SEGH Society for Environmental Geochemistry and Health

SEGH 2024

39TH INTERNATIONAL CONFERENCE ON
ENVIRONMENTAL GEOCHEMISTRY AND HEALTH

Mon. 1st - Thur. 4th July, 2024

ABUJA, NIGERIA

Co-Organisers

NIGERIAN MINING AND GEOSCIENCES SOCIETY

IMGA — INTERNATIONAL MEDICAL GEOLOGISTS ASSOCIATION

Supported by

IUGS — International Union of Geological Sciences

Welcome to 'Abuja 2024'

The entire Geological and Geochemical Communities in Nigeria welcome the members of SEGH and the global environmental geochemist's community to the city of Abuja this month of July 2024 for the 39th International Conference on Environmental Geochemistry and Health.

The conference is coming to Nigeria, one of the leading African countries with the large number of practicing Geoscientists, Environmental Scientists and Researcher for the first time. The conference is returning to Africa after the successful organisation at Victoria Fall, Zambia and Eldoret, Kenya.

The conference is being co-organised the Nigerian Mining and Geosciences Society (NMGS), the umbrella Society for geoscience and mining engineering profession in Nigeria, and the Nigerian Chapter of the International Medical Geology Association (IMGA-Nigeria) with generous financial support from the International Union of Geological Sciences (IUGS), Aret Adams Professorial Chair in Geology at the Geology Department, University of Ibadan, the Mining Cadastre office, the Senior Advisor on Geology, African Mineral Development Centre (AMDC) in his personal capacity.

The hosting of the SEGH conference affords the global Geoscientific and Environmental Scientists opportunity to interact and network with a variety of international scholars attending the conference. Abuja, the Federal Capital territory, being the host city of the conference, is the most ideal setting for the 39th International Conference on Environmental geochemistry and health as it showcases the best of what Nigeria can offer.

You are all welcome to Abuja.

Prof. Akinade Olatunji, FNMGS

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'ABUJA 2024' Conference Programme

Opening Ceremony

7:00-8:30	Arrival of participants and Continuation of Registration
8:30-8:50	Participants are Seated and the Protocol is Established
8:50-9:00	Introduction of the Plenary 1 Speaker
9:00-9:30	Plenary 1 Presentation
9:30-9:45	Q & A on Plenary 1
9:45-10:00	Health Break
10:00-10-15	Introduction of VIPs and Dignitaries
10:15-10:20	Nigerian National Anthem
10:20-1030	Welcome Address by the Conference Chair and the NMGS President
10:30-10:30	Address by the IMGA-Nigeria Chair
10:40-10:50	Address by the SEGH President
10:50-11:15	Goodwill Addresses
11:15-11:45	Keynote Address on the *linkage between human wellness and the quality of the environment*
11:45-11:50	National Anthem
11:50-12:00	Group photographs

39th International Conference for Environmental Geochemistry and Health 'ABUJA 2024' Conference Programme

Day & Date	Time	Events	Venue/Authors
Monday 1 July 2024	08:00-16:00	**Pre-Conference Workshop**	Rockview Hotel
	08:00-16:00	Arrival of Participants & Collection of Conference Materials	Rockview Hotel
	18:00 - 20:00	**Ice Breaker/Welcome Cocktail**	Rockview Hotel
Tuesday 2 July 2024	08:00-09:00	**Conference Registration Continues**	Rockview Hotel
	09:00-10:00	**Conference Plenary Presentation 1:** *'Addressing impact of Unregulated Mining on the Quality of Livelihood of Rural Communities'* **Dr Joy Agene** Task Team Leader, ACReSAL, World Bank Project, Nigeria	
	10:00-12:00	**Official Conference Opening Ceremony**	
	12:00-13:00	**Lunch Break**	
	13:00-15:30	**Technical Session 1**	
	13:00-13:15	DELINEATION OF HEALTH RISK POTENTIAL ZONES USING HYDROCHEMICAL ANALYSIS AND GROUNDWATER MAPPING OF SOME LOCATIONS WITHIN BARKIN LADI, NORTH-CENTRAL NIGERIA	J. A. Ramadan & A.I. Haruna
	13:15-13:30	ARTIFICIAL INTELLIGENCE APPROACH TO CRUDE-OIL EXPLOITATION AND ENVIRONMENTAL ISSUES IN COASTAL AREAS OF NIGERI	O. M. Orogbemi; O. A. Ehinola; A. O. Adetunmbi & M. O. Orogbemi
	13:30-13:45	TRACE ELEMENT CONCENTRATIONS IN SURFACE WATER, AND ITS POTENTIAL HEALTH IMPLICATIONS: A CASE STUDY OF ISHIAGU, SOUTHEASTERN NIGERIA	J. N. Okonji-Ojeh & V.U. Ukaegbu
	13:45-14:00	DIETARY EXPOSURE TO AFLATOXIN IN SOME CEREALS AND ANIMAL FEEDS IN BOMET COUNTY, KENYA	E.K. Kemoi, F.O. Onyangore, & Bii. C.C.

	14:00-14:15	CHARACTERISATION OF FOUR NIGERIAN CLAYS USING X-RAY AND MICROSCOPIC TECHNIQUES AND THEIR APPLICATION IN REMOVAL OF CHROMIUM AND LEAD FROM WATER	A. I. Umarein & C. M. Davidson
	14:15-14:30	COMPOSITION AND HEALTH RISK ASSESSMENT OF TRONA CONSUMED IN URBAN AREAS IN NIGERIA: COMPARATIVE STUDY OF OSOGBO AND IBADAN METROPOLISES	J. Olajide-Kayode & O. Olisa
	14:30-14:45	ADSORPTION CAPACITY OF POLYETHYLENE, POLYETHYLENE TEREPHTHALATE, POLYPROPYLENE AND POLYVINYL CHLORIDE FOR ARSENIC, CADMIUM, CHROMIUM AND LEAD IN FRESHWATER SYSTEM	B. W. Osungbemiro; C. M Davidson & J. J. Liggat
	14:45-15:00	WORKPLACE EXPOSURE TO POTENTIALLY TOXIC ELEMENTS AMONG MANUAL STONE-CRUSHING WORKERS IN NORTH CENTRAL NIGERIA	Simon G. Mafulul; Elizabeth O. Okoh; Kiri H. Jaryum; Jonathan D. Dabak; Samuel Y. Gazuwa; Jane-Rose I. Oche; Samson I. Wuti; Oladele F. Anjorin; Raymond I. Daspan; , Isaac Shola Laka & Mariam D. Solomon
	15:00-15:15	GEOCHEMICAL CHARACTERISTICS OF SOILS IN PARTS OF ILORIN SHEET 223 NORTH CENTRAL NIGERIA	Omorinoye Omolayo Ajoke; Eso Kehinde Samuel; Bamigboye Olufemi Sijuade; & Alebiosu Mercy Titilayo
	15:15-15:30	ASSESSMENT OF SOME HEAVY METALS DISTRIBUTION AND CONTAMINATION IN FAYA AND ENVIRONS, MIDDLE BENUE TROUGH, CENTRAL NIGERIA	Piwuna, Raulatu. M and & Daku, Sunday. S
	15:30-16:00	**Health Break**	
	16:00-18:00	**Technical Session 2**	
	16:00-16:15	HEAVY METALS CONCENTRATION IN SOME EDIBLE PLANTS GROWING NEAR MANUAL STONE CRUSHING SITES IN NORTH CENTRAL NIGERIA	Simon G. Mafulul; Elizabeth O. Okoh; Kiri H. Jaryum; Samuel Y. Gazuwa; Jane-Rose I. Oche; Samson I. Wuti; Oladele F. Anjorin; Raymond I. Daspan; Isaac Shola Laka; Mariam D. Solomon & Jonathan D. Dabak

	16:15-16:30	STRUCTURAL FE(II)-INDUCED GENERATION OF REACTIVE OXYGEN SPECIES ON MAGNETITE SURFACE FOR AQUEOUS AS(III) OXIDATION DURING OXYGEN ACTIVATION	Fangyuan Meng; Fei Wu & Chengshuai Liu
	16:30-16:45	CONTAMINATIONS IN THE MEGA-CITY OF LAGOS AND ITS HEALTH IMPLICATIONS, SOUTHWESTERN NIGERIA	Olubukola O. Afolabi & Akinade S. Olatunji
	16:45-17:00	LEVEL OF HEAVY METAL IN SOIL, DOWN STREAM WATER, AND Solanum tuberosum FROM A TIN MINE AREA, MANGUNA DISTRICT, BOKKOS LGA, PLATEAU STATE, NIGERIA	Anjack.L. Augustine; Adams. U. Itodo; & Raymond .A. Wuana
	17:00-17:15	ELEVATED CONCENTRATION OF NITRATES IN SHALLOW GROUNDWATER OF THE COASTAL AQUIFERS AND ITS IMPLICATION ON PUBLIC HEALTH; A CASE STUDY OF EASTERN DAHOMEY BASIN, SOUTHWESTERN NIGERIA	J. A. Aladejana; I. Hassan; U. R. Eze & M. N. Tijani
	17:15-17:30	HYDROGEOCHEMICAL EVALUATION OF SHALLOW AND DEEP-GROUNDWATER QUALITY IN APATA-NNPC: A PETROCHEMICAL PRODUCTS STORAGE FACILITY HOSTING AREA IN IBADAN, SOUTHWEST NIGERIA	F. F. Ajayi & O. Ishola
	17:30-17:45	BEYOND THE SURFACE: EXPLORING HIDDEN HEALTH RISKS IN LAGOS SLUMS	P.O. Falae; O.M. Oladepo & O.O Afolabi
	FLASH PRESENTATIONS		
	17:45-17:50	INFLUENCE OF SEED PELLETING ON SEED QUALITY OF SPIDER PLANT (Cleome gynandra L.) DURING STORAGE	M. Muga; J.O. Ochuodho & V. Anjichi
	17:50-18:55	ESSENTIAL ELEMENTS HETEROGENEITY IN SOIL AND UPTAKE BY CROPS-ITS IMPLICATION FOR INCREASED NUTRIENT AVAILABILITY IN HUMAN AND ANIMAL FOODS	Ogunlade-Anibasa, G.O.,Gideon, G. Otteh, E.I. and Musa, S.
	17:55-18:00	WATER QUALITY ASSESSMENT IN KIFISSOS RIVER, GREECE	E. Anastasiadou, O. Cavoura

	18:00-18:05	HEAVY METAL CONCENTRATION AND DISTRIBUTION IN SOILS AROUND ARTISANAL WORKSHOPS IN AGO-IWOYE, SOUTHWESTERN NIGERIA	O. G. Olisa, O. T. Olatunji, O.M. Keyede and O.A. Ajayi
	18:05-18:10	A GLOBAL REVIEW OF LEVEL OF LAMBDA CYHALOTHRIN IN AQUATIC SYSTEMS AND ALONG THE FOOD CHAIN	F. O. Onyangore and E. K Kemoi
Wednesday 3 July 2024	09:00-10:00	**Conference Plenary Presentation 2:** **'Strategic plan for Coastal Environmental Sustainability in Nigeria'** **Prof. O. A. Ehinola** *Aret Adams Professorial Chair in Geological Studies, University of Ibadan*	
	10:00-12:30	**Technical Session 3**	
	10:00-10:15	IN SEARCH OF A CONSENSUS METHOD FOR THE ISOLATION OF MICROPLASTICS FROM FRESHWATER SEDIMENTS	D. E. Enenche & C. M. Davidson
	10:15-10:30	HEALTH RISK ASSESSMENT OF HEAVY METALS IN WATER IN THE VICINITY OF MANUAL STONE CRUSHING SITES IN NORTH-CENTRAL NIGERIA	Simon G. Mafulul; Elizabeth O. Okoh; Jonathan D. Dabak; Samuel Y. Gazuwa; Jane-Rose I. Oche; Samson I. Wuti; Oladele F. Anjorin; Raymond I. Daspan; Isaac Shola Laka; Mariam D. Solomon & Kiri H. Jaryum
	10:30-10:45	THE INTERPLAY OF URBANIZATION AND ENVIRONMENTAL QUALITY: TRENDS, CHALLENGES, AND OPPORTUNITIES	P.O. Falae
	10:45-11:00	HEALTH IMPACT OF HEAVY METAL CONTAMINATION IN SOILS AND GROUNDWATER AROUND CEMENT FACTORY IN SAGAMU	Ajibade O.M; Faleye B.R; Akinsanya F. M; Babatunde O.E & Oketogun B. G
	11:00-11:45	GEOCHEMICAL ENRICHMENT AND HEALTH RISKS OF THALLIUM IN WEATHERED GRANITE SOILS OF SOUTH CHINA	Tangfu Xiao; Shuxin Pan; Ying He & Enzong Xiao
	11:45-12:00	THALLIUM IN GEOLOGICCAL MEDIA AROUND MINING SITES IN NIGERIA: ARE THERE POTENTIAL ECOLOGICAL AND HEALTH RISKS INVOLVED?	O.J. Popoola, T.A. Laniyan2, T. Xiao3

	12:00-12:15	GEO-ENVIRONMENTAL INFLUENCE ON GROUNDWATER QUALITY IN NDELE, SOUTHERN NIGERIA.	J. N. Okonji-Ojeh & M. M. Kekwaru
	12:15-12:30	GEOCHEMICAL ANOMALIES AND SECONDARY MINERALISATION AS POTENTIAL INSTIGATORS OF NATURAL HEALTH HAZARDS: PERSPECTIVE FOR A REGIONAL APPRAISAL IN NIGERIA	O. A. Okunlola
	12:30-13:30	**Lunch Break**	
	13:30-16:00	**Technical Session 4**	
	13:30-13:45	POTENTIALLY TOXIC METAL POLLUTION PREVENTION AND ENVIRONMENTAL SUSTAINABILITY OF WATER, SOILS AND STREAM SEDIMENTS IN SOUTHWESTERN NIGERIA	T. A. Laniyan, O. M Morakinyo
	13:45:14:00	NON-CARCINOGENIC HEALTH RISK ASSESSMENT OF FLUORIDE AND NITRATE CONTAMINATION OF GROUNDWATER OF KALTUNGO AREA, GOMBE NORTHEAST NIGERIA.	E.Y. Mbiimbe; I.B. Gonil; J.M. El-Nafaty; M. Bukar & SulaimanI A.
	14:00-14:15	MICROBIAL ASSEMBLAGE AND ECOLOGICAL FUNCTION OF PLANT ASSOCIATED MICROBIOMES ACROSS PLANT NICHES UUDER CADMIUM STRESS	Enzong Xiao; Li Shao; & Tangfu Xiao
	14:15-14:30	SEED-MEDIATED GROWTH OF SCHWERTMANNITE FOR APPLICATION IN ACID MINE DRAINAGE TREATMENT	Feng Jiang, Zhi Dang, Lijuan Zhang, Bichun Huang & Xiaoyun Yi
	14:30-14:45	THE ENVIRONMENTAL GEOCHEMISTRY OF PIT LAKES IN ENYIGBA AND ENVIRONS, ABAKALIKI MINE DISTRICT, SOUTHEASTERN NIGERIA	Chinenye Florence Onyeabor, Daniel Chukwuemeka Ozoko, Agwu Ama Irem and Stella Tochukwu Animba
	14:45-15:00	ASSESSMENT OF HEAVY METAL CONTAMINATION IN GROUNDWATER FROM COMMUNITIES WITH COMPROMISED PETROLEUM PIPELINE IN LAGOS STATE, NIGERIA	M. Adeyemi; A. Gbadebo; A. Taiwo; O. Sojinu &, A. Adeola

	15:00-15:15	THE PURIFICATION OF ACID MINE DRAINAGE THROUGH THE FORMATION OF SCHWERTMANNITE WITH FE(0) REDUCTION AND ALKALI-REGULATED BIOMINERALIZATION PRIOR TO LIME NEUTRALIZATION	Xiaoyun Yi, Feng Jiang, Zhi Dang, Lijuan Zhang, Bichun Huang
	15:15-15:30	HEAVY METAL CONCENTRATION AND UPTAKE OF JATROPHA CURCAS. L. GROWN IN ABUJA, FEDERAL CAPITAL TERRITORY, NIGERIA	Saminaka, I.B and Ogunlade-Anibasa, G.O.
	15:30-15:45	ASSESSMENT OF CONTAMINATION, HEALTH RISK AND BIO-ACCESSIBILITY OF POTENTIALLY TOXIC ELEMENTS (PTES) IN THE SOIL OF ARTISANAL GOLD MINE SITES IN NORTH CENTRAL NIGERIA	Abiodun M. Odukoya; Michael J. Watts & Temitope O. Adedayo
	15:45-16:00	OPPORTUNITIES AND PLATFORMS FOR MEDICAL GEOLOGY TRAINING IN AFRICA: THE JOSE CENTENO INTERNATIONAL CENTER FOR MEDICAL GEOLOGY RESEARCH, NASARAWA STATE UNIVERSITY, KEFFI, NIGERIA	K'tso Nghargbu, Robert B Finkelman, Jose A. Centeno, Suleiman B Mohammed
	16:00-18:00	**Technical Session 5**	
	16:30-16:15	ASSESSMENT OF COASTAL GROUNDWATER QUALITY FOR SUITABILITY OF DRINKING PURPOSES IN OKERENKOKO, NIGER DELTA REGION OF NIGERIA	O.M Omorogieva, R.D Beckie, J.A Tonjoh, O.A Ehinlaye and B.C Adebayo
	16:15-16:30	ASSESSMENT OF NATURAL RADIONUCLIDES OF SELECTED BASEMENT ROCKS FROM SOUTHWESTERN NIGERIA AND POTENTIAL HEALTH EFFECTS	S. O. Olayemi and Olatunji A.S.
	16:30-16:45	NOVEL FRAMEWORK TO ASSESS AND MANAGE OFFSHORE PRODUCED WATER FOR EFFICIENCY, RELIABILITY, SAFETY AND SUSTAINABILITY AT THE NIGERIAN OFFSHORE ENVIRONMENT	Bamanga Awwal and Bassey Bassey

	16:45-17-00	HEAVY METAL CONTENT IN URBAN SOILS AND DUSTS OF BATTERY MAINTENANCE WORKSHOPS IN OSOGBO, SOUTHWESTERN NIGERIA	Tesleem O. Kolawole, Jerry O. Olajide-Kayode and Luqmon A. Azeez
	17:00-17:15	GEO-ENVIRONMENTAL IMPACT OF SELECTED LANDFILLS IN LAGOS, SOUTHWESTERN NIGERIA	A.S. Olatunji, A.; S.M. Shasore.; Kuseju, M. O. Oloruntola, T. Kolawole, O. O. Baiyewu, J. Olajide Kayode, O. Olisa and T. M. Amodu
	17:15-17:30	ASSESSEMENT OF POLLUTION LEVEL RESULTING FROM SMALL SCALE ATISANAL MINING OPERATIONS IN NEW BUSSA BORGU LOCAL GOVERNMENT AREA NIGER STATE	J.A. OLATUNJI, O.V. OMONONA, D. OLASEHINDE
	17:30-17:45	GEOCHEMISTRY OF SOILS BENEATH THREE FOREST TREES IN AN ARBORETUM OF FORESTRY RESEARCH INSTITUTE OF NIGERIA (FRIN), IBADAN, SOUTHWESTERN NIGERIA	Ruth O Ojedokun and A.S. Olatunji
	17:45-18:00	HEAVY METAL CONCENTRATIONS IN *PERIOPHTHALMUS BARBAROUS* OF ESCRAVOS ESTUARY, NIGER DELTA, DELTA STATE, NIGERIA	J.S. Ewutanure, O.M. Omorogieva and O.P. Endoro
	20:00-23:00	**Conference Dinner and Awards Evening**	
Thursday 4 July 2024	09:00-14:00	**Post Conference Field Excursion**	

DELINEATION OF HEALTH RISK POTENTIAL ZONES USING HYDROCHEMICAL ANALYSIS AND GROUNDWATER MAPPING OF SOME LOCATIONS WITHIN BARKIN LADI, NORTH-CENTRAL NIGERIA

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Abstract

The study investigates the presence of harmful heavy metals in water resources in Barkin Ladi and environs due to the persistent health challenges experienced by residents amongst which are cancers of various kinds, increased cases of miscarriages and infertility issues. Chemical analyses of forty-Six (46) water samples drawn from mine ponds, streams, hand dug wells and boreholes was carried out using the Inductively Coupled Plasma Mass Spectrometry (ICP-MS) technique. Also, questionnaire responses from two hundred and seventeen (217) participants were conducted on the subject matter as well as the static water level measurements of two hundred and twenty-seven (227) wells to determine the groundwater flow directions. Statistical analysis using the Statistical Package for Social Sciences (SPSS; 23.0) and pollution/contamination index calculations were performed to identify contamination sources and the single value range of each metal present in the water samples. In addition, the health risks assessments for adults and children were computed using the standard formulae and input parameters which facilitated in identifying the potential impact of a hazard to the children and adults. The metals responsible for the contamination/pollution are Al, Pb, Mn, Fe, Ba as revealed through the computations of the indices, and anthropogenic activities, such as mining and agriculture near most of the mine ponds were found to contribute significantly to the contaminations. Groundwater flow directions suggest potential contamination of hand dug wells due to recharge from the ponds and streams. Health risk assessment revealed risks for both adults and children since they consume from these sources of water which may perhaps be responsible for the health challenges experienced by inhabitants within the area. The integration of the results assisted to the delineation of high and medium health risk zones to inform future water supply strategies for the region.

ARTIFICIAL INTELLIGENCE APPROACH TO CRUDE-OIL EXPLOITATION AND ENVIRONMENTAL ISSUES IN COASTAL AREAS OF NIGERIA

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Abstract

This study examined the effects of crude-oil exploitation disasters on host communities and environments, as well as the health and safety of inhabitants in the coastal region of Nigeria from selected case studies scenario of coastal areas in Bayelsa, Delta, Edo, Ondo and River States respectively. The specific objective of the study was to investigate the effects of crude-oil and natural gas mining and exploitations disasters in the region and environmental issues such as water pollution, environmental de-gradation, lack of social and economic benefits from crude-oil operations to the host communities, and access frameworks to support the development of host communities. In attaining the highlighted objectives, supervised learning and artificial intelligence algorithms were proposed to approach the study of the effects of crude-oil exploitation effects on environmental issues identified in this paper. Classification supervised algorithms (support vector machine and random forest) were deployed to examine the crude-oil exploitation disasters such as water pollution, gas flaring, environmental health impacts on humans and agriculture, and sea incursions in the areas. The expected output is to predict social and economic benefits from crude-oil operations to the host communities, access framework to support the development of host communities, and foster sustainable prosperity within the host communities.

Keywords: AI algorithms, crude-oil, exploitation, disaster, host communities

TRACE ELEMENT CONCENTRATIONS IN SURFACE WATER, AND ITS POTENTIAL HEALTH IMPLICATIONS: A CASE STUDY OF ISHIAGU, SOUTH EASTERN NIGERIA.

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Abstract

This study on surface water was carried out in Amaeze pond, Amaeze quarry, Amagu, Amokwe and Ihie communities in Ishiagu, south-eastern Nigeria. The study aims to evaluate the concentration of trace elements in surface water in that area due to the presence of geologic materials, with a focus on the potential health implications associated with human exposure to trace metals from mining activities in that region via inhalation and ingestion. Surface water samples were collected in one litre quantity from ponds, farmlands, and active quarries with ongoing mining activities for analyses using Atomic Absorption Spectrometry (AAS). Trace elements reported in the samples have mean concentrations ranges in: Ni 0.01 - 0.14mg/L, Zn 0.01 - 0.043mg/L, Co 0.01 - 0.012mg/L, V -1.16 - 0.2mg/L, Se -0.03 - 0.21mg/L, and Cr 0.01 - 0.032mg/L, Cu 0.01 - 0.11mg/L, Pb 0.00 - -0.01mg/L, Cd 0.001- 0.004mg/L, As 0.43 0.67mg/L, and Sb -0.25 2.36mg/L. From the results, essential trace elements (Ni, Zn, Co, V, Cr) present in surface water samples are below the recommended threshold of trace elements in surface water, but Se exceeded the threshold. Toxic elements such as Cu, Pb, and Cd are below the permissible limit but Cd, As and Sb exceeded the threshold. Long term exposure to trace elements in surface water in this region is by irrigation farming, washing, and bathing. The potential health implications associated with long-term exposure to trace elements Se, Cd, As and Sb toxicity include neurological anomalies, myocardial damage and gastrointestinal irritation, high blood pressure, rapid heart rate, and developmental effects in young children.

DIETARY EXPOSURE TO AFLATOXIN IN SOME CEREALS AND ANIMAL FEEDS IN BOMET COUNTY, KENYA

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Abstract

Aflatoxin is a type of mycotoxin originating from fungi and contaminating human food and animal feeds, causing serious health effects in both humans and animals. The purpose of the study is to determine fungal and mycotoxin contamination of human food and animal feeds for public health initiatives in the County. One hundred and twenty-three samples were collected randomly (85 Maize and 38 animal feeds) from farms and animal feed dealers in the Bomet County and; approximately 250g of the maize/feed was sampled and cultured on mycological media. Fungi classification was based on macro, micro-morphological features, and biochemical methods. Mycotoxin detection was done using the ELIZA-based envirologist Quick Toxin Kit and the positive samples, was subjected to High-performance Liquid Chromatography analysis for QC purposes. *Fusarium* species and *Aspergillus* species (*A. parasisticus, A. flavus, A. niger, A. terreus, A. versicolor,* and *A. tamarii*) were isolated from 75 (88%) of the cereals and 30 (79%) of animals feed. AFB1 and AFB2 were the most commonly identified, largest proportion of Aflatoxins ranges from 10 µg/kg to 98µg/kg. Amounts of aflatoxin detected in some foods were unsafe and not fit for human consumption according to the European Union's acceptable limits

CHARACTERISATION OF FOUR NIGERIAN CLAYS USING X-RAY AND MICROSCOPIC TECHNIQUES AND THEIR APPLICATION IN REMOVAL OF CHROMIUM AND LEAD FROM WATER

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Abstract

Mining and industrial activities have rendered surface water unsafe for human consumption in parts of the world. Remediation of such polluted water is a major challenge especially in rural communities. Due to the high cost of sophisticated water treatment techniques, there is a huge interest in the use of sustainable locally sourced alternatives. Clay has been reported to be a good adsorbent for removal of Cr and Pb from water due to its high cation exchange capacity, large pore volumes and surface area.

Four clays obtained from Eme, Ihievbe and Imiegba in Owan West, Owan East and Etsako East Local Government Area in Edo state, Nigeria, were characterised using microscopy, X-ray and infrared spectrometry. Batch sorption experiments were performed and Cr and Pb concentrations determined using inductively coupled plasma mass spectroscopy.

Clay diffractograms reveal illites as principal mineral, which was confirmed by infrared spectra. Photomicrographs of the clays show irregular platelets, spongy surfaces and stacked flakes of large particles. Elemental analysis of the clays revealed Al, C, Fe, O and Si as major constituents, with Ca, K, Mg and Ti as minor constituents. All clays demonstrated high adsorption capacities for Cr and Pb with over 90 % removal from solution. Increasing pH and adsorbent dosage increased the percentage removal of Cr and Pb from solution. Sorption was spontaneous within 10 mins and equilibrium was reached after 20 minutes of sorption time.

Further studies will be carried out to establish the effect of ion interference from simulated and real freshwater.

Keywords: clay, potentially toxic elements, water treatment.

COMPOSITION AND HEALTH RISK ASSESSMENT OF TRONA CONSUMED IN URBAN AREAS IN NIGERIA: COMPARATIVE STUDY OF OSOGBO AND IBADAN METROPOLISES

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Abstract

There exists a link between the composition of geological materials and human health, hence the need to assess the composition of these materials. The geochemical and mineralogical composition, and possible health risks associated with trona consumed in parts of Osogbo and Ibadan metropolises of southwestern Nigeria were compared in this study.

Trona samples from Osogbo (n=10) and Ibadan (n=14) were pulverized and analysed for mineralogy by X-Ray Diffraction (XRD), and Potentially Toxic Elements (PTEs) concentration using Inductively-Coupled Plasma techniques. Metal Enrichment (ME), Contamination Factor (CF) and Degree (C_{Deg}), non-carcinogenic/carcinogenic risks were calculated for the samples.

Trona, quartz and halite were dominant in Osogbo trona; while trona, quartz and pirssonite were dominant in Ibadan trona. Concentrations (ppm) of As, Cu, Ni, V and Zn in Osogbo and Ibadan trona were not detected (nd)-9, 1-3, 1-6, 2-23, 3-9; and nd-9, 3-7, 2-3, 2-23 and 1-5, respectively. The ME assessment revealed significant contamination of As, Cu, Ni and Zn in the trona from both areas. The CF values for PTEs in Osogbo and Ibadan trona, using Food Regulatory Benchmark, were: As, 9 and 10; Cu, 1 and 2; Ni, 7 and 5; and Zn, 3 and 1, respectively. The C_{Deg} values were 20 and 19 respectively for Osogbo and Ibadan samples. Additionally, Hazard Quotient (HQ) values for the trona were <1.

Though health risk assessment revealed no immediate non-carcinogenic and carcinogenic risk to consumers, the elevated concentrations of the PTEs pose health risks such as gastrointestinal problems, lung, bladder, liver, cardiovascular and brain damage. liver, cardiovascular and brain damage.

ADSORPTION CAPACITY OF POLYETHYLENE, POLYETHYLENE TEREPHTHALATE, POLYPROPYLENE AND POLYVINYL CHLORIDE FOR ARSENIC, CADMIUM, CHROMIUM AND LEAD IN FRESHWATER SYSTEM

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Abstract

The potential of microplastics (MPs) to act as hosts and facilitate the transportation of potentially toxic elements (PTEs) in the aquatic ecosystem has attracted many studies in recent times. However, there is a dearth of knowledge about the adsorption mechanisms involved.

This study investigated the adsorption behaviour of virgin and artificially weathered polyethylene (PE), polyethylene terephthalate (PET), polypropylene (PP) and polyvinyl chloride (PVC) for As, Cd, Cr and Pb. Photo-weathering (PW), thermal weathering (TW) and mechanical weathering (MW) were each simulated in the laboratory for 10 weeks, with weekly analysis of the MPs by Fourier transform infrared (FTIR) spectroscopy. Adsorption was carried out with both virgin and weathered MPs using 500 μg/L analyte solutions at the average pH of freshwater (7.5) with agitation for 24 h at 170 rpm. The concentrations of As, Cd, Cr and Pb were determined by inductively coupled plasma mass spectrometry.

The virgin PET, PA and PVC MPs adsorbed higher amounts of PTE than virgin PE, PP and PS. Weathered MPs adsorbed higher concentrations of all PTEs than virgin MPs following the order PW > MW > TW. The FTIR spectroscopy analysis detected the presence of carbonyl groups in PE and PP after exposure to UV light, indicating photo-oxidation had occurred, which may be responsible for the adsorption trend observed. This study confirmed that the ageing of MPs enhanced their adsorption capacity for PTEs. Further work will involve analysis of virgin and weathered MPs by scanning electron microscopy to determine the effect of weathering on morphology.

Keywords: microplastic, potentially toxic elements, adsorption

WORKPLACE EXPOSURE TO POTENTIALLY TOXIC ELEMENTS AMONG MANUAL STONE-CRUSHING WORKERS IN NORTH CENTRAL NIGERIA

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Abstract

Manual stone-crushing is a common activity in the North-central region of Nigeria, where workers are exposed to stone dust and potentially toxic elements. The use of Personal Protective Equipment (PPE) is often inadequate or inappropriate, and the health effects of this exposure are poorly understood. This study determined the concentration of selected potentially toxic elements in hair, nails, and blood plasma of manual stone-crushing workers and examined against *a few variables, including the use of personal protective equipment, age of workers, site place, the gender of workers, and duration at work.* Hair, nails, and plasma samples were collected from 151 manual stone-crushing workers in six states and FCT (Abuja). The samples were analysed for potentially toxic elements concentration in hair, nails, and blood plasma of manual stone-crushing workers using X-ray fluorescence spectroscopy (XRF) for hair and nails and atomic absorption spectrometry (AAS) for blood plasma. The results showed that the mean concentrations of heavy metals in the human samples varied significantly across different variables. The use of PPE reduced the accumulation of some elements (Cu, Cr, and Fe in hair and nails; Cd, Fe, Mn, and Zn in plasma) but not some. The age, gender, site place, and duration at work also influenced the distribution of potentially toxic elements among the human samples. Manual stone-crushing workers are exposed to high levels of potentially toxic elements that may pose health risks. PPE is insufficient to prevent metal accumulation and should be complemented by other measures, such as regular medical check-ups, environmental monitoring, and education.

GEOCHEMICAL CHARACTERISTICS OF SOILS IN PARTS OF ILORIN SHEET 223 NORTH CENTRAL NIGERIA

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Abstract

This research investigates the concentration, contamination, and ecological risk of heavy metals in soil samples from the Ilorin sheet 223. The soil samples were collected from the study area were analyzed for Cu, Pb, Zn, Fe, Mn, Ni, and Co using atomic absorption spectrophotometry (AAS). The grain size distribution were also determined. The results showed a range (mg/Kg) for each heavy metal as follows: Cu, 0.239 to 1.857, Pb, 0.115 to 0.639, Zn, 0.577 to 1.363, Fe, 15.229 to 15.855, Mn, 2.4455 to 7.168, Ni, 0.173 to 1.341, and Co, 0.038 to 0.396. For the assessment of the contamination levels of the soils, various indices were used, including the Contamination Factor (CF), Degree of Contamination (Cdeg), the Pollution Load Index (PLI), and the Geoaccumulation Index (Igeo). The results showed that the CF, Cdeg and PLI for all samples were classified as having low contamination and low pollution. The Igeo values showed that all samples indicated no significant anthropogenic contamination. These indices suggested that the soils had low contamination and pollution from heavy metals and that their presence was mainly attributed to natural geological processes rather than anthropogenic sources. The analysis also revealed weak correlations between heavy metals and grain size parameters in soil samples, with Ni showing the highest positive correlation with gravel (0.27) and Fe with sand (0.27). Cu, Pb, Zn, Mn, and mud displayed positive correlations with values of 0.39, 0.36, 0.23, and 0.43 respectively.

Keywords: Heavy metals, soil, grain size, environmental pollution indices, anthropogenic

ASSESSMENT OF SOME HEAVY METALS DISTRIBUTION AND CONTAMINATION IN FAYA AND ENVIRONS, MIDDLE BENUE TROUGH, CENTRAL NIGERIA.

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Abstract

Thirty-three soil samples and twenty-five water samples were collected from both Surface (Dams, Ponds, Rivers, and Streams) and Groundwater (Boreholes and Wells) at Faya and environs underlain by Shale, Limestone, Black Shales, Sandstone and Migmatite formations of Central Nigeria. This research assesses heavy metal accumulation in the selected area using pollution indices of Geo-accumulation index (Igeo), Enrichment factor (EF) and Contamination factor (CF).

The heavy metals mean concentration values show Mn>Ba>Zn>As>Cd>Cr>Cu>Pb>Co>Se. Cd and Se showed moderate contamination levels from the Igeo values; moderate enrichment of As, significant for Se and very high enrichment for Cd; moderate, considerable and very high Contamination factor values for the elements As, Se and Cd respectively.

The TDS mean value for Groundwater was 312mg/L and 175mg/L for the Surface waters; the mean hardness value in the Groundwater is 572mg/L and 361mg/L for the Surface waters indicating both water sources have hardness values above the Nigerian Standards for Drinking Water Quality (NSDWQ).

The mean order of concentration of the anions is $Cl>HCO_3>NO_3>PO_4>F>SO_4>NO_2$ in both Ground and Surface Waters of the area; the metal Ca with the highest mean value and K the least in both Groundwater and Surface water all within the MAC except Mg with 99mg/L in Groundwater and 64mg/L in Surfacewaters above the MAC of NSDWQ limit of 0.20mg/L. The Cl and F are above the MAC of the NSDWQ limit of 250 mg/L and 1.5mg/L respectively with a mean value of 412mg/L and 9mg/L respectively in Groundwater and 300mg/L and 12mg/L respectively in the Surface water. The NO_3 is 39mg/L in Groundwater and 45mg/L Surface water within the NSDWQ.

The positive Igeo values suggest anthropogenic activities in the study area contributed to the distribution and concentration of the trace elements within the area. The hazards posed by high concentrations of TDS, Hardness, Cl, F in water of this region would require monitoring and effective implementation of management practice and basic filtration methods to curtail harmful effects from long term taking-in of these elements.

Keywords: Soil Contamination, Ground and Surface water, Heavy Metals, Middle Benue Trough.

HEAVY METALS CONCENTRATION IN SOME EDIBLE PLANTS GROWING NEAR MANUAL STONE CRUSHING SITES IN NORTH CENTRAL NIGERIA

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Abstract

Stone crushing activities generate dust and release heavy metals into the environment, which may lead to contamination of nearby plants and eventually affecting human health through the food chain. This study investigated the accumulation of heavy metals in some selected plants growing near manual stone crushing sites in six states of North Central Nigeria and FCT and assess the potential health risk associated with the plant consumption using the data recommended by the United States Environmental Protection Agency. Plant samples of *Parkia biglobosa, Anacardium occidentale, Mangifera indica, Psidium guajava, Vitex doniana and Carica papaya* were collected from 18 sites and analysed using inductively coupled plasma mass spectrometry (ICP-MS). The concentrations of heavy metals varied among the plants determined and the various stone crushing sites. Most of the essential metals such as Cu, Fe, Mn and Zn were within the WHO permissible limits in most of the plant samples, except for Mn and in *Parkia biglobosa* and Cu in *Mangifera indica* from some sites. The concentrations of the toxic metals, As, Cd, Pb, and Hg which have no known biological functions, were very high in all the plant samples from all the sites. The results indicate that stone crushing activities may pose a potential risk to the environment and human health through the accumulation of heavy metals in plants. The hazard quotient (HQ) values for most of the heavy metals were greater than 1, indicating potential health risks for both adults and children. It can be concluded, based on the results and risk assessment provided by this study, that human exposure to edible plants from stone crushing sites constituted a potential health risk for consumers.

STRUCTURAL FE(II)-INDUCED GENERATION OF REACTIVE OXYGEN SPECIES ON MAGNETITE SURFACE FOR AQUEOUS AS(III) OXIDATION DURING OXYGEN ACTIVATION

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Abstract

Magnetite is a reductive Fe(II)-bearing mineral, and its reduction property is considered important for degradation of contaminants in groundwater and anaerobic subsurface environments. However, the redox condition of subsurface environments frequently changes from anaerobic to aerobic owing to natural and anthropogenic disturbances, generating reactive oxygen species (ROS) from the interaction between Fe(II)-bearing minerals and O_2. Despite this, the mechanism of ROS generation induced by magnetite under aerobic conditions is poorly understood, which may play a crucial role in As(III) oxidation. Herein, we found that magnetite could activate O_2 and induce the oxidative transformation of As(III) under aerobic conditions. As(III) oxidation was attributed to the ROS generated via structural Fe(II) within the magnetite octahedra oxygenation. The electron paramagnetic resonance and quenching tests confirmed that O_2, H_2O_2, and OH were produced by magnetite. Moreover, density function theory calculations combined with experiments demonstrated that O_2 was initially formed via single electron transfer from the structural Fe(II) to the adsorbed O_2; O_2 was then converted to OH and H_2O_2 via a series of free radical reactions. Among them, O_2 and H_2O_2 were the primary ROS responsible for As(III) oxidation, accounting for approximately 52% and 19% of As(III) oxidation. Notably, As(III) oxidation mainly occurred on the magnetite surface, and As was immobilized further within the magnetite structure. This study provides solid evidence regarding the role of magnetite in determining the fate and transformation of As in redox-fluctuating subsurface environments.

CONTAMINATIONS IN THE MEGA-CITY OF LAGOS AND ITS HEALTH IMPLICATIONS, SOUTHWESTERN NIGERIA

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Abstract

Information on the causes and sources as well as the ecological implications of potentially toxic elements (PTEs) such as Zn, Cd, Cr, Ni, As and Cu pollution is very important to abate environmental pollution especially within the urban system. This study was undertaken to assess the concentrations and distributions of potentially toxic elements in soils, sediments and dusts across Lagos city as well as evaluate the potential health risk of exposure.

This study presents the results of forty-eight (48) soils, fifty-eight (58) surface sediments and twenty-seven dust samples collected from Lagos mainland. These samples were air-dried at room temperature, pulverized and sieved to obtain silt fractions for chemical analysis. The sieved samples were partially digested using aqua regia while the concentrations of Zn, Pb, Cd, As, Ni, Cr and Cu were determined using ICP-MS.

The results in mg/kg showed that Pb ranges from 22.0729.0; Zn 125.01510.0; Cu 19.0630.0, As 2.3-10.2, Cd 1.4-10.5 for sediments, for soils Pb 20.0-963.0, Zn 17-1712.0, Cu 7.0-368.0, As 0.01-14.1 and Cd 0.25-3.1 for soils while for dusts Pb 23.0-829.0, Zn 140.0-1586.0, Cu 29.5-655.5, As 0.2-7.6 and Cd 0.8-10.2. All the sample media displayed elevated concentrations that were in multiple folds above the local background values with the exceptions of As in a few locations. Comparing the results with some standards revealed that over 60% of the samples in the three media were more elevated than the guideline standards.

Evaluating the results using geochemical indices showed that the media are moderately to heavily contaminated with Cu and As, and heavily to extremely contaminated with Pb, Zn and Cd. The ecological risk assessment indicated that Cu and Zn were within moderate to very high risk while Pb ranged within high to very high ecological risk factor. The overall Risk Index which determines the potential ecological risk of the environment indicated high risk potential in all the studied media in the study area. This can cause potential environmental hazard most especially to children age 0 to 5 and adults age 70 and above while a larger percentages of the PTEs in the studied media are currently associated with carbonate, organic/sulpides and reducible phases. These phases poses a serious environmental concern the PTEs are readily available for biosphere interactions and possible bioaccumulation.

Keywords: Potentially-toxic-elements; environmental media,; Contamination; Lagos; Ecological Risk

LEVEL OF HEAVY METAL IN SOIL, DOWN STREAM WATER, AND SOLANUM TUBEROSUM FROM A TIN MINE AREA, MANGUNA DISTRICT, BOKKOS LGA, PLATEAU STATE, NIGERIA

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Abstract

Exposure to heavy metals from mining activities poses both ecological and health risks. This study investigates the concentration of heavy metals in soil, downstream water and food crops grown and irrigated with the water from both control (non-mining) and mining areas and compares them against World Health Organization (WHO) maximum permissible limits (MPL). Samples were analysed for each of the heavy metals using inductively coupled plasma mass spectrometry (ICP-MS). Our results revealed elevated levels of arsenic (As), copper (Cu), mercury (Hg), nickel (Ni), and lead (Pb) in the mining areas, indicating potential environmental and health risks. Specifically, the concentrations of As, Cu, Hg, Ni, and Pb in soil; As and Pb in water and Zn in plants from the mining area significantly exceed those in the control area. For instance, the toxic metal, Pb is significantly higher in the mining area (7.60 mg/L) compared to the control (0.36 mg/L). Furthermore, the concentrations of all the heavy metals in water; As, Hg, Ni, and Pb in soil and Cd, Ni, Pb, and Zn in plants from mining areas significantly exceed their corresponding WHO MPL. The bioaccumulation factors indicate that Cd and Zn have a greater tendency to accumulate in plants cultivated in mining areas, potentially entering the food chain. It can be concluded based on this study that mining activities lead to elevated levels of heavy metals in the environment, which may pose risks to ecological and human health. These emphasize the need for regular monitoring and the implementation of effective remediation strategies to mitigate heavy metal pollution in affected regions.

ELEVATED CONCENTRATION OF NITRATES IN SHALLOW GROUNDWATER OF THE COASTAL AQUIFERS AND ITS IMPLICATION ON PUBLIC HEALTH; A CASE STUDY OF EASTERN DAHOMEY BASIN, SOUTHWESTERN NIGERIA

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Abstract

Nitrate concentration in groundwater in shallow coastal aquifers of some developing countries due to improper waste management and incessant flooding resulting from extreme weather conditions driven by climate change is of concern. Higher Nitrate ingestion through drinking water has been linked to diseases such as infant methemoglobinemia, risk of specific cancers and congenital disabilities. This work analyzed nitrate, other major ions, and Oxygen and Deuterium Isotopes in 85 samples from shallow wells and boreholes in densely populated parts of the Eastern Dahomey Basin, Southwestern Nigeria. The results reveal a nitrate concentration ranging from 0.45 to 311 mg/l with an average concentration of 37.9 mg/l. Nitrate pollution index showed 49 (57%) pure, 16 (19%) light pollution, 1 (1%) moderate pollution, 8 (9%) significant pollution and 11 (13%) very significant pollution. Nitrate concentration(s) in sampled water compared to WHO drinking water standard revealed 42% above the permissible limit. Calculated Nitrate hazard quotient by ingesting groundwater water showed 14.72 (male), 15.28 (female) and 15.83 (juvenile). These results posed a high risk to the infants/juveniles. The spatial distribution map shows that most of the wells with elevated concentrations fell within the flood plains and rivers at different locations across the basin. Principal component analysis (PCA) reveals anthropogenic sources of nitrate in sampled groundwater. At the same time, the oxygen and deuterium isotopes suggested that the aquifers were recently recharged by runoff and rivers from precipitation influenced by municipal and sewage contamination.. Considering this, periodic inspection of the water supply regarding nitrate concentration to preserve public health is desireable.

Keywords: *Groundwater, Coastal Aquifer, Nitrate pollution Index, Public health and Ingestion*

HYDROGEOCHEMICAL EVALUATION OF SHALLOW AND DEEP-GROUNDWATER QUALITY IN APATA-NNPC: A PETROCHEMICAL PRODUCTS STORAGE FACILITY HOSTING AREA IN IBADAN, SOUTHWEST NIGERIA

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Abstract

In most developing countries like Nigeria, groundwater constitutes major source of water because it is less vulnerable to contamination. This assured safety could be easily compromised in populated environment where dispensing of petroleum-products is common activity. This study aimed at evaluating quality of groundwater in Apata-NNPC area of Ibadan, southwestern Nigeria.

In-situ measurement of physico-chemical parameters such as pH, Temperature and TDS were carried-out on twenty randomly collected Groundwater samples from hand-dug wells and boreholes across the study area. Electrical Conductivity was derived for samples. Atomic Absorption Spectrometer, Flame Photometer, Colometric and Titrimetric methods were used to analyze the concentration of ions in the samples.

The pH measurement revealed samples were slightly alkaline, while TDS and EC readings showed they were good for domestic consumption. Analysis revealed majority of anions, cations and trace elements when compared to the WHO drinking water standards and Nigerian Standard Drinking Water Quality, have values that agree with the recommended limits except for Iron, Manganese, Chloride and Phosphate which had high concentration in few locations. Irrigation parameters showed good water quality except for sodium percentages which revealed few unsuitable water qualities. Gibbs plot revealed 60% of groundwater plotted in the rock water interaction while 40% in the evaporation precipitation dominance.

This observation suggests dissolution of silicate minerals and anthropogenic sources controls the ground water chemistry, water is fairly good in terms of portability and fairly suitable for irrigation. Also, industrial activities have shown limited impact on water quality except in few areas which are close to the depot.

Keywords: Groundwater qualities, Irrigation parameter, rock-water interaction, Colometric and Titrimetric methods

BEYOND THE SURFACE: EXPLORING HIDDEN HEALTH RISKS IN LAGOS SLUMS

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Abstract

This study explains the depths of health risks concealed within the urban landscape of Lagos slums, shedding light on hidden challenges that jeopardize the well-being of residents. Despite the bustling vibrancy of Nigeria's economic hub, Lagos, its sprawling slums harbour myriad health hazards often overlooked by conventional assessments. This study aims to unveil these hidden risks and their implications for public health and urban development. Lagos slums, characterized by overcrowded living conditions, inadequate sanitation, and limited access to healthcare, serve as fertile grounds for the propagation of health threats. From infectious diseases like cholera and tuberculosis to non-communicable ailments such as respiratory illnesses and mental health disorders, residents of these marginalized communities face a myriad of health risks exacerbated by poverty and social exclusion. Moreover, environmental hazards, including contaminated water sources, air pollution, and improper waste management, further compound the health burden in Lagos slums, posing significant challenges to health equity and sustainable development. Vulnerable populations, such as women, children, and the elderly, bear the brunt of these hidden risks, perpetuating cycles of poverty and ill-health. However, amidst these challenges lie opportunities for targeted interventions and community-driven solutions. Empowering local stakeholders, enhancing access to healthcare services, and improving living conditions through infrastructure upgrades and environmental remediation efforts are critical steps toward mitigating hidden health risks in Lagos slums. The findings in this study highlights the imperative of looking beyond the surface to uncover and address the multifaceted health risks entrenched within Lagos' urban fabric. By acknowledging these hidden challenges and adopting a holistic approach to urban health, policymakers, healthcare practitioners, and community leaders can pave the way for healthier, more resilient communities in Lagos slums and beyond.

Keywords: Lagos slums, health risks, urban health, hidden challenges,

INFLUENCE OF SEED PELLETING ON SEED QUALITY OF SPIDER PLANT (*Cleome Gynandra L.*) DURING STORAGE.

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Abstract

African leafy vegetables (ALVs) are highly nutritious and good sources of revenue in Kenya. However, production of these vegetables has been limited by physiological seed dormancy. An experiment was conducted during 2021-22 session to study the influence of seed pelleting on seed quality parameters of cleome gynandra during a storage period of one year. 100 certified seeds were handpicked using forceps as per ISTA protocols, checked for quality parameters after 30 days' intervals. Two formulations of rhizobium (powder and liquid) along with control (unpelleted) were used for experiment. The analysis of variance revealed significant effects of seed pelleting and storage periods on seed germination, seedling length, seedling dry weight, seed vigour index-I and seed vigour index-II. Seeds that were pelleted with liquid formulation of rhizobium gave maximum germination (93.55%), whereas, unpelleted seeds gave minimum germination (91.45%) when germinated on filter paper. However, the germination decreased as the storage period increased. It ranged from 94.42% germination at 0 month to 59.52% at 12 months of storage. The interaction effects on germination due to seed pelleting and storage periods were found to be non-significant at 5% level of significance. Seed vigour index I was found to be maximum (2980.48) when fresh seeds were pelleted with liquid Rhizobium and minimum (2315.58) in unpelleted seeds stored for 12 months. Consequently, this trend was exhibited by seed vigour index II. It was found to be (7451.34) in fresh seeds pelleted with liquid Rhizobium, and (6310.23) in unpelleted seeds stored for 12 months.

Keywords: Cleome gynandra, Seed pelleting, Storage.

ESSENTIAL ELEMENTS HETEROGENEITY IN SOIL AND UPTAKE BY CROPS-ITS IMPLICATION FOR INCREASED NUTRIENT AVAILABILITY IN HUMAN AND ANIMAL FOODS

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Abstract

As human population grows and climates change unpredictably, it is imperative to explore ways to maximize the productivity and nutritional value of plants used as crops. The nutrients are heterogeneous in soils, and this affects plant productivity and uptake - but very little is known about how to manage heterogeneity to maximize productivity and nutritional value of crops. Heterogeneity refers to how lumpy particles are distributed in terrestrial environment. It has been demonstrated that realistic forms of *in situ* heterogeneity modelled in greenhouse pot trials is a significant factor controlling uptake of trace elements in soil, growth, and performance of plants. This can be potentially harnessed in agriculture to enhance the availability of essential nutrients for healthy crop growth, production, and improved yield of food crops and fodder for human and animal consumption respectively. All plants can take up and accumulate essential nutrients in varying amount from the soil for healthy growth and yield. However, some of these essential nutrients are often deficient in some soils, thus resulting in their deficiencies in crops growing in such soils and subsequently in animal and human foods. These are important factors influencing crop yield and productivity. Climate change and global warming are direct consequences of environmental contamination and degradation. Soil potassium (K) is vital for plant growth and its spatial distribution potentially affects crop nutrition and productivity. This study investigated effects of simulated heterogeneous soil K distribution on its uptake by *Talinum triangulare*. Pot trial modelled control (0 mg/kg K added), homogeneous (1000 mg/kg K added), and heterogeneous (simulated realistic heterogeneity) treatments which was maintained in the greenhouse for 60 days after transplanting in the treatments. The shoots and roots were analysed for potassium after acid digest by nitric acid. The mean concentrations of potassium in the root of the control, homogeneous, heterogeneous treatments were 9972±1184 mg/kg, 9526±1299 mg/kg and 10854.7±147 mg/kg respectively, while the shoot potassium concentration were 11864±162 mg/kg, 12069±184 mg/kg and 11967±268 mg/kg respectively. However, the root K concentration in the heterogeneous treatment was 0.088 times as high as the control and 0.139 times as high as the homogeneous. Conversely, the homogeneous shoot K concentration was 0.017was 0.017 times as high as the control and 0.009 times as high as than the heterogeneous. The shoot K concentration was higher than the root. This suggest that *T.triangulare* would trans-locate potassium from the root to the shoot by almost 90%. The Concentration factors for the control, homogeneous, and heterogeneous conditions were

differences (p>0.05) between treatments. Overall, simulated heterogeneity did not substantially affect K nutrition and growth of *T. triangulare* within experimental constraints. Furthermore, long-term field studies are recommended to elucidate heterogeneity influences over crop cycles. The findings provide baseline insights on K uptake by *T. triangulare* under variable nutrient conditions. This   ongoing study has implications improving essential and trace nutrients in food crops.

Keyword: Potassium, Heterogeneity, Climate change, Simulation, Agriculture S

WATER QUALITY ASSESSMENT IN KIFISSOS RIVER, GREECE

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Abstract

This research focused on the assessment of water pollution in the Northern part of the Kifissos River, in Attica, Greece. By studying the main flow of the river, water and soil samples were taken from 10 locations and analyzed based on standard methods. Soil was alkaline with a pH above 7.7 at most locations. For water samples, dissolved oxygen ranged from 7.80 to 10.1 mg/L, turbidity ranged from 2.43 to 10.9 NTU, total dissolved solids ranged from 424 to 668 mg/L, conductivity ranged from 606 to 954 µS/cm, nitrate ion concentrations ranged from 17.3 to 101 mg/L, phosphate from 0.06 to 1.31 mg/L, pH from 7.72 to 8.32, ammonia from 0.34 to 1.39 mg/L, hexavalent chromium ranged from 0.01 to 0.06 mg/L, biochemical oxygen demand was below 4 mg/L and nitrite ions concentration was in the range of 0.05 to 0.98 mg/L. Overall water quality was determined using an adapted calculation of the National Sanitation Foundation Water Quality Index (WQI). Results indicated fairly polluted surface water throughout the study area. Location "Agia Sotira", where farming and residential activities were observed, was most polluted with a WQI = 44, corresponding to "bad" water quality, while "Acharnes" was found to be the least polluted region with WQI = 60, corresponding to "medium" water quality. Ongoing monitoring of surface water quality is necessary to assess the impact of pressures on the aquatic ecosystems and evaluate the effectiveness of water policies and legislation.

Keywords: Water Quality Index (WQI), Environmental pollution, Kifissos River, National Sanitation Foundation

HEAVY METAL CONCENTRATION AND DISTRIBUTION IN SOILS AROUND ARTISANAL WORKSHOPS IN AGO-IWOYE, SOUTHWESTERN NIGERIA

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Abstract

Anthropogenic activities, including those carried out by artisans, have been confirmed to be one of the various means by which heavy metals are introduced into the soil. This study aims to determine the heavy metal concentration and distribution in soils around artisanal workshops in Ago-Iwoye, southwestern Nigeria. 20 soil samples comprising ten (10) samples from soil around auto-mechanic workshops, six (6) from soils around vulcanizer workshops and four (4) from soils around welder workshops were collected analyzed for elemental concentration using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Elemental analysis revealed the following trend for selected metals in auto-mechanic, vulcanizing and welding workshops respectively: Ba 60-100, 100-200 and 130-590 ppm; Co 10-47, 8-19 and 15-37 ppm; Cr 29-161, 22-95 and 57-272 ppm; Cu 28-123, 16-100 and 88-486 ppm; Ni 11-33, 7-29 and 34-112 ppm; Pb 17-75, 12-77 and 36-677 ppm; Sc 2-16, 1-7 and 2-8 ppm; Sr 13-55, 17-72 and 33-91 ppm; V 35-212, 20-117 and 40-103 ppm and Zn 82-684, 70-548 and 314-3240 ppm. Geochemical assessment using metal ratio, contamination factor, and geo-accumulation index, revealed that the artisanal workshops exhibited significant contamination levels for metals such as Ba, Cu, Ni, Pb, Sr, and Zn. The contamination level varied across the artisan workshops with soils around welders' workshops showing highest contamination index. Furthermore, the Pollution Load Index (PLI) indicated a decline in soil quality across all artisanal workshops. The Quantification of Contamination (QoC) further substantiated that the soil contamination in these workshops can be attributed to anthropogenic sources.

Keywords: Heavy metal, Artisans, Pollution Index

A GLOBAL REVIEW OF LEVEL OF LAMBDA CYHALOTHRIN IN AQUATIC SYSTEMS AND ALONG THE FOOD CHAIN.

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Abstract

Toxicants are substances that have either been banned or restricted for years or even decades, but due to their persistence, some traces can still be found extensively in the environment. The review at hand has focused on lambda cyhalothrin an insecticide and a persistent organic pollutant that is higher in fish as compared to other foods. Lambda cyhalothrin is a pyrethroid insecticide and pyrethroids are synthetic chemical analogues of pyrethrins, which are naturally occurring insecticidal compounds produced in the flowers of chrysanthemums (*Chrysanthemum cinerariaefolium*). The present review has focused on reviewing the levels of lambda cyhalothrin from polluted water sources and aflatoxin from feeds in aquaculture to ascertain the various levels globally. The uptake of POPs in the marine environment can be either through the skin, the respiratory system or by dietary absorption.

Analytical method GRM043.09A was used for the determination of lambda-cyhalothrin from the review data collected. A desk top review was conducted from journals, books and webpages to compare the various levels of the chemical for comparison purposes globally.

Residues have been spotted in runoff resulting from agricultural, public health, and residential applications. For example, lambda cyhalothrin was detected in water at 0.110.14 g/L from agricultural watersheds in Stanislaus County, California. Lambda cyhalothrin residues were also detected in sediments obtained from sites sampled in Imperial, Monterey, Stanislaus, and Placer Counties. Residues in sediment ranged from 0.003 to 0.315 g/g of dry weight (Starner, 2007). In a study conducted in Kenya, residue levels ranging from below detection limit (BDL)-0.44 µg/l in river Nzoia water, between BDL-0.34 µg/l in river Sio water, BDL-0.26 µg/l in water from Sio Port, and between BDL-0.31 µg/l in water from Lake Victoria at Marenga Beach were detected.

Lambda Cyhalothrin has been detected to significantly dangerous levels in water bodies globally and hence stringent measures be put in place to prevent water pollution.

IN SEARCH OF A CONSENSUS METHOD FOR THE ISOLATION OF MICROPLASTICS FROM FRESHWATER SEDIMENTS

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Abstract

Due to the rise in use and disposal of microplastics (MPs), their quantification in aquatic systems is vital. Several analytical approaches have been employed for the isolation of MPs from freshwater sediments based on density separation followed by digestion of naturally occurring organic matter. However, there is a lack of consensus in these methods.

In this work, a sediment matrix was simulated using sand and peat with addition of virgin polyamide (PA), polyethylene terephthalate (PET), polypropylene (PP), polystyrene (PS), polytetrafluoroethylene (PTFE), and polyvinyl fluoride (PVF) microplastics. Comparative flotation experiments were conducted on (a) similar-sized MPs of different types and (b) three size fractions (<1 mm, 1-2 mm and >2 mm) of the same plastic, using aqueous solutions of NaCl, $CaCl_2$, $ZnCl_2$ and NaI. Organic matter removal efficiency was compared for HNO_3, NaOH and Fenton's reagent.

Only NaI solution resulted in 100 % flotation of all types of MPs. However, $CaCl_2$ recovered all but PVF and PTFE, and is considerably cheaper. Different flotation patterns were observed for different size fractions of the same plastic in all solutions with isolated MPs ranging from 4-80 % of experimental samples. Digestion efficiencies ranged from 6-78 % in HNO_3, 4-45 % in NaOH, and 49-80 % in Fenton's reagent, with temperature and time noted to affect efficiency. In conclusion, $CaCl_2$ is recommended for isolation of MPs from sediments in future studies. Also, Fenton's reagent was recommended for organic matter removal at the optimized conditions of 30? for 360 mins, or at ambient temperature for 24 h digestion period.

THE INTERPLAY OF URBANIZATION AND ENVIRONMENTAL QUALITY: TRENDS, CHALLENGES, AND OPPORTUNITIES

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Abstract

Urbanization, a global phenomenon, has profound implications for environmental quality, presenting a complex interplay of trends, challenges, and opportunities. This study probes into the multifaceted relationship between urbanization and environmental quality, aiming to explain key dynamics and avenues for sustainable development. As urban populations continue to surge, cities serve as epicentres of economic growth and cultural exchange, driving unprecedented urban expansion. However, rapid urbanization poses significant challenges to environmental quality, including air and water pollution, loss of green spaces, and biodiversity decline. Such challenges are compounded by inadequate infrastructure, inefficient resource management, and socio-economic disparities inherent in urban landscapes. Nevertheless, amidst these challenges lie opportunities for innovative solutions and transformative change. Sustainable urban planning approaches, such as compact city designs, green infrastructure integration, and circular economy principles, offer pathways to mitigate environmental degradation while promoting inclusive development. Technological advancements, including smart city solutions, renewable energy integration, and data-driven environmental monitoring, hold promise for enhancing urban environmental quality and resilience. Moreover, fostering community engagement, promoting green lifestyles, and investing in environmental education are critical for nurturing a culture of environmental stewardship within urban communities. Embracing nature-based solutions, such as urban reforestation, green roof initiatives, and wetland restoration, can further enhance urban biodiversity and ecosystem services. This study addresses the urgency of addressing the interplay between urbanization and environmental quality to ensure sustainable urban futures. By recognizing emerging trends, confronting existing challenges, and capitalizing on innovative opportunities, cities can chart a course towards resilient, inclusive, and environmentally sustainable urban environments.

Keywords: Environmental Quality, Sustainable Development, Green Infrastructure, Smart Cities

HEALTH IMPACT OF HEAVY METAL CONTAMINATION IN SOILS AND GROUNDWATER AROUND CEMENT FACTORY IN SAGAMU

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Abstract

This study assessed the distribution of heavy metals in ground water and soils and their likely health implications. Ten samples were collected (seven well and boreholes waters and three soil samples). These were analyzed with inductively coupled plasma mass spectrometry (ICP-MS) method and the results is interpreted with Geo-Accumulation Index (Igeo), Contamination factor (C_f), Contamination degree (C_d), Quantification of contamination (QoC) and Hazard Index (HI).

The concentration of metals in groundwater samples for Cd, As, Cr, Pb, Zn, Fe, Mn, Ni is 0.0001 - 0.004ppm, 0.00007 - 0.0011ppm, 0.005 - 0.01ppm, 0.0003 - 0.046ppm, 0.0204 - 0.26ppm, 0.000005 - 0.013ppm, 0.0009 - 2.5ppm and 0.001 - 0.03ppm respectively while for soil samples Cd 0.036 - 0.96ppm, As 3.3 - 10.45ppm, Cr 95.7 - 127.5ppm, Pb 28.7 - 57ppm, Zn 45 - 539ppm, Mn 166 - 873ppm and Ni 12.5 - 45.7ppm respectively. The Igeo and Cf used for groundwater revealed water with low degree contamination while soil is highly contaminated signifying inputs from effluents discharges from the industries within the study area. The QoC value in groundwater show negative values between -60000 to 234 indicating contamination from geological processes which specify mineralized water while the soil positive QoC values (-279.73 to 87191.18) specify anthropogenic inputs. The total hazard index (HI >1) in groundwater samples showed children and adult are at low risk of non-carcinogenic health problems while HI of soils indicates children and adult were seriously at high risk of chronic non-carcinogenic health problems revealing HI values of Cr-1.61 and Cr-15.01 for both adult and children respectively.

Sagamu cement factory groundwater was contaminated with Pb and Mn thereby reducing the quality. Moreover, the soils were contaminated with Cr-3.64, As-5.23, Pb3.35 and Zn-10.37 because exposure through inhalation and ingestion can cause adverse health effects.

Keywords: heavy metal, cement factory, contamination, health impact, Sagamu

GEOCHEMICAL ENRICHMENT AND HEALTH RISKS OF THALLIUM IN WEATHERED GRANITE SOILS OF SOUTH CHINA

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Abstract

Thallium (Tl) is a toxic metal element not essential to animal and plant organisms. The weathering of granite in South China forms a high geological background of soil Tl, yet its geochemical enrichment mechanism and environmental impact remain unclear. This study focuses on the weathered soils of Triassic and Jurassic granites in South China to explore the supergene enrichment mechanism of Tl, as well as its ecological and potential health risks. It was found that the supergene enrichment of Tl during the in-situ weathering process of granite is closely related to the rapid decomposition of potassium feldspar into illite and is also promoted by the adsorption/fixation action of iron-manganese oxides. The ecological and health risks of Tl in weathered granite soils are mainly influenced by the distribution of Tl, K, and P in the soil. The differences in the distribution of Tl, potassium, and phosphorus in the soil are constrained by the chemical composition of weathered granite soils from two different periods. The ecological risk caused by the accumulation of Tl in crops is significant. A safe usage threshold for Tl in cultivated land is proposed at 1.45 mg/kg, providing a scientific basis for setting soil Tl quality standards in high geological background areas and for the management of Tl-contaminated soils.

Keywords: Thallium; Geochemical enrichment; Soil; Health risk

THALLIUM IN GEOLOGICCAL MEDIA AROUND MINING SITES IN NIGERIA: ARE THERE POTENTIAL ECOLOGICAL AND HEALTH RISKS INVOLVED?

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Abstract

Thallium (Tl) presence in environmental matrices represents a significant hazard to both ecosystems and human well-being. This investigation aimed to ascertain the extent of contamination, toxicity, and associated ecological and health risks attributable to thallium across diverse environmental compartments surrounding specified mining locales. The findings indicate that the mean concentrations (expressed in micrograms per gram, μg/g) of Tl in tailings, rocks, groundwater, surface water, and mine water within the Anka area were 7.89, 8.82, 0.04, 0.006, and 0.048, respectively. Similarly, in the Ijero area, the corresponding mean concentrations of Tl in these media were 9.78, 18.99, 0.004, 0.003, and 0.03, respectively. Elevated Tl levels observed across these media primarily emanate from artisanal mining and the processing of gold (Au), lead (Pb), zinc (Zn), and pegmatite-associated minerals. The single factor pollution index surpassed unity, indicating contamination of tailings and water sources, whereas soils and sediments exhibited negligible contamination by Tl. Notably, Tl exhibited heightened bioavailability in local flora, with Tl levels in plants exceeding established regulatory thresholds. Moreover, daily Tl intake surpassed recommended limits, engendering low to very high ecological risks. Importantly, the health risk index (HRI) revealed a significant potential for adverse health outcomes attributable to Tl-contaminated food crops and vegetables, particularly among younger demographics. Considering these findings, heightened scrutiny of Tl-related research endeavours is advocated, concurrently with concerted national endeavours aimed at mitigating the ramifications of illicit mining activities.

TRACE ELEMENT CONCENTRATIONS IN SURFACE WATER, AND ITS POTENTIAL HEALTH IMPLICATIONS: A CASE STUDY OF ISHIAGU, SOUTH EASTERN NIGERIA.

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Abstract

This study on surface water was carried out in Amaeze pond, Amaeze quarry, Amagu, Amokwe and Ihie communities in Ishiagu, south-eastern Nigeria. The study aims to evaluate the concentration of trace elements in surface water in that area due to the presence of geologic materials, with a focus on the potential health implications associated with human exposure to trace metals from mining activities in that region via inhalation and ingestion. Surface water samples were collected in one litre quantity from ponds, farmlands, and active quarries with ongoing mining activities for analyses using Atomic Absorption Spectrometry (AAS). Trace elements reported in the samples have mean concentrations ranges in: Ni 0.01 - 0.14mg/L, Zn 0.01 - 0.043mg/L, Co 0.01 - 0.012mg/L, V -1.16 - 0.2mg/L, Se -0.03 - 0.21mg/L, and Cr 0.01 - 0.032mg/L, Cu 0.01 - 0.11mg/L, Pb 0.00 - -0.01mg/L, Cd 0.001- 0.004mg/L, As 0.43 0.67mg/L, and Sb -0.25 2.36mg/L. From the results, essential trace elements (Ni, Zn, Co, V, Cr) present in surface water samples are below the recommended threshold of trace elements in surface water, but Se exceeded the threshold. Toxic elements such as Cu, Pb, and Cd are below the permissible limit but Cd, As and Sb exceeded the threshold. Long term exposure to trace elements in surface water in this region is by irrigation farming, washing, and bathing. The potential health implications associated with long-term exposure to trace elements Se, Cd, As and Sb toxicity include neurological anomalies, myocardial damage and gastrointestinal irritation, high blood pressure, rapid heart rate, and developmental effects in young children.

GEOCHEMICAL ANOMALIES AND SECONDARY MINERALISATION AS POTENTIAL INSTIGATORS OF NATURAL HEALTH HAZARDS: PERSPECTIVE FOR A REGIONAL APPRAISAL IN NIGERIA

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Abstract

Geochemical anomalous zones which are areas of unusual excess or preferred concentration of certain elements or minerals are not only significant in terms of economic appraisal of mineral deposits but are also significant in terms of their effect on the terrestrial environment and the natural balances in the local ecosystem. These, which express themselves as lithogeochemical anomalies - rocks, ore bodies, hydrogeochemical anomalies - surface and underground waters; and induced anomalies - abandoned prospect pits, mines and dumps in Nigeria, are presented to be interrelated and interdependent as possible sources and/or instigators of natural non communicable diseases. A direct relationship is thus established in the study between anomalous elemental accumulation in the rocks, ore bodies and soils and the quality of streams, underground water plants and animals flowing or situated in such environments since they are the final beneficiaries of such environment.

On the basis of the distribution and occurrence of primary lithogeochemical anomalous zones, potential pollution and hazardous zones have been demarcated to serve as a basis for a regional appraisal of potential health effects They include base/Heavy metal Pb -Zn, Cu, Hg, As, Au and associated disease zones mostly within the central east and west far northwest and south west, an induced rare metal Sn, Ta, Nb, W, Li, zones, fluorine, (Fluorosis), in the central area, water hardness disease instigator in the $CaCO_3$ (Limestone/Dolomitic areas of the Sedimentary basins of the West , Northwest, south east, south west and Benue aulacogen and Sn (north central, south west); Ba (south east); $Fe/P_2O_5/CO_3$ (north west); U, Th, (east central north west) Fe (confluence region, north west); Hydrocarbon zones (HC) (south central south east); The associated possible regional trend of associated diseases in these zones are also discussed in the paper. Bearing in mind also that processes meant to remove or neutralize the effects of these hazardous elements in the soils ,waters and plants and disease controls as it affects man and animals is still very much limited, a multi-disciplinary approach towards the understanding and study of the problem is suggested. the problem is suggested.

POTENTIALLY TOXIC METAL POLLUTION PREVENTION AND ENVIRONMENTAL SUSTAINABILITY OF WATER, SOILS AND STREAM SEDIMENTS IN SOUTHWESTERN NIGERIA

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Abstract

Increased anthropogenic activities associated with poor waste management causes release of potentially toxic metals into the environment. This has become a major public health concern due to little or no pollution prevention method and ability to sustain a clean environment. The study was therefore aimed at assessing ways by which pollution can be prevented with enhanced environmental sustainability in Ibadan, Southwestern, Nigeria. Groundwater (12), soil (9) and stream sediments (4) were randomly collected 5 m away from the various locationswithin the metropolis. Physical parameters (pH, Ec, TDS) was collected in-situ, while major and trace metals were analysed using inductively coupled plasma- mass spectrometry at the Acme Analytical Laboratories, Canada. Results of the physical parameters and heavy metals (Fe, Zn, Cu, Pb, As,and Cd) concentration in water were compared with WHO permissible limits. Risk index evaluation was done on soil and stream sediment to assess the impact of this metal on public health. Mean parameters of the elements in groundwater were within WHO permissible limit with the exception of TDS (624.35). Migration of elements were observed from stream sediment (Cu; 79.75; Pb; 93.25; Zn; 379.00) to soil (Cu; 50.28; Pb; 333.89; Zn; 770.78) with all metal concentration above the average crustal value. Elevated mean metal concentraion in soil and stream sediment were attributed to improper disposal of wastes disposal. Risk index showed dangerous to extremely dangerous. Evidence of high TDS revealed high level of organic matter and indiscriminate disposal of dumps. High Cd, Zn and Pb observed in stream sediment and soil could be due to anthropogenic activityin the study area. Organization of enlightenment program to conserve the environment; provision of adequate disposal facilities, thus sustaining the environment and public health of the study area should be effected.

Keywords: Environmental, Sustainability, Hazardous elements, Pollution Prevention

NON-CARCINOGENIC HEALTH RISK ASSESSMENT OF FLUORIDE AND NITRATE CONTAMINATION OF GROUNDWATER OF KALTUNGO AREA, GOMBE NORTHEAST NIGERIA.

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Abstract

Groundwater has remained the main available source of water supply to most population around the world as most of the surface water sources are consistently depleting due to the devastating effects of global warming. Another important attribute of groundwater is its quality that is not easily contaminated but when it becomes contaminated the health risk associated with it is always high. The present study assessed the non-carcinogenic health risk on inhabitants of Kaltungo area with a view of exposing the level of potential risk associated with continuous consumption of groundwater with high content of fluoride and nitrate. Eighty-two groundwater samples were collected from fifty boreholes and thirty-two hand dug wells and analyzed for fluoride, nitrate and other physico- chemical parameters. The results show that the groundwater chemistry is dominated by Ca^{2+}, Mg^{2+}, K^+ and Na^+ and HCO_3^-, Cl^-, NO_3^- SO_4^{2-} and F^- with mean concentrations of 59.50mg/l ,37.69mg/l ,6.98mg/l, and 3.48mg/l, for cations respectively and 341.72mg/l ,51.94mg/l, 59.18mg/l 22.62mg/l and 1.70 mg/l respectively for anions. The physical parameters of pH, EC, TDS and TH gave mean values in the range of 8.07, 371.31 µs/cm, 249.44mg/l and 303.28mg/l respectively. All other parameters are within the permissible limits of WHO and NSDWQ but for fluoride and nitrate whose permissible limits of 1.5mg/l and 50mg/l respectively have been exceeded in 89% and 81.7% of the groundwater sources. A total of one hundred and ninety- three inhabitants including 111 children of 0-18years and 82 adults of above 18years were surveyed for daily water intake (CDI) through drinking, average body weight BW) and exposure duration (ED) to the two non-carcinogenic fluoride and nitrate to determine potential hazard risk index. The results were computed using the USEPA model which prescribes that a hazard quotient index of above 1 indicates high risk and less than 1 means no risk of ingestion of the substance. The computed results from this study revealed that the mean risk index from fluoride for children is 2.13 and 1.75 for adults. The nitrate risk index also shows that children reported a mean value of 1.96 and 1.53 for adults. In all, the results of the percent risk index for the two parameters maintain a consistently higher values for children (98.2%) than the adults (79.3%). This high vulnerability of children to this hazard risk may be probably due to their average moderate body weight which subject them to higher daily intake of water. Another deduction from the results is that areas with high risk index for fluoride corresponded with low risk for nitrate for both children and adults which may also be a pointer to their perceived divergent geochemical origin. The study therefore recommends for alternative sources of water for the consuming public especially for children.

Key words: non-carcinogenic, health risk, assessment, fluoride and nitrate, groundwater contamination and Kaltungo

MICROBIAL ASSEMBLAGE AND ECOLOGICAL FUNCTION OF PLANT ASSOCIATED MICROBIOMES ACROSS PLANT NICHES UUDER CADMIUM STRESS

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Abstract

The assemblies of plant associated microbiomes throughout the plant host's lifecycle are hypothesized to furnish a resilient reservoir of ecological functions for plant growth performance under environmental stresses. Metal(loid) hyperaccumulators exhibit distinctive adaptive capabilities in comparison to non-hyperaccumulators when faced elevated metal(loid) concentrations. Nevertheless, comprehensive understanding of the assembly of microbiomes associated with hyperaccumulators and their roles on the plant growth as plant grows remains limited. Employing cadmium hyperaccumulator of Sedum alfredii, our study investigated the dynamic changes in microbial assemblage and ecological functions across plant growth stages at each plant niche. We demonstrated that microbial assemblage dynamically changes across plant growth stages within each corresponding plant niche by changing its abundance and species. Furthermore, we found that the leaf endosphere, root endosphere, and rhizosphere harbors more stable networks in the seedling, transition, and mature stage, respectively, than that of other two growth stages within each corresponding plant niche. Notably, we revealed a significant correlation between the relative abundance of keystone taxa and plant root length and fresh weight across plant growth stages. This study provides new insights into how the assemblies of plant associated microbiomes throughout the plant host's lifecycle contribute to the fitness of its host.

SEED-MEDIATED GROWTH OF SCHWERTMANNITE FOR APPLICATION IN ACID MINE DRAINAGE TREATMENT

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Abstract

The biomineralization-driven formation of schwertmannite is an environmentally friendly strategy for Acid Mine Drainage (AMD) treatment. In this study, a targeted approach using seed-mediated growth of schwertmannite was proposed. The biomineralization time was successfully shortened by one-third compared to biomineralization without seed mediation. In addition, the seed-mediated schwertmannite (S-Sch) exhibited superior adsorption performance towards As(V) and slightly improved adsorption of Cr(VI) than a non-seed-mediated schwertmannite sample (Sch). Furthermore, the whiskers that create the typical pincushion structure grew directly on the surface of the seed during the growth process with S-Sch, whereas biomineralization of Sch needed to nucleate crystals before growing the whiskers. More whiskers were found on S-Sch than on Sch, and the whiskers were arranged loosely on S-Sch while they were packed tightly on Sch. Following adsorption, As(V) is enriched at the whisker sites, where substantial >Fe-OH/OH2 existed, thereby inhibiting subsequent sulfate exchange at inner sites, the open structure of S-Sch decreases this passivation and allows continuous sulfate exchange. Cr(VI) adsorption is mainly due to sulfate exchange with little >Fe-OH/OH2 involved. Cr(VI) was distributed evenly on the surface of S-Sch, but an open mineral structure allows more inner sites to be reached, explaining the slightly better performance of S-Sch. The results suggest that the method proposed in this paper could be an effective way to shorten the biomineralization time and provide schwertmannite with excellent performance for the removal of As(V) and Cr(VI), which could lead to practical applications of biomineralization in the treatment of AMD.

Keywords: Acid mine drainage; Schwertmannite; Biomineralization; Seed-mediated

THE ENVIRONMENTAL GEOCHEMISTRY OF PIT LAKES IN ENYIGBA AND ENVIRONS, ABAKALIKI MINE DISTRICT, SOUTHEASTERN NIGERIA

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Abstract

Pit lakes in Nigeria have been created because of mining activities in various regions, due to the economic implications of backfilling and insufficient monitoring and enforcement of laws regarding land-mine reclamation. The geochemical and physical processes occurring in the Enyigba pit lakes and surrounding areas were analyzed for potential toxicity and distribution patterns of heavy metals present. Solution, suspension and bottom sediment samples from each pit lake were analyzed for pH, EC, TDS, major cations (Na^+, Ca^{2+}, K^+ and Mg^{2+}), major anions (Cl^-, SO_4^{2-}, PO_4^{2-}, $CaCO_3^-$ and HCO_3) and heavy metals (Pb, Cu, Ni, Zn, Mn, Fe, Cd and As) using Atomic Absorption Spectrophotometer (AAS). The results show that the pit lakes are highly acidic, with a pH range of 3.73 to 5.37, an EC range of 0.49 scm^{-1} to 1.43scm^{-1} and TDS of 84.43mg/l to 202.6mg/l. The heavy metal analysis of the lakes revealed the following ranges: Mn,0.155 mg/l -0.1756mg/l; Fe^{3+},0.268mg/l-1.206mg/l; Cu,0-0.00003mg/l; Zn,0.0025mg/l0.0054mg/l; As,0.0021mg/l-0.0050mg/l; Cd,0.0002 mg/l -0.00048mg/l; Ni,0.004 mg/l -0.0033mg/l; Cr,0.002 mg/l -0.000047mg/l; and Pb,0.004 mg/l -0.0067mg/l;. The pH values of the pit lakes range from 5.4-6.5, while the TDS varies between 76.4-181.6mg/l. The heavy metal values for Mn,0.0009 mg/l -0.2mg/l; Fe^{3+},0.0002 mg/l-0.3mg/l; Zn,0.0003 mg/l-0.0012mg/l; Pb,0.0003 mg/l -0.0017mg/l; and As,0.0002 mg/l-0.0012 mg/l; are higher than the acceptable limit due to AMD in the area. This is particularly evident in the pit lakes with acidic pH values compared to the hand dug wells. The results suggest a potential interaction between the pit lakes and the ground water, which could lead to ground water pollution vis-à-vis, the hand dug wells if the system is not regulated. Consequently, the continuous practice of abandonment of mines in the area may result in the poisoning of both animals and humans in the mine district. Therefore, it is imperative to monitor the pit lakes, undertake remediation and reclamation measures, so as to prevent the spread of heavy metal pollution to the surrounding areas and water bodies.

Keywords: Pit lakes, Reclamation, Heavy metals, Pollution, Acid Mine Drainage

ASSESSMENT OF HEAVY METAL CONTAMINATION IN GROUNDWATER FROM COMMUNITIES WITH COMPROMISED PETROLEUM PIPELINE IN LAGOS STATE, NIGERIA.

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Abstract

The heavy metals (Al, Fe, Zn, Mn, Pb, As, Ba, Cr, Ni, Cu, Cd, Hg) concentrations of thirty (30) groundwater samples from communities (Baruwa, Ijegun, Ijedodo and Ejigbo) surrounding compromised petroleum pipelines in Lagos State were determined using Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) analysis. Metal Index (MI) as well as the human health risk for 3 body weights groups (A:14.5kg, B:27.5kg and C:70kg) were derived to assess the impact of the water quality. The range concentration of the determined elements are: Al (0.017-57.665) > As (0.001-0.064) > Ba (0-0.061) > Cr (0-0.123) > Cu (0-0.073) > Fe (0.013-20.796) > Mn (0.005-1.08) > Ni (0-0.02) > Pb (0.001-0.129) > Zn (0-0.933) > Cd (0-0.024) > Hg (0-0.008). Concentrations of Pb (86%), As (68%), Fe (53%), Cd (16%), Mn (6.25%) and Hg (6.25%) in the wells were observed to be above the WHO permissible limit set for drinking water standard. The MI values of groundwater from the wells showed they all exhibited some degree of heavy metal pollution, with pollution levels showing 7% of the wells were slightly affected, 13% moderately affected, 30% strongly affected and 50% were observed to be seriously affected by metal pollution. The hazard quotient (HQ) for Group B (majority children) ranged between 0.000161 and 0.003365 suggesting a low risk of non-carcinogenic effect. However, the Hazard Index (HI) derived showed significant possibility of adverse effect (1 < HI = 10) in majority of the wells except for B1, B2 and E5 which are likely to pose serious health risk (HI > 10). The lifetime cancer risk (LCR) for dietary ingestion ranged between 0.01 and 0.09 suggesting significant carcinogenic risks.

THE PURIFICATION OF ACID MINE DRAINAGE THROUGH THE FORMATION OF SCHWERTMANNITE WITH FE(0) REDUCTION AND ALKALI-REGULATED BIOMINERALIZATION PRIOR TO LIME NEUTRALIZATION

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Abstract

Acid mine drainage (AMD) contains abundant Fe(II), Fe(III), and SO42-, as well as a large amount of dissolved toxic metals and metalloids, posing a serious threat to the environment. In this study, an integrated technique for the treatment of AMD was proposed. The technique started with pre-oxidation followed by Fe(0) reduction and alkali-regulated biomineralization and then ended with lime neutralization. The technique removed toxic metal oxyanions in the pre-oxidation stage and recovered pure schwertmannite during the subsequent alkali-regulated biomineralization. Fe(III), which could not be directly biomineralized, was reduced to Fe(II) by Fe(0). A small amount of alkali was added to regulate the hydrolytic mineralization reaction after Fe(II) oxidation in AMD, which in a single biomineralization could remove in the form of schwertmannite more than 95% of soluble Fe in the AMD. In the subsequent lime neutralization process, the amount of lime required and the sludge produced were reduced by 75.4% and 84.9%, respectively, compared to the raw AMD. Additionally, the content of non-ferrous metals in the sludge increased 5.6-fold. Compared with non-alkali-regulated biomineralization, the schwertmannite obtained by the alkali-regulated biomineralization had a higher adsorption capacity for oxyanions (e.g., arsenic, chromium, and antimony). The new approach should significantly reduce the treatment cost of AMD and recover Fe and S elements in the form of valuable secondary minerals, such that it is reasonable to expect that it will be widely adopted in practical applications.

Keywords: Acid mine drainage; Schwertmannite; Biomineralization; Alkali regulation

HEAVY METAL CONCENTRATION AND UPTAKE OF JATROPHA CURCAS. L. GROWN IN ABUJA, FEDERAL CAPITAL TERRITORY, NIGERIA.

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Abstract

This study determined the heavy metal concentration and uptake of *Jatropha curcas L*. Plants were harvested from the outskirt of Iddo area of Abuja along with the contiguous soil. The soil, root, and shoot samples were analyzed for metal concentrations using Atomic Absorption Spectrometer (AAS) Perkin Elmer 400 after nitric acid digestion. The mean soil metal concentrations were Fe, 13.36 Cd, 0.90 Co, 0.34 Mn, 4.11 Cu, 1.74 Ni, 1.19 Zn, 529.42 Pb, 0.58 all in mg/kg while mean root metal concentrations of the plant were Fe, 3.18 Cd, 0.90 Co, 0.28 Mn, 1.60 Cu, 0.31 Ni, 0.78 Zn, 10.9 Pb, 0.34 all in mg/kg. Similarly, the mean shoot metal concentrations were Fe, 0.83 Cd, 0.10 Co, 0.22 Mn, 1.0 Cu, 0.13 Ni, 1.04 Zn, 9.30 Pb, 0.35 all in mg/kg. Zinc had the highest mean soil, root and shoot concentration followed by Mn and Fe. Zinc concentration was 5 to 8 times as high as the concentration of other elements in the soil, root, and shoot. There was a statistically significant difference ($p<0.05$) in the soil, shoot and root metal concentrations. Metals' contamination factors (CF) ranged from 0.1 to 0.5 with lead, nickel and cobalt being 50% higher than the other metals and translocation factor (TF) were relatively similar but slightly higher in iron, cobalt, nickel, zinc and lead. This indicates plant's tendencies of better uptake of potentially toxic elements. There was a weak relationship ($r = 0.329$) between the concentration factor and soil concentration accounting for about 30% of the experimental variance. This implied other factors that may be responsible for the way and quantity of metals that can be taken up from the soil by this plant. The percentage of metals removed by plants from the soil showed that about 1-5% of all metals were taken up by *the* plants to the shoot and roots of the plants. The study established that *Jatropha curcas L* may not be an excellent candidate for phytoremediation but possess metal accumulating potential that can be explored genetically produce a hyperaccumulating variety for use in phytoremediation.

Keywords: *Jatropha curcas,* Concentration Factors, Phytoremediation, Heavy metals, Accumulation

ASSESSMENT OF CONTAMINATION, HEALTH RISK AND BIO-ACCESSIBILITY OF POTENTIALLY TOXIC ELEMENTS (PTES) IN THE SOIL OF ARTISANAL GOLD MINE SITES IN NORTH CENTRAL NIGERIA.

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Abstract

The research investigated the contamination, health risk and bioaccessibility of ten Harmful Elements (HEs) within the soil of small-scale gold mining and processing sites in Minna, North-Central Nigeria. Geochemical analysis of thirty-three soil samples was conducted using Inductively Coupled Plasma Mass Spectrometry (ICPMS) method. Harmful elements (HEs) in the soil which include Cu, Pb, Zn, Ni, Fe, As, Mn, U, Cr and Cd varied in ppm from 12.24 - 1387.66, 9.21-22595, 20.78-1068.05, 3.49-76.40, 13797.20 - 106242.50, 1.0 - 3659.04, 257.21-1850.36, 0.93 - 10.01, 8.65 - 121.57 and 0.03-11.83 respectively. The concentration of HEs was above upper crustal continental value (UCC) and China standards recommended for agricultural soil in most of the samples. The contamination degree and potential ecological risk ranged between 5.1 to 2224.8 and 34.44 to 35110.34 which indicated low to very high degree of contamination and low to very high potential risk posed by HEs in soil respectively. The health risk index (HI) calculated for non-carcinogenic varied between 3.44 - 327.4 and 0.59 - 68.99 for child and adult respectively with most values greater than safe level of 1. Pb, Cd, Cr and As also posed a low to moderate carcinogenic risk in the soil. Pb and As contributed >70% to the health risk and highest exposure routes was from ingestion. The results of bioaccessible fraction (BAF), as the proportion of HEs which are bioaccessible in the stomach or gastrointestinal tract from the sample matrix showed that Mn, Cu, Zn, Pb and Cd were within very high bioaccessibilty factor, Arsenic showed high bioaccessibilty factor, Cr, Ni, and U showed intermediate bioaccessibilty factor while Fe showed low bioaccessibility factor. Bioaccessibility hazard quotient (BHQ) for most HEs was also above safe value of 1. This showed that all the HEs investigated are bioaccessible and could cause both carcinogenic and non-carcinogenic health risks to residents with a higher risk in child than in adult.

Keywords: Bioaccessibility, Cancer, Gold, Health Risk, Mining

OPPORTUNITIES AND PLATFORMS FOR MEDICAL GEOLOGY TRAINING IN AFRICA: THE JOSE CENTENO INTERNATIONAL CENTER FOR MEDICAL GEOLOGY RESEARCH, NASARAWA STATE UNIVERSITY, KEFFI, NIGERIA

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Abstract

The NSUK Jose A Centeno International Medical Geology (JACMEDGEO) Center was formally established in May 2020 to provide a research and training center for students, researcher scientists and professors with a wide range of backgrounds and perspectives in geoscience, environmental health, public health and medical geology. The Center is aimed at bringing together participants from the academic community, state and local government, industry and relevant sectors who are actively engaged in scientific activities, research and training activities related to medical geology and environmental health. In terms of Mission, the Center is to serve as a centralized facility for the sharing of scientific knowledge, ideas and innovation in the emerging field of Medical Geology; to investigate links between the natural environmental and health; to serve as a training facility for students pursuing their master and/or doctorate degree in Medical Geology; and to promote the field of Medical Geology throughout Africa. At the moment, the Center has put together a range of Senate approved programmes which include short courses, a Post Graduate Diploma, Masters, and PhD in Medical Geology. This paper sets out to discuss the curriculum of the Center, topics in Medical Geology, as well as sub - divisions and their concepts, with a view to providing knowledge and information to the Geoscience Community globally.

Keywords: Nasarawa State University, Curriculum, Training, Medical Geology, Center

ASSESSMENT OF COASTAL GROUNDWATER QUALITY FOR SUITABILITY OF DRINKING PURPOSES IN OKERENKOKO, NIGER DELTA REGION OF NIGERIA

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Abstract

This paper is aimed at determining the quality of drinking water in Okerenkoko, Niger Delta region in Nigeria. A total of thirteen representative drinking water samples from existing boreholes, dug wells, sachet and boiled groundwater were collected for the study. Basic physicochemical and bacteriological parameters of pH, EC, TDS, Pb, Fe, Mn, as well as bacterial and fungal counts using appropriate methods were measured. The results were recorded in triplicate and presented in mean values as follows; pH ranged from 6.0 - 7.33; Pb 0.04 - 0.60 mg/L; Fe 0.33 - 5.84 mg/Land Mn 0.18 - 2.60 mg/L. The bacteriological results indicated a range of 2×10^3 - 18.3×10^3 (cfu/ml) and 2×10^3 - 20.3×10^3 (cfu/ml) total bacteria count respectively. On isolation, *Escherichia, Staphylococus Epidermis, Streptococus Spp* and *Staphylococcus Aureus* were recovered as bacteria isolates, while *Trichoderma Spp, Agergillus Flavus, Ahergillus Niger, Penicillium Spp* and *Mucor* were recovered as fungi isolates in some of water samples collected. Correlation analysis at P < 0.01 revealed a similar source for Pb, Fe and Mn which is attributed to the anthropogenic activities including open defecation in the study area. Juxtaposing correlation analysis with regression analysis using Pb as an independent variable, the result showed an increasing trend of the metals against the natural background which further confirms anthropogenic input. Drinking water sources in the area requires deliberate improvement prior to consumption.

Keywords: Shallow aquifer; coastal environment; health impact and bacteria count

ASSESSMENT OF NATURAL RADIONUCLIDES OF SELECTED BASEMENT ROCKS FROM SOUTHWESTERN NIGERIA AND POTENTIAL HEALTH EFFECTS

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Abstract

Rocks from different geological terrains are usually crushed into various aggregates and used for construction and civil engineering works. Some of these rocks often contain varying amounts of radionuclides, which could pose radiological hazards to human health. It is therefore essential to assess the radiological hazard potentials of such rocks before they are used. This study undertaken to assess the radionuclides in selected basement rocks from parts of Southwestern Nigeria with a view to determining their potential radiological hazards.

Forty-eight fresh rock samples were used in the investigation. The samples were analysed for mineralogical and elemental contents using X-ray diffraction (XRD), ICP-MS and SEM/EDX. The results obtained were evaluated using standard geochemical plots and variation diagrams, while the uranium and thorium concentrations of the rocks were compared with known radioactive mineral-enriched rocks in the world.

The mineral assemblages identified in the rock units were biotite, hornblende, quartz, plagioclase, muscovite, microcline, orthoclase, and pyroxene, respectively. The major oxide compositions (wt%) of SiO_2, Al_2O_3, Fe_2O_3, MgO, CaO, Na_2O, and K_2O in the rock units were: 49.6-71.8, 12.0-16.9, 1.6-11.9, 0.4-4.5, 1.4-9.8, 2.9-4.3, and 1.8-8.1, respectively. The trace elements revealed higher values (ppm) for Ba, Sr, and Zr, with ranges of 672.2-2271.5, 114.1-910.6, and 214.3-1839.8. The Th/U ratio revealed that all the granite and granite gneiss samples had a value greater than 15, which put them in the highly radioactive Th-bearing granites. The radioactive-bearing minerals such as monazite, uraninite, kasolite, orthoclase, thoriannite, zircon, titanite, samarksite, brannerite, and quicklime was also confirmed in the rock samples occurring mostly in the metamict state. Magnetite, cuprite, sphalerite, galena, and pyrrhotite were found as accessory minerals in the rocks. The radiological parameters determined were comparable to the average worldwide ranges and were found to fall within the permissible limit. The radiation hazards associated with the analysed rock units are categorized as Low.

Keywords: granitoids; southwestern Nigeria; monazite; radionuclide count; radiological hazards

NOVEL FRAMEWORK TO ASSESS AND MANAGE OFFSHORE PRODUCED WATER FOR EFFICIENCY, RELIABILITY, SAFETY AND SUSTAINABILITY AT THE NIGERIAN OFFSHORE ENVIRONMENT

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Abstract

Globally, Produced Water (PW) is regarded as inseparable component of hydrocarbon recovery processes in the Oil and Gas sector; still it carries the principal capacity of waste associated with recovery. Nigeria is Africa's largest Oil producer and sixth largest in the world with maximum crude oil production capacity of 2.5 million barrels per day. The PW constitutes natural salts and organic compounds which poses economic and environmental challenges in the marine environment as well as biodiversity.

The PW are generated from Floating Production Storage and Offloading (FPSO) which are core element of the oil and gas extraction and refinement process in Nigeria. In line with Sustainable Development Goal (SDG 6, 13, 14 and 17) which encourages collaboration towards achieving sustainability for blue economic growth from harnessing marine resources such as petroleum produce; a joint research collaboration was established amongst the Nigerian Maritime Administration and Safety Agency (NIMASA), Petroleum Technology Development Fund (PTDF) and Oil Producers Trade Section OPTS and Nigerian Upstream Petroleum Regulatory Commission (NUPRC) to champion a sustainable development in the Oil and Gas Industry.

The study seeks to assess and propose new emerging technologies for adequate characterization, treatment, minimization, and separation using Nanotechnology with the application of smart gel-viscosity reducer (SGVR) to control/reduce the unwanted produced water.

The PW sample were collected from the Nigerian offshore FPSOs' ranging transversely from Western, Central to Eastern zone and investigated across two distinctive seasons to characterize organics and Inorganics components as well as other hazardous constituents using advanced analytic equipment at Teesside Laboratory United Kingdom, prior to the completion of preliminary survey specifically to designate the FPSO's location and mode of operation.

Upon review of the characterized PW, nanomaterials are utilized for the treatment to ensure satisfactory standard of structural integrity as this would maximize profit and safe discharge compared to conventional treatment methods. The expected outcome from the Nigerian FPSOs activities generating PW concentrations from its characterized components could be higher than international regulatory standards, hence pose a greater threat to marine biodiversity as well as the aesthetic value of the offshore environment. Beneficiaries are petroleum technology and maritime safety agencies which will establish Nigeria Offshore PW Databank and Development of Standards as well as Patent disclosures for Companies and co-inventors.

Keywords: Produced water, FPSO, Marine Environment, Nanotechnology, Offshore pollution

HEAVY METAL CONTENT IN URBAN SOILS AND DUSTS OF BATTERY MAINTENANCE WORKSHOPS IN OSOGBO, SOUTHWESTERN NIGERIA

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Abstract

This work is aimed at determining the impact of heavy metal in battery maintenance workshops on soils and dusts in Osogbo, southwestern Nigeria.

Twenty (20) samples each were collected for soils and dusts in battery maintenance workshops. The soil samples were collected at 20 cm depth with stainless steel hand auger, while the dusts were collected with plastic brush and dust pans. The soil samples were air-dried and subsequently sieved through <63 µm. Both the soil and dust samples were analysed for heavy metal such as Cu, Pb, Zn, Co, Mn, Fe, As, Cd, Sb, Cr, and Al contents using inductively coupled plasma optical emission spectrometry.

There are very high concentrations of Fe, Al, and Pb in both the soil (31256, 10477, 17937 mg/kg) and dust (67841, 13667, 17417 mg/kg). The occurrence of Fe and Al was because of their presence in the soil and dust of the study area, while the high Pb content in both media is a characteristic reflection in the component of the battery that was discharged directly to the soil. Furthermore, the concentrations of Cu, Zn, As, Cd, Sb, reflected their contribution from the activities of battery maintenance workshops based on their high variation between the lowest and highest values in both media. However, like the major elements (Fe and Al), Mn, Cr, and Co showed low contrast in their range, which reflect their composition in the soil. There is higher contamination factor of all the heavy metals in the dust than the soil. The geoaccumulation and enrichment factor showed high contamination and enrichment of Cu, Pb, As, Sb, and to some extent Zn for both media. While there is low contamination and enrichment for Co, Mn, Fe, Cr, and Al. Consequently, Pb, Cu, Zn, As, Cd, and Sb indicated high potential ecological risk factor (ER^i) for both media. Similarly, there is high ecological risk index (RI) for both media.

Therefore, the activities in the battery maintenance workshops impacted heavy metal in the soils and dusts of the study area.

Keywords: Battery maintenance workshop, heavy metal, ecological risk index, ecological risk factor, contamination, enrichment.

GEO-ENVIRONMENTAL IMPACTS OF SELECTED LANDFILLS IN LAGOS, SOUTHWESTERN NIGERIA

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Abstract

Lagos is served by several landfills where the huge wastes generated in the city are finally disposed. These Landfills are now part of the sprawling city center in the middle of urban population and commercial areas. As Landfills are known as point sources of contamination, this study is part of an ongoing effort to determine the geo-environmental impact of the Landfills on the quality of groundwater and soils in the vicinity of the Landfills.

Three Landfills located at Olusosun, Abu-Egba and Isolo-Oke Afa areas of the city were selected for investigation. Soils (50) and groundwater (30) samples were obtained from the Landfills and surrounding areas. Physico-chemical parameters of the water samples were determined on the field, while the retrieved soil and samples were analysed for elemental constituents by ICP-MS. The results of the potentially harmful elements were evaluated using various contamination assessments methods.

The pH for the Olusosun, Abule Egba and Isolo-Oke Afa leachate samples are 8.17-8.24; 7.45 and 7.74 while the pH for the groundwater samples is 4.65-7.56; 4.23-7.09 and 4.84-7.08. The Leachates samples are all alkaline in nature while the groundwater samples are slightly acidic to slightly alkaline. The TDS for the leachates at Olusosun, Abule Egba and Isolo-Oke Afa are 4621-7837ppm; 796ppm and 4500ppm respectively, while the TDS for the groundwater samples is 25-1464ppm; 31-2600 ppm and 92-930ppm for the Olusosun, Abule Egba and Isolo Oke Afa landfills groundwater samples. The EC for Olusosun, Abule-Egba and Oke Afa Leachates are 9240-15670µS/cm 1590 µS/cm and 2246 µS/cm, while the EC for the water samples is 50-2920 µS/cm; 63-50300 µS/cm and 196-1930 µS/cm respectively. The salinity for the Olusosun, Abule-Egba and the Oke Afa leachates are 4380-7560 ppm; 735ppm and 2180 ppm while that of the groundwater samples are 15-1380 ppm, 24-2440ppm and 76-874 ppm respectively. All the major elements (K, Mg, Ca, Al, Fe, Na, P and Si) analysed for revealed elevated concentration in the leachate samples compared to the freshwater sample in all the landfills. The calculated Water Quality Index revealed that majority (>60%) of the water samples are unsuitable for drinking. The concentrations in mg/kg for As, Cd, Cr, Cu, Ni, Pb and Zn in the soils of the Olusosun, Abule-Egba and Oke Afa Landfill sites revealed a range of 0.80-13.10, 0.05-19.00 and 0.04-5.97; 0.03-24.40, 0.13-22.70 and 0.10-51.5; 45.00-122.00, 41.00-142.00 and 49.00-143.00; 14.7-502.00, 31.8-10,000.000 and 26.4-2160.00; 11.50-63.70, 15.70-219.00 and 9.60-184.00; 22.10-448.00, 34.7-5000.00 and 18.20-1700.00; 36.70-2230.00, 79.0-5000 and 28.90-4830, respectively. The evaluated contamination indices revealed that these metals have compromised the quality of the soil within and the surroundings of the landfills. The spatial distribution also revealed that the prevalent wind direction has effect on the distribution of these metals in the surroundings of the Landfills. The study established that there is significant potential ecological and human health risks hazard associated with the PHE from exposure to contaminated groundwater and soils from the Landfills and surrounding environment.

ASSESSEMENT OF POLLUTION LEVEL RESULTING FROM SMALL SCALE ATISANAL MINING OPERATIONS IN NEW BUSSA BORGU LOCAL GOVERNMENT AREA NIGER STATE

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Abstract

The need for addressing effect of mining activities for adequate public enlightenment necessitated the present study. The study focused on assessment of pollution level resulting from small scale mining operations in New Bussa area of Borgu Local Government Niger State. Soil samples were collected within the study area and subjected to various analytical techniques. Parameters determined include; pH, TDS, EC, NO^-_3, K, P.   From the results, the value of pH ranged from 8.2 to 8.8. The pH within the study area varied significantly and the soil can be considered slightly alkaline. The total dissolved solid (TDS) values ranged between 17.8mg/l to 25.7mg/l with the mean value of 22.4. The standard deviation for TDS is 17.92 with coefficient of variation of 80%. This parameter is also observed to be highly varied within the study area. The Electrical conductivity ranged from 32.9µs/cm and 45.5µs/cm with the mean value of 28.3. The standard deviation and coefficient of variation for electrical conductivity are 30.66 and 0.8% respectively. The nitrate values varied between 108.6ppm and 172.4ppm. It has the standard deviation of 120.64 and coefficient of variation of 80%. This implies significant degree of Nitrate variation within the study area. Potassium values range from 6.4 to 10.4meq/l with mean of 7.5. The standard deviation and coefficient of variation of Potassium are 5.984 and 0.8% respectively. Phosphate has a range between 15.8mpd and 127mpd. Its Standard deviation is 79.01 while that of coefficient of variation is 0.8%. The study suggests the need for careful consideration before the commencement of any agricultural practices within the study area.

Keywords: Pollution assessment, Mining impact, Electrical Conductivity, Coefficient of variation

GEOCHEMISTRY OF SOILS BENEATH THREE FOREST TREES IN AN ARBORETUM OF FORESTRY RESEARCH INSTITUTE OF NIGERIA (FRIN), IBADAN, SOUTHWESTERN NIGERIA

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Abstract

Tree plantation systems have been proven to have the the potential as a land-management alternative for soil conservation, fertility maintenance and increase in productivity because the forest tree could interact with the soil intimately to alter their structure. It is therefore important to understand the effects of forest trees on the geochemistry of underlying soil to ascertain what sort of forest trees that would be suitable for such operation. This study therefore was aimed at understanding the geochemistry of forest soils under different tree species.

Three forest tree species ((Nuclea diderichii, Eucalyptus globulus and Terminalia superba) were selected for this study. A total number of 32 soil samples were collected from 9 profile pits dug in the arboretum of the Forestry Research Institute of Nigeria, Ibadan, Oyo State. The soil samples were dried, disaggregated and sieved to appropriate sizes for physiochemical and geochemical analysis. The samples were digested and subsequently for elemental constituents using inductively coupled plasma optical emission spectrometry.

The pH of the soil ranged from 4.90 to 7.48. The major element oxides composition (in %) are Fe_2O_3, 2.12-9.04; K_2O, 0.05-0.70; MgO, 0.07- 0.58; Na_2O, 0.01- 0.04; P_2O_5, 0.01- 0.07; SO_3, 0.01 - 0.05 and CaO, 0.08-0.24, respectively. The potentially toxic elements concentration (in mg/kg) ranged as Cu, 14.00 45.00; Mn, 483.00-1850.00; Ni, 10.00-38.00; Pb, 15.00 -34.00; Zn, 27.00-80.00; Co, 13.00-35.00; and Cr, 21.00-59.00, respectively.

Elemental composition showed similarities across the three plantations but their relationship with soil pH varied notably, and this was particularly evident in the *Terminalia superba* plantation, where oxides displayed a more positive correlation with pH compared to the other two plantations. Vertical distribution of potassium in all the soil horizon under the forest covers increases from the upper horizon to the lower horizons, while calcium oxide content at the three study locations decreased with depth. Also, a consistent positive correlation between Fe and Ni across all plantations was observed a reflection of the lateritic nature of the underlying soils of the area. The results showed that tree species contributed to the changes of soil chemistry along the depths of the soil layers.

HEAVY METAL CONCENTRATIONS IN PERIOPHTHALMUS BARBAROUS OF ESCRAVOS ESTUARY, NIGER DELTA, DELTA STATE, NIGERIA

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Abstract

Heavy metal concentrations in *Periophthalmus barbarous* (Atlantic mudskipper) from crude oil polluted aquatic environments impacts their survival, human who consumes it and the aquatic ecosystem. This study investigated the concentrations of heavy metals (lead, cadmium, mercury and arsenic) concentrations (ppm) in *P. barbarous* tissues collected from Escravos Esuary (E.E). Spatially, E.E was stratified into three stations (A, B, C) based on closeness to key anthropogenic activities, while monthly stratification covered July to December, 2023. Samples were collected by using a cast net, while their liver, gills and muscle tissues harvested and preserved in 5 % formalin, processed and analyzed for metal content using atomic absorption spectroscopy according to standard methods. Data obtained were subjected to statistical analysis at $a_{0.05}$ by using SPSS, version 22. Significantly highest concentrations of Lead (0.07±0.01; 0.04±0.01; 0.04±0.02) and Cadmium (0.05±0.02; 0.04±0.02; 0.04±0.01) were obtained in the liver, gills and muscles in October, November and December, respectively. Lead and cadmium were higher in liver, while mercury (0.09±0.03) showed elevated levels in the gills. But Arsenic distribution was relatively consistent across all tissues. These findings revealed significant bioaccumulation of heavy metals in *P. barbarous* tissues from E.E., indicating potential risks to its health, its consumers and the aquatic ecosystem. This study established insights into the impacts of crude oil pollution on coastal biodiversity and ecosystem health. Further research is necessary to assess the long-term effects of heavy metal exposure on *P. barbarous* and their role as bioindicators of environmental contamination of crude oil polluted E.E.

Keywords: Pollution, Aquatic ecosystem, Bio-indicator, Bioaccumulation