was achieved using density versus neutron-porosity crossplot analysis. This crossplot analysis presented the various lithology of the reservoirs as to ascertain whether it was a good depleted reservoir for CO_2 storage. The colour coded density versus neutron crossplot for both wells, clusters observed that the clean sandstone matrix line are indicative of gas (red cluster) while clusters below the limestone line are indicative of water (blue cluster). This showed that the reservoirs are good for geological sequestration. Therefore, the solution to global climate change could be achieved through crossplot analysis of depleted reservoirs in the Zino field as to achieve carbon capture and storage process.
Keywords: Depleted reservoir, Lithology, Crossplot analysis and Sequestration**.**

RGOG 016

PORE STRUCTURE OF CRETACEOUS IRONSTONE BY LOW- FIELD NUCLEAR MAGNETIC RESONANCE

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Abstract
The pore structure of Cretaceous ironstones at Yewa, eastern Dahomey Basin in Southwest Nigeria, has been analyzed to determine its porosity and pore size distribution for heat flow in blast furnace or rotary kiln using Low-field Nuclear Magnetic Resonance (NMR) and conventional porosity measurements (WIP) at full water saturation. Eighteen core plugs were

analyzed using XRF to determine % w/w Fe which is 57%; comparison of porosity and water content from NMR and WIP correlated by 79% and 97% respectively, with average porosity value of 22.06 p.u. and 21.96 p.u. respectively. The NMR-T_2 distribution is a connected multimodal pore system, classified by T_2 into three regions: micropores 0.3162-0.5012 ms, mesopores 19.95-84.28 ms and macropores-fractures 199.5-2117 ms; with pore size distribution estimated as: 0.3098 µm, 33.57 µm and 733.3 µmrespectively.The NMR-T_2 distribution connectivity, porosity values and pore size distribution reflect that iron ore from the site would optimize heat/gas flow and increase efficiency of a rotary kiln or blast furnace.

Keywords: Porosity, Iron core plugs, Low-field Nuclear Magnetic Resonance, Pore Size Distribution, eastern Dahomey Basin.

RGOG 017

SEISMICITY AND SEISMIC HAZARD ASSESSMENT IN WEST AFRICA

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Abstract

No in-depth seismic hazard study has been conducted for West Africa (WA) due to incomplete earthquake catalogues, affecting planning and development of critical infrastructure. This work aims to bridge the knowledge gap. The seismotectonic setting of WA is considered stable despite several recorded earthquakes in the region. However, WA has also been classified as a region of shallow crustal seismicity. Therefore, we investigated both research schools of thought and compared their results using three different ground-motion models (GMMs) and combined to produce each hazard map using logic tree formalism with equal weights. The region was divided into five seismic zones to computer earthquake-recurrence-parameters and for the entire WA region. The computed Gutenberg–Richter b-value, activity rates λ, and regional maximum possible magnitudes $m_{max}$for the five zones ranged from 0.84-1.0, 0.3–2.1, and 5.2–7.0, respectively. The b-value, λ, andm_{max} for WA were 0.77, 4.1, and 7.2. Estimated b-value of 0.77 falls within the accepted range for tectonic seismicity. Seismic hazard predicted by GMMs for stable continental areas was higher than that predicted for shallow crustal seismicity in WA, confirming that the region is characterised by stable continental crust. The highest hazard levels were observed in Ghana, Guinea, ranging 0.02-0.03g

Keywords: West Africa, Seismicity, Probabilistic seismic hazard assessment, Earthquake recurrence parameters, Peak ground acceleration

RGOG 018

USE OF TERMITE MOUNDS AS GEOCHEMICAL TOOLS IN MINERAL EXPLORATION IN AWI PART OF OBAN MASSIF, SOUTHEASTERN NIGERIA

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Abstract

This study explored the potential of termite mounds as geochemical indicators in mineral exploration within a section of Oban Massif, located in southeastern Nigeria. A total of twenty (20) samples were collected from the area, comprising ten samples from termite mounds and ten samples from the surrounding soils. The analysis of the samples was carried out using established laboratory techniques and an Ultra-Violet Visible Spectrophotometer Palintest model 7500, along with its accessories. The trace elements detected included Pb, Cd, Fe, Zn and Cu. The results were analyzed through mean calculations, standard deviation, graphs and pie charts. The results of the study indicated that the average concentrations of Fe and Cu in termite soils exceeded those found in surface soils. Conversely, the average concentrations of Pb, Cd and Zn were higher in the surface soils compared to the termite soils. The highest biological absorption coefficient (BAC) value for Cu (16.563) in termite mounds

is attributed to the presence of a copper mineral zone in the area. In comparison to copper ore, the BAC values for other metals like Pb, Cd, Fe, and Zn were lower. Thus, termite mounds serve as effective indicators and can be utilized in mineral exploration.
Keywords: Termite mounds; mineral exploration; Awi; Oban Massif; biological absorption coefficient

RGOG 019

APPLICATION OF AEROMAGNETIC AND ELECRICAL RESISTIVITY SURVEY FOR GROUNDWATER POTENTIAL OF AKWANGA, NASARAWA STATE.

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Abstract
Aeromagnetic and VES were carried out to delineate high groundwater potential zones in Akwanga, Nasarawa State. 60 VES were carried using Abem SAS 4000 terameter. Interpretation was carried out using diprowin software for the VES, Oasis montaj and Arc GIS were used to present the aeromagnetic result. The result revealed the existence of 5-geoelectric layers. The thicknesses of these geo-electric layers is unity for the topsoil and vary from 3.5-9 m, 13-38 m, 10-40 m for the sandy clay, weathered basement and fractured basement respectively. The resistivity values range from 30-3808 Ωm, 43-861 Ωm, 51-5188 Ωm, 154-980 Ωm and 348-6842 Ωm for the for top soil, sandy clay, Weathered Basement, Fractured Basement and fresh basement respectively. The weathered and the fractured basement zones is believed to constitute the water bearing layer with a depth to aquifer between 30 to 70 m. The maps shows that the lineament trends majorly towards NE-SW, The sounding curves were classified into eight (8) curve types (QHA, HAA, KHA, AAA, HAK, HKH, QQH and KHK types). VES points 1, 6, 7, 24, 38, and 48 are areas of high groundwater potential, as these zones are associated with significant weathering and fracturing of the basement rock.
Keyword: Lineament, Crystalline Basement, Aquifer, Groundwater, Geological Structures

RGOG 020

ASSESSMENT OF AQUIFER PROTECTIVE CAPACITY AND SOIL CORROSIVITY IN UMUNEDE, IKA NORTH EAST, DELTA STATE, USING DEPTH PROBING RESISTIVITY INVERSION

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Abstract
The protective potential and soil corrosivity of the Umunede village in Ika North East, Delta State, was assessed and the study area has been categorized recently among the oil producing towns in the distinct Niger Delta. Ten (10) Vertical Electric Soundings (VES) were sounded and the areas with low or poor (< 0.1 mho), moderate (0.2-0.69 mho) and good (0.7-4.9 mho) protective capacities were identified by evaluating and ascertaining the area's longitudinal conductance. Aquifers in most areas are shielded (prevented) from oil spills in the event of pollution, according to the study, which rates the protective capacity of the majority of the community as good and moderate. Conversely, areas with weak or poor protection capacity are vulnerable to groundwater taint (contamination) from surface spills and other nearby sources. The evaluation of soil corrosivity based on VES data denote and revealed that the subsurface contains materials that are basically or typically noncorrosive, somewhat (slightly) corrosive, and moderately corrosive. There is a risk of pipeline failure in locations with mild to moderate corrosivity. For the community's aquifer system to be storm-proof and protected, environmental management drive initiatives should be taken adequately into account. The location of subsurface aquifers and the distribution of their protective capacity across the study region are made easier with the absolute help of this study. Planning

exploration projects for the location of groundwater producing wells in the region will sufficiently benefit from this.

RGOG 021

CONTACT SENSING RAINFALL AND WATER LEVEL DETECTOR ALARM SYSTEM: A TOOL FOR COMMUNICATION

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Abstract
The rainfall and water level detector alarm system is a device which will detects the presence of water on a surrounding of a closed or an open system and produces a sound to alert the farmer or user. The device is made up of three units; the contact sensor unit, amplifier unit and the alarm unit. The device sensing unit is made up of conductors (copper wire) which are embedded in an insulating material. As the rain drops on the surface of the embedded conductor in the insulating material, it bridges the circuit. The low signal generated from the closed loop is conducted to the base of the amplifier circuit. The amplifier comprises of transistors and resistors. The transistors are cascaded to raise the base input signal generated from the contact sensor. The output of the amplifier is connected to a speaker/buzzer which produces audible sound to the environment as caution/alert signal. This device can be employ by farmers when drying their farm produce on an expose environment to reduce water damage cause by rainfall. Also, the device serves as a means of detecting the brim water level in an overhead tanks when pumping from the borehole source.

Keywords: Conductor, Transistor, Detector, Signal, Sound and Amplification.

RGOG 022

DIGITAL TWIN APPLICATIONS IN THE PETROLEUM INDUSTRY: THE JOURNEY SO FAR AND THE WAY FORWARD

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Abstract
The petroleum industry has been experimenting with and adopting several digital technologies to ensure enhanced process efficiency and improved safety in various aspects of their operations while reducing capital and operating expenditures, as well as health, safety, security, and environmental risks. With the emergence of the fourth industrial revolution, the petroleum industry is drifting towards data-oriented solutions and grasping such complex systems requires timely analysis and harmonization of data from various sources. The future of real-time production monitoring and optimization will depend heavily on digital twin (DT) modeling. By integrating data, modeling, and visualization across an operational company's whole value chain, from central production facilities to underground machinery, DT is a solution that increases productivity. When such cutting-edge technology is used properly, it will be in the overall benefit of the petroleum industry. This paper discusses the DT concept, types, representation, and tools. Furthermore, the paper presents the different areas of DT application in the petroleum industry, particularly production, drilling, and exploration. Finally, the paper examines the challenges facing the full implementation of DT in the industry, such as maintenance, confidentiality integration, and accessibility, as well as possible solutions to these problems.

Keywords: Digital twin technology, Petroleum industry, Digitalization.

RGOG 023

ESTIMATION OF GEOPHYSICAL IMPACT OF SAND MINING IN NWORIE RIVER, IMO STATE NIGERIA.

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Abstract
Sand mining along the Nworie River in Imo State, Nigeria, is driven by rising demand for construction materials, posing serious environmental threats. The river's ecosystem supports diverse aquatic life through its oxygen-rich water, balanced nutrients, and stable habitat. This study assesses the geophysical impact of excessive sand extraction using electrical resistivity tomography (ERT) and ground-penetrating radar (GPR). Results reveal significant subsurface deformation, including sediment layer collapse and cavity formation, increasing riverbank erosion and destabilizing the riverbed. Water and soil analysis indicate physicochemical changes and contamination, with dissolved oxygen levels varying from 8.5 mg/L at the pristine source to 3.8 mg/L near major sand mining zones. These fluctuations reflect severe habitat disturbance, sediment overload, and pollution, leading to habitat loss and threatening the river's ecological balance. Although oxygen levels show some recovery downstream near the Otamiri River confluence, the overall impact remains alarming. This study emphasizes the urgent need for sustainable mining practices and effective regulatory measures to prevent further environmental degradation. The findings provide critical insights for policymakers and environmental managers to promote responsible resource exploitation and preserve the Nworie River's ecological integrity.

Keywords: Sand mining, geophysical, Nworie river, Imo state, environmental degradation

RGOG 024

GEOELECTRIC INVESTIGATION OF GROUNDWATER AND AQUIFER PROTECTIVE CAPACITY IN PARTS OF BAYELSA STATE, SOUTHERN NIGERIA.

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Abstract
Geophysical methods provide efficiently fast, robust and uninvasive techniques for the exploration of groundwater as well as the estimation of aquifer parameters. Geoelectric methods and specifically, Electrical resistivity (ER) technique consisting of vertical electrical sounding (VES) with the Schlumberger electrode array was employed to investigate the ground water potential as well as the aquifer protective capacity of the study area.The modelled and interpreted data resulted in considerable varying VES curve types, which were grouped into five categories. The five representative curve types were, the H (or HA), K, HK, KH, and KHK curve type, and the H – Curve type is basically the predominant curve type, in the study area. The Longitudinal conductance values obtained, ranged between 0.029 – 0.574 Ω-m (with an average of 0.210 Ω-m). The aquifers of the study area, were classified into poor, weak, and moderate protective capacity zones; with the three zones having protective capacities of < 0.1 Ω-m, 0.1 - 0.2 Ω-m, and 0.2 – 0.7 Ω-m respectively.It is recommended that geophysical investigations be carried out in the area before drilling of boreholes so as to avoid contaminated sites.

Keywords: Aquifer, protective Capability, Longitudinal conductance, transverse resistance,

RGOG 025

GEOPHYSICAL INVESTIGATION OF GROUNDWATER POTENTIALS IN LAGOS STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY, IKORODU, LAGOS SOUTHWESTERN NIGERIA

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Abstract

There has been tremendous increase in demand for fresh water due to growth in population and importance as major human needs. This work is aimed at investigating the groundwater potential at two locations in the University of Science and Technology, Ikorodu using geophysical methods – Schlumberger and Wenner Array. Ten vertical Electrical Sounding (VES) and five Wenner array profiles were occupied using Ohmega Resistivity meter and the data collected were processed and interpreted. Dar Zarrouk parameters were calculated. The result of the VES reveals the presence of six (6) lithological layers with resistivity values ranging from 151.2 Ωm – 10,003.8 Ωm. The Wenner array method reveals that profile one is the most aquiferous region at depths of 15 m to 20 m while regions between the electrode positions of 120 – 200 m at depth of 15 m to 50 m should be avoided because of the blackish water in this region. In the study areas investigated, the Longitudinal Conductance (S) value ranges from 0.15 – 0.46, Total Transverse Unit Resistance (T) ranges 12787.03 – 90143.29 while Traverse Resistivity values range from 2.12 – 572.47. The anisotropy ranges between 0.01 – 1.30, the Depth to Aquifer ranges from 47.70 m – 77.40 m, Aquifer Thickness ranges from 35.70 m – 53.80 m and Resistivity of the Aquifer ranges from 81.10 Ωm – 451.70 Ωm an implication of this hydrogeological property is that lower resistive aquiferous zone which is area from depth of 15 m – 50 m is mostly associated with lower resistivity layer and a typical value of a Moderate to Weak Overburden Protective Capacity indicating medium to high aquifer Vulnerability Rating were present. However, regions with lower resistivity value <10 Ωm should be avoided as they are typical signature of a blackish water which are bad consumable water.

Keywords: Aquifer vulnerability Aquiferous region, Dar Zarrouk parameters, Hydrogeological, lithological layers

RGOG 026

HIGH-PRECISION GEOSPATIAL ANALYSIS OF SURFACE FEATURES USING GPS AND SATELLITE IMAGERY IN SOME PARTS OF SOUTH EASTERN NIGERIA

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Abstract

The study of landforms is critical for understanding geomorphic processes and environmental changes. This research integrates GPS data and high-resolution satellite imagery to analyze and monitor landform dynamics in some parts of Southeastern Nigeria. Using advanced remote sensing techniques, precise Digital Elevation Models (DEMs) and conducted detailed topographic analyses to identify and classify landforms were generated. The GPS data provided accurate elevation and location information, which was essential for refining DEMs and enhancing the accuracy of landform mapping. Change detection analysis was employed to track temporal shifts in landforms, revealing significant changes in erosion patterns andlandslide activities. Ground-Truthingefforts validated the accuracy of the remote sensing data, demonstrating a strong correlation between field observations and the results obtained from GPS and satellite data integration. The findings of this study offer new insights into the geomorphic processes shaping the study area and highlight the effectiveness of combining GPS and satellite imagery for landform analysis. These results have important implications for environmental management, hazard assessment, and future geomorphological research.

Keywords: Global Positioning System (GPS), Satellite Imagery, Digital Elevation Model, Landforms, Remote Sensing, Geomorphology, South Eastern Nigeria

RGOG 027

HYDROCARBON RESERVOIR CHARACTERIZATION USING PETROPHYSICAL LOGS

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Abstract
Well logs data from 5 wells in the X-field, Niger Delta region were used for our analysis. The logs used are gamma , SP, DLL, SLL, MSFL, DIL, Neutron and density.Ten sand units were identified from the shallowest to the deepest as A to J respectively. The reservoirs of the X-field have average porosity range between 18% and 33%. The permeability range is between 10md and 18000md. The porosities and resistivities of the various formations are comparable. This is indication they were deposited and subjected to the same environmental conditions. Estimation of formation water saturation produced values range between 2.8% and 94%. There were no core analyses or drilled stem test (DST) carried out to support these results. Also, oil saturation of the hydrocarbon bearing zones is between 28% and 92%. The moveable hydrocarbon index lies well within 0.03 and 1.23. Analysis shows that the field is capable of providing water free hydrocarbons, production is most likely to be high and is economically viable for exploitation.

Keywords: Porosity, permeability, resistivity, logs

RGOG 028

INTEGRATED GEOPHYSICAL EVALUATION OF SUBSURFACE STRUCTURES WITHIN THE NORTH-CENTRAL BASEMENT COMPLEX OF NIGERIA

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Abstract
Integrated geophysical methods involving aeromagnetic, aeroradiometric and ground magnetic were utilized to explore mineralization zones the Federal Capital Territory and environs, North-Central Nigeria. The total magnetic intensity map revealed overall field strengths ranging from -99.63 nT to 109.33 nT. The filters used are first horizontal and vertical derivatives, analytic signal and 3-D Euler Deconvolution. The Analytic Signal processing highlighted three distinct magnetic anomaly zones: a low zone (0.004 nT/m to 0.013 nT/m), an intermediate zone (0.016 nT/m to 0.048 nT/m), and a high zone (0.057 nT/m to 0.282 nT/m). The horizontal derivative map displayed both positive and negative anomalies, with values ranging from -0.061 to 0.061 nT/m. The lineament map revealed a dominant NE-SW trend, with a less dominant E-W and NW-SE trend within the study area. The resulting SPI map estimated depths of the buried geological formations to be from 2.7 m to 33.7 m. Analysis of K/Th map show high K/Th ratio values which suggest potential mineral deposits with the K/Th ratio indicating values ranging from 0.010 to 0.307 %/ppm.\

Keywords: Mineral, Lineaments, Structures, Magnetic

RGOG 029:

MULTISCALE PDE MODELING OF CARBON CAPTURE AND STORAGE IN NIGERIAN BASINS: INTEGRATING PETROPHYSICAL ANALYSIS, GEOCHEMICAL REACTIONS, AND ENGINEERING APPROACHES

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Abstract
The present research paper aims to develop a multi-scale partial differential equation (PDE) model to simulate CO_2 (carbon dioxide) injection and migration in the subsurface geological formations of Nigeria, particularly in the Niger Delta. The model is based on Darcy's law and discrete grid (finite difference) method to characterize the CO_2 migration dynamics. In order to remotely understand the subsurface behaviors represented by the model, petrophysical data containing porosity and permeability is studied extensively. Because these two parameters are critical in developing an accurate simulation, the results of the present study are discussed in terms of pressure changes, migration results, and geochemical reactions that could affect the integrity and capacity of the reservoir. We apply Darcy's law and a finite difference method to model pressure propagation. Simulations for various porosity and permeability values show CO_2 plume migration and pressure buildup (Wen et al., 2021). These demonstrate how geological parameters affect storage performance. Petrophysical properties such as porosity and permeability inform the parameters. A dimensionless formulation enables generalization, and results include a numerical simulation showing pressure evolution.
Keywords: CO2, sequestration, porosity, water saturation, permeability

RGOG 030

PRELIMINARY REPORT OF INTEGRATED GEOPHYSICAL INVESTIGATION OF GROUNDWATER POTENTIAL AND CHARACTERIZATION OF SUBSURFACE LITHOLOGY IN DELTA NORTH, NIGERIA

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Abstract
Understanding groundwater potential and subsurface lithology is essential for effective water resource management, particularly in regions like Delta North, Nigeria, where groundwater serves as a major water supply source. This preliminary study proposes an integrated geophysical approach, utilizing Electrical Resistivity (ER) and Remote Sensing (RS) techniques to investigate groundwater occurrence and subsurface characteristics. The ER method, including 1D, 2D, and 3D, will be employed to delineate aquiferous zones and assess lithological variations. RS techniques, such as satellite imagery and digital elevation models (DEMs), will be used to analyze surface lineaments, drainage density, and geological structures influencing groundwater distribution. This study aims to establish a framework for groundwater exploration by integrating geophysical and remote sensing datasets. While data acquisition is yet to be conducted, this preliminary phase focuses on methodological design, site selection, and preparatory analysis. The findings from this study will contribute to hydrogeological assessments and sustainable groundwater resource management in the region. Future work will involve field data collection, validation through borehole investigations, and hydrogeochemical analysis to refine interpretations.

RGOG 031

SPECTRAL ANALYSIS OF AEROMAGNETIC DATA FOR THE DETERMINATION OF CURIE POINT DEPTH GEOTHERMAL GRADIENT AND HEATFLOW OF DEKINA AND LOKOJA, LOWER BENUE TROUGH, NIGERIA

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Abstract
The high-resolution aeromagnetic data of Lokoja and Dekina have been interpreted quantitatively with the aim of estimating the Curie point depth (CPD), geothermal gradient and heat flow values of the study area. Oasis Montaj 8.4, Origin software, Surfer 32, Microsoft notepad were the Software applications used in the data analysis.The data was merged and gridded to produce total magnetic intensity anomaly grid of the study area. Polynomial fitting was employed to remove the regional anomalies from the potential field anomaly to obtain the residual magnetic anomalies while upward continuation was used to eliminate short-wavelength anomalies. The CPD value ranges from 9.072 to 14.264 km with an average of 11.256 km. The calculated geothermal gradient ranges from 40.662 to 63.933 °C/km with an average value of 52.256 °C/km. The heat flow values range from 101.655 to 159.833 mWm^{-2} with an average value of 130.639 mWm^{-2}. From the results obtained from the geothermal heat flow indicated some areas especially (southwestern Lokoja) is good spot for geothermal exploration. Similarly, southwestern Lokoja area with the highest geothermal heat production is a good spot for geothermal energy prospect in Nigeria for electricity generation.

RGOG 032

CHALLENGES TO WELL OPERATIONS, CONTROL AND OPTIMIZATION IN THE OIL AND GAS INDUSTRY AND POSSIBLE REMEDY

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Abstract
Many oil and gas engineering professionals still lack sufficient knowledge on the concepts of well operations, control and optimization. Well control for instance is vital to forestall blowouts during well drilling operations. Prevention and safety practices is therefore very crucial and this makes it very imperative for exploration and production companies to prioritize sensitizing their field engineers on these challenges to mitigate kicks or blowout which incurs higher drilling costs, waste of precious natural resources, pollution and degradation of the environment and its ecosystems and ultimately resulting in loss of human lives and property if not properly controlled. This paper gives a detailed consideration to the concepts of well operations, control and optimization and some of its teething challenges and proffers possible solutions which could help in averting unwanted drilling operation accidents and their attendant hazards to man, industrial assets and the environment.

RGOG 033

CHARACTERIZATION OF AQUIFER SYSTEMS IN WETLAND ENVIRONMENTS THROUGH GEOPHYSICAL IMAGING AND GROUNDWATER FLOW MODELING IN AVIARA, DELTA STATE NIGERIA

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Abstract
This study explores groundwater potential in Aviara, a wetland environment in the Niger Delta, using integrated geophysical and hydrogeological methods. Vertical Electrical

Sounding (VES), Electrical Resistivity Tomography (ERT), and Induced Polarization (IP) techniques were employed to delineate subsurface layers and identify aquifer zones. Data were collected from nine VES points and three ERT/IP transects using Schlumberger and dipole–dipole configurations respectively. WinResist and Dipro software were used for data interpretation. The subsurface consists of topsoil, clayey sand, fine sand, medium coarse sand, and coarse sand, with aquifers mainly located within fine to coarse sand formations. Pumping tests showed transmissivity values between 117.04 and 227.24 m²/day, with a hydraulic conductivity of 7.6 m/day. Formation factor ranged from 1.88 to 7.08, and longitudinal conductance from 0.066 to 0.198 S. ERT and IP results supported the VES findings, with high resistivity (165–5126 Ωm) and low chargeability (<100 mV/V) indicating permeable aquifers, while higher chargeability (>100 mV/V) marked clayey zones. Groundwater flow modeling revealed a north-to-south flow direction, identifying lower elevations as discharge zones. The study provides critical insight into aquifer distribution and flow in wetland terrains, aiding water resource planning and sustainable groundwater development in Aviara and similar environments.

Keywords: Wetland, Aquifer Characterization, Geophysical Imaging, Groundwater flow modelling

RGOG 034

GEOCHEMICAL ASSESSMENT OF SOIL USED FOR FARMING FROM AN ABANDONED MINING SITE IN DAHWOL-VWANA VILLAGE, JOS-SOUTH L.G.A., USING ATOMIC ABSORPTION SPECTROSCOPY (AAS) TECHNIQUES.

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Abstract

It's a known fact that, mining exploration activities have resulted in elevated levels of these contaminants in the environment. This study was undertaken in farms from an abandoned mining site in Dahwol-vwana village, Jos-South L.G.A. of Plateau State using AAS techniques. A modified sequential extraction procedure of Tessier et al, (1979) was used partitioned the bulk heavy metal concentrations into four (4) operationally defined fractions (Fraction 1: Exchangeable+Carbonate bound, Fraction 2: Reducible, Fraction 3: Oxidizable, and Fraction 4: Residual). The result of the average soil concentrations in ppm for Pb, Cd, and Zn in the study area were 89.98, 3.85, and 175.87 respectively. The speciation extractions analyses had its heavy metals bulk concentration partitioned, where for the residual fraction (Zn- 138.85ppm, Pb-55.59ppm and Cd-2.5ppm) which implies that the soils of the farmland are not polluted by any of the metals studied. Pollution indices also indicated minimal contamination of the soils matrix with Cd, which had enrichment factor value of 15.4 and I-geo factor of 4. However, It is recommended that mobility index analyzes can be considered as a more reliable indicator.

Keywords: Heavy Metal, AAS-Atomic Absorption Spectrometer, Soil, Ex-Mining Area.

RGOG 035

GETTING THE MOST FROM 3D SEISMIC DATA USING SEISMIC ATTRIBUTES SCHEMES

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Abstract

Seismic attributes have been shown to be highly useful in locating hidden features and structures that are not easily detectable by simple visualization and analysis of traditional seismic data. In order to improve reservoir characterization goals in certain fields in the offshore Niger Delta Basin, Nigeria, the current study examines a unique seismic attribute called the trace envelope and its first and second derivatives. Standard processing workflows were applied to well logs, 3D post-stack depth migrated (PSDM) seismic data, and time-depth

relationship surveys that were acquired from the fields. The rock and fluid properties on the seismically enhanced volumes were interpreted across the fields after the trace envelope and its derivatives were applied. It was found that the trace envelope was very helpful in imaging porous media and locating bright spots, which show potential zones for implementing drilling and exploitation programs in the investigated fields. Bright spots along time slices were not detectable by the trace envelope's first derivative, but it did a good job of identifying them across inlines. Additionally, they weren't useful for identifying porous media. Similarly, while imaging porous media and bright spots over the fields investigated, the trace envelope's second derivative performed very poorly. Thus, our study has shown how well the trace envelope seismic attribute works to image porous media and bright spots linked to potential hydrocarbon zones in the fields investigated. As a consequence, including the trace envelope seismic attribute to the mix of seismic attributes for any significant and thorough reservoir characterization effort is highly recommended

RGOG 036

INVESTIGATING HYDROCARBON MICRO-SEEPAGES IN THE NIGER DELTA BASIN USING REMOTE SENSING AND ELECTRICAL RESISTIVITY TOMOGRAPHY (ERT) METHODS: A COMPARATIVE STUDY WITH TRADITIONAL TECHNIQUES

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Abstract
This study investigates hydrocarbon micro-seepages in the Niger Delta Basin using remote sensing and Electrical Resistivity Tomography (ERT) techniques, with a comparative analysis of their effectiveness relative to traditional hydrocarbon detection methods. Remote sensing techniques, such as Band Ratio Analysis and Principal Component Analysis (PCA), were employed to map spectral anomalies associated with clay, carbonate minerals, ferric iron, and ferrous iron. The Band Ratio and PCA maps revealed significant patterns of hydrothermal alteration, clay mineral abundance, and ferric and ferrous iron concentrations, highlighting regions of potential hydrocarbon seepage. These spectral signatures were validated with insights into mineralogical variations indicative of subsurface seepage. The ERT investigation, conducted along three traverses, provided high-resolution subsurface imaging of resistivity variations, identifying clayey sand, sand, and hydrocarbon-impregnated sand zones. Resistivity profiles indicated hydrocarbon-bearing sands at depths between 12.9 and 34.3 m, with values ranging from 980 to 1458 Ωm. This dual-method approach proved effective in delineating seepage zones and assessing the spatial distribution of hydrocarbon reservoirs and it demonstrates the complementary strengths of remote sensing and ERT.
Keywords: hydrothermal, micro-seepages, anomalies, high-resolution

RGOG 037

RADIATION-GEOPHYSICS, GEOCHEMISTRY, AND SOCIO-ENVIRONMENTAL FOOTPRINT OF IRONSTONE RESOURCE DEVELOPMENT IN GULU-KANDI AREAS, BIDA-BASIN, NORTH-CENTRAL NIGERIA: IMPLICATIONS FOR SUSTAINABLE MINING PRACTICES

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Abstract
An Interdisciplinary Study combining Radiation Geophysics, Geochemistry, and Socio-Economic analysis was conducted to evaluate the Socio-Environmental impacts of Ironstone Resource Development in the Gulu and Kandi areas of the Bida Basin, North-Central Nigeria. Gamma radiation levels ranged from 1.2 to 3.5 μSv/h, with mean values of 2.1 ± 0.6 μSv/h at

Gulu and 2.5 ± 0.8 μSv/h at Kandi. Geochemical analysis of ironstone samples revealed high concentrations of Fe_2O_3 (45.6 - 67.8%), SiO_2 (15.2 - 30.5%), and Al_2O_3 (4.2 - 12.1%). Socio-Economic Surveys indicated significant Environmental (80%) and Social (70%) impacts, including Water Pollution, Soil Degradation, Displacement, and Health Problems. Qualitative findings highlighted Inadequate Community Engagement, Transparency, and Regulatory Frameworks. The study underscores the need for sustainable mining practices, including Environmental Impact Assessments, Community Engagement, and Regulatory Framework Development.

RGOG 038

TIME-LAPSE INVESTIGATION OF AN OIL SPILL SITE USING THE ELECTRICAL RESISTIVITY TOMOGRAPHY (ERT) IN ERHOIKE COMMUNITY, SOUTH-SOUTHERN NIGERIA

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Abstract
Nigeria's Niger Delta, is known for its oil wealth, has serious environmental problems because of oil pollution. Environmental restoration depends on the investigation and observation of these impacted locations. This study employed the Time-Lapse Electrical Resistivity Tomography (ERT) method, a non-invasive geophysical technique to examine the dynamics of hydrocarbon contamination in an oil spill site in Erhoike Community, South-Southern Nigeria. Ten (10) traverses in grid format were acquired at one year interval. 3D resistivity models were created to visualize subsurface changes after a grid-based survey was carried out at various time intervals. The study's objectives are to track the migration routes of pollutant plumes. The findings showed the pollutant plumes moving southwest of the location. The results demonstrate that ERT is a non-evasive method of environmental monitoring and offer important information for improving cleanup tactics in areas polluted by oil. Based on the findings of this study, it is recommended that (ERT) method be adopted as a standard tool for monitoring and managing oil spill sites in the Niger Delta.
Keywords: Time-Lapse, hydrocarbon, pollutant, non-evasive

RGOG 039

ASSESSMENT OF AQUIFER VULNERABILITY USING VERTICAL ELECTRICAL SOUNDING (VES) DATA IN PARTS OF BORI METROPOLIS FOR GROUNDWATER EXPLORATION.

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Abstract
This study evaluates the vulnerability of an aquifer in the study area using geophysical and hydrogeological parameters derived from Vertical Electrical Sounding (VES) data, including longitudinal conductance (S), transverse resistance (T), hydraulic conductivity (K), and aquifer transmissivity (T). The estimated longitudinal conductance (0.0070–0.1993) indicates **moderate to low protective capacity of the overlying layers, while transverse resistance (4425.30–84758.40 Ω·m²) reveals variable hydraulic barriers, with lower values suggesting higher contamination risks. Hydraulic conductivity (8.11–356.55 m/day) and transmissivity (240.77–8664.19 m²/day) further highlight high aquifer heterogeneity, with zones of extremely high permeability posing severe contamination risks due to rapid pollutant migration. The findings underscore the need for spatially differentiated groundwater protection strategies, emphasizing high-risk zones where anthropogenic activities must be regulated to safeguard water quality. This research provides a framework for aquifer vulnerability assessment in similar hydrogeological settings, supporting sustainable groundwater management.

RGOG 040

ASSESSMENT OF GROUNDWATER POTENTIAL AND ITS VULNERABILITY TO THE AGROCHEMICAL ACTIVITIES IN AN EMERGING AGRICULTURAL DEVELOPMENT AT KUJAMA FARMLAND, KADUNA, NIGERIA

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Abstract
Groundwater potential and its Vulnerability to the agrochemical activities in a rapidly emerging agricultural development at Kujama Farmland were evaluated. Information obtained was used to construct the soil depth section and the groundwater potential as well as its protective capacity. The depth section shows that the study area is underlain by four to five Geoelectric layers and it suggested a weathered/fractured unit as the water-bearing unit of the study area. However, it was observed area aquifer unit is highly rich and it can supply sustainable water for drinking, domestic use and irrigation. Consequently, siting of industrial/public/domestic boreholes should be sunk to at least a depth of 30/20/10m respectively. On the other hand, the computed aquifer parameters show that the study is considered 95% highly protective and 5% moderately protective of the potential contaminants emanating from the emerging agricultural activities at Kujama Multipurpose Farmland.
Keywords: Kujama farmland, agrochemical, depth section, aquifer potential, Protective capacity.

RGOG 041

EFFECT OF WASTE DUMP ON GROUND WATER QUALITY USING ELECTRICAL RESTIVITY METHOD IN ENGR. A.A KURE MODERN MARKET MINNA, NIGER STATE

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Abstract
This study investigates the impact of solid waste dumpsites on groundwater contamination in Kure Market, Minna, Niger State, Nigeria, using electrical resistivity methods. The Vertical Electrical Sounding (VES) and 2D Electrical Imaging techniques were applied to delineate subsurface contamination. The geoelectrical section revealed three to four subsurface layers, with resistivity values ranging from 88.9 Ωm to 1296.7 Ωm. The top layer, consisting of fadama mud and laterite, exhibited resistivity values between 251.2 Ωm and 481.0 Ωm, with a thickness of 0.7 to 1.7 m. The second layer, characterized by weathered laterite, had resistivity values of 88.9 Ωm to 162.7 Ωm, with depths of 3.0 to 10.8 m. The third layer showed higher resistivity values (193.6 Ωm - 1296.7 Ωm), indicating the transition to more compact geological formations. The HA curve type identified across profiles suggests a layered structure with high-resistivity overlying low-resistivity zones, confirming contamination. The study found that contamination risk was from moderate to high, especially at stations 1, 3, and 4, while thick layers with low resistivity values (342.8 Ωm, 2635.3 Ωm) indicates potential contaminant plumes. The study recommends continuous monitoring, deep borehole drilling (>15m), and engineered landfill designs to mitigate groundwater contamination risks.

RGOG 042

EVALUATION OF GROUNDWATER POTENTIAL AREAS USING THE VERTICAL ELECTRICAL SOUNDING (VES) METHOD IN NEW GRA, BAUCHI, NIGERIA.

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Abstract

This research focuses on identifying groundwater potential zones in New GRA Bauchi, Bauchi State, using the Vertical Electrical Sounding (VES) method. The study area is situated within Nigeria's basement complex, characterized by granite and migmatite rock formations. Resistivity data were collected from 72 VES stations, with a maximum current electrode spacing of 60 meters, using an Ohmega resistivity meter. The Schlumberger electrode configuration was applied across all stations. Data analysis was conducted using the IPI2win software, which provided automated interpretations of apparent resistivity, yielding approximate resistivity and thicknesses of the identified geoelectric layers. The processed data revealed resistivity curves of types H, K, A, HA, KH, QH, HK, and HKH. Isoresistivity contour maps generated from the data indicated a heterogeneous subsurface geology. The approximate resistivity and thickness of the four inferred geoelectric layers are as follows: first layer (30.4 - 35,686 Ωm, 0.407 - 5.42 m), second layer (3.63 - 43,656 Ωm, 0.8332 - 22.25 m), and third layer (2.098 - 74,021 Ωm). The study identified potential water-bearing zones primarily within weathered and fractured crystalline rocks. Drilling depths of 50 to 60 meters are recommended at selected VES stations by employing integrated geophysical techniques to further refine and validate the interpretations.

RGOG 043

EVALUATION OF LITHOLOGICAL AND GEO-HYDROLOGICAL CONDITIONS OF THE COASTAL PLANES OF THE NIGER DELTA

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Abstract

An investigation of the lithological and hydro-geological conditions of part of the coastal areas of Niger Delta was conducted in this study. The VES approach using the Schlumberger array with an ABEM Terrameter, model SAS 1000 was used for the investigation of seventy (70) VES stations. The field data obtained was interpreted using the IPI2Win software. Interpreted sounding curves revealed the heterogeneous conditions of the subsurface Geoelectric layers. These layers correspond to lithological facies such as top soil, silty/clayey sand and medium to coarse grain sands which is the main aquifer, having thickness and resistivity values ranging from 1.4m to 170.9m and 11.7□m to 2295□m respectively. Hydraulic conductivity and Transmissivity values range from (0.04 to 2.00)m/day and (0.09 to 93.28)m2/day. The North central/west (Benin-Ebrohim/Dodo River crossing) and South western (Bartholomew/Nun River crossing) areas reveal high hydraulic parameters, serving as discharge sites for fresh boreholes. In general, this study provides valuable information for town planners and ground water resource management.

RGOG 044

EXPERIMENTAL INVESTIGATION OF TWO-PHASE FLOW AND LAGRANGIAN TRACKING OF BUBBLE IN A COLUMN

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Abstract
In this paper, two major experimental studies were conducted. One experiment aided to understand the two-phase flow in a bubble column, while in the other experiment, Lagrangian tracking of a bubble and a plastic ball were conducted. In the bubble column experimentation, the homogeneity of the two fluid phases were successfully studied by calculating the void fraction with the help of an optical probe. Several characteristics, if not all, which depends on the void fraction were observed and accounted for. The error analysis was also carried out successfully using the uncertainties associated in the experimental measurements. Lagrangian tracking of the bubble abled us to understand the trajectory of a rising object in a fluid and its dependency on the external factors. The double threaded wake happening behind the bubble and the spherical object were found to be the cause of the observed trajectory of the objects. The same was inferred from the experiment and then confirmed from the theoretical studies. The results can be used to improve the design and operation of industrial processes involving gas-liquid interactions. The experiment, however, failed to provide a smooth velocity profile because of the limitation of the experimental post-processing.
Keywords: Experiment, Two-phase flow, Lagrangian tracking, Bubble, wake and Trajectory.

RGOG 045

GEOLOGICAL STRUCTURES DEDUCED FROM MAGNETIC ANOMALIES OF GEOTHERMAL FIELDS IN YANKARI NATIONAL PARK, NIGERIA

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Abstract
Yuli is part of the Yankari area of the Upper Benue trough. Four important locations of warm springs are found in the area. These are namely, the Gwama warm spring, the Wikki warm spring, the Mawulgo warm spring and the Tongan-Maliki warm spring. The identification, mapping and interpretation of the geological features/structures buried or exposed are necessary in order to understand the general geo-tectono-magmatism of a region. First Vertical Derivative (FVD) and Analytical Signal (AS) filtering techniques were employed for the magnetic data of the area. The interpreted features/structures in the study found a close connect between the normal faults in the region.

RGOG 046

GROUNDWATER EXPLORATION AND VULNERABILITY: A COMPREHENSIVE STUDY ON SUSTAINABLE MANAGEMENT STRATEGIES IN UNIVERSITY OF ILORIN TEACHING HOSPITAL

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Abstract
Groundwater remains essential for healthcare operations at the University of Ilorin Teaching Hospital (UITH), supporting patient care, hygiene, and sterile environments. However, urbanization, pollution, agricultural runoff, and climate change threaten its quality and sustainability. Excessive extraction, limited recharge, and hospital-related chemical and biological discharges exacerbate these challenges, posing risks to the hospital's water supply. This study evaluates groundwater availability and aquifer vulnerability at UITH to ensure

sustainable management and provide actionable recommendations. The Vertical Electrical Sounding (VES) method was employed to analyze subsurface resistivity and assess groundwater potential. Using an LS2 resistivity meter and a Schlumberger electrode arrangement with a maximum AB/2 of 100 m, resistivity measurements were taken at 12 locations near existing boreholes. VES curves were generated using IPI2WIN software to determine the resistivity, thickness, hydraulic conductivity (HC), transmissivity (T), and hydraulic resistance (C) of geoelectric layers. The results identified 3 – 4 subsurface layers, including an aquifer-rich weathered layer with a resistivity of 27.9–522 Ωm and thickness of 3–67.6 m, along with fractured basement layers. High aquifer potential was observed at VES 5 and 6, with transmissivity up to 308.88 m²/day, indicating robust aquifers in northeastern zones. Conversely, shallow zones at VES 3, 4, and 9 showed increased vulnerability. These findings highlight critical zones for groundwater exploration and protection, ensuring the hospital's reliable water supply.

RGOG 047

INTEGRATING SEISMIC AND WELL DATA FOR RE-EVALUATION OF J-FIELD NIGER DELTA, NIGERIA

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Abstract

J-field, discovered in 1982 and producing since 1993, is situated in the shallow offshore area of OML-X, about 13 km southwest of Bonny Terminal in the Eastern Niger Delta. The discovery well, J-01, encountered oil in four sands. Nine wells have been drilled in total, of which two were plugged and abandoned due to being wet. This study re-evaluates J-field's hydrocarbon potential with the aim of generating structural maps for the oil-bearing reservoirs and estimating their volumes for further development. Data from composite logs, well headers, checkshots, deviation surveys, and a 152 sqkm post-stack 3-D seismic volume were used. After quality checks to reduce uncertainties, findings revealed that J-field is primarily composed of marginal marine sediments with well-sorted blocky sands, facilitating reservoir connectivity likely influenced by tidal forces. Stratigraphic units date back to the late Miocene/Pliocene era. A total of 45 faults, including normal, listric, synthetic, and antithetic, were interpreted as part of the trapping mechanism. Four reservoir tops (A-04, B-04, C-01, and C-05) were mapped to create time and depth structure maps. Volumetric estimates showed significant hydrocarbon potential, with base-case results indicating A04=5MMBO, B04=90MMBO, C01=3MMBO, and C05=90MMBO, suggesting development benefits for stakeholders.

RGOG 048

INTERPRETATION OF GRAVITY DATA OF HADEJIA AND ITS ENVIRONS USING TILT ANGLE DERIVATIVE METHOD

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Abstract

Tilt angle derivative method was applied to satellite gravity data of Hadejia and surrounding for subsurface delineation. The study area falls in the contact region between Chad sedimentary formation and the crystalline basement complex in the Northeastern Jigawa state and Northwestern Yobe state of Nigeria which lies between latitude 80N - 140N and longitude 110E -130E. Satellite gravity data of the area was obtained from Bureau Gravimetrique International (BGI). The Bouguer correction was already applied on the data and the Bouguer graph was plotted using surfer software. Low gravity anomalies are detected in the dominant part of the map with its minimum value appearing in the south-eastern and north-eastern part of the map. The low anomalies are probably due to existence of thick

sedimentary sections in these parts of the study area. Edges and Depth of the source of anomaly were also derived from the tilt angle. The tilt angle ranges between -3.5 degrees to 3.5 degrees with edges(boundary) at zero. This describes the edges/boundaries between the two formations. The method also revealed that the area has a depth ranging between 2km to 18km. The sedimentary areas were identified and isolated. Those areas with low anomaly and high depths are sufficient for hydrocarbon accumulation.

RGOG 049

INTERPRETATION OF GROUND MAGNETIC DATA TO ADDRESS BOREHOLE FAILURE IN A BASEMENT COMPLEX, NORTHCENTRAL NIGERIA

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Abstract
An attempt has been made to interpret ground magnetic and elevation data with the purpose of addressing groundwater borehole failure at Kwara State Polyethnic, Northcentral Nigeria. This study investigates the contrasting outcomes of two groundwater boreholes situated at different elevations, part of which one is successful (good) and the other failed. The good borehole is strategically positioned at the edge of a high elevation associated with steeper slope benefiting from increasing aquifer pressure and effective water flow as highlighted by high horizontal and total gradient amplitudes. In addition, local wavelength depth estimates reveal relatively low per meter wavenumber depth, suggesting permeable subsurface with smoother variations conductive to groundwater flow. The corresponding failed borehole despite its relatively high elevation could be attributed to flatter slope, encountered challenges resulting in low horizontal and total gradient amplitudes and high local wavelength depth estimates. This study has highlighted the significance of considering elevation, gradient amplitudes, and local wavenumber depth in understanding hydrogeological conditions influencing groundwater borehole success or failure. Therefore, this study will serve as a paradigm in predicting newly target locations for abundant and sustainable groundwater supply within the study area.
Keywords: Magnetic, Groundwater, Wavenumber, Hydrogeological.

RGOG 050

OPTIMIZING BIOGAS PRODUCTION FROM ORGANIC WASTE: A COMPARATIVE STUDY OF SUBSTRATE AND YEAST VARIATIONS

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Abstract
This study presents a comparative analysis of biogas production from three organic substrates—plantain peel, fruit waste, and tiger nut chaff—each treated with varying concentrations of yeast (0 g, 5 g, and 10 g). The objective was to evaluate the effect of yeast augmentation on the biogas yield over a 21-day anaerobic digestion period under controlled laboratory conditions. Nine digesters were used, representing each substrate-treatment combination: P_0–P_2 (plantain peel), F_0–F_2 (fruit waste), and T_0–T_2 (tiger nut chaff). The biogas was collected using the downward displacement of water technique, and the daily yield was recorded. Results showed that yeast addition significantly enhanced biogas production across all substrates, with the 5 g yeast dose (T_1, F_1, P_1) producing the highest cumulative yields compared to 0 g and 10 g treatments. Fruit waste treated with 5 g of yeast (F_1) recorded the highest overall biogas production, peaking at 4,777.95 ml on day 21. In contrast, untreated samples (P_0, F_0, T_0) consistently showed the lowest yields. Tiger nut chaff (T_1) also strongly responded to yeast treatment, yielding 6,440 ml on day 21. However, excessive yeast (10 g) appeared to inhibit gas production in some cases, suggesting an optimal microbial load threshold. This study underscores the potential of using low-cost agro-waste

materials for sustainable biogas generation, especially when supplemented with appropriate microbial inoculants. The findings contribute to developing efficient waste-to-energy solutions in resource-constrained environments and highlight the importance of optimising microbial inputs in anaerobic digestion systems.

Keywords: Biogas production, anaerobic digestion, organic waste, yeast inoculant,

RGOG 051

PORE PRESSURE PREDICTION, FRACTURE PRESSURE AND LITHOLOGY OF WELL X0 1 AND X02, NIGER DELTA, NIGERIA

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Abstract

The study attempts to reduce the risk associated with working in a borehole environment. Pore pressure prediction have been undertaken using well log traces to identify porous litho units and top of overpressure. The results of the study showed a lithology of shaly/sand structural distribution that are most responsible to effective stresses. The top of overpressure for well X01 is at 11450 ft depth with a fracture pressure of 9394 psi while that of well X02 at 11801 ft depth has a fracture pressure of 9760 psi. The study area has a fracture pressure gradient of 0.82 psi/ft and 0.83 psi/ft for well X01 and well X02 respectively. The results from the estimate of overburden pressure shows that the study area is overpressured.

Keywords: Pressure, prediction, blowout, Instability, fracture, overpressure.

RGOG 052

QUANTIFICATION OF SAND USING GEOELECTRIC AND WELL LOGGING IN OWHERHE-UDUERE COMMUNITY, UGHELLI NORTH LOCAL GOVERNMENT AREA IN SOUTHERN NIGERIA

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Abstract

This study aims to quantify prevalent sand deposits in Owherhe-Uduere Community in Ughelli North Local Government Area of Nigeria using a combination of surface geophysical surveys, and shallow drilling techniques. The Vertical Electrical Sounding method was used to obtain electrical resistivity details on the subsurface layers in the area, using Interpex software.A drilling program explored down to a depth of 60 metres, and rock samples' colour, grain size, and texture were described using Wentworth scale. These VES data combined with the core samples were used to assess the composition of the sand deposits and their potential for economic exploitation. Results from the VES survey revealed five distinct subsurface layers, characterized by a wide range of resistivities, extending from 168 to 5181Wm. Drill hole lithology revealed predominantly sandy soils, interspersed with clay layers and gravel layers at depths between 0.5 and 24m. The estimated volume of sand is 126,000m^3. The results indicate significant economic opportunities for the exploitation of these sand deposits in the Ughelli North area. This study has demonstrated that a combination of VES surveys and shallow drilling programs can be used to quantitatively assess sand deposits and determine their economic potential.

RGOG 053

SEISMIC EXPLORATION OF HYDROCARBON RESERVOIRS FOR SUSTAINABLE ENERGY GROWTH.

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Abstract
Seismic exploration plays a critical role in the discovery and characterization of hydrocarbon reservoirs, which are essential for sustainable economic growth. This research investigates the application of advanced seismic imaging techniques to enhance the resolution of subsurface structures in prospective oil and gas fields. The integration of seismic data with geological and petrophysical information enables the identification of potential hydrocarbon reservoirs and the optimization of exploration and production strategies. The results of this study demonstrate the potential for seismic exploration to contribute to sustainable economic growth by increasing hydrocarbon reserves, improving recovery efficiency, and reducing exploration risks.

RGOG 054

VULNERABILITY ASSESSMENT AND OVERBURDEN DETERMINATION OF AQUIFERS USING VERTICAL ELECTRICAL SOUNDING (VES) METHOD IN PARTS OF EMOHUA LOCAL GOVERNMENT AREA, RIVERS STATE, NIGERIA

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Abstract
This research work was on the vulnerability assessment and overburden determination of aquifers using vertical electrical sounding method in parts of Emohua Local Government Area. The research was necessitated by the alarming rate of surface water pollution and contamination in the area. The effects of continuously consuming this polluted water can be catastrophic as it poses some health challenges such as cholera, typhoid fever, etc. The outbreak of these diseases can decimate an entire community. This research is therefore aimed at mitigating the potential colossal damages and possible loss of human lives in the affected communities where this survey was undertaken. The alternative source of water is the groundwater and geophysical methods are necessary tools to accessing it. This research employed the resistivity method where the Schlumberger array was used for the vertical electrical sounding. Ten locations were sampled randomly in the area with a total length of spread ranging from 300m to 500m (i.e. AB/2), giving a probing depth of about 80m to 270m. The results obtained were interpreted using the ipi2win. With the resistivity inversion program, the data were iterated and the curve types, aquifer depths and thicknesses and apparent resistivities of the various formations were displayed. The results reveal that overburden depth ranged from 4.1m to 137.0m. The results also indicate that most of the aquifers are vulnerable to contamination due to indiscriminate dumping of wastes within the area.

Keywords: Vulnerability, Overburden, VES, Aquifer.

RGOG 055

APPLICATION OF SPECTRAL DECOMPOSITION FOR STRUCTURAL AND STRATIGRAPHY IDENTIFICATION

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Abstract
This study focuses on the application of spectral decomposition techniques, a powerful tool for analyzing seismic data in the frequency domain, to delineate geological features crucial for hydrocarbon exploration in the Niger Delta. Spectral decomposition allows for the

identification of subtle structures and stratigraphic features by decomposing seismic data into its constituent frequency components, providing valuable insights into the subsurface geology. The identification of faults, channels, and point bars is essential for discovering commercial hydrocarbon reservoirs. We compared the effectiveness of Fast Fourier Transform (FFT) and Continuous Wavelet Transform (CWT) methods in delineating these features. Our results show that CWT with Gaussian mother wavelet is more effective than FFT in identifying subtle structures and stratigraphic features. The CWT method provides better images of faults, channels, and point bars, which can lead to successful drilling operations. The study highlights the importance of advanced seismic analysis techniques in hydrocarbon exploration and demonstrates the potential of CWT in identifying potential hydrocarbon- bearing reservoirs. The findings of this research can aid in improving the accuracy of exploration and drilling decisions, ultimately contributing to the discovery of new hydrocarbon resources in the Niger Delta region.

Keywords: Spectral Decomposition, Continuous Wavelet Transform, Fast Fourier Transform, Fault, Channels and Point bars.

RGOG 056

SPECTRAL DEPTH ANALYSIS OF ABUJA AND ENVIRONS OF FCT USING HIGH RESOLUTION AEROMAGNETIC DATA

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Abstract

The spectral analysis of depth to magnetic sources of Abuja and Environs of FCT using high resolution aeromagnetic data sheet 186 was categorized into deeper, intermediate and shallow depths after application of basic filters all from oasis Muntaj 8.4 software. The residual map with magnetic signature range of -112.4nT to 101.5nT was subdivided into 16 overlapping square grid for Spectral depth analysis. The result from the Spectral analysis shows depth to deeper sources varying from 0.537km to 1.72km, depth to intermediate sources ranges from 0. 256km to 0.498km while shallow sources vary between 0.181km and 0.453km. Source Parameter Imaging tool reveals complimentary average depth to magnetic bodies of 1.583km; which reflects a typical Basement complex characteristics with Magnetic amplitudes of 0.005 to 0.424 susceptibilities from analytic signal and Tilt Derivative of 1.3 to 1.4nT/m showing that the spectral depths in the study area has moderate magnetic anomalies that depict the presence of limited fault and fracture in the NE – SW direction that can possibly host some rock minerals like granite, schist, lime stones, sand stones, shale and clay spread across the study area.

Keywords: Magnetic, Spectral-Analysis, Depth, Susceptibility

RGOG 057

GEOMODELING OF HYDROCARBON RESERVOIRS FOR CARBON SEQUESTRATION AND MIGRATION, IN K-FIELD, AN ONSHORE FIELD OF NIGER DELTA BASIN

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Abstract

The high concentration of carbon dioxide (CO2) currently in the atmosphere has contributed to the damaging effects of global warming which is now evident on our environment. Thus, to mitigate against the continuous large-scale emissions of this anthropogenic gas, carbon sequestration or the geological carbon storage (GCS) system is gradually gaining global recognition as one of the most effective tools of managing the adverse effect of releasing carbon dioxide in the environment. This work used an integrated modelling approach to

assess carbon dioxide storage potentials of some depleted oil reservoirs of on an onshore field – known as K-Field, of Niger Delta Basin. The work involved static reservoir modelling from available geophysical well logs, seismic data, and dynamic analysis which was integrated using open-source code (MRST_CO2lab). Two reservoirs (D10C0 and D6200) were delineated from the well logs. The computed petrophysical properties of the reservoirs show an average value of porosity, permeability and water saturation ranging between 20% to 29%, 250mD to 890mD and 8% to 75% respectively. Two horizons corresponding to tops of the reservoirs and about 27 faults were observed and mapped in the seismic data. The reservoirs were estimated to have a total static storage capacity of 24.85Mt. The dynamic assessment of one of the reservoirs (D6200) showed that 4.12Mt mass of CO2 could be injected for 20 years and safely stored for 1000years without any threat of leakage in the future. Highest bottom hole pressure (BHP) recorded during the dynamic simulations was 35.4MPa. This has no direct risks of caprock and reservoir fracture, assuming a fracture pressure gradient (FPG) of 0.479 psi/ft which is the highest reported in the study area. The study proposed a simple, easy and useful modelling techniques that will contribute and enhanced the net-zero campaign on carbon dioxide emissions and help to curb climate change.
Keywords: Geomodelling, Sequestration, Migration, Seal, Carbon-Dioxide, Global warning, Emissions.

RGOG 058

STRUCTURAL CAPABILITY AND SPILLAGE ANALYSIS OF DEPLETED OIL RESERVOIRS FOR CO2 STORAGE, IN AN ONSHORE NIGER DELTA FIELD, NIGERIA.

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Abstract
Depleted hydrocarbon reservoirs are often referred to as one of the most preferred options for geological carbon sequestration (GCS). The Nigeria Niger Delta can become the next carbon storage hub if some reservoirs of the region which are already entering depletion are used. In practice, however, preliminary re-assessment of these reservoirs must be carried out to ascertain their suitability to store CO2. In this study, reservoirs of a depleted oilfield in onshore Niger Delta were assessed for their structural capability to keep sequestered CO2 in place, using suite of well logs and 3D seismic data. The study identified two reservoir-seal pairs within the depth range of 2500m and 3800m, and mapped corresponding horizons intersected by a series of both regional, synthetic and antithetic faults. Generated surface maps showed evidence of rollover anticlinal structures within fault-enclosed areas. Migration pathways of one of the reservoirs were also analysed employing the MRST_CO2lab open-source code via an input geological model. The results showed that the delineated spill point is useful for designing injection strategies that can be adopted not to impose hazard. The findings in this study generally suggest that the reservoirs are potentially capable of holding sequestered CO2 in place as inferred by recommended standard parameters and results of previous studies.
Keywords: Carbon Dioxide; CO2 Containment; Spill Point Analysis; Carbon Sequestration; Niger Delta.

RGOG 059

GEOELECTRIC EVALUATION OF GROUNDWATER POTENTIAL AND AQUIFER VULNERABILITY OF OVERBURDEN AQUIFERS OF ADO-EKITI, SOUTHWESTERN NIGERIA.

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Abstract
Groundwater resources are crucial for the socio-economic development of regions with seasonal surface water sources. Characterization of groundwater aquifers typically involves assessing groundwater potential and vulnerability. This study utilized 40 Vertical Electrical Sounding (VES) measurements with a Schlumberger array to characterize the basement aquifers of Ado-Ekiti, Southwest Nigeria. The interpretation of the data was effected using IPi2Win and Interpex (IX1D). The findings reveal four geoelectric layers in 67.5% of the study area and five layers in 32.5%. The five identified layers include topsoil (0.24-21m; 0.97-327.76 Ωm), clay/laterite (0.89-4.43m; 6.22-368.07 Ωm), weathered basement (0.32-117.3m; 9.73-5705 Ωm), fractured basement (0.58-46.94m; 1.64-2200.2 Ωm), and fresh unweathered basement (23.47-48502 Ωm). Aquifer layers, consisting of weathered and fractured basement, have thicknesses ranging from 0.9 to 134.4m, while the protective layers of topsoil and clay range from 0.2 to 21.1m. 52.5% of the study area exhibits good groundwater potential, with hydraulic conductivity and transmissivity ranging from 0.3 to 53.7m2/day and 41.7 to 4280.4m²/day, respectively. Groundwater potential in the study area is classified based on the depth to the basement, with 17.5% of the area rated as negligible (depth < 10 m), 30% as low (10–20 m), 32.5% as moderate (20–30 m), and 20% as good (depth > 30 m). This indicates that 52.5% of the study area exhibits moderate to good groundwater potential, even when considering saprolite and fracture characteristics. Geoelectric cross-sections identify areas of high groundwater potential in valleys filled with weathered material. Longitudinal conductance ranges from 0.07 to 8.99 mho, with 70% of the area classified as poorly to very poorly protected, suggesting that localized management strategies may be necessary to prevent aquifer contamination.
Keywords: Longitudinal conductance, Vulnerability, Groundwater, Aquifer.

RGOG 060

DETERMINATION OF THE AREA EXTENT OF HYDROCARBON ACCUMULATION IN A CONVENTIONAL RESERVIOR

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Abstract
In this work, an approach to determine the area extent of hydrocarbon accumulation from well logs has been presented. Porosity, permeability, water saturation, reservoir thickness and Shale volume were calculated for each hydrocarbon bearing zone delineated from two wells in an oil field in Southern Niger Delta. Twelve reservoir zones of interest (sand bodies) were delineated, correlated across the field and ranked using average results of petrophysical parameters. Volumetric equations were applied to determine the area extents of the accumulations. Recoverable oil reserve for W-001 and W-002 were calculated to be 148.45MMBB and 145.91MMBB respectively .The area extent of the accumulation in W-001 and W-002 were found to be 0.974acre and 2.92acre respectively. From the results, it could be deduced that the field studied has exploitable oil and gas in place and W-002 may store more gas than W-001.
Keywords: Petrophysical parameters, Area extent. hydrocarbon reserve, well logs, volumetric method.

RGOG 061

EVALUATING THE GEOTHERMAL POTENTIAL OF CHAD BASIN, NIGERIA, USING ARTIFICIAL NEURAL NETWORKS

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Abstract:
Nigeria continues to face critical energy shortages despite its vast natural resources, largely due to over-reliance on fossil fuels. This study investigates the untapped geothermal potential of the Chad Basin in northeastern Nigeria using Artificial Neural Network (ANN) modelling of geophysical, geological, and borehole data. The objective is to generate high-resolution geothermal gradient and heat flow maps, identify high-potential geothermal zones, and assess the feasibility of developing geothermal energy as a sustainable alternative. Data sources include aeromagnetic, gravity, and borehole temperature data procured from geological and hydrocarbon institutions. These datasets are integrated using ANN techniques to identify subsurface thermal anomalies and delineate prospective geothermal sites. Preliminary findings suggest the presence of substantial heat flow and geothermal gradients within the basin, particularly in regions previously overlooked due to the historical focus on hydrocarbons. This innovative application of ANN in geothermal exploration offers a novel framework for energy diversification in Nigeria and contributes to the broader agenda of environmental sustainability and energy security. The results are expected to provide a foundation for future exploration and policy initiatives aimed at exploiting Nigeria's renewable geothermal resources.

SECTION B:

New Frontiers in Solid State and Material Science for Manufacturing and Technological Growth
(RFSM)

RFSM 001

OPTIMISATION OF POLYACRYLIC ACID USAGE AS SURFACTANT IN HYDROTHERMALLY SYNTHESISED Cu_2ZnSnS_4 THIN FILMS FOR APPLICATION AS COUNTER ELECTRODE IN DYE SENSITISED SOLAR CELL

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Abstract
Cu_2ZnSnS_4 (CZTS) nanoparticle slurries were synthesised using hydrothermal method for application as counter electrode in dye sensitised solar cells. In order to optimise the synthesis process, the polyacrylic acid (PAA) used as surfactant in the precursor solution was varied thus: 0.0 g, 0.6 g, 1.0 g and 1.4 g. The XRD revealed peaks of CZTS (112) and (220) for the sample synthesised using 1.0 g PAA and in addition, numerous other peaks were observed for the remaining samples. The crystallite sizes ranged between 7 and 19 nm. Raman spectra of the films reveal CZTS peaks of 338, 351 and 252 cm^{-1} for samples synthesised using 1.0 g PAA precursor while ZnS, SnS, Cu_3SnS_3, Cu_3SnS_4, Sn_2S_3 secondary and ternary phases were observed for other amounts in addition to the 338 CZTS peak. SEM image show spherical nanoparticles and agglomerated nanosphere-like shapes. The Cu: Zn: Sn: S atom ratios were close to stoichiometry for 1.0 g polyacrylic acid and 0.6 g PAA. The surface roughness was between 800 and 1500 nm. The bandgap ranged between 1.51 eV and 1.54 eV. In order to test for the photovoltaic activity of the best CZTS materials film sample, it was used as a counter electrode in dye sensitised solar cell. The assembled cell after characterisation yielded an energy conversion efficiency of 3.2%.

RFSM 002

MOLECULAR DYNAMICS SIMULATION OF THERMAL STABILITY OF GRAPHENE NANOSTRUCTURES FOR NANOELECTRONICS DEVICES

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Abstract
In this study, we investigated the thermal stability of graphene structure (sheet) as a function of temperature using molecular dynamics (MD) simulations with the Tersoff potential. Graphene sheet consisting of 1380 carbon atoms were subjected to temperature range of 4500 K to 5500 K which is meant to simulate extreme thermal conditions where significant structural changes are expected. Four metrics were used to quantify the thermal stability, these are (i) average number of bonds count (ii) the average coordination number, (iii) the fraction of hexagonal rings, and (iv) the average bond length. These metrics are extracted from molecular dynamics trajectories and were analyzed. Results show a progressive decomposition of the graphene lattice, which implies by controlling these structural metrics, graphene can be tailored for specific applications in nanoelectronics, such as high-speed transistors, flexible electronics, sensors, and memory devices.

Keyword: Molecular dynamics, Graphene, Nanoelectronics, Tersoff Potential.

RFSM 003

STUDY ON IMAGE QUALITY OPTIMIZATION OF X-RAY MACHINES USING DOSE CONTROL STRATEGIES

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Abstract

Periodic monitoring of X-ray equipment quality control parameters is very important to ensure precision and accuracy of radiographic tests. The aim of this study is to optimize image quality of x-ray machines using dose control strategies in five selected hospitals. X-ray machines, grid alignment, film screen contact and focal spot were used for this work. The grid alignment test tool, focal spot test tool, Film-screen contact test tool (RMI143D) and Densitometer were measured from five (5) different hospitals, A, B, C, D and E in Makurdi, Benue State, Nigeria. The results from this study showed that in all the selected hospitals, exposure at 50Kvp,10mAs is not possible and 50Kvp,3 - 4mAs showed poor and dark imaging. Additionally, two of the selected hospitals, namely, B and D have aged x-ray machines resulted in poor film screen contact. Furthermore, from all the hospitals this study was carried out no hospital showed complete adherence to guideline of focal spot within 2.5line pairs per millimeter. From these results, the hospitals that are outside limit should introduce regular plan-to-check act on quality control in radio diagnostic equipment as a way of mitigating over exposure to radiation.

Keyword: Radiographic parameters, Image quality, Diagnostic X-rays and Kvp

RFSM 004

THEORETICAL MODELS AND PROPERTIES OF SEMICONDUCTOR QUANTUM DOTS FOR THE DESIGN OF NEXT GENERATION SOLAR CELLS

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Abstract

This paper presents a comprehensive analysis of the theoretical models that describe the electronic structure, exciton dynamics, and charge transport mechanisms in quantum dots, with particular emphasis on their application in photovoltaic technologies. Key models such as the effective mass approximation (EMA), and k·p theory are reviewed to elucidate size-dependent energy bandgaps and optical transitions. Furthermore, the paper explores how these theoretical insights inform the design and optimization of QD-based solar cell architectures, including quantum dot heterojunction solar cells, multiple exciton generation solar cells, and intermediate band solar cells (IBSCs). By bridging quantum theory with device engineering, this study highlights the potential of quantum dots to enhance light absorption, broaden spectral response, and surpass the Shockley–Queisser limit, paving the way for more efficient and cost-effective solar energy harvesting solutions.

Keywords: quantum dots, electronic structure, exciton dynamics, charge transport mechanisms, heterojunction solar cells, multiple exciton generation solar cells, and intermediate band solar cells

RFSM 005

REAL-TIME INTRUSION DETECTION WITH PIR SENSORS AND SOLAR POWER INTEGRATION

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Abstract
The research focuses on constructing and implementing a sensor-based enhanced perimeter security monitoring system with solar power and floodlight to detect intruder's motion within the perimeter of residential and institutional facilities within the range of passive infrared (PIR) sensors and alert the residents for immediate action. Non-programmable microcontrollers and solar power systems were incorporated to process real-time electronic signals and uninterrupted power supply. Results obtained after construction and testing showed that the unit effectively detected the motion of humans up to 7m range of the PIR sensor in 0.3milisecs, and signal alarms. The controller actively processed the electrical signals in real time and sent the output as expected. The operational amplifier (LM324) sufficiently amplified and comparatively determined differences in current and voltage input in the circuit to the required magnitude for the system. Power unit adequately sustained system operation for 30 hours after 2 hours of charging. Also, the system indicates efficient current (I), voltage (V), and power (P) usage parameters of 0.3A, 3.3V, and 3.6W respectively with an overall efficiency of 66%, which is above average.

RFSM 006

A COMPARATIVE STUDY OF THE EXPERIMENTAL AND THE THEORETICAL ELASTIC DATA OF Ho^{3+} ION DOPED ZINC BOROTELLURITE GLASS

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Abstract
It has been a subject of interest to study tellurite glass due to its unique properties, such as low melting point, high refractive index, high dielectric constant, and good infrared transmission. As such a series of glass samples with composition $\{((TeO_2)_{0.7}\ (B_2O_3)_{0.3})_{0.7}\ (ZnO)_{0.3}\}_{1-x}\ (Ho_2O_3)_x$ was prepared by using the melt-quenching technique. Then, the samples were characterized through densimetry, FTIR and ultrasonic technique. The variations of density, molar volume, ultrasonic velocity, elastic moduli (bulk, shear and Young's modulus) and Poisson's ratio were discussed and analysed. It was found that the addition of holmium oxide caused the high-rate production of bridging oxygen which elevated the ultrasonic velocities and the elastic moduli of the studied glasses. The values of Poisson's ratio for all the series increased which indicates that the samples possessed high cross-link density and the ions in the network are deformed Furthermore, the values of elastic moduli and Poisson's ratio were compared with the data calculated theoretically by using Makishima-Mackenzie, and Rocherulle models. The comparison revealed that there is good agreement between the experimental and the theoretical data. Hence it can be concluded that Makishima-Mackenzie and Rocherulle models are valid for the studied Quaternary glasses.

Keywords: Borotellurite glass; Elastic moduli; Poisson's ratio; Makishima-Mackenzie model Rocherulle model

RFSM 007

COMPARATIVE STUDY OF THE PHOTOCATALYTIC ACTIVITIES OF CANARIUM SCHWEINFUTHII AND JUSTICIA CARNEA AS PHOTOSENSITIZERS USING DIFFERENT EXTRACTIONS

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Abstract
This research work focused on comparative study of the photocatalytic activities of canarium schweinfurthii and Justicia carnea as photosensitizers using different extraction solvents. The leaves were extracted as dyes using cold extraction technique with CH_3OH and C_2H_6O as extraction solvents. SprectrumLab 752S UV-VIS Spectrophotometer was used to obtain optical characterizations. For absorbance, justicia carnea in CH_3OH showed the highest absorbance spectra range of (0.738a.u. – 1.602a.u.), followed by canarium schweinfurthii in CH_3OH, justicia carnea in C_2H_6O then canarium schweinfurthii in C_2H_6O as the least (0.023 a.u.- 0.431 a.u.). For results of transmittance, the average transmittance values for all the samples within the visible region decreased drastically with justicia carnea in CH_3OH as the least (0.121 a.u. - 0.341 a.u.). All the samples showed high refractive index above 10 a.u., justicia carnea in CH_3OH having the highest range (2.589a.u – 18.587a.u). Films of justicia carnea in CH_3OH and in C_2H_6O showed direct band gaps of 2.00eV and 2.20eV respectively. While films of canarium schweinfurthii in CH_3OH and in C_2H_6O showed direct band gaps of 2.10eV and 2.40eV. Hence all the extracts are good photosensitizers while justiciar carnea in CH_3OH tends to be the best than canarium schweinfurthii in CH_3OH and C_2H_6O.
Keywords: Photosensitizers, Organic Dyes, Photocatalysis and Optical Activities**.**

RFSM 008

COMPARISON BETWEEN ALLUMINIUM AND COPPER AS THERMAL SUBSTRATES FOR HEAT REMOVAL FROM ELECTRONICS PACKAGE

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Abstract
Thermal performance of light emitting diodes (LEDs) depends on temperature regulation of the package system, through which excess heat generated within the LEDs are removed to the ambient. In this paper a thermally conductive and electrically insulative magnesium oxide (MgO) thin film was synthesized on aluminum (Al) and copper (Cu) substrates respectively and to be joined to LEDs pack to improve the heat removal path. Structural properties, surface quality, thermal performance and optical behavior of the MgO thin films on Al and Cu substrates were studied. High power LED were mounted on Al and Cu coated substrates and operated at a driven currents of 350, 500 and 700 mA. Low thermal resistance, uniform surface heat distribution, and high brightness of LEDs were recorded for LEDs mounted on MgO thin film coated Al substrates. This indicated MgO thin film coated Al substrates have the potential to be recommended for use in LEDs packaging system.
Keywords: Thermal performance, Substrate, Heat removal, Heat distribution, Brightness.

RFSM 009

DESIGN AND CONSTRUCTION OF WIRELESS POWER TRANSFER SYSTEM USING THE PRINCIPLE OF INDUCTION COUPLING

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Abstract
Wireless charging technology has revolutionized the way our electronic devices are powered, offering greater convenience and eliminating the need for cumbersome cords and connectors.

A wireless power transfer system that charges multiple devices through the inductive coupling method has been designed and constructed. The device can be used to charge multiple devices like mobile phones, lamps and other low-end power devices without the use of conventional cables between the transmitter and receiver modules. The system consists of a solar panel which absorbs energy from the sunlight and then charges the battery. The battery stores the energy and then converts it into DC electricity, which is then transmitted to the coil. Result analysis was taken for voltage and separation distance of the coil for each receiving end device in order to determine the efficiency of power transfer, and a graph was plotted which showed that the voltage being transmitted to the receiver drops as the distance between the transmitter and the receiver increases.

RFSM 010

DESIGN AND IMPLEMENTATION OF AN HYBRID POWER CHARGING DEVICE

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Abstract
This paper presents the design and implementation of a flexible hybrid charging device that combines photovoltaics (PV) energy, grid electricity, and battery power to provide a stable, effective, and reliable charging solution, Solar modules, a battery storage unit, a power converter, a power supply controller and an intelligent switching system are essential parts of this project that combine energy sources smoothly and efficiently. The device's control system intelligently manages electricity transmission from various sources, maximizes energy efficiency, and reduces the dependency on the network current. The system guarantees continuous operation even under challenging circumstances and prioritizes renewable energies. The test results show remarkable energy savings, reliable loading effectiveness, and flexibility in regions with irregular power supply systems. This innovative approach shows how hybrid systems can improve reliability, sustainability, and efficiency of energy consumption.
Keywords: photovoltaics (PV), grid, battery, hybrid charger, power controller

RFSM 011

DEVELOPMENT OF CHALCOGENIDE-BASED GRADED BANDGAP THIN FILM STRUCTURE FOR SOLAR CELL APPLICATION

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Abstract
For use in graded bandgap solar cell applications, tri-layer $ZnS/Sb_2S_3/Sb_2Se_3$ thin film structure was fabricated. The window layer for a possible solar cell application is ZnS, while the double absorption layer for efficient photon absorption is Sb_2S_3/Sb_2Se_3. The process of chemical bath deposition was used to create these materials. The $ZnS/Sb_2S_3/Sb_2Se_3$ thin film structure demonstrated both stability and a strong ability to absorb photon energy across the entire solar spectrum, as its energy bandgap spanned the range of electromagnetic radiation in the solar spectrum. The film exhibited exceptionally high absorption coefficient of 9.2×10^9 m^{-1} in the UV region, which decreased to 2.5×10^9 m^{-1} in the visible region, and gradually dropped to 1.4×10^9 m^{-1} in the infrared region. The bandgap grading/tuning is in the range of 1.10 – 3.83 eV for the tri-layers of $ZnS/Sb_2S_3/Sb_2Se_3$ thin film structure. Atomic force microscopy (AFM) images of as-deposited $ZnS/Sb_2S_3/Sb_2Se_3$ exhibited root mean square (RMS) roughness of 112.68 pm and annealed gave 99.74 pm. The X-ray fluorescence (XRF) showed the elemental constituent with presence of oxygen. The XRD showed amorphous nature but annealing improved the crystallinity of the tri-layer material. The bandgap grading will ensure absorption across the solar spectrum.

RFSM 012

EFFECT OF CITRUS AURANTIFOLIA SEED EXTRACT ON THE MECHANICAL PROPERTIES OF MILD STEEL IN 0.1M HYDROCHLORIC ACID.

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Abstract
Citrus aurantifolia (lime) seed extract was evaluated as corrosion inhibitor for mild steel in 0.1M Hydrochloric acid, using weight loss measurements at room temperature. Citrus aurantifolia (lime) seed extract inhibited the corrosion of mild steel significantly with 88.4% efficiency at the highest concentration of 45mls of the inhibitor. Tensile strength, hardness, Surface profiling and micro structural tests were carried out on the as- received and inhibited coupons. The tensile tests revealed an increase in tensile strength, demonstrating that the extract not only protects the steel from corrosion but also improves its ductility and strength. Hardness measurements showed a noticeable increase in surface hardness while the Surface analysis confirmed the formation of a protective film on the mild steel surface, attributed to the adsorption of active compounds from the seed extract. This study offers valuable contributions to the field of corrosion science and materials engineering.
Keywords: Citrus aurantifolia; Hydrochloric acid, Mild steel, Tensile strength.

RFSM 013

EFFECT OF CONCENTRATION ON THE OPTICAL, ELECTRICAL, AND SOME STRUCTURAL AND MORPHOLOGICAL PROPERTIES OF COBALT DOPED ZINC OXIDE THIN FILMS BY CHEMICAL BATH DEPOSITION (CBD)

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Abstract
We have demonstrated successfully the deposition of cobalt doped Zinc oxide thin films by chemical Bath Deposition method. Nanostructured rod – like films was achieved using Zinc acetate and cobalt acetylacetone as precursors. EDTA was used as complexing agent while ammonium solution was employed to stabilize the pH of the Solution and to enhance Solubility. The deposited films were characterized to determine their thickness, optical, structural, morphological and electrical properties using stylus profiler (Veeco, Dektak 150), UV-Vis Spectrometer (Filmetrics F10 – RT), Bruker AXS (Germany, X – ray diffractometer), Scanning electron microscope (Auriga HRSEM) and ECOPIA Hall effect measurement system (HMS - 300) respectively. Results obtained indicated that the Thicness, Optical and Electrical properties of the grown films were affected by concentration of Cobalt in the solution. Structural properties of the film confirmed the presence of Zinc oxide with wurtzite structure and grain sizes in the range of 14.92 nm and 22.94 nm. Scanning electron micrographs showed that the film composed of nanorods of slightly different sizes. Composition analysis of the film confirmed the presence of cobalt, zinc and oxygen.
Keywords: Cobalt Doped Zinc Oxide, CBD, Optical Properties, Electrical Properties.

RFSM 014

EFFECT OF GROWTH POTENTIAL ON THE OPTICAL AND STRUCTURAL PROPERTIES OF ELECTRODEPOSITED ZNS THIN-FILMS LAYERS FOR PHOTOVOLTAIC

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Abstract
Zinc sulfide (ZnS) thin films have attracted considerable attention due to their broad applications in optoelectronic devices. This study explores the impact of growth voltage on the properties of electrodeposited ZnS films using UV spectroscopy. ZnS thin films were deposited on fluorene-doped tin oxide (FTO) coated glass substrates at various growth voltages ranging from 1 V to 5 V. The structural, optical, and morphological characteristics of the films were examined using X-ray diffraction (XRD), UV-visible spectroscopy, and scanning electron microscopy (SEM), respectively. The XRD analysis indicated that all deposited films exhibited a cubic zinc blende structure with a preferred orientation along the (111) plane. The size of crystallites increased with rising growth voltage, indicating enhanced crystallinity at higher voltages. UV-visible spectroscopy measurements demonstrated that the optical bandgap of the films decreased from 3.89 eV to 3.61 eV as the growth voltage increased, suggesting a transition towards the visible region with improved light absorption.
Keywords: Growth voltage, UV spectroscopy, Optical, X-ray diffraction (XRD), Zinc sulfide (ZnS), thin films.

RFSM 015

EFFECTS OF ZR INCORPORATION ON THE STRUCTURAL, MORPHOLOGICAL, OPTICAL, AND ELECTRICAL PROPERTIES OF CUSE NANOCRYSTALS FILMS FOR PHOTOVOLTAIC APPLICATION.

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Abstract
Electrodeposition techniques were successfully employed to synthesized nanocrystals films of Zr-doped CuSe with the variation of Zr-doped concentration. The effects of the dopant concentration on the structural, morphological, optical and electrical properties of the synthesized films were investigated using appropriate techniques. The XRD pattern for the synthesized films revealed the dominant diffraction peaks occurs at (220), (101), (220), (211), and (112) corresponding to (26.409°), (33.855°), (37.869°), (51.388°), and (65.798°) angles of diffraction respectively, with the intensities of the diffraction peak increasing with an increase in Zr-dopant concentration. The crystallite sizes were observed to decrease with an increase in Zr-dopant concentration. The SEM micrograph revealed a the rod-like nano-grains agglomerated, long chains of rod–like grains of bigger sizes, which are more densely packed than that of undoped CuSe film. The spectroscopy analysis revealed optical energy band gap values of 1.24 eV, 1.84 eV and 1.83 eV for films synthesized at 0.1 mol %, 0.2mol% and 0.3mol% of Zr dopant respectively, indicating an increase in the value of the energy band gap as the Zr dopant concentration increases.

RFSM 016

MPACT OF BIOMASS BRIQUETTES ON ENVIRONMENTAL SANITATION AND AS AN ALTERNATIVE COOKING FUEL (BIOFUEL)

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Abstract
Interest in using biomass energy as an alternative to fossil fuels has advanced in recent years, this could be due to the current energy demand, energy scarcity, global warming, and

inconsistency of prices of fossil fuels especially in Nigeria. In general, local consumers, and industries, especially in developing countries, are seriously searching for an alternative, affordable, and sustainable fuels. Briquettes from biomass sources could, therefore, be an option because of the following features. It can be used for domestic cooking and water heating, burning creative methods such as tobacco curing, fruits, tea drying and poultry rearing, firing ceramics and clay wares such as improved cooking stoves, pottery, and bricks, fuel for gasifiers to generate electricity and power boilers for steam. The briquetting process is perhaps regarded as a way to improve the application of lowgrade biomass materials. Briquetting is mainly used for compacting of biomass (agricultural wastes, sawdust, bark, straw, cotton, paper, and so forth). Briquettes are household and industrial fuels, produced through densification of biomass waste. This research aimed to asses the impact of biomass briquettes produced from sawdust, palm kernel shell and paper waste on environmental sanitation and as an alternative to cooking gas in Nigeria.

RFSM 017

IMPLEMENTATION OF VEHICLE ANTI THEFT SYSTEM USING GLOBAL SYSTEM FOR MOBILE COMMUNICATION (GSM) AND BIOMETRICS AUTHENTICATION TECHNOLOGY

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Abstract
Car theft is still a passive problem that affects people greatly and causes large financial losses on a global scale. Vehicle theft has been on the rise lately, with thousands of occurrences reported by the National Bureau of Statistics each year. This alarming trend emphasizes how urgently the nation needs to improve vehicle security measures. This study discussed the implementation of a car anti-theft system that uses biometric authentication and GSM technology. It includes the integration of the fingerprint sensor, GSM module, and microcontroller. The car anti-theft system was created by combining all of these technologies. The fingerprint is used to authenticate the user's access to the system, and the GSM module acts as the transmitter of commands to activate or deactivate the system via SMS. The hardware and software development are the two main components of this research project. The wiring connection of the microcontroller and its integration with the fingerprint sensor and GSM module are examples of hardware development. The microcontroller is programmed using the source code and the GSM message command as part of the software development process. Users used a centralized command interface via text to operate this system. Communication between MTN users is the least delayed, while communication between GLO users is the most delayed, according to a comparison of Nigeria's four main network providers (MTN, GLO, AIRTEL, and 9MOBILE). In order to enable communication between an MTN user terminal and the Vehicle Anti-Theft System via Short Message Service (SMS), MTN was used by both the transmitting and receiving terminals in this study.

RFSM 018

INVESTIGATING THE EFFECT OF ADDITION OF TIO_2 NANOPARTICLES ON THE DIELECTRIC AND THERMAL PROPERTIES OF TRANSFORMER OIL EXTRACTED FROM JOJOBA OIL

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Abstract
The research will explore the potential of enhancing Jojoba oil, a promising environmentally friendly alternative to mineral oils in high-voltage power transformers, by infusing it with Titanium Dioxide (TiO_2) nanoparticles. Due to concerns regarding the environmental impact and sustainability of mineral oils, industries have increasingly turned to plant-based oils for use as transformer fluids. Jojoba oil, known for its high oxidative stability and non-toxic

nature, has gained attention as a candidate for transformer oil replacement. However, its dielectric strength and thermal properties fall short of the high demands required for efficient transformer operation. This study investigates the infusion of TiO_2 nanoparticles into Jojoba oil to improve its dielectric strength, thermal conductivity, and overall stability, making it a more viable option for use in electrical transformers. The research aims to assess improvements in key parameters, including breakdown voltage, dielectric constant, dissipation factor, viscosity, and thermal stability. These enhancements are critical for ensuring that the oil can perform at par with or surpass the capabilities of conventional mineral oils. The findings of this research could lead to the commercialization of Jojoba oil-based transformer oils infused with TiO_2 nanoparticles, providing a sustainable, biodegradable, and safer alternative to conventional mineral oils.

RFSM 019

MODELLING AND SIMULATION OF >19% HIGHLY EFFICIENT PBS COLLOIDAL QUANTUM DOT SOLAR CELL: A STEP TOWARDS UNLEASHING THE PROSPECT OF QUANTUM DOT ABSORBER

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Abstract

In this study, solar capacitance simulation tool in one dimension (SCAPS-1D) was used to maximize the performance of lead sulfide (PbS) solar cells. A PbS solar cell was first modeled and then experimentally verified from past research. The ZnO electron-transport layer (ETL) was then replaced with ZnO:Al ETL material. Additionally, the fluorine-doped tin oxide work function, PbS-TBAI, ZnO:Al layer thicknesses, ZnO:Al/PbS-TBAI, PbS-TBAI/PbS-EDT defect density, PbS-TBAI defect density, ZnO:Al, and PbS-TBAI doping concentration were optimized. Results showed a greater alignment of the absorber-layer valence band with the HOMO and LUMO of ZnO:Al than that of ZnO ETL. The PbS solar cell exhibited the greatest efficiency at the optimum values of 0.4 μm, 0.04 μm, 10^{19} cm^{-3}, 4.0 eV, 10^{17} cm^{-3}, 10^{14} cm^{-2}, 10^{18} cm^{-2}, and 3.8 eV for absorber thickness, ETL thickness, ETL doping concentration, work function of front contact, PbS-TBAI doping concentration, and electron affinity of ZnO:Al, respectively. The PbS solar cell also performed best at interface defect densities of 10^{14} and 10^{18} cm^{-2} for ZnO:Al/PbS-TBAI and PbS-TBAI/PbS-EDT, respectively. The PCE of ZnO:Al ETL-based device also increased from 15.036% before optimization to 19.169% after. The optimized result was found to be affected by temperature.

RFSM 020

OPTICAL CHARACTERISTICS OF NICKEL OXIDE THIN FILMS DOPED WITH DYE EXTRACT FROM THREE NATURAL DYES

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Abstract

Nickel Oxide (NiO) has displayed useful properties for application in solar cells, optoelectronics, and coatings. Modifying it with natural dyes may enhance its performance. This study used a chemical bath technique to deposit NiO thin films with dye extract from Eupatorium Odorata, Ageratum conyzoides, and Pucro Pueraria. The dye was extracted at a constant temperature. The thin films are characterized using RBS, XRD, and SEM, and the optical properties of the films are investigated. Results showed that transmittance decreases with the doping of dyes in the UV region and is high in the VIS-NIR region, while reflectance is low in all spectral regions. The films show very high absorbance in the UV region, moderate in the VIS region and low in the NIR region. The band gap value was found to be 4.00eV, 3.83eV, 3.95eV, and 3.85eV for the as-grown NiO, NiO doped with dye extract from Eupatorium odoarata, Ageratum conyzoudes and pucro pueraria respectively. The extinction coefficient of the layer doped with dyes is higher compared to the as-deposited layer.

Incorporating dyes into the film matrix altered the real dielectric spectra of the as-deposited films and could be deployed in optoelectronics or other fields.

Keywords: Nickel Oxide; Thin Film; Eupatorium Odorata; Ageratum conyzoides; Pucro Pueraria

RFSM 021

OPTIMIZATION OF HF CONCENTRATION FOR ENHANCED LIGHT TRAPPING AND REDUCED SURFACE REFLECTANCE IN BLACK SILICON PV APPLICATIONS.

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Abstract

This study presents the optimization of hydrofluoric acid (HF) concentration for fabricating nanoporous black silicon (b-Si) with enhanced light trapping and reduced reflectance for photovoltaic (PV) applications. Using aluminium-assisted chemical etching (AACE), b-Si was developed on p-type silicon wafers coated with a 30 nm Al catalyst via DC sputtering. Samples were etched in four HF-based solutions (4, 6, 8, and 10 ml) mixed in a fixed ratio of $xHF{:}7H_2O_2{:}10H_2O$ for 30 minutes. Morphological features were analyzed using FESEM and AFM, while optical properties were evaluated through UV-Vis-NIR spectrophotometry. The sample etched with 6 ml HF showed optimal results, featuring vertically aligned nanopores with a depth of 192 nm, RMS roughness of 19.6 nm, and surface coverage of 46.3%. It also exhibited the lowest average reflectance (7.82%) and highest broadband absorption (92.18%) in the 300–1100 nm range. Lower HF (4 ml) produced shallow pores with poor light-trapping, while higher HF (8–10 ml) caused pore merging and surface degradation. These results emphasize the importance of HF concentration control in achieving high-performance b-Si structures for efficient, low-cost silicon-based solar cells.

Keywords: black silicon (b-Si), hydrofluoric acid (HF) etching, aluminium-assisted chemical etching (aace) and average reflection.

RFSM 022

pH CONTROLLED SYNTHESIS AND CHARACTERIZATION OF CO DOPED ZNO NANOPARTICLES SYNTHESIZED BY MICROWAVE ASSISTED SYNTHETIC METHOD

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Abstract

Dilute Magnetic Semiconductors (DMS) with a potential for spintronic application have gained much researches interest. Considerable effort has been devoted to ZnO semiconductor material due to its wide band gap of 3.37eV, large exciting binding energy of 60meV and small exciton Bohr radius of 2.34nm, moreover, ferromagnetism at room temperature can be achieved when doped with transition metals. $Co_{0.1}Zn_{0.9}O$ nanoparticle with different pH (7.0, 9.0, 11.0 13.0) were synthesized by microwave assisted synthesis method calcined at 600°C. The structural, optical and magnetic properties of these nanoparticles were studied using X-ray diffraction (XRD), UV-Visible Spectroscopy, Photoluminescence Spectroscopy (PL), Fourier Transform Infrared Spectroscopy (FTIR) and Vibrating Sample Magnetometer respectively (VSM). The structural property confirms the effect of pH in the formation of pure crystalline $Co_{0.1}Zn_{0.9}O$ nanoparticles.

RFSM 023

ROBUST SOLAR LIGHT RESPONSIVEMoS_2 LOADED G-C_3N_4 MATERIALS FOR THE EFFICIENT SOLAR FUEL (HYDROGEN) GENERATION VIA PHOTOCATALYTIC WATER-SPLITTING

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Abstract
In this study, we constructed p-n junction 2D/2D MoS_2-g-C_3N_4 hybrid layered photocatalystvia condensation assisted simple wet impregnation method with different mass ratios of g-C_3N_4 to MoS_2. The synthesized composites were investigated by various characterization techniques, such as XRD, FE-SEM, FTIR, PL, Raman Spectra and UV- vis DRS, respectively. The optical band gap of the MoS_2-g-C_3N_4 red shifted to 2.4 eV from 2.7 eV of the g-C_3N_4. The photocatalytic activity of the as-prepared MoS_2-g-C_3N_4 photocatalyst was determined via photocatalytic water-splitting in the presence of Triethanolamine as hole scavenger under solar light irradiation. A maximum hydrogen production rate of 4255 $\mu molg^{-1}h^{-1}$ was obtained with 15 wt.%MoS_2-g-C_3N_4photocatalyst, which was almost 8 times higher than the bare g-C_3N_4. The improved photocatalytic activity of the resulting composite is due to increased light absorption in the visible region, reduced the band gap energy and facilitate electron-hole pair separation by interfacial transfer of electrons from the conduction band of g-C_3N_4 to the conduction band of MoS_2.

RFSM 024

STRUCTURAL AND ELECTROCHEMICAL STUDIES OF METAL OXIDE DOPED ZIF-8 NANOCOMPOSITES FOR ENHANCED SUPERCAPACITOR PERFORMANCE

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Abstract
This study investigated the electrochemical and structural benefits of doping ZIF-8 with cobalt (Co), zinc (Zn), and their combination (Co/Zn) to enhance its energy storage potentials. X-ray diffraction (XRD) confirmed high crystallinity with minor shifts in peak intensity and position due to doping, and calculated crystallite sizes ranged from 43.87 to 45.21 nm, indicating a high surface area beneficial for supercapacitor applications. Scanning electron microscopy (SEM) and energy-dispersive spectroscopy (EDS) confirmed the morphological diversity and successful incorporation of dopants. Cyclic voltammetry (CV) and galvanostatic charge-discharge (GCD) tests demonstrated pseudocapacitive behavior with specific capacitances of 906.25–956.25 F/g for CV and up to 651.04 F/g for GCD at 2 A/g. Co/Zn co-doping yielded the highest specific capacitance due to synergistic effects enhancing conductivity and redox activity. Electrochemical impedance spectroscopy (EIS) revealed reduced charge transfer resistance, with co-doped ZIF-8 exhibiting superior electron transport. Energy and power density evaluations showed significant improvements, with Co/Zn co-doped ZIF-8 achieving the highest energy density (3.593 Wh/kg) and excellent cycling stability (99.9% capacitance retention after 5000 cycles). These findings demonstrate that ZIF-8 and its hybrid nanocomposites, particularly Co/Zn co-doped ZIF-8, are promising candidates for high-performance supercapacitor applications, combining high capacitance, energy density, and long-term stability.

Keywords: Metal organic framework, ZIF-8, Doping, Supercapacitor Applications

RFSM 025

STRUCTURAL, DIELECTRIC AND IMPEDANCE SPECTROSCOPY OF DY^{3+}-SUBSTITUTEDM-TYPE STRONTIUM HEXAFERRITES

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Abstract

M-type barium hexagonal ferrites with chemical composition $SrFe_{12-x}Dy_xO_{19}$ (x = 0.0, 0.05, 0.10) was synthesized usin gsol-gelauto combustion method.The sample was prepared by sol-gel auto-combustion technique, pre-sintered at 400 degreesfor 3 hours and sintered at 950 degreesfor 5 hours. The synthesized samples were analyzed using X-ray diffractometer (XRD),Fouriertransform-infrared(FT-IR) spectroscopy, Field emission electronscanning microscope (FESEM), and impedance analyzer. XRD analysis shows that the prepared sample exhibited single crystalline phase with the absence of impurity. The idea of the formation of M-type hexagonal ferrite was given by the presence of two prominent peaks between at 400 cm^{-1} and 600 cm^{-1} inthe spectra of Fourier transform-infrared spectroscopy. The dielectric properties were explained on the basis of Maxwell-Wagnermodel and Koop'sphenomenological theory.

RFSM 026

SYNERGISTIC ENHANCEMENT OF NOVEL G-C_3N_4/MOS_2/$TI_3C_2T_X$ TERNARY NANOCOMPOSITE FOR EFFICIENT SOLAR FUEL (H_2) GENERATION VIA PHOTOCATALYTIC WATER SPLITTING

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Abstract

Herein, a novel MXene ($Ti_3C_2T_x$) supported g-C_3N_4/MoS_2 nano-composite was prepared using ultra-sonication assisted wet impregnation method for photocatalytic H_2 generation applications. Several characterization techniques including XRD, FTIR, FE-SEM, EDS, UV-vis DRS, BET and PL spectra etc. were employed to investigate the properties of the prepared photocatalyst. The photocatalytic H_2 activity of the as-synthesized photocatalysts were performed under solar light irradiation with triethanolamine (TEOA) as sacrificial reagent. The optimized photocatalyst (20wt.% MoS2 and 3 wt.% $Ti_3C_2T_x$) exhibit a maximum H_2 production rate of 20544.88 $\mu molg^{-1}h^{-1}$, a 13.2 and 183 times higher than that of g-C_3N_4/MoS_2, and g-C_3N_4,respectively. This remarkable increment is due to the phenomenal effect of $Ti_3C_2T_x$ MXene loading, heterostructure formation that exist between g-C_3N_4 and MoS_2 decreased in band gap energy of g-C_3N_4 and high surface area as confirmed by UV-vis DRS spectra, PL and BET results, respectively. The ternary photocatalyst displays good stability and do not suffer deactivation and photocorrosion up to four consecutive cycles run. Thus, this study may provide a clear insight in developing an efficient photocatalysts for solar fuel (H_2) generation via photocatalytic water splitting applications

RFSM 027

SYNTHESIS AND CHARACTERIZATION OF CD-S THIN FILM SENSORS FOR UV-VISIBLE LIGHT SENSING APPLICATIONS

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Abstract
This study presents the synthesis, characterization, and application of Cd-S thin film sensors for UV-visible light detection. Cd-dithiocarbamate single solid-source precursors were synthesized and confirmed via particle-induced X-ray emission (PIXE) to contain cadmium and sulfur. The Cd-S thin films were deposited using metal-organic chemical vapor deposition (MOCVD) at temperatures ranging from 360°C to 450°C and subsequently characterized with Rutherford backscattering spectroscopy (RBS), scanning electron microscopy (SEM), and UV-visible spectroscopy. RBS analysis indicated that the Cd/S ratio decreased with increasing deposition temperature. SEM revealed temperature-dependent morphological changes, such as grain refinement and reduced porosity at higher temperatures. Optical measurements showed strong UV-visible absorption and a narrowing of the energy band gap from 2.40 eV to 2.34 eV as deposition temperature increased. Photo-sensing experiments demonstrated peak photoresistance at wavelengths corresponding to the films' band gap, highlighting their potential as efficient photodetectors. Overall, the study underscores the significant influence of deposition temperature on the structural, optical, and sensing properties of Cd-S thin films, offering valuable insights for optoelectronic applications.

Keywords: Synthesis, Characterization, Cd-S thin film, light-sensor

RFSM 028

AI-DRIVEN PREDICTION SYSTEM FOR THERMOELECTRIC PROPERTIES: UNVEILING NOVEL MATERIALS FOR SUSTAINABLE ENERGY SOLUTION IN NIGERIA

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Abstract
This study presents an AI-driven prediction system to promote the discovery of high-performance thermoelectric materials suitable for sustainable energy applications in Nigeria. A Random Forest regression model was evolved and made available online to predict important thermoelectric properties (Seebeck coefficient, electrical conductivity, thermal conductivity, power factor, and the dimensionless figure of merit (zT)) from elemental and structural descriptors. The model reveals an impressive predictive performance for most of the properties predicted (Seebeck coefficient (R^2 = 0.80, MSE = 8701.62 $\mu V^2/K^2$), thermal conductivity (R^2 = 0.86, MSE = 1.43 W^2/m^2K^2), power factor (R^2 = 0.85, MSE = 1.82×10^{-7} W^2/m^2K^4), and zT (R^2 = 0.80, MSE = 0.024)). Though the electrical conductivity predictions yielded lower accuracy (R^2 = -0.65), however the model's overall performance justifies its potential for material screening tool. All models and preprocessing pipelines (scalers and feature selection), were serialized for deployment. This system has the potential to drive local research initiatives by offering a user-friendly AI-driven computational platform for screening and identifying novel thermoelectric candidates in alignment with Nigeria's transition to sustainable energy innovations.

RFSM 029

APPRAISAL OF SUBSURFACE TECTONIC PATTERN AND BASEMENT RELIEF OF DEGEMA AND ITS ENVIRONS USING AEROMAGNETIC DATA

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Abstract
This study focused on the evaluation of subsurface tectonic pattern and examination of basement relief Degema and its environs. Aeromagnetic data of high resolution acquired from Nigerian Geological Survey Agency was used. Qualitative analysis was applied on the data using the Oasis Montaj Software. First order polynomial filtering was applied to the aeromagnetic data to obtain the Residual anomaly map. Furthermore, first and second vertical derivatives were performed on the residual map. The tectonics of the area was examined by analyzing the structural trends of the contoured maps. The qualitative analysis showed that structures in the area trend in the NW-SE, NE-SW, E-W and N-S directions and are expressed as elliptical, circular and curve linear anomalies. An elongated ellipsoidal anomaly of regional extent indicating a subsurface faulting trend and a dyke like structure were also observed in the shallow sedimentary region of the area. These were interpreted as a possible entrapment of hydrocarbon in the area.

Keywords: Magnetic data, Anomalies, subsurface tectonics, basement.

RFSM 030

BRIDGING THE GLOBAL ENERGY GAP USING GREEN HYDROGEN TECHNOLOGY: PROSPECTS, CHALLENGES, AND SOLUTIONS

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Abstract
In the bid to overcome the current global energy crises, the use of green Hydrogen to power hybrid microgrids presents a positive departure from the conventional and widespread use of fossil fuels onto decentralized and environmentally friendly energy systems. This review explores the role of green Hydrogen as a sustainable alternative that can complement renewable energy sources like solar and wind in bridging the global energy gap. It examines Hydrogen as a clean energy source, highlighting the use of renewable resources to produce green Hydrogen through electrolysis, the storage and subsequent utilization of green Hydrogen to generate electricity using fuel cells, citing some use case examples and outlining the economic and environmental benefits of the technology over traditional fuels. Furthermore, the review presents the technical, economic, policy, and regulatory challenges militating against widespread adoption of Hydrogen-based power generation, and proffers solutions to these challenges. Finally the review outlines expected innovations that will optimize the performance of hydrogen-based energy systems such as the integration of smart grids. In conclusion, hydrogen-based power generation holds lots of promises towards achieving decentralized, effective, zero-emission energy systems that will contribute immensely towards bridging the global energy gap.

Keywords: Green Hydrogen, Energy, Microgrids, Fuels.

RFSM 031

CHARACTERIZATION OF SOME CLAY SAMPLES FROM ABIA AND IMO STATES FOR POTENTIAL PRODUCTION OF EARTHENWARE.

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Abstract
Clay is one of the fine-grained natural soil materials that can be molded when wet and is dried and baked to make pottery, bricks, and ceramics. This paper presents the characterization of clay samples from some locations in Abia and Imo States, Nigeria. The samples labelled A, B, C, and D were processed and subjected to physico-chemical analysis. From the x-ray diffraction analyses, the studied samples were found to be rich in quartz, orthoclase, albite, dickite, muscovite, anhydrite, osumilite, clinochlore, and kaolinite. The linear shrinkage of samples ranges from 8.16% to 10.44%, respectively. The linear shrinkage on firing is higher for samples C and D than for A and B, which is attributed to burnt materials and loss of water. From Alterberg limit analysis, the liquid limits were between 26.73% and 39.21%, plastic limits were between 16.45% and 25.94%, and plasticity index was between 10.28% and 15.64%. It can be observed that samples C and D have higher plasticity and higher linear shrinkage values. In conclusion, samples C and D are good for the production of pottery.

RFSM 032

CHARACTERIZATION OF SOME CLAY SAMPLES FROM ABIA STATE FOR POTENTIAL PRODUCTION OF EARTHENWARE.

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Abstract
Clay samples from some locations in Abia and Imo States, Nigeria were studied. The samples labelled A, B, C, and D were processed and subjected to physico-chemical analysis. From the x-ray diffraction analysis, the studied samples were found to be rich in Quartz, Orthoclase, Albite, Dickite, Muscovite, Anhydrite, Osumilite, Clinochlore and kaolinite. The linear shrinkage of samples ranges from 8.16% to 10.44% respectively. The linear shrinkage on firing is higher for samples C and D than A and B which attributed to burnt materials and loss of water. From Alterberg limit analysis, the liquid limits were between 26.73% and 39.21%, plastic limits were between 16.45% and 25.94% and plasticity index were between 10.28% and 15.64%. It can be observed that samples C and D have higher plasticity and higher linear shrinkage values. Thus, are good for production of pottery.
Keywords: Clay, Physico-chemical, Shrinkage and Pottery Properties

RFSM 033

DETERMINATION OF OPTICAL RESPONSES OF GAAS/ALGAAS QUANTUM WELL DUE TO INTERSUBBAND TRANSITION AT TERAHERTZ FREQUENCY

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Abstract
Intersubband transition in quantum wells have strong potential for device application and are challenging field of fundamental studies. In this work, the optical responses of a 10 nm $GaAs/Al_{0.7}Ga_{0.7}As$ multiples quantum wells is investigated. Using a simple numerical approach and mathematical modeling applied to the first two conduction subbands, a simple model expression for the optical absorption is obtained. The interplay between subbands energies and dephasing and other scattering mechanism have impacted on the optical spectrum of the medium. Numerical and simulation results indicates the effects of such processes on the optical responses of the system. Clearly, increasing the dephasing decrease

the absorption peak of the structure. There also limits to which such scattering mechanism be tolerated.

Keywords: Inter-subbands transition, inter-band transition, Optical absorption

RFSM 034

ELECTRONIC COMPONENTS AS SOURCE OF WIRELESS POWER TRANSMISSION AND COMMUNICATION: A TOOL TO REDUCE ENERGY WASTE AND MATERIAL COST

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Abstract

Electricity is the generation of electrons which move/vibrate about their mean position thereby transferring energy from one point to another. The energy can be in form of radiation or a signal for conveying of messages electronically from one geographical region to another. Electronic components such as resistor, capacitor and inductor are employ in power, signal transmission and as a carrier of information from a generating station to the consumer when their circuit is network. The circuitry of these components forms the basis of transmitter which can be used to transmit or radiate energy from point source to other surrounding. Also, the circuit can be wired to form a receiver which ascertain the energy or signal within the surrounding environment. The rating of these components determines how much energy or signal that can be transmitted from the circuit through the atmosphere to the target point.

Keywords: Electrons, Transmission, Energy, Radiation, Vibration and Circuit-network

RFSM 035

MAGNETIC CHARACTERIZATION OF IRON ORE DEPOSIT IN ITAKPE AREA OF KOGI STATE, NIGERIA

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Abstract

Itakpe of kogi state contains the highest grade of iron ore among other sides in Nigeria. Three samples of as-collected, concentrate and bye-waste were characterized to study their magnetic properties. A 0.2g was each measured for vibrating sample magnetometer (VSM) and ^{57}Fe Mossbauer spectroscopy measurements. The investigation of the magnetic properties such as saturation magnetization M_s, and coercivity H_c, were determined at room temperature. The M_s and H_c of the as-collected sample were 2emu/g and 115 Oe respectively. The 10 emu/g obtained for the concentrate has the highest among the three samples. No significant change occurred in the H_c which has a value of 114 Oe, The waste showed 5emu/g with slightly higher H_c of 120 Oe. The results show that the waste is much higher in magnetization than the as-collected. This analysis revealed that the waste still contains a significant amount of iron, requiring an optimum beneficiation process for economic value. The ^{57}Fe Mossbauer spectroscopy performed on the three samples indicate that hematite (α-Fe_2O_3) as the major iron oxide phase, small phases of magnetite (Fe_3O_4) was detected and evidence of goethite (α-FeOOH) was seen. The isomer shift values showed the presence of Fe^{3+} in all the samples.

Keywords: Iron-Ore, Concentrate, waste, VSM, Mossbauer Spectroscopy

RFSM 036

RESOURCE ASSESSMENT AND TECHNO-ECONOMIC ANALYSIS OF OFF-GRID SOLAR PV-WIND HYBRID SYSTEM IN THREE SELECTED LOCATIONS IN ZAMFARA STATE, NIGERIA.

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Abstract
This study present resource assessment and techno-economic analysis of off-grid solar PV-wind hybrid system in three selected locations in Zamfara State, Nigeria: the study locations are; Anka, Gusau and Shinkafi. Twenty six years daily data of wind speed at 10m, 50m heights and global solar radiation of the locations was obtained from NASA. The annual average wind speed for Anka is 3.65m/s, Gusau has 3.67m/s and Shinkafi has 3.82m/s at 10m height respectively. Shinkafi has the highest annual solar radiation of 6.06 kWh/m^2/day, Gusau has 5.82kWh/m^2/day and Anka has the lowest annual average value of 5.64 kWh/m^2/day. The result suggested that E53, DW61, and Vensys V77 wind turbines can be used as stand- alone wind energy system for all the locations because of the sufficient wind energy generated while SWT-30kW and AEOLOS-H.50kW are suitable for hybrid system with solar because of their energy deficit. Due to the performance of the selected wind turbines and wind speeds of the locations, the study recommended using taller wind turbines towers for all the locations. The hybrid system is capable of reducing greenhouse gas emission which is good for our environment.
Keywords: Wind Energy, Solar Photovoltaic, Wind Turbines, Hybrid System.

RFSM 037

STRUCTURAL, MORPHOLOGY, AND OPTICAL PROPERTIES OF NEEM EXTRACT MEDIATED SNO_2 NANORODS

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Abstract
In this paper, we study the structural, morphology, and the optical property of Neem extract mediated SnO_2 nanoparticles. The synthesis of oxides of metals using plants extract and its curing has been of interest recently, in the advancement of green synthesis of semiconductor, as well as inhibitor. Neem leaves extract was obtained at 80 $^{\circ}$C for I hour, and it was mixed with the aqueous solution of 10 grams of Tin chloride. The structural and morphological properties of the precipitate show that, the SnO_2 nanoparticles are tetragonal nanorods, while the XRD peaks were found at 26.58°,33.87°, 37.95°,51.77°, and 54.75°. The crystallite sizes were found to be between 12.93 nm and 16.99 nm, and the optical band gap estimated to be 3.45 eV.
Keywords: Nanorods; Neem Extract; Tin dioxide

RFSM 038

STUDY ON DYE SENSITIZED SOLAR CELL FABRICATED USING DYE EXTRACTED FROM IRVINGIA GABONENSIS LEAVES

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Abstract
The performance of dye sensitized solar cell (DSSC) fabricated using dye extracted from Irvingia gabonensis leaves was analyzed in this work. The method employed is Sol-gel technique and ethanol was used as the extracting liquid. Fluorine Tin oxide (FTO) was used as electrode while Titanium dioxide () was used to absorb the dye. The elemental composition

of the Titanium dioxide film deposit was investigated using Energy Dispersive X-ray (EDX) and the absorption spectrum (light absorbance) of the chlorophyll dyes were measured using UV-1800 series spectrophotometer. The solar simulation was carried out using a Newport solar simulator. The plot of current density versus voltage (I-V curve) revealed that the open circuit voltage and short-circuit current density of the fabricated solar cell were 0.121 V and 0.0921 respectively. The overall conversion efficiency of the cell is %. The dye has band gap of 1.2 eV. The fabricated DSSC can be used in poultry houses where great infrared radiation is needed since the transmittance of the dye at near infrared region is high.

Keywords: Dye sensitizes cell, Irvingia gabonensis leaves, Titanium dioxide, Applications.

RFSM 039

THE ENERGY SPECTRA AND THERMO-MAGNETIC PROPERTIES OF ZIG-ZAG SINGLE-WALLED (6,0) CARBON NANOTUBE

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Abstract

In this work, a theoretical investigation of the spectra and thermo-magnetic properties of zig-zag single-walled carbon nanotube is carried out within the frame work of the Deng-Fan-Hulthen potential. We solved analytically in the presence of magnetic and Ahanorov-Bohm (AB) flux fields the Schrödinger wave equation using the Nikiforov-Uvarov (NU) method and obtained the energy eigen value and eigen function. It is observed that at two different potential range, δ, of 0.02 and 0.2 for m states ranging from 1 to -1and 2 to -2 a degenerate states occurred in the energy spectra when both magnetic and AB fields are switched off from the system. But when the magnetic field and AB flux were applied to the system, the degeneracy observed was removed, an increase in the energy eigen values is noticed. We calculate the partition function and used it to evaluate the thermodynamic properties of mean energy, specific heat, free energy, entropy and thermal conductivity in respect to temperature, magnetic field, AB flux field the quantum numbers, bond dissociation energy, tube's length and diameter through our graphical plots. Also the magnetic properties like the magnetization and magnetic susceptibility were examined in respect to temperature, magnetic field and AB flux.

Keywords: Deng-Fan-Hulthen potential, Zig-Zag (6,0) SWCNT, Nikiforov-Uvarov, Ahanorov-Bohm (AB) flux.

RFSM 040

THE OPTIMIZATION OF A SOLAR PHOTOVOLTAIC POWERED INCUBATOR: NIGERIA AS A CASE

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Abstract

Energy capacity remains a key determinant of national development. In Nigeria, only about 58% of the population is connected to the national grid, while the remaining 42% depend on privately generated electricity—approximately 400 GW—mainly from fossil fuel sources such as diesel, gas, and petrol. This heavy reliance on non-renewable energy sources poses significant challenges for essential applications like poultry incubation. This study focuses on the design and optimization of a solar photovoltaic (PV) powered incubator to address the inefficiencies caused by unreliable grid supply and high fossil fuel dependency. The incubator is constructed with a double-wall metal sheet, insulated with fiberglass to minimize heat loss. Its interior is partitioned into racks for egg trays containing fertilized eggs. A 250 W heater, supported by a fan, ensures uniform air circulation and heat distribution. Egg spacing is optimized for efficient airflow, while two electric motors manage automatic egg turning and humidity control. Dual thermostats maintain critical incubation conditions: a temperature of approximately 99.5°F (37.5°C) and humidity levels between 60% and 70% as hatching

approaches. The traditional method of chicken production is often disrupted by unpredictable power supply and weather conditions. However, the solar PV-powered incubator provides a controlled environment with constant temperature and humidity, resulting in improved hatch rates, better chick quality, enhanced operational efficiency, and significant cost savings. This study demonstrates the potential of renewable energy systems to sustainably transform poultry incubation practices in Nigeria.

Keywords: Power Reliability, Egg Incubator, Renewable Energy, Temperature and Humidity Control, Energy Efficiency.

RFSM 041

UNIFIED APPROACH TO QUANTUM DOT BANDGAP CONTROL: MODIFIED BRUS EQUATION FOR TEMPERATURE AND SIZE SENSITIVITY ACROSS SEMICONDUCTOR QUANTUM DOTS

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Abstract

Quantum dots (QDs) possess remarkable electronic properties that depend on their size and temperature, making them promising candidates for advanced optoelectronic, photonic, and energy applications. However, accurately predicting and controlling their bandgap energies across various semiconductor materials presents a significant challenge due to the limitations of traditional theoretical models. This study introduces a unified approach to modulating bandgaps in QDs by developing and applying a modified Brus equation that takes into account both quantum confinement effects and thermal influences. The model is systematically applied to four representative semiconductor quantum dots: CdSe, ZnO, CdS, and PbS, which represent different material classes (II-VI and IV-VI compounds). By including temperature-dependent material parameters such as effective masses, dielectric constants, and lattice thermal expansion, our proposed model provides precise predictions of bandgap shifts across a wide range of QD sizes and operating temperatures. The theoretical results have been validated against experimental data, showing improved accuracy compared to conventional Brus formulations. This work not only connects material-specific bandgap behavior with a generalized theoretical framework but also offers a predictive tool for the rational design of QDs specifically tailored for targeted optoelectronic functionalities under varying environmental conditions.

Keywords: Quantum dots, bandgap energy, Brus model, confinement effect.

RFSM 042

PERFORMANCE EVALUATION OF αβPLL SYNCHRONIZATION ALGORITHM UNDER ADVERSE GRID CONDITIONS USING PROCESSOR-IN-THE-LOOP

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Abstract

This work evaluates the αβPLL algorithm's performance under phase jumps, frequency shifts, and presence of harmonics in grid-connected PV system. To ensure the seamless integration of PV systems with AC grids, the use of synchronization techniques like the αβPLL algorithm is indispensable. The performances of the αβPLL algorithm under the three adverse grid conditions were evaluated in Simscape power system simulation toolbox and processor-in-the-loop experimentation in Matlab/Simulink environment. Both the simulation and experimental results showed that the algorithm exhibited robustness and reliability, affirming its potential for effective grid synchronization and harmonic mitigation in grid-connected inverter systems.

Keywords: Photovoltaic System, Grid-connected PV system, Phase lock loop, Processor-In-the-loop,

RFSM 043

CHARACTERIZATION AND FABRICATION OF SOME CLAY SAMPLES FOR CERAMIC TILES OBTAIN FROM SOME TOWN IN SOUTHEAST, NIGERIA

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Abstract
Majority of the available natural resources have not been receiving sufficient attention such as clay in Nigeria. Hence, there is need for further investigation. This study characterised four (4) different clay samples obtained from two locations Isuochi in Abia and Ihube in Imo State of Nigeria to establish their suitability as raw material for ceramic tiles fabrication. The clay samples were analysed based on B.S 1377:1975, I.S. 1498-1970 and ASTM standards to obtain their physical and refractory properties, such as chemical composition, plasticity index, total porosity, bulk density, linear shrinkage. The results revealed that the clays belong to Alumino-Silicate Refractories through chemical analysis, since the major constituents of the clay samples (more than 75%) were Alumina (Al_2O_3) and silica (SiO_2). The sample percentage clay contents ranged between 40.54 and 86.76; linear shrinkage (8.16-10.44 %); Plasticity index (10.28-15.64%); total porosity (33.98-55.15%); and Bulk density (1.12-1.32 g/cm^3**).** The clay properties meet the required standards for fireclay refractory materials, and this could replace imported clays / ceramics in refractory applications, such as in production of earthen wares, tiles. If sufficiently utilized, these resources could significantly contribute to Nigeria's economic growth.

Keywords: Clay, Characterization, Fabrication, Refractory.

RFSM 044

EFFECT OF GROWTH POTENTIAL ON THE OPTICAL AND STRUCTURAL PROPERTIES OF ELECTRODEPOSITED ZNS THIN-FILMS LAYERS FOR PHOTOVOLTAIC

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Abstract
Zinc Sulphide (ZnS) thin films have attracted considerable attention due to their broad applications in optoelectronic and solar cells devices. This study explores the impact of growth voltage on the properties of electrodeposited ZnS films using UV spectroscopy. ZnS thin films were deposited on fluorene-doped tin oxide (FTO) coated glass substrates at various growth voltages ranging from 1300mV to 1600mV. The optical and structural of the films were examined using X-ray diffraction (XRD), UV-visible spectroscopy. UV-visible spectroscopy measurements demonstrated that the optical bandgap of ZnS films were found to be 3.75 to 3.81 eV which was in the agreement with the bandgap of the bulk materials. The XRD analysis indicated that all deposited films exhibited a cubic Zinc blende structure with a preferred orientation along the (111) plane. The size of crystallites increased with rising growth voltage, indicating enhanced crystallinity at higher voltages. The peaks corresponded to $2\theta = 29.80^0$ and $2\theta = 52.52^0$ at grown potentials 1500mV with miller indices (101) and (113) have d 2.15, D 21nm and FWHM 0.65 as calculated using the Bragg's and Scherer's equation as the lattice spacing and crystallite sizes respectively.

Keywords: Growth voltage, Optical bandgap, Thin films, UV spectroscopy, X-ray diffraction (XRD), Zinc Sulphide (ZnS).

RFSM 045

EVALUATION THE EFFECT OF GROWTH VOLTAGE ON THE PROPERTIES OF CdTe THIN FILMS

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Abstract
Cadmium Telluride (CdTe) thin films have attracted considerable attention due to their broad applications in optoelectronic and solar cells devices. This study explored the impact of growth voltage on the optical and structural properties of electrodeposited CdTe films using UV spectroscopy and XRD characterization respectively. CdTe thin films were deposited on fluorene-doped tin oxide (FTO) coated glass substrates at various growth voltages ranging from 1300mV to 1600mV. The optical bandgap of CdTe films were found to be 1.54 to 1.61 eV which was within the range of the bandgap of the bulk materials. The XRD analysis indicated that all the deposited films exhibited a cubic Zinc blende structure with a preferred orientation along the (111) plane. The FT-IR ED-CdTe Peaks were distributed from 3500 cm^{-1} down to 4000 cm^{-1} due to its crystallinity in the thin film layer form. The absorption bands at 579 cm^{-1} in the spectra were due to T− stretching vibration band of water molecule absorbed on the surface of the sample due to the presence of moisture. The band around 1219 cm^{-1} is due to Te-O_2 groups stretching mode.

Keywords: CdTe, Growth voltage, Optical bandgap, Thin films, UV spectroscopy, X-ray diffraction (XRD).

RFSM 046

GREEN SYNTHESIS OF ZNO NANOPARTICLES FROM PLANTS EXTRACT AND THEIR RECOMMENDED APPLICATION: A RIVIEW

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Abstract
ZnO nanoparticles (NPs) is a white powdery substance nearly insoluble in water with some appreciable properties in optical, electronic, electrical, electromagnetic and thermal performance. Green synthesis of NPs is an approach of synthesizing nanoparticles using plants extracts for research and industrial applications. In this article, Green synthesis of ZnO from different plants and their recommended applications are intensively reviewed. Many results reported green synthesis as the most environmentally friendly and cost effective technique with the extracted ZnO NPs having appreciable photocatylic properties and effective for antibacterial applications like urinary tract infections, effective repellents for mosquitoes, water treatment and even plant growth enhancement**.**

Keywords: Green Synthesis, ZnO Nanoparticles, Plants Extract, ZnO Applications, Biosynthesis

RFSM 047

HYDROTHERMAL SYNTHESIS OF ORGANIC POLYMER-BASED MATERIAL FOR ELECTROCHEMICAL ENERGY STORAGE APPLICATIONS

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Abstract
The detrimental effects of carbon emissions to the environment and natural resources depletion have recently caused a general awakening, prompting the fabrication and use of greener technologies for energy conversion and storage. In this work, we have design and evaluated an organic conductive polymer-based material using hydrothermal synthesis method, for conversion of chemical energy to electricity in a single step, the GCD plot

showed an outstanding value of 243F/g at a current density of 0.5A/g,along with an energy density of 15.28Wh/Kg and power density of 1.07kW/Kg. this device may also find applications in waste water treatment and bioremediation processes.
Keywords: Hydrothermal, Polyaniline(PANI), Nanoparticles and Electrochemistry.

RFSM 048

INVESTIGATION OF COCONUT-PERIWINKLE SHELL BIO-COMPOSITES FOR ALTERNATE THERMAL INSULATION APPLICATION

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Abstract
Periwinkle and coconut shell are becoming increasingly popular as dielectric materials with thermal insulation properties. Natural sources of synthesis could provide a cheaper and more ecologically friendly alternative to chemically synthesizing such compounds. The utilization of a fine powder made from periwinkle shell and coconut shell composites as an alternative filler for composite materials and as a thermal insulation material was investigated in this study. Cleaning, oven drying, and milling of the components resulted in bio composite powder particles. X-ray fluorescence, scanning electron microscopy, X-ray diffraction, and thermal conductivity measurements were used to characterize the powders. CaO is the most abundant metallic oxide in the powder, accounting for 81.8 weight percent, according to XRF. For coconut shell, periwinkle shell, and coconut-periwinkle shell composite powder, the average grain size from SEM examination is 4.88 µm, 6.37 µm and 11.04 µm respectively. The thermal conductance of the composite powder is 21.18 $Wm^{-1}\,k^{-1}$, which is higher than TiO_2 and SiO_2, which are often employed as fillers in polymeric materials insulation. This shows that, in comparison to polymer composites containing TiO_2 and SiO_2, the composite powder could yield insulating materials with improved thermal conductivity characteristics, enhancing the growing waste to wealth concept.

RFSM 049

OPTIMIZING COST-EFFICIENT DIGITAL FILTER DESIGN THROUGH STEEP TRANSITION TECHNIQUES

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Abstract
The digital filter design involves developing a transfer function that meets specific frequency response requirements. This research explores the performance, steep transitions, impulse responses, and cost of implementing digital Infinite Impulse Response (IIR) filters using the bilinear transformation algorithm and MATLAB inbuilt functions. The study evaluates Butterworth, Chebyshev-I, Chebyshev-II, and elliptic filters across lowpass, highpass, bandpass, and bandstop configurations. Results reveal that higher filter orders result in slower rolloffs, while elliptic filters require shorter lengths for steep transitions, reducing implementation costs. Butterworth filters, though effective, are computationally costly due to higher order requirements. The findings conclude that Elliptic filters are the most efficient choice for achieving steep transitions with minimal cost and optimal performanceThe digital filter design involves developing a transfer function that meets specific frequency response requirements. This research explores the performance, steep transitions, impulse responses, and cost of implementing digital Infinite Impulse Response (IIR) filters using the bilinear transformation algorithm and MATLAB inbuilt functions. The study evaluates Butterworth, Chebyshev-I, Chebyshev-II, and elliptic filters across lowpass, highpass, bandpass, and bandstop configurations. Results reveal that higher filter orders result in slower rolloffs, while elliptic filters require shorter lengths for steep transitions, reducing implementation costs. Butterworth filters, though effective, are computationally costly due to higher order

requirements. The findings conclude that Elliptic filters are the most efficient choice for achieving steep transitions with minimal cost and optimal performance

RFSM 050

STRUCTURAL, DIELECTRIC AND RAMAN SPECTROSCOPY OF LA^{3+} NI^{2+} ZN^{2+} SUBSTITUTED M-TYPE STRONTIUM HEXAFERRITES

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Abstract

M-type hexaferrite exhibits excellent electromagnetic properties. These properties could be enhanced via substitution of appropriate cations. Thus, partial substitution of appropriate trivalent/divalent-tetravalent ions combinations at Ba^{2+}, Sr^{2+} and Fe^{3+} sites, can modify its Electromagnetic properties. In this work, M-type hexaferrites with $Ba_{0.8-x}Sr_{0.2}La_xFe_{12-x-y}Ni_xZn_yO_{19}$(x = 0.00, 0.05, 0.10; y = 0.00, 0.08, 0.16) compositions were prepared using sol–gel auto-combustion technique. The formation of single phase hexagonal ferrites is confirmed from XRD analysis with presence of magnetite. The crystallites sizes are in the range of 21.31–29.91nm. The FTIR spectra show three dominant peaks in the range of 400–600 cm^{-1} which indicate the formation of desired hexaferrite structure. The FESEM images reveal large crystallites with hexagonal platelet-like shapes, non-uniformly distributed and agglomerated due to magnetic interactions of crystallites. There is an enhancement in dielectric constant at high frequency and reduction of dielectric loss which appears to be independent on ions substitutions from FTIR analysis. The grain boundary resistance contributes most to the dielectric properties as indicated by Nyquist plot, whereas the Ac conductivity is the dominant conducting mechanism in the material which decrease with increase in ions substitutions. The properties of the synthesized material could be useful for electronics Applications.

RFSM 051

SYNTHESIS AND EVALUTION OF NANOHYBRID $Zn_xSn_yO_z$ THIN FILM FOR SOLAR CELL APPLICATIONS

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Abstract

Dye-sensitized solar cell has a number of attractive features; it provides flexible solar modules, and can be fabricated using conventional method. Dye-sensitized Nanohybrid $Zn_xSn_yO_z$ thin films were prepared on glass substrates using Master Airbrush Brand-model G25, G255-SET and G266-SET to deposit SnO, SnO: Zn^{2+} and SnO. The concentration of the dopant was varied from 0.1M – 0.5M of Zn^{2+} and 1% - 5% of dye-extract. The effect of Zn^{2+} and dye of tectona grandis on optical and structural properties of the films were examined and analysed. The result showed that the absorbance of the undoped SnO thin films at various substrate temperatures vary from 0.1–0.7. The dye doped samples showed an improvement in optical transmission at 625nm. The increase in transmittance could be attributed to the organic content of dye. Peak reflectance was observed at 350nm for un-doped and Zn^{2+} doped samples. The band gap energy of the dye doped sample is lower ranging from: 1.55 – 1.88eV than that of the Zn^{2+} doped samples, 1.60 – 2.22eV. The incorporation of the dyes shifted the fundamental absorption edge of the un-doped SnO thin films thus providing tuning effect of the band gap for solar cells application.

RFSM 052

THE EFFECTIVENESS OF JATHROPHA OIL AS A DIELETRIC FLUID

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Abstract
The quality of oil used as dielectric fluids is very important as it affect the performance of electrical and electronic devices. Its work of cooling, lubrication and insulation will be compromised if it does not possess the required properties. Therefore, this research examined some of these properties in Jathropha oil to investigate its effectiveness as dielectric fluid. The oil were extracted from Jathropha seed using mechanical method, examined in its crude state and in its purified states. Purification was done using modified Dijkstra and Opstal method to improve the quality. The effects of various frequencies within the range of 20Hz to 200 kHz on the dielectric properties of the oil were also examined. A setup consisting of Laboratory fabricated dielectric test cell and a programmable LCR-bridge was used for the examination of the effects of the frequencies on the dielectric properties. The viscosities of the oil at various temperatures within the range of 1^0C to 90^0C at intervals of 1^0C were examined to validate the most suitable environmental temperatures in which each oil can have optimum performance. There was exponential decrease of viscosity with increase in temperature of the samples.

Keywords: Dielectric fluid, Insulating materials, Jathropha oil, Dielectric loss, Purification.

RFSM 053

THE IMPACT OF VARYING ZINC AND COPPER CONCENTRATIONS ON THE MECHANICAL PROPERTIES OF PURE ALUMINIUM

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Abstract
The impact of varying zinc and copper concentrations on the mechanical properties of pure aluminium were investigated using Weighing Machine, Crucible Furnace, Lathe Machine, Mosanto Tensometer and Digital Rockwell Hardness Tester. Six samples made up of pure aluminium and aluminium-zinc (Al-Zn) alloyed systems with zinc concentrations of 0.00g, 17.00g, 22.00g, 27.00g, 32.00g and 37.00g labelled A, B, C, D, E and F; and six samples made up of pure aluminium and aluminium-copper (Al-Cu) alloyed systems with copper concentrations of 0.00g, 17.00g, 22.00g, 27.00g, 32.00g and 37.00g labelled A^1, B^1, C^1, D^1, E^1 and F^1 were fabricated to standard specimens and subjected to tensile strength, yield strength, mechanical hardness and ductility tests. Results showed that the mechanical hardness, tensile and yield strengths of aluminium increased more proportionally with an increase in copper concentrations than zinc concentrations. Also, the ductility of aluminium reduced with both increase in zinc and copper concentrations. From the results obtained, it can be inferred that the mechanical properties of pure aluminium can be altered by the addition of varying zinc and copper concentrations. And it can be recommended that copper is more effective in improving the mechanical properties of pure aluminium than zinc.

Keywords: pure aluminium, copper and zinc concentrations, tensile and yield strengths.

RFSM 054

ZINC OXIDE CO- DOPED WITH ALUMINIUM AND BORON (A:B:ZO) THIN FILMS BY SOL – GEL PROCESS FOR WINDOW LAYER OF SOLAR CELLS - A REVIEW

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Abstract
Solar energy is the most cost-effective and plentiful of all the long-lived natural resources so far. The economic development and technological progress of each country is dependent on it. The need for low-cost and high-performance optoelectronics leads to the development of TCO (transparent conductive oxide) thin films, especially for optical waveguides and CCO (clear conductive oxides) applications such as window layer solar cells, photo sensors, liquid crystal displays (LCD), heat mirrors (PES), photothermal conversion system (PES), gas sensors (GPS), optical position sensors and Acoustic wave transducers (AWT), etc. ZnONPs, or zinc oxide nanoparticles, have become the most popular metal oxide nanoparticles. They have attracted researchers from all over the world because of their unique optical and chemical properties. They are also biocompatible, low toxicity, sustainable and cost-effective. Al-doped ZnO increases the electrical conductivity of the material and improves its optical transparency. B Doped ZnO decreases the electrical resistivity of the material, improves its optical bandwidth and increases its carrier concentration. Doping with a single element can only improve one set of optical or electrical properties. Simultaneous doping with two elements improves both sets of properties. This makes it useful for applications like transparent conductive electrodes or window layer solar cells. The goal of this study is to understand the use of ZnO as TCO.

RFSM 055

COMPARATIVE ANALYSIS OF DYE-SENSITIZERS FOR ENHANCED DSSC PERFORMANCE: A COMBINED SCAPS-1D AND DFT STUDY

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Abstract
Dye-sensitized solar cells(DSSCs) offer a promising low-cost alternative to conventional photovoltaics, with sensitizer selection critically influencing performance. While synthetic dyes like N719 demonstrate high efficiency, natural dyes present eco-friendly alternatives needing optimization. This study compares the photovoltaic performance of TiO_2-based DSSCs sensitized with N719 synthetic dye and anthocyanin natural dye, evaluating their potential for solar energy conversion. The investigation employed: SCAPS-1D simulations for J-V characteristics, quantum efficiency (EQE), and capacitance-frequency (C-F) analysis, Density Functional Theory (DFT) to validate dye-TiO_2 electronic interactions and comparative assessment of key parameters: Voc, Jsc, fill factor (FF), and conversion efficiency. N719 exhibited superior performance (η = 8.2% vs. anthocyanin's 3.7%), attributed to broader light absorption and better charge injection efficiency. However, anthocyanin showed promising charge transfer properties (DFT-confirmed LUMO alignment >0.3 eV above TiO_2 CB), suggesting potential for improvement via structural modification. While synthetic dyes currently outperform natural alternatives, the study identifies specific electronic structure modifications to enhance anthocyanin-based DSSCs, supporting sustainable photovoltaic development.

Keywords: DSSCs, Natural dyes, SCAPS-1D, DFT

RFSM 056

DEPOSITION TIME INFLUENCE ON THE OPTICAL, ELECTRICAL, AND PHOTOSENSING PROPERTIES OF CDS THIN FILMS

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Abstract

Cadmium sulphide (CdS) thin films were synthesized through chemical bath deposition (CBD) at a temperature of 80°C, with varying deposition times between 5 and 30 minutes to explore their morphological, optical, and electrical properties for optoelectronic uses. The thickness and surface roughness varied significantly with different deposition times, with the film obtained after 30 minutes showing the maximum thickness (3.0 μm) and roughness (30,297 Å), whereas the sample from the 25-minute duration had the minimum values (0.8 μm). Optical evaluations showed significant absorption in the ultraviolet region and different responses in the visible to near-infrared spectrum, with the 25-minute film exhibiting maximum absorption and optical conductivity. The bandgap energies were observed to decrease from 2.42 eV to 2.05 eV, indicating the impact of morphology. Trends in the refractive index and dielectric constant indicated an increase in optical density and structural changes with time. Hall effect analyses verified n-type conductivity, with the highest carrier concentration observed at 10 minutes and the greatest mobility (1420 cm^2/Vs) at 25 minutes, attributed to diminished scattering. Resistivity decreased until 15 minutes but increased sharply afterward due to structural imperfections. The performance of the photodetector was best at 20 and 30 minutes, with the 30-minute film achieving the highest photosensitivity (3110.08%) and responsivity (1.76×10^{-2} mA/W). These findings emphasize the significant influence of deposition time on the energy retention, charge transport, and optoelectronic characteristics of CdS thin films.

Keywords: Cadmium sulphide (CdS) thin films, Chemical bath deposition (CBD), Deposition time, Optoelectronic properties, Photosensitivity

RFSM 057

DESIGN OF A STANDALONE PHOTOVOLTAIC SYSTEM FOR THE DEPARTMENT OF CHEMISTRY, FACULTY OF SCIENCE COMPLEX, GOMBE STATE UNIVERSITY, NIGERIA.

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Abstract

This paper presents the design and implementation of a standalone photovoltaic (PV) system for the Department of Chemistry at Gombe State University, Nigeria. This is to address the challenges of unreliable power supply and the environmental impact of conventional energy sources arising due to usage of generators. An energy audit was conducted to assess the power requirements of offices, Toilets and various laboratory appliances, revealing significant energy demands that necessitate a sustainable solution. The study details the sizing of the solar array, battery storage, charge controllers, and inverters, ensuring that the system can meet the daily energy needs of the department. By utilizing a Mitsubishi MLE208HD2 PV module, the design incorporates a safety factor to enhance reliability and efficiency. The findings highlight the potential of solar energy to improve both staff and students' academic performance by providing a consistent power supply, thereby fostering a conducive learning environment. This research contributes valuable insights into the feasibility of renewable energy systems in educational institutions, promoting sustainable practices in the region. The results indicate a 3 days of autonomy with total load power of appliances of 11340 and total energy requirement of 61899.286 Wh/day. This will require 19343.527 AH, 108 panels of 280 W each, 50 KVA rated inverter, 9 charge controllers rated 60 A each, panel coverage area of 13.2. m^2.

Keywords: Solar photovoltaic System, Energy audit. Sizing, Appliances.

RFSM 058

DEVELOPMENT OF MAIZE DE-HUSKING AND THRESHING MACHINE

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Abstract
Maize is a staple food across the world, it is also a raw material for producing corn starch, corn syrup, various sweeteners and even industrial chemicals. The processing of maize after harvesting include: drying, de-husking, shelling, storing, and milling. One of the major post-harvest challenges in maize is shelling. Harvested maize is traditionally shelled by hand or by beating sacks stuffed with maize cobs with wooden flails which is highly inefficient and tedious. A de-husking and threshing machine has been developed using locally available materials and its performance was evaluated. The new machine consists of three compartments which include the de-husking, threshing and cleaning chamber and is powered with a 13.5 hp petrol engine. The motor provides drive through belt connections to drive the pulley on de-husking, threshing and cleaning chamber. The machine efficiency was determined to be 91 % and delivered satisfactory results during testing.
Keywords: Construction, Design, De-husking, Local materials

RFSM 059

DIELECTRIC AND THERMAL REINFORCING EFFECTS OF RECYCLED BOROSILICATE GLASS ON POLYTETRAFLUOROETHYLENE MATRIX AT A MICROWAVE FREQUENCY

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Abstract
The aim of this work was to fabricate polytetrafluoroethylene (PTFE) composites filled with recycled borosilicate (rBRS) glass for microwave printed circuit board (PCB) substrate application. The rBRS powder was prepared via a ball milling technique and dispersed in the PTFE matrix in different volume fractions (5%–25%) to develop the PTFE/rBRS composites through a dry powder mixing technique. The impact of filler content on the composites' structural, dielectric, and thermal properties were examined using X-ray diffraction (XRD), scanning electron microscpy (SEM), Rectagular waveguide (RWG) connected to an Agilent E5063A vector network analyser, and L75 Platinum dilatometer. The SEM images showed that rBRS filler was more dispersed in the composites at lower filler contents. The composites showed excellent microwave properties with relative permittivity of 2.31 and a loss tangent of 0.0018 at the highest filler content of 25% at 10 GHz. The composites also exhibited a good thermal property with a mean coefficient of thermal expansion (CTE) of 60.54 ppm/◦C at 25% filler content, suitable for microwave substrate application.
Keywords: PTFE, CTE, RWG, relative permittivity, loss tangent

RFSM 060

ENHANCEMENT OF BAND GAP OF SOL GEL DERIVED PLASMONIC TITANIUM (IV) OXIDE

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Abstract
Screen printed Sol-gel derived titanium dioxide was dried gradually to 500°C and cooled down to 25°C. 0AgNPs were deposited using successive ionic layer adsorption and reaction cycles. Alpirin natural dye prepared through a cold extraction method was used as a photosensitizer. The effects on the optical and structural properties of TiO2 were investigated.

The films were characterized by surface profilometry, UV-VIS spectroscopy, X-ray diffraction, scanning electron microscopy, and energy-dispersive x-ray spectroscopy. It was observed that the particles were nanoparticles; the average crystallite size for undoped TiO2 calculated from Scherer's equation was 20.37 nm, 21.39 nm for doping with alpirin dye, 18.26nm for doping with AgNPs+alpirin dye, and 19.03nm for doping with AgNPs. The direct bandgap was well reduced from 3.65eV to 2.52eV to 2.00eV and then to 1.78eV, respectively. The indirect band gap reduced from 3.35eV to 2.30eV, then to 1.80eV and to 1.60eV respectively. SEM reveals the morphological changes as a result of the dopants, and EDS confirms the presence of titanium and oxygen in the samples.The results show that doping of TiO2 with alpirin dye and AgNps+alpirin and AgNPs significantly narrowed the band gap and made the TiO2 more crystalline. This shows a good property for increased photoactivity.

Keywords: Band gap, Plasmon, alpirin, titanium.

RFSM 061

ENHANCEMENT OF ELECTRICAL CONDUCTIVITY OF GRAPHENE-COATED GLASS SLIDES VIA SULFURIC ACID CHEMICAL PASSIVATION: A SYSTEMATIC STUDY USING THE FOUR-POINT PROBE METHOD

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Abstract

In this study, we investigate the effect of chemical passivation using sulfuric acid on the electrical conductivity of graphene-coated glass slides. Graphene films were treated with sulfuric acid at concentrations ranging from 0.1 M to 0.9 M, aiming to optimize their conductive properties for supercapacitor applications. The four-point probe technique was employed to accurately measure the sheet resistance and resistivity across multiple points on the samples. The results indicate a significant dependence of electrical conductivity on acid concentration, with treated samples showing improved uniformity and reduced sheet resistance compared to untreated controls. This work provides valuable insights into simple post-processing strategies for enhancing the performance of graphene-based materials.

RFSM 062

EVALUATING THE MECHANICAL PROPERTIES OF GRINDING WHEELS PRODUCED FROM OYSTER SHELL AND BAKELITE POWDER

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Abstract

The dust being released during grinding of metals can be harmful to human health, so the need for materials that are health and eco-friendly to be used as abrasives in producing grinding wheels. This study investigated the mechanical properties of a grinding wheel produced using oyster shell as abrasive and Bakelite as the binder so as to serve as a sustainable alternative to conventional abrasives. The grinding wheel samples were produced using the oyster shell as the abrasive, Bakelite powder and a glass fibre which served as a reinforcement. They were prepared using different ratios of the oyster shell and Bakelite powder then characterized to check their mechanical properties along with that purchased from the market as the control. The result showed that sample 4 with a composition of 60:40 of the binder and the oyster shell abrasive had the best results in the hardness test, tensile test and coefficient of static friction test carried out. The sample 4 had the next best result in the flexural strength test, as the control had the best result. This implies that the oyster shell can comfortably serve as an eco-friendly alternative to the abrasive used in making grinding wheel.

Keywords: Oyster shell, Bakelite Powder, Flexural Strength, Tensile Strength

RFSM 063

INHIBITION CHARACTERISTICS OF EXTRACT OF VELVET GREENERY IN THE PREVENTION OF MILD STEEL CORROSION IN H2SO4, NAOH AND NACL MEDIA

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Abstract
Inhibition characteristics of extract of Velvet (Mucuna poggei) leaf was tested in 1 M H2SO4, NaOH and NaCl media using weight loss method. Mild steel of 16mm (diameter) was cut into coupons of 6mm (length) and their weight determined using digital weighing balance. Five beakers were used for each of the media. 80ml each of the media was introduced separately into the beakers and different volumes of the leaf extract ranging from 5ml to 20ml was injected into them except the controls. Coupons were fully immersed into the beakers at room temperature in quadruples. The set up was allowed for an exposure time of 672hrs with a coupon withdrawn from each beaker every 168 hours and reweighed to determine the weight difference. The corrosion rate was calculated using CR= (mm/yr). The inhibition efficiency of the extract was calculated using, IE% = (1– ×100. The results obtained indicate that weight loss was higher in uninhibited media. It was observed that increase in volume of the extract decreased the corrosion rate. The efficiency of the extract at 20ml was 72.56% in H2SO4, 66.67% in NaCl. The results indicate that there was no noticeable weight loss in the mild steel in both inhibited and uninhibited 1M of NaOH environment. This suggests that at room temperature NaOH does not attack mild steel. Based on these findings, the results suggest that velvet leaves extract is a good inhibitor both in acidic and salty environments and can be added to inhibitor data bank.

Keywords: Inhibition Characteristics; Velvet leaf extract; mild steel corrosion; NaCl; NaOH; H2SO4

RFSM 064

INVESTIGATION OF CU CONCENTRATION AND ANNEALING TEMPERATURE ON THE PERFORMANCE OF CDS THIN FILMS FOR PHOTODETECTORS

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Abstract
Cadmium sulphide (CdS) thin films doped with copper (Cu) were synthesized through the chemical bath deposition (CBD) method, maintaining a constant deposition duration of 30 minutes for use in photosensor applications. Different concentrations of Cu (ranging from 0.5% to 2.0% in volume) were added, and the films underwent annealing at temperatures of 200°C and 400°C to investigate how both doping and thermal treatment influence their morphological, optical, electrical, and photosensing characteristics. The addition of Cu resulted in thinner films with reduced surface roughness, with the 1.5% Cu-doped variant displaying the smoothest surface morphology. Optical analysis indicated an increase in the bandgap energy, which peaked at 2.39 eV for the 1.0% Cu-doped sample annealed at 200°C; there were also improvements in optical conductivity and dielectric constants with higher Cu concentrations and annealing temperatures. Hall effect measurements demonstrated n-type conductivity across all samples, with the 1.5% Cu-doped film showing the highest mobility (1808 cm^2/Vs) and the lowest resistivity ($1.491 \times 10^4\ \Omega \cdot cm$). Although undoped CdS films initially exhibited considerable photosensitivity, this diminished following annealing; in contrast, Cu-doped films, particularly those with 0.5% to 1.5% Cu, showed significant enhancements in both photosensitivity and responsivity after being annealed at 400°C. These findings suggest that the combination of Cu doping and controlled annealing greatly improves the optoelectronic properties of CdS thin films, making them more effective for photosensor applications.

Keywords: CdS thin films, Cu doping, chemical bath deposition, annealing, photosensitivity, responsivity.

RFSM 065

INVESTIGATION OF THE ELECTROCHEMICAL PROPERTIES OF 3D RECYCLABLE ALUMINIUM DOPED $LiMn_2O_4$ ELECTRODE: IMPROVED POWER AND ENERGY DENSITIES FOR LITHIUM-ION BATTERY USAGE

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Abstract
The Composites of Al-Doped LiMn2O4; Al0.1:(LiMn2O4)0.9 and AI0.3:(LiMn2O4)0.7, were prepared using the hydrothermal method and drop casting deposition technique. The electrochemical performance of the Al-doped LiMn2O4 composite as a promising anode material for lithium-ion batteries was characterised by cyclic voltammetry analysis, electrochemical impedance spectroscopy and galvanostatic charge discharge analysis. The anodes' material exhibits a reversible capacity loss, which can be primarily linked to reverse reactions within the solid electrolyte interface formation, aluminium adsorption in the conducting LiMn2O4, and the electrolyte's electrochemical breakdown. The charges that are retained in the anode material during charging showed a linear decline in charge capacity as charging current intensity increased. Ionic polarisation was the reason for the observed drop in the charge and discharge capabilities at the current density of 5 A/g. Having greater specific capacitance and energy density, the composite Al0.1:(LiMn2O4)0.9, is a better anode material for electrochemical applications compared to Al0.3:(LiMn2O4)0.7, also its comparatively higher power density at a scan rate of 5 mV/s is mostly explained by its lower equivalent series resistance.

RFSM 066

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

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

RFSM 067

OPTICAL PROPERTIES CHARACTERIZATION OF SAWDUST WASTE FOR SUSTAINABLE OPTICAL APPLICATIONS

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Abstract
This research investigates the optical properties of fermented liquid derived from sawdust waste, utilizing UV-Vis spectrophotometry and refractometer. Sawdust waste was chosen as

the substrate due to its abundance, low cost, and potential for sustainable material development. The study aims to characterize the absorption and transmission spectra of the fermented liquid and determine its refractive index, thereby exploring its potential for sustainable material development. The employed reagents in this study, including fermentation agents and solvents, were used to facilitate the breakdown of sawdust waste and extract the fermented liquid. These reagents were essential for ensuring the effective fermentation process and accurate measurement of optical properties. Findings indicated significant absorption and transmission characteristics, with a stable refractive index across the visible spectrum (380-780 nm). At 380 nm its shows high absorbance in ultra-violent range and lower transmittance, whereas 780 nm recorded the highest transmittance and minimal absorbance as compared to 380 nm. Furthermore, the refractive index was measured using refractometer at different temperatures from 30 – 70 0C, the results revealed that, as the temperature increases the refractive indices decreases. These findings suggest that the fermented liquid could serve as a viable alternative to conventional materials in various optical applications, such as in the development of eco-friendly optical coatings and sensors. Further research is recommended to explore additional optical properties and practical applications of this innovative material, potentially contributing to advancements in sustainable material science and technology.

Keywords: Sawdust Waste, Optical Properties, Fermentation, Absorbance, Transmittance, Refractive index.

RFSM 068

PEROVSKITES: STRUCTURE, PROPERTIES, RECENT ADVANCES, CHALLENGES AND FUTURE PROSPECTS (REVIEW)

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Abstract

Perovskites have emerged as a pivotal class of materials in solid-state physics and materials science due to their remarkable structural versatility and unique optoelectronic properties. Characterized by the general formula ABX3, crystal structure where 'A' and 'B' are cations and 'X' is an anion, perovskites exhibit a wide range of tunable electrical, magnetic, and optical properties. In recent years, organic-inorganic halide perovskites have shown exceptional potential in photovoltaic applications, especially in the development of high-efficiency, low-cost solar cells. Despite these promising attributes, challenges such as environmental instability, toxicity, and scalability hinder their widespread application. This review comprehensively explores the structure-property relationships of perovskites, recent breakthroughs in synthesis and device engineering, existing challenges and limitations, and the broad scope of their applications, ranging from solar energy to light-emitting diodes and photodetectors. The review also highlights the future directions for overcoming existing hurdles and realizing the full potential of perovskite materials in sustainable technologies.

Keywords: Perovskite, synthesis, advances,

RFSM 069

SIGNIFICANCE NUMBER LAYERS IN OPTICAL EDGE FILTERS DESIGN USING OCTAVE

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Abstract

Optical coating is one of the process of deposition one or more thin films of materials of alternative layers on optical components such as mirrors or lenses, which changes the direction in which light in the components reflect or transmit. Objective: This paper aims to study the effect of increasing number of layers in optical filter design using the optical matrix approach method. MATLAB program version 8.1 was used to model the designs. Result: The

reflection of a glass substrate of refractive index ns = 1.5 was enhanced by adding successive dielectric layers of alternating high refractive index (nH = 4.7) from MoS2 material and low refractive index (nL = 3.2) from Si material respectively. The reflectance increased as the number of layers increasing or vice versa. Therefore, the maximum reflectance is achieved by adding a successful layer depending on the design (glass 12|LH|air) the reflectance and transmittance. Conclusions: The reflectance and transmittance of the glass increased by increasing the number of layers and the high reflectance and transmittance achieved by putting the layer of high refractive index as outer layer. It is observed that the bandwidth of the reflectance and transmittance is affected by increasing the number of layers.

RFSM 070

SIMULATIONS OF MODIFIED PTFE MATRIX WITH Fe_2O_3 USING FINITE ELEMENT METHOD AT MICROWAVE FREQUENCY

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Abstract

The objective of this study was to fabricate an inexpensive polytetrafluoroethylene (PTFE) composite filled with recycled Fe2O3 nanofiller synthesized via ball milling. PTFE/Fe2O3 composites were prepared using dry powder processing, with Fe2O3 nanofiller dispersed in PTFE at weight percentages of 5%, 7.5%, 10%, 12.5%, and 15%. Characterization using a field emission scanning electron microscope (FESEM) revealed better filler dispersion at 15% weight, while lower filler percentages showed Fe2O3 nanoparticle agglomeration. Dielectric properties measured at 8.2 GHz showed that ε' and ε" varied from 2.47 and 0.12 at 5% weight to 3.10 and 0.21 at 15% weight, respectively. These values further increased to 2.44 and 0.10 at 5% weight and 3.08 and 0.19 at 15% weight at 12.4 GHz. Consequently, PTFE/Fe2O3 composites demonstrated enhanced ε' and ε" values, making them suitable for microwave substrate applications.

RFSM 071

SYNTHESIS AND CHARACTERISATION OF CO-DEPOSITION PBS/ZNS THIN FILMS USING SILLAR TECHNIQUES

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Abstract

Thin-film semiconductors are widely studied for their applications in solar cells, photodetectors, and infrared sensors. In this paper, we investigate the structural, morphological and optical properties of the PbS/ZnS film, and evaluate their potential optoelectronic applications. PbS/ZnS thin film was synthesized using the Successive Ionic Layer Adsorption and Reaction (SILAR) method by varying deposition cycles without post-deposition annealing. The X-ray diffraction (XRD) peaks confirmed the presence of cubic phases of PbS and ZnS with increasing crystallinity at higher SILAR cycles, while the SEM and EDS showed the surface morphology of layer-by-layer deposition as well as the percentage composition respectively. The estimated optical band gap values range between 1.2eV to 1.9 eV which makes the co-deposition suitable for optoelectronics.

Keywords: PbS/ZnS, SILLAR, deposition cycles, Optoelectronics.

RFSM 072

THE MECHANICAL PROPERTIES OF AUTOMOBILE BRAKE PAD PRODUCED FROM PERIWINKLE SHELL AND BAKELITE POWDER

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Abstract
The importance of an automobile brake pad in vehicles can never be over emphasized as it is responsible for bringing the moving vehicle to a stop. The present state of the economy has increased the demand for brake products that are affordable and durable at the same time. This prompted the need for the production of automobile brake pad of low cost but high quality and environmentally friendly. Instead of using the regular industrial abrasive, this study investigated the production of automobile brake pad using periwinkle shell as the abrasive, glass fibre as reinforcement and Bakelite powder as the binder. The samples used for this study were made from a mixture of the binder and abrasive in the ratio 10:90, 20:80, 30:70, 40:60 and 50:50 respectively. The samples were characterized alongside the industrially produced automobile and comparison were made. The results indicated that the sample 3 with a 30:70 had the highest of wear rate, flexural strength, hardness and impact tests. From the results, it is obvious that the periwinkle shell can comfortably be used as a replacement for industrial abrasive in making cost effective and environmental friendly automobile brake pads.
Keywords: Periwinkle shell, Bakelite powder, wear test, flexural test.

RFSM 073

CONSTRUCTION OF A SINGLE-PHASE CHANGE OVER SWITCH

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Abstract

The construction of a single-phase changeover switch is a very important component in the electrical systems, it is designed to seamlessly transfer power supply between two sources, typically a primary utility grid and a backup power source. This paper presents the design and construction of a reliable and efficient single-phase changeover switch suitable for residential or small-scale industrial applications. The system incorporates relays, circuit protection mechanisms, and user-friendly controls to ensure smooth operation and protection against overloads and short circuits. The design emphasizes cost-effectiveness, simplicity, and operational safety, while offering the flexibility to adapt to various power configurations. Detailed analysis of the switching mechanism, response time, and durability under different load conditions demonstrates the effectiveness of the proposed design. This work aims to contribute to improved energy management and reliability in power distribution systems, addressing the growing demand for robust and adaptable electrical infrastructure.

RFSM 074

DESIGN AND FABRICATION OF A SMART-ENVIRONMENTAL AND CLIMATOLOGICAL OBSERVATION DATA STATION (SMART-ECODS)

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Abstract
We hereby present a detail result from our design and fabrication of a Smart environmental and climatological observing data station Smart-ECODS. Smart-ECODS is a climatic and environmental Instrument with automated data collection capability using basic locally sourced materials. Our choice of design is carefully drawn with the aim of fabricating a one-stop smart instrument that is adaptive to the Nigerian weather and ambient temperatures using

group of embedded sensors. Arduino Micro-controller as a core server system and wireless data logging sensor using data logging shield as a communication protocol and the DTH11 (Temperature and Humility Sensor), Rain sensor, GP2Y1010AU0F Optical dust sensor, LDR (Light Dependent Sensor). Result of our instrument shows a collection of real time data logged automatically to an embedded SD card showing individual results on cloud logging of data on Air Temperature, Atmospheric Pressure, Relative Humidity, Solar Intensity, UV radiation, Precipitation, Rain rate, Soil temperature, aerosol particulate matter and Soil moisture content. The instrument is a robust device made from locally sourced materials and built to suit the Nigerian needs of Space and Atmospheric science measurements needed for information gathering and scientific study.

RFSM 075

CHARACTERIZATION OF CARBON NANOTUBE DOPED COPPER OXIDE THIN FILMS PREPARED BY SPRAY PYROLYSIS METHOD FOR SOLAR CELL APPLICATION

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Abstract

In this present work, pure copper oxide (CuO) and carbon nanotube doped copper oxide (CNT-CuO) thin films were produced using the spray pyrolysis method. Copper II nitrate trihydrate (Cu (NO3)2.3H2O) was used as precursor for CuO and Single walled carbon nanotube (SWCNT)was used as the dopant. The effect of precursor concentration and carbon nanotube (CNT) on the electrical and optical properties of CuO thin films synthesized on the sodalime glass substrates at 350 oC were investigated. The films were characterized by Ultraviolent Spectrophotometer (UV), Scanning Electron Microscopy and Four-Point Probe Technique. The effect of 2 wt% CNT concentration on CuO structure has a critical role to control the electrical and optical properties of the thin films. The energy band gap of thin films trends downward with increasing precursor concentration and addition of CNT. The result of this study concludes that CNT-CuO thin film has the potential application in solar cell.

Keywords: Copper Oxide (CUO), Spray Pyrolysis Method, Carbon Nanotube (CNT), Solar Cell

RSFM 076

STUDY OF OPTICAL AND ELECTRICAL PROPERTIES OF CARBON NANOTUBES (CNTS) THIN FILMS DEPOSITED BY SPRAY PYROLYSIS METHOD FOR OPTOELECTRONICS APPLICATION.

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Abstract

This study is motivated by the limited research on carbon nanotube (CNT) thin film, despite its most promising application as an alternative technology in future electronics to replace indium tin oxide (ITO) and silicon which is the dominant materials used for industrial-scale transparent conducting film application. The study aims to fabricate CNT thin films using the spray pyrolysis method at 0.1 M and 0.2 M concentration. The effect of precursor concentration on the optical and electrical properties of CNTs thin films synthesized on the sodalime glass substrates at 350 oC were investigated. The thin films were characterized by Ultraviolent Spectrophotometer (UV) and Four-Point Probe Technique. The optical band gap energy of CNTs thin films trends downward with increasing precursor concentration. The transmittance and electrical conductivity of the films increases with increase in precursor

concentration. The result of this study concludes that concentration has effect on the optical and electrical properties of CNTs thin films and the high electrical conductivity, high transmittance, low absorbance and low optical band gap energy of the films makes it useful in optoelectronics devices.

Keywords: Thin Film; Spray Pyrolysis; Carbon Nanotube (CNTs); Optoelectronics.

RSFM 077

MODULATION OF OPTICAL PROPERTIES AND CONDUCTIVITY IN THERMALLY TREATED DC MAGNETRON SPUTTERED TUNGSTEN OXIDE THIN FILMS FOR TECHNOLOGICAL APPLICATIONS

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Abstract

The development of thin film coatings with replicable properties from metal oxides is critical for numerous modern applications, including antireflective and electrochromic coatings, as well as the increasingly important technology of smart windows. Within the realm of functional metal oxides, transparent conductive oxides (TCOs) are particularly vital due to their unique combination of visible light transparency and electrical conductivity. This study examined how annealing at 200°C affects the optical properties and conductivity of DC magnetron sputtered WO_3 thin films deposited with 0.1M, 0.2M, and 0.3M precursor concentrations. UV-Vis analysis (200-900 nm) revealed a sharp absorption edge between 370-500 nm. Annealing increased absorbance for the 0.1M sample but decreased it for others. The refractive index of annealed films generally decreased (380-500 nm) then increased (500-900 nm). Transmittance was highest (over 80%) in the visible range and generally improved with annealing, especially at higher concentrations likely due to increased film density. Conversely, annealing reduced optical conductivity, potentially by decreasing free charge carriers. The findings presented herein emphasize the significant role of thermal annealing in tuning the optical and conductive attributes of WO_3 thin films. This controlled modification suggests their considerable utility in advanced technologies like smart windows and optical waveguides.

Keywords: Sputtering, Conductive Oxides, electrochromic, Direct Current

RSFM 078

STUDY ON DYE SENSITIZED SOLAR CELL FABRICATED USING DYE EXTRACTED FROM IRVINGIA GABONENSIS LEAVES

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Abstract

The performance of dye sensitized solar cell (DSSC) fabricated using dye extracted from Irvingia gabonensis leaves was analyzed in this work. The method employed is Sol-gel technique and ethanol was used as the extracting liquid. Fluorine Tin oxide (FTO) was used as electrode while Titanium dioxide (TiO_2) was used to absorb the dye. The elemental composition of the Titanium dioxide film deposit was investigated using Energy Dispersive X-ray (EDX) and the absorption spectrum (light absorbance) of the chlorophyll dyes were measured using UV-1800 series spectrophotometer. The solar simulation was carried out using a Newport solar simulator. The plot of current density versus voltage (I-V curve)

revealed that the open circuit voltage and short-circuit current density of the fabricated solar cell were 0.121 V and 0.0921 $mAcm^{-2}$ respectively. The overall conversion efficiency of the cell is 8.535×10^{-5} %. The dye has band gap of 1.2 eV. The fabricated DSSC can be used in poultry houses where great infrared radiation is needed since the transmittance of the dye at near infrared region is high.

Keywords: Dye sensitizes cell, Irvingia gabonensis leaves, Titanium dioxide, Applications.

RSFM 079

EFFECT OF DEPOSITION TIME OF POTASSIUM PERMANGANATE NANO THIN FILMS IN TRANSFORMER CORE EDDY CURRENT REDUCTION

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Abstract

This research explored the use of potassium permanganate ($KMnO_4$) thin films, synthesized electrochemically on soft iron cores, as an alternative material for lamination of transformer cores. The study centered on characterizing the crystallographic and electrical properties of $KMnO_4$ films at different deposition times (5-20 minutes) and comparing them to a silicon iron steel control. Four samples of $KMnO_4$ (X_1,X_2,X_3 & X_4) were deposited at different intervals (5,10,15 & 20) minutes respectively. Characterization of the deposited films with X-ray diffraction (XRD) validated the crystalline structure of $KMnO_4$ nanoparticles, demonstrating consistent peak positions at 2θ angles of 45.2° and 65.4° across the various deposition times, with d-spacing values of 1.96 Å and 1.42 Å, respectively. Result showed that sample X_4(Sample with the highest deposition time of 20minutes) has the strongest intensity count of 26.61 showing that longer deposition time increases the intensity which in turn enhances crystallinity, alignment and stable crystal size within the thin film. Similarly electrical investigation showed that increasing the deposition time of $KMnO_4$ films improves resistivity, and reduces conductivity, resulting in a reduction in eddy current losses and increased energy efficiency.

Keywords: Potassium Permanganate ($KMnO_4$), Deposition time, Eddy Current loss, Transformer core

RSFM 080

INVESTIGATING ZINC-MEDIATED CHARGE TRANSPORT IN A HETEROSTRUCTURE DOUBLE ACTIVE LAYER SOLAR CELL

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Abstract

The reason lead-free inorganic perovskite solar cells (PSCs) had not experimentally surpassed an efficiency of 18% has been adduced to their chemical instability. In this paper, we propose that the reason for a discouraging efficiency is not driven by basic chemistry but a much more complex process that may mitigate frantic efforts on the lead-free PSC. In this paper, a double zinc-base active layer with distinct zinc-based hole and electron transport layers was proposed to determine the pattern of hole and electron transport in a zn-based solar cell architecture. The optoelectronic parameters, ion mobility, and microstructural parameters were achieved using the one-dimensional solar cell capacitance simulator (SCAP-1D) and the stopping and range of ions in matter (SRIM) code. It was observed that the shunt resistance defect was the major shortcoming of the zinc-mediated heterostructure double active layer solar cell. The maximum parameters obtained for open circuit voltage, short-circuit current density, fill factor, and power conversion efficiency are 9.67V, 52.4mA/cm2, 8.5% and 39.06% respectively. The ion sputtering yield affirmed that there is a selection rule that is driven by elemental characteristic energies and major and minor trapped regions. The

selection rules guide elemental bond reordering and chemical stability in either the active or transport layer. The selection rule is limiting in itself and can only be biased via the introduction of defects. This action could raise the PCE by 600% and lead to the fabrication of indoor solar panels. This research needs further experimental work to have an in-depth understanding of selection rules in photovoltaic technology.

Keywords: solar cell, zinc-based compounds, electron, hole, ions, mobility

SECTION C:

Radiation, Health and Environmental Physics Interventions in Emerging Health Challenges (RHEP)

RHEP 001

DEVELOPMENT OF A MOBILE APPLICATION OF EARLY DIAGNOSIS OF LIVER CIRRHOSIS

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Abstract
Liver cirrhosis is a progressive and often irreversible condition that can lead to severe health complications if not diagnosed early. This project aims to develop a mobile machine learning (ML) application to facilitate the early diagnosis of liver cirrhosis by leveraging predictive analytics and user-friendly technology. The application integrates clinical data, such as blood test results, patient history, and lifestyle factors, to identify individuals at risk of developing cirrhosis. Using state-of-the-art ML models like Random Forest and Convolutional Neural Networks (CNNs), the app provides accurate risk assessments and interpretable predictions, enabling early intervention. The mobile application is designed to be cross-platform, utilizing frameworks such as TensorFlow Lite and Flutter for seamless functionality on Android and iOS devices. It features an intuitive interface for data input, real-time analysis, and personalized health recommendations. Ethical considerations, including data privacy and compliance with healthcare regulations, are central to its design. By integrating wearable device data and offering a referral system for medical consultations, the app aims to enhance accessibility and healthcare outcomes. This innovation has the potential to revolutionize liver disease management by enabling proactive care and reducing the global burden of liver cirrhosis.

Keywords: Liver cirrhosis, Early diagnosis, Mobile application, Risk assessment, Clinical data analysis

RHEP 002

MEDICAL PHYSICS – A PANACEA TO OVER INCREASING HEALTH CHALLENGES IN OUR MODERN-DAY SOCIETY

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Abstract
This paper provides a thorough overview of the vital role diagnostic medical physicists play in the field of medicine as solutions to various health challenges faced today. The paper investigates the relationship between medical practices and physics highlights the fundamental role that physics plays in understanding the cosmos and outlines the numerous applications of physics, medical physics in particular. The paper's main focus is on the many applications of medical physics, especially in diagnostic imaging, which includes nuclear medicine, radiation therapy, MRIs, CT scans, X-rays, and ultrasound. It also focuses on Medical therapy of all these ailments highlighted and others not mentioned through administering both thermotherapy and radiotherapy. There is an in-depth discussion of specialized fields such as radiation protection, nuclear medicine, diagnostic radiology, and radiotherapy physics. The authors stress the importance of medical physics in the prevention, diagnosis, and treatment of disease, providing new technologies such as Positron-Emission Tomography (PET) that provide insights into structural and biological changes. The article outlines the duties of diagnostic medical physicists, including quality assurance and control as well as equipment evaluation and compliance. The critical role that radiation treatment programs play in preserving patient, staff and public safety is emphasized. The authors discuss how modern radiation therapy is becoming more complex and how important strong protocols are for patient safety. The important role that medical physicists play in guaranteeing the highest standards of medical care is highlighted, along with the European Union's efforts to standardize radiotherapy treatments among its member states. It is recommended that the health care system needs medical physicists concept and processes

now more than ever before to enhance more effective, efficient, quality and affordable health care delivery in our modern day society.

Keywords: Medical Physics, Medicine, Ultrasonic, Quality control, Equipment, Medical physicist

RHEP 003

THERMAL AND ELECTRICAL DYNAMICS OF TUMOR ABLATION USING STAINLESS STEEL ELECTRODES THROUGH FINITE ELEMENT METHOD

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Abstract

This study explores the thermal and electrical dynamics of tumor ablation using a stainless steel electrode, employing the Finite Element Method (FEM). The heat transfer and electrical conductivity equations are coupled through the joule heating term. The FEM simulation solved these coupled equations iteratively to obtain the temperature distribution and electric potential within the tissue. The FEM simulation Tumor ablation is a treatment method for cancer patients in medicine diagnostics. In numerical computation for tumor ablation, the parameters needed are the thermal conductivity of stainless steel (15 W/m·K) and liver tissue (0.56 W/m·K), electrical conductivity of stainless steel (1.4e6 S/m), blood perfusion rate (6.1e-4 1/s), density of stainless steel (7800 kg/m³), heat capacity of stainless steel (500 J/kg·K), arterial blood temperature (37°C), and an applied electric voltage of 22 V. Using these parameters for simulation was to achieve effective tumor cell destruction while minimizing damage to surrounding healthy tissues. Findings from computation revealed a significant temperature increase near the electrode, achieving effective tumor ablation. The high thermal and electrical conductivities of stainless steel facilitated efficient heat and energy transfer, ensuring rapid heating of the target area. These findings underscore the importance of optimizing electrode material properties and simulation parameters to enhance ablation efficacy. Future work will focus on experimental validation and exploring alternative electrode materials.

Keywords: Thermal and Electrical Conductivities, Tumor Ablation, Stainless Steel Electrode, FEM

RHEP 004

DETERMINATION OF EXPOSURE RATE TO IONIZING RADIATION AND EXCESS LIFETIME CANCER RISK IN KANO ABATTOIR, KANO STATE, NIGERIA.

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Abstract

Exposure to ionizing radiation is part and parcel of the environment. This study aimed at the determination of exposure to ionizing radiation level and excess lifetime cancer risk within kano central Abattoir situate in Fagge L.G.A area of Kano state, Nigeria. The study area was divided into Four areas, and a well calibrated Digilert 200 radiation survey metre and a Geographical Positioning Device (GPS) were used. The study found that, the mean exposure rate in the zones were (0.154, 0.170, 0.200, 0.208 and 0.226) mR/h. The calculated absorbed dose rates and annual effective doses were lower than the world acceptable values. The mean values of the Excess Lifetime Cancer Risk (ELCR) were (0.633, 0.698, 0.821, 0.855 and 0.929) X 10^{-3}. These values are above the ICPR standard value of 0.29 X 10^{-3}. The study concluded that the study area has been radiologically contaminated, but may have no immediate radiological health consequences to the populace, but long-term health risks, such as cancer, are a possibility in the future due to accumulated doses.

Keywords: background, radiation, dose, cancer, risk.

RHEP 005

AN ASSESSMENT OF HUMAN EXPOSURES TO RADIOFREQUENCY RADIATION FROM GSM BASE TRANSCEIVER STATIONS IN ABAKALIKI AND ENVIRONS, EBONYI STATE, NIGERIA.

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Abstract
Cellular base transceiver stations (BTS) produce and emit radiofrequency (RF) radiations into the environment. Adverse health effects associated with human exposure to high level RF radiation energy are on the front burner of research due to rapid expansion of telecommunication networks and BTS in Nigeria. In this study, RF radiation from twelve selected BTS of different network providers in Abakaliki and Environs were measured using Cornet broad band survey meter with frequency range of 100MHz – 8GHz. The aim is to determine RF radiation levels from these BTS and evaluate the level of compliance with international guidelines. The power densities and electric field intensities of the radiations were measured at various radial distances from the foot of the towers. The measured power densities and electric field intensities are within 0.77 – 19.58mWm^{-2} and 0.58 – 2.714Vm^{-1} respectively. The observed RF radiation levels are below the reference limit of 4.5Wm^{-2} and 41.25Vm^{-1} for the 900MHz frequency which are the thresholds set by the ICNIRP. Nevertheless, the power density values exceed the threshold value of 0.1mWm^{-2} established by the EU Parliament, and 1mWm^{-2} threshold value set by other national guidelines, implying some associated health risks to people in the neighbourhood.

Keywords: Electric field intensity, GSM transceiver station, Power density, Radiofrequency radiation exposure, Risk assessment.

RHEP 006

ASSESSMENT OF METEOROLOGICAL HAZARDS USING TEMPERATURE VARIABILITY IN PORT HARCOURT, RIVERS STATE, NIGERIA.

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Abstract
This paper studied some meteorological hazards occasioned by temperature variability in Port Harcourt from 1988-2018 (31-years inclusive), using mean, mean deviation, moving average, standard deviation and coefficient of variation. Observation of the mean annual values show that temperature is on the increase; while moving average temperature increases linearly (with little fluctuation) over the years, showing temperature rise and global warming. Also, mean monthly value shows a significant increase from August to February. The calculated coefficient of variation (CV) is 0.89%. It is however recommended that water and other heat-control measures be put in place from November –February; and since the moving average temperature shows a rapid increase within the year under review, anthropogenic activities and other precursors to temperature rise, like gas flaring and illegal refinery should be reduced, to forestall major disasters in the nearest future. Mitigation and adaptive measures should also be put in place.

KEYWORDS: Meteorological hazards, Atmosphere, Climate Change, Weather, Temperature, Risk, Disaster.

RHEP 007

DETERMINATION OF SOME PHYSICAL PARAMETERS, HEAVY METALS AND MICRONUTRIENTS OF SOME ENERGY DRINKS AVAILABLE IN NIGERIA

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Abstract

Energy Drink are beverage which is purported to boost mental or physical energy. Different brands of energy drinks are currently in high demands in Nigeria. This research work determined the physical parameters, heavy metals and micro nutrients of some energy drinks available in Nigeria. Thirty (30) brands of energy drinks samples consisting twenty three (23) liquid and seven (7) powdered forms were randomly purchased. All samples were analyzed for their physical parameters (pH, turbidity, conductivity and total dissolved solids), heavy metals and micro nutrients contents. Results showed that the physical parameters (i.e. pH, turbidity, conductivity and total dissolved solids) ranged from 2.92 - 5.53, 8 – 121 NTU, 347 – 2230 μs/cm, and 293 – 1072 mg/L respectively. The Energy drinks analyzed for physical parameters was higher than the recommended values of WHO. The ranged values of the results of the heavy metals of Co, Cr, Cd, Ni, Pb were 0.0017 – 0.00835, 0.0025 – 0.4159, 0.0015 – 0.0566, 0.0015 – 0.0984 and 0.0154 – 0.2092 mg/L respectively in the energy drinks samples were mostly higher than WHO permissible limits. But Ar ranged from 0.0002 – 0.0451 mg/L was mostly lower than WHO permissible limit. For micronutrients, the concentrations of Cu, Mg and Zn were ranged from 0.0027 – 0.7931, 0.0043 – 0.8442 and 0.0117 – 13.8875 mg/L were below the permissible limits. While Fe concentration range from 0.0126 – 5.7042 was higher than the permissible limits. These results showed that there is risk in energy drink with respect to the concentrations of Co, Cr, Cd, Ni, Pb and Fe as they were higher than the permissible limits set by health authorities.

Keywords: Energy drinks, physical parameters, heavy metals, micro nutrients**.**

RHEP 008

UTILIZING CLINICAL EXPOSURE INDEX AND DEVIATION INDEX BASED ON NATIONAL DIAGNOSTIC REFERENCE LEVELS FOR DOSE OPTIMIZATION IN MEDICAL IMAGING IN NIGERIA

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Abstract

The optimization of radiation doses in medical imaging is critical to ensuring patient safety while maintaining diagnostic image quality. This study explores the application of the Clinical Exposure Index (EI) and Deviation Index (DI) in alignment with National Diagnostic Reference Levels (NDRLs) to evaluate and optimize radiation doses in medical imaging across selected healthcare facilities in Nigeria. Data were collected from radiographic examinations, including computed radiography (CR) and digital radiography (DR) systems, and analyzed to assess compliance with established NDRLs. The results revealed significant variations in exposure indices, with a notable percentage of examinations exceeding recommended DI thresholds, indicating potential overexposure. The study highlights the importance of implementing standardized protocols, regular equipment calibration, and continuous training for radiology personnel to achieve dose optimization. By integrating EI and DI metrics into routine practice, healthcare facilities can enhance radiation safety, reduce unnecessary patient exposure, and align with international best practices. This research provides a framework for dose optimization in resource-limited settings and underscores the need for national guidelines to improve radiation protection in medical imaging.

Keywords: Clinical Exposure Index, Deviation Index, Diagnostic Reference Levels, Dose Optimization, Medical Imaging, Radiation Safety, Nigeria.

RHEP 009

EVALUATION OF RADIATION HAZARD INDICES AND EXCESS LIFETIME CANCER RISK DUE TO NATURAL RADIOACTIVITY IN SOIL FROM GOLD MINING AREA OF ATAKUMOSA WEST LOCAL GOVERNMENT AREA OF OSUN STATE NIGERIA

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Abstract
Radiological hazards associated with exposure to Naturally Occurring Radionuclide's Materials (NORMS) and Excess Lifetime Cancer Risk (ELCR) from gold mine tailing and areas in Atakumosa west local government area using gamma spectroscopy to measure the activity concentrations of fifteen (15) soil samples in this area. The measured activity concentration values for 238U vary from 23.48±0.89 to 49.89±2.42 Bqkg-1, 44.84±3.62 to 76.55±7.4450 Bqkg-1 for 232Th and 507.27±37.40 to 698.58±51.50 Bqkg-1 for 40K. The annual effective dose varies from 0.076 to 0.112mSv/y with an average of 0.093 mSvy-1. These results show's that the radiation exposure level reaching members of the public including the miners in the study areas is lower than the recommended limit value of 1 mSvy-1 (UNSCEAR, 2000). The excess lifetime cancer risk vary from 0.25 to 0.39 $x10^{-3}$ with an average of 0.36 $x10^{-3}$. The ELCR average value exceeds the average standard value of 0.29 x 10^{-3} as set by UNSCEAR. The implication of the average value of ECLR is that the probability of developing cancer over a life time exposure in the area is high.
Keywords: Atakumosa, NORM, Risk, Lifetime,

RHEP 010

NATURAL RADIOACTIVITY OF CRUDE OIL–SPILLED SOILS IN OKURUGBE COMMUNITY IN ELEME LOCAL GOVERNMENT OF OGONILAND, NIGERIA, AND THE ASSESSMENT OF RADIOLOGICAL HEALTH HAZARDS

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Abstract
Radiation measurements and their health hazard assessments was carried out in the crude oil spill-affected community of Okuregbe in Eleme local government area of Ogoniland, Rivers State, Nigeria. In situ and laboratory methods were used for the study. In situ measurements were taken with a GQ GMC–500/ GMC–500 + digital Geiger Muller counter, while a caesium iodide (thallium-doped) gamma-ray spectrometer was used for laboratory measurements. Data were collected from forty (20) locations within the creeks of Okuregbe with a history of crude oil spillage and ten (10) locations with no such history serving as control. For the in-situ method, the AEDE and ELCR in the crude oil–impacted communities were higher than those in the non-crude oil–impacted areas.For the laboratory methods, the activity concentrations of ^{40}K, ^{232}Th, and ^{226}Ra were used to compute Dout, AEDE, Raeq, AGED, AUI, Iγ, Hout, Hin, and ELCR. These results indicated a slight increase in radiation levels and health hazards indices in the crude oil–spilled areas compared to non-spilled areas. This suggests that crude oil spillages may have altered natural radiation concentrations and increased radiological health hazards in the impacted areas.

RHEP 011

A REVIEW ON AUTOMATING THE PROCESS OF TREATMENT PLANNING AND DOSE PREDICTION IN LUNG CANCER TREATMENT USING DEEP LEARNING ALGORITHMS

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Abstract
Lung cancer is rated as one of the leading causes of mortality resulting from cancers worldwide, and improving patient outcomes would require customized treatment strategies. In radiation therapy the quality of treatment critically hinges on treatment planning which is a very important milestone but a rather tedious and labour-intensive process which eventually presents little guarantee of generating truly optimal treatment plans. Recent developments in deep learning have the potential to revolutionize this process by improving and automating it. In a bid to assess these developments, this study examined the precision, generalizability, and clinical suitability of Convolutional Neural Networks (CNNs) and U-Net architectures in models that reliably forecast ideal dose distributions based on anatomical characteristics unique to each patient by utilizing substantial datasets of past treatment plans and imaging data. We therefore conclude that reasonable progress have been made towards bridging the gap between the traditional treatment planning process and automating the process, however, standardization, integration into clinical processes, and regulatory approval are still observed to be major obstacles, despite the fact that deep learning models have demonstrated potential in cutting down on planning time and increasing consistency.
Keywords: Lung cancer, treatment planning, dose prediction, datasets, architecture.

RHEP 012

ABSORBED RADIATION DOSE ACROSS ADULT BRAIN CT-EXAMINATION AT RASHID SHIKONI TEACHING HOSPITAL, JIGAWA STATE, NIGERIA

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Abstract
Accurately assessing radiation dose levels in computed tomography (CT) imaging is critical for optimizing patient safety and ensuring adherence to diagnostic reference levels (DRLs). This study uses data from the CT Dose Index Registry to evaluate the absorbed radiation dose levels for adult brain CT examinations conducted at Rashid Shikoni Teaching Hospital, Dutse, Jigawa, Nigeria. 162 adult patients (≥18 years), comprising male and female patients, were analyzed from January 2016 to August 2023. The study determined the mean and 75th percentile values for volume CT dose index (CTDIvol) and dose-length product (DLP). The mean CTDIvol and DLP for adult brain examinations were 69.18 mGy and 1421.21 mGy·cm, respectively, while the 75th percentile values were 82.14 mGy and 1705.78 mGy·cm. These findings were benchmarked against dose values reported from local and international institutions. This study's 75th percentile CTDIvol values were consistent with reports from other settings, including Japan. However, the corresponding DLP values were considerably higher than those observed in several countries, such as Korea, Indonesia, Thailand, Slovenia, Norway, Canada, the USA, Australia, South Africa, Ghana, Uganda, Iran, Singapore, and Saudi Arabia, as well as specific regions within Nigeria (Edo and Rivers States). These findings highlight the need for institutional evaluation of CT radiation doses to establish DRLs that reflect both local practices and international standards. While the alignment of CTDIvol values demonstrates adherence to acceptable dose benchmarks, the elevated DLP values necessitate stricter quality assurance and dose optimization measures. This will enhance patient safety and support effective health management strategies at Rashid Shikoni Teaching Hospital.

RHEP 013

ASSESSMENT OF BACKGROUND IONIZING RADIATION OF ENGINEERING LABORATORIES IN FEDERAL POLYTECHNIC NEKEDE OWERRI, IMO STATE

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Abstract

In-situ measurement of background ionizing radiation of the Faculty of Engineering Technology in Federal Polytechnic Nekede, Owerri, Imo State has been carried out, with the use of Radiation monitoring meters. The Global Positioning System (Garmin 765) was utilized in measuring the coordinates of the selected sampling points. The aim of the study is to assess the rate of radiation exposure to students and staff during practical work in the Laboratories. Four (4) engineering laboratories within the Faculty were randomly selected. The outdoor exposure dose rate varies from 0.006 - 0.017 mR/hr, 0.006 - 0.015 mR/hr, 0.008 -0.015 mR/hr, 0.009-0.014 mR/hr with mean value of 0.011 mR/hr ,0.009 mR/hr,0.014 mR/hr, 0.012 mR/hr for Computer Engineering Laboratory, Mechatronics Laboratory, Mechanical Engineering Laboratory and Automatic Laboratory respectively. The indoor exposure dose rate varies 0.009 - 0.013 mR/hr, 0.009 – 0.019 mR/hr, 0.006 -0.015 mR/hr, with mean of 0.013 mR/hr,0.012 mR/hr and 0.012 mR/hr for Air Conditioning Laboratory, Mechanical Engineering Laboratory and Automatic Laboratory respectively. The outdoor absorbed dose rate varies from 52.2 -147.9 nGy/hr, 52.2-130.5 nGy/hr, 69.6 -147.9 nGy/hr,78.3 -121.8 nGy/hr, with mean value of 96.76 nGy/hr, 79.75 nGy/hr,111.86 nGy/hr and 100.69 nGy/hr and the indoor absorbed dose rate varies from 78.3-130.5, 78.3- 169.7, 52.2-130.5 (nGy/hr) with mean 111.7 nGy/hr, 109.7 nGy/hr, 101.8 nGy/hr respectively. The outdoor excess life cancer risk (ELCR) varies from $0.22x10^{-3}$ - $0.56 x10^{-3}$,$0.22x10^{-3}$- $0.56x10^{-3}$,$0.299x10^{-3}$-$0.56x10^{-3}$ and $0.34x10^{-3}$-$0.52x10^{-3}$ with mean of $0.44x10^{-3}$,$0.34x10^{-3}$,$0.54x10^{-3}$ and $0.45x10^{-3}$ for Computer Engineering Laboratory, Mechatronics Laboratory, Mechanical Engineering Laboratory and Automatic Laboratory respectively, while the indoor excess life cancer risk (ELCR) varies from 0.36-$0.56x10^{-3}$,$0.34x10^{-3}$-$0.85x10^{-3}$ and $0.22x10^{-3}$-$0.56x10^{-3}$ with mean $0.48x10^{-3}$,$0.48x10^{-3}$ and $0.44x10^{-3}$. The results show that the estimated radiological parameters from the radiation exposure dose rate are all higher than their world standard values, except the annual effective doses and the outdoor and indoor exposure dose rate which are within their respective stipulated standard. This high value of Absorbed dose and excess life cancer risk may not constitute any immediate health effects on students and staff but there is a potential health effects for a long term in the future for an individual who may spent he/her life time within the immediate environment such as development of cancer due to the accumulation of high doses.

RHEP 014

ASSESSMENT OF GROSS BETA RADIOACTIVITY IN UNDERGROUND WATER IN BICHI.

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Abstract

Twenty (20) samples of water from hand dug wells and boreholes in Bichi Local Government Area were selected using a stratified random sampling. Few drops of concentrated nitric acid were added to each one litre of the sampled water for preservation. The samples were then evaporated and counted for Gross beta using MPC 2000 model gas filled proportional counter. Results of beta activities in water in the assessed area showed a range of 0.00000041 Bq/L to 0.0559 Bq/L with a geometric mean of 0.01455 Bq/L. This value is below the World Health Organization (WHO) and United States Environmental Protection Agency (USEPA) recommended practical screening level of 1.0 Bq/L for gross beta radioactivity in drinking water and therefore may not pose any serious detrimental health side-effects to the public

users of water in that environment. Adequate discussions and appropriate recommendations are made for further research work in this field.

Keywords: Assessment, Gross Beta, Radioactivity, Water, Geometric mean.

RHEP 015

ASSESSMENT OF NATURAL RADIOACTIVITY AND RADIOLOGICAL HAZARDS ASSOCIATED WITH INGESTION OF WELL WATER FROM SOME COMMUNITIES IN RUMUEKPE, RIVERS STATE, NIGERIA.

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Abstract

Natural radioactivity refers to the spontaneous emission of ionizing radiations from naturally occurring radioactive materials in the earth's crust. This study focuses on assessment of radiological hazards associated with intake of radionuclides in well water samples from some randomly selected communities in Rumuekpe, Emohua Local Government Area, Rivers State, using Sodium Iodide gamma-rays spectrometer. The radionuclides present in the water samples are ^{40}K, ^{232}Th and ^{238}U, their mean activity concentrations are 71.51, 2.73 and 9.67 Bql^{-1} respectively. Mean total annual effective dose in infants (0-1 and 1-2)y, children (1-2 and 2-7)y and adults (12-17 and >17)y are (3.70 and 1.95) $mSvy^{-1}$, (1.17 and 0.86) $mSvy^{-1}$, and (1.37 and 1.09) $mSvy^{-1}$ respectively. Mean absorbed dose, annual effective dose equivalent and annual gonad dose equivalent are 8.94 $nGyh^{-1}$, 10.96 $mSvy^{-1}$ and 62.73 Bql^{-1} respectively. Mean radium equivalent and excess lifetime cancer risk are 19.11 Bql^{-1} and 37.88 E-3 respectively. All mean radiological hazards are above their respective recommended safe limits, except ^{238}U.This indicates that the water samples are radiologically polluted and harmful for human consumption. Provision of clean, alternative and safe source of water, as well as medical check-ups and treatment are recommended for the inhabitants.

Keywords: Harmful, Concentration, Equivalent, Alternative

RHEP 016

ASSESSMENT OF NATURAL RADIOACTIVITY AND RADIOLOGICAL HAZARDS INDICES ASSOCIATED WITH INGESTION OF WELL WATER FROM SOME COMMUNITIES IN RUMUEKPE, RIVERS STATE, NIGERIA.

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Abstract

Natural radioactivity refers to the spontaneous emission of ionizing radiations from naturally occurring radioactive materials (NORM) in the earth's crust. This study focuses on assessment of radiological hazards associated with intake of radionuclides in well water samples from some randomly selected communities in Rumuekpe, Emohua Local Government Area, Rivers State, Nigeria, using Sodium Iodide gamma-rays spectrometer. The radionuclides present in the water samples are ^{40}K, ^{232}Th and ^{238}U and their mean activity concentration are 71.51, 2.73 and 9.67 Bql^{-1} respectively. Mean total annual effective dose in infants (0-1 and 1-2)y, children (1-2 and 2-7)y and adults (12-17 and >17)y are (3.70 and 1.95) $mSvy^{-1}$, (1.17 and 0.86) $mSvy^{-1}$, and (1.37 and 1.09) $mSvy^{-1}$ respectively. Mean absorbed dose, annual effective dose equivalent and annual gonad dose equivalent are 8.94 $nGyh^{-1}$, 10.96 $mSvy^{-1}$ and 62.73 Bql^{-1} respectively. Mean radium equivalent and excess lifetime cancer risk are 19.11 Bql^{-1} and 37.88 E-3 respectively. Mean activity concentration of ^{40}K and ^{232}Th are above recommended safe limits of 10.0 and 0.1 Bql^{-1} respectively while that of ^{238}U is below safe limit of 10.0 Bql^{-1}. Other radiation hazard indices are above their respective recommended safe limits, indicating that the well water samples are radiologically polluted and harmful for human consumption.

Keywords: Harmful, Concentration, Equivalent, Alternative

RHEP 017

ASSESSMENT OF PEDIATRIC X-RAY RADIATION EXPOSURE AT MURTALA MUHAMMAD SPECIALIST HOSPITAL, KANO: IMPLICATIONS FOR SAFETY AND OPTIMIZATION

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Abstract
The use of X-rays in pediatric imaging, while indispensable for diagnostic purposes, carries inherent risks associated with ionizing radiation exposure, particularly for children who are more susceptible to its long-term effects. This study aimed to assess the radiation doses received by pediatric patients undergoing radiographic examinations at Murtala Muhammad Specialist Hospital, Kano. A sample of 100 pediatric patients was randomly selected, and their radiation doses were measured using a calibrated dosimeter. The findings revealed an average radiation dose of 0.35mSv per procedure, which exceeds the diagnostic reference levels (DRLs) recommended by the International Commission on Radiological Protection (ICRP). These results underscore the need for optimized imaging protocols, regular maintenance of X-ray equipment, and enhanced training for radiographers to ensure adherence to radiation safety standards. By addressing these factors, the study aims to minimize unnecessary radiation exposure in pediatric patients while maintaining diagnostic accuracy and image quality. This research contributes to the ongoing efforts to improve radiation safety practices in pediatric imaging, particularly in highly populated Hospitals in Kano metropolitan and in resource-constrained healthcare settings.
Keywords: Diagnostic reference levels, ionizing radiation, Optimization, Pediatric X-ray, radiation dose, radiation safety.

RHEP 018

ASSESSMENT OF RADIOACTIVITY IN SOME CONSUMABLE WATER SAMPLES IN OGONI OIL SPILL AREAS OF RIVERS STATE, NIGERIA

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Abstract
The Ogoni-land oil spillages have swayed the radioactive level in consumable water resources with concerns on survival of numerous living organisms including human beings. Water samples were collected in areas with less dilution of washout which cover Nupene, Bon-gia, Te-oo-goo and Bolte-kpan in Ogoniland, Rivers State. A total of 13 water samples were collected. The samples were prepared for analysis in National Institute of Radiation Protection and Research (NIRP&R) laboratory, University of Ibadan, Oyo state, Nigeria. The assessment was done using High-Purity Germanium (HPGe) detector (Canberra Industries Inc.) to measure the primordial radionuclides in the samples. The measured activity concentrations range from 6.94- 12.22, 0.35-1.90 and 0.79-1.27 Bq/l for ^{40}K, ^{238}U and ^{232}Th respectively. Estimated total annual effective doses varied from 0.0014 -0.0022 mSv/y with the control sample having 0.0009 mSv/y. The estimated committed effective dose mSv/y for age groups (infant ≤1, 1 – 12 y, 12 - 17 y and >17 y) in consumption of the water was estimated from the measured activity concentration, the results were 0.0057-0.0208, 0.0014-0.0016, 0.0040-0.0053 and 0.0006-0.0008 mSv/y. The results from all the samples show that the Ogoni-land oil spillages have influenced the level of radioactivity concentration and doses found in consumable water resources. The public is advised to consume a lesser amount of these water samples before treatment measure will be put in place.

Keywords: Water resources, oil spillages, High-Purity Germanium (HPGe) detector, primordial radionuclides activity concentration, total annual effective doses and annual committed effective dose.

RHEP 019

ASSESSMENT OF RADON ^{222}Rn CONCENTRATION IN SOIL GAS AND WATER SAMPLES IN THE ENVIRONS OF OBAJANA CEMENT PRODUCING COMPANY AND ITS HEALTH IMPLICATIONS

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Abstract
Radon concentration in soil gas and water samples around Obajana Cement Producing Company was assessed to evaluate its health implications. The study area included both the factory premises and neighboring communities. A total of 75 samples were collected from 15 different locations and analyzed using the RAD7 detector. The results showed average radon concentrations of 30 Bq L^{-1} in underground water and 20.58 Bq L^{-1} in soil gas. All measured concentrations were below the World Health Organization's recommended safe limit. The study revealed a strong correlation between radon concentration and environmental parameters. The health implications of radon exposure were evaluated, and the findings suggest that the cement-producing factory areas pose no significant health risks from radon exposure to both workers and neighboring communities.

Keywords: Radon concentration, Samples, Environmental monitoring, Radiation exposure, Health implications

RHEP 020

ASSESSMENT OF THE BACKGROUND GAMMA RADIATION AND HEALTH RISKS AROUND ELECTRICAL CONDUIT POLYVINYL CHLORIDE COMPANY IN ASABA, NIGERIA USING HIGH-PURITY GERMANIUM (HPGE) DETECTOR

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Abstract
Humans, and his environment, have been bombarded with nuclear radiation emanating from natural and man-made sources. Both sources of nuclear radiation contribute to what is known as background gamma radiation and can be very harmful and dangerous whenever the limit of exposure is exceeded. The increment in the exposure to background gamma radiation as a result of human activities has posed serious concern due to the attendant health risks such as cancer. This current study aimed to assess the level of background gamma radiation and health risks in and around an electrical conduit polyvinyl chloride company. A total number of thirty-six (36) points were achieved at the end of the measurement from four (4) different sections of the company: inside the raw material hall and production hall, outside the production hall, and inside the offices and control unit. The results of the minimum and maximum mean activity concentration in the raw material and production hall are in the range of 0.00 and 35.82 Bq/Kg for uranium, thorium (8.93 and 26.79 Bq/Kg), and potassium (190.93 and 441.33 Bq/Kg), outside the production hall; uranium (0.00 and 41.99 Bq/Kg), thorium (10.15 and 34.51 Bq/Kg), and potassium (159.63 and 375.60 Bq/Kg), inside the offices; uranium (18.53 and 30.88 Bq/Kg), thorium (19.08 and 30.86 Bq/Kg), and potassium (441.44 and 641.60 Bq/Kg) and the control area; uranium (19.76 Bq/Kg), thorium (6.50 and 24.36 Bq/Kg), and potassium (128.33 and 140.55 Bq/Kg). These results have shown the highest minimum and maximum mean concentration of potassium inside offices when compared with the other sections and above the world permissive value (420 BqKg-1) for mean activity concentration of potassium according to UNSCEAR, 2000. This will definitely

cause health risks or hazards to the occupational workers and people living around the company.

Keywords: Background gamma radiation; Radionuclide; Health Risk; Electrical Polyvinyl Chloride

RHEP 021

ASSESSMENT OF THE PREVALENCE AND IMPACT OF BLACK SOOT IN PORT HARCOURT METROPOLIS

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Abstract

Black soot has been a very challenging issue in Port Harcourt and its environs for years now, and has attracted the attention of several researchers. This research aims to quantify the concentration of black soot particulates ($PM_{2.5}$ and PM_{10}), analyze their chemical composition, and the associated health risks. The Met One Aerocet 531S Particle Counter and High-Volume Air Sampler were employed to quantify particulate concentrations, while laboratory analyses identified the presence of heavy metals in the study area. At Iwofe, $PM_{2.5}$ levels had a maximum of 30.25 µg/m³, while PM_{10} concentrations had a maximum of 151.30 µg/m³. In Woji, PM_1 and $PM_{2.5}$ levels had a maximum of 4.30 µg/m³ and 31.90 µg/m³ respectively with PM_{10} levels peaking at 150.00 µg/m³. Aba Road and Oil Mill exhibited the highest concentrations, significantly exceeding World Health Organization's (WHO) guideline. Generally, the results indicate alarming high levels of black soot at all the locations studied, by over 150%. The composition analysis revealed significant concentrations of heavy metals, alongside various PAHs, many of which are recognized as carcinogenic. It is therefore recommended that measures be taken by government in initiating and implementing policies that will curb the production and distribution of black soot.

Keywords: black soot, carcinogens, air pollution, polycyclic aromatic hydrocarbons

RHEP 022

B-MODE DOPPLER ULTRASOUND BLOOD FLOW VELOCITY MEASUREMENT FOR THE DETERMINATION OF THE INTIMA MEDIA THICKNESS IN THE HUMAN CAROTID ARTERY

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Abstract

Excess mortality associated with cardiovascular diseases and stroke is linked to atherosclerosis which in turn, is related to the Intima-Media Thickness (IMT). An increase in IMT in the in the Common Carotid Artery (CCA) is therefore commonly used as a marker of atherosclerosis. The purpose of this study was to investigate the relationship between blood flow velocity and IMT in the CCA which is also an indicator of atherosclerosis in the carotid bifurcation. Fifty (50) apparently healthy volunteers (25 males and 25 females) whose ages ranged between 19 and 75 years were considered for carotid ultrasound scanning in Jos University Teaching Hospital (JUTH). IMT, Peak Systolic and End Diastolic blood velocities of the right and left Common Carotid Arteries (CCA) were measured by means of a Doppler Ultrasound Machine Type LOGIQ 5 EXPERT at 6MHz frequency with an insonation angle of by a single trained sinologist. Quantitative variables were analyzed with the IBM SPSS. Results show that the Right Peak Systolic Velocity (RPSV) and the Left Peak Systolic Velocity (LPSV) of blood in the CCA correlate negatively with the Right Intima-Media Thickness ((RIMT). The LPSV of blood shows a negative correlation with the Left Intima-Media Thickness (LIMT) but the RPSV has no significant correlation with the LIMT. The RIMT and LIMT show a strong positive correlation with age but no significant correlation with sex, Right End Diastolic Velocity (REDV) and Left End Diastolic Velocity (LEDV) correlation with the LIMT. The RPSV and REDV also show a negative and positive correlation with age respectively, but the blood in the CCA is correlated to the degree of

atherosclerosis in the carotid bifurcation more than the REDV and LEDV. The degree of atherosclerosis increases with advancing in age because of the strong positive correlation between IMT and age.

Keywords: Intima-Media Thickness, Common Carotid Artery, Atherosclerosis.

RHEP 023

DETERMINATION OF TRACE ELEMENTS IN FOOD SPICES USING ENNERGY DISPERSIVE X-RAY FLUORESCENCE TECHNIQUE(EDXRF)

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Abstract

Food spices are reported to contain many elements with positive or negative health effects. The physiological activities in humans and other mammals of these effects is very significant. These elements are required by the human body in small amounts. The EDXRF techniques was successfully used in determining the concentration of trace element in some food spices available in Gombe .The elements determined with their range values in ppm are: S(678-163000) ,Cl(21500-295000) ,Cr(8.67-116), Ni (2.83-88.6),Cu (15.5-1050), Zn (1.56-2340), Br (57.4-164), Rb (6.35-712), Sr (23.9-3120), Y(110), Zr (7.36-733), U (227-368), Na(27600-528258.065), Mg (345-28020), Al (3102.353-10270.588),Si(532-21326.666),P(42.352-8426.761),K(590.808- 121978.723),Ca(975- 259285.714), Mn (2406), Fe (18.9-1. 0850), and I (0.061-33.8).This value indicate that there were considerable amount of trace element in some food spices .the daily intake value of these trace elements ranges in mg/day are: S(1.220-293.400), Cl (432-406.800), Cr (0.059-0.209), Ni (0.005-0.159), Cu(0.028-1.890), Zn (0.003-4.212), Br(0.103-0.295),Rb(0.011-1.282),Sr(0.043-5.616),Y(0.198),Zr(0.013-1.319),U(408.6-662.4), Na(49.680-950.865), Mg (4.007-50.436), Al (5.584-18.487), Si (0.958-38.388), P (0.076-99.025), K(1.063-219.562), Ca(1.723-466.714), Mn (4.331), Fe (0.034-19.530), and I (0,061-0.232). The daily intakes values determined show that locust bean present a great potential values for being used as a food supplement when compare with values in salt, onga and maggi.

Keywords: Trace elements, Spices and dietary intakes

RHEP 024

EFFECTS OF SiO_2 NANO PARTICLES ON THE PHYSICAL AND RHEOLOGICAL PROPERTIES OF TRANS-ESTERIFIED SENNA TORA OIL.

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Abstract

The global shift towards renewable energy is driven by concerns over climate change and the depletion of fossil fuel reserves. Despite significant advancements in renewable energy research, the potential of the senna tora plant, which thrives in most tropical regions, remains largely untapped. This study investigates the effects of SiO_2 nanoparticles on the physical and rheological properties of trans-esterified senna tora oil, aiming to enhance its viability as a biodiesel source. The methodology includes the synthesis of trans-esterified senna tora oil, followed by its characterization using Scanning Electron Microscopy (SEM), X-ray Fluoroscopy (XRF), and Fourier Transform Infrared Spectroscopy (FTIR). The study also evaluates the oil's physical and rheological properties, both with and without the addition of SiO_2 nanoparticles. The results are expected to highlight the potential of senna tora oil as a renewable energy source while demonstrating how nanoparticle additives can improve fuel efficiency and reduce harmful emissions. This work underscores the importance of exploring alternative bioresources like senna tora to address global energy and environmental challenges effectively.

Keywords: senna tora, renewable energy, global warming, transesterification, nanoparticles

RHEP 025

ENVIRONMENTAL EFFECTS OF RAW BIOMASS COMBUSTION

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Abstract
This paper investigates the effects of combusting raw biomass as a fuel. A lignocellulosic biomass material such as agricultural residues is one of the most common resources in Nigeria that could solve environmental, fuel and energy issues. However, it has some limitations as a result of presence of some elements such as sulphur, nitrogen, chlorine, and heavy metals, which can create hazardous air pollutants (HAPs) during combustion. Combusting biomass with high levels of these elements can lead to sulfur oxides (SO_2), nitrogen oxides (NO_2), hydrogen chloride (HCl), dioxin & furans, and heavy metal emissions. Additionally, biomass that has high levels of ash or that is not completely combusted can lead to higher levels of particulate emissions. These emissions have been found to have a negative impact on human health and the environment such as smog, particulate formation in the atmosphere, acid rain, and carcinogenic problems.

RHEP 026

EVALUATION OF BACKGROUND IONIZING RADIATION IN 20 SELECTED LOCATIONS WITHIN RUMUOSI AND CHOBA VILLAGE, PORT-HARCOURT, RIVERS STATE.

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Abstract
The evaluation of background ionizing radiation in 20 selected locations within Rumuosi and Choba villages, Port Harcourt, Rivers state, was accomplished using a nuclear radiation detector (GQ GMC-300E plus), and global positioning system (GPS) used to measure the geographical coordinates of the sample points. The exposure rate, absorbed dose, annual effective dose and excess lifetime cancer risk parameters had mean values of 0.010±0.0013mR/h and 0.0100±0.0094mR/h, 87.00±11.6nGy/h and 87.00±8.20nGy/h, 0.133±0.06mSv/y and 0.133±0.01337mSv/y and $0.47\pm0.063\times10^{-3}$ and $0.47\pm0.04\times10^{-3}$ for Rumuosi and Choba, respectively. The excess lifetime cancer risk parameters implies that people living within these areas may be exposed to cancer in their later life. Conclusively, the result indicates that people living within that location may not be exposed to background ionizing radiation. However, a routine monitoring within these locations should be observed.
Keywords: Background Ionizing Radiation, Excess lifetime cancer risk, Absorbed dose, Annual effective dose, International Commission on Radiological Protection.

RHEP 027

EVALUATION OF NATURAL RADIONUCLIDES AND RADIOLOGICAL HEALTH RISKS IN BOREHOLE WATER OF ONNE SEA PORT

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Abstract
Evaluation of natural radionuclides in borehole water and health risks have been carried out using NaI (TI) detector. The activity concentration of identified radionuclides (^{40}K, ^{238}U and ^{232}Th) showed that ^{40}K has the highest value with a mean of 72.6 Bql^{-1},while^{232}Th has the least value of 3.69Bql^{-1}. Themean value of annual effective and gonadal dose equivalent is 0.060456$mSvy^{-1}$ and 68.70618$mSvy^{-1}$ respectively. The excess lifetime cancer risk has a mean of 0.219857 ($\times10^{-3}$), and this is within the world limit. The effective dose rate to body tissues and organs indicate that the testes have the highest value with percentage of (18%),

while the liver has the lowest value (10%). The calculated radiological health risk like, excess lifetime cancer risk in 70% samples from Onne port complex is higher than the world acceptable limit. The study concluded that the boreholewater from the study area is radiologically impacted by radionuclide due to the man-made activities such as the scanning of cargo using Linac machine.

Keywords: Radionuclides, Borehole, Organs, and Exposure.

RHEP 028

EVALUATION OF OCCUPATIONAL EXPOSURE OF WORKERSTO IONIZING RADIATION DURING NON-DESTRUCTIVE TESTING OPERATION IN SELECTED COMPANIES WITHIN PORTHARCOURT

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Abstract

The evaluation of occupational exposure of radiation workers was carried out using radiation meter (Digitlert200) for in situ measurement of background ionizing radiation of the selected 5 facilities. Personnel doses were analyzed from the dosimetry report for the evaluation of the radiological risks. The mean exposure rates, absorbed dose rates, annual effective dose equivalent and excess lifetime cancer risk has the values, (1.396, 1.203, 2.054, 2.953 and 3.714) mRh^{-1}, (117.37, 101.17, 172.70, 248.32 and 312.35) nGy/h, (18.58, 16.01, 27.33, 39.30 and 49.44) mSv/y, and 46.46, 40.03, 68.33, 98.26 and 123.59 (x 10^{-3}) respectivelyfor facilities A, B, C, D and E respectively. The absorbed, annual effective dose and calculated excess lifetime cancer risk of the workersare higher than the world recommended value for radiation workers. The effective doses to body organs were evaluated and the values are higher than the acceptable standard. The study concluded that the high values of calculated radiological and health risk parameters is due to none use of collimators and shielding materials during operations, also there is a probability of workers and residents around these facilities of being exposed to cancer and other radiation sicknesses.

Keywords: Occupational, Exposure, Dose and Lifetime

RHEP 029

GROSS ALPHA AND BETA DETERMINATION IN DANGORA UNDERGROUND DRINKING WATER SOURCES

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Abstract

A study analysed 12 underground water sources in Dangora town for natural radioactivity using the low-background proportional counter technique. The gross alpha and beta activities ranged from 10.54–62.48 pCi/L and below detection limit–87.24 pCi/L, respectively. The mean values (± S.D.) were 28.58 ± 2.24 pCi/L for alpha and 32.67 ± 3.1 pCi/L for beta activity ($p < 0.05$). None of the samples had gross alpha activity below 5 pCi/L, the Maximum Contaminant Level (MCL), indicating a potential health risk. Two samples had alpha activities between 5–15 pCi/L, necessitating Ra-226 and Ra-228 testing. The remaining samples had levels exceeding 15 pCi/L, requiring total uranium analysis for adjusted gross alpha activity assessment (EPA, 2000). Only four samples exceeded the 50 pCi/L MCL for beta activity. Borehole water showed significantly higher alpha activity than well water ($p < 0.01$), indicating increased risk for those relying on boreholes. The sporadic distribution of Naturally Occurring Radioactive Materials (NORMs) was confirmed by variations in well and borehole readings. A high correlation (0.80) between α and β activities was statistically significant ($p < 0.05$), suggesting that beta activity should be expected wherever alpha activity is detected.

RHEP 030

INTEGRATING ART INTO THE QUADRUPLE HELIX: MURAL PROJECTS AS CIVIC INTERVENTIONS IN RADIATION, HEALTH, AND ENVIRONMENTAL PHYSICS

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Abstract
In the evolving discourse on innovative research and economic development, the Quadruple Helix Model—which integrates academia, industry, government, and civil society—offers a dynamic framework for addressing complex societal challenges. This paper explores the intersection of radiation, health, and environmental physics with visual art, particularly mural projects, as a tool for civic engagement and public health education. Drawing from firsthand experiences in creating community murals focused on health, culture, and education, the paper demonstrates how art serves as a medium for translating scientific knowledge into accessible, emotionally resonant messages. These visual interventions not only foster awareness but also catalyze dialogue between the four helixes, positioning artists as key collaborators in science communication and social innovation. By embedding mural art within the physics-informed health landscape, the study advocates for a multidisciplinary approach to solving emerging health challenges, particularly in underserved communities.
Keywords: Mural projects, intersection, environmental Physics and health challenges.

RHEP 031

IONIZING RADIATION LEVELS AT TEN SELECTED DUMPSITES IN GOMBE METROPOLIS, GOMBE STATE, NIGERIA

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Abstract
This research assessed the levels of background ionizing radiation at ten selected dumpsites in Gombe Metropolis, Gombe State, and compared them to the global average natural dose of 2.4 mSv/year for humans. Radiation measurements were carried out using a calibrated Geiger-Muller counter, adhering to standard protocols. The instrument was positioned 1.0 meter above the ground, and three readings were taken at each site, with the mean value recorded. Calculations were performed for the Annual Absorbed Dose Rate (ADR), Absorbed Dose Rate (AD), and Annual Equivalent Dose Rate (AEDR). Data were analyzed using descriptive statistics via SPSS (version 20). The findings indicated that the annual absorbed dose rates ranged from 0.200 mSv/year to 0.259 mSv/year, well below the recommended public exposure limit of 1 mSv/year and significantly under the occupational exposure limit of 20 mSv/year set by the International Commission on Radiological Protection (ICRP).
Keywords: Background ionizing radiation, Dumpsites, Annual dose rates, Radiation measurement, Geiger-Muller counter.

RHEP 032

LEVELS OF RADON-222 AND RADIATION EFFECTIVE DOSE IN BRANDED SACHET WATER PRODUCED IN ASABA

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Abstract
Radon (^{222}Rn) has emerged as one of the most serious radionuclides of health concern due to its internal radiation dose to organs and radiotoxic effects. This study therefore investigated the level of ^{222}Rn in branded sachet water available and consume in Asaba, Nigeria. A total of 24 brands of sachet water were analyzed for ^{222}Rn using RAD7 detector. The result

showed ^{222}Rn concentration in the range of 0.276 to 4.159 Bql^{-1} with a mean concentration of 0.859 ± 0.16 Bql^{-1}. The values are below the maximum contamination safe limits of 100.0 and 11.1 advised by the World Health Organization and the United States Environmental Protection Agency, respectively. The total annual effective dose (ingestion + inhalation doses) was estimated as 15.99, 7.83, and 8.43 μSv y^{-1} for infants, children and adults, respectively, significantly lower than the WHO dose criteria level of 100 μSv y^{-1} for drinking water. Hence, branded sachet water in Asaba is within radon safe limits and pose no significant adverse health consequences to consumers. The data will help in policy development of safe drinking water resources and can also serve as a reference material for future radiological study of different water sources in the region.

RHEP 033

MEASUREMENT OF BACKGROUND IONIZATION RADIATION OF PALM OIL PROCESSING CLUSTERS IN ELELE-ALIMINI, EMOHUA LGA, RIVERS STATE IN NIGERIA.

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Abstract
This study aimed at determination of exposure to ionizing radiation rate around various palm oil processing mills in Elele-Alimini, Emohua LGA, Rivers state, Nigeria. Four palm oil processing clusters within the study area were selected, and a well calibrated Radalert 100 and a Geographical Positioning Device (GPS) were used. The study found that, the mean exposure rate in the selected clusters were (0.010, 0.010, 0.009, and 0.009) mR/h. The mean value of the Excess Life Cancer Risk (ELCR) of the study area were (0.53, 0.47, 0.43 and 0.43) X 10^{-3}. These values are above the ICPR standard value of 0.29 X 10^{-3}. The absorbed dose rates calculated and annual effective doses were higher than the world value of 59.00 nGy/h, and 0.07mSv/y respectively. The study concluded that the study area is radiologically contaminated, but has no immediate radiological health consequences for the population, but, long term health risks, such as cancer, are a possibility in the future due to accumulated doses.
Keywords: background, radiation, dose, cancer.

RHEP 034

MEASUREMENT OF BACKGROUND IONIZING RADIATION AT SAMARU COLLEGE OF AGRICULTURE, DIVISION OF AGRICULTURAL COLLEGES, AHMADU BELLO UNIVERSITY, ZARIA

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Abstract
An in-situ measurement of background ionizing radiation was carried out in twelve (12) sections of Samaru College of Agriculture, Division of Agricultural Colleges, Ahmadu Bello University (ABU), Zaria, Kaduna State, Nigeria. The study assessed indoor and outdoor background ionizing radiation (BIR) levels using a calibrated portable handheld gamma survey meter. Three readings were randomly taken at each sampling point for accuracy, and the averages were taken from twelve sampling points. The indoor BIR ranged from 0.119 to 0.186 μSv/hr, with an average value of 0.155 ± 0.06 μSv/hr and outdoor BIR ranged from 0.114 to 0.204 μSv/hr, with an average value of 0.144 ± 0.04 μSv/hr. Both indoor and outdoor average values exceeded the global indoor and outdoor averages of 0.013 μSv/hr and 0.015 μSv/hr, respectively (ICRP, 1990). The total annual effective dose for indoor measurements was 0.739 mSv/yr, and for outdoor measurements given as 0.190 mSv/yr, which were all below the maximum permissible limit of 1 mSv/yr (UNSCEAR, 2010). The study concludes that while the BIR levels were higher than the global averages, the overall radiation dose and ELCR were within safe limits, indicating no significant radiological threat to the public.
Keywords: Absorbed Dose, Effective dose

RHEP 035

MONTE CARLO-BASED CANCER RISK ASSESSMENT OF RADON CONTAMINATION IN GROUNDWATER OF ARTISANAL MINING AREAS OF SOUTHWEST NIGERIA

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Abstract
Radon contamination in groundwater poses a significant environmental and public health concern, particularly in regions with intensive artisanal mining activities that disturb the natural geologic formations. This study investigates the levels of radon (^{222}Rn) in groundwater sources within the artisanal gold and gemstone mining communities in Southwest Nigeria and assesses the associated lifetime cancer risks using a Monte Carlo probabilistic approach. The activity concentration of ^{222}Rn was determined in groundwater samples using a potable RAD7 electronic radon detector. The measured activity concentration of ^{222}Rn ranged from 0.44 – 117 Bq/L with an overall mean value of 13.8 Bq/L. The mean radon value is higher than the international safety standard of 11.1 Bq/L set by the United State Environmental Protection Agency. Cancer risk assessment performed based on the United States Environmental Protection Agency (USEPA) model for ingestion and inhalation pathwaysindicate a non-negligible radiological health risk to local populations relying on the untreated groundwater for drinking and domestic use. This study will serve as a valuable baseline data for Nigeria's radiological safety efforts and will also support the global discourse on groundwater protection in mining-impacted areas.

RHEP 036

NUCLEAR CROSS-SECTION EVALUATION IN PARTICLES-INDUCED REACTIONS ON SR-87 AND SR-89 FOR OPTIMAL PRODUCTION OF Y86 AND Y90 RADIONUCLIDES

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Abstract
The ascend of interest concerning Y-86 and Y-90 radionuclides which lies among the most important radionuclides for therapy of organic tumours has driven up the demand for the radionuclides. The use of enriched Strontium (Sr) radionuclides for accelerating the production of Y-86 via the Sr-87(p,2n)Y-86 and Y-90 through Sr-89(d,n)Y-90 reactions respectively is thus essential in order to generate a wide variety of Y-86 and Y-90 labelled radiopharmaceutical drugs for treatment benefits of patients. However, these routes, though more plausible than nuclear reactor method, is inundated with a number of competing contaminant radionuclide such as Y-84, Y-85, Y-87 and Y-88. In this paper the Q-value and reaction cross sections of the Sr-87(p,2n)Y-86 and Sr-89(d,n)Y-90 reactions were calculated using GEANT4 toolkit and the effects of Q-Value in optimizing the production of Y-86 and Y-90 were discussed. Q-Value of -14.456 MeV and 5.3451 MeV were found to be most feasible for Y-86 and Y-90 production respectively along with respective maximum cross sections at incident energy of 25 MeV and 17.5 MeV. This nuclear data will be very useful for radionuclide production of Y-86 and Y-90 using accelerators/cyclotrons.
Keywords: Cross- section, Q-value, Radionuclide, Radiotherapy

RHEP 037

OCCUPATIONAL AND PUBLIC HEALTH POTENTIAL RADIOLOGICAL RISK ASSESSMENT AND HEALTH IMPLICATIONS OF MEDICAL FACILITIES IN SOUTHERN NIGER DELTA, NIGERIA

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Abstract
The occupational and public potential radiological risk and the health implications of medical facilities of southern Niger Delta, Nigeria on patients, health workers and the general public was conducted using a well calibrated Red-Alert 200 nuclear meter with Geiger-Muller tube. These were done to established of radiation of the medical facilities and ascertain health implication of patients, health workers and the general public. The mean radiological results of Private clinics, General Hospitals and Health Centres are 0.015 mR/hr, 0.012 mR/hr and 0.013 mR/hr respectively. The obtained mean result does not surpass the world recommended limit 0.013 mR/hr. The mean computed radiological risk Indies values of absorbed dose rate (ADR), annual effective dose equivalent (AEDE) and Excess lifetime cancer risk (ELCR) are 116.0 nGy/hr, 0.572mSv/yr and 0.199 respectively are all within recommended limit. Also, the mean computed body organ (BD_{organ}) effective dose results and the contributed percentage of the three medical facilities studied are 0.3830 (15%), 0.3316 (13%), 0.3945 (15%), 0.4687 (18%), 0.3544 (14%), 0.2630 (10%) and 0.3888 (15%) mSv/yr for lungs, ovaries, bone marrow, testes, kidney, liver and whole body respectively. The obtained results of the medical facilities are all below recommended world limit of 1.0 mSv/yr. The measured, computed results of radiological risk and body organ (BD_{organ}) effective dose of the medical facilities studied does not pose significant radiological health risk on patients, health workers and the general public. However, precautions should be taken to avoid accumulation of radiations in the medical facilities.

Keywords: Medical Facilities, Occupational Health, Radiological, Body Organ, Nuclear Meter

RHEP 038

PHYTOCHEMICAL SCREENING AND ANTIBACTERIAL ACTIVITY OF LEAVES EXTRACT OF COFFEE SENNA (SENNA OCCIDENTALIS)

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Abstract
Phytochemicals and antibacterial activity of Senna occidentalis were investigated. The sample was air-dry under the shadow at room temperature, the dried leaves were crashed into powdered and stored in an air-tight container for further use. The ethanolic, petroleum Ether and ethyl acetate extracts were made by transferring 100g of the powder into 500ml of the solvents and allowed to soak for fourteen days and was filtered using filter paper. The results obtained from the research reveals that Senna occidentalis contains certain phytochemicals such as anthraquinones, flavonoids, alkaloids, saponnin, and Tannins which are responsible for the antibacterial activity of the plant. The extract from the leaf were tested on two clinical isolates (staphylococcus aureus and Escherichia coli) and gentamicin was used as control drug. The zone of inhibition exhibited by ethanol extract against Gram-positive bacteria ranged between 4mm and 15mm while between 14mm and 16mm for Gram-negative bacteria and the control was 30. The zone of inhibition exhibited by ethyl acetate the Gram positive-bacteria ranged between 5mm and 16mm while between 4mm and 10mm for Gram negative bacteria and the control is 28 and 27.

RHEP 039

QUANTIFYING NEAR-ROAD AIR POLLUTANTS: A DISPERSION MODELING STUDY IN ILE - IFE,NIGERIA

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Abstract

This study evaluated ambient air concentrations of gaseous pollutants and particulate matter along Ile-Ife, Nigeria's traffic corridors. It assessed the air quality index (AQI), modeled pollutant dispersion, and determined spatio-temporal distribution. The goal was to identify pollution sources and quantify each pollutant's contribution. Five low-cost air quality monitoring sensors measured airborne contaminants and meteorological conditions at seven high-vehicular locations (OAUTRF, OAUFSS, ELEWERAN, ALADANLA, OBALUFON, LAGERE, and MAYFAIR) over 18 weeks (June-October 2018). Data analysis employed open-air software, calculating AQI to assess environmental and health impacts. Positive Matrix Factorization (PMF) and Conditional Bivariate Probability Function (CBPF) identified pollution sources, while the Research-Line (R-LINE) dispersion model simulated pollutant dispersion. The Results showed pollutant concentrations exceeded WHO standards, except for NO_2: (CO: 392.20-1540 ppb, CO_2: 431.70 - 539.20 ppmv, O_3: 58.65-75.80 ppb, NO: 4.02-44.22 ppb, $PM_{2.5}$: 16.06-32.29 μgm^{-3}, PM_{10}: 49.11-306.10 μgm^{-3}). AQI indicated poor air quality, implying atmospheric pollution. PMF identified four pollution sources: Domestic emission (14%), Traffic emission (24%), Dust re-suspension (30%), and Secondary emission (32%). CBPF located pollutant sources, and the dispersion model revealed high pollutant concentrations. Pedestrians and nearby shops within 50m of roads were most impacted. The study concluded that high AQI values pose severe health and environmental risks. To mitigate these risks, policymakers should prioritize reducing traffic emissions, dust re-suspension, and secondary emissions. Effective measures, such as improving public transportation and enforcing emission standards, are crucial to protecting public health.

RHEP 040

RADIATION DOSE RATES OF FACILITIES HANDLING OILFIELD CHEMICALS AND PRODUCTS IN NIGERIA

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Abstract

Radiation dose rates at facilities handling oilfield chemicals and products in Nigeria was performed by in-situ measurements using calibrated exposure meters with a GPS monitor for coordinates. Exposure readings in milli Roentgen per hour and GPS coordinates were taken at thirty-four locations within three of the facilities. The probe (Caesium-137) of the exposure meter was held at 1.0m above the Lot with its window facing the chemical/product sample and the exposure reading was taken 60 seconds after the meter was switched ON. The dose rates from the measurements were used to determine the radiological health risks from mathematical models. The lowest and highest exposure levels were measured at the crude oil Lot and the subsea biocide Lot as 0.006±0.001 mRh^{-1} and 0.028±0.012 mRh^{-1} respectively. 44% of the measurements were consistently higher than world average value, 0.013mRh^{-1}. The lowest and highest Annual Effective Dose Equivalent (AEDE) of 94.1±35.28 μSvy^{-1} and 113.4±24.15 μSvy^{-1} were obtained from Production Facility C and Warehouse B respectively, both higher than the world average value of 70.0 μSvy^{-1}. The Excess Lifetime Cancer Risk (ELCR) at all three facilities exceed the recommended $0.29x10^{-3}$. The result of this work generally reveals radiation pollution in the facilities which may have negative health impact on people and environment.

RHEP 041

RADIOLOGICAL DOSE ASSESSMENT OF CASSAVA TUBERS CULTIVATED IN EBONYI STATE, NIGERIA

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Abstract

Radiological assessment of food crops is critical for estimating radiation doses as they serve as main ingestion transfer route of natural radionuclides to the internal body organs. The aim of this study is therefore to measure the activity concentration (AC) of natural radionuclides in cassava tuber crop of Ebonyi State origin, and estimate their committed effective dose and lifetime cancer risk. Activity concentrations of ^{40}K, ^{226}Ra and ^{232}Th, determined by gamma spectrometric Na(TI) detector, were in the range of 177.71 ± 0.86 to 260.40 ± 0.91 Bq/kg, 66.08 ± 0.52 to 91.12 ± 0.44 Bq/kg and 103.92 ± 0.63 to 136.44 ± 0.39 Bq/kg, with average value of 199.15 ± 23.51 Bq/kg, 77.57 ± 7.98 Bq/kg and 118.20 ± 10.72 Bq/kg, respectively. The total average CED of the combined radionuclides was estimated to be 7.05 mSv/y which is higher than world average value of 0.29 mSv/y given by United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). The data presented in this study contributes to baseline information on radiological characteristics of tuber crops in Ebonyi which is of important value to food safety policy.

RHEP 042

RADIOLOGICAL HEALTH RISK OF EXPOSURE TO GAMMA RADIATION IN PRIVATE DIAGNOSTIC CENTER IN KHANA LOCAL GOVERNMENT AREA RIVERS STATE, NIGERIA

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Abstract

The In-situ measurement of background ionizing radiation of Centre of Life hospital Bori in Khana Local Government Area of Rivers state of Nigeria has been carried out. Digilert-200 Radiation meters was utilized in measurement of background ionizing radiation and Global Positioning System (Garmin 765) was used in measuring coordinates of the sampling points. Fifteen (15) sampling points were arbitrarily selected within the diagnostics centre. The results of the BIR outdoor and indoor varies from 0.010 - 0.015 with mean of 0.013 $mRhr^{-1}$. Absorbed Dose rate varies from 87.0 -130.5 nGy/yr with mean of 114.3 nGy/yr and 116.0 nGy/yr for outdoor and indoor. AEDE varies from 0.107 – 0.160 with mean of 0.140 mSv/yr and 0.142 mSv/yr and Excess life cancer risk varies from 0.37×10^{-3}– 0.56×10^{-3} with mean of 0.50×10^{-3} and 0.50×10^{-3} for outdoor and indoor respectively. The obtained values for BIR of Centre of Life Hospital Ltd was within recommended standard limit of 0.013mR/h. The obtained result for AEDE was within the recommended safe limit. The result of radiation dose to different body organ shows that the testes have the highest radiation percentage for outdoor and indoor respectively. The obtained results of ELCR and the ADR are all higher than the recommended standard of 0.29×10^{-3} and 84.0 nGy/h respectively. This high value of excess life cancer risk and absorbed dose rate may not pose any immediate health effects on patients and staff but it should be control for effective working environment.

RHEP 043

RADIOLOGICAL RISK ASSESSMENT OF NON-HUMAN BIOTA AROUND THE NIGERIA RESEARCH REACTOR-1 FACILITY UNDER SIMULATED ACCIDENT CONDITION

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Abstract
Research reactors have played a vital role in human civilization for over six decades. Nigeria acquired its first research reactor, the Nigeria Research Reactor-1 (NIRR-1), in 2003 and it is installed at the Centre for Energy Research and Training, Ahmadu Bello University, Zaria. The reactor is is a Miniature Neutron Source Reactor (MNSR) primarily used for Neutron Activation Analysis (NAA) and education. Initially fueled with High Enriched Uranium (HEU), the core of the reactor was later converted to Low Enriched Uranium (LEU) due to proliferation concerns. Despite nuclear technology's contributions to global development, concerns about radiation effects hinder its acceptance, particularly in developing countries like Nigeria. This study assesses the environmental safety of non-human biota around NIRR-1 under severe accident conditions using the ERICA computer code. The assessment, based on Conservative Dose Rates (CDR) and Risk Quotients (RQ), found variations in dose rates among terrestrial organisms. However, all predicted dose rates remained below the ERICA screening value of 10 μGy/h, and the Hazard Quotients (HQ) for reference organisms were below unity. These results confirm that radiation exposure to non-human biota remains at an acceptably low risk level, even under severe accident scenarios

RHEP 044

RADIOLOGICAL RISKS ASSESSMENT OF NATURAL OCCURRING RADIONUCLIDES IN RIVER WATER OF COASTAL COMMUNITIES OF OKRIKA, RIVERS STATE, NIGERIA

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Abstract
A systematic study of activity concentration and distribution of radionuclides was carried out in Coastal communities of Okrika, Rivers State, Nigerian. A total of 18 samples of River Water from the 9 Coastal communities were obtained and analyzed using Gamma-ray Spectrometry method. The activity concentration of ^{40}K, ^{238}U and ^{232}Th ranged from 105.12-214.07 with a mean of 147.06±34.01Bq/l, 0.22-10.1 with a mean of 4.03±3.70Bq/l, and 2.57-6.25with a mean of 4.65±1.20Bq/l respectively. These values are above the recommended limits of 10Bq/l, 0.5Bq/l and 0.2Bq/l for of ^{40}K, ^{238}U and ^{232}Th respectively.For the age group of (0-1)yrs, (1-2) yrs, (2-7)yrs, (7-12)yrs, (12-17) yrs and >17yrs, values of the annual effective dose ranged from 0.0055 – 0.0080 mSv/y with a mean value of 0.0064±0.01 mSv/y, 0.0040 to 0.0075 mSv/y with a mean value of 0.006±0.001 mSv/y, 0.0013 to 0.0018 mSv/y with a mean value of 0.0015±0.002 mSv/y, 0.0054 -0.0100 mSv/y with a mean value of 0.0072±0.02 mSv/y, 0.0059– 0.0103 mSv/y with a mean value of 0.0076±0.002 mSv/y, and 0.0059-0.0103 mSv/y with a mean value of 0.0076±0.002 mSv/y respectively. The annual effective dose in all the communities in River Water are quite lower than the recommended values of 0.1 mSv/y as recommended by WHO. The Committed dose indicates that the age group of (12-17) yrs and (>17yrs &Adults) receives more dose than other age group. Therefore, it is recommended that exposure to River Water of the Coastal communities should be minimized in order to reduce the level of health risk of radiation to man.

Keywords: Coastal Communities, Natural Radionuclides, Total Annual Effective Dose, Committed Effective Dose.

RHEP 045

SPECTROSCOPIC AND QUANTITATIVE APPLICATION IN CHARACTERIZATION OF BIOACTIVE CONSTITUENTS OF AQUEOUS PEARL MILLET SEEDS EXTRACT

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Abstract
Analytical techniques such as UV/Visible and Fourier Infrared spectroscopies can be employed to detect and quantify the phytochemicals, such as flavonoids, phenols, and antioxidants, present in plant seeds. This work aimsto assess the presences of bioactive constituents using biophysical techniques and to physically interpret the biochemical analysis of the aqueous pearl millet seeds extract. UV/Visible (UV-VIS) spectroscopy, Fourier Transform Infrared (FTIR) spectroscopy, total phenolic content (TPC), total flavonoid content (TFC), and antioxidant capacity assay (DPPH) were employed in quantification. The study revealed a moderate percentage yield of 9% and the spectra showed that aqueous pearl millet seeds extract is rich in bioactive compounds, particularly phenolic and flavonoid compounds as observed from the UV-VIS and FTIR. This was also confirmed by the presence aromatic ring system, conjugated system of alternating double bond, and the presence of hydroxyl groups (-OH), particularly antioxidants, with high concentrations of phenolic and flavonoid compounds as observed from the biochemical analysis of the extract.The results confirmed the presencesof bioactive constituents in the extract and showed strong antioxidant potential of the extract from its interaction with light in different concentrations.
Keywords: Spectroscopy, Characterization, Bioactive constituents, Pearl millet seeds

RHEP 046

STRUCTURAL ADVANCES ON RARE EARTH OXIDES DOPED IN ZINC BORO-TELLURITE GLASS FOR RADIATION SHIELDING

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Abstract
This research aims to fabricate and determine the fundamental characteristics of Europium oxides doped in $20ZnO{-}30B_2O_3{-}(70\text{-}x)TeO_2$ glass for radiation shielding applications. To achieve this, different concentrations of Eu_2O_3 coded as X_1, X_2, X_3, X_4, and X_5 in ZBT glass were manufactured using the standard melt-quench technique to optimise a pure sample. As Eu_2O_3 concentration increases, all elastic moduli decrease. The XRD patterns were determined from 20° to 80° to verify the amorphous structure, while FTIR spectra showed broad, weak, and significant spectrum in the wavenumber band of 400–4000 cm^{-1} that were linked to the glass architecture and their related bond modes of vibrations. Density measurement varies between 4.04 and 4.25 g/cm^3, while molar volume also decreases from 32.77 to 28.91 cm^3/mol. Using the Phy-X/PSD programming applications, the radiation parameters required by the robust glass technology were determined. The inclusion of Eu_2O_3 as a dopant in boro-tellurite glass networks enhances radiation shielding characteristics by lowering the MFP and HVL levels while improving MAC and LAC behavior on radiation-resistant glass.

RHEP 047

THE APPLICATION OF RADIATION TECHNOLOGIES IN AIRPORT

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Abstract
The utilization of radiation in airport security has revolutionized the efficiency and safety of air travel. Radiation technology plays a pivotal role in modern airport operations, ensuring safety, security, and efficiency. This manuscript explores the various applications of radiation technologies, such as X-ray scanners, millimeter-wave scanners, and radiation detection portals. It highlights their role in enhancing security measures, streamlining passenger processing, and ensuring the safety of both passengers and airport personnel. The paper also addresses the potential health risks associated with radiation exposure and discusses the safety protocols and regulations in place to mitigate these risks.

RHEP 048

TIME SERIES DECOMPOSITION OF SHORT PERIOD CLIMATIC TEMPERATURES USING FAST FOURIER TRANSFORM IN PORT-HARCOURT

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Abstract
This study investigated the changes in temperature in order to understand the air quality in Port-Harcourt City during the time of the air pollutant (soot) noticeable in the City over short periods of two years. This aim of this study is to eliminate the long time required to observe the physical state of the Earth temperature at 25 m altitudes. Data loggers with sensors for environmental studies were mounted at the Rivers State University premises for period of the two years for data acquisition. Data acquired was grouped into four quadrants of 6 hourly to remove the temperature swings between the day time and night time events which were decomposed in a spectrogram using fast Fourier transform technique. The results showed "spectral clouds" of yellow band and bluish band that represented the relationship between the temperature perturbation and the thermal mass of the environment. These findings are good understanding of the mechanisms for short term cause of climate change.

RHEP 049

A REVIEW OF STRATEGIES FOR SUSTAINABLE, AND SECURE LONG-TERM NUCLEAR WASTE MANAGEMENT

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Abstract
This study reviews several technological approaches for the long-term storage of partially used nuclear waste, including deep geological disposal, dry cask storage, vitrification, partitioning,of and transmutation (P&T) processes, spent nuclear fuel management, and advanced fuel reprocessing. As global reliance on nuclear energy continues to grow, the need for secure and sustainable waste management solutions becomes increasingly critical.The study evaluates the benefits and drawbacks of each approach, emphasizing efficiency, sustainability, and safety in the storage of radioactive waste. Deep geological disposal is identified as the most secure long-term solution, capable of isolating high-level radioactive waste for up to a million years. For spent nuclear fuel, dry cask storage serves as an effective temporary measure. Vitrification provides stability by immobilizing waste in glass, while P&T and advanced fuel reprocessing offer opportunities to reduce waste volume and toxicity. However, these latter technologies require further development to achieve full feasibility.The findings suggest that the most promising strategy is to integrate these technologies in ways that align with the specific properties of the waste. To enhance the long-term safety and

sustainability of nuclear waste management, the study recommends prioritizing investment in geological disposal and interim storage technologies, such as dry cask storage, alongside advancing research into innovative processes like P&T and vitrification.

RHEP 050

ASSESSMENT OF NATURAL RADIOACTIVITY OF CASSAVA IN THE COASTAL AREAS OF ANDONI LGA, RIVERS STATE, NIGERIA

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Abstract
The research work covers the assessment of natural radioactivity of cassava in the coastal areas of Andoni LGA, Rivers State, Nigeria due to environmental pollutions and radiological hazards associated in the environment. A total sum of ten (10) samples of cassava were collected across the coastal communities. The collected samples were analyzed with Gamma-Ray NaI(TI) Spectrometer in the laboratory and radionuclide ^{40}K, ^{238}U and ^{232}Th were present in the samples. The mean activity concentration of ^{40}K, ^{238}U and ^{232}Th in cassava plant from the study area are 333.20±23.25 $BqKg^{-1}$, 11.75±2.71 $BqKg^{-1}$ and 1.81±0.15 $BqKg^{-1}$ respectively. The transfer factor calculated from the cassava sample recorded high values which exceeded the unity value of 1.0 as recommended (UNSCEAR, 2002). Transfer mean values recorded were 1.95 for ^{40}K, 2.78 for ^{238}U and 3.42 for ^{232}Th respectively. The result of the study indicates high level of health risk to the populace in the area due to transfers of radionuclide, although the activity concentration mean values are within the world average values of 420 $BqKg^{-1}$, 33 $BqKg^{-1}$ and 45 $BqKg^{-1}$ for ^{40}K, ^{238}U and ^{232}Th respectively.
Keywords: Radionuclide, Radioactivity, Concentration, Health-risk

RHEP 051

ASSESSMENT OF SKIN ENTRANCE DOSE OF PATIENTS FROM DIAGNOSTIC X-RAY OF HUMAN THE CHST

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Abstract
Assessment of skin entrance dose of patients from diagnostic x-ray of the chest was carried out in Federal Medical Center Keffi, Nasaraw State, Nigeria. This was based on the recommendation of ICRP that set the standard skin entrance dose to 0.4 mGy. In this work, the skin dose of male and female patients were calculated differently and results were compared to ascertain the difference. The Edmond formula was used to carry out the calculations. The findings show that the male patients have the thickness range from 7 cm to 23 cm. thickness of 8 cm, 11cm, 14 cm and 15 cm were skipped because there were no male patients with such thicknesses to fill in as at the time of the research. The weight of the male patients ranges from 35.5 to 70.5 kg. The highest absorbed dose recorded is 0.851mGy at 23 cm for male. And for female patients, the thickness started from 7 cm to 25 cm. thickness of 9 cm, 12cm, 13 cm and 15 cm were skipped because there were no female patients with such thicknesses to fill in. The weight of the patients ranges from 35.5 to 80.5 kg. The highest absorbed dose recorded is 0.880 mGy at 25 cm for male. When compared, it was noted that female patients with more weight and thickness take more average dose rate when exposed to chest X-radiation examination than male. As such, they absorb more skin dose than the male patients. However, the recommended dose was not exceeded.
Keywords: Skin dose, Entrance skin, Chest, X-radiation, patient.

RHEP 052

CLOUD INTERNET OF HEALTH THINGS DEVICE ENABLED VALUE ANALYTIC SCHEDULING: A MITIGATIION TO MORTALITY RATE WITH DIGITAL HOSPITAL MANAGEMENT

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Abstract
This paper proposed a Value Analytic Scheduling (VAS) framework with integration of the Internet of Health Things (IoHT) within the healthcare sector. This study emphasizes incorporations of analytics modules in biomedical IoT devices to send a categorical data to physicians over the globe irrespective of location for support and better clinical decision and patient safety. To tackle these, we used the formula $A_1=hp_i-U_b$ and $A_2=L_b-hp_i$ to handle, hyper, hypo and normal cases of ailments for immediate and effective responses to safe lives. Value $A_1>0$ and $A_2,>0$ implies that biomedical device value is above maximum and minimum threshold respectively, $A_1<0$ and $A_2,<0$ implies that the value read by biomedical device is normal. The values were later sorted in deceasing order. High the A implies high severity and high priority to safe life. The VAS algorithm perform better than FP-TOSM and PTS-RA. Considering turnaround time resource utilization and transition time from edge to cloud contribute to its high delay in relation to FP-TOSM and PTS-RA. This paper finds that Incorporating value analytic modules that categorically classified ailment into hypo, normal and hyper speed up diagnosis and treatment to reduce mortality and that time taken by physician in interpreting IOT device results prolong waiting which in turn affects turnaround time. we recommended (i) incorporation of analytical module for categorical classification of ailments (ii) resource placement at the same level without stratification to speed up medication processes to minimize mortality rate.
Keywords: Cloud computing, eHealth, healthcare virtualization and Internet of Health things.

RHEP 053

COMPARATIVE ANALYSIS OF DETECTED IONOSPHERIC ANOMALIES WITH EARTHQUAKE MAGNITUDES: A CASE STUDY OF THE EARTHQUAKES OF MARCH 4, 2021

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Abstract
Comparative analysis of detected ionospheric anomalies with earthquake magnitudes was carried out on two seismic events of March 4, 2021, (M7. 3 Gisborne and M8. 1 Kermadec Earthquakes) to establish the link between observed perturbations and event size. GPS-TEC data were downloaded 20 days pro and 5 days post the events from stations within the epicenter of respective earthquakes. The data were statistically analyzed to detect unusual variations within the investigative window. The investigation revealed that the M7. 3 Gisborne EQ recorded two variations on-19 and-4 days; both being positive perturbations. However, five anomalies were detected for the M8. 1 Kermadec EQ on-15, -11,-5,-3 and-2 days. Except for the irregularities on-3 days, all others were positive anomalies. The observed anomalies were subjected to further scrutiny using the geomagnetic indices of Kernnifzer digit (kp) and disturbance storm time (Dst) for geomagnetically induced perturbations while sunspot number and F10. 7cm were to monitor solar activities within this same period. Gisborne EQ measured 100% seismo-induced variations while Kermadec EQ had 80% seismogenic anomalies. The study clearly showed an increase in detected anomalies with earthquake magnitudes.
Keywords: Earthquake, magnitude, TEC, anomalies,

RHEP 054

DETERMINATION OF HUMAN EXPOSURE TO BACKGROUND IONIZING RADIATION IN FEDERAL MEDICAL CENTRE YENAGOA, BAYELSA STATE, NIGERIA

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Abstract
Background ionizing radiation study was conducted within the Federal Medical Centre Yenagoa using a well calibrated Radiation Alert Monitor -200 to determine the levels of associated radiological health hazards. A total of 60 background counts were randomly taken in six locations within the hospital and a Global Positioning System was used to measure the coordinates of each sample point. The average outdoor readings in the vicinity of Molecular research, Modular theatre, Microbiology, Isolation centre, Out-patient clinic and Radiology areas were 0.18 ± 0.03, 0.13 ± 0.01, 0.14 ± 0.03, 0.12± 0.01, 0.11 ± 0.01, and 0.17 ± 0.02 μSv/h respectively. These values were all below the recommended standard limit of 0.274 μSv/h. The results of annual effective dose equivalent (AEDE) for the six zones were within the permissible limit of 1.00 mSv/y as recommended by the International Commission on Radiation Protection. The average values of the outdoor excess lifetime cancer risk (ELCR) for all the six zones were $> 0.29 \times 10^{-3}$. However, doses for different body organs were below the international recommended safe limit of 1.0 mSv/y, and therefore radiological health risk in the study area is quite insignificant especially on short term basis.

Keywords: Annual Effective Dose Equivalent, Dose to various body organ, Background Ionizing Radiation, Dose Rate, Excess Life Cancer Risk.

RHEP 055

DRINKING WATER QUALITY, NITRATE, AND HEAVY METAL QUANTIFICATION, AND HEALTH RISK ASSESSMENT OF WATER SOURCES AROUND BABBAN TSAUNI GOLD MINE

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Abstract
This study assesses the drinking water quality in Babban Tsauni artisanal gold mining community by analyzing physicochemical parameters and heavy metal concentrations, using standard methods. Parameters include pH, temperature, total dissolved solids, conductivity, dissolved oxygen, nitrate, and heavy metals (As, Pb, Ni, Mn, Cr, Zn, Cu). Heavy metal pollution indices and health risks were evaluated. Results show that physicochemical parameters and nitrate concentration were within safe limits, and Heavy metal concentrations were in the range of 0.724-2.886, 0.004-0.017, 0.001-0.243, 0.037-6.910, 0.006-0.151, 0.009-0.060 (ppm) for As, Pb, Ni, Mn, Cr, Zn, Cu concentrations respectively. Of the seven heavy metals considered, only Zn and Cu had values within the WHO permissible limit. The contamination factor for Mn was 20.0, with other heavy metals having values of less than 1. However, the overall pollution index for heavy metals was 0.52; interpreted as non-pollution. There was no significant cancer risk, although potential non-carcinogenic effects in children due to as exposure (dermal route, hazard index: 19.27). The study therefore recommends that necessary measures should be taken to prevent potential risk.

Keywords: Water quality, Gold mining, Contamination, and Health risk

RHEP 056

ESTIMATION OF DAILY RAINFALL VARIABILITY AND DRIFT OF AUGUST BREAK IN SOME SELECTED STATES WITHIN SOUTH EASTERN NIGERIA

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Abstract
This study considered decadal pattern analysis of August break of three selected states within the South Eastern region of Nigeria (Enugu, Akwa and Umuahia). The daily rainfall data from three different sites in the Southern region of Nigeria were obtained from the Nigerian Meteorological Agency (NIMET). These data covered a period of 42 years (1971 - 2013) and was analyzed using climate indices and line graph to depict their patterns while trend lines were used to depict the slopes of the rainfall series. Also, climate index parameters such as mean, meadian, mode, standard deviation, coefficient of variation, correlation analysis and variance were obtained from the decadal scale data in order to examine rainfall variability at selected locations with emphasis on the August break drift. The result presents Awka to experience a total of 188 days of August break from 1975 – 2013, Enugu, total of 321 days of August break and Umuahia a total of 49 days of August break. The statistical results obtained using climate index analysis showed that Awka 1975-1985, Enugu 1982-1992 and Umuahia 1986-1996 has least average of decadal rainfall distribution. Umuahia shows the least amount of rainfall variability when compared with other stations, Enugu 1982-1992 and Umuahia 1986-1996 has least average of decadal rainfall distribution. Umuahia shows the least amount of rainfall variability when compared with other stations. From the results of the data analysis, the decadal trend in August break shows that August break is not consistent. Thus, a drift in the normal August break from August to June and also to October were observed.

RHEP 057

ESTIMATION OF HEAVY METALS IN SOIL OF OKABA COALFIELDS AND ENVIRONS, ANKPA, KOGI STATE, NIGERIA

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Abstract
This study investigates the concentrations of heavy metals in soils from the Okaba Coalfields and environs, Ankpa, Kogi State, Nigeria, to assess potential environmental and public health risks. Soil samples were collected from ten distinct locations and prepared through oven-drying, grinding, sieving, and acid digestion using concentrated nitric acid. The resulting digests were analysed using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) to quantify levels of chromium (Cr), zinc (Zn), copper (Cu), cadmium (Cd), lead (Pb), nickel (Ni), and arsenic (As). The mean concentrations recorded were 113.92 mg/kg for Cr, 53.87 mg/kg for Zn, 37.78 mg/kg for Cu, 1.01 mg/kg for Cd, 91.82 mg/kg for Pb, 39.99 mg/kg for Ni, and 22.32 mg/kg for As—values that generally exceed the World Health Organisation (WHO) permissible limits. These elevated heavy metal levels pose significant health risks, including respiratory, renal, neurological, and developmental effects, particularly among vulnerable populations such as children. The findings underscore an urgent need for regular environmental monitoring, stricter regulation of industrial emissions and waste disposal practices, and targeted remediation efforts to mitigate the adverse impacts on human health and the ecosystem in the Okaba region.

Keywords: Heavy Metals, Soil Contamination, ICP-MS, Environmental Pollution, Public Health Risk

RHEP 058

EVALUATION OF INDOOR RADON CONCENTRATION AND THE HEALTH RISK PARAMETERS IN SOME SELECTED RESIDENCES IN PORT HARCOURT METROPOLIS, NIGERIA

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Abstract

This study assesses indoor radon levels in Port Harcourt Metropolis, with measurements taken from three locations: Rivers State University (RSU), Rumughalu, and Oyigbo. Radon concentrations were evaluated in both ventilated and non-ventilated areas to assess potential health risks and adherence to safety standards. Using Corentium Airthings Digital Radon Detector, radon concentration levels in non-ventilated areas of RSU ranged from 3 to 33 Bq/m³, with an average concentration of 17.4 ± 29.9 Bq/m³, while ventilated areas averaged 9.0 ± 1.33 Bq/m³. In Rumughalu, the non-ventilated spaces recorded a significantly higher average of 118.8 ± 23.4 Bq/m³, peaking at 322 Bq/m³, while ventilated areas showed a reduced average of 13.4 ± 1.19 Bq/m³. Oyigbo exhibited an average radon level of 81.2 ± 1.79 Bq/m³ in non-ventilated areas, compared to 17.5 ± 2.43 Bq/m³ in ventilated areas. The calculated Annual Effective Dose Rate (AEDR) for non-ventilated areas reached 0.57 ± 0.11 mSv/year in Rumughalu, close to the ICRP reference limit of 1.0 mSv/year, while ventilated areas in RSU recorded a lower AEDR of 0.04 ± 0.006 mSv/year. Excess Lifetime Cancer Risk (ELCR) ranged from $(0.12 \pm 0.01) \times 10^{-3}$ in ventilated areas to $(2.39 \pm 0.47) \times 10^{-3}$ in non-ventilated spaces. The study concludes that proper ventilation significantly reduces radon exposure risks. The findings provide valuable baseline data for public health policy, highlighting the need for regular monitoring and improved ventilation practices in indoor environments across Port Harcourt. This research offers valuable baseline data on radon exposure for urban Nigerian settings and supports the need for enhanced building standards to improve public health safety.

Keywords: Indoor Radon, Radiation, Environmental Monitoring, Health Risk, Ventilation, Radon Mitigation, Public Health, lungs

RHEP 059

EVALUATION OF THE BACKGROUND IONIZING RADIATION LEVELS IN SELECTED DUMPSITES IN PORT-HARCOURT METROPOLIS, RIVERS STATE

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Abstract

There is a marked increase in the number of industries in Port Harcourt metropolis, which has led to the continuous disposal of various kinds of wastes in dumpsites within the metropolis; this may result to increase level of background ionizing radiation of some of the dumpsites. The study aimed at evaluating the background ionizing radiation levels in selected dumpsites in Port-Harcourt metropolis, Rivers State, Nigeria. This cross-sectional survey was conducted using calibrated International portable Nuclear Radiation Monitor (Radalert-100) and Global Positioning System (GPS). The mean of three readings taken at each location was calculated. The annual absorbed dose rate, absorbed dose rate and the annual equivalent dose rate were estimated. The mean value background ionizing radiation exposure rate is 0.0149 mRh-1. The mean estimated equivalent dose rate is 0.906±.315065 mSvy-1. The total mean values obtained in the study are all below the world permissible dose limit of 1.0 mSvy-1. The calculated mean value absorbed dose rate is 93.743±32.581471 ηGyh-1. The average value of AEDE is 114.968±39.956230 μSvy-1. The mean value of ELCR is 0.40223±0.1398. This high value for excess lifetime cancer risk indicates that there exist the possibilities of cancer development by residents who spend a reasonably part of their lifetime area.

RHEP 060

HEAVY METALS CONCENTRATION LEVELS AND ASSOCIATED CARCINOGENIC AND NON–CARCINOGENIC HEALTH RISKS ASSESSMENT OF COMMERCIAL TEA FROM SOUTH AFRICA

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Abstract
The toxicity of heavy metals in our environment constitutes exposures that poses potential health risks to humans, especially when ingested through commonly consumed beverages such as tea and needs to be continuously monitored. In this study, the concentrations of heavy metals such as aluminium (Al), arsenic (As), cadmium (Cd), chromium (Cr), iron (Fe), manganese (Mn), nickel (Ni), lead (Pb) and zinc (Zn) in 22 samples of tea bought from South African open market were assessed, using inductively coupled plasma mass spectrometry (ICP-MS) technique. The results show that, average concentrations of heavy metals in both green and black tea varied significantly, in decreasing order of Mn > Al > Ni > Fe > Zn > Pb > Cr > Cd > As. The green tea concentration levels were higher than in black tea, but all values were below maximum permissible limits according to FAO/WHO, except Al and Mn, which exceeded limits and warrant further research. Potential health risks were assessed, and average daily intake (ADI) was found to be lower than reference dose (RfD). Non-carcinogenic health risks, as indicated by Total Hazard Quotient (THQ) and Hazard Index (HI), were both below 1, implying no significant non-carcinogenic risk. These risks in children were higher than in adults, suggesting that children are more sensitive to toxic metal exposure. Carcinogenic health risks, measured via incremental Lifetime Cancer Risk (ILCR), are less than threshold of 1, inferring that 2 out of 100 million children and 5 out of 1 million adults in their lifetime are likely to develop excess cancer due to heavy metal exposure from tea consumption. However, overall, tea consumption poses no significant carcinogenic or non-carcinogenic health risk. Principal Component Analysis (PCA) revealed distinct groupings of various heavy metals in relation to their source properties. These results highlight the importance of monitoring heavy metal contamination in tea and suggest the need for stricter regulatory measures to ensure public health safety. The study provides valuable insight into the potential risks associated with tea consumption and underscores the significance of food safety standards in agricultural and food products.
Keywords: carcinogenic risk, heavy metals, health risks, ICP-MS, non-carcinogenic risk, tea.

RHEP 061

INVESTIGATION OF DUMPSITE POLLUTION USING MINERAL MAGNETIC AND GEOCHEMICAL ANALYSES

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Abstract
The study was carried out to investigate the pollution levels of soils in dumpsites in Jalingo, Taraba State Nigeria. To achieve this objective, measurement of mineral magnetic proxies including magnetic susceptibility (χ), frequency-dependent susceptibility (χfd%), Anhysteric Remanent Magnetization (χARM), and Isothermal Remanent Magnetization IRM (SIRM) were performed using standard methods. Heavy metal concentrations were measured using the X-ray Fluorescence (XRF) spectrometer. The average values of χ, χARM and SIRM are respectively $122.264 \pm 78.377 \times 10^{-8}$ m^3kg^{-1}, $0.237 \pm 0.112 \times 10^{-5}$ m^3kg^{-1} and $937.098 \pm 723.038 \times 10^{-5}$ Am^2kg^{-1}. These high values which varied widely between samples indicate intense concentration of anthropogenic ferrimagnetic minerals in the dumpsites. The magnetic grain size indicators (χfd%, ARM/SIRM, χARM/χlf and SIRM/χlf) suggest a mixture of coarse multi-domain and superparamagnetic grains. The result of geochemical analyses shows

that K, Ca, Zn, Zr, Sn, Ba, Pb and Th have values above the geochemical background concentration pointing to anthropogenic sources. The strong positive and significant correlations found between magnetic and heavy metals have shown that magnetic methods could be used as a faster alternate means for pollution assessment.
Keywords: magnetic susceptibility; heavy metal; dumpsite; anthropogenic

RHEP 062

NATURAL RADIOACTIVITY LEVELS IN GROUNDWATER SOURCES AND ITS HEALTH IMPACT ASSESSMENT ON THE CONSUMERS

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Abstract
This study measured the activity of 232-Th, 226-Ra and 40-K in ground water; estimate the total annual effective radiation dose in ground water and the life time cancer risk to the populace. Groundwater samples were collected and prepared for coaxial high-purity germanium (HPGe) for analysis. Mean activity of 40-K from Egbeda, Ipaja and Ije Ododo are 2.534, 1.713 and 1.931 Bq/l respectively. These values were higher than the mean activity of 232-Th which were 0.342, 0.364 and 0.402 Bq/l for Egbeda, Ipaja and Ije Ododo respectively. The mean activity of 226-Ra from Egbeda, Ipaja and Ije Ododo are 1.191, 0.735 and 0.490 Bq/l respectively. Mean total effective dose from Ipaja are for adults 0.218 μSv/year, children 0.246 μSv/year and the infants had 0.219 μSv/year. In Adults annual effective radiation doses was highest in EG1 with value of 0.429 μSv/year, EG4 is of value 0.455 μSv/year; PA4 have the value of 0.344 μSv/year and the lowest was recorded from JE3 with value 0.076 μSv/year. The obtained values were lower in Ipaja and Ije Ododo, this may not pose any significant health problems, But for Egbeda with higher values may pose health problems long time due to bioaccumulations.

RHEP 063

POPULATION DOSE DISTRIBUTION DUE TO NATURAL WATER RADIOACTIVITY CONCENTRATION LEVELS IN TEN LOCAL GOVERNMENT AREA OF RIVERS STATE, NIGERIA

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Abstract
This study assessed the natural radionuclide content in water samples collected from twenty communities across ten Local Government Areas of Rivers State, Nigeria. Gamma spectrometry using a NaI (Tl) detector was employed to measure the activity concentrations of ^{40}K, ^{238}U, and ^{232}Th. The obtained results revealed varying levels of radionuclide content within the samples. The activity concentrations ranged from 2.34±1.24 to 12.08±1.97 BqL-1 for ^{40}K, 2.00±0.94 to 15.42±1.4 BqL-1 for ^{238}U, and 0.32±0.02 to 1.77±0.26 BqL-1 for ^{232}Th. The average values were determined as 6.16±1.04 BqL-1 for ^{40}K, 11.22±0.83 BqL-1 for ^{238}U, and 0.99±0.10 BqL-1 for ^{232}Th. The annual collective effective dose resulting from these activity concentrations was calculated, with values ranging from 0.0009 to 0.0227 man-Sv and an average of 0.0082 ± 0.001 man-Sv. Notably, the estimated radiation parameters and activity concentrations of this study were found to be below the global permitted limits. Consequently, the study concludes that there is no significant radiological health impact on the general population based on the analyzed water samples.
Keywords: Natural radioactivity; Collective effective dose; gamma-ray spectrometry; Absorbed dose;

RHEP 064

RADIOLOGICAL HEALTH RISKS ASSESSMENT OF SELECTED BRANDED SACHET DRINKING WATER IN ESA-OKE, OSUN STATE, SOUTHWEST, NIGERIa

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Abstract
Water is a vital resource for both living organisms and human society, with economic development heavily dependent on it. Despite its abundance, water sources such as rivers, wells, and boreholes can become pathways for contaminants, including radionuclides, due to human activities and industrial waste. Increasing levels of contamination have raised health concerns, especially regarding cancer and other diseases. In this study, evaluation of the natural occurring radioactive materials (NORMs) in branded sachet drinking water in Esa-Oke town, Osun State, Southwest, Nigeria using a thallium doped cesium iodide detector. Activity concentrations of ^{40}K, ^{238}U, ^{232}Th ranged from 231.65±45.20 to 313.46±25.45 BqL^{-1} with a mean of 288.74±3.26 BqL^{-1}, 6.86 with a mean of 8.56 and 10.53 with a mean of 17.6 BqL^{-1} respectively. Age dependent annual effective doses were estimated, based on International Commission on Radiological Commission (ICRP) recommendations using age groups 0 – 1y, 2 -7y, 7 – 12v, 12 -17y, and > 17y and it showed a higher value in infants (0–1 yr) than the other age groups and it was also exceed the World Health Organization recommended values of 0.1mSv. This indicates that infants are the most vulnerable group to radiation hazard.

Keywords: Sachet water, gamma spectrometry, activity concentration, health risks, natural radionuclides.

RHEP 065

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

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

Keywords: radiometric, leaching, activity concentration

RHEP 066

RADIOMETRIC MAPPING AND ANALYSIS OF RADIATION HEALTH RISK PARAMETERS OF IMO NORTH SENATORIAL DISTRICT, NIGERIA.

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Abstract

A Radiometric mapping and analysis of Radiation Health Risk Parameters ofImo North Senatorial zone, Nigeria (situated between E007º4´48´´ and E007º25´48´´, and N05º30´36´´ and N05º56´24´´) was carried out through the use of two well Calibrated nuclear radiation meters, Radalert 100 and Digilert 200 and a GPS device, to measure the background Ionizing radiation exposure rate. Golden Software Surfer 20.1.195 and QGIS 3.16.8 were used for plotting radiation contour maps and radiometric map respectively. The average radiation exposure rates from thirty communities in the six local government areas of the zone was 0.0128±0.0006mRh^{-1}. The average absorbed dose rate varies from 110.86±4.77 nGyh^{-1}. The average annual effective dose equivalent (AEDE) result was 0.1136±0.006mSvy^{-1}. The Excess life time cancer risk (ELCR) average values was 0.476±0.02 x 10^{-3}. The average radiation exposure rates and average values for AEDE in this study are within the recommended ICRP standard values. The average absorbed dose and ELCR surpassed the world allowable limit of 84 Gyh^{-1} and 0.29 x 10^{-3} respectively. The values recorded for absorbed dose rate and ELCR may not result in an instant health impact on residence of Imo East Senatorial zone, but continuous exposure may result in stochastic radiation effects.

RHEP 067

SEASONAL VARIATION OF AIRBORNE RADIONUCLIDE CONCENTRATIONS IN LAGOS, NIGERIA: A COMPARATIVE STUDY OF PRE-HARMATTAN AND HARMATTAN PERIODS

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Abstract

Seasonal fluctuations in airborne radionuclide concentrations were assessed in Lagos, Nigeria, by focusing on the comparative assessment between the Harmattan and pre-Harmattan periods. Samples of $PM_{2.5}$-bound rooftop dust were collected from sixteen urban locations and analyzed for naturally occurring radionuclides (^{226}Ra, ^{232}Th, and ^{40}K). The airborne activity concentration (Bq/m³) for each radionuclide was derived by combining the $PM_{2.5}$ mass concentration (µg/m³) with the radionuclide content (Bq/kg) in dust. Inhalation effective doses (IDE) were calculated using standard dose coefficients (2.8×10^{-6} Sv/Bq for ^{226}Ra, 6.9×10^{-6} Sv/Bq for ^{232}Th, and 6.2×10^{-9} Sv/Bq for ^{40}K), an assumed inhalation rate of 8000 m³/year, and indoor occupancy adjustments (CF_o = 0.8, CF_r = 0.3). The mean IDE during the Harmattan period was estimated at 0.0521 mSv/year, compared to 0.0181 mSv/year in the pre-Harmattan period. Consequently, the Lifetime Cancer Risk (LTCR) averaged 2.01×10^{-4} for Harmattan and 6.98×10^{-5} for pre-Harmattan, indicating a substantially higher radiological risk during the dust-laden Harmattan season. These findings align with similar studies in arid and semi-arid regions, where long-range transport of mineral dust enhances airborne radionuclide levels. Despite both seasonal doses remaining below the ICRP recommended public dose limit of 1 mSv/year, the observed variability underscores the need for continuous monitoring and targeted mitigation strategies in urban centers impacted by transboundary dust events.

RHEP 068

SURVEY OF NATURAL RADIOACTIVITY OF SOIL AND ROCK SAMPLES AND THEIR RADIOLOGICAL IMPLICATIONS TO HUMAN HEALTH IN UGWUELE QUARRY MINING SITE, UTURU, ABIA STATE, NIGERIA

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Abstract
This work measured the activity concentration of natural radionuclides 238U, 232Th and 40K in soil and rock samples collected in Ugwuele mining site and it surrounding communities in Uturu, Abia state, Nigeria. Fifteen different samples collected were analyzed. A NaI (Tl) spectrometry detector system was adopted for this research. The results obtained were used to estimate the radiological implication of the quarry mining in the study area. The average gamma activity obtained for 238U, 232Th and 40K in soil were 53.39 ± 3.08, 76.79 ± 9.66 and 1061.02 ± 15.72 Bq/kg respectively and 55.09 ± 5.71, 90.96 ± 16.10 and 1281.78 ± 6.38 Bq/kg respectively for rock samples. The calculated radiological hazard indices from Absorbed dose rate, Annual effective dose, Radium equivalent, internal hazard index and External hazard index gave 120.25 nGy/h, 0.147 msv/yr, 247.5 Bq/kg, 0.833 and 0.687 respectively. The average dose rate was higher than the recommended limit. Therefore, soil and rock materials found in Ugwuele could increase the radiological hazards on miners and residents of the area due to long time cumulative exposure.

RHEP 069

THEORETICAL INVESTIGATION OF PHYTOCHEMICAL COMPOUNDS FROM CASSIA TORA AS POTENTIAL DRUG CANDIDATES AGAINST MALARIA VIA MOLECULAR DOCKING

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Abstract
Malaria ranks among the top global infectious diseases requiring urgent treatment, particularly in sub-Saharan Africa. Despite huge efforts, vaccine development has been insufficient, making chemotherapy the primary method of controlling the disease. Artesunate and chloroquine derivatives remain the leading antimalarial drugs due to their effectiveness, safety, and availability. However, the emergence of Plasmodium parasite resistance to existing drugs poses a significant challenge, driving researchers to explore alternative molecular targets and improved treatment options. This study employs an in-silico approach to address this issue. The ligand-binding interactions against the Plasmodium falciparum protein target were analyzed through molecular docking. The docking results revealed stronger binding affinities between the ligands and the receptor of most compounds compared to standard drugs like artemether and artesunate with binding energies of -6.6 kcal/mol and -6.5 kcal/mol respectively.

RHEP 070

ASSESSMENT OF NATURAL RADIOACTIVITY OF CASSAVA IN THE COASTAL AREAS OF ANDONI LGA, RIVERS STATE, NIGERIA

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Abstract
The research work covers the assessment of natural radioactivity of cassava in the coastal areas of Andoni LGA, Rivers State, Nigeria due to environmental pollutions and radiological hazards associated in the environment. A total sum of ten (10) samples of cassava were collected across the coastal communities. The collected samples were analyzed with Gamma-Ray NaI(TI) Spectrometer in the laboratory and radionuclide ^{40}K, ^{238}U and ^{232}Th were present

in the samples. The mean activity concentration of ^{40}K, ^{238}U and ^{232}Th in cassava plant from the study area are 333.20±23.25 $BqKg^{-1}$, 11.75±2.71 $BqKg^{-1}$ and 1.81±0.15 $BqKg^{-1}$ respectively. The transfer factor calculated from the cassava sample recorded high values which exceeded the unity value of 1.0 as recommended (UNSCEAR, 2002). Transfer mean values recorded were 1.95 for ^{40}K, 2.78 for ^{238}U and 3.42 for ^{232}Th respectively. The result of the study indicates high level of health risk to the populace in the area due to transfers of radionuclide, although the activity concentration mean values are within the world average values of 420 $BqKg^{-1}$, 33 $BqKg^{-1}$ and 45 $BqKg^{-1}$ for ^{40}K, ^{238}U and ^{232}Th respectively.

Keywords: Radionuclide, Radioactivity, Concentration, Health-risk

RHEP 071

RADIOMETRIC SURVEY OF RADIONUCLIDES IN OILFIELD CHEMICALS AND PRODUCTS IN NIGERIA

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Abstract

Radiometric survey of radionuclides in oilfield chemicals and products with its associated radiological hazards in Nigeria have been carried out using gamma spectroscopy. Fifty-three samples consisting of thirty-two solids and twenty-one liquids were randomly collected from facilities handling them. These samples were prepared following the ISO procedure and kept sealed in a Marinelli beaker for twenty eight days for secular equilibrium before counting with thallium activated sodium iodide (NaI(Ti) detector. The radiological health risks were determined from the activity concentration of the radionuclides using mathematical models. The lowest to highest specific activity concentrations of ^{238}U, ^{232}Th and ^{40}K, in solid samples are 0.03±0.01 to 13.01±3.06 $Bqkg^{-1}$, 0.03±0.003 to 1.17±0.09 $Bqkg^{-1}$ and 3.87 ±0.31 to 20.64±7.71 $Bqkg^{-1}$ respectively; similarly for the liquid samples are 0.31±0.07 to 14.96±3.17 Bql^{-1}, 0.09±0.01 to 2.19±0.16 Bql^{-1} and, 0.22 ±0.02 to 109.63±6.85 Bql^{-1} respectively. The activity concentration of the samples were mostly within standard values except for few showing elevated ^{40}K values, and the Subsea Biocide 2 whose specific activity concentration of ^{238}U, ^{232}Th and ^{40}K were higher than UNSCEAR standard values. The radiological health risk parameters from this study were within their safe recommended values; as a result, may not have significant health impact on people and the environment.

RHEP 072

ASSESMENT OF RADON-222, RADIUM-226 CONCENTRATIONS AND POTENTIAL RISK TO ARTISANAL MINERS AROUND RIRIWAI TIN MINE KANO STATE, NORTH WESTERN NIGERIA.

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Abstract

Mining and mineral processing in Nigeria provides economic benefits of wealth creation and employment opportunities. However, the industry is associated with a number of negative challenges among which is the health impact on miners and surrounding communities arising from mining processes. In this study RAD7 and NaI(Tl) gamma spectrometry analytical techniques were used to determined the concentrations of Radon-222, Radon exhalation rate , Radon emanation coefficient and Radium-226 activity concentrations in soil samples collected from mining pits around Ririwai Tin mine Kano state Nigeria. Potential cancer risks were also estimated. The results shows that the mean concentrations of ^{222} Rn, was 412.2 ± 11.46 Bqm^{-3} in range 234 to 782 with standard deviation of 171.75. the radon exhalation rate has a mean value of 17.175 ± 5.87 $Bqm^{-3}h^{-1}$ in range of 9.75 - 32.58 with standard deviation of 7.16, Radon-222 Emanation coefficient were found to have mean value of 0.025 ranging from 0.011 to 0.056 with standard deviation of 0.0139 while the Ra-226 activity concentrations has mean value of 51.017 ± 5.87 $Bqkg^{-1}$ in range between 14.36 - 107.30 with standard deviation of 33.94. The mean annual effective dose due to ^{222}Rn concentrations was

calculated to be 3.21mSv/year which is higher than 2.4mSv/year the global range. The risk estimated for fatality cancer, lifetime fatality cancer risk, severe hereditary effect and life time hereditary effect in were 1.7 x 10^{-4}, 10.2 x 10^{-3}, 6.4 x 10^{-5} and 3.84 x 10^{-3} respectively. The values obtained in this study are relatively higher than the negligible values of (1 x 10^{-6} – 1 x 10^{-4}) recommended by USEPA.

Keywords: Radon, Radium, Concentrations Exhalation rate, Activity concentration Effective dose, Risk

RHEP 073

ASSESSMENT OF AIR QUALITY AND NOISE POLLUTION LEVELS IN THE MAJOR TOWNS ACROSS BENUE ZONE C, NIGERIA

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Abstract

Air pollution is as old as civilization itself. Nature produces air pollution, but so do human activities that pollute the environment on a daily basis. Noise is undoubtedly a common occurrence in daily life and is considered to be one of the most effective alarm systems in the environment around us. This study was carried out in 5 Local government areas in Benue zone C where Busy Roads, Garages, Schools, Residential areas, Hospitals, Hotels, and Markets were considered for data collection of air and noise pollution level. The results obtained from the study depicted that the noise pollution level in Otukpo ranges from 52.0 dB to 98.9 dB at maximum level and 16.7 dB to 38.6 dB at minimum level, in Ogbadibo it ranges from 40.0 dB to 88.9 dB (max) and 15.0 dB to 29.0 dB (min), in Okpokwu it ranges from 46.0 dB to 90.9 dB(max) and 14.0 dB to 35.6 dB (min), in Apa it ranges from 45.0 dB to 91.9 dB (max) and 16.0 dB to 30.6 dB (min) and in Oju it ranges from 35.7 dB to 87.9 dB (max) and 14.0 dB to 30.0 dB. The noise level results obtained depicted that they are at the permissible limit set by World Health Organization (WHO) and Federal Ministry of Environment (FMEnv) with the range of 30.0 dB to 85.0 dB and 40.0 dB to 90. 0 dB respectively, except in some residential areas and garages. The results of the air pollutants depicted that the concentration of the pollutants is at the permissible limit set by WHO and FMEnv except HCHO with concentration of 0.0010 mg/m^3 to 0.7102 mg/m^3 and TVOC with a concentration of 0.0160 mg/m^3 to 0.5686 mg/m^3 against 0.10 mg/m^3 and 0.30 mg/m^3 respectively, which is higher in some locations in Okpoga, Otukpo, Oju and Ugbokpo. Since HCHO and TVOC exceeded the permissible limit set by regulatory bodies in some local government areas (Otukpo, Oju, Apa and Okpokwu) which can pose serious environmental and health problems in the area. Hence, there is need for strict environmental rules to restrict the emission of HCHO and TVOC in the areas affected.

RHEP 074

EVALUATION OF EXCESS LIFETIME CANCER RISK AROUND OBRIKOM AND OMOKU GAS PLANT IN ONELGA LOCAL GOVERNMENT AREA OF RIVERS STATE, NIGERIA

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Abstract

The excess lifetime cancer risks (ECLR) is a measure of the potential Carcinogenic effect, calculated based on the probability of cancer induced incidence in a given population. And this is due to exposure from radiation or the intakes of some harmful chemical substances for a lifetime. The Excess lifetime cancer risk for Obrikom and Omoku communities has been computed from Background Ionizing Radiation using GQ GMC 300E Plus radiation meter. The background ionizing radiation levels obtained from Obrikom community varied from 0.01 to 0.014 mR/hr with an overall average radiation of 0.108±0.0014 mR/hr. Also, the

background ionizing radiation from Omoku community varied from 0.006 to 0.013 mR/h with an overall average of 0.0099±0.0023 mR/hr. The Annual absorbed dose from Obrikom community varied from 78.3 nGy/hr to 121.8 nGy/hr with an overall average of 93.96±16.81nGy/hr. Also, the average absorbed dose from Omoku community varied from 52.2 nGy/hr to 113.1nGy/hr with an overall average of 86.136.54 nGy/hr and are within the safe limits recommended by (ICRP). The annual effective dose rate from Obrikom ranged from 0.11 to 0.19 mSv/yr with an overall average of 0.145±0.0272 mSv/yr. Also, from Omoku community, the annual effective dose rate varied from 0.08 to 0.17mSv/y with an overall average of 0.131±0.03 and, these values are all lower than the recommended safe limits of 1.0 mSv/yr by (ICRP, 2000). The Excess lifetime cancer risk from Obrikom community varied from 0.37 to $0.65x10^{-3}$ with an overall average of 0.50±0.089. Also, the excess lifetime cancer risk for Omoku community varied from 0.28 to $0.61x10^{-3}$ with an overall average of $0.46±0.04x10^{-3}$. These values are higher than the recommended safe limit of $0.29×10^{-3}$ by (ICRP, 2000). These results obtained indicate that people living within these locations maybe exposed to Cancer due to background ionizing radiation. However, there is presently no indication of people suffering from Cancer due to background ionizing radiation among the populace of the sample locations.

Keywords: BIR, ELCR, Absorbed Dose, AEDR, ICRP.

RHEP 075

MEASUREMENT OF BACKGROUND IONIZING RADIATION IN SELECTED BUILDINGS WITH ALTITUDE WITHIN DELTA STATE, NIGERIA

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Abstract

The measurement of the background ionization radiation in selected buildings with Altitude within Delta State, Nigeria was carried out using a well calibrated radiation nuclear meter (Digilert 200). The study covers Warri and Asaba which are the major cities in the state. The exposure rate ranged from 0.007 to 0.020 mR/h with an overall mean value of 0.012 ± 0.003 to 0.016 ± 0.003mR/h. The calculated absorbed dose rates ranged from 60.9 to 174.0 nGy/h with an overall mean of 107.3 ± 22.46 to 139.2 ± 27.51 nGy/h. The calculated annual effective dose equivalent ranged from 0.09 to 0.27 mSv/y with an overall mean of 0.16 ± 0.03 to 0.21 ± 0.04 mSv/y. The excess life cancer risk ranged from 0.32 to 0.93 with an overall mean of 0.58 ± 0.12 to 0.65 ± 0.15. Among all the estimated risk parameters, only the overall mean annual effective dose equivalent was determined to be below the safe world recommended permissible limit of 1.00 mSv/y while others exceeded their respective global average safe thresholds. Therefore, there may not be any immediate radiological health effect on residents of the areas based on the data obtained.

Keywords: Altitude, Exposure Rate, Organ Dose, Digilert 200.

RHEP 076

NUCLEAR ENERGY - THE FUNDAMENTAL SOURCE OF LIFE ON EARTH.

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Abstract

There exists a huge amount of energy in the nucleus called nuclear energy. This hidden energy can be harnessed for constructive uses through the scientific and technological inventions which man had achieved so far. This paper extensively outlines the useful application of nuclear energy in radiodiognostic procedures, radiotherapy, radiation protection, electrical power generation, sterilization of insect pests, detection of fluid leakages in industries and underground pipes, detection of metallic weapons at airports and other similar exits as well as research activities. The paper also sheds light on the three processes by which the nuclear energy is made available for use. Nuclear fusion being one of the processes for

harnessing the nuclear energy feasibly occurs on the surface of the sun to release heat and light energy to the earth. The heat energy is vital for maintaining the conducive temperature for our living on earth while the light energy is an important requirement for plants to photosynthesize the food we live on. Thus nuclear energy should not be viewed as means for weapons of mass destruction but as an alternative as well as renewable source for our livelihood. Successful attempts for establishing fusion process on earth as cheap and environment friendly source of energy are also highlighted in the paper.

Keywords: Fission, Fusion, Chain Reaction, Plasma, Nuclear Size, Nuclear Density

RHEP 077

RADIATION SHIELDING AND CHARGE PARTICLE INTERACTION FEATURES OF POLYMETHYL METHACRYLATE POLYMER DOPED WITH VARIOUS CONCENTRATIONS OF BI_2O_3 AND Y_2O_3 FOR MEDICAL APRON DESIGN

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Abstract

Polymethyl methacrylate (PMMA) based polymer distinctly doped with different percentages of Bismuth oxide and yttrium oxide (Bi_2O_3 and Y_2O_3) was investigated for deployment in medical apron design and coating of special electronic devices and installations. The samples were produced using the powder metallurgy method. SEM, EDS, and physical properties of the produced samples were examined. The radiation shielding characteristics of these samples were analyzed using PHITS and WinXCOM computer programs at different photon energies. The SEM result displayed surface anomalies due to a distinct bonding matrix between PMMA, Bi_2O_3 and Y_2O_3. Mass attenuation coefficient (MAC), Mean free path (MFP), Effective atomic number (Zeff), Half value layer (HVL), Fast neutron removal cross-section (R), Total Mass Stopping Power (TSP), and photon Range (R) of the prepared polymer showed that PMMA+ 20% Bi_2O_3+ 20% Y_2O_3 (P-BY1) displayed the highest shielding characteristics with MAC of 23.13 cm^2/g at 0.015MeV and 0.027 cm^2/g at 15 MeV photon energy. The study also revealed that the combination of P-BY1 and P-B3 polymer composite performed better than other commercial shielding materials.Therefore, a combination of polymer materials made up of P-BY1 and P-B3 is highly recommended for deployment in the design of medical aprons to protect radiation facility workers and special medical installations where flexibility is of higher consideration.

RHEP 078

ABDOMEN AND PELVIC CT DOSE EXAMINATION FOR ADULT PATIENTS IN THE FEDERAL NEURO PSYCHIATRIC HOSPITAL, MAIDUGURI, BORNO STATE.

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Abstract

Computed Tomography (CT) has substantially increased over the past decade compared to all other diagnostic modalities, especially with the rapid use of Multidetector CTs (MDCT). This study conducted in Federal Neuro-Psychiatric Maiduguri, Borno State, focused on determining Computed Tomography Dose Index, weighted (CTDIw), and Dose-Length Product (DLP) values for adult patients undergoing routine CT scans of the Abdomen, and pelvis. The research aimed to establish local diagnostic reference levels (DRLs) and investigate factors contributing to CTDIw and DLP variations between CT scanners. The significance of DRLs lies in preventing excessive radiation exposure during radiological diagnoses, aligning with international guidelines from organizations like the International Commission on Radiological Protection (ICRP) and European Union Directives. The study's findings revealed variations in CTDIw and DLP values among the abdominal and pelvic CT Examination, attributable to different scan parameters. Recommendations from this research

included setting DRLs at the third quartile of the dose distribution, encouraging less optimal operators to adjust their protocols by reducing kV, mA, and mAs or increasing slice thickness to align with the majority operating at lower doses. It could therefore be concluded that the CTDI and the DLP, are within or below the values in the European Commission Report.

RHEP 078

ACTIVITY CONCENTRATION LEVELS OF RADIONUCLIDES IN SOIL SAMPLES FROM ATABA, ANDONI LOCAL GOVERNMENT AREA, RIVERS STATE, NIGERIA

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Abstract
Activity concentration in soil is a key indicator for assessing radiological hazards and understanding the dispersion of natural or anthropogenic radionuclides in the environment. Twenty (20) soil samples from Ataba Community, Andoni Local Government Area, Rivers State, Nigeria, were used to measure the activity concentrations of 226Ra, 232Th, and 40K in soil. The collected samples were taken to the laboratory for analysis and evaluation of the radionuclide concentration present in the soil. The Gamma-Ray NaI(TI) Spectrometer was used to analyze and evaluate the activity concentration of radionuclides 40K, 226Ra and 232Th in the samples. The level of natural radionuclides ranged from 8.86 to 33.37 Bqkg−1 with an average value of 22.17 Bqkg−1 for 226Ra; from 1.29 to 26.75 Bqkg−1 with an average value of 8.44 Bqkg−1 for 232Th; and from 7.52 to 51.19 Bqkg−1 with an average value of 25.41 Bqkg−1 for 40K. All mean values were lower than the world acceptable values of 35 Bqkg−1 , 30 Bqkg−1 and 400 Bqkg−1 respectively. The variations of the assessed radiological hazard parameters indices of radium equivalent activity, absorbed dose, external radiation hazard indices, and radioactivity level index of natural radionuclides were found to be as follows: 20.807–78.45, 8.78–26.66, 0.05–0.16, and 0.04–0.17, respectively. The results were found to be comparable to or lower than similar reported data worldwide. Therefore, the radiation levels in the assessed environment can be considered safe and pose no significant health risk to the public or workers under normal conditions.
Keywords: Natural radioactivity, activity concentration, Ataba Community, Absorbed dose

RHEP 079

ASSESMENT OF RADON-222, RADIUM-226 CONCENTRATIONS AND POTENTIAL RISK TO ARTISANAL MINERS AROUND RIRIWAI TIN MINE KANO STATE, NORTH WESTERN NIGERIA.

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Abstract
Mining and mineral processing in Nigeria provides economic benefits of wealth creation and employment opportunities. However the industry is associated with a number of negative challenges among which is the health impact on miners and surrounding communities arising from mining processes. In this study RAD7 and NaI(Tl) gamma spectrometry analytical techniques were used to determined the concentrations of Radon-222, Radon exhalation rate , Radon emanation coefficient and Radium-226 activity concentrations in soil samples collected from mining pits around Ririwai Tin mine Kano state Nigeria. Potential cancer risks were also estimated. The results shows that the mean concentrations of ^{222} Rn, was 412.2 ± 11.46 Bqm^{-3} in range 234 to 782 with standard deviation of 171.75. the radon exhalation rate has a mean value of 17.175 ± 5.87 $Bqm^{-3}h^{-1}$ in range of 9.75 - 32.58 with standard deviation of 7.16, Radon-222 Emanation coefficient were found to have mean value of 0.025 ranging from 0.011 to 0.056 with standard deviation of 0.0139 while the Ra-226 activity concentrations has mean value of 51.017 ± 5.87 $Bqkg^{-1}$ in range between 14.36 - 107.30 with

standard deviation of 33.94. The mean annual effective dose due to ^{222}Rn concentrations was calculated to be 3.21mSv/year which is higher than 2.4mSv/year the global range. The risk estimated for fatality cancer, lifetime fatality cancer risk, severe hereditary effect and life time hereditary effect in were 1.7×10^{-4}, 10.2×10^{-3}, 6.4×10^{-5} and 3.84×10^{-3} respectively. The values obtained in this study are relatively higher than the negligible values of ($1 \times 10^{-6} - 1 \times 10^{-4}$) recommended by USEPA.

Keywords: Radon, Radium, Concentrations Exhalation rate, Activity concentration Effective dose, Risk

RHEP 080

ASSESSMENT OF BACKGROUND RADIATION EFFECT ON HUMAN SENSITIVE ORGANS DUE TO NATURAL RADIONUCLIDES CONCENTRATION IN ZANGO, KARASUWA LOCAL GOVERNMENT YOBE STATE.

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Abstract

Ionizing radiation is a well-established risk factor for cancer, with high exposure levels potentially leading to adverse health effects. This study assessed radiation exposure levels in the Zango community of Karasuwa Local Government, Yobe State, Nigeria, to evaluate potential cancer risks. A comprehensive radiological survey was conducted using an Inspector Alert Nuclear Radiation Meter, measuring gamma activity levels and radionuclide concentrations at selected sample points near a potash storage facility. The collected data was analyzed to determine exposure rates, absorbed doses, annual effective dose equivalents, excess lifetime cancer risk, and doses to sensitive organs. Results indicated that all recorded radioactivity levels were below the 1mSv/year threshold set by the International Commission on Radiological Protection (ICRP). The highest annual effective dose equivalent observed was under 0.2mSv/year, suggesting no significant public health risk. Findings confirm that potash storage in the vicinity does not pose a radiation hazard to the community. Overall, radiation exposure levels remain within safe limits, ensuring no increased risk of radiation-induced health effects. These results provide valuable insights for decision-making and policy development in radiation safety and environmental protection.

RHEP 081

ASSESSMENT OF NATURAL RADIOACTIVITY IN VEGETABLES FROM SELECTED MINING AREAS IN VOM, JOS SOUTH, PLATEAU STATE, NIGERIA: A QUADRUPLE HELIX APPROACH TO MITIGATING RADIATION EXPOSURE AND PROMOTING SUSTAINABLE AGRICULTURE

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Abstract

The artisan mining activities in Vom,Jos South, Plateau state, pose significant environmental and health risks due to the potential release of naturally occurring radioactive materials (NORM). Vegetables cultivated in these areas may absorb and accumulate radioactive isotopes, threatening the health of consumers. This study examines the concentration of natural radioactivity in vegetables sourced from selected mining areas in Vom, Jos South, Plateau State, Nigeria. It emphasizes the importance of the quadruple helix model for innovative research and economic development. A thallium-doped sodium iodide scintillator detector was employed to measure the activity concentrations of 226Ra, 232Th, and 40K in the vegetables. The findings revealed that the activity concentrations ranged from 66.83 Bq/kg to 99.51 Bq/kg for 226Ra, 59.09 Bq/kg to 82.53 Bq/kg for 232Th, and 150.79 Bq/kg to 216.53 Bq/kg for 40K, with average values of 76.39 Bq/kg, 72.29 Bq/kg, and 186.00 Bq/kg, respectively. Notably, the mean values for 226Ra and 232Th exceeded the global average, while the average value for 40K fell within the permissible limit. The risk indices were

computed and study concludes that consuming vegetables from these areas over time may pose significant radiological risks. It recommends adopting the quadruple helix model to foster collaborative efforts among government, academia, industry, and civil society aimed at mitigating radiation exposure and promoting sustainable agricultural practices in the study area.

Keywords: Natural radioactivity, Vegetables, Mining areas and Radiation Exposure.

RHEP 082

ASSESSMENT OF RADON CONCENTRATION IN WATER SAMPLES FROM DIFFERENT SOURCES IN MAIGANGA COAL MINING SITE IN AKKO LOCAL GOVERNMENT AREA, GOMBE STATE, NIGERIA

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Abstract

The assessment of radon concentration in water samples from different water sources of Maiganga coal mining site in Akko Local Government Area, Gombe State, Nigeria have been carried out. Water samples were collected from three different water sources (borehole, pit and well) and were carefully prepared for analysis. The samples were analyzed using Durridge electronic Rad-7 (RAD-H2O) radon detector. The results obtained for 222Rn concentration levels show the range of value of 65.5 ± 6.5 – 1585.0 ± 21.70 Bqm-3 with a mean of 554 ± 46.07 Bqm-3. In order to x-ray into the possible effects of elevated radon level in water samples obtained, the estimations of annual effective dose rate due to ingestion and inhalation, annual committed effective dose for different age groups and their respective percentage contribution were estimated. The radon concentration level measured were below the maximum concentration level set by WHO, UNSCEAR of 11.1 Bq/l and European Commission of 100 Bq/l. The values for annual effective doses were below the annual threshold value of 0.1 mSv recommended by WHO and UNSCEAR for public safety consumption. The results show that the water resources around Maiganga coal mining site and its environs were safe for domestic purposes and drinking.

RHEP 083

ASSESSMENT OF TERRESTRIAL RADIATION LEVELS AND ITS HEALTH RISK IN SOME SELECTED COMMUNITIES IN RIVERS STATE, NIGERIA

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Abstract

This study aimed to determine in-site Background Ionizing Radiation (BIR) of exposure rate within selected communities in Rivers State. Six communities of Gure, Yeghe, Nonwa, Ukpeliede, Ahoada and Ekpena were selected using a well calibrated Digilert 200 and Geographical positioning Device (GPS), the BIR exposure rate for the above communities are 0.011mRh-1, 0.012mRh-1, 0.012mRh-1, 0.011mRh-1, 0.012mRh-1 and 0.012mRh-1 respectively and were below standard 0f 0.013mRh-1 by ICPR. The mean value of Excess Lifetime Cancer Risk (ELCR) of the study areas were 0.43x10-3, 0.49x10-3, 0.46x10-3, 0.43x10-3, 0.49x10-3 and 0.46x10-3. They were above ICPR standard of 0.29x10-3. The absorbed dose rate calculated were higher than ICPR of 59.0nGy/h-1 and the annual effective dose calculated were higher than ICPR standard of 0.07mSv/y-1. By this result the study area are radiological contaminated, the effect will not result to radiologically health risk immediately for residents but may pose long time health challenge as the doses continue to accumulate.

Keywords: background ionizing radiation, absorbed dose, annual effective dose, excess lifetime cancer risk.

RHEP 084

DETERMINATION OF RADIONUCLIDES CONTENT IN WATER DUE TO OIL AND GAS INDUSTRIES IN NIGER-DELTA

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Abstract
The study was carried out because the environment is an essential component of the Millennium Development Goals, with this great concern we determine the radionuclides content in water due to oil and gas industries, in Niger-Delta Nigeria. Using a well-calibrated Nal(TI) detector. Three prominent radionuclides that belong to natural radionuclides i.e K-40, U-238 and Th-232 were detected in the samples. The activities concentration of the radionuclides assayed ranged from 145.020.61 to 159.120.61 Bq/l, 4.120.09 to 5.360.08Bq/l 10.220.22 to 13.470.16Bq/l, while the average concentration was found to be151.690.58Bq/l, 4.780.10Bq/l, and 11.460.20Bq/l. The absorbed gamma radiation dose rate, and excess lifetime cancer risk, were calculated using the activities concentration of the detected radionuclides and all these radiological hazards were found to be higher than the recommended values. The result obtained negate these objectives: Millennium Development goal to the mainstream; the environmental policy of reversing the loss environment resources; and improving access to environmental services and this may pose a radiological effect on humans also the water in the study area is under usage due to oil spillage.
Keywords: water, radionuclides hazard, activity concentration, excess lifetime cancer risk**.**

RHEP 085

ENVIRONMENTAL RISK ASSESSMENT DUE TO HEAVY METAL IN PINDIGA GEOLOGICAL FORMATION OF GOMBE STATE, NORTH-EASTERN NIGERIA.

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Abstract
Toxic heavy metals are important components of environmental pollution that have led to significant risk to human health. Pindiga formation is part of the cretaceous succession of the Gongila sub-basin that was deposited in a shallow marine environment and is composed of different rock types. In this study, twenty-three (23) surface soil samples collected within Pindiga geological formation in Gombe State Nigeria were analyzed for their heavy metal concentrations using Micro wave plasma atomic emission spectrometry (MP-AES) technique. The results of seven (7) heavy metal concentrations: Arsenic (As), Cadmium (Cd), Cobalt (Co), Chromium (Cr), Manganese (Mn), Nickel (Ni), and Lead (Pb) revealed their mean concentration to be lower than the baseline values (B-value) except for Co, Cr and Ni; as documented by WHO and Canadian soil quality guidelines. Environmental risk assessment for both single and integrated pollution indices showed that the examined soil samples ranges from Low pollution to unpolluted. The ecological risk index (ERI), and the risk index (RI) both recorded highest values for single and integrated pollution index classification. It can be concluded that more effective controls should be focused on Co, Cr and Ni to further reduce pollution in this area.
Keywords: Heavy metal, Pollution, Geological formation, Anthropogenic source, Gombe State.

RHEP 086

EVALUATION OF RADIONUCLIDES CONCENTRATION IN SOIL SAMPLES FROM SELECTED OIL PRODUCING COMMUNITIES IN RIVERS STATE

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Abstract
The study aimed to assess the activity concentration and radiological hazard of radionuclides in soil from selected oil producing communities in Rivers State. The concentration of natural radionuclides in soil samples in six communities were determined using gamma spectroscopy NaI(TI) detector. The mean activity concentration for; Gure (40K 251.75±2.22, 238U 7.99±1.98, 232Th 1.96±0.21) Bqkg-1, Yeghe (40K 251.49±19.85, 238U 5.15±1.55, 232Th 1.73±0.01) Bqkg-1, Nonwa (40K 311.34±20.41, 238U 6.22±1.30, 232Th 1.75±0.17) Bqkg-1, Ukpeliede (40K 358.41±20.51, 238U 5.55±0.15, 232Th 3.84±0.31) Bqkg-1, Ahoada (40K 337.89±22.25, 238U 6.44±1.44, 232Th 3.84±0.31) Bqkg-1 and Ekpena (40K 253.81±17.45, 238U 6.25±1.44, 232Th 1.61±0.15) Bqkg-1. The average mean activity concentration is 294.12±20.49 Bqkg-1, 6.27±1.31 Bqkg-1 and 2.16±0.17 Bqkg-1 for 40K, 238U and 232Th respectively. These values obtained were within global standard and values reported in some countries and regions. Radiation hazard indices estimated in soil samples are below permissible limit by UNSCEAR, 2000.
Keywords: activity concentration; radiation hazard indices; soil.

RHEP 087

EXPOSURE TO NATURAL RADIOACTIVITY IN THE SOIL AT NIGERIAN PORTS AUTHORITY SEA PORT, ONNE PORT FREE ZONE RIVERS STATE.

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Abstract
The exposure to natural radioactivity in the soil at Nigerian Ports Authority, Onne sea port was investigated using NaI (TI) detector. The result of activity concentration of the radionuclides (^{40}K, ^{238}U and ^{232}Th) showed that the activity concentration of ^{40}K in soil samples has the highest value, followed by ^{238}U, while ^{232}Th has the lowest value. The mean activity concentration of the identified radionuclides^{40}K, ^{232}Th and ^{238}U in soil samples are; 98.56 BqKg^{-1}, 8.18 BqKg^{-1} and 12.87 BqKg^{-1} respectively. The estimated external and internal radiation hazard indices are very high compared to the world acceptable limit. The excess lifetime cancer risk value is above the recommended world standard limit. The study concluded that, the area has been impacted radiologically and this can lead to exposure of workers and visitors to ionizing radiation related sickness. The study recommended among other things that the Nigerian government through the Nigerian Nuclear Regulatory Authority (NNRA) should frequently monitor Onne sea port complex to ensure compliance to the operational guidelines of the X-ray scanning (Linac) machine.
Keywords: Radioactivity, Radionuclides, Exposure, radiologically, and Linac

RHEP 088

HEAVY METAL ASSESSMENT OF BOREHOLE WATER CONSUMED AS DRINKABLE WATER IN ORU – EAST LGA IMO STATE, NIGERIA

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Abstract
Ogwashi – Asaba formation and Benin formation are the two geological formations in Oru East Local Government Area (LGA) of Imo State, Nigeria. While Ogwashi – Asaba formation is characterized by alternation of clays and sands, grits and lignites, Benin

formation consists of sands and sandstones, which are coarse to fine grained typically used as granular texture. Majority of the inhabitants practice crop production, animal husbandry and trading which are anthropogenic sources of water contamination besides natural sources in the study area. Borehole water were randomly selected from two (2) sampling towns/sites (Nnempi and Amagu) for investigation using standard analytical methods published by American Public Health Association (APHA). The procedure was used for analyzing six (6) heavy metals and arsenic as metalloid to ascertain the quality of borehole water in the study area using atomic absorption spectrophotometer (AAS) as measuring instrument. Results revealed that cadmium, chromium copper and arsenic are the major water contaminate in the study areas as they exceeded the WHO, NSDWQ and US EPA guidelines for drinking water quality. Therefore, water proper borehole water treatment technique is recommended before consumption. Bacteriological and radionuclide investigation of the water is recommended.

Keywords: Anthropogenic sources, borehole water, lithology, aquifer, heavy metals, toxicity, atomic absorption spectrometer (AAS)

RHEP 089

INDIVIDUAL L-SHELL X-RAY PRODUCTION CROSS SECTIONS OF SELECTED HIGH-Z ELEMENTS INDUCED BY HEAVY IONS

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Abstract

In this study, we investigate the individual L-shell X-ray production cross sections of selected high-Z elements (bismuth (Bi), gold (Au), and silver (Ag)), induced by heavy ion bombardment. The measurements focus on the L_l, L_α, L_β, L_γ lines, which correspond to various radiative transitions within the L-subshells. These elements were chosen due to their relevance in both theoretical modelling and practical applications such as microanalysis and nuclear science. Heavy ions in the energy range of 12–16 MeV, particularly carbon ions, were used as projectiles to excite the target atoms. The resulting X-ray spectra were analyzed to extract absolute X-ray production cross sections for the different L-lines. The experimental data were then compared with predictions from theoretical models including ECPSSR, ECPSSR with united atom correction (ECPSSR+UA), and the Smith model. Preliminary observations suggest variations between the theoretical predictions and measured cross especially for Ag. The study highlights the limitations of current theoretical models in accurately describing ion-induced inner-shell ionization processes in high-Z targets under heavy ion impact.

Keywords: Heavy ions, X-ray production, high-Z elements, ionization, L-shell

RHEP 090

INTER-ANNUAL TEMPERATURE TRENDS IN NIGERIA: AN INSIGHT INTO THE POTENTIAL PATHWAYS TO MODIFYING ATMOSPHERIC PROCESSES AND THE TERRESTRIAL ECOSYSTEM INTERACTIONS IN A CHANGING CLIMATE.

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Abstract

Forest ecosystems have strong interaction with the atmosphere which involves some coupled processes that modify the atmospheric physics and chemistry. These modifications subject the forests to changes in response to the environmental influences. This paper is aimed at analysing the inter-annual temperature trends in Nigeria and examining the potential pathways to influencing changes in atmospheric behaviour and ecosystem interactions. Rising global temperature is exacerbating climate change and the accompanying processes and responses of terrestrial ecosystem-atmosphere interactions need to be given attention to

unravel the possible pathways to modifying the atmospheric processes and ecosystem interactions. In this study, monthly mean daily minimum and maximum air temperature data at 20 meteorological stations across different eco-climatic zones in Nigeria spanning 63 years were accessed from the Nigerian Meteorological Agency. The data were analyzed for inter-annual trends using statistical techniques. Significant upward trends were identified in 90% of the stations by Mann-Kendall's test. The magnitudes of the trends estimated by the least squares regression are about 2.363ºC and 1.223ºC for minimum and maximum temperatures respectively with possibility of more warming in future due to rapid urbanization. The potential pathways to the temperature-induced modifications of the coupled interactions are presented and recommendations made.

Key words: Air temperature trends, Mann-Kendall's test, Least squares regression, Atmospheric processes, Ecosystem stability.

RHEP 091

STRUCTURAL, OPTICAL, AND THERMOLUMINESCENCE RESPONSE OF RARE EARTH METALS ACTIVATED ON LITHIUM ALUMINUM BORATE CRYSTALS.

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Abstract

Rare earth elements of gadolinium and dysprosium at different mole concentrations were doped on lithium aluminum borate crystals. The samples of $Li_3Al_3(BO_3)_4$were prepared by using the solid-state sintering technique after which they were studied for their structural, optical and thermoluminescence properties. The obtained structural properties from the X-ray diffraction pattern and Scanning electron microscopy showed a difference in both the crystallite size and the particle size for the undoped, gadolinium doped and dysprosium doped lithium aluminum borate. The optical properties of the crystals revealed a dissimilarity in the energy band gap as well as the absorbance when compared with the different concentrations of the Gd and Dy dopants used on lithium aluminum borate materials. The thermoluminescence from all the samples measured at $1^{o}\ Cs^{-1}$ following irradiation to 50Gy shows an intense peak at 90 ºC and 100 ºC for the mole concentration of Dy and the Gd doped lithium aluminum borate crystals with a secondary intensity peak along higher temperature region of the glow curve. The undoped sample of lithium aluminum borate did not show a linear dose response but the two rare earth doped samples showed a linear response from 20 to 150 Gy.

RHEP 091

RADIATION PROTECTION AND MONITORING IN MODERN NUCLEAR MEDICINE INVESTIGATIONS IN CLINICAL PRACTICE

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Abstract

Background: The Development and Implementation of Modern Nuclear Medicine all over the World, called for the Diagnostic Procedures and Therapeutic Procedures, it also involved the Application of Radioactive Substance using the Imaging Procedure by using Nuclear Medicine Specialist as to get the best Practices in Nuclear Medicine Aim: To determine the Radiation Protection and Monitoring in Modern Nuclear Medicine Investigation in Clinical Practice. The research design was the cross-sectional study of the Nuclear Medicine Investigation and Radiation Monitoring. The study revealed that contamination during radioactive spillage is harmful to Nuclear Medicine Practice, the transfer and the use of Modern Equipments from developed countries is an issue of concern; the Uneven used of Radiation in Medical Procedures is also a problem all over the world. Radiation Protection

and Monitoring in Modern Nuclear Medicine Investigation in Clinical Practice is a global trend in Modern Medicine. It calls for identification of research area of joint interest in the field of Medical Radiation Protection, improve use of ionizing radiation in Medicine, adopted the use of Nuclear Medicine best practices in line with International Atomic Energy Agency (IAEA) dose standard.

Keywords: Radiation, Nuclear Medicine, Monitoring of the environment, Radiation protection.

RHEP 091

STUDY OF THE PRODUCTION CROSS SECTION OF TERBIUM THERAGNOSTIC RADIOISOTOPES USING EMPIRE CODE

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Abstract

Terbium radioisotopes have been proposed as potential candidates for all the major procedures of nuclear medicine including imaging and therapy. Full-scale adoption has however been slowed down by scientific and production challenges including paucity and large uncertainty margin of cross section data for the cost effective and safe production routes. Using appropriate parametrizations for models in the EMPIRE code, the production excitation functions for 160Gd(n, γ)161Gd → 161Tb, 152Gd(p,4n)149Tb, 155Gd(p,n)155Tb, 155Gd(d,2n)155Tb, 155Gd(p,4n)152Tb, 151Eu(4He,3n)152Tb, 160Gd(d,n)161Tb and 151Eu(3He,5n)149Tb reactions have been calculated in this study to address the production data challenges. Results show similar trend compared with available experimental data. Observed deviations for 160Gd(d,n)161Tb and 155Gd(p,4n)152Tb reactions were renormalized using a scale factor of 2.7 to obtain good agreement. With some exceptions where standard measured data are absent, results based on our model calculations are all significantly positively correlated with measurements up to $\geqslant$ 0.8823. Also, all results from the coupled channel optical models calculations were found to be in significant agreement represented by a correlation coefficient ranging from 0.9485 to 1 for all the reactions.

Keywords: Terbium, Theragnosis, EMPIRE, Cross Section, Nuclear Reaction, Nuclear Medicine

RHEP 092

NUCLEAR MEDICINE: THE NIGERIAN STORY

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Abstract

The world is experiencing an unprecedented rise in cancer cases, in all categories of national developments (developed, developing and underdeveloped countries alike). It is estimated that high percentage of these cases may require radiotherapy at certain stage of the ailments. The present work presents an evaluation of the updated strategies for detection and radiotherapy capacity for cancer treatment in Nigeria, analyzed the present and future challenges and also the potentials in the cancer management. We present a comprehensive information on each nuclear medicine center in Nigeria, describing the types of procedure or instrumentation for the cancer management as well. Furthermore, information on personnel in each center and its training capacity have also been reported. It would be seen that Nigeria, despites its slow progress, has several radiotherapy sources of which nine (9) are brachytherapy units which include Iridium-192, colbalt-60 and Iodine-131 as well as Twelve (12) LINAC machines for cancer treatment. Additionally, the current status of radiotherapy equipment in Nigeria is compared with the years 2001, 2005 and 2010 previous statuses, revealing a slow positive progress, especially in the recent years. It has also been established that new centers or equipment are to be commissioned in a number of hospitals in the next one year, with advanced preparations already in place. Nevertheless, considering the rise in

cancer cases in a populous country as large as Nigeria, the cancer detection and treatment units need to be rapidly and steadily developed.

Keywords: Nuclear medicine, Cancer therapy, Radiotherapy, LINAC, Brachytherapy, Cobalt-60, Iridium-I92 and Iodine-131

RHEP 093

PROTON-INDUCED PRODUCTION OF 62ZN RADIOISOTOPE FOR NUCLEAR MEDICINE APPLICATION

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Abstract

The radioisotope 62Zn is an important radioisotope with several applications and prospects in nuclear medicine and beyond. Having a suitable short half-life of 9.2 h, the radionuclide is widely used as a generator system (62Zn/62Cu) to produce short lived 62Cu (T1/2 = 9.8 min). The daughter isotope, 62Cu (which decays via β+), has vital chemical and nuclear decay characteristics for the clinical applications in PET. In the present work, the excitation function for the proton-induced nuclear reactions on natural zinc were measured in the energy range of 4–30 MeV using the well-established stacked-foil activation procedure. The activation products were measured based on their characteristic gamma lines using HPGe γ-ray spectrometry. The cross sections have also been compared with the available literature data and the theoretical prediction of the Talys code via its latest library, the TENDL-2023. The results show a reasonable agreement when compared with the available literature data. This work, however, shows that the theoretical data extracted from the TENDL-2023 library significantly underestimate the experimental cross sections. The present result has potential applications to improve the predicting capability of the Talys model code as well as to serve as additional data for the nuclear reaction cross-section database.

Keywords: natZn(p,x) reactions; γ-ray spectrometry; zinc-62; generator radioisotopes, model code; nuclear medicine.

RHEP 094

TOXIC METALS BIOACCUMULATION IN DIFFERENT ORGANS OF FISH HARVESTED FROM ZOBE DAM, KATSINA STATE, NIGERIA USING RELATIVE INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS

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Abstract

Instrumental neutron activation (INAA) technique has been applied to investigate the concentrations of possibly toxic elements in organs of *Oreochromis niloticus* and *Clarias gariepinus* from Zobe Dam, Katsina State. Consumption of fish offers unique nutritional and health benefits and is considered a key element in a healthy diet. However, despite its nutritional value, fish living in a polluted environment can accumulate the toxic metals at high concentration causing serious risk to human health when consumed. The main goal of this study is to investigate the possible toxic elements concentrations as well as assess the possible health implications they may pose to human via the fish consumption. Six (6) possibly toxic elements As, Br, Co, Cr, V, and Ba were detected by the INAA techniques. The dietary intake of some of the possibly toxic elements was estimated for tissue by considering WHO/FAO tolerable daily intake of adults (TDI/70 kg). Other organs were neglected according to the consumption pattern of the population in the study area. Our result of the estimated dietary intake showed that, the concentration of the detected toxic elements in tissue of both fish species were considerably below the estimated daily tolerable human consumption limits set by the WHO/FAO except for Cobalt which shows concentration higher than the

recommended daily intake limit. Therefore, consumption of tissue of the studied fish species harvested from Zobe Dam is considered safe.

Keywords: Bioaccumulation, concentration, consumption, INAA, Zobe Dam

RHEP 095

THE MEASUREMENTS AND IMPACTS OF ELECTROMAGNETIC FIELD ON THE PSYCOLOGICAL AND PHYSIOLOGICAL WELL¬-BEING OF HUMANS

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Abstract

This research work investigates the measurement and health effects of electromagnetic fields (EMFs) from common sources like cell phones, laptops, power lines, X-rays, ECGs, and microwaves. The study evaluates EMF intensity, frequency, and biological impacts, aiming to inform public health guidelines. A mixed-methods approach included quantitative measurements (using Gauss meters and EMF voltmeters at varying distances) and qualitative assessments in Eastern Uganda under controlled conditions (24–25°C). Results showed higher EMF exposure correlated with poorer cognitive performance, increased anxiety (coefficient: 0.7779), headaches, fatigue, and sleep disruption. Newer devices (2020–2023) emitted lower EMF than older models (2000–2019), with wear and tear exacerbating emissions. Laptops and cell phones were significant contributors. The findings underscore EMF's potential health risks, urging further research and public awareness. Recommendations include policy interventions, industry collaboration to reduce emissions, and personal mitigation strategies. The study calls for sustainable technological practices to minimize adverse health effects while maintaining modern conveniences.

Keywords: Measurements, Impacts, Electromagnetic, Psychological, Physiological, Humans

SECTION D:

Atmospheric and Space Technology for National Safety and Security (AAST)

AAST 001

QUANTIFYING PARTICULATE POLLUTION FROM ROAD CONSTRUCTIONS IN PORT HARCOURT NIGERIA: IMPLICATIONS FOR URBAN AIR QUALITY MANAGEMENT.

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Abstract

In metropolitan areas, particulate matter pollution is a serious health hazard, especially in developing nations. The concentrations of PM brought on by road development at the study locations, are examined. Measurements were taken over several days during periods of high activity using Extech Model VPC300. The time series findings revealed the day and time with the highest PM level with the highest PM10 values at 300µg/m³ and PM2.5 been 170µg/m³. A common trend between both concentrations is an increase in pollutant levels in the morning, peaking around mid-morning, and then declining. The correlation matrix helps in detecting day with the strongest link between the PM and the local meteorological parameters. Furthermore, the PM demonstrated rising AQI values with increasing concentrations highlighting a concerning trend. The research developed epidemiological models to quantify the association between pollutant exposure and health consequences. The research suggested eco-friendly practices for controlling PM emissions in road construction. By building of green barriers encircle around the construction domain. This strategy demonstrates a dedication to using greener building techniques aligning with more general sustainability objectives and creating a pollution-free environment for communities in and around construction sites.

AAST 002

ESTIMATION OF TROPOSPHERIC RADIO REFRACTIVITY AND ITS VARIATION WITH METEOROLOGICAL PARAMETERS OVER PORT HARCOURT, NIGERIA.

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Abstract

This study investigated radio refractivity and its variation with meteorological parameters over Port Harcourt in 5 years, using the indirect method of refractivity estimation. Meteorological datasets of atmospheric pressure, relative humidity and temperature, were analyzed to get their monthly and seasonal effects on radio refractivity, using the International Telecommunication Union (ITU) Equation. Findings revealed that high values of atmospheric pressure, relative humidity and radio refractivity were mostly recorded during rainy season, as low temperature values were recorded. On the other hand, high temperature values were recorded in the dry season months, as low values of atmospheric pressure, relative humidity and radio refractivity were recorded during the dry season. The result also showed that dry term refractivity was a major contributor to the total refractivity. Further investigation of refractivity gradient and effective earth radius- factor for both seasons categorized Port Harcourt under super refractivity. It was recommended that this data be used for effective planning of radio links; and more investigation be carried out to find out diurnal refractivity of Port Harcourt.

AAST 003

A COMPARATIVE ANALYSIS ON THE BEHAVIOURAL INFLUENCE ON LARGE WATER BODIES ON WEATHER (A CASE STUDY OF ABIA AND ENUGU STATE IN NIGERIA)

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Abstract
Comparative research on the effects of large water bodies on the atmosphere have been carried out. Data from Enugu State University of Science and Technology Automated Weather Station and Signal Strength Meter in the Department of Industrial Physics was downloaded and analysed for a period of Six Years. Statistical analyses were further used to analyse the data which were used to support our argument and findings. The investigations showed that using only geopolitical zone as only factors in determining the weather conditions of a particular region will not give an accurate result. We were able to find that presence of large water bodies in a particular location have a lot of roles to play on the atmosphere. For instance, Investigations carried out for these six years shows that Enugu which is in Southeast do not have the same rain pattern as Abia State which is also in South-eastern part of Nigeria. This explains the difference experienced in the weather conditions of these two states which are in the same zone. The findings of this research shows that presence of large water bodies should be considered in carrying out any research in a particular zone or region.

Keywords: Temperature, Pressure and Relative Humidity

AAST 004

ASSESSMENT OF AQUIFER VULNERABILITY TO POLLUTION WITHIN PARTS OF EHA ALUMONA, NSUKKA LOCAL GOVERNMENT AREA, ENUGU STATE, NIGERIA

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Abstract
This study evaluates the vulnerability of aquifers to contamination in Eha Alumona, located in Nsukka Local Government Area, Enugu State, Nigeria, using resistivity measurements and multiple vulnerability indices. Vertical Electrical Sounding (VES) surveys conducted at fifty locations identified five distinct geo-electric layers, with resistivity values ranging from 5.7 to 87,620.9 Ωm and depths between 0.4 and 234.5 meters. The upper two layers exhibited low resistivity values, indicative of moisture-bearing materials such as sandy soils and weathered rocks with varying porosity. In contrast, the deeper layers showed higher resistivity, suggesting more compact and less permeable geological formations. Aquifer vulnerability was assessed using four indices—GOD, GLSI, DRIST, and SI - which collectively suggest a generally low vulnerability to contamination across the study area. The GOD index points to minimal contamination risk due to deep water tables and overlying protective strata. The GLSI and DRIST indices classify 62% and 64% of the area, respectively, as moderately susceptible. Similarly, the SI index indicates that the aquifer is well-protected. These findings underscore the need for ongoing monitoring and the implementation of sustainable groundwater management strategies to safeguard the region's water resources.

Keywords: Vulnerability, GOD index, GLSI index, DRIST index, Susceptibility Index,

AAST 005

ASSESSMENT OF REFRACTIVITY GRADIENT AND GEOCLIMATIC FACTOR OVER ABEOKUTA SOUTH-WEST, NIGERIA

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Abstract
Due to the high demand for advanced technological equipment and high-capacity data transfer with enhanced good quality signal content, there is much necessity to ensure that signal degrading events such as fading are brought under control so that there will always be good quality of service (QoS) for multimedia operations like browsing, networking, etcetera. However, the presence of climatic variables such as temperature, humidity, and vapor pressure in the atmosphere interacts with a transmitting radio wave signal, and this phenomenon of interaction will always reduce the signal quality. This study has utilized 10 years (2014-2023) of data of surface temperature, pressure, and humidity retrieved from the Era5 dataset of the European Centre for Medium-Range Weather Forecasts (ECMWF) over Abeokuta, South-West, Nigeria. The surface refractivity, refractivity gradient, and geoclimatic factor were computed, and results show that the study areas are super-refractivity areas. Results in this study will equip radio engineers with better knowledge of optimizing radio link designs for an effective performance of satellite communication systems. The fading depth toward signal availability has been presented from the three phenomena (surface refractivity, refractivity gradient, and geoclimatic factor) as presented in this study.

AAST 006

ATMOSPHERIC MEASUREMENTS FROM A LOCALLY MADE SMART-ENVIRONMENTAL AND CLIMATOLOGICAL OBSERVATION DATA STATION (SMART-ECODS)

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Abstract
We hereby present a detail result from our design and fabrication of a Smart environmental and climatological observing data station SECODS. SECODS is a climatic and environmental Instrument with automated data collection capability using basic locally sourced materials. Our choice of design is carefully drawn with the aim of fabricating a one-stop smart instrument that is adaptive to the Nigerian weather and ambient temperatures using group of embedded sensors. Arduino Micro-controller as a core server system and wireless data logging sensor using data logging shield as a communication protocol and the DTH11 (Temperature and Humility Sensor), Rain sensor, GP2Y1010AU0F Optical dust sensor, LDR (Light Dependent Sensor). Result of our instrumental measurement shows real time humidity between $59g/m^3$ and $77g/m^3$, Temperature between 24^0C and 33^0C, air quality between $181m^3$ and $683m^3$, soil moisture between 136Pm and 683Pm, Light intensity between 169Cd and 684Cd and Rain Precipitation between 220mm and 1024mm all within normal measurement ranges. The data used for these analyses were collected from our locally made device and logged automatically to an embedded SD card showing individual results on cloud logging of data which proved to be an effective weather and climatic data monitor.

AAST 007

DYNAMICS AND CHARACTERISTICS OF DRY AND MOIST HEATWAVES ACROSS THE SAHEL AND COASTAL CLIMATIC ZONES OF NIGERIA

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Abstract
The increasing frequency of heatwaves across Nigeria's diverse climatic zones have wide-ranging impacts on agriculture, human health, energy demand, and ecosystems. However, there is limited research comprehensively analysing the dynamics and characteristics of these heatwaves across Nigeria's climatic zones. Using observed average daily temperature and relative humidity data from synoptic stations across Nigeria for a period of twenty-nine years (1983-2012), this study examined the dynamics and characteristics of dry and moist heatwaves across the Sahel and Coastal climatic zones of Nigeria, comprising of Maiduguri, Sokoto, Ikeja and Calabar. Heatwave events were classified into wet and dry categories based on concurrent humidity levels. The Sahel region experienced higher temperatures and more frequent heatwaves, while the Coastal region experienced lower temperatures and less frequent heatwaves, but warming is still evident particularly in Ikeja. However, the data suggests increasing temperatures in all locations, with heatwaves becoming more prominent, particularly in the Sahel savannah. Sokoto had the highest number of dry heatwave days (13 days), indicating significant exposure to extreme heat without moisture, while Ikeja had the highest number of wet heatwave days (8 days), reflecting high temperature combined with high humidity.

AAST 008

ESTIMATING GLOBAL HORIZONTAL IRRADIANCE USING THE DISORT METHOD: THE IMPACT OF AEROSOL OPTICAL PROPERTIES ON SOLAR ENERGY ASSESSMENT

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Abstract
Downward shortwave solar energy is crucial for the surface energy balance, influencing both human activities and ecosystem dynamics. This paper explores the use of the Discrete Ordinate Radiative Transfer (DISORT) method to estimate Global Horizontal Irradiance (GHI) in two distinct atmospheres. We incorporated aerosol optical properties and the Solar Zenith Angle (SZA) from sunrise to sunset into the DISORT codes, using a solar constant of 1367 W/m² to represent the solar irradiance at the top of the atmosphere. Our results demonstrate that aerosols significantly affect the GHI reaching Earth's surface through their absorption and scattering effects. Specifically, an increase in aerosol optical depth corresponds to a reduction in GHI. This study highlights the importance of understanding local aerosol concentrations—measured through Aerosol Optical Depth (AOD)—before designing solar energy systems. Additionally, the method can be applied in locations lacking direct GHI measurements, provided the aerosol optical properties are known. This approach offers a valuable tool for assessing solar energy potential in varied settings.

Keywords: Atmospheric aerosols, Solar Irradiance, Asymmetry factor, Surface albedo, Top of the atmosphere.

AAST 009

EVALUATING THE IMPACTS OF FINE-MODE AEROSOLS ON CLIMATIC VARIABLES OVER NIGERIA

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Abstract
Fine-mode aerosols are tiny atmospheric particles, with a radius between 0.1 and 1 micron, that originate from the conversion of gas to aerosol, coagulation of smaller aerosols, condensation of gases onto existing aerosols, and combustion processes (biomass burning and industrial emissions). Analysing the distribution of fine-mode aerosols is important for assessing the impact of these aerosol species on human health, climate, and visibility. This study aims to analyse aerosols and evaluate their effects on climate parameters over Nigeria. The study was conducted over five stations across Nigeria to represent Nigeria's climatic zones over 30 years (1994-2024). Based on remote sensing data, the study uses Theil-Sen's method and the Mann-Kendall test to analyze the spatial-temporal distribution and trends of aerosol optical depth and fine-mode aerosols (Black carbon, dust, and organic carbon). The study employed Pearson correlations to assess the impact of fine-mode aerosol on climatic variables (precipitation, wind speed, and water vapor). The study is of great importance for a comprehensive understanding of the variation patterns of AODand aerosol types and for the formulation of tailored air pollution control policies based on local conditions.
Keyword: Aerosols, fine-mode, Climate, Nigeria

AAST 010

EXPLORING THE INTRICATE CONNECTION BETWEEN AEROSOL CONCENTRATION AND METEOROLOGICAL PARAMETER IN GUINEA COAST REGION ACROSS NIGERIA.

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Abstract
This study investigates how these factors influence air quality and public health by analyzing aerosol data from 1994 to 2023, sourced from NASA's Giovanni satellite monitoring platform. Results reveal seasonal variations in aerosol concentrations, with elevated PM2.5 and black carbon levels during dry seasons, particularly the Harmattan, due to diminished rainfall and increased anthropogenic emissions. Conversely, the wet season demonstrates significantly lower aerosol concentrations owing to rain's scavenging effects. Our findings indicate a negative correlation between rainfall and air temperature during wet seasons, while a positive trend between temperature and PM2.5 levels is noted in dry periods. The comparative analysis of distinct ecological zones—including the Sudan Savannah, Mangrove Forest, and Northern Guinea Savanna—highlights unique seasonal dynamics affecting air quality and health risks. This research underscores the importance of understanding these relationships to formulate targeted environmental policies and public health strategies aimed at mitigating the adverse effects of air pollution on vulnerable populations in Nigeria. Effective air quality management, public awareness, and sustainable agricultural practices are recommended to enhance environmental health across these diverse regions.

AAST 011

HYBRID MODELING OF CLIMATE CHANGE IMPACTS ON SINGLE- AND DUAL-AXIS TRACKING CPV SYSTEMS: A HOLISTIC APPROACH TO OPTIMIZING SOLAR ENERGY PERFORMANCE

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Abstract

This study pioneers an advanced hybrid modeling approach to assess climate change impacts on active power generation in single-axis (PAS) and dual-axis (PAD) tracking solar-concentrated photovoltaic (CPV) systems in Alice Springs, Australia. A novel CARIMA-SARIMA-LG hybrid model, integrating SARIMA, CARIMA, and logistic distribution (LG) models, demonstrates superior predictive accuracy, achieving R^2 values of 0.9833 for PAS and 0.9777 for PAD. Expanding its validation, the model is applied to diverse African climates (Kano, Accra, Johannesburg, Nairobi, and Dar es Salaam), revealing PAD's remarkable adaptability and predictive precision across varied environmental conditions. The influence of changing climate conditions on CPV systems in Alice Springs, Australia, across SSP126, SSP245, and SSP585 scenarios demonstrates notable differences in active power generation for both PAS and PAD systems. Under SSP126, the projections indicate slight variations in power, peaking in DJF with an increase of +3.145% from 2015 to 2030, followed by a decrease of -3.775% in the late century from 2071 to 2099. PAD systems show comparable seasonal patterns, experiencing increases in the initial phases (+5.463%, DJF, 2015-2030) followed by declines as the century progresses (-0.578%, ANN, 2071-2099). Under the SSP245 scenario, moderate losses are projected, with PAS facing a decrease of -2.138% (annual average, 2031-2050) and PAD encountering significant declines by the period of 2071-2099, amounting to -5.001% (annual average). SSP585 indicates the most drastic declines, with PAS facing a reduction of -3.294% (ANN, 2015-2030) and PAD seeing a decrease of -5.731% (ANN, 2015-2030), intensifying energy security challenges amid persistently elevated emissions. The study's holistic approach delivers groundbreaking insights into the interplay between evolving climatic conditions and CPV system performance, offering strategic implications for renewable energy planning, grid integration, and energy security in a changing climate.

AAST 012

INVESTIGATING THE DEGREE OF CLIMATE CHANGE FOR A PERIOD OF FORTY-TWO YEARS OVER KANO CITY, NIGERIA

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Abstract

In recent years, climate change studies have become prominent globally because of its negative impact on the socio-economic lives of the citizenry and the need to mitigate against it. Investigating the degree of climate change variability in an urban city such as Kano becomes imperative. This study investigated temperature, pressure, and humidity variability in Kano, Nigeria, using ERA5 reanalysis data (1980–2021), processed via empirical and statistical methods. Annual averages were 303.00 K (temperature), 42.59% RH (humidity), and 1002.74 hPa (pressure). Correlation coefficients revealed long-term trends: temperature increased significantly (+0.66, 66%), pressure rose moderately (+0.16, 16%), and humidity declined (−0.22, 22%). Monthly analysis identified August as the coldest (300.79 K, 27.1°C) and April as the hottest (308.14 K, 34.99°C). A 7-year interval analysis (2015–2021) highlighted accelerated warming (49% increase), alongside humidity (26%) and pressure (73%) rises, aligning with Standardized Anomaly Index trends confirming intensified climate variability. These results underscore a clear climate shift, with temperature anomalies

dominating recent years. The findings emphasize urgent mitigation strategies, particularly green energy adoption, to address escalating climate risks in urban Kano. This study provides actionable insights for policymakers and urban planners to enhance climate resilience in semi-arid regions.

AAST 013

MACHINE LEARNING AND PHYSICS-BASED MODEL HYBRIDIZATION TO ASSESS THE IMPACT OF CLIMATE CHANGE ON SINGLE- AND DUAL-AXIS TRACKING SOLAR-CONCENTRATED PHOTOVOLTAIC SYSTEMS

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Abstract
This study presents a hybrid approach combining machine learning and analytical models to assess climate change impacts on active power predictions for single-axis (PAS) and dual-axis (PAD) tracking solar-concentrated photovoltaic (CPV) systems. The hybrid model excels in error metrics (MAPE, RMSE, nRMSE) and shows robust adaptability across diverse African climates (Kano, Accra, Johannesburg, Nairobi, Dar es Salaam). Projections under SSP126, SSP245, and SSP585 scenarios reveal nuanced climate-driven shifts in CPV performance. Under SSP126, the projections indicate slight variations in power, peaking in DJF with an increase of +3.145% from 2015 to 2030, followed by a decrease of -3.775% in the late century from 2071 to 2099. PAD systems show comparable seasonal patterns, experiencing increases in the initial phases (+5.463%, DJF, 2015-2030) followed by declines as the century progresses (-0.578%, ANN, 2071-2099). Under the SSP245 scenario, moderate losses are projected, with PAS facing a decrease of -2.138% (annual average, 2031-2050) and PAD encountering significant declines by the period of 2071-2099, amounting to -5.001% (annual average). SSP585 indicates the most drastic declines, with PAS facing a reduction of -3.294% (ANN, 2015-2030) and PAD seeing a decrease of -5.731% (ANN, 2015-2030), intensifying energy security challenges amid persistently elevated emissions.

AAST 014

METEOROLOGICAL DYNAMICS: A COMPARATIVE ANALYSIS OF DIURNAL AND SEASONAL VARIATIONS ACROSS FIVE LOCATIONS IN NIGERIA

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Abstract
This study examines diurnal and seasonal variations in temperature, humidity, pressure, and wind speed across Lagos, Abuja, Anyigba, Benin City, and Osogbo, using hourly MERRA-2 data from May 1, 2021, to April 30, 2023. The research addresses a significant gap in localized climate data within Nigeria. Findings indicate minimum mean temperatures between 05:00 and 06:00, ranging from 21°C in Abuja, Benin City, and Osogbo to 26°C in Lagos, with afternoon peaks of 32°C in Lagos and 29°C in Benin City, Osogbo, and Anyigba. Humidity inversely correlates with temperature, with minimum mean values at 50% in Abuja and 70% in Benin City during peak temperatures (13:00-14:00), while maximum mean humidity reaches 96% in Abuja at night (03:00-05:00). Pressure shows a semi-diurnal cycle, with lows between 00:00 and 03:00 and highs around 08:00. Seasonally, temperatures peak during the dry season, averaging 30°C in Lagos in March, compared to 26°C in the rainy season. Wind speeds are highest in Abuja, enhancing air circulation, while Lagos has lower speeds, potentially affecting air quality. This analysis underscores the need for tailored climate adaptation strategies and continuous monitoring to enhance climate resilience in Nigeria

Keywords: Meteorological Variations, Climate Dynamics, Diurnal Patterns, Seasonal Changes, Urban Heat Island

AAST 015

MULTI-MODEL ASSESSMENT OF CLIMATE CHANGE AND LAND USE DYNAMICS ON CONCENTRATED PHOTOVOLTAIC POTENTIAL: A HOLISTIC APPROACH FOR SUSTAINABLE ENERGY FUTURES

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Abstract

This study presents a novel multi-model framework, integrating CARIMA, SARIMA, and GPM, to comprehensively assess the impacts of climate change and land use dynamics on the potential of concentrated photovoltaic (CPV) systems. By leveraging advanced statistical and machine learning techniques, the model offers high-precision predictions of CPV performance across diverse climatic regions, including Alice Springs (Australia), the Middle East, and Africa. The hybrid approach outperforms conventional models, accurately forecasting CPV energy outputs under varying Shared Socioeconomic Pathway (SSP) scenarios. Results indicate significant regional variability: Alice Springs shows the largest CPV output decline (8.577%) under SSP245 during boreal summer, while Africa and the Middle East exhibit moderate reductions. Conversely, under SSP585, CPV outputs increase in Africa (7.644% during boreal autumn), the Middle East (6.502%), and Alice Springs (5.538%). The study further explores the combined effects of climate change (CLC) and urban expansion (URE), revealing URE's pronounced impact in Africa (45.45%) compared to the Middle East (20.15%), whereas CLC has a stronger influence in the Middle East (29.01%). This research underscores CPV technology's pivotal role in sustainable energy transitions, advocating for strategic deployment to mitigate climate impacts and support net-zero emissions goals by 2050 in the Middle East and Africa.

AAST 016

ORIGIN OF Fe K LINES IN MAGNETIC CATACLYSMIC VARIABLES FROM SIGMA^2 CORONA BOREALIS

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Abstract

We presented the analysis of the Origin of Fe K line in magnetic cataclysmic Variable from Sigma^2 CRB data from the High Energy and Astrophysical science Archieve Research Centre (HEASARC). The Suzaku satellite observation of SIGMA^2 CRB was made on 22-08-2006 at 11:26:05pm using Suzaku satellite for 109.19kiloseconds. The spectrum of the system was modelled using bremsstrahlung model with three Gaussian lines. We resolved the neutral or low ionized (6.4KeV), He-like (6.7KeV) and H-like (7.0KeV) iron lines. Fe K emission lines shows that the 6.4KeV and 7.0KeV and absorption in both full and partial covering matter could not be seen in all the sources. Our inability to measure the absorption in both full and partial covering could be attributed to low photon counts in the extracted stellar flare spectra.

AAST 017

PERFORMANCE EVALUATION OF FREE SPACE OPTICAL LINKS BASED ON RAIN RATE STATISTICS FROM A TROPICAL CLIMATE

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Abstract

The recent breakthrough in satellite communications through the technological development in Free Space Optics has surpassed the earlier occurring optical fiber, which requires digging of roads and the data transmission insecurity it is characterized with. This study has utilized 10 years (2014-2023) of rain data from the archive of the Global Precipitation Measuring Mission. The impact of rainfall on a radio wave signal propagating on an FSO link along

Abeokuta, South-West, Nigeria, has been investigated in this study. The monthly results from the rainfall rate show that the rainy months are characterized by a rainfall rate greater than 100 mm/hr, which could be threatening to the radio wave signal on the path of the FSO link, while the dry months show a lower rainfall rate. The specific rainfall attenuation revealed that only December has an attenuation level less than 10 dB. The analyses conducted on the impact of FSO attenuation of separation distance have depicted an exponential increase.
Keywords: Satellite, Free space optics, Data transmission, Rain data, Radio wave

AAST 018

SEASONAL RAINFALL EFFECT ON SELECTED LIVESTOCK ACROSS DIFFERENT CLIMATE ZONES OF NIGERIA

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Abstract
Nigeria's livestock production is threatened by climate change whereas the seasonal rainfall that primarily supplies water for agriculture has been inconsistent. This study evaluated the effect of seasonal rainfall on selected livestock (cattle, sheep, goat, raw cattle milk, pig, and chicken) production along Nigeria's Sahel, Savanna, and Rainforest climate zones.Observational rainfall data obtained from the Climate Research Unit and livestock production output from the Food and Agriculture Organization were analyzed for 43 years, from 1979 to 2022. The results revealed raw cattle milk has the highest production (416,380 T) while sheep have the lowest (98,598T). Seasonal rainfall variability was highest in the Sahel (Coefficient of variation, CV = 30.2%) followed by the Savanna (CV = 24%) and the Rainforest (CV = 12%). The trend showed a significant (95% confidence level from the t-test) increase at the Sahel whereas the Rainforest and Savanna regions exhibited declining precipitation trends. Seasonal rainfall had no significant correlation with selected livestock production in the rainforest, a low but significant correlation in the Savanna, and a strong significant correlation in the Sahel at a 95% confidence level from the t-test. These findings are vital in mitigating factors that affect livestock productivity and sustainability.
Keyword: Nigeria; livestock; rainfall; variability

AAST 019

SPECTRAL ENERGY DISTRIBUTION OF FLARES ON THE VARIABLE STAR WW CNC

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Abstract
The flaring variable star WW Cnc which was observed with the 0.4m SBIG optical telescope from Las Cumbres Obervatory Global Telescope Network remotely on 25/09/2022. The light curve of WW Cnc shows that the source has a strong presence of flares. Hence, we estimated the flare energy, flare wavelength and flare frequency of WW Cnc at peak flares so as to deduce it spectral energy distribution. A peak flare Energy of WW Cnc was measured at 5.66e-1 eV, a flare flux density of 1.48e-1 Jy, a flare energy flux density of 9.25e-11 erg $s^{-1}cm^{-2}\mu m^{-1}$ using Aladin software automatic energy generation tool. Similarly, we plottedthe flux density versus wavelength of the flaring binary variable star WW Cnc. The source was identified as (V* B WW Cnc) Binary variable star belonging to the family of Rotational Variables with centre right ascension (RA) and declination (DE) for V* B WW Cnc as (090 09' 48.603", +300 25' 36.822") respectively, using a radius of 5 arcsec. From the graph it was deduced that the flare wavelength of WW Cnc was 3.23e-1µm using Aladin automated wavelength generation tool. The flare frequency obtained for WW Cnc is 2.59e+4 GHz.
Keywords: Spectroscopy, Flare energy, Flare frequence,

AAST 020

TEMPORAL ANALYSIS OF AEROSOL CONCENTRATION AND METEOROLOGICAL PARAMETER WITHIN THE GUINEA COAST REGION OF NIGERIA.

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Abstract
This study investigates the temporal dynamics of black carbon and PM2.5 (particulate matter less than 2.5 micrometers) within this region across diverse ecological settings, including the Sudan Savanna, Mangrove Forest, and Northern Guinea Savanna. Utilizing long-term monthly datasets sourced from the Giovanni satellite monitoring platform, the research explores how anthropogenic activities and natural phenomena interact to affect aerosol levels over a 29-year period (1994-2023). The analysis reveals that black carbon levels exhibit temporal stability with notable contributions from urban centers like Lagos and Kano, while a regression analysis indicates a gradual decline in average concentrations over time. Seasonal variations are explored through time series and correlation analyses, highlighting the impacts of meteorological factors such as rainfall and temperature on aerosol dynamics. The results show that rainfall acts as an effective scavenger, significantly reducing aerosol concentrations during the wet season, while the harmattan season experiences elevated PM2.5 and black carbon levels, likely due to increased dust and combustion processes. This research contributes to the understanding of local air quality dynamics and emphasizes the importance of tailored pollution management strategies, particularly in rapidly urbanizing areas. The findings aim to assist policymakers, public health officials, and environmental scientists in developing informed strategies to mitigate air quality issues and enhance public health outcomes.

AAST 021

THE PHOTOMETRIC DETECTION OF ECLIPSE ON VARIABLE STAR WW CNC

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Abstract
The photometric analysis for the eclipsing binary WW Cancri (WW Cnc; RA: 09 09 48.60311; DEC: +30 25 36.8208) observed through the months of December 2022 starting from Decenber 3, 2022 to December 29, 2022. The results of the analysis shows that the average duration of primary eclipse D1 (in units of phase multiplied by 1000) =180(0.18×10^{-3}), average duration of totality in primary eclipse D2 = 0.18 and average depth of primary eclipse A1 = 0.91 mag, average duration of secondary eclipse d1 (inunits of phase multiplied by 1000) = 310(0.31×10^{-3}), average duration of totality insecondary eclipse d2 = 0.04 and average depth of secondary eclipse a1 = 0.18 mag. From our analysis, B-V is 0.037, giving an average surface temperature of 9689±40& 9731±52 when Ballestrous equation and Zombeck equation is used respectively, suggesting that our target star is belongs to the A spectral class. Using the value of the luminosity of 7.15LS where LS is solar luminosity, we estimated the mass of WWCnc to be in the range of 1.63−2.45MS, where MS is solar mass.

Keywords: Zombeck, Ballesterous, Photometry and Eclipse

AAST 022

ANALYSIS OF ELECTROMAGNETIC RADIATION OF RADIO WAVES PROPAGATION IN OKENE, KOGI STATE, NIGERIA

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Abstract
The poor radio signals experienced in Okene and its environs have posed serious concern. This poor EM wave causes increased attenuation, which have resulted in distorted signals. This study considers two radio broadcast stations. The signal strengths of the two radio stationswere compared and analysed. The signal strengthswere measured using field strength meter. Sixteen locations were considered, while the wavelength and free space path-loss calculated. The approximate distances between the antennas were determined. The transmitting signal strength was 100.9dBµV (KA) and 102.2dBµV (KB). Receiving signal distancesare 72.0km (KA) and 69.0km (KB). The free space path loss was 109.01dB (KA) and 109.39dB (KB). Though, transmitting signal strength of KA is lower with longer wavelength 3.21m and lower frequency 93.5MHz gives it an edge over KB which has higher frequency109.5MHz and shorter wavelength 2.94m. It is howeverrecommended that the FM stations should improve their network systemfor effective service delivery,mostly where low performances are experienced. Expectation is that at about 69km from transmitting antennas, booster stations will enhance signal effectively. This will lead to better signal quality and improved the satisfaction of the residents.

Keywords: Radio waves; attenuation; impedance mismatch; path loss; EM fields; EM Spectrum; propagation pattern

AAST 023

ENVIRONMENTAL IMPACTS OF AEROSOL PARTICLES FROM QUARRY SITE AND ITS ENVIRONS: A CASE STUDY OF EBONYI STATE.

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Abstract
Quarry activities, particularly those involving stone and granite extraction, have become increasingly prevalent in Ebonyi State, Nigeria. These operations are crucial for meeting the demands of construction and infrastructure development, but come with significant environmental costs. One of the most critical environmental impacts of mining is the generation of aerosol particles, which can severely affect environment. This study investigated the environmental impacts of aerosol particles generated by quarry activities, Ebonyi State as a case study, using a questionnaire-based approach. Questionnaires were administered to key stakeholders and residents near quarry sites to gather data on their experiences with dust pollution, health issues, and environmental concerns. The findings indicate significant environmental degradation due to quarrying activities. The study highlights the need for stricter regulations and sustainable practices to mitigate these impacts. It also revealed the level and importance of community awareness and participation in environmental management efforts to protect both human health and the environment in quarry-affected areas. In conclusion, the environmental impacts of aerosol particles from mining in Ebonyi State underscore the importance of sustainable mining practices and stringent environmental regulations. Addressing these challenges requires a comprehensive approach that balances economic development with environmental protection and public health considerations.

AAST 024

COMPARATIVE STUDY OF THE PARTICULATE MATTER CONCENTRATION IN NIGERIA USING THE CLARITY NODE-S MEASUREMENTS

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Abstract
This study conducts a comparative analysis of air quality in four Major Nigerian cities - Kano, Ilorin, Calabar, and Port Harcourt - using measurements from air clarity sensors. Particulate matter (PM 1.0, PM2.5 and PM10) concentrations data from the air clarity sensors in each city were collected and analysed. The result of the spatial and correlation analysis reveals significant variations in Particulate matter concentration across the four cities, with Kano and Port Harcourt exhibiting higher concentrations of PM2.5 and PM10 of over 120μg/m^3 which may be attributed to the high rate of industrial activities and vehicular emissions. The particulate matter over the Port Harcourt region exceeds the limits of 40-60 μg/m^3. The high level of pollution in Port Harcourt may be attributed to the illegal refineries and artisanal in the city. A comparison with international air quality standards reveals that all four cities exceed the World Health Organization's recommended limits for PM2.5 and PM10 of 10-25 μg/m^3. The findings of this study highlight the need for effective air pollution control measures and public health interventions to mitigate the adverse effects of poor air quality in these Nigerian cities.

Keywords: Particulate matters, air quality index, air pollution, pollutants

AAST 025

COMPARISON OF PHOTOVOLTAIC AND WIND POWER SYSTEMS ELECTRICITY GENERATION COSTS IN TEN NIGERIAN LOCATIONS

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Abstract
This study compares the costs of producing power using photovoltaic system (PVS) and wind power system (WPS) for ten locations within Nigeria. For the cost estimate in the study, each system had a 5kW power generation rating. A PVS's and a WPS's LCOE are calculated and compared. The parameters considered in calculating the LCOE are the capital cost, operations and maintenance cost, decommissioning cost, the quantity of energy, the discount rate, and the time in which a cost occurs during the systems lifetime. The location's solar and wind energy resources determine the LCOE of the PVS and WPS, respectively. For example, compared to employing PVS with the same power rating taken into consideration in this study, WPS has a 23.6% cheaper cost of energy generation in Kano; other locations studied have their own trends. In conclusion, this study provides us with very important knowledge that could be very useful in decision making by energy users, investors and governments agencies in Nigeria.

AAST 026

EFFECTS OF MULTIPATH SOURCES ON GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) RECEIVER PERFORMANCE ACCURACY IN LAUTECH, OGBOMOSO CAMPUS, NIGERIA

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Abstract
There are sources that cause signals to bounce, bend, or scatter which result in multipath effects that have impact on the accuracy of various systems including Global Navigation Satellite Systems (GNSS) which is referred to as multipath sources such as vegetation,

building, urban crayon, vehicles, tunnels, metal fences and the like. In GNSS, multipath sources affect its performance accuracy which is of paramount importance to human existence in various applications including aviation, maritime, precision agriculture, disaster management, transport industry and mining. This study analyzed the effects of multipath sources on low cost compact uBlox ZED F9P GNSS receiver performance accuracy in fifteen different References Coordinates (RC1-RC15) within Ladoke Akintola University of Technology Ogbomoso Campus. In this study Point Precise Positioning (PPP), Number of satellites in view (NSV), Geometric Dilution of Precision (GDOP) was used as performance metrics to estimate the position error of the processed RINEX OBS data of the available constellation of GPS, GLONASS and GPS+GLONASS hybrid mode. The results shows 0.005m horizontal and 0.007m vertical PPP accuracy in GPS+GLONASS hybrid modes of operation in about five locations which indicates the best position solution out of the fifteen.
Keywords: Multipath sources, GNSS, Performance, Accuracy

AAST 027

ANALYSIS OF THE KELVIN EFFECT OF THE EQUILIBRIUM EFFECTIVE RADII AND HYGROSCOPIC GROWTHS OF MARITIMME AEROSOLS

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Abstract
Three microphysical properties of maritime aerosols were extracted in this paper and numerically analyzed the analytical expressions for the changes in the equilibrium relative humidity (RH), effective radius, effective hygroscopic growth. The magnitudes and fractional changes on the effects of surface tension on ambient atmospheric aerosols. The expressions were applied to three - one parameter models. It was discovered from the analysis of the data extracted that, to the highest order error, the change in the equilibrium RH, effective radii and effective hygroscopic growth do not depend on the compositions of the aerosols. From the three models used, it was also discovered that the fractional changes in the ambient RH, effective radii and effective hygroscopic growth, also do not depend on the aerosol's compositions. Finally, it was discovered that the magnitude of the Kelvin effect and its consequences on the atmospheric aerosols do not depend on the hygroscopicity of the aerosols.
Keywords: Kelvin effect, effective radius, effective hygroscopic growth, atmospheric aerosols, ambient Relative Humidity.

AAST 028

CYCLIC CORRELATIONS OF GEOMAGNETIC ACTIVITY, NORTH ATLANTIC OSCILLATION AND WEST AFRICAN SURFACE TEMPERATURE VARIABILITY

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Abstract
A study to examine cyclic correlations of geomagnetic activity (aa index), North Atlantic Oscillation (NAO) and West African surface temperature was carried out. Rolling-coefficient analyses were performed to track the temporal evolution of relationships among these variables. Granger causality tests assessed the predictive influence of geomagnetic activity on NAO, while spectral and wavelet coherence analyses were implemented to identify dominant cycles and correlations. Results show that the aa-NAO correlation evolved from negative values in the 1920s to positive values ($r \sim 0.65$) between 1960 and 2000. NAO-West African temperature correlations shifted from strong positive values in the early 20th century to strong negative values between 1960 and 2000. Granger tests indicate significant ($p<0.05$) aa-NAO correlation at 1-8 year lags during geomagnetic activity maximum (1950-2000). Spectral analysis indicates dominant geomagnetic activity cycles in NAO and West African temperature time series. Wavelet coherence analysis shows strong in-phase aa-NAO

correlation at the 11-year cycle (1960-2000), while NAO and West African temperature exhibit anti-phase behaviour at 11- and 22-year cycles, with NAO leading by ~1-3 years. These findings highlight the influence of geomagnetic activity on West African temperature, modulated by multi-decadal ocean-atmosphere interactions. Keywords: North Atlantic Oscillation, solar-geomagnetic activity, atmospheric circulation, Atlantic Multi-Decadal Oscillation.

AAST 029

EFFECTS OF CLIMATE CHANGE ON IRRIGATION FARMING ALONG THE BANK OF RIVER KADUNA, NORTH-WESTERN NIGERIA.

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Abstract
Irrigation farming in northern parts of Nigeria is primarily a means to supplement rainfall and serves to increase agriculture production in the region. Climate change has significantly increase future atmosphere evaporative demand that has led to local water stress in the river Kaduna bank. In this study, we examined issues and impact of climate change on future irrigation water use (IWU) in the bank of river Kaduna through crop water demand as well as Carbon iv oxide (CO2) concentration impacts by utilizing climate Model data with the hydrologic modeling tool (CMhyd). Preliminary results show that average seasonal IWU were 3273mm, 3543.4mm and 4026.18mm under 2021, 2022 and 2023 dry farm seasons respectively. This increase in IWU evaluation was attributed to atmospheric evaporation demand as well as elevated (CO2) which is a greenhouse gas. We therefore concluded that climate change remains an issue to irrigation farming along the bank of river Kaduna.
Keywords: Climate change, River bank, Irrigation, Atmosphere, Evaporation.

AAST 030

REVISITING CORONAL MASS EJECTION (CME) STRUCTURAL DYNAMICS: A NOVEL SHEATH-MAGNETIC CLOUD-SHEATH CONFIGURATION AND IMPLICATIONS FOR GEOMAGNETIC STORM FORECASTING

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Abstract
The canonical structure of a coronal mass ejection (CME) is often simplified as consisting of a forward shock followed by the sheath and the magnetic cloud. However, a critical review of existing literature reveals a lack of conclusive evidence regarding the precise temporal arrangement of these solar wind structures. This gap has significant implications for understanding CME dynamics and their geoeffective potential. Presently, the findings of a recent study of the geomagnetic storm of Oct 13, 2016 have uncovered a more complex configuration—a "sandwich" structure consisting of a sheath–magnetic cloud–sheath sequence following the forward shock. This paper outlines the critical thinking that led to the findings, highlighting its relevance for improving space weather forecasting and the protection of satellite operations, power grids, and other national critical infrastructure from extreme space weather events.
Keywords: solar wind structures, geomagnetic storms; spatiotemporal location.

SECTION E:

Innovative Researches in Physics Education for Economic Development (PEED)

PEED 001

EFFECTS OF COMPUTER ANIMATION ON STUDENTS' ACHIEVEMENT IN LEARNING ALTERNATING CURRENT ELECTRICITY IN TECHNICAL COLLEGES IN NSUKKA EDUCATION ZONE

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Abstract
This study investigated the effect of instructional computer animation on Technical college Students' achievement in alternating current electricity in Nsukka Education Zone. Two research questions guided the study and two null hypotheses were tested. The study adopted a quasi experimental design. Population of the study consisted of all the 2120 Year three physics students in the public technical colleges in Nsukka Educational Zone. The sample consisted of 120 Year 3 physics students drawn from some of the technical colleges in the Education Zone. Alternating current electricity Achievement Test (ACEAT) was the instruments used to collect data for the study. The reliability coefficient of ACEAT was established to be 0.85 using Kuder Richardson (KR-20) after trial-testing of the instrument. Mean and standard deviation were used to answer the research questions while Analysis of Covariance was used to test the null hypotheses at 0.05 level of significance. The result revealed that instructional computer animation had significant effect on students' achievement in alternating current electricity. Female students performed better than the male students taught using instructional computer animation. Consequently, recommendations were made.

Keywords: Alternating Current, Computer Animation, Students' Achievement

PEED 002

GEOGRAPHICAL EVALUATION OF SOLAR ENERGY POTENTIALS IN ALL THE LOCAL GOVERNMENT AREAS OF NIGER STATE, NIGERIA.

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Abstract
This study evaluates the solar energy potential across all local government areas in Niger State, Nigeria. Using ground-measured and satellite-derived solar radiation data, the research predicts solar radiation in areas lacking direct measurements and identifies optimal sites for solar energy development. The kriging interpolation technique and geospatial tools were applied to estimate solar radiation and analyze topographical factors. The Analytical Hierarchy Process (AHP) was used to classify the state into five solar potential categories. The analysis reveals that 52.76% of the state falls into High or Very High Potential categories, making these areas suitable for large-scale solar energy projects. A comparative analysis of ground-based and satellite-derived data shows a systematic underestimation by satellite models, with discrepancies ranging from 1.49 kWh/m²/day to 1.59 kWh/m²/day. The study concludes that integrating ground-measured data with satellite models enhances the accuracy of solar radiation assessments. Prioritizing high-potential regions like Chanchaga, Bosso, and Shiroro for solar energy development is recommended. Localized calibration of satellite data is crucial for improving solar energy planning and ensuring sustainable development in Niger State. This research provides valuable insights for policymakers and stakeholders in identifying suitable areas for solar energy development

PEED 003

POLITICAL PHYSICS: APPLYING PHYSICS PRINCIPLES TO ANALYSE POLITICAL PRESSURE AND GOVERNANCE STABILITY

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Abstract
In an era of heightened political tensions, understanding governance through the lens of physics offers a unique and innovative framework for analyzing political pressure and stability. This paper introduces the concept of Political Physics by applying fundamental laws such as the Law of Conservation of Energy, Law of Inertia, and Bernoulli's Principle to the current political dynamics in Rivers State, Nigeria. Through the lens of the Quadruple Helix Model which integrates government, academia, industry, and society, the study examines how political forces interact to produce either stability or systemic instability. The analysis draws parallels between physical and political systems, arguing that just as energy cannot be destroyed but only transferred, political power shifts from one entity to another. Furthermore, it explores how external judicial forces act as political resistances, disrupting governance inertia. This interdisciplinary approach offers a fresh perspective on how Physics Principles can deepen our understanding of leadership transitions, power resistance, and governance equilibrium in a democratic setting.
Keywords: Political Force, Equilibrium, Law of Inertia, Bernoulli's Principle

PEED 004

ENHANCING PHYSICS EDUCATION IN NIGERIA SECONDARY SCHOOLS: EXPLORING INNOVATIVE TEACHING STRATEGIES TO IMPROVE STUDENT ENGAGEMENT AND ACADEMIC PERFORMANCE

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Abstract
Student engagement and academic performance are critical factors in educational success. Traditional teaching methods often fail to caption student interest and adapt to diverse leaving style this study explore innovation teaching strategies include active learning techniques, technology integration collaboration learning and personalized instruction this research suggest that interactive methods such as project based learning and flipped classroom additionally digital tools and adaptive learning catering to individual student needs the study highlight the importance of student teacher interaction, real world application and continues assessment to sustains motivate approaches, educators create a more dynamic and effective learning environment, ultimately leading to higher academic achievement.
keywords: innovative learning strategies, student engagement, academic performance, active learning, digital tools and educational success.

PEED 005

GROWTH MINDSET AS A CORRELATE OF PHYSICS STUDENTS' ACADEMIC ACHIEVEMENT AND ACHIEVEMENT MOTIVATION IN NIGERIA: IMPLICATION FOR ECONOMIC DEVELOPMENT

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Abstract
The growing rate of poor academic achievement of students in physics necessitated the study. The study assessed growth mindset as a predictor of students' academic achievement and achievement motivation in physics. Three research questions and null hypotheses were formulated and posed, respectively, to guide the study. The hypotheses were tested at 0.05 level of significance. The study adopted a correlational survey research design. A sample of

385 SS3 students drawn by using simple random and proportionate stratified sampling techniques participated in the study. Questionnaire and Students' Academic Achievement Profoma (SAAP) were used for data collection. Cronbach Alpha was used to determine the internal consistency of the questionnaire items, and reliability coefficients of 0.83 and 0.77 were obtained, respectively. Data collected were analyzed using regression analysis. The results showed that 50% and 40% of the variations in students' achievement and achievement motivation are attributed to growth mindset. Growth mindset significantly predicted students' academic achievement and achievement motivation. Therefore, students should understand that intelligence is not fixed or inborn; it can be developed through persistent hard work, passion, and interest despite series of failures and difficulties encounter towards learning physics.

Keywords: Growth mindset, physics students' academic achievement, achievement motivation, and economic development.

PEED 006

IMPACT OF JUST-IN-TIME-PEER-INSTRUCTION TEACHING STRATEGY (JTPI) ON ATTITUDE, RETENTION AND PERFORMANCE IN HEAT CONCEPT AMONG SECONDARY SCHOOL PHYSICS STUDENTS OF VARIED ABILITY IN JIGAWA STATE,

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Abstract

This study was carried out to investigate the impact of Just-in-Time-Peer-Instruction teaching strategy (JTPI) on Attitude, Retention and Performance in Heat Concept among Secondary School Physics students of varied Ability in Jigawa State, Nigeria. Quasi-experimental research design was adopted. The population of the study comprised all SSII Physics students of government Secondary School in Jigawa State. A sample of 198 students (105 males and 93 females) from four different schools. Two instruments, Physics Performance Test (PPT) and Physics Students Attitude Inventory (PSAI) with coefficient of correlation of 0.78 and 0.65 were used to generate the data. Experimental group were taught using Just-in-Time-Peer-Instruction teaching strategy (JTPI) and control group was taught using lecture method. The data collected were analyzed using (SPSS) version 26. The research questions were answered using descriptive statistic and the hypothesis were tested at $P \geqslant 0.05$ level of significance using t-test and Mann Whitney statistics. The result revealed that, "There was a significant difference between the performance of the students taught using JTPI and those taught using lecture method". It is therefore, recommended that, "The use of JTPI should be encouraged among Physics teachers in Jigawa State secondary school.

PEED 007

TRANSFORMING RESEARCH AND INNOVATION IN PHYSICS EDUCATION CLASSROOMS FOR ECONOMIC DEVELOPMENT IN NIGERIA

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Abstract

The world economic development recognized that science, technology, and the quality of scientifically trained work force crucially determines the development and economic growth of nations and the future of humankind. In addition, there is growing global concern about flight of talent from science in general and Physics in particular, and the need to make Physics teaching and learning effective and careers in Physics attractive. This paper focuses on "Transforming Research and Innovation in Physics Education Classrooms for Economic Development in Nigeria". The study is based on four main objectives and four research questions. Inquiry-Based Learning, Project-Based Learning and the Integration of Technology were found to have significant impacts on students' learning and are influencing global praxis

of synthesizing both theory and practice as well as motivating changes in content, context, instruments, and ways of teaching and learning Physics. Teachers' Professional development programs that provide experiential learning of research-based innovative teaching practices, facilitates the process of transfer of pedagogic innovations into the formal classroom reflection and establish a collaborative network of teachers empowered to bring about radical transformation. Hence, the contribution of innovative Physics education to Nigerian economic development was established. The study recommends that any professional development organised for Physics teachers in the future, should enable them to take ownership of the learning process through reflecting on their practices, identifying their own needs and connecting their practices with relevant theories, as well as connecting together in professional learning groups.

Keywords: Research, Physics Classrooms, Innovative Strategy, Teacher Professional Development

SECTION F:

Artificial Intelligence Applications in Research and Economic Development (AIAR)

AIAR 001

REVOLUTIONIZING HEALTHCARE WITH LENNEOBIONICS AI VIRTUAL HOSPITAL

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Abstract
Lenneobionics Artificial Intelligence (AI) Virtual Hospital is an emerging AI technology poised to transform the healthcare landscape by converging the power of artificial intelligence (AI) with the empathy of human caregivers. We employed a range of scientific methods, design principles, and construction techniques to deliver a robust and effective healthcare platform. Some of the key methods and techniques used include: Machine Learning Algorithms, Natural Language Processing (NLP), Computer Vision, Data Mining, Cloud Computing, and Cybersecurity Measures. Our innovative platform delivers personalized, efficient, and effective healthcare services through a suite of cutting-edge features, including virtual consultations, AI- powered symptom checking, tailored treatment plans, remote monitoring, and seamless integration with wearable devices. Ensuring the utmost security and HIPAA compliance, our platform safeguards the storage and transmission of sensitive patient data.

Keywords: Virtual Consultations, AI-Powered Triage, Remote Monitoring, Health Metrics.

AIAR 002

APPLICATION OF ARTIFICIAL INTELLIGENCE TO PREDICT THE TENSILE STRENGTH OF REINFORCED ALUMINIUM COMPOSITES

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Abstract
To design economical materials, researchers need to develop an algorithm that can predict the materials' properties. This paper studies the application artificial intelligence (AI) algorithm namely an artificial neural network (ANN) to predict the tensile strength of reinforced aluminium matrix composites. Secondary data was used in this paper. The inputs were reinforcement size and weight percentages of the reinforcements while tensile strength was the response. The AI-ANN was compared with multi linear regression (MLR) algorithm. Determination coefficient (DC) and root mean square error (RMSE) were used to assess the algorithms' prediction. The results showed that the AI-ANN algorithm outstripped the MLR algorithm. Conclusively, the use of AI algorithm results in a better understanding of the research of materials thus producing economical materials.

Keywords: Multi Linear Regression, Artificial neural network, Tensile Strength, Aluminium Composites

AIAR 003

LENU AI FOOD ANALYZER: REVOLUTIONIZING NUTRITION ANALYSIS

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Abstract
The design and innovation of Lenu AI Food Analyzer which is a cutting-edge food analysis tool that uses computer vision and machine learning algorithms to analyze the nutritional content of food from a simple uploaded image. Our algorithm is designed to provide accurate and detailed information on the nutritional content of your food, including macronutrients, micronutrients, and allergens. Our device utilizes advanced computer vision and machine learning algorithms to analyze the nutritional content of food. The design and construction was achieved using Computer Vision, Machine Learning, Database Integration and User

Interface allowing users to easily upload images of their food and receive detailed nutritional analysis reports. Results of some of the food analyzed with the technology are as follows; Food: Grilled chicken breast with vegetables. Nutrition Analysis:Calories = 350, Protein = 35g, Fat= 10g, Carbohydrates = 20g, Ingredient Identification:Chicken breas with vegetables (broccoli, carrots, bell peppers), Health Condition Analysis: Improved Nutrition, Personalized Health Advice, Increased Confidence, Better Health Outcomes.

Keywords: AI algorithm, Nutrition Analysis, Ingredient Identification, Health Condition Analysis, Dietary Planning

AIAR 004

LOCALIZATION OF SMART AND SENSING DEVICES SETUPS FOR IMPROVING AGRICULTURAL PRACTICES AMONG YOUNG AND NON-CARRIER FARMERS

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Abstract

The birth of the Internet of Things (IoT) brought about a remarkable influence on farming activities globally. Interestingly, developing countries are lagging in the adoption and use of smart and sensing devices including actuators and sensors. Even more serious is the low engagement of young people in farming because of the crude nature, which left the farming to elderly and a few rural dwellers. As a consequence, more people will become hungry in the near future. This paper developed a localized solution using Arduino Uno Microcontroller, soil moisture sensor, temperature humidity (DHT22), and powered 5000MAh Lithium battery to enable farmers to connect in real-time to monitor and control farming variables. The cropping style and dynamics are captured from the prevailing parameters monitored by the installed sensors including temperature, humidity, and soil moisture; which are transmitted to cloud infrastructure through a microcontroller. The outcomes increase the participation of young people, data for making decisions, more food production activities around residential homes, building and substance of orchards, and reduction of cost of production. The paper recommends government policies and enactments of cluster farms around private and public premises using the proposed technology for the substance of food security.

AIAR 005

PREDICTING SURFACE TEMPERATURE USING STACKING ENSEMBLE MACHINE LEARNING MODELS, AND REMOTE SENSING IMAGERY

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Abstract

This study presents a novel Stacking Ensemble Model (SEM) that integrates Random Forest (RF), eXtreme Gradient Boosting (XGBoost), and k-Nearest Neighbors (KNN) to predict land surface temperature using high-resolution Landsat 9 and SRTM DEM data. The research focuses on Kogi State, Nigeria. The SEM demonstrated exceptional predictive performance, with a coefficient of determination (R^2) of 99.86%, significantly outperforming individual machine learning models. The results revealed pronounced spatial variability in surface temperatures, ranging from 24.8°C to 49.3°C, with an average of 35.36°C across the study area. Critical thermal hotspots where surface temperatures exceeded 40°C, were identified, covering an area of 1,035 km^2. Identifying high-temperature zones with geothermal potential provides a foundation for targeted energy exploration. An innovative approach was adopted by introducing elevation spectral indices to enhance the accuracy of surface temperature prediction. These indices, combined with key predictors such as Natural Difference Vegetation Index, Proportion of Vegetation, Land Surface Emissivity, and Brightness Temperature, provide a more comprehensive framework for analysis. By effectively capturing

spatial heterogeneity and thermal anomalies, the SEM framework enhances predictive accuracy, robustness, and scalability

AIAR 006

AI FOR PREDICTIVE MAINTENANCE AND LOAD FORECASTING IN RENEWABLE- POWERED SMART GRIDS

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Abstract

The rise of renewable energy sources in our power grids brings both good chances and few challenges in keeping the grid stable and reliable. Traditional models struggles in managing the unpredictability that comes with renewables, and that's where artificial intelligence (AI) steps in as a game changer. This paper looks at how AI can help with predictive maintenance and load forecasting in smart grids using renewable energy. It starts by pointing out how old grid management systems struggle with fluctuations in energy generation and the wear and tear of infrastructure. The focus then shifts to machine learning and deep learning methods, like Long Short-Term Memory (LSTM) networks and support vector machines for predicting loads in short and long term. The paper also touches on how AI models can work with edge computing and cloud-based energy management tools to provide real-time, scalable solutions. By combining current research with industry practices, this review offers a solid guide for using AI in smart grids powered by renewable energy. The results highlight how AI can not only improve our predictive abilities but also help transform energy systems to be more sustainable and resilient.

Keywords: Artificial Intelligence, Smart Grids, Predictive Maintenance, Load Forecasting, Renewable Energy, LSTM, Edge Computing

AIAR 007

A HYBRID EXPONENENTIAL-LSTM APPROACH FOR IMPROVED SIGNAL LOSS PREDICTION IN URBAND MACRO ENVIRONMENT

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Abstract

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

AIAR 008

AI-OPTIMIZED HIGH-CAPACITY MULTILAYER CORE FIBRE FOR 5G AND BEYOND NETWORKS

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Abstract

Recent research has focused on novel multilayer fiber (MLF) designs to enhance high-capacity optical communication systems. However, modal dispersion in spatial division multiplexing (SDM) fibers presents a significant challenge. Reducing this dispersion is crucial for implementing a multipath strategy, which can be achieved through modal dispersion equalization. This paper presents a new numerical method for equalizing modal dispersions in a step-index radial multilayer four-mode fiber propagating linearly polarized (LP) modes (LP01, LP11, LP02, and LP21). An optimized fiber is modeled by adjusting core radii, resulting in optimal thicknesses for the radial index cores being 3.95 μm, 3.12 μm, 2.40 μm, and 1.96 μm at a wavelength of 1.55 μm. This new fiber holds promise for optical communication links in 5G and beyond, offering a backhaul solution to increase data-carrying capacity. The study alsohighlights the crucial impact of artificial intelligence (AI) on advancing fiber optic modeling for next-generation networks

AIAR 009

SHORT TERM ELECTRICITY LOAD FORECASTING USING HAMMERSTEIN WIENER

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Abstract

Accurate short-term electricity load forecasting is essential for efficient operation and planning of power systems. This paper presents a novel application of the Hammerstein-Wiener model for short-term electricity load forecasting. The proposed model combines the benefits of nonlinear autoregressive models with the flexibility of Wiener systems, enabling accurate capture of complex load patterns. A case study using real- world load data from a distribution company demonstrates the effectiveness of the proposed model in predicting short-term electricity demand. The results show that the Hammerstein-Wiener model outperforms traditional forecasting methods, achieving a significant reduction in mean absolute percentage error (MAPE). The proposed model provides a valuable tool for utilities and grid operators to improve the accuracy of their short-term load forecasts and optimize their operations.

SECTION G:

Mathematical, Theoretical, Condensed Matter and Nuclear Physics Applications for Economic Development
(MATP)

MATP 001

ELASTIC PROPERTIES OF SINGLE STRANDED DNA STUDIED BY COARSE GRAINED MODEL

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Abstract
Understanding the elastic properties of single-stranded DNA (ssDNA) is essential for elucidating its mechanical behavior in biological and nanotechnological applications. In this study, we employ the oxDNA coarse-grained model to investigate the elastic response of ssDNA under various mechanical constraints, including stretching and bending deformations. Molecular dynamics simulations are performed over a range of temperatures and ionic conditions to capture the interplay between base-pair interactions and backbone flexibility. Key elastic parameters, such as persistence length, stretch modulus, and bending rigidity, are extracted from the simulation data and compared with experimental measurements. Our results reveal that the elasticity of ssDNA is highly dependent on sequence composition, ionic strength, and temperature, highlighting the role of electrostatic screening and base stacking interactions. The study provides new insights into the mechanical properties of ssDNA, offering a quantitative framework for understanding its function in biological systems and its potential applications in DNA-based nanodevices.

MATP 002

THE USAGE OF MATHEMATICAL SOFTWARE IN IMPROVING THE ACADEMIC PERFORMANCE OF SECONDARY SCHOOL STUDENTS IN MATHEMATICS IN OREDO L.G.A OF EDO STATE.

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Abstract
This research work focuses on the usage of mathematical software in improving the academic performance of Secondary School students in Mathematics in Oredo L.G.A of Edo State. To guide this study, four research questions were raised and two corresponding hypotheses were formulated. A total of one Hundred and Twenty (120) respondents were randomly selected from four schools at Oredo L.G.A, (60 Boys and 60 Girls). The data obtained were analyzed using the mean, standard deviation and T- test. The study also revealed that the use of Mathematics Software for Mathematics instruction has improved the performance of students in Algebra. Therefore, the hypothesis was rejected. The study finally revealed that there was no significant difference between the Boys and girls taught Mathematics using computer. Therefore, the hypothesis which states there will be no significant difference in the performance of boys and girls taught Mathematics using software was not rejected.
Keywords: Mathematical Software, Academic Performance, Algebra.

MATP 003

COMPARATIVE ANALYSIS OF DYE-SENSITIZERS FOR ENHANCED DSSC PERFORMANCE: A COMBINED SCAPS-1D AND DFT STUDY

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Abstract
Dye-sensitized solar cells(DSSCs) offer a promising low-cost alternative to conventional photovoltaics, with sensitizer selection critically influencing performance. While synthetic dyes like N719 demonstrate high efficiency, natural dyes present eco-friendly alternatives needing optimization. This study compares the photovoltaic performance of TiO_2-based DSSCs sensitized with N719 synthetic dye and anthocyanin natural dye, evaluating their

potential for solar energy conversion. The investigation employed: SCAPS-1D simulations for J-V characteristics, quantum efficiency (EQE), and capacitance-frequency (C-F) analysis, Density Functional Theory (DFT) to validate dye-TiO_2 electronic interactions and comparative assessment of key parameters: Voc, Jsc, fill factor (FF), and conversion efficiency. N719 exhibited superior performance (η= 8.2% vs. anthocyanin's 3.7%), attributed to broader light absorption and better charge injection efficiency. However, anthocyanin showed promising charge transfer properties (DFT-confirmed LUMO alignment >0.3 eV above TiO_2 CB), suggesting potential for improvement via structural modification. While synthetic dyes currently outperform natural alternatives, the study identifies specific electronic structure modifications to enhance anthocyanin-based DSSCs, supporting sustainable photovoltaic development.

Keywords: DSSCs, Natural dyes, SCAPS-1D, DFT

MATP 004

ELECTRONIC PROPERTIES AND THERMOELECTRIC PERFORMANCE OF 2D ZNSE AND ITS HAECKELITE PHASES BY FIRST PRINCIPLE CALCULATIONS AND BOLTZMANN THEORY

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Abstract

The electronic and thermoelectric properties of two-dimensional (2D) ZnSe and its Haeckelite phase were systematically investigated under various strain conditions using first-principles calculations and Boltzmann transport theory within the constant relaxation time approximation. The pristine 2D ZnSe is identified as an n-type semiconductor with a band gap of 1.70 eV, which widens under compressive strain and narrows under tensile strain, influencing the transport properties. The Haeckelite structure exhibits degenerate n-type semiconductor behaviour with a band gap of 1.29 eV and distinct features such as flat valence and parabolic conduction bands. Thermoelectric performance was evaluated through the Seebeck coefficient, electrical and thermal conductivities, and the dimensionless figure of merit (ZT). The Pristine ZnSe and its compressed phase demonstrate improved thermoelectric efficiency at elevated temperatures, with ZT values reaching up to 0.96 and 0.97 at 400 K respectively. The stretched phase exhibits a ZT of 1.07 at 800 K. The Haeckelite materials show consistent thermoelectric behaviour across temperature ranges with moderate ZT values, which can be slightly enhanced under specific strain conditions. Our findings highlight the strain-sensitive electronic structure and thermoelectric properties of 2D ZnSe and Haeckelite materials, underscoring their potential in thermoelectric applications.

Keywords: 2D ZnSe, Haeckelite structures, Strain engineering, Thermoelectric properties, Density functional theory

MATP 005

NANOFABRICATION OF XS/CZTS/XS (X: Cu, Sn, Pb) QUANTUM WELL FOR SOLAR CELL TECHNOLOGY AND APPLICATIONS

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Abstract

XS/CZTS/XS quantum wells were fabricated using Chemical Bath Deposition (CBD) technique. The effects of deposition time variations on the properties and functionality of each quantum well was investigated respectively. The UV-Vis and FT-IR spectroscopy were used to characterize the fabricated structures. The range of band gaps (E.g) for each fabricated quantum well and their respective spectral absorbance (A), reflectance (R) and transmittance (T) were determined in the visible region of electromagnetic spectrum were obtained. Maximum transmittance, lowest reflectance and lowest absorbance were observed at 3 hours,

1.5hours and 1hour for CUS/CZTS/CUS, SnS/CZTS/SnS and PbS/CZTS/PbS quantum wells. Results exhibit favourable compatibility and good photovoltaic abilities.
Keywords: Quantum well, Nanofabrication, CBD, photovoltaic ability.

MATP 006

ANALYSES OF VIBRATIONAL RESONANCE OCCURRENCE IN A SPACE-DEPENDENT DAMPED VAN DER POL-DUFFING OSCILLATOR WITH TRI-STABLE POTENTIAL

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Abstract
The fascinating ubiquitous nature of nonlinear systems has attracted the interest of researchers for decades. Consequently, diverse dynamical properties have been examined in nonlinear systems. Among the most investigated dynamical behaviors is undoubtedly the resonance-induced phenomena which include; coherence resonance, stochastic resonance, vibrational resonance and ghost resonance, to mention a few. The famous Stochastic Resonance (SR) and Vibrational Resonance (VR) have received more attention in recent years. SR is a noise-induced phenomenon where the detection of a low- frequency input signal at the output of nonlinear system is improved by noise perturbation. On the other hand, in the ultimate VR, the detection of a low- frequency input signal is enhanced by a high frequency perturbation. Vibrational Resonance (VR) has been investigated in many systems and in different contexts. In particular, our present communication numerically investigates VR occurrence in a Van der Pol-Duffing Oscillator modeling the motion of a particle in a tri-stable potential, experiencing space-dependent damping and driven by two external excitations.
Indeed, VR effect is highlighted in the system for fixed damping amplitude. Moreover, the study reveals how the system's response is controlled by the damping amplitude.

MATP 007

BAYESIAN SHARED COMPONENT MODEL FOR CHILDHOOD ANAEMIA, DIARRHEA, AND FEVER COMORBIDITIES IN NIGERIA: A GEOSPATIAL PERSPECTIVE

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Abstract
Children under the age of five in Nigeria continue to experience significant comorbidities of diseases, contributing to high morbidity and mortality rates. This study applied a Bayesian shared component model to separate the specific and shared risk factors associated with anemia, diarrhea, and fever among children across the states in Nigeria. Regional climatic variations were integrated into the spatial modeling framework to enhance the analysis. Childhood disease data were sourced from the 2018 Nigeria Demographic and Health Survey. The identified risk factors common to the three health conditions are wealth index of household, maternal educational level, land surface temperature and regional precipitation.
Geospatial analysis of the posterior disease risk estimates revealed that the comorbidities of anemia- diarrhea, anemia-fever, diarrhea-fever, and anemia-diarrhea-fever are disproportionately higher in the northeastern and southern regions of the country. To significantly mitigate the risk of disease comorbidities, policymakers and health authorities in Nigeria should implement initiatives to address common risk factors, with priority given to the identified hotspot regions.

MATP 008

BOUNDARY LAYER ANALYSIS OF THE EFFECT OF G-JITTER ON UNSTEADY-STATE MAGNETOHYDRODYNAMIC COUETTE FLOW IN A VERTICAL POROUS CHANNEL

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Abstract
This research examines the effects of g-jitter, characterized as an oscillating gravitational force, on time- periodic temperature boundary conditions in unsteady Magnetohydrodynamic (MHD) Couette flow within a vertical porous channel. The fluid is assumed to be non-Newtonian, with exponentially varying velocity boundary conditions. The governing momentum and energy equations are formulated as partial differential equations, which are appropriately non-dimensionalized and solved using a two-step approach involving Laplace transformation and Riemann-sum approximation for Laplace inversion. The study derives temperature distributions, velocity profiles in the Laplace domain, and quantities of engineering interest such as the Nusselt number and skin friction at both channel walls. Analytical steady-state solutions for temperature distribution, velocity profile, Nusselt numbers and skin frictions are also obtained to validate the method employed. Computational results, presented through graphs and tables, reveal that shear effects significantly amplify velocity near boundaries under oscillatory forcing. Additionally, suction (S) and porosity (Darcy number, Da) stabilize the boundary layer by suppressing velocity peaks and reducing flow resistance. Further findings are detailed in the conclusion section.
Keywords: Boundary Layer Analysis, g-jitter, Time-periodic, MHD, Couette flow, Darcy Number, Nusselt Number, Skin Frictions, Vertical channel

MATP 009

DOWNSTREAM FLOW ENERGY OF NON-NEWTONIAN FLUID IN A SYMMETRICAL BRANCHED CHANNEL

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Abstract
The study of the downstream flow energy of unrefined hydrocarbon in a symmetrically branched channel was conducted using both experimental and analytic techniques. Realistic data representing the behavior of this fluid sample is obtained using the experimental technique, while the energy model for the downstream system considered in this study was analytically developed. In the experimental method, the fluid sample was allowed to flow from the reservoir that was kept at a height through a symmetrically branched channel that is kept at an incline position from the recovery ends to the bottom of the reservoir, where it is connected. As the fluid sample flows downward from the reservoir through symmetrically branched angles of 10^o, 20^o, 30^o, 40^o, 50^o and 60^o into the recovery ends, the time intervals it takes to recover 100ml, 200ml, 300ml, 400ml, and 500ml are recorded and further used to compute the velocity head of the flow through the various branched angles. Trends for the flow energy for these fluid samples for each of the branched angles through all recovery volumes show a linear relationship. And results further reveal that, in a continuous flow situation, the energy of the flow head tends to be more stable.
Keywords: Unrefined Hydrocarbon, Downstream flow, Symmetrical bifurcation, Total flow energy

MATP 010

EFFECT OF SILAR CYCLE ON THE CHEMICALLY DEPOSITED LEAD SULPHIDE (PbS) THIN FILM

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Abstract
Successive Ionic Layer Adsorption and Reaction (SILAR) method is relatively simple, quick and economical and more suitable for large area deposition of any configuration. Lead Sulphide (PbS) thin films were deposited on Soda Lime Glass (SLG) substrate with a variation in the molar concentrations of lead (Pb) ions (0.3, 0.5 and 0.7) M as well as Indium-doped Tin Oxide (ITO) substrate with a variation of SILAR cycles (15, 25 and 35 cycles). The sources of Pb2+ and S2- were lead nitrate and thiourea respectively while NaOH was used as a complexing agent. The XRD patterns of the PbS thin film was observed to be crystalline in nature and has a cubic structure. The SEM micrographs of PbS thin films revealed that the particles forming the films are in nano scale and are densely packed, uniform and homogeneous. Also, increase in number of SILAR cycle brought about increase in the absorbance of the films whereas increase in the number of SILAR cycle on SLG and ITO substrates brought about decrease in the energy band gap. Increase in concentration and number of SILAR cycle decrease the transmittance of PbS thin films.

MATP 011

ENHANCING THE SAFETY AND RELIABILITY OF REPURPOSED LITHIUM-ION BATTERIES FOR ECONOMIC DEVELOPMENT IN NIGERIA

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Abstract
Lithium-ion (Li-ion) batteries, widely used in high-demand applications such as electric vehicles, are often retired with 70-80% State of Health (SOH). These partially degraded batteries hold significant potential for second-life applications, offering a cost-effective and sustainable energy storage solution. However, the performance, safety, and reliability of repurposed batteries remain underexplored. This research investigates the theoretical and practical aspects of characterizing and optimizing repurposed Li-ion batteries to enhance their economic viability and operational safety. The study employs advanced electrical measurement techniques to evaluate the performance of batteries after first-life use and develops predictive models for monitoring their health and safety during second-life applications. Additionally, optimization methods are proposed to extend the lifetime of repurposed batteries, ensuring their reliability in diverse applications. By addressing the challenges of battery reuse, this research contributes to sustainable energy practices and highlights the economic potential of second-life batteries in supporting the energy transition.
Keywords: Li-ion batteries, second-life applications, State of Health, performance monitoring, optimization, safety, economic development

MATP 012

EVALUATION OF MAGNETOHYDRODYNAMICS WATER BASE AND ETHYLENE GLYCOL BASE TIN OXIDE NANOFLUID FLOW PAST A SPHERICAL ENCLOSURE

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Abstract
Analytical approach was used for the evaluation of water base (SnO2/H2O) and ethylene glycol base Tin oxide (SnO2/H2O) nanofluid (NF) in magnetohydrodynamic spherical enclosure that was carried out using the Continuity equation, momentum equation, energy equation and concentration equation in spherical coordinates. This set of equations which

become our governing equation is transformed into nanofluid equation and nondimensionlized for homogeneity and solved using the Laplace Transform for velocity, temperature and concentration. Result shows that as SnO2 nanoparticle volume fraction increases the mass concentration of SnO2/H2O NF increases and SnO2/C2H6O2 NF increases. The temperature profile of SnO2/H2O NF is enhanced, while the temperature profile of SnO2/C2H6O2 NF is also enhanced. Also, as the nanoparticle volume fraction increase the velocity profile of SnO2/H2O NF and SnO2/C2H6O2 are enhanced.
Findings also reveal that as Hartmann number increases by 100% from 10, the velocity profile of the SnO2/H2O NF and SnO2/C2H6O2 NF drops. Important findings reveal that as SnO2 nanoparticle increase, Brownian motion causes enhancement in the temperature profile of SnO2/H2O NF and SnO2/C2H6O2 NF. While Brownian motion elevates the velocity profile of SnO2/H2O NF as Hartmann number increase.
Keywords: MHD, Nanofluid, Tin Oxide, water ethylene glycol, Lorentz force

MATP 013

EXTENNDED STUDY ON NEWTON'S DYNAMICAL THEORY OF GRAVITATION TO EXPLAIN THE PRECESSION AND DEFLECTION OF LIGHT

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Abstract
The well - known Einstein's geometrical theory of gravitation (EGTG) came to limelight because of the inability of Newton's dynamical theory of gravitation (NDTG) to explain the anomalous orbital precession of the orbit of the planet as well as the gravitational shift by the sun. In this study the great Riemannian metric tensor was used to extend Newton's dynamical theory of gravitation (NDTG) to derive an extended precession and deflection equation of light in the gravitational field of spherical mass. Results reduces to the corresponding pure Einstein's equations in the order of and to the order of it contains additional correctional terms which are not found in Einstein's equations. These results point to the fact that Newton's dynamical theory of gravitation (NDTG) can be used to explain the precession and deflection of light with post - Einstein correction terms which are open up for theoretical development and experimental investigations and possible applications.

MATP 014

FIXED POINT RESULTS FOR RELATION-THEORETICAL ALMOST - CONTRACTIONS WITH APPLICATION

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Abstract
Metric fixed-point theory has been a key area of research in mathematics for over a century, and has had a profound impact on the development of functional analysis and other areas of mathematics. In this article, we extend the classic Banach contraction principle to a complete metric space endowed with a binary relation. We accomplish this by generalizing several key notions from metric space equipped with an amorphous relation to prove results on the existence and uniqueness of fixed points for almost -contraction mapping to the relation-theoretic setting. We also apply our results to determine a unique solution of a boundary value problem associated with nonlinear elastic beam equations. We demonstrate the practical relevance of our suggested theoretical results with examples. Future work could also explore the extension of this results to F- metric space.

MATP 015

GSM SIGNAL STREGTH MEASUREMENT IN KWALE DELTA STATE NIGERIA

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Abstract
This research work was carried out by investigating signal strength along the travelling path of two GSM network service provider in Kwale, Delta State using a network monitor. The distance of the network service provides Base Station (BS) to the mobile station (MS) and the difference in signal level were investigated. The effect of the properties of signal strength in relation to that of the environment were observed. To study this effect, measurement of signal power was taken by moving away from the Base Station with the use of standary parameters and the computed values of the free-space and obtained; value of the signal power received and pathloss is less than the value obtain from measurement.

MATP 016

INFORMATION-THEORETIC ANALYSIS OF QUANTUM SYSTEMS USING THE VARSHNI-HELLMANN POTENTIAL

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Abstract
This work explores Shannon entropy and Fisher information for the Varshni-Hellmann potential (VHP) in one and three dimensions using the Nikiforov-Uvarov method and the Greene-Aldrich approximation scheme. The derived energy eigenvalues and wavefunctions reveal similar high-order features in position and momentum spaces. Enhanced accuracy in predicting particle localization is observed, with combined entropies satisfying the Berkner-Bialynicki-Birula-Mycieslki bounds. In three dimensions, the Stam-Cramer- Rao inequalities are fulfilled across eigenstates. A decrease in position Fisher entropy, indicating higher position precision, leads to increased momentum entropy and reduced precision. This interplay highlights the constraints of the uncertainty principle on the simultaneous measurement of conjugate variables in quantum mechanics.
Keywords: Schrödinger equation, Stam-Cramer-Rao inequality, Nikiforov-Uvarov method; Shannon entropy; Fisher information.

MATP 017

NON-RELATIVISTIC ENERGY SPECTRUM IN D-DIMENSIONS OF SELECTED DIATOMIC MOLECULES WITH A MODIFIED KRATZER PLUS GENERALIZED INVERSE QUADRATIC YUKAWA POTENTIAL MODEL

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Abstract
In this research, we have obtained the energy eigenvalues and the corresponding normalized eigen function for the linear combination of the modified Kratzer and generalized inverse quadratic Yukawa potential via two different approaches: the exact quantization rule approach and formula method respectively. Also, the thermodynamic properties such as ro-vibrational mean energy, ro-vibrational free energy, ro-vibrational entropy and the ro-vibrational specific heat capacity were calculated. Numerical results were generated for some selected diatomic molecules which agreed with other works and also plots where carried out to ascertain the nature of the energy spectrum of our potential on the state n,l and potential parameters.
Keywords: ModifiedKratzer potential, generalized inverse quadratic Yukawa potential, Schrödinger equation, Exact quantization rule, Greene and Aldrich approximation.

MATP 018

NUMERICAL SOLUTION OF HEAT FORM OF BLACK-SCHOLES EQUATION USING FINITE DIFFERENCE METHOD

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Abstract
This study examines and compares the numerical solution of the Black-Scholes equation, a financial model transformed into a heat equation, with its analytical counterpart derived from the Black-Scholes formula for European call option. A finite difference method is employed for numerical computations, and results are presented in tabular and graphical formats. The findings demonstrate a strong agreement between the numerical and analytical solutions, supporting the finite difference approach for option pricing
Keywords: Black-Scholes, Finite-Difference, European-Options, Heat-Equation

MATP 019

NUMERICAL TREATMENT OF MAGNETOHYDRODYNAMIC STEADY-STATE COUETTE FLOW IN A VERTICAL CHANNEL: A GEOFLUID DYNAMIC APPLICATION

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Abstract
In this study, the numerical treatment of Magnetohydrodynamic (MHD) steady-state Couette flow in a vertical channel is investigated. The momentum and energy equations are non-dimensionalized and solved for velocity and temperature using the shooting method in MATLAB and the method of undetermined coefficient. Skin friction and heat transfer rates (Nusselt number) are then obtained. Graphs and tables of numerical results were obtained to explore the effects of parameter variations on fluid flow characteristics. The findings reveal that an increase in the Hartmann number (M) results in reduced fluid velocity, indicating the damping effect of the Lorentz force. Conversely, higher values of the Darcy number (Da) enhance fluid flow due to decreased resistance in the porous medium. Similarly, increasing the Grashof number (Gr), representing buoyancy effects boosts velocity across the channel. Enhanced suction (S) also decreases the velocity at lower layers while maintaining boundary adherence. The computed velocity profiles for different parameter values (M, Da, Gr, S) show consistent behaviour, increasing velocity from zero at $\eta = 0$ to one at $\eta = 1$. The study explores MHD flow interactions involving magnetic fields, buoyancy, and porous media, with geofluid and industrial implications. Skin friction and Nusselt number findings are in the conclusion.
Keywords: MHD, Couette flow, Vertical channel, Shooting Method, Steady-state, Nusselt number

MATP 020

QUANTUM FRICTION IN A DISSIPATION MEDIUM: A HARMONIC APPROXIMATION APPROACH

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Abstract
Modeling quantum friction in realistic (three-dimensional) dissipation media remains challenging due to the complexity of the interactions and the non-equilibrium nature of the problem. Here we developed a theoretical model of quantum friction in a dissipation medium using the harmonic approximation. This approach simplifies the problem by treating the environment as a collection of harmonic oscillators from which we were able to calculate the

time dependent probability distribution of the intrinsic excitation energy and obtain time dependent effective mass and friction coefficient. These results are comparable to the earlier ones obtained for one dimensional models of coupled oscillators.
Keywords: friction, harmonic, non-equilibrium, dissipation.

MATP 021

QUANTUM MECHANICAL STUDY OF THE MAGNETOCALORIC EFFECT, ENERGY SPECTRA AND THERMOMAGNETIC PROPERTIES OF SELECTED DIATOMIC MOLECULES UNDER THE INFLUENCE OF MAGNETIC AND AHARANOV-BOHM (AB) FLUX FIELDS WITH SCHIOBERG-HULTHEN POTENTIAL MODEL USING NIKIFOROV-UVAROV-FUNCTIONAL-ANALYSIS (NUFA) METHOD

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Abstract
Quantum mechanical description of the magnetocaloric effect (MCE), thermomagnetic properties and energy spectra of five diatomic molecules, namely: lithium hydride (LiH), scandium hydride (ScH), titanium hydride (TiH), vanadium hydride (VH) and, chromium hydride (CrH) was done by obtaining the analytical solutions of the radial Schrodinger wave equation (SWE) with the Schioberg-Hulthen potential model in the presence of magnetic and Aharanov-Bohm flux fields using NUFA method [1]. The aim of combining these potentials is to broaden their application and also to ensure that theoretical results agree with experiment – these are unlikely with single potential. The Greene-Aldrich approximation scheme was used to overcome the centrifugal term [2]. The energy eigenvalue equation and the corresponding eigenfunction for each of the proposed potentials was obtained in closed and compact form. The energy equation was used to estimate the eigenvalues of the selected diatomic molecules for various states with the aid of some spectroscopic parameters [3]. The results revealed that although the AB field performs better than the magnetic field in its ability to remove degeneracy, the combined impacts of the magnetic and AB flux fields completely eliminates the degeneracy of the energy spectra and controls the magnetocaloric effects. Also, the proposed potentials reduced to various exceptional cases, and thermomagnetic plots obtained for the analysed diatomic molecules agreed perfectly with previous works. This study has the potential to be applied in molecular physics and MCE studies for a variety of molecules

MATP 022

TEMPORAL DYNAMICS OF THE LYAPUNOV EXPONENT OF THE SIGNATURE OF CHAOS IN SOLAR RADIATION IN MAKURDI NIGERIA

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Abstract
This research analyzes Makurdi weather variable of solar radiation, by exposing the chaos present in it which is an evidence of climate change. The method of nonlinear dynamics is employed to reveal how climate change has been threatening the existence of man and animals. The uncontrollable activities of man such as over dependence on standby generators, burning of bushes and woods, carbon released from the exhaust of motorist and many more are responsible for the emission of Greenhouse gases into the atmosphere causing the solar radiation to be constantly increasing. This claim is achieved by computing the Average Largest Lyapunov Exponent (LLE) to ascertain the level of chaos (system that is sensitively dependence on initial condition) present in the solar radiation. Thirty-five years daily data of solar radiation has it that the result of the LLE is 0.006/Day and is positive, which indicate the presence of chaos in the variable. The weather trends was also computed using Mann-Kandell and Sen's Slope Estimator to further prove the claims. The result shows no progression as the

decrease is not significant. So, it is paramount to say that the issues of global warming is sure and need not be taken lightly.

Keywords: Solar Radiation, Largest Lyapunov Exponent, chaos, climate change

MATP 023

UNRAVELING THE INFLUENCE OF OXYGEN VACANCY WITH AND WITHOUT REPLACEMENT ON Cu2O: A DFT STUDY

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Abstract

This study delves into the structural and electronic effects of oxygen vacancies in Cu2O using density functional theory (DFT) enhanced with Hubbard U corrections (DFT+U). A 3x2x1 supercell of Cu2O was employed. The study meticulously investigates the removal of 1, 2, and 3 oxygen atoms, analyzing the ensuing changes in both structural stability and electronic properties, with particular emphasis on the band gap. The structural analysis revealed that oxygen vacancy formation induces significant modifications in Cu- O and Cu-Cu bond lengths, with elongations observed around the vacancy sites in which the Cu-Cu bond length decreased to 2.4035 Å, compared to 3.0066 Å in the pristine structure. The structural distortion followed the Jahn-Teller effect, leading to the formation of isolated units and transformation in bond angles. The introduction of oxygen vacancies without replacement (WOR) caused significant distortions in the Cu2O lattice, which were more pronounced with increasing vacancy concentration. The Cu-O bond length increased from 1.8492 Å in the pristine structure to 1.9840 Å in the single vacancy configuration. However, in the oxygen vacancies with replacement (WR) the Cu-Cu bond length increased slightly to 3.0218 Å, with the Cu-O bond length expanding to 1.8505 Å. The band structure analysis indicated a decrease in the band gap with increasing vacancy concentration. The pristine Cu2O exhibited a band gap of 1.67 eV as calculated, which was increased to 1.97 eV with a single vacancy and 1.16 eV with two vacancies, reflecting the significant impact of oxygen vacancies on the material's optoelectronic properties. The findings underscore the critical role of oxygen vacancies in modulating the structural and electronic properties of Cu2O, providing insights that are pivotal for optimizing its performance in applications like photocatalysis and solar cells.

Keywords: Cu2O, DFT+U, Hubbard Value, Oxygen Vacancies, Jahn Teller effect.

MATP 024

AZIMUTHAL QUANTUM NUMBER ZERO COMPARISON OF FIRST OPTICAL TRANSITION PROBABILITY FOR NINE SPHERICAL QUANTUM DOTS

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Abstract

Azimuthal quantum number zero AQNZ states of spherical quantum Dot QD system is derived. An expression for the maximum possible s-states is given and it is dependent on the radius of the QD. In this work a model for comparing the first Optical transition probabilities of nine AQNZ spherical QD's made from nine ternary semiconductor alloy, based on the Hydrogenic atom model and the Fermi's golden rule for optical transition between levels is developed. The highest transition probability obtained is for indium Antimonide InSb Dot, while the lowest obtained is for Zinc SelenideZnSe. The result gives a clue of the fact that for the first time using short length of InSb nanowire Scientist in Leo Kouwenhoven's research group were able to generate a pair ofMajorana fermions to appear at either end of the InSb nanowire. Also, InSb QD will more than the other eightalloy best function in the visible light region nanosensor used in medical diagnostics for monitoring Biophotons.

Keywords: Azimuthal, Spherical, Biophotons, semiconductor

MATP 025

DETERMINATION OF STRUCTURAL ELECTRONIC AND THERMOELECTRIC PROPERTIES OF TIRHSN HALF-HEUSLER COMPOUND BY FIRST-PRINCIPLE CALCULATION.

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Abstract
In this study, structural, electronic and thermoelectric properties of a novel TiRhSn half-Heusler compound were evaluated. Employing Perdew-Burke-Errnzerhof for solids (PBEsol) by means of Density Functional Theory (DFT), with the foundation of Generalized Gradient Approximation (GGA), lattice constant 6.1094Å, volume 384. 2894 a.u3 and an indirect semiconductor type with band energy gap of 0.6eV were calculated for both structure and electronic attributes. Semi-classical Boltzmann Transport equation was also applied to analyze thermoelectric essential qualities of an extrinsic semiconductor, TiRhSn half-Heusler compound. The results showed that a n-type calculations at a temperature 800K for Seebeck coefficient, electronic fitness function, power factor and figure of merit are more pronounced while the electrical conductivity computation at a temperature 300K for a p-type semiconductor TiRhSn half-Heusler compound was prominent. The estimated outcomes expose this material to be an up- and-coming material for thermoelectric usage.

MATP 026

GEOSPATIAL ANALYSIS OF MALNUTRITION AND DIARRHEA AMONG CHILDREN UNDER FIVE IN NIGERIA: LEVERAGING SHARED COMPONENT MODEL.

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Abstract
Malnutrition and diarrhea are among the leading health issues among children under five in Nigeria contributing to high morbidity and mortality rates. This study applies a shared component model (SCM) to investigate the co-occurrence of these health conditions with a view to identifying underlying socio- economic, demographic and health care related factors. Utilizing a geospatial data from the 2018 Nigeria demographic and health survey, we explore spatial pattern of malnutrition and diarrhea, highlighting shared determinants that contribute to their prevalence. The shared component modelling approach allows for a more integrated understanding of these conditions, revealing insights for more effective, targeted intervention. The identified significant factors associated with comorbidity of both childhood conditions are maternal educational status, family wealth index, area of residence and age of the child. Based on the posterior map, many states in the northern part of Nigeria are at high risk of disease comorbidity. The generated map serve as crucial tools to guide public health policies and resource allocation to address these dual health challenges in hotspots regions of Nigeria.
Keywords: malnutrition, diarrhea, co-occurrence, spatial pattern, morbidity, share component model.

MATP 027

SECONDARY PARTICLE GENERATION AND MEAN FREE PATH ANALYSIS IN NEUTRON-SODIUM INTERACTIONS USING GEANT4

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Abstract
This study investigates the secondary particles produced and the mean free path behaviour during neutron- induced reactions with sodium-23 using the GEANT4 Monte Carlo simulation toolkit. Neutron interactions were simulated within an energy range of 0 to 20

MeV using high-precision physics lists. The simulation results reveal significant secondary particle production, including gamma rays, protons, tritons, and various isotopes such as Na-22, Ne-21, and F-19. The dominant presence of sodium-23 in the residuals suggests elastic and inelastic scattering as primary mechanisms. Mean free path values were calculated across the energy spectrum and showed an increasing trend with energy, providing critical insight into sodium's effectiveness as a neutron moderator and shielding material. This work reinforces the versatility of GEANT4 in nuclear material evaluation and contributes to enhanced design in radiation shielding and reactor systems.

Keywords: GEANT4, Mean free path, Neutron interactions, Radiation shielding

MATP 028

SMALL MODULAR REACTORS: A REVIEW OF EMERGING DESIGNS, CHALLENGES AND POTENTIALS

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Abstract

A small reactor can be defined in terms of power or size. The International Atomic Agency Energy (IAEA) defines a small nuclear reactor as one with power up to 300 MW-electric (MWe). It has a number of potential advantages over the large-scale power reactors currently in use. The paper reviews the unique features of emerging SMR designs such as light water reactors, liquid metal-cooled reactors, molten salt reactors and high-temperature gas-cooled reactorsand compares them to those of the early era of nuclear power, highlighting their current status, technological variations, safety considerations, economic prospects and environmental impact. Furthermore, the paper assesses the potential role of small modular reactors in addressing global energy demands, the climate change challenge and grid stability. Finally, the paper aims to offer a balanced overview of the opportunities and challenges associated with small modular reactor deployment, emphasizing ongoing research and development efforts that are likely to influence the future of nuclear energy.

Keywords: Nuclear power, small modular reactors, light water reactors, molten salt reactors, high- temperature gas-cooled reactors

MATP 029

SMALL MODULAR REACTORS: POSSIBILITIES, CHALLENGES AND POTENTIALS FOR MITIGATING NIGERIA'S ENERGY POVERTY

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Abstract

Nigeria suffers from a strange and ironic malady – she is oil rich, but electricity poor. This energy poverty has significant consequences for her socio-economic development, healthcare, education and the overall quality of life of her citizens. Small modular reactors (SMRs) present a promising solution to mitigate this energy deficit. This paper explores the possibilities, challenges and potentials of small modular reactors in alleviating Nigeria's energy poverty. The paper discusses the current energy landscape in Nigeria, the benefits and challenges of small modular reactors and proposes a framework for the safe, secure and beneficial deployment of small modular reactors in Nigeria which include, among others, energy demand forecasting, articulation of policy and regulatory framework that are consistent with international best practices. The paper also recommends an implementation roadmap.

Keywords: Small modular reactors, energy poverty, energy security, regulatory framework, environmental sustainability

MATP 030

APPLICATION OF TETRAD FIXED POINT THEOREM TO NONLINEAR MATRIX EQUATION FOR BINARY RELATION IN METRIC SPACES

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Abstract
This study explores the application of the tetrad fixed point theorem to nonlinear matrix equations within the framework of metric spaces endowed with a reflexive binary relation. By extending the concept of fixed points to tetrads, this work establishes a novel approach to solving nonlinear matrix equations. The contractive condition for mixed monotone mappings is analysed under the assumptions of relative comparability in the binary relation, ensuring a robust theoretical foundation. This approach demonstrates the existence and uniqueness of positive definite solutions to nonlinear matrix equations, showcasing the efficacy of the tetrad fixed point theorem in addressing problems involving binary relations in metric spaces.

MATP 031

NUMERICAL INVESTIGATION OF HEAT TRANSFER IN CORIUM-BASED SYSTEMS USING COMPUTATIONAL FLUID DYNAMICS(CFD), A CASE STUDY OF SODIUM -COOLED FAST REACTORS (SFR).

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Abstract
A thorough numerical analysis of heat transfer in corium-based systems was presented in this work, with emphasis on sodium-cooled fast reactors (SFRs). We simulated heat transfer in SFRs by utilizing the capabilities of Computational Fluid Dynamics (CFD), which allowed us to capture the complex relationships between coolant flow, temperature, and geometry. Our findings show that optimal designs have the ability to reduce coolant pressure drop by 15% and enhance heat transmission by up to 25%. This research contributed to the development of advanced SFR designs by stating the critical role that CFD plays in optimizing heat transfer in corium-based systems. We carried out a parametric analysis, examining the effects of varying temperatures (500-800 K), flow rates (10-50 m/s), and geometrical configurations (e.g., fuel pin spacing, wrapper tube thickness). Our CFD model achieved a mean absolute error of 10.2% in predicting heat transfer coefficients compared to experimental data.
Keywords: Computational Fluid Dynamics (CFD), Heat Transfer Optimization, Sodium-Cooled Fast Reactors (SFRs)

MATP 032

THE COMPLEXITY MEASUREMENT AND UNCERTAINTY RELATIONS FOR THE HELLMANN-GENERALIZED MORSE POTENTIAL MODEL

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Abstract
Measuring particles at the atomic domain has been made possible with quantum mechanical principle. Heisenberg provided the basis and mathematical formulations that come with the measured quantities. Within the framework of the Hellmann Feynman theorem, the complexity and uncertainty relations for the Hellmann-Generalized Morse potential model have been studied. The precise measurement of the momentum and positions of some diatomic particles have also been determined theoretically; and the result obtained for the sum of the uncertainties in position and momentum is greater than or equal to 0.5 . This agrees with the Heisenberg's uncertainty relations.

MATP 033

STEADY MAGNETOHYDRODYNAMIC (MHD) ELECTROOSMOTIC FLOW OF THIRD GRADE FLUIDS IN A VERTICAL CHANNEL WITH ASYMMETRIC ZETA POTENTIALS

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Abstract
This paper deals with the problem of electromagnetohydrodynamic (EMHD) flow of third grade fluid through a parallel plate channel. An Analytical solution for the governing models which consists of momentum and energy equations was obtained using homotopy perturbation technique. Graphical results for the velocity and temperature distribution are presented and discussed. Analysis of the physical parameters involved in the model(s) problem was conducted. Results show that velocity increases at lower level and decreases at upper level with increase in the parameter K, the temperature increases at lower level and decreases at upper level with an increase in the parameter Ha.
Keywords: Electromagnetohydrodynamic, Micro-pump of third grade fluid, Porous microchannel, thermo- fluidic transport

MATP 034

A NEW HEAVY TAILED COSINE WEIBULL DISTRIBUTION: PROPERTIES, APPLICATIONS AND REGRESSION

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Abstract
The pursuit of creating distributions with more desirable and flexible properties for data modeling has prompted researchers to concentrate on developing new families that expand upon existing distributions. This paper presents a new three-parameter lifetime model known as the New Heavy Tailed Cosine Weibull (NHTCW) distribution. This distribution extends the Cosine Weibull distribution through the heavy tailed distribution framework. We derive several structural properties of the NHTCW distribution, including ordinary and incomplete moments, quantile and generating functions, and order statistics. We also discuss parameter estimation using the maximum likelihood method and provide simulation results to evaluate the distribution's effectiveness. Additionally, we introduce a regression model based on the new distribution for the first time. Finally, three applications are analyzed to demonstrate the superiority of the NHTCW distribution over the other probability models considered in this study. The first two applications examine the mortality rates of COVID-19 patients in Italy and Canada, respectively, while the third dataset focuses on injury rates.

MATP 035

APPLICATION OF NEW MASS – ENERGY CONCEPT IN THE WEIZSACKER'S MASS EMPIRICAL FORMULA FOR CALCULATION OF NUCLIE MASSES

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Abstract
In this study, the binding energy fitting coefficients were obtained from krane in mega electron volt (MeV) and calculated in unified atomic mass unit (u) using relativistic mass – energy relation mc2 and non relativistic mass – energy theory (mbc). The nuclei masses ranges from light, medium and heavy were calculated by employing relativistic mass – energy relation (mc2) and non relativistic mass – energy theory (mbc) along with the corresponding binding energy fitting coefficients, each into the beth - weizsacker's mass formula using computer program. The results from extrapolation of the calculated and experimental masses as a function of atomic number, shows close correlation between the calculated mass using

mc2 relation and the experimental mass. It was also observed that, the calculated mass using mbc theory, under estimate the above correlated masses due to the mass – energy conversion factor (b) which was found to be less than the speed of light (c), since the increase in mass produced greater change in energy and this is depicted in Einstein mass- energy relation E = mc2, on this ground, the non-relativistic mass-energy equivalence will help in the calculation of the minimal energy release in nuclear reactions and in charged particles stopping powers.

MATP 036

CORRELATION OF SPIN PARAMETERS WITH THE MASSES AND AGES OF SOME BARRED SPIRAL GALAXIES

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Abstract

Galaxy is a dynamically bound system that consists of many stars. Galaxies are classified depending on their morphology: elliptic, lenticular, spiral or irregular. Bars are a form of dynamical instability in differentially rotating stellar disks. They can funnel gas to the center of the galaxy. This work aimed at analyzing the spin parameters of some barred spiral galaxies and to use the calculated spin parameter to predict the ages, total mass and gas mass of some of the galaxies. The spin parameter happen to be the cardinal tangible parameter in verifying the morphological and visual feature of a spiral galaxy.λ=21/2V2RD/GMH was used to calculate the spin parameter, Bravais Pearson correlation for the correlation and prediction was done using MATLab. Calculation of spin parameters of 10 spiral barred galaxies was done. The spin parameter for the Milky Way galaxy was gotten as 0.0253, Andromeda, 0.0491 and NGC 4258 as 0.8051. The correlation between the spin and ages of the galaxies was found to be high but that of the total mass and mass of gas was low. Using polynomial from MATlab, predictions of the ages of some of the galaxies, total masses and masses of gas were made.

MATP 037

DIFFERENTIAL EQUATIONS FOR CAPTURING THE DYNAMICS OF ENERGY STORAGE PROCESSES AND SYSTEMS: A PRACTICAL GUIDE FOR RENEWABLE ENERGY

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Abstract

Energy storage systems are critical for renewable energy applications, addressing the challenges of intermittency and ensuring stable energy supply. Capturing the dynamics of these systems requires the use of differential equations to model key processes such as charging, discharging, thermal effects, and efficiency losses. This paper presents a practical guide to formulating and solving differential equations for energy storage systems, including batteries, supercapacitors, and thermal storage. It also discusses numerical methods and implementation techniques, providing a foundation for optimizing energy storage in renewable energy systems.

Keywords: Differential Equation Renewable Energy Optimization Battery During the 46th Annual National Conference of NIP, May 12- May 16, 2025 @ RSU

MATP 038

INVESTIGATION OF THE THERMAL PROPERTIES OF THE INVERSE SQUARE ROOT POTENTIAL USING THE EXTENDED NIKIFOROV-UVAROV (ENU) TECHNIQUE

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Abstract
In this study, we use the concept of the extended Nikiforov-Uvarov technique to investigate the exact bound state eigenenergy spectra and their corresponding normalized eigenfunctions of the inverse square root potential. The eigenenergy equation so obtained was then used to derive the partition function of a typical statistical system, and from it we were able to determine some thermodynamical parameters of the system, namely: the internal energy, Helmholtz free energy, entropy and the heat capacity. The graphical visualizations of these parameters were generated using algorithms implemented in Python language. Our results are in excellent agreement with those found in existing literature and find applications in diverse areas of research such as atomic and molecular physics, chemical physics, nuclear physics and solid-state physics amongst others.

Keywords: Eigenvalues, Eigenvectors, Inverse square root potential, extended Nikiforov-Uvarov, Hellmann-Feynman theorem, confluent Heun's equation. Partition function, internal energy, Helmholtz free energy, entropy and heat capacity.

MATP 039

MATHEMATICAL ANALYSIS OF A FRACTIONAL-ORDER MATHEMATICAL MODEL FOR HIV/AIDS TRANSMISSION DYNAMICS

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Abstract
HIV/AIDS remains one of the most significant global public health challenges, affecting millions of individuals and communities worldwide. The disease, caused by the Human Immunodeficiency Virus (HIV), weakens the immune system, leading to acquired immunodeficiency syndrome (AIDS), a severe and life- threatening condition. Vulnerable populations, particularly those with limited healthcare access, are disproportionately affected. This study presents a comprehensive mathematical model to analyze the transmission dynamics of HIV/AIDS, incorporating multiple compartments to represent various stages of disease progression and treatment intervention. The model employs nonlinear differential equations and integrates the Adams-Bashforth method with fractional-order derivatives to capture memory effects and nuanced transmission behaviors. Sensitivity analysis highlights the critical role of antiretroviral therapy (ART) in reducing viral load, increasing recovery rates, and mitigating disease spread. The study also considers the impact of public health measures, such as reducing diagnostic delays, improving treatment access, and promoting safe practices, on HIV/AIDS control. Simulation results demonstrate that a multifaceted approach—combining ART, education, and public awareness—can effectively curb transmission and improve health outcomes.

MATP 040

OPTIMIZED SYNTHESIS OF GOLD NANOPARTICLES USING PALM OIL LEAVE EXTRACT (POLE): MODELING AND STATISTICAL ANALYSIS OF KEY VARIABLES

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Abstract
This study focuses on the optimization of gold nanoparticle (AuNP) synthesis using palm oil leave extract (POLE) as a stabilizing agent. A response surface methodology (RSM) with central composite design (CCD) was employed to systematically investigate the effects of key synthesis parameters—concentration of HAuCl4.3H2O, concentration of POLE, sonication amplitude, and sonication time—on the hydrodynamical size, zeta potential, and polydispersity index (PDI) of the synthesized AuNPs. Quadratic, linear, and two- factor interaction (2FI) models were selected for hydrodynamical size, zeta potential, and PDI, respectively, based on statistical parameters including R-squared, adjusted R-squared, predicted R-squared, and significance of model terms. Analysis of variance (ANOVA) revealed significant effects of HAuCl4.3H2O concentration, POLE concentration, and sonication time on all three responses, while sonication amplitude showed limited significance. Interaction effects between variables were examined using contour plots and 3D response surface graphs, highlighting synergistic and antagonistic relationships. Regression models were developed to predict response values, demonstrating strong predictive capability with adequate precision ratios of 11.54, 22.36, and 15.60 for hydrodynamical size, zeta potential, and PDI, respectively. The hydrodynamical size was most influenced by the interplay of HAuCl4.3H2O and POLE concentrations, with weak interactions observed for sonication amplitude and time. Zeta potential and PDI models showed high statistical significance ($p < 0.01$), validating the robustness of the optimization approach. This work demonstrates the feasibility of employing POLE as an effective, sustainable stabilizing agent for AuNP synthesis and highlights the importance of statistical modeling in fine-tuning synthesis parameters for desired nanoparticle characteristics. The findings pave the way for eco-friendly and scalable nanoparticle production methods in biomedical and industrial applications.

MATP 041

THE VARIABILITY OF SOME LOW-TEMPERATURE PROPERTIES OF METALS

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Abstract
The density function, chemical potential and Fermi energy of metals and their variations with temperature were computed and studied. The results obtained revealed that the density function of metal increases with increase in temperature. The chemical potential decreases with an increase in temperature and remains the same for metals in the same group at the temperature below. The Fermi energy decreases with an increase in temperature and remains the same at a temperature of. The result revealed that the density function, chemical potential and Fermi energy of the metals depends linearly on the electron gas parameters and electronic concentration of the metals. The results obtained is an important tool for describing the various quantum mechanical interference phenomena. Experiments should be designed to determine the chemical potential of metals and compared with the ones obtained in this work.
Keywords: Electron gas, Density Functions, Chemical Potential, Fermi energy.