PROGRAMME AND ABSTRACT BOOK

SETAC AFRICA 11TH BIENNIAL CONFERENCE

8–11 OCTOBER 2023 | ACCRA, GHANA

"ENVIRONMENTAL DATA-DRIVEN POLICIES FOR INNOVATION AND SUSTAINABLE DEVELOPMENT"

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Welcome to Accra!

At long last, we are finally here in Accra. It is the year SETAC Africa returns to a physical meeting after our last in-person meeting, which occurred four years ago. This makes this year's meeting a special one and one we are certain many are relishing.

In planning this meeting, we chose Accra, coincidentally, the main city that hosted the "Year of Return" for African Diasporas and thousands of visitors from all over the world in 2019. Accra is renowned for its colour, contemporary arts, vibrant nightlife and entertainment centres, as well as for its safety and welcoming residents.

In Africa, we recognise that the strength of our scientific community lies mainly in our ability to work together, share information, and learn from shared data to improve policy and stimulate development. This is the main objective of this year's meeting and over the course of four days, participants will have the opportunity to attend informative presentations, engage in thought-provoking discussions, and make connections with fellow researchers and experts from all over the world. The diversity of backgrounds and perspectives from abstracts received is a testament to the richness of our scientific community and makes this a potentially thrilling prospect.

We extend our heartfelt gratitude to all our sponsors and volunteers who have helped to bring this event to fruition. We are particularly proud of our partnership with Bayer Crop Science on the planned student events and our collaboration with SETAC Journals in organising a workshop for writers and reviewers.

The meeting has been designed with substantial social activities, good networking opportunities, and a variety of cuisines to savour. We hope you take the time to explore Accra and Ghana's amazing tourist destinations, rich and unique culture and history, arts, various local cuisines, and more.

On behalf of the SETAC Africa council and organising committee, we wish you a rewarding experience at SAF2023.

Akwaaba!

Welcome to Accra!

Enock Dankyi
SETAC Africa President

About SETAC

The Society of Environmental Toxicology and Chemistry (SETAC), with offices in North America and Europe, is a not-for-profit, worldwide professional organisation composed of more than 16,000 researchers, students, and expert practitioners from universities, institutions, governmental authorities, businesses, and nongovernmental organisations as well as 85 partner organisations in more than 90 countries dedicated to advancing environmental science and environmental management.

Specific goals of the society are:

- Promote research, education and training in the environmental sciences
- Promote the systematic application of all relevant scientific disciplines to the evaluation of chemical hazards
- Participate in the scientific interpretation of issues concerned with hazard assessment and risk analysis
- Support the development of ecologically acceptable practices and principles
- Provide a forum (meetings and publications) for communication among professionals in government, business, academia and other segments of society involved in the use, protection and management of our environment

These goals are pursued through the conduct of numerous activities, which include:

- Conduct meetings with study and workshop sessions, platform and poster presentations, and achievement and merit awards
- Publish peer-reviewed scientific journals, Environmental Toxicology and Chemistry (ET&C) and Integrated Environmental Assessment and Management (IEAM), as well as electronic newsletters and special technical publications
- Provide funds for education and training through the SETAC grants programme
- Organise and sponsor chapters and branches to provide a forum for the presentation of scientific data and for the interchange and study of information about local and regional concerns
- Provide advice and counsel to technical and nontechnical persons through a number of standing and ad hoc committees

For further information, visit setac.org or contact us at setac@setac.org.

Programme Committee

Programme Committee and Local Organising Committee

Enock Dankyi (Chair), *University of Ghana, Ghana*

Beatrice Opeolu, *Cape Peninsula University of Technology, South Africa*

Gabriel Dedeke, *Federal University of Agriculture, Nigeria*

Suresh Kumar, *Arba Minch University, Ethiopia*

Faith Kandie, *Moi University, Kenya*

Tarryn Botha, *University of South Africa, South Africa*

Conrad Sparks, *Cape Peninsula University of Technology, South Africa*

Eunice Ubomba-Jaswa, *Water Research Commission, South Africa*

Ogemdi C. Anika, *De Montfort University, United Kingdom*

Support SETAC Africa

SETAC Africa is accepting donations to support its initiatives and activities and assure their durable vitality. Any small contribution can make a big difference and can help ensure scientists' participation in any upcoming events or projects.

AH Hotel & Conference

Situated in the serene neighbourhood of East Legon, AH Hotel and Conference brings to the city a true urban experience, with over 75 generously neat and spacious guest rooms and a total of 703.54 square meters of conference spaces.

The venue is easily accessible as it is only a 10-minute drive from the Kotoka International Airport and is
located close to significant landmarks like Ghana's Premier University, The University of Ghana, Legon as well as highway roads to the neighbouring cities and onwards to the international border town of Aflao.

AH Hotel & Conference
Hse # 84/86 1ST Boundary Road,
American House, East Legon, Accra, Ghana
ahhotelafrica.com

Badges

Badges must be worn to gain access to the meeting.

Emergencies and First Aid

If you need medical attention, ask any of the local volunteers. For emergencies, call 112.

Wifi Information

Free wireless internet will be available throughout the venue during the conference hours. Please note that the connection may be slower during peak hours.

SETAC Policies

SETAC provides open, safe forums for the purpose of exchanging ideas and information on the study, analysis and solution of environmental problems, the management and regulation of natural resources, promotion of scientific research and the development of strong environmental education.

Attendees of SETAC meetings are expected to adhere to all SETAC policies, including SETAC Participant Policies.

Learn more at **www.setac.org/learn-about-setac/policies.html**.

Conduct

Participants in SETAC activities are expected to adhere to the highest standards of integrity and professionalism and comply with the SETAC Code of Conduct. Attendees are reminded to observe SETAC's principles and values and to maintain an atmosphere of civil and constructive scientific exchange.

Time (UTC)	Programme	Location
8:00–16:15	Badge Pick-Up & Registration	
9:00–11:00	Scientific Publishing – Writers' and Reviewers' Workshop (Part 1)	Syndicate Room 1
11:00–11:15	Cocoa Break	
11:15–13:15	Scientific Publishing – Writers' and Reviewers' Workshop (Part 2)	Syndicate Room 1
13:15–14:15	Lunch Break	
14:15–16:15	Introduction to Environmental and Human Health Risk Assessment & IBERA Certification Program	Syndicate Room 1
16:15–16:30	Cocoa Break	
18:00–20:00	Student's Data Analysis Workshop (hybrid)	Syndicate Room 1

Sunday 8 October

Workshops

Scientific Publishing – Writers' and Reviewers' Workshop

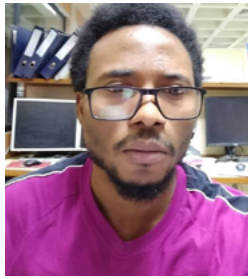
*Kindly Sponsored by the **SETAC Journals***

This half-day workshop is designed to help participants build their skills as authors, reviewers, and editors, helping them learn how best to disseminate their research. We also hope to establish collaborations between journal editors and the SETAC Africa community, so that we can jointly strategize on growing journal content from the region and increasing opportunities for engagement with the SETAC journals. The three-part workshop will include:

- Getting to Know SETAC Publications and Communication Options
- Storytelling for Scientific Publishing: Framing Your Narrative
- Peer-Review Training

Student Data Analysis Hybrid Workshop (hybrid)

Are you interested in harnessing the power of data analysis to supercharge your research and make meaningful discoveries? Then make sure to join this free workshop on "Univariate and Multivariate Analysis of Quantitative Data Using R", organised by the SETAC Africa Student Advisory Council (SAC). The workshop is designed exclusively for students and early career researchers and will be accessible both onsite at the venue as well as online via Zoom.



The workshop will feature speaker **Dr Bolaji F. Oyeyemi**, who is a research fellow at the Arturo Falaschi ICGEB in New Delhi, India and a lecturer at the Federal Polytechnic in Ado-Okiti, Nigeria.

To join, please register online by 20 September. For any questions or additional information, feel free to reach out to the SETAC Africa Student Advisory Council Chair at anifowoshe.at@unilorin.edu.ng.

Attendees wishing to join, should have a laptop with internet access and the R statistical Software installed.

Agenda
18:00 – 18:05: Welcome & Introductions
18:05 – 18:10: About SETAC and SAC
18:10 – 19:10: Workshop on Data Analysis using R
19:10 – 19:55: Question and answer session
19:55 – 20:00: Vote of Thanks & Announcements

Time (UTC)	Programme	Location
7:45–8:45	Badge Pick-Up & Registration	
8:00–8:45	Poster Hang Up	
8:45–10:30	Opening Ceremony & Plenary: **Chris Gordon**	Syndicate Room 1
10:30–11:00	Cocoa & Poster Break	
11:00–12:17	**Session 1.01A**: Biomonitoring and Deposition of Pollutants and their Impacts in Aquatic Ecosystems **Session 3.01**: The Management of Contaminants of Emerging Concern in Developing Countries	Syndicate Room 1 Syndicate Room 3
12:20–13:37	**Session 1.01B**: Biomonitoring and Deposition of Pollutants and their Impacts in Aquatic Ecosystems **Session 3.03A**: Biomass Valorization for Sustainable Waste Management and Clean Energy Generation in a Circular Economy Context	Syndicate Room 1 Syndicate Room 3
13:40–14:40	Lunch & Poster Break	Syndicate Room 4
14:40–15:57	**Session 3.05A**: Plastics in Africa from Macro to Micro: Why Accurate Data Is Critical for Protecting the Environment and Public Health **Session: 3.03B**: Biomass Valorization for Sustainable Waste Management and Clean Energy Generation in a Circular Economy Context	Syndicate Room 1 Syndicate Room 3
16:00–17:17	**Session 3.05B**: Plastics in Africa from Macro to Micro: Why Accurate Data Is Critical for Protecting the Environment and Public Health **Session 3.02**: Ecotoxicology of Pesticides: Lethal and Sublethal Effects, Ecological Risk Assessment (EcoRA)	Syndicate Room 1 Syndicate Room 3
17:20–17:50	Cocoa & Poster Break	
17:50–18:50	Sponsored Event	Syndicate Room 1
18:50–20:50	Student Event	

Monday 9 October

Plenary Speaker

From Data to Policy: The Need for Knowledge Brokerage and Communication

Chris Gordon

University of Ghana, Ghana

It is difficult to know what is real and what is fake. There are always conspiracy theorists and sceptics that prey on the lack of knowledge and the poor understanding of the scientific basis of global challenges the planet faces. Much of Ghana's data and evidence our scientists generated never manifests in our policy documents and frameworks. The reasons are myriad, but one main issue is that the science needed by the policymaker is usually in a form that can be understood and appreciated only by other scientists and often just by scientists working in a specific area. Chemistry is a case in point. In other jurisdictions, green chemistry is a solution to climate change, pollution and the need for energy transitions. However, in Ghana, science, especially chemistry, is perceived as a complex subject, often rooted in the ' terror' of science from secondary school days. Suppose we want our policies to be science-based and rooted in evidence. In that case, it is necessary to broker the results and the knowledge that scientists generate to make it understandable and applicable to policymakers. In this presentation, the Green Chemistry and Sustainable Chemistry examples illustrate the importance of knowledge brokerage. A PhD module in knowledge brokerage at the Pan African Doctoral Academy of the University of Ghana targeting students in the College of Basic and Applied Science will be introduced to fill this gap.

Prof. Chris Gordon holds a PhD in Human Environmental Sciences from King's College, London, and a B.Sc. (Hons.) and Masters in Zoology from the University of Ghana, Legon. An Environmental Scientist with experience as a limnologist and aquatic resource management advisor, with a particular interest in biodiversity, the functioning of coastal, wetlands, freshwater systems, and climate adaptation. Working at Legon since 1986, he was the founding Director of the Institute for Environment and Sanitation Studies and was Dean, International Programmes at the University. He was Executive Vice President, of the International Society of Limnology (SIL) and Vice-President and Member Management Board of Wetlands International. He has supervised over 60 Graduate students at MPhil and PhD levels. He is a member of the Earth Commission of Future Earth, the IPBES Multidisciplinary Expert Group, the Evidence Advisory Group of the Global Centre on Biodiversity for Climate (GCBC) and the Ghana Country Advisor for Climate Development Knowledge Network (CDKN)as well as the Advisory Board Member for UNU-Institute for Natural Resources in Africa. Chris Gordon won the Parker-Gentry Conservation Biology Award from the Field Museum, Chicago, USA. He also received the Order of the Volta from the Government of Ghana for service in Development, Education and Research.

Monday Platform Presentations

	11:05	11:17	11:29
	Session 1.01A: Biomonitoring and Deposition of Pollutants and their Impacts in Aquatic...		
Syndicate Room 1	**1.01.T-01** Contaminants of Emerging Concern in the Lower Volta River, Ghana, West Africa: The Agriculture, Aquaculture, and Urban Development Nexus | **Heiko Schoenfuss**, University of Minnesota	**1.01.T-02** Ameliorating Effects of Bioremediation Treatment on Bisphenol-Induced Oxidative Stress In Tissues of Juvenile African Catfish Using Immobilized Bacteria | **Folasade Olajuyigbe**, Federal University of Technology Akure	**1.01.T-03** Selected Heavy Metals Concentration in Water, Sediment and Prawn Species of Benin River, Edo State, Nigeria. | **Uchenna Ezeunara Okeke**, University of Benin
	Session 3.01: The Management of Contaminants of Emerging Concern in Developing Countries		
Syndicate Room 3	**3.01.T-01** Assessing Community Knowledge, Practices, and Perceptions Regarding Environmental Determinants of Health in Melusi, Pretoria | **Sean Patrick**, University of Pretoria	**3.01.T-02** Selection of a Diagnostic Tool for Microbial Water Quality Monitoring and Management of Faecal Contamination of Water Sources in Rural Communities | **Maggy Ndombo Benteke Momba**, Tshwane University of Technology	**3.01.T-03** Radiation Safety of Veterinary Clinics in Oyo State | **Caleb Oyepitan**, University of Ibadan

	12:25	12:37	12:49
	Session 1.01B: Biomonitoring and Deposition of Pollutants and their Impacts in Aquatic...		
Syndicate Room 1	**1.01.T-07** Exploring the Contribution of Pollution Gradients to the Sediment Microbiome and Potential Pathogens in Urban Streams Discharging into Lake Victoria, Kenya | **Memory Tekere**, Jaramogi Oginga Odinga University of Science and Technology	**1.01.T-08** Endocrine Disruptive Activity and Occurrence of Pharmaceuticals and Viral Content in Selected Water Sources in Melusi, Pretoria | **Sean Patrick**, University of Pretoria	**1.01.T-09** Cadmium, Chromium, Lead and Mercury Species in African Sharp Tooth Catfish (Clarias Gariepinus) Tissue From Pools Associated With ASGM Operations in the Upper uMzingwane Catchment Area in Zimbabwe | **Donald Tapfuma**, National University of Science and Technology
	Session 3.03A: Biomass Valorization for Sustainable Waste Management and Clean Energy ...		
Syndicate Room 3	**3.03.T-01** Comparative Performance Assessment of Biomass-derived Urea-Furfuraldehyde Resins as Oilfield Scale Inhibitors | **Cynthia Victor-Oji**, University of Port Harcourt	**3.03.T-02** Time and Temperature Requirements for Efficient Treatment of Digestate as a Safe Biofertilizer | **Cyprian Oshoma**, University of Benin	**3.03.T-03** Nigerian Economy, Agricultural Waste Valorization and Transition to Circular Economy | **Rosemary Okoh**, Delta State University

	11:41	11:53	12:05	
	Ecosystems			
	1.01.T-04 Roles of Catchment Tributaries and Hydrological Conditions in the Increasing Nutrient Loads of Lagos Coastal Aquatic Ecosystems. | **Folake Echebiri**, University of Lagos	**1.01.T-05** TBD	**1.01.T-06** A Comparison of Oxidative Stress Associated with Lead and Electronic Waste Pollution in Aquatic Organisms | **Joanna Change**, National University of Science and Technology	Syndicate Room 1
	Session 3.01: The Management of Contaminants of Emerging Concern in Developing Countries			
	3.01.T-04 Ambient Concentrations of PM2.5 in Three Locations within the Accra Metropolis, Ghana | **Kojo Ayittey**, University of Ghana	**3.01.T-05** Endocrine Disrupting Compounds; Bioremediation; Bacterial Laccase; Bio Composites; Bio Catalytic Degradation | **Maggy Ndombo Benteke Momba**, Tshwane University of Technology	**3.01.T-06** TBD	Syndicate Room 3

	13:01	13:13	13:25	
	Ecosystems			
	1.01.T-10 Effect of Stored Hair Dressing Saloon Effluents on Haemato-Biochemical Changes on Juveniles of African Catfish (Clarias Gariepinus) | **Peace Chinedu-Ndukwe**, Michael Okpara University of Agriculture	**1.01.T-11** Effects of Pharmaceuticals on Aquatic Ecosystems | **Paul Van Den Brink**, Wageningen University & Research	**1.01.T-12** The Pre-dredging Assessment of the Water Physico-Chemical Status of Benin River Prior the Seaport Development. | **Uchenna Ezeunara Okeke**, University of Benin	Syndicate Room 1
	Generation in a Circular Economy Context			
	3.03.T-04 Assessing the Impact of Inoculum to Substrate Ratio on Biogas Production during Batch Anaerobic Co-digestion of Cattle Rumen Content and Food Waste | **Andrew Amenaghawon**, University of Benin	**3.03.T-05** Enhancing Soil Health and Crop Yield: Assessing the Potential of Digestate as an Organic Fertilizer in Tomato Cultivation in Nigeria | **Valerie Ifeyinwa Ofili Edosa**, University of Benin	**3.03.T-06** TBD	Syndicate Room 3

Monday Platform Presentations

	14:45	14:57	15:09
	Session 3.05A: Plastics in Africa from Macro to Micro: Why Accurate Data Is Critical for...		
Syndicate Room 1	**3.05.T-01** TBD	**3.05.T-02** Microplastics in the Coastal Environment of the Western Cape, South Africa: is there Cause for Concern? | **Conrad Sparks**, Cape Peninsula University of Technology	**3.05.T-03** Pollution Assessment Around a Big City in West Africa Reveals High Concentrations of Microplastics and Microbiologic Contamination | **Ousmane Diankha**, Université Iba Der THIAM de Thiès
	Session: 3.03B: Biomass Valorization for Sustainable Waste Management and Clean Energy...		
Syndicate Room 3	**3.03.T-07** Microbial Assessment of Solid and Liquid Digestate: Pathogen Reduction and Plant Growth Promoting Properties | **Abraham Ogofure**, University of Benin	**3.03.T-08** TBD	**3.03.T-09** Circular Economy of Wastes: Evidence from Edo State in Nigeria | **Lawrence Ezemonye**, Igbinedion University

	15:21	15:33	15:45	
	Protecting the Environment and Public Health			
Syndicate Room 1	**3.05.T-04** Invisible Peril: Assessing Microplastic Pollution in Ghanaian Mangroves | **Albert Koomson**, The Scottish Association for Marine Science	**3.05.T-05** Estimating the Presence and Diversity of Microplastics in South African Seagrass Meadows | **Bianca Boshoff**, Stellenbosch University	**3.05.T-06** Exploring the Seasonal Variation of Macroplastic Transport in the Odaw River | **Rose Boahemaa Pinto**, Wageningen University and Research	Syndicate Room 1
	Generation in a Circular Economy Context			
Syndicate Room 3	**3.03.T-10** Molecular and Biochemical Studies Reveal the Cellulolytic Enzyme System of Ligninolytic Bacillus Subtilis CFB-09 for Simultaneous Delignification and Saccharification of Corncob | **Folasade Olajuyigbe**, Federal University of Technology Akure	**3.03.T-11** The Risks and Safety Practices of Waste Pickers at Selected Dumping Sites During the COVID-19 Pandemic | **Liziwe Mugivhisa**, Sefako Makgatho Health Sciences University	**3.03.T-12** Cash for Trash: An Impetus for Plastic Waste Valorization in Edo State | **Lawrence Ezemonye**, Igbinedion University	Syndicate Room 3

	16:05	16:17	16:29
	Session 3.05B: Plastics in Africa from Macro to Micro: Why Accurate Data Is Critical for...		
Syndicate Room 1	**3.05.T-07** Determination of Microplastics in Sediment, Water, and Fish Across the Orange-Senqu River Basin | **P. Mark Graham**, GroundTruth	**3.05.T-08** Microplastic Abundance and Physico-Chemical Quality of Sediment From Ogunpa River, Nigeria | **Kelechi Obodo**, University of Ibadan	**3.05.T-09** An Assessment of Microplastics Pollution Indices and Microbial Activities in Portable Water in Lagos State, Nigeria. | **Folashade Ajagbe**, Yaba College of Technology
	Session 3.02: Ecotoxicology of Pesticides: Lethal and Sublethal Effects, Ecological Risk...		
Syndicate Room 3	**3.02.T-01** Silicone Wristband Sampling as a Tool for Insecticide Exposure Assessment of Vegetable Farmers | **Saada Mohammed**, Vrije Universiteit	**3.02.T-02** TBD	**3.02.T-03** TBD

	16:41	16:53	17:05	
	Protecting the Environment and Public Health			
Syndicate Room 1	**3.05.T-10** Assessment of Microplastic Pollution and Biodegenerating Potentials of Microorganisms in Selected Water Bodies Inriver State, Nigeria | **Omega Immanuel**, University of Port Harcourt	**3.05.T-11** The Microbiological Effects of Wastewater Derived Microplastics in the Ocean | **Raeesa Bhikhoo**, North-West University	**Poster spotlights:** **3.05.P-Mo019** **3.05.P-Mo023** **3.05.P-Mo027**	Syndicate Room 1
	Assessment (EcoRA)			
Syndicate Room 3	**3.02.T-04** Recommended Insecticide Application Shows Significant Effect on Insects Diversity in Cocoa Ecosystems | **Enock Dankyi**, University of Ghana	**3.02.T-05** Elemental Characterization of Atrazine Treated Soil Amended With Different Biochar Types Using EDX Spectroscopy | **Yetunde Oyeyiola**, Ladoke Akintola University of Technology	**3.02.T-06** Chlorophyll as A Biomarker for Evaluating the Impact of Hydrocarbons on Soil Ecosystem and Hence Soil Productivity | **Chigoziri Osuji**, Gregory University Uturu	Syndicate Room 3

1.01 – Biomonitoring and Deposition of Pollutants and their Impacts in Aquatic Ecosystems | Paul van den Brink, Nwakanma Chioma, Ogbulie Toochukwu Ekwutosi, Unachukwu Marian Nneka, Matilda Ntowa Bissah

1.01.P-Mo002 Ecosystem Services and Implications on Water Abiotic and Biotic Properties of The Ndongo Stream at The Southeast Slopes of Mount Cameroon | **Daniel Brice Nkontcheu Kenko**, University of Buea

1.01.P-Mo004 Oxidative Stress Induced Effects by Pharmaceutical and Personal Care Chemicals in the Aquatic Snail Lymanaea Natalensis | **Joanna Change**, National University of Science and Technology

3.01 – The Management of Contaminants of Emerging Concern in Developing Countries | Eunice Ubomba-Jaswa, Nonhlanhla Kalebaila

3.01.P-Mo007 Evaluation of the Environmental Pollution Effect of Garri Processed Wastewater Collected From Garri Processing PLants in Nsukka Agricultural Zone, Enugu State, Nigeria. | **Arinze Onwurah**, University of Nigeria

3.02 – Ecotoxicology of Pesticides: Lethal and Sublethal Effects, Ecological Risk Assessment (EcoRA) | Daniel Brice Nkontcheu Kenko, Miranda Egbe Awo

3.02.P-Mo011 Ecological Risk Assessment of Pesticides on Earthworms at The Lower Slopes of Mount Fako in The Monomodal Equatorial Agroecological Zone of Cameroon | **Daniel Brice Nkontcheu Kenko**, University of Buea

3.03 – Biomass Valorization for Sustainable Waste Management and Clean Energy Generation in a Circular Economy Context | Lawrence Ezemonye, Akanimo Odon, Isioma Tongo, Valerie Ofili-Edosa

3.03.P-Mo012 The Informal Toilet System, Open Defecation and Renewable Sewage Infrastructure Framework in Ovia North East LGA | **Lawrence Ezemonye**, Igbinedion University

3.05 – Plastics in Africa from Macro to Micro: Why Accurate Data Is Critical for Protecting the Environment and Public Health | Holly Nel, Conrad Sparks, Sika Abrokwah, Keshnee Pillay

3.05.P-Mo019 Microplastic Contamination in Two Marine Fish Species in Ghanaian Waters | **Pearl Sakyi-Djan**, University of Cape Coast

3.05.P-Mo021 Microplastics in Sediments From Two Estuaries in Ghana | **Charles Faseyi**, University of Cape Coast

3.05.P-Mo022 Spatio-Temporal Distribution of Microplastics in Water Samples of the Swartkops River, Eastern Cape, South Africa | **Enahoro Owowenu**, Rhodes University

3.05.P-Mo023 Microplastics Occurrence and its Correlation to Physicochemical Properties of the Diep River (Milnerton), Western Cape, South Africa | **Asmat Khan**, Cape Peninsula University of Technology

3.05.P-Mo024 Meso- and Macroplastic Pollution on Two Coastal Beaches of Ghana | **Pearl Sakyi-Djan**, University of Cape Coast

3.05.P-Mo025 Occurrence and Characteristics of Microplastics in the Visceral Tissues of Four Commercial Fish Species in the Lagos Lagoon, Nigeria | **Fadekemi Akinhanmi**, Covenant University

3.05.P-Mo026 In Vitro Exposure of Polystyrene Nanoparticles and Co-exposure with North Sea Marine Oil: Assessing Sensitive Endpoints of Toxicity | **Marianne Brookman-Amissah**, University of Gothenburg

3.05.P-Mo027 Monitoring Microplastics in South Africa: An Issue of Methodology | **Marco Worship**, Department of Forestry Fisheries and the Environment

3.05.P-Mo030 Characterization of Microplastics from the Hennops River, Gauteng: South Africa | **Phedisho Mphahlele**, Tshwane University of Technology

3.05.P-Mo031 Assessing the Toxicity of Microplastic in Surface Water of Uyo Metropolis, Akwa Ibom State, Nigeria | **Chioma Nwakanma**, University of Buea

6.02 – Late Breaking Science

6.02.P-Mo032 Mercury in the Ghanaian Environment: Environmental Concentrations, Fate, Human Exposure and Health Risk Assessment | **Opoku Gyamfi**, Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development

6.02.P-Mo034 Atrazine-Induced Intestinal Histopathology in Juvenile African catfish, Clarias gariepinus (Burchell, 1822) | **Prosper Ashibudike Opute**, University of Benin

Time (UTC)	Programme	Location
7:55–8:55	Badge Pick-Up & Registration	
8:10–8:55	Poster Hang Up	
8:55–10:12	**Session 1.02A**: Ecological and Human Health Risk Assessment of Legacy and Emerging Contaminants in Africa **Session 4.02**: Sources, Distribution, and Remediation of Anthropogenic Pollutants in Sub-Sahara Africa's Environment	Syndicate Room 1 Syndicate Room 3
10:15–10:45	Cocoa & Poster Break	
10:45–12:02	**Session 1.02B**: Ecological and Human Health Risk Assessment of Legacy and Emerging Contaminants in Africa **Session: 4.03**: Contaminants in Unusual Urban Environments	Syndicate Room 1 Syndicate Room 3
12:05–13:05	Plenary: **Paul van den Brink**	Syndicate Room 1
13:05–14:05	Lunch & Poster Break	Syndicate Room 4
14:05–15:22	**Special session 6.01**: UNEP's Science-Policy Panel to Contribute Further to the Sound Management of Chemicals and Waste and to Prevent Pollution	Syndicate Room 1
15:25–16:42	**Session 3.07**: Natural Resources Exploitation, Ecological Consequences and Remediation/Restoration for Sustainability **Session 2.01**: Trends in Legacy and Emerging Contaminants in Terrestrial Ecosystems	Syndicate Room 1 Syndicate Room 3
16:45–17:15	Cocoa & Poster Break	
17:15–18:15	Bayer Sponsored Event: Bayer Safe Use Ambassador- Sowing the Seed of Safety for Pesticides Among the Next Generation of Professionals	Syndicate Room 1
18:15–20:15	Women's Event	Syndicate Room 1
20:30–22:30	Dinner	

Tuesday 10 October

Plenary Speaker

The Interactive Effects of Climate Change and Chemicals on Aquatic Ecosystems

Paul J. van den Brink

Wageningen University and Research, The Netherlands

In his keynote, Paul van den Brink will briefly introduce the EU funded ECORISK2050 project which assesses the effects of global change on the emission, fate, effects and risks of chemicals in aquatic ecosystems. He will dive deeper into the effects of temperature increases on the toxicity and ecological effects of pesticides. At the individual level we found that temperature may act as a stressor on its own, but also may alter the effects of chemicals though changes in their toxicokinetics and toxicodynamics (TK-TD). Experiments showed that mortality and effects on sublethal endpoints due to the insecticides imidacloprid and flupyradifurone exposure increases with increasing temperature. Using an adjusted TK-TD modelling framework the results show that predictions of TK–TD models improve if we include the toxicity modulating effect of temperature explicitly. We exposed aquatic ecosystems to heating using mesocosm and the warming made the zooplankton community shift from Rotifera to Cladocera and Copepoda. Community recovery after exposure to an insecticide was faster under warming conditions. In our mesocosm experiment we found that both temperature and pesticides affected the structure as the functioning of the aquatic ecosystems. Therefore, temperature should be integrated within the ecological risk assessment of chemicals.

Paul J. Van den Brink is a personal professor at the Aquatic Ecology and Water Quality Management Group of Wageningen University and a senior scientist at the research institute Wageningen Environmental Research, both belonging to the Wageningen University and Research. At Wageningen University Paul chairs the chemical stress ecology group which currently consists of himself and 14 PhD students. He is involved in supervising and executing international projects on assessing the ecological effects of contaminants like pesticides, veterinary medicines and personal and home care products as well as those of multiple stressors, including climate change, drought, nutrients and salinization. Paul van den Brink has published over 280 ISI-listed papers (h-index = 60; SCOPUS). Paul currently coordinates the EU-funded Innovative Training Network ECORISK2050 which studies the effects of global change on the emission, fate, effects and risks of chemicals in aquatic ecosystems.

SETAC Africa Women's Event (SAFWE)

Rising Together for Innovation and Sustainable Development in a Data and Technology-Driven Age

Beatrice Opeolu, Chioma Blaise Chikere, Gertie Arts, Laurel A. Royer, Lorraine Maltby and Sabine E Apitz

Women continue to face a number of unique challenges in their workplaces and careers. The SETAC Africa Women's Events (SAFWE) sessions seek to foster the development of authentic leadership, as well as encourage measurable and achievable goal setting for participants. The SAFWE first convened in 2017 and again at subsequent SETAC Africa meetings in 2019 and 2021. It has provided opportunities that engaged, inspired and support over hundred women in science.

The sessions support attendees in their evolution as individuals and, with time, leaders, within the scientific community. With the theme "Rising together for innovation and sustainable development in a data and technology-driven age", SAFWE is again ready to energize and uplift women at the 2023 SETAC Africa meeting. Women will be provided a safe space to share experiences and stories of challenges and wins, as well as to identify needs and opportunities. The meeting aims to empower women scientists as professionals. Experiences and strategies for maintaining the delicate "balance" between career and other roles and responsibilities will be shared. Participants will have the opportunity to engage with others, including SETAC global women leaders, and to brainstorm how SETAC, as a global society, can better serve its full membership.

Sponsored Event

Bayer Safe Use Ambassador- Sowing the Seed of Safety for Pesticides Among the Next Generation of Professionals

Sponsored by ***Bayer***

Bayer is working with universities around the globe to build teams of ambassadors to work with farmers in their communities on safe and responsible use training to protect the health of these growers and their families. Join us to learn more about how this programme is making a difference for small holder farmers around the world.

Tuesday 10 October

Special Session

6.01 – UNEP's Science-Policy Panel to Contribute Further to the Sound Management of Chemicals and Waste and to Prevent Pollution

Michelle Bloor, Tarryn Botha

The Special Session's focus is the UNEP Science-Policy Panel to contribute further to the sound management of chemicals and waste and to prevent pollution (SPP). UNEA Resolution 5/8 declared that a science-policy panel should be established to contribute further to the sound management of chemicals and waste and prevent pollution, and to convene, subject to the availability of resources, an ad-hoc Open Ended Working Group (OEWG) that will begin work in 2022, with the ambition of completion by the end of 2024. The Special Session at the SETAC African Biannual Meeting will be one of many membership engagement activities on this topic, in Africa. Similar events, consultations, and surveys will also take place in SETAC's other geographical areas (Europe, North America, Asia Pacific and Latin America) to support SETAC's input and participation at OEWG meetings and to support SETAC's involvement in the Technical Advisory Group to UNEP's Executive Director (TAG), which will be organised by the SETAC CheM Panel, who leads on this initiative for the society.

Prior to the Special Session, a survey of SETAC members will be undertaken, which will be used as a framing for the event, and to inform the discussion that will take place. The survey will focus on questions relating to key themes that are generated through the ad-hoc 1.2 OEWG meeting that took place in Bangkok (30th January to 3rd February). A call for questions will also be made to the SETAC membership and a selection of those questions will be incorporated into the session.

Special Session Structure:

- Chair(s) will provide background and introduction to the session.
- In order to set the context for the following session discussion, between 6 and 8 invited speakers (including speakers from Academia, Business, Government and NGO) will be given 3-5 mins each to talk about their pre-determined theme.
- The audience will be invited to select their preferred panel discussion questions (a QR code will be shared with the audience), based on the survey results and the sessions pre-determine themes (that feedforward from the ad-hoc 1.2 OEWG meeting), and the questions will be addressed in the order of the audience's preference.
- The invited speakers will join a panel discussion of the audience's preferred questions, and the audience will also be invited to join in the discussion.
- During the Special Session, the audience will be asked to complete several poll questions (a QR code will be shared with the audience).
- Chair(s) will lead the plenary and will bring the session to a close with their final thoughts.

	9:00	9:12	9:24
	Session 1.02A: Ecological and Human Health Risk Assessment of Legacy and Emerging...		
Syndicate Room 1	**1.02.T-01** Mercury Concentrations in Sediments, Fish and Shellfish from the Pra Estuary (Ghana) and its Human Health and Ecological Implications | **Comfort Opoku**, University of Ghana	**1.02.T-02** Exposure to Carcinogenic and Non-Carcinogenic Toxicants in Environmental Media in Gold Mining Communities in the Asutifi North District, Ahafo Region, Ghana: A Human Health Rrisk Assessment Approach | **Samuel Obiri**, CSIR-Building and Road Research Institute	**1.02.T-03** Adverse Effects of Bifenthrin Exposure on Neurobehavior and Neurodevelopment in a Zebrafish Embryo/Larvae Model | **Kojo Eghan**, Korea Institute of Toxicology
	Session 4.02: Sources, Distribution, and Remediation of Anthropogenic Pollutants in Sub-Sahara...		
Syndicate Room 3	**4.02.T-01** Assessment of Iron (III) Removal in Aqueous Solution by Mycofiltration, Through a Fixed-Bed Column Biosorption Approach | **Sanele Mnkandla**, University of the Free State	**4.02.T-02** Impacts, Contamination Pathways, Risks, and Remediation of Chemical Pollution within a Wetland System Following of One of Africa's Largest Agrochemical Spills | **P. Mark Graham**, GroundTruth	**4.02.T-03** The Exposure of Metal(loid)s in Top Soils from Gold-Mining Activities in Ghana | **Peter Osei**, University of Ghana

	10:50	11:02	11:14
	Session 1.02B: Ecological and Human Health Risk Assessment of Legacy and Emerging...		
Syndicate Room 1	**1.02.T-07** Water Quality Assessment From Thatched Roof and Implications for Human Health | **Joshua Nosa Edokpayi**, University of Venda	**1.02.T-08** Cannabichromene: Appraisal of the Toxicological Potentials on Hepato-renal Tissues of Adolescent Rats. | **Odunayo Taiwo**, Federal University of Agriculture Abeokuta	**1.02.T-09** Heavy Metals Contamination and Health Risk Assessment of Soils in Dumpsites Within the Vicinity of University of Port Harcourt, Nigeria | **Kingsley Patrick-Iwuanyanwu**, University of Port Harcourt
	Session: 4.03: Contaminants in Unusual Urban Environments		
Syndicate Room 3	**4.03.T-01** Indoor Particulate Matter and Gaseous Pollution of High School Kitchens in the Kumasi Metropolis | **Boansi Adu Ababio**, Kwame Nkrumah University of Science and Technology	**4.03.T-02** Toxicological Impact of Gasoline Generator Emissions on Occupationally Exposed Workers in A Nigerian Business Cluster Environment | **Ifeoma Ijeh**, Michael Okpara University of Agriculture	**4.03.T-03** Ecological and Human Health Impact of Car Washing Bay on the Quality of Receiving Surface Water and Fish in Obuasi Municipal of Ghana | **David Azanu**, Kwame Nkrumah University of Science And Technology

9:36	9:48	10:00	
Contaminants in Africa			
1.02.T-04 Polycyclic Aromatic Hydrocarbons (PAHs) in Surface Water and Sediments at the Federal Lighter Terminal, Onne, Nigeria: An Evaluation of Their Potential Health Effects | **Kelechi Charity Lele**, Imo State University	**1.02.T-05** Prevalence of Per- and polyfluoroalkyl Substances (PFASs) in Marine Seafood from the Gulf of Guinea | **Abraham Ekperusi**, Ifremer, CCEM	**1.02.T-06** Human Risk Assessment of Phthalates and Bisphenol A in Freshwater Fish From Ose and Owan Rivers, Southwestern Nigeria | **Josephine Olayinka-Olagunju**, Adekunle Ajasin University	Syndicate Room 1
Africa's Environment			
4.02.T-04 TBD	**4.02.T-05** Potentials of Indigenous Plants (tree crops/shrubs) for Remediation of Major Metals in Mining Impacted Soils from North Central, Nigeria. | **Beatrice Opeolu**, National Biotechnology Development Agency	**4.02.T-06** Spatial Distribution, Fate, and Source of Microplastics in the Water Systems in Botswana. | **Sylwia Oleszek**, Kyoto University	Syndicate Room 3

11:26	11:38	11:50	
Contaminants in Africa			
1.02.T-10 Unveiling Antibiotic Resistance Genes and Mechanisms in Soil Samples from an Effluent Disposal Point of a Cassava Processing Plant using Shotgun Metagenomics | **Babasola Fateye**, Grand Valley State University	**1.02.T-11** Occurrence, Human Exposure, and Risk Assessment of Organophosphorus Flame Retardants in Landfill Sediments From Gauteng, South Africa | **Innocentia Sibiya**, University of Johannesburg	**1.02.T-12** Aquatic Risk Assessment of Commonly-Used Pesticides in Matazem Stream in Santa, North West Region of Cameroon | **Patricia Bi Asanga Fai**, The University of Bamenda	Syndicate Room 1
Session: 4.03: Contaminants in Unusual Urban Environments			
4.03.T-04 Assessment of Human Health Risks of Groundwaters Close to Electrical Waste Dumpsites in Lagos, Nigeria | **Oluwatoyin Fatunsin**, University of Lagos	**4.03.T-05** TBD	**4.03.T-06** Potentially Toxic Metals in Roadside Soils and Himalayan Blackberries in Vancouver and Victoria, BC, Canada | **Matt Dodd**, Royal Roads University	Syndicate Room 3

Tuesday Platform Presentations

	14:05			
	Special session 6.01: UNEP's Science-Policy Panel to Contribute Further to the Sound...			
	15:30	**15:42**	**15:54**	**16:06**
	Session 3.07: Natural Resources Exploitation, Ecological Consequences and...			
Syndicate Room 1	**3.07.T-01** Fixing Failures or Re-thinking Futures? From Resilient Remedies to Resilient Land- and Water-Scapes | **Sabine Apitz**, SEA Environmental Decisions Ltd	**3.07.T-02** Just Energy Transition From Coal In South Africa: A Scoping Review | **Sean Patrick**, University of Pretoria	**3.07.T-03** Tolerance Effects and Biodegradability of Oil-Based Drilling Fluids in Diverse Soil Types | **Chukwuka Ogobnna**, University of Nigeria	**3.07.T-04** Environmental Assessment of Sub-Soil Around a Mechanic Village in Effurun Community, Delta State Nigeria | **Godwin Etuk-Udo**, Sheda Science and Technology Complex (SHESTCO)

	15:30	**15:42**	**15:54**	
	Session 2.01: Trends in Legacy and Emerging Contaminants in Terrestrial Ecosystems			
Syndicate Room 3	**2.01.T-01** Chronic Exposure to Yellow Light at Night Induced Oxidative Stress in the Testes of Albino Rat Rattus norvegicus | **Festus Kehinde**, Kogi State University	**2.01.T-02** Aflatoxin Contamination Risk from the Consumption of Major Staple Crops in Ghana. | **Richard Boadu Opoku**, University Of Ghana	**2.01.T-03** Assessment of Heavy Metal Contamination in Amphibians from Otofure Dumpsite, Edo State, Nigeria | **Omoyemwen Edo-Taiwo**, University of Benin	

	Management of Chemicals and Waste and to Prevent Pollution				
	16:18	**16:30**	**16:42**	**16:54**	
	Remediation/Restoration for Sustainability				
Syndicate Room 1	**3.07.T-05** Bacteria-Mediated Treatment of Synthetic Textile Waste Water and Bioelectricity Generation Using a Microbial Fuel Cell | **Jude Echejiuba**, University of Port Harcourt	**3.07.T-06** Utilisation of Naphthalene and Dibenzofuran by Stenotrophomonas sp. Isolated from a Hydrocarbon-Impacted Site in Nigeria | **Habiba Atta**, Ahmadu Bello University	**3.07.T-07** Biodegradation of Petroleum Hydrocarbon in Soils Co-contaminated With Heavy Metals and Petroleum Hydrocarbon | **Obioma Mejeha**, Federal University of Technology Owerri	**3.07.T-08** Metal Pollution and Fish Edibility: The Status of the Olifants and Umgeni River Systems in South Africa | **Jeffrey Lebepe**, Sefako Makgatho Health Sciences University	

	16:06	**16:18**	**16:30**	
	Session 2.01: Trends in Legacy and Emerging Contaminants in Terrestrial Ecosystems			
Syndicate Room 3	**2.01.T-04** Impact of Bushfire on Vegetation, Soil Properties and Microbial Community in a Semi-arid Environment in Botswana | **Willie Marenga**, Botswana International University of Science & Technology	**2.01.T-05** Biogeographical Venom Variation of Bitis Arietans and Naja Nigricollis From Northern and Southern Nigeria; Implications for Antivenom Effectiveness | **Akindele Adeyi**, University of Ibadan	**2.01.T-06** Avian Feathers as a Biomonitoring Tool to assess Organochlorine Pesticide and Metal Residues in Birds at the Botanical Garden, University of Ibadan, Nigeria | **Adeola Oni**, University of Ibadan	

1.02 – Ecological and Human Health Risk Assessment of Legacy and Emerging Contaminants in Africa | Beatrice Opeolu, Gabriel Dedeke, Enock Dankyi, Patricia Bi Asanga Fai

1.02.P-Tu007 Climatic Zone Related Variations in Toxicity of Imidacloprid Towards Aquatic Species and Outlooks: A Review | **Paul van den Brink**, Wageningen University & Research

1.02.P-Tu008 Testicular and Reproductive Toxicities via Oxidative Stress in Male Wistar Rats Exposed to Water-Soluble Fraction of Bonny light Crude Oil. | **Kingsley Patrick-Iwuanyanwu**, University of Port Harcourt

1.02.P-Tu010 Insights Into Microbial Quality Of Drinking Water In Treatment Plants And Distribution System | **Memory Tekere**, University of South Africa

1.02.P-Tu012 Patterns of Multi-Antibiotic Resistant Bacteria in Potable Water: An Indication of Contamination | **Bukola. O Atobatele**, Bowen University

3.07 – Natural Resources Exploitation, Ecological Consequences and Remediation/Restoration for Sustainability | Lorraine Maltby, Udebuani Angela C, Abara Priscilla N, Onwurah Ikechukwu

3.07.P-Tu015 Ornamental Plants As Sustainable Candidates For Remediation Of Polluted Environment: A Review | **Beatrice Opeolu**, National Biotechnology Development Agency

3.07.P-Tu016 Mapping Land Use Change Impacts of Artisanal Small-Scale Cobalt Mining Using Satellite Image Analysis (SIA) in Lualaba and Haut-Katanga in the Democratic Republic of Congo (DRC). | **Mohammed Engha Isah**, Tohoku University

4.02 – Sources, Distribution, and Remediation of Anthropogenic Pollutants in Sub-Sahara Africa's Environment | Venecio Ultra, Sylwia Oleszek

4.02.P-Tu019 Sequestration of Methylene Blue in Single and Binary Solution by Biochar from Moringa Oleifera Seed Husk | **Deborah Aderibigbe**, Nigeria Maritime University

4.02.P-Tu020 The Use of Modified Ceramic Water Filter for Arsenic and Mercury Removal | **Lydia Senanu**, University for Development Studies

4.02.P-Tu021 Optimization of Sorption of Phenol and its Congeners in Aqueous Solution by Biomass of African Breadfruit (Treculia africana) Hull | **Adaora Oguejiofor**, National Agency for Science and Engineering Infrastructure (NASENI)

4.02.P-Tu023 Smartphone-Enabled Turbidity Measurements for Environmental and Medical Monitoring in Africa | **Sylwia Oleszek**, Shibaura Institute of Technology

4.02.P-Tu024 Heavy Metal Accumulation of Aquatic Plant Species from Metaleferous Environment in Botswana: Their Potential for Rhizofiltration of Acid Mine Drainage | **Gorata Ishmael**, Botswana International University of Science and Technology

4.02.P-Tu025 Heavy Metal Contamination in Food Crops Grown in Farmlands near Cu-Ni Mine in Central Botswana | **Koziba Gaotlhobogwe**, Botswana International University of Science and Technology (BIUST)

4.02.P-Tu027 Bacterial Community Composition, Quantification of Antibiotic Resistance Genes and Antibiotic Residues in Wastewater Effluent and Receiving Rivers | **Karabo Tsholo**, North-West University

Tuesday Poster Presentations

4.03 – Contaminants in Unusual Urban Environments | Matt Dodd, Godfred Darko, Marian Nkansah

4.03.P-Tu027 The Influx of Foreign Herbal Medicines: Regulatory and Risk Assessment Perspective | **Eva Gyamfi**, Ghana Atomic Energy Commission

6.02 – Late Breaking Science

6.02.P-Tu031 A Comparative Qualitative Assessment of Water Quality Index Using Physicochemical Parameters of Selected Rivers in Rivers State, Nigeria | **Sandra Okere**, University of Port Harcourt

6.02.P-Tu032 Evaluation of the Cyanobacterial Toxin and a Volatile Organic Compound in Galleria Mellonella: A Case for a Cheap Model for Undergraduate Toxicology Teaching and Research | **Babasola Fateye**, Grand Valley State University

6.02.P-Tu033 Biodegradation of Polystyrene by Bacteria Isolated From the Gut of Rhynchophorous Phoenicislarvae | **Omega Immanuel**, University of Africa Toru-orua

6.02.P-Tu036 Assessment of Potentially Vulnerable Use Areas in Western Africa | **Godwin Lemgo**, Bayer Crop Science

6.02.P-Tu039 Application Of Geospatial Tools for Monitoring Wetland Degradation In Rwanda | **Fayola Autry**, California State University Dominguez Hills

6.02.P-Tu040 Diversity of Sandstone Cave-dwelling Bats in Enugu State, Nigeria | **Elijah Okwuonu**, University of Nigeria

Time (UTC)	Programme	Location
7:55–8:55	Badge Pick-Up & Registration	
8:10–8:55	Poster Hang Up	
8:55–10:12	**Session 3.04**: Linking Agenda 2063 and the United Nations SDGs through Research and Innovation to Stimulate a New Africa **Session 3.06:** E-Waste in Africa: Challenges and Opportunities for Sustainable Management	Syndicate Room 1 Syndicate Room 3
10:15–10:45	Cocoa & Poster Break	
10:45–12:02	**Session 4.01**: Environmental Occurrence, Risk Assessment and Regulation of Organic Contaminants in Africa **Session 5.01**: Education for Sustainable Development and Open Science Platforms in Africa	Syndicate Room 1 Syndicate Room 3
12:05–13:05	Plenary: **Beatrice Olutoyin Opeolu**	Syndicate Room 1
13:05–14:05	Lunch & Poster Break	Syndicate Room 4
14:05–15:05	**General Assembly**	Syndicate Room 1
15:05–16:05	Closing Ceremony & Cocoa Break	Syndicate Room 1

Wednesday 11 October

Plenary Speaker

Legacy and Emerging Contaminants in the Environment: Insights and Lessons Learnt by An African Scientist

Beatrice Olutoyin Opeolu

BEE Solutions and Consultancy Services, Cape Town, South Africa

Man's quest for economic growth, better quality of life and longevity continues to drive the need for resource exploitation, exploration, and technological advancement. A drawdown of these activities has adverse consequences on the environment and human health. Legacy contaminants are chemicals produced or used in industry and remain in the environment long after they were introduced. Many are persistent in soil and water as parent products and metabolites. The metabolites are sometimes more toxic than the parent compounds. They include heavy metals, polychlorinated biphenyls (PCBs), dioxins and furans, methylmercury, and some existing and banned pesticides. Emerging contaminants are mostly unregulated compounds with potential risks and concerns about their impact on human and ecological health. They include industrial chemicals, food additives, pharmaceuticals, and personal care products. Legacy and emerging contaminants abound in African countries in different environmental matrices. A journey of studying the occurrence of legacy and emerging pollutants in the environment and their impacts on human health and the health of ecosystems will be presented. Implications for Africa, lessons learnt and recommendations for global sustainable development will be presented.

Beatrice Olutoyin Opeolu obtained her BSc (Hons) in Environmental Management and Toxicology at the Federal University of Agriculture, Abeokuta (FUNAAB) in Nigeria in 1995. She graduated with an MSc in Environmental Biology from the University of Ibadan, Nigeria, in 2001; and a PhD in Environmental Toxicology from the FUNAAB in 2007. She was appointed Extended Curriculum Coordinator in the Faculty of Applied Sciences, CPUT in 2011. At CPUT, she is a full professor and the Leader, The Environment, Climate Change and Sustainability Research Focus Area. Beatrice is an established researcher (C3-rated) in South Africa. Her field of specialisation is in Environmental Toxicology and Chemistry. She focuses on the interactions between man and the environment, investigating chemical contaminations and the health risks (toxicology) to humans and ecosystems. She is also interested in the remediation of toxic chemicals in the environment. She has published over 120 articles in peer-reviewed journals, book chapters and conference proceedings in Environmental Chemistry and Environmental Toxicology discipline. She has published over 120 articles in peer-reviewed journals, book chapters and conference proceedings. Beatrice serves on the Technical Committees of several nationally funded projects in South Africa. She is a South African Bureau of Standards (SABS)- Biological Testing Methods voting committee member. She was a co-developer of an international programme of the SETAC online short course aimed at developing countries. Beatrice is well regarded as an evaluator of academic programmes for the South African Council on Higher Education (CHE). She is the Immediate Past President of the Society of Environmental Toxicology and Chemistry (SETAC) Africa and the Vice-president of the SETAC World Council. Beatrice is involved in community engagement projects and has a robust research network of scientists across the globe. Over the past two decades, Beatrice has delivered several speeches as a participant, invited speaker, and keynote speaker in local, regional, and international conferences. She is a sought speaker and panellist at events, including the United Nations Commission on Status of Women (CSW) side events. She has supervised scores of students at undergraduate and postgraduate levels. Beatrice mentors many environmental science practitioners in academia, business, and government. Beatrice is passionate about people, science, and the environment. This inspired her to establish BEE Solutions and Consultancy Services to build a sustainable future with science and indigenous wisdom.

Wednesday Platform Presentations

	9:00	9:12	9:24
	Session 3.04: Linking Agenda 2063 and the United Nations SDGs through Research and...		
Syndicate Room 1	**3.04.T-01** Using an Ecosystem Services Framework to Assess and Manage Chemical Risk can help meet Sustainable Development Goals | **Lorraine Maltby**, University of Sheffield	**3.04.T-02** Nitrogen-Fixing Capacity of Hydrocarbonoclastic Bacteria from Nembe Oil Field, Niger Delta Region Nigeria | **Prof. Chioma Blaise Chikere**, University of Port Harcourt	**3.04.T-03** Molecular Characterization of Petroleum Hydrocarbon-Degrading Bacteria from Oil Field in Nembe, Nigeria | **Prof. Chioma Blaise Chikere**, University of Port Harcourt
	Session 3.06: E-Waste in Africa: Challenges and Opportunities for Sustainable Management		
Syndicate Room 3	**3.06.T-01** Health Risk Assessment of Polycyclic Aromatic Hydrocarbons among Informal Electronic Waste Recyclers at Agbogbloshie in Ghana | **Lawrencia Kwarteng**, CSIR-Water Research Institute	**3.06.T-02** Effects of Biochar Amendment in E-Waste Contaminated Soil on the Survival and Growth of Alma nilotica, an indigenous Earthworm Species | **Patricia Bi Asanga Fai**, University of Dschang	**3.06.T-03** Effectiveness of an Activated Charcoal-fabricated Furnace in Air Pollution Reduction During Resource Recovery Practices in Ibadan, Nigeria | **Abiola Olusho-la**, University of Ibadan

	9:36	9:48	10:00	
	Innovation to Stimulate a New Africa			
Syndicate Room 1	**3.04.T-04** Environmental Importance of Crude Oil Polluted Soil Microbiomes | **Chidinma Peace Okafor**, Imo State University	**3.04.T-05** A Policy Based Distance-to-Target (DTT) Life Cycle Impact Assessment (LCIA) Method for Nigeria Under the 2030 Agenda, using the Ecological Scarcity Method. | **Mohammed Engha Isah**, Tohoku University	**3.04.T-06** Improving the Quality of River Water Using a Bio-adsorbent from Ripe Plantain Peels | **Ihesinachi Kalagbor**, Rivers State University	
	Session 3.06: E-Waste in Africa: Challenges and Opportunities for Sustainable Management			
Syndicate Room 3	**3.06.T-04** Mechanical Properties of Concrete Incorporated with E-Waste Plastics as Coarse Aggregate | **Oluseun Popoola**, Yaba College of Technology	**3.06.T-05** Perceived Stress at Work and Associated Factors among E-Waste Workers in French-Speaking West Africa | **Marius Nonvignon Kedote**, University of Abomey-Calavi	**Poster Spotlights:** **3.06.P-We006** **3.06.P-We009**	

	10:50	11:02	11:14
	Session 4.01: Environmental Occurrence, Risk Assessment and Regulation of Organic...		
Syndicate Room 1	**4.01.T-01** Spatial-Temporal Occurrence of Pesticides and Pharmaceuticals from Selected Water Systems within Western Kenya | **Faith Kandie**, Moi University	**4.01.T-02** Model Based Risk Assessment of Pesticides and Its Regulatory Implications in Ethiopia | **Paul Van den Brink**, Wageningen University & Research	**4.01.T-03** TBD
	Session 5.01: Education for Sustainable Development and Open Science Platforms in Africa		
Syndicate Room 3	**5.01.T-01** How to Improve Diversity in Research and Science Education | **Gertie Arts**, Wageningen University and Research	**5.01.T-02** Managing and Mitigating Environmental Pollution Through Action Research: Experiences From South Africa | **Jon Mccosh**, Institute of Natural Resources	**5.01.T-03** Building Science-Action Partnerships to Manage and Mitigate the Impacts of Pollution: Learnings From the Environmental Pollution Programme in South Africa | **Isabella Gosetto**, Joint Nature Conservation Committee

	11:26	11:38	11:50	
	Contaminants in Africa			
Syndicate Room 1	**4.01.T-04** TBD	**4.01.T-05** Towards Sustainable Cocoa Production: Assessing the Impact of Pesticides on Pollinators | **Phebe Tagbor**, Cocoa Research Institute of Ghana	**4.01.T-06** Occurrence of Biocides, Pesticides, and Pharmaceuticals in Rivers Near Agricultural Fields. | **Chepchirchir Ruth**, Moi University	
	Session 5.01: Education for Sustainable Development and Open Science Platforms in Africa			
Syndicate Room 3	**5.01.T-04** Using Open-Source Software to Develop a Geographic Information System-Based Knowledge Hub for Contaminants of Emerging Concern in South African Water Resources | **Eunice Ubomba-Jaswa**, Water Research Commission	**5.01.T-05** TBD	**5.01.T-06** TBD	

3.04 – Linking Agenda 2063 and the United Nations SDGs through Research and Innovation to Stimulate a New Africa | Chioma Blaise Chikere, Gertie Arts, Memory Tekere, Chidinma Peace Okafor

3.04.P-We002 Water Quality Status of Lower River Niger, Agenebode, Nigeria | **Osas Adeniyi**, Ajayi Crowther University

3.06 – E-Waste in Africa: Challenges and Opportunities forSsustainable Management | Suresh Kumar, Julius Fobil, Elizabeth Oloruntuba, Patricia Bi Asanga Fai

3.06.P-We006 Assessment of Air and Dust from Electronic Waste Recycling Sites in Lagos, Nigeria for Potentially Toxic Metals | **Omolola Adeyeye**, University of Lagos

3.06.P-We007 Characterization and Toxic Potency of Airborne Particles Formed upon Recycling Waste from Electrical and Electronic Equipment (WEEE) – A Case Study | **Marianne Brookman-Amissah**, University of Gothenburg

3.06.P-We008 Awareness and Knowledge Level of E-Waste Among Students of Higher Educational Institutions (HEIs) in Lagos, Nigeria | **Oluseun Popoola**, Yaba College of Technology

3.06.P-We009 Advocacy for the Implementation of Biomonitoring in Benin | **Marius Nonvignon Kedote**, University of Abomey-Calavi

4.01 – Environmental Occurrence, Risk Assessment and Regulation of Organic Contaminants in Africa | Faith Kandie, Paul van den Brink, Enock Dankyi, Michael Onwona-Kwakye

4.01.P-We010 Influence of Beers of Different Alcohol Concentration on Haematological Indices of Male Albino Rats | **Chinedu Imo**, Federal University Wukari

6.02 – Late Breaking Science

6.02.P-We013 Isolation, Identification and Characterization of Heavy Metal Resistant Bacteria from Soil Samples Collected in /Around Benue Cement Company, Nigeria | **L.M. Ayantse**, University of Nigeria

6.02.P-We014 Assessment of the Material Value of Precious Metals in End-of-Life Mobile Phones in Accra-Ghana | **Karikari Williams**, Mountain Research Institute

6.02.P-We019 Non-aqueous Reversed Liquid Chromatography Separation Technique to Monitor Fullerene Congeners-Colloidal Nanoparticles in the Environment | **Nokwanda Hendricks**, University KwaZulu-Natal

6.02.P-We020 Tripartite Magnetic Montmorillonite Nanocomposite for Semi-Onsite Removal of Bisphenol A from Industrial Effluents | **Okon Okon**, University of Uyo

6.02.P-We021 Alterations of Physiological, Behavioural and Reproduction of Daphnia Magnaexposed to Functional Groups of Nanogold | **Avela Mbangatha**, North West University

Wednesday Poster Presentations

6.02.P-We023 Concentrations of Organophosphate Pesticides In Dust And Soil From Urban, Semi-Urban And Rural Areas Of Delta State, Nigeria | **Ethel Okocha**, Delta state University

6.02.P-We024 Influence of Fertilizers and Herbicides on Aflatoxin Concentrations in Sesame Grains Across Some Selected States in Nigeria | **Nkechinyere Isienyi**, University of Ibadan

6.02.P-We025 Nutrient Leaching Dynamics in Light Textured Calcareous Soil Treated with Common Chemical Fertilizers and Mitigation by Tithonia Biochar | **Yetunde Oyeyiola**, Cape Peninsula University of Technology

Abstract Book

Track 1. Aquatic Toxicology and Ecology

1.01 - Biomonitoring and Deposition of Pollutants and their Impacts in Aquatic Ecosystems

1.01.T-01 Contaminants of Emerging Concern in the Lower Volta River, Ghana, West Africa: The Agriculture, Aquaculture, and Urban Development Nexus

Anndee Huff Chester[1], Christopher Gordon[2], Heather Hartmann[3], Stephen Bartell[4], Emmanuel Ansah[2], Tao Yan[5], Nfamara Dampha[1], Paul Edmiston[3], Paige Novak[1], Heiko Schoenfuss[6]

[1]University of Minnesota, USA. [2]University of Ghana, Ghana. [3]College of Wooster, USA. [4]Normandale Community College, USA. [5]University of Hawaii, USA. [6]St. Cloud State University, USA

Abstract

Contaminants of emerging concern (CECs) are ubiquitous in aquatic environments across all continents and have been studied extensively in Asia, Europe, and North America. However, few studies have investigated their presence and biological effects in African rivers. Here, we report on CEC presence in the Volta River, Ghana and examine the microbial consequences of anthropogenic activities along this economically and ecologically important waterway. Water and sediment samples were taken by boat or from shore at 14 sites spanning 118 km of river course from the Volta estuary to the Akosombo dam. Sample extracts were prepared for targeted analysis of antimicrobial CECs, the insect repellant DEED, and perfluorochemicals (PFAS). Concurrent samples were extracted to characterize the microbial community and antibiotic resistant genes (ARGs). Antibiotics, DEET, and PFAS (SPFAS: 2-20 ng/L) in the low ng/L concentration range were commonly detected. These values are lower than those reported for many other rivers across continents. The number of different genes detected (between one and ten) and total ARG concentrations varied in both water (9.1×10-6 to 8.2×10-3) and sediment (2.2×10-4 to 5.3×10-2). Greater gene variety was linked to urban development, sand mining, agriculture, and aquaculture. Agriculturally impacted sites experienced ARG concentration spikes. However, there were no correlations between water quality parameters, CEC presence, and /or ARGs. The overall low concentrations of CECs detected in the Lower Volta River is encouraging. Enacting mitigation measures such as sanitation infrastructure and public education about CEC use and disposal can stymy future CEC pollution in the Volta River. Ongoing studies will investigate CEC seasonality through passive sampler use and expand CEC source identification through geospatial data integration.

1.01.T-02 Ameliorating Effects of Bioremediation Treatment on Bisphenol-Induced Oxidative Stress In Tissues of Juvenile African Catfish Using Immobilized Bacteria

Folasade Olajuyigbe, Tolulope Ajayi, Tosin Olawumi, Iyabo Amogunla, Oluwafunmi Afe, Mathew Oladipupo

Federal University of Technology Akure, Nigeria

Abstract

Bisphenol A (BPA) used in the production of polycarbonate plastics and epoxy resin has been associated with endocrine-disruptive properties with adverse effects on human and aquatic health, banned and replaced with analogues, bisphenol F (BPF) and bisphenol S (BPS). Regrettably, there is paucity of data on potential health hazards of BPF and BPS while research on their removal from aqueous media is still emerging. This study investigated effects of BPF and BPS exposure and bioremediation treatment on oxidative stress indices in tissues (gills, liver, kidney, muscle and brain) of juvenile African catfish (*Clarias gariepinus*) at sublethal concentration of BPF and BPS (16 - 24 mg/L, 640 - 800 mg/L, respectively), and 10% immobilized bacterial consortium on loofah sponge used for bioremediation treatment. Three Hundred and Sixty (360) fish were used for study, and experiments were carried out in duplicates for 9 groups comprising polluted and treated for BPF and BPS, respectively. Malondialdehyde (MDA) an index of lipid peroxidation, was assayed as biomarker for oxidative stress. Activities of antioxidant enzymes {superoxide dismutase (SOD) and catalase (CAT)}, glutathione peroxidase (GPx), glutathione S transferase (GST)}, level of non-enzymatic antioxidant (reduced glutathione (GSH), and activity of brain acetylcholinesterase (AChE) were assayed in fish tissues as markers for environmental stressor. Results of polluted and treated groups were compared with control. Levels of MDA and GPx significantly increased with significant inhibition of other antioxidant enzyme activities in polluted groups. Remarkably, activities of SOD, CAT, GST, GPx and AChE, and levels of GSH in bioremediated groups were not significantly different from control. Findings demonstrate the efficacy of bioremediation treatment using immobilized bacteria in alleviating bisphenol-induced oxidative stress in fish and provide insight into ecological safety of the bioremediation method.

This project was funded by the TETFund National Research Fund (NRF) Grant (TETFund/DR&D/CE/NRF/STI/67/Vol1) awarded to Prof. Folasade M. Olajuyigbe (Principal Investigator).

1.01.T-03 Selected Heavy Metals Concentration in Water, Sediment and Prawn Species of Benin River, Edo State, Nigeria.

Uchenna Ezeunara Okeke, Anthony Ogbeibu

University of Benin, Nigeria

Abstract

Concentration of heavy metals (Fe, Zn, Cu, Pb, Cd and Cr) levels were investigated in the water, bottom sediment and prawn species of Benin River using Atomic Spectrophotometer (ASS).The prawn species identified from the study area were Macrobrachium macrobrachion, Macrobrachium vollenhovenii and Macrobrachium felicinum. Seasonal variations of the heavy metals concentrations level in the three species were higher during the dry season than the wet season. High concentrations of Fe were recorded in all the prawn species while M. vollenhovenii had the highest concentration (6.843) of all the heavy metals amongst the prawn species. The sequence of the heavy metals for all prawn species is in this order: Fe>Zn>Cu>Pb>Cd>Cr. The most abundant elements in the different parts of the prawn were Fe, Zn and Cu while the less abundant were Cd and Cr. However, the ranking profile for the heavy metal concentrations were head>shell>flesh with the respective concentrations (mg/l) thus: Fe (4.264, 6.843, 4.420), Zn (1.143, 2.120, 1.317), Cu (0.194. 0.326. 0.231), Pb (0.014, 0.023, 0.018), Cd (0.011, 0.018, 0.015) and Cr (0.006, 0.011, 0.012). Significant biological accumulation factors (BAF>1) were observed in Fe, Zn and Cu while there was no significant BAF in Pb, Cd and Cr for the prawn species. Moreover, non-significant Biota_sediment accumulation (BSAF>1) was observed for the entire heavy metals studied for all the prawn species. This study provided information on the extent of the bioaccumulation of the heavy metals in the prawn species of Benin river indicating the part of the prawn that accumulated most these metals.

1.01.T-04 Roles of Catchment Tributaries and Hydrological Conditions in the Increasing Nutrient Loads of Lagos Coastal Aquatic Ecosystems.

Folake Echebiri, Najeem Oladosu, Akeem Abayomi, Kehinde Olayinka

University of Lagos, Nigeria

Abstract

Coastal waters are important ecosystems globally; however, increasing nutrient loads from anthropogenic activities have continuously imperiled them. The Lagos coastal ecosystem is made up of creeks, mangroves, and lagoons, which serve important functions to the people of the state; however, enrichment of these waters with phosphorus; a limiting nutrient, which causes seasonal eutrophication has negatively impacted its socioeconomic values such as tourism, transportation, and artisanal fishing. In this study, coastal watersheds consisting of tributaries, canal inlets, and non-discharge points were investigated to determine their contribution to the nutrient load of the waters. Water and sediment samples were collected during wet and dry seasons and phosphorus species in the samples determined spectrophotometrically using the molybdenum blue method. The level of reactive phosphorus in the water samples was observed to be higher in the dry than wet season with a concentration range of 0.02 ± 0.39 mgL-1 across sampled locations. Physicochemical conditions were observed to influence phosphorus release into the water, thereby sustaining the cyclical eutrophication process. Thus, there is a need for the enforcement of extant regulatory framework to arrest the wanton discharge of nutrient into coastal waters through tributary catchments so as to promote environmental sustainability of the aquatic systems.

1.01.T-06 A Comparison of Oxidative Stress Associated with Lead and Electronic Waste Pollution in Aquatic Organisms

Joanna Change, Sharon Mumbamuchena, Norah Basopo

National University of Science and Technology, Zimbabwe

Abstract

The advent of electronic gadgets greatly improved the lifestyles of people. The problem arose due to a lack of proper disposal of electronic waste which resulted in their disposal in open landfills exposed to the different weather conditions. The major issue with electronic waste disposal is that toxic elements such as lead, zinc and nickel leach into the environment and eventually affecting aquatic bodies. The effect of lead and electronic waste on aquatic organism Helisoma duryi was investigated using superoxide dismutase, catalase enzymes and malondialdehyde concentration as biomarkers. Freshwater snail Helisoma duryi was exposed to 0.03 mg/l lead and 50 mg/l electronic waste over a 14 day period, with snails collected on days 1, 7 and 14 to determine time dependant effects. Post mitochondrial fractions were prepared from exposed snails and used to determine superoxide dismutase (SOD), catalase (CAT) activity and malondialdehyde concentration. Inhibition of enzymatic activity was observed for both enzymes with electronic waste showing more effect due to its complex nature. A time dependant increase in malondialdehyde concentration was shown which correlates with the decrease in antioxidant enzyme activity. Based on the results obtained, there is a need to come up with sustainable electronic waste disposal management systems to reduce pollution levels.

1.01.T-07 Exploring the Contribution of Pollution Gradients to the Sediment Microbiome and Potential Pathogens in Urban Streams Discharging into Lake Victoria, Kenya

Kennedy Achieng' Odhiambo[1], Henry Joseph Oduor Ogola[2], Benson Onyango[1], Memory Tekere[2], Grace N. Ijoma[2]

[1]Jaramogi Oginga Odinga University of Science and Technology, Kenya. [2]University of South Africa, South Africa.

Abstract

In sub-Saharan Africa (SSA), urban rivers and streams have long been exposed to human-induced pollution. However, there remains a lack of understanding regarding the response of microbial communities and pathogens in these bodies to intensified anthropogenic inputs. To bridge this knowledge gap, we used a combination of physicochemical analyses, high-throughput 16S rDNA targeted metagenomic sequencing, and predictive metagenomic function profiling to assess the spatial distribution of bacterial communities and their metabolic functions in the sediment of two urban streams that traverse Kisumu City, Kenya. Our findings demonstrated that sediment samples collected from the heavily urbanized catchment areas of both streams exhibited significantly higher levels of total organic carbon (TOC), total nitrogen (TN), and total phosphorous (TP) compared to the less urbanized upper catchment zone. Furthermore, these sediments were found to be severely contaminated with toxic heavy metals, including lead (Pb), cadmium (Cd), and copper (Cu). Analysis of the bacterial composition in the sediment revealed distinct variations along the different stream catchment zones, with the phylum *Actinobacteria*, *Proteobacteria*, *Chloroflexi*, and *Verrucomicrobia* exhibiting differential distribution patterns. Polluted catchment zones were enriched in potential pathogens such as *Corynebacterium*, *Staphylococcus*, *Cutibacterium*, *Turicella*, *Acinetobacter*, and *Micrococcus*, as well as enteric bacteria such as *Faecalibacterium*, *Shewanella*, *Escherichia*, *Klebsiella*, *Enterococcus*, *Prevotella*, *Legionella*, *Vibrio*, and *Salmonella*. Moreover, our study revealed an increasing abundance of genes associated with C and N metabolism, disease pathogenesis, and virulence in the sediments. We also identified environmental factors such as TOC, Pb, Cd, TN, and pH, along with geographical distance, as significant drivers shaping the assembly of sediment bacterial communities. The insights gained from this research provide valuable information crucial for developing proactive and sustainable strategies for urban waste management, monitoring, and water pollution control in low-income countries. By understanding the impact of pollution gradients on the sediment microbiome and potential pathogens in urban streams, we can work towards more effective and targeted interventions to safeguard the health of aquatic ecosystems and protect public health.

1.01.T-08 Endocrine Disruptive Activity and Occurrence of Pharmaceuticals and Viral Content in Selected Water Sources in Melusi, Pretoria

Hermina Swanepoel[1], Joyce Shirinde[1], Sean Patrick[1]

[1]University of Pretoria, South Africa.

Abstract

Background: The quality of drinking water is of global concern with the increase in ineffective Wastewater Treatment Plants (WWTP) and human activity contributing to water pollution. These result in adverse health effects in various populations dependent on these water sources. Water sources are often contaminated with chemicals and pollutants, some of which have endocrine-disrupting chemicals (EDCs) properties.

Methods: This study investigated the occurrence of endocrine-disrupting activity, screening and quantification of select pharmaceuticals and viruses in water samples from water sources in Melusi, Pretoria, South Africa. Analyses were done on water samples to determine EDCs using a battery of bioassays (T47D-KBluc and MDA-kb2 assays), pharmaceutical screening (Agilent Forensic Toxicology Personal Compound Database and Library [PCDL] of 9200 compounds) and quantification using LC/MS-QTOF, and viruses using real-time reverse transcription-polymerase chain reaction (RT-PCR).

Results: Estrogenic activity was present in 13 out of 15 samples and the manner of which water was stored had an impact on the Estrogenic activity. There were three Pharmaceuticals quantified and Atrazine was the most prominent likely compound to be present across the samples. Lastly, there was no Norovirus detected however there was Adenovirus detected in the local dam water.

Conclusion: Findings suggest that water is a potential source for human exposure to EDCs, pharmaceuticals and viruses which can result in that poverty-stricken rural communities such as Melusi being at a higher risk for exposure to these contaminants since the community lacks proper water systems. Exposure to these contaminants has the potential for health risks and warrants further investigation.

Advocacy message: More focus on EDC in water quality guidelines will contribute to better monitoring of water quality regarding EDCs. Additionally, greater awareness can be created of the harm that endocrine disruptors and pharmaceuticals can cause.

1.01.T-09 Cadmium, Chromium, Lead and Mercury species in African Sharp tooth Catfish (Clarias gariepinus) tissue from pools associated with ASGM operations in the Upper uMzingwane catchment area in Zimbabwe

Donald Tapfuma, Norah Basopo, Yogeshkumar Naik

National University of Science and Technology, Zimbabwe

Abstract

This study sought to determine the bioaccumulation and mobility of selected metal species; Cd, Cr, Pb, methylmercury, methylmercury, and Hg (II) in Clarias gariepinus tissue collected from 6 pools associated with ASGM operations in the Upper uMzingwane catchment area. Liver, kidney, gill, and white muscle tissue were excised from benthopelagic Clarias gariepinus fish endemic in the study area to determine metal distribution and bioaccumulation. Cd and Cr concentration in the respective tissue samples was analyzed using FAAS, whereas, Hg species were quantified using the HPLC-CVAFS technique. A control site was used to evaluate the impact of ASGM operations on metal species accumulation in Clarias gariepinus tissue by comparing this with impacted sites (ASGM hotspots). Cd, Cr, Pb, and Hg species (methylmercury, methylmercury, and divalent Hg) concentration distribution followed the following order: gills<liver<kidney<white muscle; kidney<liver<gills<white muscle; gills<liver<kidney<white muscle; kidney<liver<white muscle<gills respectively. There was no statistically significant difference between male and female metal concentration in the respective Clarias gariepinus tissue excised. The BAFs computed were well above 1 across all sites for all the metal species under study in the respective tissues and there was no statistically significant difference between BAFs in the impacted site in comparison with the control site ($p<0.05$) in the respective tissues, bar, Cd $BAF_{sediment}$ in kidney tissue, Pb BAF_{water} in liver tissue and Hg BAF (water and sediment) in liver and kidney tissue. The study revealed that ASGM operations may be responsible for the bioaccumulation of metal species in the study area.

1.01.T-10 Effect of Stored Hair Dressing Saloon Effluents On Haemato-Biochemical Changes on Juveniles of African Catfish (Clarias gariepinus)

Peace Chinedu-Ndukwe, Anthonia Amadi

Michael Okpara University of Agriculture, Nigeria

Abstract

Unwholesome discarding of salon hair effluent has become a serious threat to aquatic biotas. However, rarity of information exists on the effect of fish response to salon hair effluent on haemato-biochemical changThe toxicity of stored hair dressing saloon effluent from various hair dressing shops in Umuariaga on Clarias gariepinus juveniles was studied using static bioassay method for a period of May to August. This study investigated hematological and biochemical changes in Clarias gariepinus juveniles with average weight 15-25g and length 16.5-18.7cm. The exposure lasted for 96 hours after series of range finding test to determine its acute toxicity. The fish specimens were acclimatized for two weeks after which they were distributed randomly into twelve transparent rectangular plastic tanks of 25 liters each consisting of graded stored hair dressing saloon effluent treatments: T1 (800ml/L), T2 (600ml/L), T3 (400ml/L), T4 (200ml/L), and T5(0%) which is the control, all in three replicates, in a completely randomized experiment. The data generated were subjected to one way analysis of variance (ANOVA) at 5% probability level using Duncan multiple range test to separate differences between means. Hematological analysis, packed cell volume (PCV), red blood cell (RBC), white blood cells (WBC), hemoglobin (HB), platelets, mean corpuscular volume (MCV), Mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were also investigated. Biochemical analysis; Aspartate aminotranferase (AST), Alanine aminotransferase (ALT), Alkaline phosphatase (ALP) was also investigated. Mortality increased as the concentration of the effluents increases and 250.96ml/L was obtained as LC50 for 96hours.. In comparison with the control, the mean value obtained for PCV, HB, AST, ALT, ALP showed significant differences ($P<0.05$) in all treatments while there was no significant difference ($P<0.05$) in all values obtained for RBC, platelets and MCH. In WBC, there was only a significant difference ($P<0.05$) between T2R2 and the control group. It was concluded that stored hair dressing saloon effluent has some negative effect on the hematology and biochemical indices of Clarias gariepinus. Therefore, it is recommended that the effluent should be properly treated before been discharged into the environment.

Keywords: Environmental pollution, Aquaculture, Freshwater fishes.

1.01.T-11 Effects of Pharmaceuticals on Aquatic Ecosystems

Paul van den Brink

Wageningen University & Research, Netherlands

Abstract

People and animals use pharmaceuticals, like antibiotics, parasiticides, hormones and anti-depressants. After use residues enter surface waters e.g. via direct application through aquaculture, via run-off of urine and faeces resulting from livestock production and via the sewage treatment plants discharge. The effects of pharmaceuticals on aquatic ecosystems are complex and wide-ranging. They can affect the behaviour, physiology, and reproductive success of individuals and herewith, community composition and functioning as well, but may also induce antibiotic resistance. In order to assess the effects of pharmaceuticals, non-standard testing methods are needed since current test methods may not provide protective endpoints to be used in their risk assessment.

In this presentation I will provide an overview on the effects of pharmaceuticals on aquatic ecosystems. I will present the results from experiments evaluating the effects of antibiotics and antidepressants using mesocosms simulating drainage ditches. Mesocosms are experimental systems used to simulate and study natural ecosystems under controlled conditions. They are typically constructed as tanks that contain living organisms and simulate the physical and chemical conditions of natural habitats, in our case of ditches. In these experiments we can follow the invertebrate, plant and microbial communities in time, as well as functional parameters like dissolved oxygen and pH. I will also present the results of behavioural assays to assess the effects on swimming and feeding behaviour of aquatic invertebrates like freshwater shrimps and snails.

1.01.T-12 The Pre-dredging Assessment of the Water Physico-Chemical Status of Benin River Prior the Seaport Development.

Uchenna Ezeunara Okeke, Anthony Ogbeibu

University of Benin, Nigeria

Abstract

Seaport development includes dredging of water bodies to make it possible. Dredging is also a critical operation that is regularly carried out to preserve safe passage for boats and ships at ports and harbours. It has the potential to impact the water quality and also cause the degradation of aquatic living systems. Four stations were sampled covering 25.2 km along the river stretch from Ajoki (upstream) to Young Town (downstream) with latitudes 05◦059'43.6"-05◦059'35.7"N and Longitudes 005◦028'06.7"-005◦025'56.2"E. two climatic seasons prevailed in the study area: wet season (April – September) and dry season (October – March). Precipitation in this area fluctuated from 1.0 – 1623 mm while the average precipitation was recorded as 636.15mm. Water samples were collected from each station from April 2019 to March 2021 between the hours of 9.00 and 12.30 noon. ANOVA set at 0.05 (95%) level of confidence was used to compute the physical and chemical parameters of water using SPSS version 20.0 while Duncan Multiple Regression Test (DMRT) was to detect the differences in mean values across the stations and seasons. Principal Component Analysis (PCA) and Water Quality Index (WQI) were computed as well. Air and water temperatures ranged from 24°C to 35°C and 22°C to 30°C respectively. The highest pH value (6.8) was recorded in July 2019 from station 1 and the lowest value (4.6) in June 2019 in station 3 and 4. The values for EC ranged from 11.70µS/cm to 3701.0µS/cm while turbidity mean values ranged 0.2NTU to 7.60NTU. The mean values of Total Suspended Solids and Total Dissolved Solids ranged from 0.7mg/l to 12.80mg/l and 6.10mg/l to 1851mg/l respectively. The PCA performed contained 33 components analyzed and the measurements of sampling adequacy and sphericity showed very highly significant difference at P<0.001 while the drinkable quality of the study area is in the order: Station 2 >Station 1> Station 3> Station4.

1.01.P-Mo002 Ecosystem Services and Implications on Water Abiotic and Biotic Properties of The Ndongo Stream at The Southeast Slopes of Mount Cameroon

Daniel Brice Nkontcheu Kenko, Agathe Lambou Fotio, Delphine Kinyuy Kihkishiy, Fabiola Maffo Mba, Eric Bertrand Fokam

University of Buea, Cameroon

Abstract

Freshwater bodies are at the junction of ecology and society. This research aimed at assessing ecosystem services and evaluating anthropogenic impact on water physicochemical quality, total coliforms and benthic macroinvertebrates community structure of the Ndongo stream, southeast slopes of Mount Cameroon. Macro-invertebrates were sampled monthly from November 2021 to May 2022 in three sampling stations along the course of the stream. In each sampling station, temperature, electrical conductivity, Total Dissolved Solids, Dissolved Oxygen, salinity, pH, flow velocity, flow rate and total coliforms were measured. For the evaluation of ecosystem services, data was collected using one hundred semi-structured questionnaires administered to nearby inhabitants at the three chosen station in the ratio 30:40:30. Significant changes in water hydrological, physicochemical and microbiological parameters across stations ($p < 0.05$) were recorded. The macroinvertebrate community differed in terms of sampling sites with a total abundance of 917 individuals. The Shannon index ranged from 1.68 to 1.76 (heavily polluted water) whereas the coliform count fluctuated between 97.29 ± 192.00 and 682.29 ± 722.08 CFU/mL, all above World Health Organization maximum acceptable value (0 CFU/mL). Evenness was between 0.5 and 0.75, synonym of an unstable community. Groups such as Cybister, stonefly larvae, Hydrachnidia, Microvelia, Physa, Chironomidae and Pyralidae had significant association with water abiotic variables and may be exploited as potential bioindicators of pollution in freshwaters ecosystems. The main sources of water used for domestic purposes in the locality was tap (65%) and the Ndongo stream (35%). Inhabitants emptied their trash by the road side, authorized spots by the council, bushes, in the Ndongo river and in pits. Interactions between inhabitants and the stream affected its abiotic and biotic composition.

1.01.P-Mo004 Oxidative Stress Induced Effects by Pharmaceutical and Personal Care Chemicals in the Aquatic Snail Lymanaea natalensis

Norah Basopo, Joanna Change, Ruvimbo Mapindu

National University of Science and Technology, Zimbabwe

Abstract

Natural aquatic reservoirs are the final sinks of chemical pollutants that are released from anthropogenic activities. These chemical pollutants, which include pesticides, polycyclic aromatic hydrocarbons, pharmaceuticals and personal care products, are of various toxicity. Literature has shown that some of these chemicals are biologically active as well as persistent and that they adversely affect aquatic life. In Zimbabwe, while considerable research has been carried out on various anthropogenic pollutants, there is not much data on the extent of pollution emanating from emerging pollutants, including chemicals like pharmaceuticals and personal care products. We investigated the effects of pharmaceutical and personal care effluents on the well-being of the inhabitants of freshwater reservoirs. Aquatic snails were exposed to pharmaceutical effluent, effluent from a personal care facility and a mixture of the two effluents for 14 days. The effects of the pollutants in the effluents on enzymatic markers in Lymnaea natalensis were analysed. The concentration of malondialdehyde, an indicator of lipid peroxidation, was also measured. Pharmaceutical and personal care effluents significantly activated the activities of ($p<0.05$) the antioxidant enzymes, superoxide dismutase, catalase and glutathione peroxidase compared to enzymatic activities in control exposed snails. Levels of malondialdehyde were significantly increased ($p<0.05$) in snails exposed to pharmaceutical and personal care effluents in comparison to MDA levels of snails exposed to control waters. The effluent mixture caused the highest degree of lipid peroxidation in effluent-exposed snails, shown by the highest concentrations of malondialdehyde in the chemical-exposed snails. Our results suggest that pharmaceuticals and personal care residue cause oxidative stress in the snails, indicated by enhanced antioxidant enzyme activities and MDA levels. The pollutants affect the well-being of aquatic life. This is a cause of concern considering literature reports indicate unchecked inflows of pharmaceuticals and personal care chemicals into aquatic reservoirs.

1.02 - Ecological and Human Health Risk Assessment of Legacy and Emerging Contaminants in Africa

1.02.T-01 Mercury Concentrations in Sediments, Fish and Shellfish from the Pra Estuary (Ghana) and its Human Health and Ecological Implications

Benjamin Botwe, Comfort Opoku, Bernice Gyamfi, Christabel Kwamin, Abel Agbanu, Daniel Zotchi

University of Ghana, Ghana

Abstract

The Pra estuary in Ghana has been affected by artisanal and small gold mining, which is an important source of metal through the release of hazardous contaminants. This study aimed to determine the concentrations of mercury (Hg) in sediments, muscles of African catfish (*Clarias gariepinus*), Bagrid catfish (*Chrysichthys nigrodigitatus*), the West African mangrove oyster (*Crassostrea tulipa*), the blue crab (*Callinectes sapidus*) and the muscles and gills of mango tilapia (*Sarotherodon galilaeus*) from the Pra estuary and assess the potential human health and ecological implications. The Hg concentrations in the sediments ranged from 0.004 to 0.21 mg/kg dw with a mean of 0.12 ± 0.02 mg/kg dw and were below the Effect Range Low (ERL) value of 0.15 mg/kg dw and the United States Environmental Protection Agency (USEPA) acceptable limit of 0.20 mg/kg dw, indicating no likely adverse effect on benthic organisms. The mean Hg concentrations in the muscles of fish and shellfish ranged from 0.22 ± 0.04 mg/kg dw in *S. galilaeus* to 0.59 ± 0.14 mg/kg dw in *C. nigrodigitatus*. *S. galilaeus* accumulated higher Hg concentration in its muscle (0.22 ± 0.04 mg/kg dw) than its gills (0.11 ± 0.04 mg/kg dw). The average Biota Sediment Accumulation Factor (BSAF) was 2.64, indicating that bioaccumulation is occurring in the muscles of fish and shellfish in the Pra Estuary. The levels of Hg in the analyzed fish and shellfish species were below the United States Food and Drug Administration (FDA) recommended limit of 1.0 mg/kg dw and World Health Organization (WHO) acceptable limit of 0.50 mg/kg dw, except *C. nigrodigitatus*, which recorded a higher concentration (0.59 ± 0.14 mg/kg dw). To evaluate the human health risks associated with the daily consumption of these species, the Target Hazard Quotients were determined. The THQs were all greater than one, indicating that the consumption of the fish and shellfish species from the Pra estuary is likely to pose adverse non-carcinogenic health effects.

1.02.T-02 Exposure to Carcinogenic and Non-Carcinogenic Toxicants in Environmental Media in Gold Mining Communities in the Asutifi North District, Ahafo Region, Ghana: A Human Health Risk Assessment Approach

Samuel Obiri[1,2], Saada Mohammed[3], Benjamin Ason[4], Isaac Kofi Yankson[1]

[1]CSIR-Building and Road Research Institute, Ghana. [2]Centre for Environmental Impact Analysis, Ghana. [3]CSIR-Water Research Institute, Ghana. [4]CSIR-Soil Research Institute, Ghana

Abstract

Gold mining has played an important role in Ghana's socio-economic and political life for the past 1000 years. However, the negative environmental and socio-economic effects associated with gold mining on the host communities have overshadowed these economic gains. It is within this context that, this study assessed the environmental and human health risk associated with exposure to carcinogenic and non-carcinogenic toxicants by resident adults and children living in gold mining communities in Asutifi North District in Ahafo region, Ghana. A total of 70 water and 30 sediment samples were randomly sampled from surface water bodies in the study area, which has been impacted by the operations of large-scale gold mining companies. In addition to this, 19 rainwater samples were also randomly collected from the study area. These samples were conveyed to CSIR-Water Research Institute Laboratory for the determination of physico-chemical and heavy metal analysis. Concentrations of arsenic (As), mercury (Hg), cadmium (Cd), manganese (Mn), and lead (Pb) were used as input parameters to calculate cancer and non–cancer health risks via exposure on residents using central tendency exposure (CTE) and reasonable maximum exposure (RME) parameters. The cancer health risk for resident adults living in and around River Awonsu who are exposed to As in water samples from River Awonsu is 4.0 ×10−2, and 4.9 × 10−2 for oral ingestion route based on CTE and RME parameters, respectively. This means that on average, 4 and 5 additional cases of cancer are likely to be recorded via the oral exposure pathway in every 100 resident adults living in and around the River Awonsu. The results of the non-cancer human health risk assessment via CTE parameters for resident adults were as follows: 1.98 (As), 4.3 (Cd), 1.45 (Pb), and 4.6 (Hg). The hazard index was above the acceptable value of 1.0, suggesting that adults in the study area are at risk of contracting non–cancerous diseases such as upper respiratory tract infection, hyper skin pigmentation, and other non-cancer-related diseases. Hence the people living around the study area have to take precautions necessary to reduce their exposure.

1.02.T-03 Adverse Effects of Bifenthrin Exposure on Neurobehavior and Neurodevelopment in a Zebrafish Embryo/Larvae Model

Kojo Eghan[1,2], Sangwoo Lee[1], Donggon Yoo[1], Cheol-Hee Kim[3], Woo-Keun Kim[1]

[1]Korea Institute of Toxicology, Korea, Republic of. [2]University of Science and Technology, Korea, Republic of. [3]Chungnam National University, Korea, Republic of

Abstract

Bifenthrin, a third-generation synthetic pyrethroid, is widely used as an agricultural insecticide. However, it can flow into surface and groundwater, leading to adverse consequences such as immunotoxicity, hepatotoxicity, hormone dysregulation, or neurotoxicity. Nevertheless, the entire range of its neurotoxic consequences, particularly in aquatic organisms, remains unclear. In this study, we conducted an extensive examination of how exposure to bifenthrin affects the behavior and nervous system function of aquatic vertebrates using a zebrafish model and multiple-layered assays. We exposed wild-type and transgenic lines *(tg(elavl3:eGFP)* and *tg(mbp:mGFP)*) to bifenthrin from <3 hours post-fertilization (hpf) to 120 hpf. Our findings indicate that bifenthrin exposure significantly affects the tail-coiling response at 24 hpf and the touch-evoked responses at 72 hpf. Moreover, it has a significant impact on various aspects of behavior such as body contact, distance between subjects, distance moved, and turn angle. We attribute these effects to changes in acetylcholinesterase and dopamine levels, which decrease in a concentration-dependent manner. Furthermore, neuroimaging revealed neurogenesis defects, e.g., shortened brain and axon widths, and demyelination of oligodendrocytes and Schwann cells. Additionally, the transcription of genes related to neurodevelopment (e.g., *tubulin, nestin, ngn1, sox2*) and neurotransmitters (e.g., *nlgn1, drd1, htr1bd*) was significantly affected. In summary, our data shows that bifenthrin exposure has detrimental effects on neurodevelopmental and neurotransmission systems in the zebrafish embryo/larvae model. The multiple-layered neurotoxicity assay tools we used proved effective in evaluating the adverse effects of chemicals on neurobehavior and neurodevelopment.

1.02.T-04 Polycyclic Aromatic Hydrocarbons (PAHs) in Surface Water and Sediments at the Federal Lighter Terminal, Onne, Nigeria: An Evaluation of Their Potential Health Effects

Kelechi Charity Lele[1,2], Olarewaju Michael Oluba[2], Oluyomi Stephen Adeyemi[2]

[1]Imo State University, Nigeria. [2]Landmark University, Nigeria

Abstract

Polycyclic aromatic hydrocarbons (PAHs) are ecological concerns owing to their involvement in various life-threatening diseases, especially cancer. Typically, the aquatic environment is a major sink for environmental pollutants, including PAHs. It is then of paramount importance to assess the state of water bodies from time to time for environmental and human safety. In this study, PAH levels and other physicochemical parameters in surface water and sediments at the Federal Lighter Terminal, Onne, were evaluated. Consequently, a preliminary risk assessment of surface water and sediments was also conducted employing the cancer risk assessment model. Water, sediments, and samples were collected from different locations within the ocean terminal and analysed for physicochemical indicators, including PAHs. PAHs were measured by gas chromatography coupled with a flame ionisation detector (GC/FID) using the EPA method. Furthermore, health risk analysis of PAHs in surface water and sediments were evaluated. The results obtained from the study show that electrical conductivity, total dissolved solids, chloride, total hardness, total suspended solids, phosphate, sulphate, and the total concentration of PAHs (TPAHs) were above WHO recommended standards for river water. Sediment samples revealed higher levels of phosphates and TPAHs than the WHO's recommended values. In conclusion, aquatic and human exposure to water and sediments from the popular ocean terminal constitutes a potential threat to the lives of Onne indigenes, especially cancer. Decreased or controlled anthropological activities around the terminal may ameliorate the dangers of exposure.

1.02.T-05 Prevalence of Per- and Polyfluoroalkyl Substances (PFASs) in Marine Seafood from the Gulf of Guinea

Abraham Ekperusi[1,2], Nadège Bely[1], Charles Pollono[1], Kélig Mahé[3], Catherine Munschy[1], Yann Aminot[1]

[1]Ifremer, CCEM, France. [2]Nigeria Maritime University, Nigeria. [3]Ifremer, HMNN, France

Abstract

PFASs are ubiquitous in the global environment due to their wide use, persistence and bioaccumulation, and are of concern for human health. This study investigated the levels of PFASs in seafood with a view to bring knowledge on the occurrence of PFASs in marine resources and to evaluate seafood safety and human health risk via dietary exposure to coastal communities in the Gulf of Guinea, where there is currently very little data. The sum of targeted PFASs was between 91 to 1510 pg g^{-1} ww (mean 465±313 pg g^{-1} ww), with PFOS and long-chain PFCAs prevailing. The concentrations of PFASs in the three species of croakers were species- and location-dependent, with habitat and anthropogenic pressure as likely drivers of the differences. Significantly higher contamination levels were found in male croakers. The trophic transfer and biomagnification of PFASs from shrimps to croakers was evidenced for PFOS and long-chain PFCAs (with a significant increase of contaminants from the prey to the predator). The calculated estimated daily intakes (EDIs) and hazard ratio (HR) for PFOS in croakers (whole fish and muscles) and shrimp were lower than the European Food and Safety Agency's recommended level for PFOS (1.8 ng kg^{-1} day^{-1}) and below the HR safety threshold value of 1. From the results, based on present safety limits, PFOS levels in croakers and shrimps from the Gulf of Guinea do not pose immediate health risks to human population. This study provided the first insight regarding the distribution of PFASs in seafood from the tropical NE Atlantic region of the Gulf of Guinea and highlight the need for further monitoring across the Gulf.

1.02.T-06 Human Risk Assessment of Phthalates and Bisphenol A in Freshwater Fish From Ose and Owan Rivers, Southwestern Nigeria

Josephine Olayinka-Olagunju[1], Adekunle Dosumu[2], Adetola Olatunji-Ojo[1], Joseph Otugboyega[3]

[1]Adekunle Ajasin University, Nigeria. [2]Trent University, United Kingdom. [3]Federal University Oye-Ekiti, Nigeria

Abstract

Phthalate esters (PAEs) and Bisphenol-A (BPA) are organic chemicals known as endocrine disruptors, found in several manufacturing and consumer products and may cause serious stimulation of estrogenic activities in humans. The aim of this study was to measure the level of PAEs and BPA in Clarias gariepinus, Clarias angularis, Labeo parvus, Oreochromis niloticus and Parachanna obscura from Ose River in Ondo State and Owan River in Edo State, Nigeria and to determine the human risk assessment of the additives. Gas chromatography-mass spectrometry (GC-MS) was used for analysis of the additives. Fourteen PAEs compounds (DMP, DCHP, DEHP, DPrP, BBP, DEP, DBzP, DPeP, DiBP, DAP, DnOP, DPhP, DBP and DHxP) and nine BPA compounds (BPF, BPE, BPC, BPG, BPAP, BPZ, BPA and TMC) were examined in the fish. The results showed that DEHP (97.80±0.465ng/g d.w.) had the highest concentration of PAEs measured in C. gariepinus from Ose River while DnOP (15.86±0.977 ng/g d.w) measured the highest in P. obscura from Owan River. In addition, DPrP and DPeP were not detected (ND) in fish species from River Ose but were seen in fish from Owan River. More so, BPC measured the highest concentration of 95.65±0.450 ng/g d.w in L. parvus from Ose and 85.69±11.59 ng/g d.w in P. obscura from Owan River. The most abundant PAEs, DEHP and DnOp, are commonly added to plastics to make them flexible and enter the aquatic environment through industrial wastewaters sticking firming to the aquatic biota while BPC can cause severe oxidative stress in fish. Risk assessment was determined from chronic daily intake (CDI) and hazard quotient (HQ). A high CDI and HQ was revealed from the consumption of fish by children while consumption from adults was lower. This study concludes that the daily intake consumption of fish from the two rivers was moderate and safe for consumption but recommends further study.

Keywords: freshwater, phthalates, bisphenol-A, risk assessment, chronic daily intake, hazard quotient

1.02.T-07 Water Quality Assessment From Thatched Roof and Implications for Human Health

Joshua Nosa Edokpayi[1], Livhuwani Vele[1], Eunice Ubomba-Jaswa[2]

[1]University of Venda, South Africa. [2]Water Research Commission of South Africa, South Africa

Abstract

The implementation of rainwater harvesting systems has a huge potential as a sustainable alternative source of water to cope with water scarcity, particularly, at the household level and can become economically feasible. There are, however, problems concerning the quality of rainwater since there are possibilities that roof-harvested rainwater might be contaminated with physical and chemical pollutants, such as heavy metals and microbiological pathogens. Hence this study aims to assess the quality of harvested rainwater from a traditional kind of roof types which is predominant is rural areas of the Northern part of South Africa. Physicochemical parameters that were measured in this study include: Physicochemical parameters of the harvested water was assessed using standard protocols. Trace metals was also analysed using Inductively coupled Plasma Mass Spectrophotometer (ICP-MS). Membrane filtration method was used for the analysis of total coliform and E. coli. The results showed that all of the physicochemical parameters analysed were within the South African National Standards as well that of the World Health Organisation for drinking water except for turbidity. The average turbidity levels detected in the thatched rooftop rainwater harvested from Univen, Sibasa and Tshikhudini village were 7.80 NTU, 5.12 NTU and 5.27 NTU, respectively. Thatched rooftop rainwater samples collected from Tshikhudini village recorded highest average E. coli (85.3 cfu/100 mL) and total coliform (158.3 cfu/100 mL) values compared with the other two sampling areas. It was recommended that Thatched Rooftop harvested rainwater must be properly treated using one of the various simple point-of-use water treatment technology before potable use.

1.02.T-08 Cannabichromene: Appraisal of the Toxicological Potentials on Hepato-renal Tissues of Adolescent Rats

Oluwatosin Dosumu[1], Odunayo Taiwo[2,1], Gabriel Dedeke[1], Oladipo Ademuyiwa[1], Raphael Bright[1], Azeez Razaq[1], Kehinde Osibowale[1], Olayimika Ayodele[1]

[1]Federal University of Agriculture Abeokuta, Nigeria. [2]Chrisland University, Abeokuta, Nigeria

Abstract

The use of non-psychoactive cannabinoids in health management and treatment is gaining global recognition. Cannabichromene (CBC) as opposed to cannabidiol its non-psychoactive counterpart has been under-studied despite its relative abundance in the Cannabis sativa plant. Although, its modulatory effect on reproductive and neurodevelopment biomarkers have been postulated through molecular docking computational approach, however, possible alterations of the hepato-renal system are essential to establish the toxicological effects and safety of use. The effects of 10mg/kg body weight dose of CBC on enzymatic and non-enzymatic antioxidant tissue biomarkers, as well as oxidative stress markers were investigated in the liver and kidney using male and female Wistar rat models. Twenty-four Wistar rats (12 male and 12 female, mean weight: 120-140 g) were allocated into control and test groups (n=6). After 21 days of oral administration of CBC, the rats were euthanized, the whole blood was collected from the retro-orbital plexus then the liver and kidney were excised for biochemical analysis (liver and kidney function marker enzymes and metabolites) and histological evaluations. The activities of catalase (CAT) and glutathione peroxidase (GPx) were significantly ($p < 0.05$) reduced while superoxide dismutase (SOD) was increased. Also, nitric oxide (NO), malondialdehyde (MDA), and glutathione (GST) levels were increased in the liver of both male and female CBC- exposed rats. A similar trend was observed in the kidneys. Furthermore, all electrolyte concentrations were significantly increased in the serum of the CBC-exposed male and female rats, as well as the level of 8-hydroxydeoxyguanosine; a DNA damage metabolite. Likewise, histological evaluations revealed lesions, significant atrophies, and modifications of the investigated tissues. A general overview of this study indicates that CBC may not possess the equivalent health benefit associated with other non-psychoactive cannabinoids, however, further intensive studies to ascertain the likely potentiating beneficial effects when co-administered could be investigated.

1.02.T-09 Heavy Metals Contamination and Health Risk Assessment Of Soils in Dumpsites Within the Vicinity of University of Port Harcourt, Nigeria

Kingsley Patrick-Iwuanyanwu, Cynthia Kelechi Anaelechi, Chinwe Ibeabuchi

University of Port Harcourt, Nigeria

Abstract

This study investigated the levels of lead(Pb), zinc (Zn), cadmium (Cd), manganese (Mn), chromium (Cr), nickel (Ni), arsenic (As) and copper (Cu) in soil samples from four selected dumpsites in the vicinity of the University of Port Harcourt, East-west Road, Choba, Rivers State, Nigeria. Analysis of metals was carried out by wet digestion and atomic absorption spectroscopy, and the concentrations were found to fall within the following range; Zn (74.54–122.42mg/kg), Cr (28.76-42.17mg/kg), Ni (15.71-24.95mg/kg), Cu (13.62-23.17mg/kg), Mn (6.15-10.74mg/kg), Pb (4.87-10.32mg/kg), Cd (2.79-5.15mg/kg) and As (0.35-0.85mg/kg) respectively. Measured levels of these metals were further used to calculate the health risk for adult and children population. The ecological health risk was assessed with pollution indices; geoaccumulation index (Igeo), enrichment factor (EF), pollution index (Ipoll), contamination factor (CF), contamination degree (CD), ecological risk index (ERi) and potential ecological risk index (PERi). The ADI of Cu in control site was greater than the RfD by WHO standards showing concerns for non-carcinogenic health complications. The Hazard Index value for the population in the control site was >1, indicating a high non-carcinogenic risk to adult and children exposed in the area. Igeo value showed that the soil samples were graded as unpolluted to moderately polluted with Cd observed to be moderately to highly polluted in all the sample areas studied. The same trend was also observed for Ipoll where all the soil samples were observed to be unpolluted to moderately polluted. However, Cd in samples A, B and C and Mn in samples A and D showed moderately to highly pollution. The EF values obtained in this study showed that Cd, Ni and Zn were exceptionally enriched in all the sample areas whereas As, Pb, were observed to be extremely enriched in soil samples A, B and D. The CD values of the metals in the analysed soils exerted moderate to high contamination.The PERi of the metals in this study exerted average to significant ecological risk to the exposed populace. In conclusion, these findings however, reveals that the indiscriminate dumping of refuse of wastes around the university may result to a public health concern.

1.02.T-10 Unveiling Antibiotic Resistance Genes and Mechanisms in Soil Samples from an Effluent Disposal Point of a Cassava Processing Plant using Shotgun Metagenomics

Babasola Fateye[1], Olayinka Osuolale[2], Lateef Salaam[2]

[1]Grand Valley State Univ, USA. [2]Elizade University, Nigeria

Abstract

Antibiotic resistance has become a global concern due to its impact on public health and the environment. Understanding the prevalence and mechanisms of antibiotic resistance in environmental reservoirs is crucial for developing effective strategies to mitigate its spread. In this study, we employed shotgun metagenomics using MiSeq sequencing to explore the antibiotic resistance gene profile and associated mechanisms in sediment samples collected from the effluent disposal point (EP) of a food processing plant and Smokin Hills golf course (GF) located in Ilara Mokin. To identify antibiotic resistance genes, we employed the Comprehensive Antibiotic Resistance Database (CARD). Our analysis revealed the presence of various resistance genes in the sediments from the 2 sites. The macB and TxR top the most abundance resistance genes at 5.2%, 3.5% respectively at the effluent point and 6.3%, 6.2% respectively at the golf course. We found at EP and GF, antibiotic efflux (61.9%, 68.4%) antibiotic target alteration (15.9%, 15.2%), protection (9%, 5%) and antibiotic inactivation (3.6%, 5.2%) as the most common resistance mechanism from both sites. The identification of various resistance genes in the sediment samples highlights the potential for antibiotic resistance dissemination through these sites. The macB and TxR genes emerged as the most abundant resistance genes, indicating their prevalence and potential role in conferring antibiotic resistance within these environments. This study provides valuable insights into the genetic landscape of antibiotic resistance in soil samples collected from an effluent disposal point of a cassava processing plant. The identification of specific resistance genes and associated mechanisms underscores the need for continuous monitoring and surveillance to prevent the spread of antibiotic resistance in environmental reservoirs. The presence of multiple resistance mechanisms suggests a complex interplay of genetic elements involved in antibiotic resistance in these sediments. The identification of specific resistance genes and mechanisms in these sediment samples highlights the need for continued monitoring and surveillance of environmental reservoirs for antibiotic resistance. By understanding the prevalence and mechanisms of antibiotic resistance, appropriate mitigation strategies can be developed to minimize the potential risks associated with these environments

1.02.T-11 Occurrence, Human Exposure, and Risk Assessment of Organophosphorus Flame Retardants in Landfill Sediments From Gauteng, South Africa

Innocentia Sibiya[1,2], Jonathan Okonkwo[2], Caliphs Zvinowanda[1], Allen Chaparadza[3]

[1]University of Johannesburg, South Africa. [2]Tshwane University of Technology, South Africa. [3]Austin Peay State University, USA

Abstract

Even though particle bound organophosphorus flame retardants (OPFRs) such as dust can undergo long range atmospheric transfer (LRAT) information on the risks associated with outdoor human exposure to landfill dust, is limited considering the adverse health effects that the general communities living near landfill sites may experience. Pollutants get dispersed by wind and lighter dust sized particles persist long enough to pose problems in distant areas, resulting in trans-boundary pollution. OPFR concentrations in 8 municipal landfill sediment in Tshwane and Johannesburg, Gauteng, South Africa were investigated using green choline chloride/urea (CU (1:2)) for extraction. Median concentrations for chlorinated, alkylated and arylated OPFRs ranged from < limit of quantification (LOQ)-4.04 x 10^3 ng/g dw,<LOQ-395 ng/g dw and <LOQ-130 ng/g dw, respectively. The source of the contributing OPFRs in landfill sediment concentrations is related to everyday household products that are discarded in landfills. Risk assessment for non-cancerous compounds (TCPP and TEHP) with reference dose (RfD) values was based on the hazard quotients and the results suggested that although infants, children, and adults residing around landfill sites spend 0.5, 2.2 and 2 hours outside their homes/day respectively, they may have adverse health effects caused by ingestion followed by the inhalation of OPFRs contaminated dust.

1.02.T-12 Aquatic Risk Assessment of Commonly-Used Pesticides in Matazem Stream in Santa, North West Region of Cameroon

Patricia Bi Asanga Fai[1,2], Francis Ngealekeloeh[2]

[1]The University of Bamenda, Cameroon. [2]University of Dschang, Cameroon

Abstract

The need to increase global food production has led to an increase in the intensity of pesticides use in agriculture. But pesticides used in agricultural fields located near aquatic environments may cause harm to human health and non-target aquatic organisms. However, very limited studies have been carried out in Sub-Saharan Africa to assess the risk of agricultural pesticides to the environment. The present study was aimed at assessing the risk posed by pesticides to non-target organisms in the Matazem stream, which runs through a major vegetable production zone in Cameroon using the PRIMET (Pesticides RIsk in the tropics to Man, Environment and Trade) model. PRIMET uses actual pesticides application data at the farm level and our results showed that 9 pesticide formulations containing 8 active ingredients were used by vegetable farmers around the Matazem streams. These included four fungicides (carbendazim, chlorothalonil, mancozeb and metalaxyl), one insecticide (cypermethrin) and three herbicides (diurin, glyphosate and paraquat dichloride). In general, the fungicides had the highest application doses and frequencies of application. The PRIMET model predicted that two of these pesticides active ingredients (chlorothalonil and cypermethrin) posed a definite acute risk. In addition, chlorothalonil as well as mancozeb also posed a possible chronic risk. The risk posed by these pesticides could be attributed to the use patterns amongst other things. We therefore recommend more farmers' education on proper pesticides use. Results from a higher tier risk assessment using the PERPEST V 4.0 model (a model that predicts the ecological risks of pesticides in freshwater ecosystems) for cypermethrin applied at only 0.27 µg/l indicated a high probability of clear toxic effects on insects (92.7%), macrocrustacea (93.8%) and microcrustacea (77.7%). The predicted probabilities for harmful effects on algae and macrophytes, fish and rotifers were respectively 35.9%, 28.3% and 30.9%. Farmers' application rates and the use of cypermethrin on farms near streams may need to be reviewed.

1.02.P-Tu007 Climatic Zone Related Variations in Toxicity of Imidacloprid Towards Aquatic Species and Outlooks: A Review

Lemessa Merga[1], Paul van den Brink[2]

[1]Ambo University, Ethiopia. [2]Wageningen University & Research, Netherlands

Abstract

Neonicotinoid pesticides, in specific the insecticide imidacloprid, are widely used and are major concern of water pollution worldwide. In this review study, monitoring values of imidacloprid in surface waters, toxicity results under different climatic regions, and possible geographical related toxicity modifiers are summarized to highlight required research gaps that help mechanistic understanding of imidacloprid toxicity variations observed between (sub)-tropical and temperate aquatic organisms. From the monitoring studies, the average and maximum values of imidacloprid reported is in the range of < 0.002 - 58.87 µg/L and 0.0082 – 294 µg/L, respectively. 16.7% and 50 - 75% of the reported mean values of imidacloprid exceeded the acute and chronic benchmarks international established for freshwater invertebrates, respectively. Toxicity reports of imidacloprid to aquatic arthropods indicated the significant geographical related toxicity variations towards aquatic communities, where (sub)-tropical organisms are remarkably sensitive to the insecticide compared to species in temperate and Mediterranean regions. For instance, the 96 h-LC50 for Cloeon sp. reported in Bangladesh is about 1416 times higher than the value reported for the species in Netherlands. These differences in sensitivity can be a result of multiple factors such as variations in temperature, food availability, altitude and generation status of the test organisms. Our review result indicates strong evidence for the manipulation of toxicity of imidacloprid with change in temperature of the water systems, indicating the increase of the imidacloprid toxicity to water arthropods along with temperature increase. However, the aforementioned other factors cannot be ruled out, thus, require further investigations.

1.02.P-Tu008 Testicular and Reproductive Toxicities via Oxidative Stress in Male Wistar Rats Exposed to Water-Soluble Fraction of Bonny light Crude Oil.

KIngsley Patrick-Iwuanyanwu, Abraham Chiedozie Nicholas

University of Port Harcourt, Nigeria

Abstract

The present was designed to investigate the water-soluble fraction of Bonny Light crude oil (WBCO) - induced testicular and reproductive toxicities in male Wistar albino rats.
Twenty-four adult male Wistar albino rats were randomly divided into four groups of six rats per group. Group 1 was fed normal rat feed and water only served as control. Group 2 was given 1 mL of 25% WSF of WBCO orally on alternate days; Group 3 was given 1mL of 50% WSF of WBCO on alternate days and Group 4 was given 1 mL of 100% WSF of WBCO on alternate days. The experiment was performed for 60 days. After the treatment, rats were sacrificed; blood samples were collected, and testes were excised, weighed, and processed for histological examination.
Final body weight increased significantly following WBCO–treatment. Percentage weight gain, absolute and relative testis weight declined in WBCO–treated rats after 60 days. Epididymal sperm count, viability, motility, and normal sperm cells declined whereas, the percentage of sluggish, abnormal, and dead cells increased significantly ($p<0.05$) in WBCO-treated rats. Plasma testosterone, luteinizing hormone (LH), and follicle-stimulating hormone (FSH) levels decreased in a dose-dependent manner in rats treated with WBCO. Malondialdehyde (MDA), an end product of lipid peroxidation increased with a concomitant decrease in oxidative stress enzymes: catalase (CAT), superoxide dismutase (SOD), and reduced glutathione (GSH) in WBCO-treated rats. Histological examination of rats treated with 100% WBCO showed distorted testis characterized by vacuolations in the seminiferous tubules.
The results suggest that treatment with WBCO altered testicular function and reproductive indices via the generation of reactive oxygen species (ROS) leading to oxidative stress.

Keywords: Water soluble fraction, bonny light crude oil, testis, testicular toxicity, oxidative stress, infertility

1.02.P-Tu010 Insights Into Microbial Quality Of Drinking Water In Treatment Plants And Distribution System

Memory Tekere[1], Chimdi Mang Kalu[1], Khuthadzo Mudau[1], Vhahangwele Masindi[1,2]

[1]University of South Africa, South Africa. [2]Magalies Water, South Africa

Abstract

Occurrence of microorganisms in treated drinking water is a concern to all that are involved in delivering safe and quality drinking water to communities. Poor public infrastructure and services delivery often compromises the quality of services outputs received by communities including drinking water. Recurrent waterborne microbial diseases such as the cholera outbreak at the end of May-early June 2023 in the Hammerskraal area, South Africa, goes to show how imperative it is to always be on guard in ensuring quality compliant drinking water. The objective of this study was to evaluate the presence of bacteria and fungi in drinking water, evaluating potential presence of antimicrobial resistant strains and the human health risks. Drinking water samples were collected from sites in the North-west, Limpopo, Mpumalanga and Gauteng Provinces for analysis. Microbial community populations characterisation was done using culture, metagenomics, and whole genome sequencing. The findings are presented in this paper and are pertinent to the understanding of potential microbial risks that drinking water by virtue of its quality, poses and informs better management of drinking water to communities.

1.02.P-Tu012 Patterns of Multi-Antibiotic Resistant Bacteria in Potable Water: An Indication of Contamination

Bukola. O Atobatele, Abimbola. A owoseni, Oluwatosin. E Atobatele

Bowen University, Nigeria

Abstract

Water is indispensable for life and growth. Lack of potable water in appropriate quality and quantities can lead to public health problems. This study assessed the diversity and distribution of multi-antibiotic-resistant bacteria in underground potable water within Iwo, Nigeria. Underground water samples were collected from thirty wells in duplicates. Bacterial species were isolated using standard microbiological procedures. Pure cultures were standardized and screened for antibiotic sensitivity using the disc diffusion method with 11 antibiotics on Mueller Hinton agar. Resistance patterns to tested antibiotics were studied. A total of 219 bacteria (177 Gram-negative and 42 Gram-positive) were isolated from all the water sampled. The organisms isolated belonged to sixteen genera and were identified as Citrobacter, Enterobacter, Escherichia, Klebsiella, Morganella, Neisseria, Proteus, Providencia, Pseudomonas, Salmonella, Serratia, Arthrobacter, Bacillus, Micrococcus, Staphylococcus and Streptococcus with Klebsiella being the most occurring. It was observed that Gram-negative bacteria recorded high resistance to cefixime (88.7%), cefuroxime (85.9%), and ceftazidime (79.7%). Gram Positive bacteria also recorded high levels of resistance to cloxacillin (90.5%), augmentin (88.1%), cefuroxime (76.2%), ceftriaxone (73.8%, and ceftazidime (71.4%). Most of the isolated bacteria were completely resistant to the β-lactam antibiotics namely the cephalosporins i.e. cefuroxime, ceftriaxone, ceftazidime, and penicillins i.e., augmentin. It was discovered from this study that thirty-one (31) bacterial isolates (16 Gram-negative and 15 Gram-positive) exhibited resistance to more than two (2) antibiotics. Multiple antibiotic resistance was found to be highest in the isolated Klebsiella genera. Multiple resistance patterns were observed with Ceftazidime-Cefuroxime-Cefixime-Ciprofloxacin-Augmentin occurring most in Gram-negative bacteria while the pattern Cefuroxime-Ceftazidime-Ceftriaxone-Augmentin-Cloxacillin-Erythromycin was the highest recorded in Gram-positive bacteria. Isolation of multiple drug resistance bacteria in potable water is a major health concern signifying a public health hazard. There is therefore a need for proper water treatment to reduce the spread to humans and ultimately drug treatment failures. It is recommended that awareness and policy be made on the usage, control, and sales of antibiotics.

Track 2. Terrestrial and Wildlife Toxicology and Ecology

2.01 - Trends in Legacy and Emerging Contaminants in Terrestrial Ecosystems

2.01.T-01 Chronic Exposure to Yellow Light at Night Induced Oxidative Stress in the Testes of Albino Rat Rattus norvegicus

Festus Kehinde[1], Gabriel Dedeke[2], Matthew Olude[2], Kehinde Ademolu[2], Adeyinka Aladesida[2], Abiodun Adewale[2], Folarin Owagboriaye[3]

[1]Kogi State University, Nigeria. [2]Federal University of Agriculture Abeokuta, Nigeria. [3]Olabisi Onabanjo University, Nigeria

Abstract

Environmental illumination with Artificial Light at Night (ALAN) is on the increase globally. ALAN has been implicated in the distortion of homeostasis by way of the induction of oxidative stress.The gadgets human are exposed to radiate different light spectra and less attention is given to its implications on health. Hence this study aimed at evaluating the effect of various light colours on the oxidative status of the testes of albino rat, Rattus norvegicus. Using complete randomize design, 105 day old rats distributed in triplicate of 5 rats in groups; blue, green, yellow, red and white light while ambient light and darkness served as the control. The rats were exposed for 126 day at night for 12 hour daily (6 pm – 6 am). The light intensity was maintained at 300 Lux and 11 watt compact florescence bulb was used as the source of light. Glutathione peroxidase, GPx; superoxide dismutase, SOD; reduced glutathione, GSH) and lipid peroxidation (MDA) of the homogenate from testes collected at days 63, 91 and 126 were examined spectrophotometrically. The data were subjected to analysis of variance and the mean separated by Duncan multiple comparisons. The levels of MDA were significantly ($p < 0.05$) elevated in the rats exposed to white light in d63 (13.50±8.22 X 10-8 nmol/g tissue). Exposure to yellow light significantly ($p < 0.05$) reduced the activities of SOD at d91 (4.81±3.49 U/mg protein) and had the least value at d126 (4.69±1.04 U/mg protein). The level of MDA was also elevated significantly ($p < 0.05$) in the testes of the rats under darkness at d126. Lipid peroxidation increased with time in the testes of the rats exposed to yellow light (d63 = 6.92±0. 76 X 10-8 nmol/g tissue; d91 = 11.5±1.00 X 10-8 nmol/g tissue and d126 = 15.20±4.10 X 10-8 nmol/g tissue), with R2 = 0.98. The testes of albino rats appeared to suffer oxidative stress when exposed to yellow light over an extended period of time.

2.01.T-02 Aflatoxin Contamination Risk from the Consumption of Major Staple Crops in Ghana

Richard Boadu Opoku, Vitus Apalangya, Dorcas Osei-Safo, Enock Dankyi

University Of Ghana, Ghana

Abstract

Aflatoxins are widely recognized as highly carcinogenic mycotoxins and important natural contaminants of a wide range of crops, particularly maize and groundnuts, which constitute integral components of staple diets in many developing countries, including Ghana. Aflatoxin contamination is widespread in Africa and poses huge public health risks due to its high presence in food and feed. Notwithstanding the widespread exposure, research data and knowledge on aflatoxins in food and exposure to the population remains low and largely restricted to exported food products, leaving millions exposed to potentially significant levels of the toxins. In this study, we report a comprehensive analysis of aflatoxin content (AFB1, AFB2, AFG1, AFG2) in 303 samples comprising 165 samples of maize and 138 samples of groundnut from farms, homes, markets, and storage centres in eight regions across Ghana. The samples were analyzed by extracting aflatoxin with methanol/water, cleaned up on an immunoaffinity column and analysed using Reverse-Phase High-Performance Liquid Chromatography (RP-HPLC) coupled to a fluorescence detector. Based on the data obtained, aflatoxins were quantified in 80.6% of the maize samples with levels ranging from 0.20 to 1129.7 µg/kg. The quantified levels of aflatoxins in groundnut samples ranged from 0.20 to 1242.9 µg/kg, with an occurrence of 73.9% in samples. Total aflatoxin was present in more than 50% of maize and 26% of groundnut samples at concentrations that exceeded the Ghanaian standard of 10 µg/kg. The study suggests that the Ghanaian population may be significantly exposed to aflatoxins, given that, the values obtained in this study represent one of the highest prevalence and levels recorded in the country. This study will help inform the policy on prioritization of aflatoxin as a significant food safety concern in the establishment of the Partnership for Aflatoxin Control in Africa (PACA) by the African Union Commission.

2.01.T-03 Assessment of Heavy Metal Contamination in Amphibians from Otofure Dumpsite, Edo State, Nigeria

Omoyemwen Edo-taiwo, Osigbeme Emmanuel Michael, Perpetual Erhunmwunse, Prosperous Odaromize Ikpamejo

University of Benin, Nigeria

Abstract

Dumpsites have been implicated in the storage of heavy metals. Amphibians are typically drawn to the dumpsite due to the abundance of permanent food/prey items and the presence of appropriate moisture, particularly during the wet season. The vulnerability of amphibians to heavy metal pollutants in open dumpsites is concerning. As a result, an atomic absorption spectrophotometer (AAS) was used to examine heavy metals contamination in amphibian tissues and soil from the Otofure dumpsite in Edo State, Nigeria. Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Lead (Pb), and Nickel (Ni) are among the metals evaluated. Two species of amphibians (Ptychadena pumilio and Sclerophrys maculata) were handpicked within the dumpsite and at ≥100m away towards human habitation in the community. Except for Cd, which was exclusively detected in the kidney and liver, all heavy metals investigated were found in amphibian organs and tissues. The kidney and liver tissues exhibited the highest Cu concentrations. Copper and Pb predominated in all amphibians from both the dumpsite and the community, while Cu and Cr predominated in the soil. Cadmium was not detected in the thigh muscles of amphibians from either location, nor in the liver or kidney of P. pumilio from the community. Copper and Pb concentrations in amphibians from the dumpsite varied from 1.53±0.16 to 3.40±0.16mg/L and 0.95±0.57 to 5.10±1.67mg/L, respectively. All six heavy metals identified in soil were above the WHO acceptable limits in plants and soil, with Cu concentrations ranging from 103.95±0.05 to 123.15±0.83mg/kg. The measured heavy metal concentration trend was Cu>Pb>Cr>Ni>Co>Cd in amphibians and Cu>Cr>Ni>Co>Pb>Cd in soil. The findings of this study show heavy metal pollution in both the dumpsite and the town of Otofure, which is most likely due to waste placed in the dumpsite. This has implications for plants and animals, as well as humans living in the neighborhood, particularly those whose residents live near the dumpsite and scavengers who earn a living off the dumpsite. As a result, the usage of open dumpsites should be discouraged, and the dumpsite should be relocated far from human habitation.

2.01.T-04 Impact of Bushfire on Vegetation, Soil Properties and Microbial Community in a Semi-arid Environment in Botswana

Willie Marenga, Venecio Ultra, Mpaphidzi Mapoka, Gaolathe Rantong, Batendi Nduna, Gizaw Mengistu

Botswana International University of Science & Technology, Botswana

Abstract

Bushfires at different extent and intensity can alter the vegetation structure and several biogeochemical cycles in soil that could have a profound impact on environmental maintenance and climate. In Botswana, the frequency of bush fires has increased in some areas due to recent changes in land use, increased vegetation vulnerability and climate change. Hence this study was conducted to determine the impact of bushfire on vegetation dynamics and some soil bio-chemical properties including the microbial community structure in the rhizosphere of dominant plant species in a semi-arid region of Botswana. Vegetation survey was conducted on burned and unburned areas (control) at Palapye, Botswana. Simultaneously, soil samples were collected on the same area and analyzed for total organic matter content, pH, EC, and soil microbial functional diversity by Biolog Ecoplates. Results showed that vegetation structure in the study area were shrub savanna and tree savanna mainly comprised of *Colophospermum mopane, Senegalia nigrescens, Combretum apiculatum, Senegalia fleckii , Strychnos spinosa, and Strychnos madagascariensi*s. The study revealed that burned areas have a higher vegetation diversity and species evenness than non-burned areas. In terms of species richness and vegetation cover, non-burned areas had higher values than burned areas. Physiological analysis of vegetation showed that control had a higher rate of photosynthesis, transpiration, and stomatal conductance than burned areas. Soil analysis of the rhizosphere and bulk soil (open area) from burned areas revealed higher pH and organic matter content than in the unburned area while the EC was higher in the control than in the burned area. The impact of bushfire on the microbial community structure was significant and there was a decline in microbial activity and substrate utilization richness on bushfire affected sites compared to the non-affected area in both the rhizosphere and bulk soil. Rhizosphere soil under grasses and trees from unburnt areas had less microbial diversity and evenness as compared to unburned areas. In contrast, high microbial diversity and evenness were observed in the rhizosphere of shrubs. Overall, the result showed that the short-term impact of bushfire occurrence could affect both the vegetation structure at recovery stage and consequently alter the soil chemical and biological properties that may have a profound impact on the biogeochemical processes and climate at wider scale.

2.01.T-05 Biogeographical Venom Variation of Bitis Arietans and Naja Nigricollis From Northern and Southern Nigeria; Implications for Antivenom Effectiveness

Akindele Adeyi[1], Emmanuel Oluwatimilehin Stephen[1], Siji Ajisebiola[2]

[1]University of Ibadan, Nigeria. [2]Osun State University, Nigeria

Abstract

Diversity and ecological distribution are major factors that play significant roles in influencing variations in snake venom protein composition with consequent effect on cross-efficacy of antivenoms. Understanding venom proteins components of snake species in respect to differences in their environment is vital for development of effective antivenom. Comparison studies regarding variations in venom proteins of snake species from different ecological zones in Nigeria is not available. Thus, this study was aimed to provide information on variations in venom proteome composition of Bitis arietans (Puff adder) and Naja nigricollis (the black-necked spitting cobra) species of Northern habitat in comparison with same species from the Southern region of Nigeria. Adult snake species of B. arietans and N. nigricollis were captured from Kaduna (North) and Ibadan (South), respectively. The snakes were milked and venom lyophilized into crystals using freeze drying method. The venom proteins components were analyzed by a combination of 2-D gel electrophoresis and LC-MS/MS. Classification of the proteins was made by BLAST search and activity determination was done using SWISS Model and CATH for the identification of protein families and folds. A total of 33 protein groups consisting of 49 proteins were identified in venom of Northern B. arietans while 32 protein groups comprising 39 proteins were identified in southern B. arietans venom with 69% similarity in proteins composition, indicating a high possibility of cross-effective antivenom to neutralize both venoms. On the other hand, a total of 121 protein groups comprising of 173 proteins were identified in venom of northern N. nigricollis whereas, 94 protein groups consisting of 215 proteins were identified in venom of southern N. nigricollis with 49% similarity in venom protein composition indicating a low cross-effectiveness of antivenom in neutralizing both venoms. This study presents the variations in venom proteome of Bitis arietans and Naja nigricollis of different ecological regions. These variations should be considered in the development of antivenoms for effective treatment of snakebite envenoming in Nigeria.

2.01.T-06 Avian Feathers as a Biomonitoring Tool to Assess Organochlorine Pesticide and Metal Residues in Birds at the Botanical Garden, University of Ibadan, Nigeria

Adeola Oni, Theophilus Oluajagbe, Temitope Akeremale, Titilayo Braimoh, Aina Adeogun

University of Ibadan, Nigeria

Abstract

Botanical gardens are special conservation centers set up to address the crisis of biodiversity loss. They are typically perceived as less contaminated sites due to an observed high level of biodiversity. However, their ability to trap and accumulate pollutants may transform them into locations with high concentrations of contaminants hence the need to appraise the contaminant levels of these biodiversity hotspots. A non-invasive biomonitoring method using avian molting flight feathers was employed to assess for organochlorine pesticides and metals in birds at the University of Ibadan Botanical Garden between January and December 2022. 15 OCPs including; α-HCH, β-HCH, δ-HCH, Heptachlor, Aldrin, p,p' DDE, Endrin, p,p' DDD, p,p' DDT, and Methoxychlor were analyzed with GC/MS while ten metals including; manganese, iron, copper, zinc, lead, and cadmium were analyzed using AAS. Asymmetry in the left and right-wing, and tail feathers, as well as tarsals, were used to assess avian fitness. A total of 57 birds comprising 9 families and 12 species were encountered over the study period. Eight OCPs were detected, five in the granivores, three in the insectivores, and four in the omnivores. p,p' DDE and p,p' DDD (metabolites of -DDT) were observed in all sampled birds across trophic levels. p,p' DDD was highest in the granivores (0.12±0.17mg/g). Heptachlor was also detected only in the granivores (1.88±2.66mg/g) and this may be linked to its use in seed treatment. The higher p,p' DDE (0.20±0.07mg/g) in the insectivores, along with p,p' DDD was probably indicative of prior exposure to DDT possibly due to the use of pesticides in adjoining farmlands. p,p'DDE levels were also highest in the Red-bellied paradise flycatcher (0.38±0.09mg/g). The Red-bellied paradise fly-catcher (Terpsiphone rufiventer), an insectivore had the highest levels of zinc (1.61±1.35mg/L), iron (0.30±0.07mg/L and magnesium (1.15±0.35mg/L), while lead and cadmium levels were below detection limits in bird feathers. 28.07% of the sampled birds showed asymmetry, of which 26.31% were residents, indicative of exposure to environmental stressors. These findings are indicative of anthropogenic contamination in the Botanical Garden and may have negative consequences for species diversity for this biodiversity hotspot.

Track 3. Environmental Assessment and Management

3.01 - The Management of Contaminants of Emerging Concern in Developing Countries

3.01.T-01 Assessing Community Knowledge, Practices, and Perceptions Regarding Environmental Determinants of Health in Melusi, Pretoria

Oliver Mhazo, Joyce Shirid-nde, Sean Patrick

University of Pretoria, South Africa

Abstract

Background: Extensive study is required to improve public health policies and services, construct an environmentally resilient health sector, and promote healthy and sustainable communities. This study aimed to determine the Melusi community's knowledge, perceptions, and practices regarding environmental determinants of health and their understanding and contribution to community health and welfare.
This cross-sectional survey was done in the Melusi informal settlement, Daspoort neighbourhood, in the western suburbs of Pretoria. Using random sampling, 448 persons were interviewed using a structured electronic questionnaire.
Over 60% of respondents were aware of various forms of pollution (water, land, and air). Newspapers, radio, and television, as well as the internet and health care workers, were the primary sources of information. Almost 90% of respondents said water was easily accessible. Predictors of water pollution were occupation, income, dwelling, toilet, water source and cooking source. Water sources, gas and paraffin as cooking sources were the predictors of air pollution. Determinants of land pollution were pit latrine as a type of toilet, water source (JoJo tank), cooking source (paraffin) and country of birth. Lastly, occupation (unemployed), water source, cooking source and place of birth.
This study found various patterns of knowledge, attitudes, and actions regarding environmental health determinants and the risks they bring to communities. More work should be done to promote awareness of pollution and climate change and their impact on South African communities like Melusi.

3.01.T-02 Selection of a Diagnostic Tool for Microbial Water Quality Monitoring and Management of Faecal Contamination of Water Sources in Rural Communities

Maggy Ndombo Benteke Momba[1], Arinao Murei[1], Ilunga Kamika[2]

[1]Tshwane University of Technology, South Africa. [2]University of South Africa, South Africa

Abstract

The current study aimed at evaluating, validating and selecting the microbial water quality monitoring tools that can be used in rural areas for management of faecal contaminants. The monitoring of water quality was performed at three various levels during wet and dry season: i) basic level focusing on sanitary inspection and H2S test; ii) intermediate level via culture-based method (enumeration of faecal indicator bacteria); and iii) advanced level based on molecular biology (qPCR detecting host marker genes and pathogens). All water samples were concurrently subjected to these three levels for monitoring purpose. Faecal indicator bacteria (FIB) detected in water sources included Escherichia coli, Enterococcus spp. and Clostridium perfringens. Pathogenic bacteria included Vibrio cholera, Escherichia coli O157:H7, and Shiga-toxin producing Escherichia coli. Host-specific Bacteriodales markers (BacHum, BacCow, CytB, Pig-2-Bac and BacCan) were used to identify whether faecal pollution was from human or non-human origin. To ascertain whether these methodologies agreed, correlation was established. Poor sanitary practices at the households were observed in many homes and H2S test was able to identify 88.9% prevalence of faecal contamination in water samples from households tap at the point of use and 79.2% prevalence at the household container-stored water. The most prevalent faecal indicator bacteria were faecal coliforms and E. coli in various water sources with varying concentrations ranging from 101 to 103 CFU/mL (with prevalence of 42.6% and 32.8% respectively). Human (93.4%) and cow (91.9%) markers were the most frequently detected in surface water for compared to chicken (35.3%), pig (63.2%) and dog (80.8 %). Shiga toxin-producing E. coli was the most frequently detected pathogen in water (60%) followed by V. cholera (55%) and E. coli O157:H7 (33%). Results of sanitary risk score correlated with those of FIB (feacal coliform, E. coli and Enterococcus spp. at $r = 0.613$ and $p < 0.002$, $r = 0.589$ and $p < 0.003$, and $r = 0.625$ and $p < 0.003$, respectively) as well as with those of H2S ($r=0.623$, $p < 0.003$; $r = 0.809$, $p < 0.001$; $r = 0.779$, $p < 0.001$; $r = 0.799$, $p < 0.001$). Similar result patterns were observed with host-specific markers and/or pathogen. Being a cost-effective tool, H2S coupled with sanitary inspection are suitable tools to capacitate rural areas at household level for sustainable management of faecal contamination in their water sources.

3.01.T-03 Radiation Safety of Veterinary Clinics in Oyo State

Adenike Olatunji-Akioye, Caleb Oyepitan

University of Ibadan, Nigeria

Abstract

Radiation safety is of paramount importance in centers where radiation is used for diagnosis. Veterinary clinics are one such center where x-rays are utilised in diagnosis. The radiation safety of such centers means that radiation is used safely for both the clinicians and the pets as well as clients who visit. The location of veterinary clinics also warrants that surrounding areas are adequately protected. There appears to be very little information about radiation safety where veterinary clinics are concerned. This study was therefore undertaken to determine the level of knowledge and practice about the radiation safety in veterinary clinics in Oyo state. A total of 30 veterinary clinics across the 33 local governemnt areas of the state were sampled. The majority of these centers use radiological services off site and the ones who have radiological services on site were very few. At the ones which used radiological services, the knowledge of radiation protection was below average and most merely set up machines with zero leading of the premises and staff protection was also negligible. Hardly any monitoring is being done and no radiation safety officer is designated. The potential harm posed by radiation to human and animals makes it imperative that radiation be safely utilised. The stochastic and non-stochastic effects of radiation make it important to put in place important means of measuring the amount of radiation being used at centers to ensure that those who work in such centers are safe and not accumulating radiation that may eventually impact on the health and safety of staff and clients. The effects of radiation being carcinogenic, mutagenic and teratogenic makes it imperative to assess if veterinary clinics are abiding with radiation safety rules and if there are laws that are enabling safety. The availability and use of radiation protective gear was also assessed. This study exposed the lack of regulation of this aspect of practice in Oyo state.

3.01.T-04 Ambient Concentrations of $PM_{2.5}$ in Three Locations within the Accra Metropolis, Ghana

Kojo Ayittey[1,2], Enock Dankyi[1], Allison Felix Hughes[1], Owiredu Gyampo[3]

[1]University of Ghana, Ghana. [2]Accra Technical University, Ghana. [3]Ghana Atomic Energy Commission, Ghana

Abstract

Ghana's capital, Accra, is one of the fastest-growing cities in Sub-Saharan Africa (SSA), with about 2.7 million inhabitants. The high population density has been associated with significant vehicular traffic and massive increases in anthropogenic activities, culminating in increasingly high levels of air pollution. This study reports the levels of ambient particulate matter ($PM_{2.5}$ fraction) sampled from three major locations in the Accra Metropolitan Area for a period of two years (2021–2022). Air Metrics MiniVol Tactical Air Sampler fitted with a 47-mm quartz filter with a 0.4µm pore size was used to sample ambient $PM_{2.5}$ fractions. Sampling was carried out for a 24-hour period every six days at the three different sites (the University of Ghana campus, Dansoman Police Station, and St. Joseph R/C Basic School) in accordance with Ghana's Environmental Protection Agency sampling protocols. A total of 287 samples were analyzed from the three locations over the study period. The study revealed high levels of mean $PM_{2.5}$ concentrations (> 41.67 µg/m^3), greater than Ghana's air quality standard (35 µg/m^3) and more than double the WHO guideline level (15 µg/m^3). The monthly mean $PM_{2.5}$ concentrations recorded at the three locations are 62.10 ± 40.05 µg/m^3, 84.32 ± 43.99 µg/m^3 and 111.75 ± 53.07 µg/m^3 with respective air quality indexes of 468.67, 624.25, and 787.67 for the UG campus, Dansoman Police Station, and St. Joseph R/C Basic School in 2021, as well as 69.09 ± 43.79 µg/m^3, 99.75 ± 65.85 µg/m^3 and 112.12 ± 42.66 µg/m^3 with respective air quality indexes of 409.08, 607.91, and 703.75 for the UG campus, Dansoman Police Station, and St. Joseph R/C Basic School in 2022. Results from Anova indicated a statistically significant difference in pollution level among the various sites (f = 28.24, p-value =). The findings from the study show that inhabitants of Accra may be exposed to undesirably high levels of ambient particulate matter, which may be associated with significant health risks. This study will help to bridge the dearth of information on air quality in major urban cities in sub-Saharan Africa.

3.01.T-05 Endocrine Disrupting Compounds; Bioremediation; Bacterial Laccase; Bio Composites; Bio Catalytic Degradation

Maggy Ndombo Benteke Momba, Phumodzo Budeli

Tshwane University of Technology, South Africa

Abstract

Conventional methods have been developed for the removal of EDCs. However, recent studies have shown that these methods are characterised by many drawbacks such as high environmental impact, operational complexities and costs. The aim of this study was to develop bacterial laccase-based bio composites for degradation of estrogens. The crude laccase was isolated from two Lysinibacillus spp. Bacterial species with high tolerance of estrogens and activity was interpreted as ABTS oxidation. Thus, a central composite design was used to investigate the interaction between factors such pH (6.0–8.0) (A), inoculum dosage (100 – 500 U/mL) (B), and copper (Cu) as a laccase co-factor (25 – 75 mg/L) (C). Estrogen degrading enzymes were further immobilized on glass beads and Silver Impregnated Clay Granules (SICG) to improve enzyme stability and efficiency in a laboratory scale fed-batch reactor. High redox potential laccase fractions recovered from L. fusiformis and L. macrolides were pooled together and immobilised on glass beads and silver-impregnated clay granules (SICG) to improve enzyme stability and efficiency. Both immobilised enzymes demonstrated a removal efficiency of 100% for E2 and over 90% for E1 and EE2, within 24 h, with EE2 (92%) being the least removed oestrogen by both biocatalysts, followed by E1 (96%). Free laccase activity showed a gradual decrease from day 7, and was completely diminished by day 14 at 4 °C. A contrary trend was observed at 25 °C where free laccase activities decreased from day 14 and were only completely exhausted by day 21. Both bead-immobilised laccase and SICG-immobilised laccase retained their activities throughout the course of the experiment. Both biocatalysts were able to retain their enzyme activity after multiple cycles. The bead-immobilised laccase retained 94% of its activity after 28 cycles, while only 6% activity loss was recorded after 35 cycles. On the other hand, SICG-immobilised laccase lost 12% of its activity after 21 cycles which remained constant throughout until cycle 30 indicating that they could be scaled up to benchtop bioreactor levels. The SICG-immobilised enzymes have greater potential, particularly in developing countries, because of their low cost (clay is widely available) and ease of preparation. The ever-increasing demand for water by agriculture, industry, and urban areas (due to rapid urbanisation) poses a competition for the limited freshwater resources.

3.01.P-Mo007 Evaluation of the Environmental Pollution Effect of Garri Processed Wastewater Collected From Garri Processing Plants in Nsukka Agricultural Zone, Enugu State, Nigeria

Ikechukwu Eze, Arinze Onwurah, Chinyere Eze, Obetta Ugwuanyi

University of Nigeria, Nigeria

Abstract

The research was carried out to evaluate the environmental toxicity of garri process wastewater generated from garri processing firms in Nsukka. A total fifteen samples of garri process wastewater (slurry) were randomly collected in a sterile conical flask from the chosen garri processing plants, each in triplicates were used for the studies. The slurry was collected in a conical flask and the initial treatment for analysis of Dissolved Oxygen (DO) given and the samples were stored in the refrigerator until analyzed within 24 hours. The average Biological Oxygen Demand (BOD) of the analyzed sample was high which signified that the wastewater is highly biodegradable. The average cyanogenic content of the wastewater samples were 23 ± 0.012, 25 ± 0.0012, 77 ± 0.005, 90 ± 0.00058 and 35 ± 0.0058 mg/100ml for samples taken from Edem, Nsukka, Ibagwa, Orba and Imilike, were high respectively. This poses a problem as the high concentration of cyanide in the waste water, had significant effect on the soil productivity, it affected seed germination, plant growth and productivity, as well as normal microbial activity of the soil. Further analysis using Life Cycle Assessment will be carried out to determine the extensive impact of the Garri Processing Wastewater as it is a very common process carried out in many areas in Sub-Saharan Africa.

3.02 - Ecotoxicology of Pesticides: Lethal and Sublethal Effects, Ecological Risk Assessment (EcoRA)

3.02.T-01 Silicone Wristband Sampling as a Tool for Insecticide Exposure Assessment of Vegetable Farmers

Saada Mohammed[1,2], Jacco Koekkoek[1], Isaac Hodgson[2], Jacob de Boer[1], Marja Lamoree[1]

[1]Vrije Universiteit, Netherlands. [2]CSIR Water Research Institute, Ghana

Abstract

Due to the constraints associated with traditional exposure studies, the use of silicone wristbands has shown to be suitable for exposure studies. Silicone wristbands were used to measure the exposures of vegetable farmers to some selected organophosphates and synthetic pyrethroid insecticides from two different irrigation schemes in Ghana. The farmers were made to wear the wristbands for 7 days after which they were collected and analysed. The worn silicone wristbands were extracted with acetonitrile. A method using Agilent 7000D gas chromatography with triple quad mass spectrometry (GC-MSMS) was developed and validated for the detection of 18 insecticides. Five organophosphates of the selected insecticides were not detected. Thirteen out of the 18 insecticides were detected above their limits of quantitation (LOQ). The selected insecticides were found in the various silicone wristbands in quantities ranging from <LOQ to 27 ug/wristband. The highest detection frequencies and concentrations were found for chlorpyrifos, followed by cyhalothrin and allethrin. This research demonstrates that silicone wristbands can be used as a tool to assess individual exposure profiles and for future exposure studies. Vegetable farmers in the study area are exposed to insecticides. Therefore the use of personal protection equipment is advised.

3.02.T-04 Recommended Insecticide Application Shows Significant Effect on Insects Diversity in Cocoa Ecosystems

Enock Dankyi, Blessing Umeh, Silas W, Rosina Kyerematen

University of Ghana, Ghana

Abstract

In the West African region, cocoa (Theobroma cacao L.) is considered the most important economic crop and contributes to significant foreign exchange and employment for thousands of farmers. The cocoa agroecosystems harbor many insect species with diverse ecological functions, including pollination, biological control, and nutrient recycling, which are crucial to the sustainable production of the crop. However, widespread and intensive insecticide application threatens insect diversity and the long-term sustainability of crop production. This study assessed the potential impact of insecticide use on insect abundance and diversity in cocoa agroecosystems. Field studies were conducted in conventional (CON) and organic (ORG) cocoa farms in Ghana using the insecticides bifenthrin and imidacloprid in conventional farms. Insect sampling was performed using a variety of methods, and a total of 29,288 (CON: 23,605; ORG: 5,683) individual insects belonging to 389 (CON: 374; ORG: 310) species from 124 (CON: 121; ORG: 95) families and 11 (CON: 11; ORG: 10) orders were recorded from both systems. From the data obtained, insect diversity was significantly higher on organic farms compared to conventional farms. In conventional farms, imidacloprid-treated plots showed lower insect diversity and had a greater impact on pest and non-target insect reduction compared to bifenthrin. The findings from this study indicate that less chemical-intensive cocoa farming supports insect population and diversity, including pollinator agents, while promoting pest reduction and mitigating the potential long-term negative impact of frequent insecticide application.

3.02.T-05 Elemental Characterization of Atrazine Treated Soil Amended With Different Biochar Types Using EDX Spectroscopy

Yetunde Oyeyiola[1,2], Beatrice Opeolu[2], Asmat Begum[2], Adesanya Olayioye[1]

[1]Ladoke Akintola University of Technology, Nigeria. [2]Cape Peninsula University of Technology, South Africa

Abstract

Recent increasing hectarage of degraded farmlands in Africa resulting from more intensive use of agrochemicals necessitates the investigation of nutrient element speciation of these agrochemical treated soils to provide sustainable management approaches. In this study, macro and micronutrient elements of atrazine (a commonly used broad spectrum herbicide in Nigeria) treated soil with or without biochar were assessed using energy dispersive x-ray (EDX) spectroscopy. The experiment consisted of atrazine alone soil combined factorially with four sawdust (SD) based biochar types: SD pyrolyzed with or without poultry manure (PM) at 350℃ (SD+PM@350 and SD-PM@350) and SD pyrolyzed with or without PM at 450℃ (SD+PM@450 and SD-PM@450) respectively with each applied at 5 and 10 t/ha equivalent to 2.37 and 4.75 g/950 g soil. Absolute control (AC) with neither atrazine nor biochar treatment was included and all treatments had three replicates in a completely randomized design. A 20 ml atrazine stock solution representing 2.5 kg a. i/ha and basal NPK 15:15:15 (0.1 g) spiked with urea fertilizer (0.03 g) was added to each treatment pot (except the AC) containing 950 g soil. This was followed by moistening each soil to field capacity with distilled water during two consecutive maize cropping schedules under screenhouse conditions. Soils sampled after second maize cropping were subjected to nutrient element characterization using the EDX spectroscopy after sputtering each soil sample with gold on the aluminum stubs. There was significant ($p<0.05$) Cu, Ni and Pb enrichments in atrazine alone soil by 215, 165 and 222% compared to their individual baseline values. These micronutrient concentrations were however lower in similar atrazine treated soils amended with biochar. Total C reduced by 10 and 17% in atrazine alone and AC soils compared to the baseline value of 26.7% while biochar amendment increased total C by a range of 24.5 – 35.9%. Higher total N, P, Mg and K percentages were however, observed in atrazine alone soil relative to the baseline and AC values with the Mg and K concentrations higher than observations from the biochar amended soils. Continued sole use of atrazine is therefore a potential source of micronutrient toxicity and carbon depletion in the soil studied. Biochar pretreatment of such soil however, provides a mitigation opportunity to these potential environmental and sustainability risks.

3.02.T-06 Chlorophyll as A Biomarker for Evaluating the Impact of Hydrocarbons on Soil Ecosystem and Hence Soil Productivity

Chigoziri Osuji

Gregory University Uturu, Nigeria

Abstract

Destroying soil is corresponding to destroying the self-renewing capacity of the earth. When soil is polluted, the ecosystem is altered, and agricultural activities are affected. Liquid hydrocarbon pipeline accidents, including leaks due to the illegal or unauthorized collection of petroleum from oil pipelines, and the indiscriminate discharge of spent engine oil (SEO) in the ecosystem, are a widespread phenomenon that can lead to pollution that may negatively affect soil quality and thus plant growth. Chlorophyll is a pigment that gives plants their characteristic green color. The quantity of chlorophyll per unit area is an indication of the photosynthetic capacity and productivity of a plant. The amount of chlorophyll in leaf tissue is influenced by nutritional availability and environmental stress. The aim of this study is to evaluate hydrocarbon uptake and accumulation in cucumber plants grown on soil contaminated with spent engine oil and its effect on the chlorophyll content of the plant and hence on soil and plant productivity. The uncontaminated soil sample (1kg) was spiked with SEO at different concentrations (0, 1, 5, 10, 15, 20, 25, 30, and 50g/kg soil). The contaminated soil samples were allowed to settle for 5 days, and seedlings of the test plant were grown thereafter and monitored for 28 days. The result of the study showed that hydrocarbons have an adverse effect on the plant chlorophyll content. The highest total chlorophyll content (2.321mg/g) was recorded in the control soil and this decreased ($p<0.05$) appreciably to (0.766mg/g) in the maximum concentration of SEO-contaminated soil (50g). The chlorophyll concentrations is directly proportional to the SEO. Based on the study, there is a large concentration difference between chlorophyll a and chlorophyll b. This study presents scientific evidence that plants growing in areas contaminated by hydrocarbon may have significantly lower levels of chlorophyll content due to vegetation stress and hence, crop productivity may thus be hampered.

Keywords: Spent engine oil, chlorophyll, soil, contamination, ecosystem, and accumulation

3.02.P-Mo011 Ecological Risk Assessment of Pesticides on Earthworms at The Lower Slopes of Mount Fako in The Monomodal Equatorial Agroecological Zone of Cameroon

Daniel Brice Nkontcheu Kenko[1], Agathe Lambou Fotio[1], Aimerance Donhachi Kenfack[2], Miranda Egbe Awo[1], Constantin Alega Amougou[1], Derick Atemlefac Acha[1], Eric Bertrand Fokam[1]

[1]University of Buea, Cameroon. [2]University of Ebolowa, Cameroon

Abstract

Agrochemicals misuse is a common practice in developing countries with many environmental implications. This work assessed ecological risk of pesticides utilised by farmers, on earthworms by using PRIMET (Pesticide Risk in the tropics to Man, Environment and Trade) at the lower slopes of Mount Cameroon. For this purpose, data on usage scheme and ecotoxicological information were collected and keyed into the PRIMET model for three main outputs: Predicted Exposure Concentration (PEC), No Effect Concentration (NEC) and Exposure Toxicity Ratio (ETR = PEC / NEC). Nematicides and herbicides were used at significantly ($p < 0.05$) higher dosages compared to other pesticides categories. Fungicides and nematicides were applied many times per crop season as compared to other compounds. Pesticides that were predicted for no acute and no chronic risk to earthworms included fipronil and chlorothalonil. A few compounds were predicted for an acute risk to earthworms comprising acetamiprid, imidacloprid, lambda-cyhalothrin, carbendazim when used on maize (PEC = 2.69 mg/kg; ETR = 5) and tomato (PEC = 16.15 mg/kg; ETR=30), 2, 4-D, abamectin when used on tomato and ethoprophos. Insecticides exhibiting a possible chronic risk to earthworms comprised acetamiprid, cypermethrin, emamectin benzoate, imidacloprid, indoxacarb, lambda-cyhalothrin, oxamyl and thiametoxam. The majority of fungicides assessed (83%) posed a possible chronic terrestrial risk, with carbendazim at the top position when applied on tomato (PEC = 16.15 mg/kg; ETR = 81). Other pesticides predicted for possible chronic risk to earthworms included 2, 4-D, diuron, glyphosate, ethoprophos and metaldehyde. Pesticides with the highest risks to earthworms comprised chlorpyrifos-ethyl, imidacloprid, ethoprophos and nicosulfuron. The riskiest pesticides should hereby be regulated or replaced by less risky ones. The measurement of pesticide residues in water and food in the various agroecological zones of Cameroon is a necessity to put more light on pesticide ecotoxicology.

3.03 - Biomass Valorization for Sustainable Waste Management and Clean Energy Generation in a Circular Economy Context

3.03.T-01 Comparative Performance Assessment of Biomass-derived Urea-Furfuraldehyde Resins as Oilfield Scale Inhibitors

Cynthia Victor-Oji, Dominica Una, Onyewuchi Akaranta

[1]University of Port Harcourt, Nigeria

Abstract

Oilfield-scale formation is a genuine problem that impedes continuing oil production. Several scale inhibitors have been employed for many decades to minimize and prevent scale formation; nevertheless, studies on scale inhibitors suggest a research gap in discovering renewable, cost-effective, ecologically friendly, and efficient inhibitors. The purpose of this study is to investigate the potential of scale inhibitors (SIs) prepared from bio-resin derivatives of red onion skin (ROF and ROFU) in the mitigation of CaCO3 and CaSO4 scales. The scale inhibition performance of ROF and ROFU was evaluated using the NACE standard static bottle test method. From the data obtained, increasing scale-inhibitor contact time, concentration, and temperature improves inhibitor efficacy, with the best inhibition efficiencies found for ROF and ROFU in the CaSO4 scale compared to the CaCO3 scale across all parameters. A comparison of the prepared SIs with a commercial scale inhibitor (CSI) revealed a high inhibition rate on all scales tested. Despite having a lower inhibition rate (IE) than CSI, ROF and ROFU have tremendous potential as green oilfield SIs. This is a sustainable technique since it turns agro-waste into a valuable oilfield chemical via a one-pot chemical process, which could benefit the economy by curbing capital flight as well as society by putting waste materials to productive use.

3.03.T-02 Time and Temperature Requirements for Efficient Treatment of Digestate as a Safe Biofertilizer

Osarumwense Onigho[1], Mike Ajieh[2], Kingsley Enerijiofi[3], Lawrence Ezemonye[1], Cyprian Oshoma[1]

[1]University of Benin, Nigeria. [2]Delta State University, Nigeria. [3]Samuel Adegboyega University, Nigeria.

Abstract

The quality, safety and utility of digestate are dependent upon chemical composition and microbial community. This study was aimed at determining time and temperature required for the effective treatment of digestate used as a safe biofertilizer. Samples of cattle rumen digestate slurry was obtained from ACTUATE research project at the University of Benin, Benin City, Nigeria. The samples were treated with different temperatures of 28±2, 55, 60, 70 and 80 °C at different exposure duration of 0, 20, 30, 40 and 60 mins. Microbiological, physicochemical and heavy metal analysis was carried out on the samples using standard methods. Bacterial isolates from the samples were screened for rhizobacterial potential. The results showed that digestate treated at 70 °C for 40 min had bacterial counts of 8.05 ± 0.71x10^2 cfu/ml, which fell below permissible limits of 1000 cfu/ml. Salmonella and Escherichiae counts were not observed at this temperature and exposure duration. The identified bacterial isolates were *Pseudomonas aeruginosa*, *E. coli*, *Proteus* spp., *Enterobacter* sp., *Citrobacter* sp., *Klebsiella pneumoniae*, *Bacillus* sp., *Enterococcus* sp., *Streptococcus* sp., *Yersinia* sp., *Salmonella typh*i and *Shigella flexneri*. The fungal isolates were *Fusarium* sp., *Aspergillus* spp., *Bipolaris sorkinaina*, *Penicillium* sp., *Aspergillus flavus*, *Trichoderma* sp. and *Rhizopus* sp. Physicochemical analysis revealed pH, total kjedahl nitrogen, nitrate content and total phosphorus were observed to be within established limits in digestate exposed to 70oC for 40 mins while heavy metal concentration in digestate treated at 70 °C for 40 mins were also below permissible limits. Screening for rhizobacterial potential revealed *Pseudomonas* sp., *Proteus* sp., *Bacillus* sp. and *Streptococcus* sp. to be positive for phosphate solubilization, nitrogen fixation, ammonia production and induction of indole acetic acid. It was concluded that treating digestate at 70 °C for 40 min confirmed the product to be safe and can be applied as biofertilizers.

3.03.T-03 Nigerian Economy, Agricultural Waste Valorization and Transition to Circular Economy

Rosemary Okoh

Delta State University, Nigeria

Abstract

The Circular Economy emphasizes the maximization of resource utilization in production and consumption by focusing on the “take, make, and reutilize” as against the “take, make, and dispose” strategy of the linear economy. The application of circularity to biomass management in Nigeria offers environmental, financial and non-financial benefits to Nigeria. These benefits are currently not being harnessed. The major questions being addressed by this research are: What constraints inhibit the valorization and probable transition to the circular economy, what can Nigeria Do to actualize the transition to a circular economy? This research is based on a desk review of literature on biomass valorization, agricultural wastes, and the transition to the circular economy. Nigeria is estimated to generate 168.49 million tonnes of agricultural waste annually. This quantity of agricultural waste and residues is capable of generating 2.01EJ (or 47.97 MTOE) of clean energy. Biogas is one of such. It has been reported that, the production of biogas from biomass has capacity to yield a wide range of benefits, such as: Expansion of Nigeria’s energy mix to include clean and green energy sources, that is also low-cost and; Transformation of organic waste into high-quality fertilizer.; Improving human health; Establishment of sustainable environment, Microeconomic benefits through energy and fertilizer substitution, additional income sources; and Macroeconomic benefits through decentralized energy generation and environmental protection. The major constraints include: Transitioning to a circular economy requires special technologies which need to be acquired or developed are virtually absent; The cost of acquiring the associated technology is high; Public awareness of the circular economy and the benefits that lie beneath Nigeria’s enormous waste is very poor; and Attitude towards waste in the environment is almost nonchalant. This negative attitude is inimical to sustainable development and environmental sustainability. It is recommended that, The government, universities, and private sector operators must invest in the development of technologies and research to enable Nigeria to participate and benefit from circular economy; they must embark on a campaign for behaviour change towards waste generation, waste disposal and waste utilization; and invest in Waste recycling to take advantage of the waste economics. There is much wealth beneath the rubble.

3.03.T-04 Assessing the Impact of Inoculum to Substrate Ratio on Biogas Production during Batch Anaerobic Co-digestion of Cattle Rumen Content and Food Waste

Newton Ihoeghian[1], Andrew Amenaghawon[1], Mike Ajieh[1,2], Cyprian Oshoma[1], Ifeyinwa Obuekwe[1], Abraham Ogofure[1], Nosakhare Erhunmwunse[1], Isioma Tongo[1], Valerie Edosa[1], Ebuwa Isagba[1], Christopher Emokaro[1], Lawrence Ezemonye[1], Kirk Semple[3], Martin Alastair[3]

[1]University of Benin, Nigeria [2]Delta State University, Nigeria [3]Lancaster University, United Kingdom

Abstract

Inoculum substrate ratio (ISR) is key to the early start-up of various anaerobic digestion systems. In this study, the biogas production via batch anaerobic co-digestion of cattle rumen content (CRC) and food waste (FW) using cattle rumen fluid (CRF) as inoculum was investigated for ISRs of 0 %, 12.5%, 25 %, 50 % on a wet basis. The control (0 % ISR) had the least biogas yield of 322 ml/gVSadded while the other respective cumulative biogas yields were 516, 653, and 411 ml/gVSadded. Analysis of variance (ANOVA) (p-value of 0.010) showed that there was a significant difference between the biogas yields. Of the four kinetic models used to study the ISR with optimum cumulative biogas yield, the cone model was found to be most suitable for predicting cumulative biogas production with kinetic parameters Pm, k, and n obtained as 1028.55 ml/gVSadded, 0.0497 day-1, and 1.169 respectively. These parameters were estimated with good statistical confidence as seen in the sum of square error (SSE), coefficient of determination values (R2, and Adj R2) of 0.0344, 0.9935, and 0.9933 respectively. The study has provided some insight into the use of available, affordable, accessible, exogenous inoculum for an improved yield in biogas production.

3.03.T-05 Enhancing Soil Health and Crop Yield: Assessing the Potential of Digestate as an Organic Fertilizer in Tomato Cultivation in Nigeria

Valerie Ifeyinwa Ofili Edosa[1], Abraham Ogofure[1], Cyprian Oshoma[1], Isioma Tongo[1], Nosakhare Erhunmwunse[1], Newton Ihoeghian[1], Andrew Amenaghawon[1], Ifeyinwa Obuekwe[1], Ebuwa Isagba[1], Mike Ajieh[1], Alfonso Lag-Brotons[2], Kirk Semple[2], Christopher Emokaro[1], Lawrence Ezemonye[1,3]

[1]University of Benin, Nigeria. [2]Lancaster University, United Kingdom. [3]Igbinedion University, Nigeria

Abstract

The use of organic manure/fertilizers such as digestate to grow crops in Sub-Saharan Africa to improve soil fertility and food security is on the increase due to the limitations and complications of inorganic fertilizer usage. This study was aimed at evaluating digestate as sustainable organic fertilizer in tomato cultivation and its influence on soil microbiological properties. Soil samples was collected from a previously vegetable cultivated farmland and treated with digestate from cattle rumen content (CRC), Food waste (FW) and co-digestion of CRC and FW. Also, the soil was treated with NPK fertilizer for comparison while the control was soil without treatment. Tomato seedlings were transplanted into the different soils with the distinctive treatments and monitored for 14 weeks. Analyses carried out were tomato plant height, stem girth, number and weight of fruits, soil bacteria and fungi count using standard methods. The identified bacteria and fungi isolates were evaluated for plant growth promoting properties. The results revealed that the highest tomato height of 116 cm was from soil treated with NPK fertilizer. The plant height for all the digestate treated soil were significant different from the control soil ($p< 0.05$). Soil treated with NPK had the highest number and weight of fruits followed by CRC and FW digestate. The values were statistically not significant ($p<0.05$). The bacteria and fungi counts in the soils of all the treatments were higher than the counts in the plant stem and fruits. The identified bacteria showed that Pseudomonas aeruginosa, Bacillus spp, and Serratia spp had the highest PGP properties of 100 %. The identified fungi showed that Aspergillus tamarii and Trichoderma viridae had the highest PGP properties of 100 %. The study showed that soil treated with digestate improved the soil nutrients and microbial population and therefore can be used as organic fertilizer for tomato growth.

Keywords: Soil, digestate, tomato, bacteria, plant growth

3.03.T-07 Microbial Assessment of Solid and Liquid Digestate: Pathogen Reduction and Plant Growth Promoting Properties

Ebuwa Isagba[1], Abraham Ogofure[1], Cyprian Oshoma[1], Mike Ajieh[2,3], Andrew Amenaghawon[1], Victoria Obatusin[4], Ifeyinwa Obuekwe[1], Isioma Tongo[1], Newton Ihoeghian[1], Valerie Edosa[1], Nosakhare Erhunmwunse[1], Alfonso Lag-Brotons[4], Christopher Emokaro[1], Lawrence Ezemonye[1], Kirk Semple[4]

[1]University of Benin, Nigeria. [2]Delta State University, Nigeria. [3]National Centre for Energy and Environment (Energy Commission of Nigeria), Nigeria. [4]Lancaster University, United Kingdom

Abstract

Digestate refers to the residue or by-product obtained from the anaerobic digestion of organic matter, typically from sources such as wastewater treatment plants or agricultural waste. Pathogens in digestate can pose risks to human health and the environment if not properly managed. By reducing pathogens in digestate, we can mitigate potential contamination risks and protect human health, aligning with the sixth sustainable development goal (SDG 6). This study was conducted to evaluate the reduction of pathogens in digestate following an 8-week composting process and the isolates' potential for promoting plant growth and sustainable food production. Digestates obtained following anaerobic digestion were separated into solids and liquids and left to compost. Isolation and enumeration of the total microbial count (bacteria and fungi) were followed by identification of the isolates using conventional and molecular techniques. Phenotypic virulence characteristics such as the production of DNAse, gelatinase, lipase, and hemolysin were evaluated for the bacteria isolates. The plant growth-promoting (PGP) potentials of the isolates were also evaluated. The results showed that bacteria counts in the digestates ranged from 3.11±0.05 – 3.49±0.03 log10 cfu/g at week 0. After eight weeks of composting, there was a corresponding 75.51 – 95.39 percent reduction in pathogens from the digestate after eight weeks of composting for the solid-exposed digestates. The percent reduction in fungal counts ranged from 58.35 - 79.79%. The identified isolates in the digestates include Bacillus, Serratia, Escherichia, Salmonella, Enterobacter, and Staphylococcus. The fungal isolates obtained were Trichoderma, Aspergillus, Penicillium, Rhizopus and yeast. Bacterial isolates were positive for at least one of the four tests for virulence. Howbeit, isolates were also found to contain plant growth-promoting properties such as fixation of nitrogen, solubilization of phosphate and production of indole-3-acetic acid. Following an 8-week composting period, the study has achieved that pathogens in digestates can be reduced by 90 %. Pathogen reduction in digestate is a crucial aspect of waste management to protect human health and the environment.

3.03.T-09 Circular Economy of Wastes: Evidence from Edo State in Nigeria

Lawrence Ezemonye, Spencer Nwangwu, Sylvester Oyeoma, Maryann Ezugwu, Patience Ozor

Igbinedion University, Nigeria

Abstract

There are myriads of challenges posed by increasing environmental degradation caused by wastes from consumption, this study examined 'From Wastes to Wealth: Evidence from Edo State in Nigeria' with focus on responsible consumption, circular economy and framework of waste management including wealth generation from wastes. The methodology applied to source for data involved both the qualitative and quantitative analysis, through the use of questionnaires with well-structured questions and informal personal interviews. 900 respondents from households, markets and industries were selected from the fifteen local government areas of Edo State. The study used descriptive and inferential statistics to analyse the results of data collected from the field work using SPSS software package. The results of the study as indicated by majority of the various respondents revealed that there were rampant cases of indiscriminate wastes disposal. The wastes constitute danger to human health, environment, block water ways and hinder drainage system and deposit debris in the affected rivers, thereby create negative externalities to our environment. Further probe revealed that these wastes could be segregated, characterized and recycled for renewable ecosystem framework that generates wealth to individuals, companies and government for economic growth and development. The study recommends the following; households, markets, industries and government authorities should provide waste bins and all wastes should be segregated, characterized, managed and monitored by their authorized agents for recycling. Private firms and government should be encouraged to establish recycling plants that can recycle wastes into other useful materials in line with circular economy principles. This will generate wealth to all and sundry for economic growth and development.

3.03.T-10 Molecular and Biochemical Studies Reveal the Cellulolytic Enzyme System of Ligninolytic *Bacillus Subtilis* CFB-09 for Simultaneous Delignification and Saccharification of Corncob

Folasade Olajuyigbe[1], Mopelola Dele-Joshua[1,2], Shams Yazdani[2], Arvind Kumar[2]

[1]Federal University of Technology Akure, Nigeria. [2]International Centre for Genetic Engineering and Biotechnology, New Delhi, India

Abstract

Bioconversion of lignocellulosic biomass to biofuels requires the use of degrading enzymes prompting continuous search to improve biochemical processes for enhanced biofuel production. A ligninolytic bacterium CFB-09 produced exo and endoglucanase, β-glucosidase, β-xylosidase and xylanase on corncob and sugarcane bagasse with highest yields of 147.57, 130.90, 812.85, 1119.52 and 39.71 U/mg protein. The whole genome sequencing (WGS) of the bacterium was done prior to proteomic profiling of secretomes, on hybrid Illumina+Nanopore platform which resulted in single contig with a genome size of 4.09 Mb. The WGS revealed the bacterium identity to be *Bacillus subtilis* by phylogenetic analysis. Gene annotation was conducted using Kyoto Encyclopedia of Genes and Genomes (KEGG), and Gene Ontology (GO) databases. Results showed that the genome of the organism was 4091928 bp long, and a total of 4023 protein-encoding genes were predicted. Proteolytic activity of extracts from *B. subtilis* CFB-09 was investigated for the presence of laccase, endoglucanase, xylanase and β-glucosidase through zymographic assays. Proteome of secretomes from *B. subtilis* CFB-09 on media supplemented with corncob, and corncob with methyl cellulose was characterized by Liquid Chromatography–Tandem Mass Spectrometry. Zymographic assays showed clear presence of laccase and endoglucanase in cell free extracts on gels. Proteomic analysis revealed high abundance of inducible CAZymes and several nonhydrolytic accessory proteins. Notably, based on the relative abundance data, the following CAZymes, GH13, GT26, GH 42, PL1, and GT8 were expressed in highest quantities. Findings indicate that *B. subtilis* CFB-09 has potentials for application in effective simultaneous delignification and saccharification of corncob.

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3.03.T-11 The Risks and Safety Practices of Waste Pickers at Selected Dumping Sites During the COVID-19 Pandemic

Liziwe Mugivhisa, Mbuyelo Paige Mphitshana, Joshua Joshua Oluwole Olowoyo

Sefako Makgatho Health Sciences University, South Africa

Abstract

Amid the COVID-19 outbreak, the pilling of waste continued to rise as the number of COVID-19 patients increased daily. Waste emanating from people infected with COVID-19 which was discarded as domestic waste ended up as a hazard to workers who handled the waste and as a threat to the environment. The coronavirus could survive on materials and surfaces for hours-to-days resulting in increased exposure of waste pickers to the coronavirus. The study assessed the safety practices and risks related to waste picking during the COVID-19 pandemic at the selected dumping sites in the north of Pretoria. The study was exploratory, purposive, and based on voluntary participation and willingness of the waste pickers to participate in the present study. The study involved the completion of the 81 structured questionnaires consisting of open-ended and close-ended questions. The questions were developed by the researchers. The researcher interviewed the waste pickers from the two selected dumping sites, in the north of Pretoria. The bulk of waste collected by each of the 81 participants came from households and included plastics (97.5%), metals (90.1%), bottles (95.1%), and paper-products (100%). The majority (86.4%) of the waste pickers used PPEs such as gloves (100%) and masks (96.3%) when handling waste. However, 21% of the waste pickers stated that they could not afford the PPEs. About 98.8% of waste pickers had access to running water and 75.3% practiced social distancing while collecting waste. Most (79.85%) of the waste pickers were aware of the COVID-19 pandemic and adhered to the safety protocols. Nevertheless, 51.9% of the waste pickers believed they could not be exposed to COVID-19 while handling waste. From the waste pickers who had tested for COVID-19, only 1.23% had positive for the COVID-19. Waste pickers knew about health risks associated with working at a dumping site and practiced safety measures. It is recommended that waste pickers should be educated on how the COVID-19 is transmitted. PPEs, water, and sanitizers should be provided for all waste pickers during the COVID-19 pandemic.

3.03.T-12 Cash for Trash: An Impetus for Plastic Waste Valorization in Edo State

Lawrence Ezemonye, Spencer Nwangwu, Sylvester Onyeoma, Georgina Erifeta, Rowland Azike

Igbinedion University, Nigeria

Abstract

Environmental degradation occasioned by indiscriminate and inappropriate disposal of non-biodegradable materials for packaging water and drinks results to economic consequences such as pollution, flooding, and other externality effects. The economic and environmental impacts of plastic waste is increasing significantly as they clog domestic sewage systems, choking water chains, threatening aquatic life in receiving water systems, often causing soil degradation, reducing biodiversity and the aesthetic quality of most Nigerian cities. The externality effects of unwholesome disposal of water cans and sachets are highly unquantifiable and sometimes, it cannot be measured. Millions of Naira is spent by the various tiers of government to enhance sanitary conditions of most Nigerian cities. Recycling is the cliché for sustainable waste management that rides on the back of circular economy. Recycling remains one of the most efficient methods of managing plastic waste. The process is driven by formal and informal plastic waste recyclers who rely on the activities of waste pickers or scavengers. The enticement of plastic waste pickers is the food it puts on the table and the bill it can defray. Tons of plastics are removed from the environment by plastic waste pickers irrespective the ever-dwindling financial rewards. This paper seeks to explore plastic waste pricing mechanism using a circular business model, social inclusion of waste pickers and policy issues in the recycling chain in the region. The methodology applied to source for data involved both the qualitative and quantitative analysis, through the use of questionnaires with well-structured questions and informal personal interviews. Results is no standard pricing mechanism for plastic waste in Edo State. Similarly, there is no legal framework on waste valorization while the activities of scavengers were not controlled. The study recommends the following; government authorities should provide price control system for plastic wastes and this should be well managed and monitored by authorized agents. Firms that are involved in sachet and plastic bottled water production should be encouraged to establish recycling plants that can recycle plastic wastes into other useful materials in line with circular economy. Government should enact a legal framework on waste valorization and also enforce the laws against indiscriminate disposal of wastes both in Edo and the entire states of the Federation

3.03.P-Mo012 The Informal Toilet System, Open Defecation and Renewable Sewage Infrastructure Framework in Ovia North East LGA

Lawrence Ezemonye, Spencer Nwangwu, Sylvester Onyeoma, Patience Ozor, Maryann Ezugwu, Kelly Orhorhoro

Igbinedion University, Nigeria

Abstract

Sub-Saharan Africa ranks least in Water Sanitation and Hygiene (WASH) services in the world with its attendant health and economic consequences. In Nigeria, 55 million have no access to clean water, 116 million people are without sanitation, 38 million people practice open defecation and 110 million people do not have basic hygiene facilities. Nigeria as a developing society is facing serious challenge of sewage management, informal toilet system, potable water supply and access to healthy environment in almost all communities, whether urban, semi-urban or rural settlements. With the increasing reported cases and the need to reduce water-borne diseases such as cholera and diarrhea, there will be a corresponding increase in environment-related challenges such as health challenges and epidemics. This work intends to ascertain the prevalence of informal toilet system, analyze the pollution and health hazards associated with informal toilet system, come up with a model renewable sewage infrastructural framework for adoption and determine the level of hand washing practice. The field study will adopt both the qualitative and quantitative methods. Questionnaire with well-structured questions and informal personal interviews was used to source for data. To ascertain the usefulness of our research in terms of its quantitative applications, a non-parametric test based on chi square was used to justify if our selected factors had significant effects on the subject of enquiry which results to some negative externality on human health and his environment. The results so far showed high prevalence level of informal toilet and open defecation mostly among farmers and low-income earners with the attendant health issues. There were also little to no WASH service available in the communities. The findings also revealed that there was indiscriminate disposal of human wastes and this constitutes land pollution, because when it rains, these wastes that litter the environment are washed into water channels, thereby causing contamination, blocking drainages and water pollution. Similarly, air pollution arises when aura evaporates into the air. It is recommended that Edo State Environmental Protection Agency (ESEPA) in collaboration with the State Ministry of Environmental and Public Utilities (MEPU) review and adopt the model renewable sewage infrastructural framework suggested in this paper to avert imminent epidemics.

3.04 - Linking Agenda 2063 and the United Nations SDGs through Research and Innovation to Stimulate a New Africa

3.04.T-01 Using an Ecosystem Services Framework to Assess and Manage Chemical Risk Can Help Meet Sustainable Development Goals

Lorraine Maltby[1], Judith Mugambi[2], Ross Brown[2]

[1]University of Sheffield, United Kingdom. [2]University of Exeter, United Kingdom

Abstract

Chemicals can help meet sustainable development goals by enhancing food production (SDG 2), controlling disease organisms and treating illnesses (SDG 3), and providing clean water and sanitation (SDG 6). They may also contribute to industrial innovation (SDG 9), economic growth (SDG 8), reduced poverty (SDG 1) and more sustainable cities (SDG 11). However, the extraction, production, use and disposal of chemical products, and their raw materials, can have adverse impacts on the environment. These environmental impacts can contribute to climate change (SDG 13) and biodiversity loss (SDG 14, SDG 15) and adversely affect human health and wellbeing (SDG 3). The environmental impacts of chemicals vary spatially and socially – not all societal groups are impacted to the same degree. An ecosystem services approach provides a framework for a spatially explicit environmental risk assessment that focuses on human-wellbeing (i.e., nature's contributions to people) and that can incorporate societal variation in benefits and impacts. We will describe how the derivation and use of ecosystem services-based environmental quality standards can facilitate the targeted management of chemicals in freshwater ecosystems. Moreover, we will demonstrate how this approach can account for spatial variation both in the biodiversity providing nature's contributions to people and in societal preferences for these contributions. The potential application of this risk assessment methodology to environmental quality standard setting in an African context will be explored.

3.04.T-02 Nitrogen-Fixing Capacity of Hydrocarbonoclastic Bacteria from Nembe Oil Field, Niger Delta Region Nigeria

Chioma Blaise Chikere[1,2], Benedict Okeke[3], Victor Ezebuiro[1], Chidinma Peace Okafor[4], Eno Williams Abang[1]

[1]University of Port Harcourt, Nigeria. [2]CAES, Florida Science Campus, University of South Africa (UNISA), South Africa. [3]Auburn University at Montgomery, USA. [4]Imo State University Owerri, Nigeria

Abstract

Nitrogen-fixing capacity is an essential characteristic that helps bacteria to increase the bioavailability of nitrogen in the soil, especially in the form utilizable by plants. This study investigated the ability of hydrocarbon-utilizing bacteria isolated from oil-impacted soils at Nembe oil field, Nigeria to fix nitrogen. Baseline physicochemical characteristics of the soils were carried out to determine the total petroleum and polycyclic aromatic hydrocarbons (TPH and PAHs) concentrations. Hydrocarbon-utilizing capacity was investigated on Bushnell Haas medium (BHM) using the redox dye 2, 6-dichlorophenol indophenol (DCPIP). Isolates positive for hydrocarbon degradation were screened for nitrogen-fixing ability on Winogradsky, Rhizobium and Azotobacter media without external nitrogen source. Data obtained revealed that the soils were contaminated with low concentrations of PAHs but high TPH concentrations ranging from 2,544.7 to 21,777.3 mg/kg. The isolates were able to utilize hydrocarbons as shown by the decolourization of DCPIP in BHM within 24 hours incubation. The hydrocarbon-utilizing bacteria isolated were able to grow without external sources of nitrogen confirming their diazotrophic capability and were subsequently identified as Nitrosomonas sp., Bacillus sp. and Pseudomonas sp. The study has revealed the capacity of hydrocarbon-utilizing bacteria from Nembe oil field to fix nitrogen in spite of the hydrocarbon contamination. The ability of the indigenous bacteria to retain their capacity for nitrogen fixation means that eco-restoration of this field in the Niger Delta region using indigenous bacteria as nature-based solutions is possible and this embraces the African Union's Agenda 2063 mandates that encourage researchers to think globally but act locally to proffer solutions to Africa's challenges. All these strategies will unequivocally enable the sustainable reclamation of the impacted soil to its full agricultural potentials thereby achieving United Nations SDG15 which supports ecosystem and biodiversity restoration to protect all forms of life on land.

3.04.T-03 Molecular Characterization of Petroleum Hydrocarbon-Degrading Bacteria from Oil Field in Nembe, Nigeria

Chioma Blaise Chikere[1,2], Benedict Okeke[3], Victor Ezebuiro[1], Chidinma Peace Okafor[4]

[1]University of Port Harcourt, Nigeria. CAES, Florida Science Campus, University of South Africa (UNISA), South Africa. [3]Auburn University at Montgomery, USA. [4]Imo State University Owerri, Nigeria

Abstract

This study reports the molecular characterization of hydrocarbon-utilizing bacteria isolated from an Oil Field in Nembe, Niger Delta region, Nigeria. Hydrocarbon-utilizing bacteria were isolated from the soils at depth between 0 and 30cm using standard microbiological methods. Hydrocarbon utilization was tested on Bushnell Haas medium (BHM) using the redox dye 2, 6-dichlorophenol indophenol (DCPIP). The hydrocarbon-utilizing bacteria were characterized based on the phylogenetic analyses of their 16S rRNA genes by employing chromosomal DNA extraction, polymerase chain reaction, Sanger sequencing and pairwise similarity search in GenBank. Maximum level of oil pollution recorded in the Nembe Oil-Field was 21,777.3 mg/kg which was beyond the regulatory intervention limit of 5000mg/kg. A total of 19 hydrocarbon-utilizing bacteria, belonging to 8 different genera were characterized. However, only 17 were accessioned with 2 isolates returning low similarity feedback suggestive of novel origins. The isolates with high scores matching with sequences deposited in GenBank database were classified as Pseudomonas aeruginosa, Lysinibacillus fusiformis, Pseudomonas aeruginosa, Acinetobacter venetianus, Pseudomonas delhiensis, Pseudomonas aeruginosa, Pseudomonas aeruginosa, Acinetobacter venetianus, Acinetobacter lactucae, Proteus mirabilis, Pseudomonas aeruginosa, Providencia thailandensis, Pseudomonas aeruginosa, Proteus mirabilis, Pseudomonas aeruginosa, Bacillus paramycoides andPseudomonas aeruginosa. These bacterial species are well reported globally in literature as known hydrocarbon degraders. Their DNA sequences have been deposited in GenBank under the accession numbers OP854801-OP854817. The most abundant hydrocarbon-utilizing isolate was Pseudomonas aeruginosa with 41.2% percentage frequency. The study has demonstrated the abundance of hydrocarbon-utilizing bacteria in Nembe Oil Field and the effectiveness of their 16S rRNA gene in classifying them. Consequently, the abundance of keystone hydrocarbon-utilizing bacteria in the Oil Field soils would play significant role in the design of the best remediation technology for this site bearing in mind the cardinal global pillars embracing sustainability, ecosystem restoration, utilization of indigenous resources, circular economy, integrated waste management, nature-based solutions and open science.

3.04.T-04 Environmental Importance of Crude Oil Polluted Soil Microbiomes

Chidinma Peace Okafor[1], Chioma Blaise Chikere[2]

[1]Imo State University, Nigeria. [2]University of Port Harcourt, Nigeria

Abstract

Crude oil is the mainstay of the Nigerian economy. To this end, oil exploration has continued unabated since the initial drilling in the late 1940's with the attendant crude oil pollution of the environmental matrix. This present site has an average of 15600mg total petroleum hydrocarbon (TPH) per kg of soil. Microbial degradation plays vital roles in the clean-up of oil spills. Hence, the heavy reliance on microorganisms for bioremediation. Shotgun metagenomic analysis of the polluted soil microbiome was carried out to analyze the polluted soil microbiome. DNA extraction, shotgun metagenomic library preparation and sequencing of the soil samples were done using zymoBIOMICS® shotgun metagenomic sequencing service for microbiome analysis. Diamond sequence aligner was used in the identification of antimicrobial resistance and virulence factor. Microbial composition was profiled with Centrifuge. Functional profiling was determined and hierarchical clustering based on Bray Curtis dissimilarity. Whereas biomarker discovery was with Linear discriminant analysis effect size (LEfSe) at P>0.05 and LDA effect size >2. However, our study on the crude oil-polluted soil microbiome reveals a reserve of both antimicrobial resistance genes, (ARGs) and genes for virulence. Multidrug efflux RND transporter permease subunit, sulfonamide-resistant dihydropteroate synthase and VanO-type vancomycin resistance DNA-binding response regulator VanR were the dominant ARGs. Bradyrhizobiaceae, Burkholderiaceae, Cellulomonadaceae Methylobacteriaceae and Xanthobacteraceae are the top phyla harboring the ARGs. This study shows that the oil polluted soil microbiome is a pool for ARGs and virulence factor genes hence a potential public health issue.

3.04.T-05 A Policy Based Distance-to-Target (DTT) Life Cycle Impact Assessment (LCIA) Method for Nigeria Under the 2030 Agenda, using the Ecological Scarcity Method

Mohammed Engha Isah, Zhengyang Zhang, Matsubae Kazuyo

Graduate School of Environmental Studies (GSES), Tohoku University, Japan

Abstract

Life Cycle Assessment (LCA) is one powerful theory and tool used to enhance the environmental sustainability and enhancement of products and services, decision making and communication with stakeholders. A myriad of life cycle impact assessment methods has been developed to model and quantify different environmental interventions into a complete, robust, and detailed set of impact categories. Nevertheless, it is still difficult to link environmental policy to LCA and to strike a balance between a robust and streamlined Life Cycle Impact Assessment Method (LCIA) approach that is understandable by policymakers and non-LCA practitioners and experts. The current study aims to develop an existing policy-oriented LCIA method; the Ecological Scarcity Method for Nigeria. The method allows for the identification of single score results for different product options and reveals the environmental hotspots at the country level and across a product's value chain. The data for the Nigerian Eco-factors (NEF) development will be obtained by reviewing publicly available policy documents that explain the state of the environment, targets, and goals of the national environmental policy for each of the substances contributing to environmental issues in Nigeria. Five environmental issues will be considered in this study: emissions to air, surface water and seawater, resource consumption and energy consumption. Global warming (GW), Ozone Layer Depletion (OD), Acidification (Ac), Eutrophication (Eu), Photochemical oxidation (PO), Abiotic depletion (fossil fuels), freshwater aquatic toxicity and human toxicity are the impact categories that will be calculated from publicly available data and characterisation factors.

3.04.T-06 Improving the Quality of River Water Using a Bio-adsorbent from Ripe Plantain Peels

Ihesinachi Kalagbor, Maria Ebong

Rivers State University, Nigeria

Abstract

Natural resources are abundant in Africa. Water bodies are one of the habitats for aquatic life. The more pristine they are, the better the flora and fauna. However, environmental degradation has introduced a lot of contaminants and pollutants into these water sources thereby rendering them unfit for use. This research is aimed at solving this problem in line with the Africa Agenda 2063 (AA 2063) by using biochar from ripe plantain peels as natural adsorbents. The bio-adsorbent was prepared from waste peels of ripe plantain. These were collected, washed, and dried in the furnace at 120oC for 4hrs then transferred to the furnace and carbonized at 450oC for 2hrs. The biochar was removed, allowed to cool, and ground into powder. It was characterized using FT-IR, XRD, and SEM. The results obtained showed that the bio-adsorbent was effective in reducing the electrical conductivity (91.8%), total dissolved solids (92.2%), total suspended solids (85.7%), total hardness (61.5%), the anions (77.9 – 99.2%) and removal of color, odor, and turbidity by 100%. The use of ripe plantain peel biochar is a good method for the removal of pollutants hence protecting our water and making it fit for use.

Keywords: Bio-adsorbent, Biochar, Africa Agenda 2063 (AA2063), Water bodies, Carbonization, Ripe plantain peels.

3.04.P-We002 Water Quality Status of Lower River Niger, Agenebode, Nigeria

Osas Adeniyi[1], Olusegun Akinwole[2], Yewande Sunday[2]

[1]Ajayi Crowther University, Oyo, Nigeria. [2]University of Ibadan, Nigeria

Abstract

Freshwater is often exposed to pollution, unhealthy environment due to rapid industrialization and population resulting in human afflictions and disease transmission. This paper reports findings from a study which evaluated the spatio-temporal variations in the physico-chemical parameters of the Lower River Niger at Agenebode (LRN). LRN is a vital resource for fishery and domestic uses for communities of over four-hundred thousand. Unfortunately, it is fast degrading due to various anthropogenic activities. LRN was stratified downstream (DNS), midstream (MDS) and upstream (UPS) zones based on hydrological features and two sampling points were randomly selected per zone. Water samples were collected bi-monthly over two wet and dry seasons and analyzed for Dissolved Oxygen (DO, mg/l), Chemical Oxygen Demand (COD mg/l), Total Suspended Solids (TSS mg/l), Alkalinity(mg/l), Phosphate(mg/l), conductivity(S/cm), Biochemical Oxygen Demand (BOD, mg/l), and temperature (0C) following standard methods.

Highest (84.46±24.95) and lowest (75.45±24.23 mg/l) alkalinity was recorded for MDS and DNS respectively. Temperature and DO ranged from 27.52±1.48 0C (DNS) to 28.32±1.56 0C (MDS) and 4.27±0.42 mg/l (UPS) to 6.06±10 mg/l (DNS) respectively, TSS varied between 51.68±8.81mg/1 to 84±19.8mg/1, with maximum value in UPS and MDS. The seasonal variation showed that mean DO values, COD, transparency, temperature, conductivity, ammonia, phosphate, chloride, TDS, TSS, calcium, magnesium, sulphate, and depth vary significantly. Conductivity were 60.28±6.1 mg/l and 58.67±6.52 mg/l, phosphate (3.89±1.63;0.52±0.09) mg/l, temperature (28.20±2.34; 25.52±1.74) 0C and DO (5.25±0.56; 5.5±0.61) mg/l in dry and wet seasons respectively. The mean values for BOD (68.52±61.21mg/l), temperature (27.52±1.48) 0C, conductivity (59.55±25.19) mg/l, alkalinity (79.03±22.61) mg/l and ions were within desirable limits for aquatic life. However, TSS 101.49 ±105.27 mg/l, Transparency 49.88±12.46 mg/l, Sulphate 5.30±4.40 mg/l and COD 84.03±25.37 mg/l were above the recommended level for aquatic life. These findings are indicative of warning signs for pollution which impact not only aquatic organisms but also drinking water. Crucial restorative steps are needed therefore to reduce direct discharges of agricultural and anthropogenic effluents into LRN

Keywords: Anthropogenic; Parameters; Pollution; Unhealthy; hydrological.

3.05 - Plastics in Africa from Macro to Micro: Why Accurate Data Is Critical for Protecting the Environment and Public Health

3.05.T-02 Microplastics in the Coastal Environment of the Western Cape, South Africa: Is There Cause for Concern?

Conrad Sparks

Centre for Sustainable Oceans, Cape Peninsula University of Technology, South Africa

Abstract

Research on the prevalence of microplastics (MPs) in coastal environments has increased exponentially in recent years. In the Western Cape Province of South Africa, MPs in the coastal environment were investigated by numerous projects and the aim of the presentation is to report on research done at a MPs lab at the Cape Peninsula University of Technology in Cape Town. MPs were extracted from catchment and coastal waters and sediment as well as invertebrates at rocky shores. Ecological risk assessments were conducted on polymer types recorded. The most common MPs recorded were dark fibers smaller than 1 mm. Between rocky shore filter-feeders, grazers and scavengers, higher MP concentrations were found in filter-feeders, suggesting that non-selective feeders are more susceptible to MP contamination. MP concentrations were highest at sites closest to river mouths and storm water pipes, indicating that MPs were mainly from land-based sources. Risk assessment of MP contamination indicated that polymer types, not concentrations, are important factors to consider when investigating the effects and risks of MPs.

3.05.T-03 Pollution Assessment Around a Big City in West Africa Reveals High Concentrations of Microplastics and Microbiologic Contamination

Ousmane Diankha[1], Amidou Sonko[2], Patrice Brehmer[3]

[1]Université Iba Der THIAM de Thiès, Senegal. [2]Université Cheikh Anta Diop de Dakar (UCAD), Senegal. [3]IRD, Univ Brest, CNRS, Ifremer, Lemar, SRFC, Senegal

Abstract

Marine pollution around West African big cities is of major concerns. Nevertheless, few attempts have been performed so far particularly on microplastic assessment. We had led first survey targeting microplastic in West African coastal waters (2016); and evaluated on the same sites microbiological contamination as well as marine sediment toxicity and mercury content. Thus, neuston marine water samples were collected over Dakar a highly populated West African city. The average abundance was around 258 954 microplastic particles per km2 and 37 442 for macroplastics. One station, downstream from the major wastewater plant, contained high abundance of microplastic particles of over 945 000 and 190 000 macroplastics. The offshore station had a lower abundance of microplastics and macroplastics. It was observed that the stations found with highest level of microbiological pollution were related to highest microplastics abundance and the presence of major effluents, suggesting wastewaters inputs and microbiological pollution favoured by microplastics and macroplastics as vector. No correlation was observed between microplastics and/or macroplastics and sediment toxicity neither mercury level, which appeared low in all studied sites. However, high level of ecotoxicity were often found near effluents. Such results are a first step within the framework of encouraging awareness and actions in West Africa.

3.05.T-04 Invisible Peril: Assessing Microplastic Pollution in Ghanaian Mangroves

Geslaine Rafaela Lemos Goncalves[1], Albert Koomson[2], Joseph Aggrey-Fynn[2], Benjamin Kofi Nyarko[2], Bhavani E Narayanaswamy[1]

[1]The Scottish Association for Marine Science (SAMS), United Kingdom. [2]University of Cape Coast, Ghana

Abstract

Plastic pollution levels are known to be increasing daily on the planet. Ghana has faced massive obstacles in managing plastic waste with its growing population and the resources required. Overconsumption of single-use plastic products, coupled with inadequate waste management infrastructure and a lack of proper waste disposal systems, has led to widespread pollution. These large plastic items degrade into smaller fragments - microplastics. This project aims to investigate the occurrence of microplastics in water and sediment samples, from four mangrove locations in Ghana: Kakum, Narkwa, Ankobra and Amanzule. Water and sediment samples were digested, oil extracted, filtered on a filter paper and identified using an ATR-FTIR. A total of 1374 particles were found. Microplastic concentrations in water ranged from 0 to 4.8 particles per litre and in sediment at 0 to 1.88 per g.dw. 868 particles were identified as a plastic polymer. The most abundant type of particle was fibres (N=1082, size 0.42 - 111.5 mm) when compared to fragments (N=292, size 0.42 - 151.58 mm). The most frequent particle colours were black and blue. During particle identification, polyester was most abundant, followed by polyethylene and polypropylene. Statistical differences in the microplastic abundance were found in our study between the mangrove regions, water and sediment samples, and microplastic fibre and fragment. This study shows that mangrove areas near urban and more populated rural regions had a higher abundance of microplastics. Synthetic hair entering the environment could be the source of black microplastic fibres, mainly polyester. Also, the greater number of black and transparent plastic film fragments (polyethylene and polypropylene) can be related to water and food packages. Our study reveals the alarming presence of microplastics in Ghanaian mangroves, indicating the pervasive plastic pollution in these ecosystems, and highlighting the urgent need for effective waste management practices and a shift towards sustainable alternatives to mitigate the detrimental impacts of plastic pollution on the environment.

3.05.T-05 Estimating the Presence and Diversity of Microplastics in South African Seagrass Meadows

Bianca Boshoff[1], Sophie von der Heyden[1], David Glassom[2]

[1]Stellenbosch University, South Africa. [2]University of Kwa-Zulu Natal, South Africa

Abstract

Microplastics are a widespread phenomenon in marine ecosystems and threaten biota and human wellbeing. Seagrasses have been hypothesized to act as natural filters of microplastics due to their particle trapping abilities, yet little is known about the extent of microplastics within the sediment of seagrass beds. The aim of this study is to evaluate and compare microplastic accumulation in the sediments of *Zostera capensis* meadows with adjacent bare sediments in four South African estuaries (Olifants, Berg River, Knysna and Swartkops), to assess if seagrass meadows act as natural filters of microplastics from the environment and serve as potential stores or reservoirs for microplastics in estuarine environments.

Intertidal sediment samples were collected between January and April of 2023 from two locations containing *Zostera capensis* meadows in the middle reaches of each estuary. A total of 15 samples were collected from each location, with five replicates coming from an area of dense seagrass coverage, five replicates from an area of patchy seagrass coverage and five replicates coming from an area of bare sediment. This sampling regime was repeated at each location within each estuary across all estuaries sampled (n=120). The surface water adjacent to the seagrass meadows were also sampled for microplastics using a Low-tech Aquatic Debris Instrument (LADI) (n=35) to get a more holistic overview of microplastic occurrence at the sample site. Density flotation was used to separate microplastics from sediments. Microplastics were identified using a stereomicroscope and microplastic identification guidelines, with further polymer analysis being done using Fourier Transform Infrared (FTIR) Spectroscopy. Preliminary results suggest that even at small spatial scales there is significant variability in the number and diversity of microplastic particles.

The findings of this study will contribute to the global data on microplastic occurrence within seagrass meadows and more generally, estuarine environments. The data from this study could have conservation implications for *Zostera capensis* meadows through revealed ecosystem services as well as serve as a baseline call for more research into the negative effects of microplastics on seagrass meadows and their associated structures.

3.05.T-06 Exploring the Seasonal Variation of Macroplastic Transport in the Odaw River

Rose Boahemaa Pinto[1], Tim H.M. van Emmerik[1], Kwame Anhwere Duah[2], Martine van der Ploeg[1]

[1]Wageningen University and Research, Netherlands. [2]TAHMO, Ghana

Abstract

Marine plastic pollution is an emerging global environmental issue, with rivers widely recognized as its major source. Plastic transport in these rivers can be highly variable over space and time, which is assumed to be driven by hydrometeorological factors and anthropogenic activities. Despite the growing concerns about plastic pollution, the understanding of the seasonal dynamics of plastic transport in urban rivers, such as the Odaw in Accra, Ghana, remains limited. Recent global studies suggest however that such rivers are among the most polluted. In this presentation, we explore the seasonal differences in macroplastic pollution within the Odaw river. Additionally, we investigate the relationship between hydrometeorological variables such as rainfall and discharge with peak macroplastic transport observed between December 2021 to December 2022. In this period, we monitored floating macroplastic transport at ten locations along the Odaw river by visual counting from bridges. From this study, we aim to gain insights on the spatial and temporal patterns of plastic pollution that can inform targeted interventions to address plastic pollution in the Odaw catchment.

3.05.T-07 Determination of Microplastics in Sediment, Water, and Fish Across the Orange-Senqu River Basin

P. Mark Graham[1,2], Nicholas B. Pattinson[1,3], Adil Baker[4], Alex R. McGoran[4], Holly A. Nel[4]

[1]GroundTruth, South Africa. [2]University of Kwa-Zulu Natal, South Africa. [3]University of Cape Town, South Africa. [4]CEFAS, United Kingdom

Abstract

Microplastics are increasingly recognized as posing a significant environmental threat across systems. Their pervasive presence in freshwater poses a serious concern, given the heavy reliance of both humans and biodiversity on healthy, functioning freshwater ecosystems. Acknowledgment of the potential risks led the transboundary Orange-Senqu River Commission (ORASECOM) to include sampling for microplastics in riverine sediment, riverine surface water, and fish, across Southern Africa as part of the third Joint Basin Survey (JBS3) in 2021. The aim was to establish a first, basin-wide estimate of the status of microplastic contamination across compartments, setting a baseline for further research and comparison. The survey showed that the abundance of microplastics in sediment (0 – 4000 particles.kg^{-1} dry weight (dw)) and water (1.00 ± 0.71 SD – 69.75 ± 68.55 SD items.l^{-1}) varied considerably at different sample sites, with no correlation between the concentrations in sediment and water. The abundance in fish was low, with microplastics detected in 10 out of 30 replicates (average of 0.7 ± 0.4 items.individual^{-1} across all sites). The abundances in each compartment were comparable to globally reported levels. Low spatial resolution sampling precluded robust conclusions about the effects of surrounding land use, though some hotspots of contamination were identified. Fibres and fragments were the most common particle morphology in sediment and water, with only fibres detected in fish. The colour of particles varied considerably in all compartments, with a general dominance of blue, clear, white, and black. The polymers in sediment comprised a majority polypropylene (PP; 64.6%), while water showed a dominance of polyester (PES; 34.4%), and fish a dominance of rayon (31.6%) and acrylic (26.3%), each followed by smaller contributions of a range of other types. This assessment provides a first insight into the characterisation and distribution of microplastics in multiple compartments across the Orange-Senqu River basin. Overall, the findings highlight for more in-depth investigation into microplastics patterns and processes to understand and mitigate the significant microplastic pollution across the basin.

3.05.T-08 Microplastic Abundance and Physico-chemical Quality of Sediment From Ogunpa River, Nigeria

Kelechi Obodo, Elizabeth Oloruntoba, Mumuni Adejumo

University of Ibadan, Nigeria

Abstract

The ubiquity of particles that are minuscule (<5mm) was investigated in five selected locations along Ogunpa river, Ibadan. Although plastic pollution of rivers and its high abundance in settleable solids has been established globally, there is dearth of information on the abundance of these particles in river sediment in Nigeria A metal scoop was used to collect sediment samples fortnightly from each sampling location into clean zip-locked bags. The experiment covered a period of two months during the rainy season. Samples were air-dried, separated with sieves of five mesh sizes and characterised in the laboratory for microplastics (MPs) by density separation using wet peroxide oxidation method with addition of Zncl2. A stereomicroscope was used to identify and quantify extracted MPs in samples prior to Fourier Transform Infrared Spectroscopy (FTIR) carried out to identify polymers of plastics. Furthermore, laboratory analysis for physico-chemical parameters (total organic carbon (TOC), total organic matter (TOM), and total nitrogen (TN)) was carried out on sediment samples following standard procedures. Data were analysed using descriptive statistics and pearson Correlation at $p<0.05$. MPs abundance in sediments was between 700 and 1480 MP/kg, with an average of 1032±305 MPs/kg while the mean for TOC (%), TOM (%) and TN (%) of sediment samples were 4.4±3.2, 7.7±5.5 and 0.1±0.03, respectively. Significantly, a positive correlation existed between MPs concentration in sediment and TN. The common polymers identified by FTIR were polyethylene, polypropylene, and polystyrene. Plastic particles identified were high in fragments and fibers at Molete and Soka. Therefore, Ogunpa river was identified as a dumping site for indiscriminate disposal and source of microplastic pollution, causing menace in the environment. Further studies to reduce environmental effect of plastic pollution in rivers will be vital to provide necessary information for policy formulation and implementation

3.05.T-09 An Assessment of Microplastics Pollution Indices and Microbial Activities in Portable Water in Lagos State, Nigeria

Folashade Ajagbe[1], Christian Enyoh[2], Funmilayo Doherty[1], Idowu Aneyo[3], Nnamdi Amaeze[3], Oluwatosin Amolegbe[1], Abdullahi Adeola[1]

[1]Yaba College of Technology, Yaba, Lagos, Nigeria. [2]Saitama University, Japan. [3]University of Lagos, Lagos, Nigeria

Abstract

The study assessed the presence of microplastics indices in bottled and sachet water, across Lagos State, Nigeria. Microplastics are non-biodegradable, thus making them accumulate in the environment. Bottled and sachet water have been used in place of tap water for its convenience, better taste, and perceived purity. The exposure to microplastics via drinking water has led to growing concerns for the potential risks associated with human health. The study was conducted using a survey research where structured questionnaires were distributed to collect information from respondents/residents across Lagos State, Nigeria. The study areas included five senatorial districts across Lagos State, Nigeria, A total of 180 water samples (Bottled and sachet water) were collected and tested for microbial analysis and Fourier-Transform Infrared Spectroscopy analysis of the samples were determined. Three composite bottled and sachet water samples were procured from each sampling location (total 15) making a total of 180 samples, and transferred into clean amber glass bottles. The spectra of the samples were recorded using Attenuated Total Reflectance -Fourier Transform Infrared spectrometer (ATR-FTIR spectrometer; (AGILENT CARY 630 FTIR Spectrophometer at CTX ion laboratory, Ikeja, Lagos State.) equipped with a single bounce diamond crystal and a deuterated triglycine sulfate detector. The Total Bacteria count for the bottled water samples ranged from 1.17 x 105 - 2.00 x 103, while fungal wasn't present in the samples. The total coliform counts for the analysis of sachet water samples in Lagos ranged from 0.0×101cfu/ml - 2.14×102cfu/ml. The two major polymers observed in the bottled water samples include Polytetrafluoroethylene and Sealing Ring Ethylene Propylene Diene Monomer, while FTIR identified four major microplastics polymers in the sachet water samples which include, Teflon/PTFE, polyurethane, quartz sand beach and acrylonitrile butadiene styrene. From the result, microplastics have been found to be present in sachet and bottled water. The microbial analysis also shows that the bottled water and sachet water samples are not microbiologically safe for consumption, which calls for great concerns. Therefore,proper measures and policies on mitigation of microplastics pollution and microbial contamination in drinking water should be put in place by the government and private sector in the and safety of drinking water in those communities

3.05.T-10 Assessment of Microplastic Pollution and Biodegenerating Potentials of Microorganisms in Selected Water Bodies in River State, Nigeria

Japhet Attah[1], Herbert Stanley[1], Francis Sikoki[2], Omega Immanuel[2]

[1]University of Port Harcourt, Nigeria. [2]University of Africa Toru-orua, Nigeria

Abstract

This study aimed to assess microplastic pollution and biodegenerating potentials of microorganisms in selected water bodies in River State, Nigeria. The physicochemical parameters of water and sediment samples from the New Calabar River and Bonny River were ascertained using standard methods. Water, sediment and fish samples were analysed for the presence of microplastics, heavy metal, polycyclic aromatic hydrocarbons (PAHs), Polychlorinated bisphenols (PCBs) and microorganisms. Plastic degradation potential of bacteria and fungi isolated from biofilms and sediment was assessed in a bioreactor for 7 weeks. Results showed that physicochemical parameters monitored in water and sediment samples varied across locations and are significantly different ($p<0.05$) for all parameter except pH. Four plastic type namely polyethylene, polyethylene terephthalate, polystyrene, polypropylene were detected in all samples. Several PAHs were detected in water, sediment and fish samples, with concentration ranging from 9.84- 3603.61 ppm. PCBs concentration ranged from 20.273-118.641 ppm. Total heterotrophic bacterial count for water ranged from 6.70x106 CFU/ml – 7.7x106 CFU/ml; sediment, 1.20x106 CFU/g – 8.50x106 CFU/g and fish, .0x107 CFU/g -5.0x107CFU/. Total fungal count for water ranged from 1.0x106 CFU/ml; sediment, 1.50x106 CFU/g – 1.55x108 CFU/g and fish, 1.55x108 CFU/g - 3.2x108 CFU/g. Analysis of 16S rRNA gene regions of the bacterial isolates revealed close relatedness to *Bacillus cereus*, *Enterobacter asburiae*, *Pseudomonas aeruginosa*, *Pantoa dispersa*, *Klebsiella pneumoniae*, *Staphylococcus edaphicus*, *Staphylococcus arlettae*, and *Lysinibacillus macroides*. The analysis of ITS regions of the fungal isolates revealed close relatedness to *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus welwitshiae*, *Aspergillus niger* and *Candida tropicali*. The isolates cause a reduction in weight of plastic in the range of 1.57% - 9.683%. Additional evidence of biodegradation was provided by FTIR spectra which showed increase in peaks areas corresponding to functional groups for alcohol, hydroxyperoxide, ketones, esters and carboxylic acids, which are degradation products from plastics. This study has shown that water, sediment and fish samples contain microplastics. Bacteria and fungi present in the sediment and microplastics biofilms were found capable of utilizing microplastic as source of carbon, thereby leading to reduction in the mass of microplastics.

3.05.T-11 The Microbiological Effects of Wastewater Derived Microplastics in the Ocean

Raeesa Bhikhoo, Carlos Bezuidenhout, Lesego Molale-Tom, Charlotte Mienie

North-West University, South Africa

Abstract

Microplastics have been identified as one of the characteristics of the Anthropocene and already acknowledged as an emerging environmental contaminant. They originate from land-based sources including wastewater treatment outfalls. Policy, at least in the South African context, dictates that partially treated wastewater from coastal cities could be deposited into the ocean. Plastics, and microplastics in particular, represent a considerable proportion of this mixture and includes a consortium of microorganisms, specifically Enterobacteriaceae. These bacteria are ubiquitously associated with gut content of humans and other animals. Furthermore, they may be resistant to antibiotics. Such antibiotic resistant Enterobacteriaceae, may form biofilms on the microplastics and these could be dispersed into oceans. This study aimed to isolate Enterobacteriaceae species from virgin microplastics by utilizing a simulation. Microcosms were set up by spiking artificial seawater with WWTP effluent and adding the plastic pieces. Pure isolates were tested against 16 antibiotics normally used in a clinical environment. Dominant species identified were Citrobacter sp., Escherichia sp., Enterobacter sp., Raoultella sp., Klebsiella sp. as well as Aeromonas sp., and Pseudomonas sp.. It is disquieting that some of these species were isolated from all three compartments of the wastewater treatment train, potentially demonstrating their extreme ability to survive, most probably due to protection in the biofilm. Resistance to beta-lactam antibiotics (ampicillin and augmentin – ampicillin-cluvanate) was common and ranged from 68% to 89% amongst isolates. Furthermore, some of these were also resistant to carbapenems (doripenem and imipenem; 9% to 27%). PCR analysis showed that many of the isolates contained the genes intI1, blaFOX and blaMOX. Bacteria containing the intI1 gene have the ability to transfer the carbapenem and also other antibiotic resistance genes to related and non-related species in biofilms. Studies should be undertaken that will challenge the current policy regulating the release of sewage through marine outfalls as well as the notion that dilution of sewage is an answer to pollution. Given the global rise in antibiotic-resistant infections and annual mortality expected to increase to 10 million by 2050, finding ways to reduce antibiotic-resistant bacteria and genes into the environment is important.

3.05.P-Mo019 Microplastic Contamination in Two Marine Fish Species in Ghanaian Waters

Pearl Sakyi-Djan[1], Joseph Aggrey-Fynn[1], Emmanuel Acheampong[1], Bhavani E. Narayanaswamy[2]

[1]University of Cape Coast, Ghana. [2]The Scottish Association for Marine Science (SAMS), United Kingdom

Abstract

This research study investigated the presence of microplastics in two marine fish species, pelagic and demersal, which are commercially important in the waters of Ghana. The study was conducted at two locations, the Elmina fish landing site and Tema fishing Harbour, and involved the analysis of two fish species, Dentex angolensis (Angola dentex) and Sphyraena sphyraena (Barracuda). The results showed a higher occurrence of microplastics in Dentex angolensis at Elmina. The microfibers found accounted for 60-100% of the ingested microplastics, with five different polymer groups identified using the FTIR spectrum. The most commonly consumed polymers were polyethylene (35.3%), polystyrene (29.4%), and polyurethane (23.5%). Though the ingestion of plastic was low, the fact remains that marine fishes and humans are being contaminated with microplastics which requires attention from all stakeholders in addressing pollution, especially plastics.

3.05.P-Mo021 Microplastics in Sediments From two Estuaries in Ghana

Charles Faseyi[1], Michael Miyittah[1], Akindayo Sowunmi[2], Levi Yafetto[1]

[1]University of Cape Coast, Ghana [2]University of Ibadan, Nigeria

Abstract

Increase in anthropogenic activities in coastal areas has led to significant increase in the presence of microplastics in marine and coastal waters. In this study, samples from Pra and Ankobra estuaries in Southwestern Ghana were analysed to assess sediment profile, and the occurrence and distribution of microplastics in the two estuaries. The findings revealed percentage sediment classification of gravel (0.65%), sand (65.15%), silt (34.20%); and gravel (0.81%), sand (64.04%), silt (35.165) in Pra and Ankobra estuaries, respectively. A total of 1184 microplastic items/10g of dry sediment were recovered from the two estuaries. The mean concentrations of microplastic particles in Pra were fibres (14.22 ± 4.99); sheets (24.44 ± 13.21); fragments (38.00 ± 25.47); beads (4.22 ± 4.84), whereas those in Ankobra were fibres (13.00 ± 7.56); sheets (20.60 ± 12.59); fragments (8.70 ± 11.22); beads (3.30 ± 4.14). One-way ANOVA test (α=0.05) showed a significant difference in the means of microplastic particles and no significant correlation of sediment profile with microplastic particles in the two estuaries. The presence of microplastic particles in both estuaries suggests microplastic contamination of these important ecosystems. It is recommended that plastic waste management should be enforced in Ghana to reduce the impact of microplastic contamination on the environment.

3.05.P-Mo022 Spatio-Temporal Distribution of Microplastics in Water Samples of the Swartkops River, Eastern Cape, South Africa.

Enahoro Owowenu[1], Oghenekaro Odume[1], Xavier Noundou[2]

[1]Institute for Water Research, Rhodes University, South Africa. [2]School of Pharmacy, Sefako Makgatho Health Sciences University, South Africa

Abstract

Microplastic pollution is widely recognized as a global issue, posing risks to natural ecosystems and human health. The combination of rapid industrial and urban development and relatively limited environmental regulation in many African countries may increase the number of microplastics entering rivers. However, basic data on contamination levels are still scant across the continent, including South Africa. The current study assessed the abundance, composition, and spatio-temporal variation of suspended and settled microplastics in the Swartkops River, Eastern Cape Province of South Africa. Water samples were collected over the wet and dry seasons from selected sites in the Swartkops River in four separate sampling trips. Extraction of microplastics from water samples in the laboratory was by density separation. Microscopy and Fourier Transformed Infrared spectroscopy were used for microplastics identification and polymer type verification respectively. We found that microplastic abundance ranged from 0.50 to 6.67 particles/L, and the spatial difference in abundance was not significant across the sampling points (ANOVA; $p>0.05$). The mean abundance of suspended microplastics (2.62 ± 1.99 S.D) during the wet season was higher than that recorded for the dry season (2.52 ± 1.99 S.D). Microplastic sizes less than 2mm accounted for 87% of the total microplastics. Fibres were the most abundant microplastic particle shape across all sites. Polyethylene, polypropylene, and polyethylene terephthalate were the dominant polymers detected. The abundances of suspended and settled microplastics varied in water samples with each site, which might be affected by multiple factors. This study provides an understanding of microplastic distribution patterns and contamination levels in the Swartkops River system and gives a baseline for future monitoring and assessment of water in South Africa River systems.

3.05.P-Mo023 Microplastics Occurrence and its Correlation to Physicochemical Properties of the Diep River (Milnerton), Western Cape, South Africa

Asmat Khan, Omoniyi Pereao, Conrad Sparks, Beatrice Opeolu

Cape Peninsula University of Technology, Cape Town, South Africa

Abstract

Microplastics are small sized particles (< 5 mm) that have become a serious global concern since they may be a potential source of hazardous chemicals in the environment. They are often found in water and sediments and may interact with various organisms. The Diep River runs through the City of Cape Town via neighbourhoods with different land use types into the ocean. In this study, the microplastic burden of the Diep River and some physicochemical parameters of the river water were assessed. Water and sediment samples were collected from five sites on the Diep River and analysed for microplastics. A 100 L sample was filtered through a 250 µm sieve on site, and a 20 L water sample and 20 g sediment sample were collected for processing in the laboratory. The water and sediment samples were filtered through a 20 µm mesh in the laboratory. Microscopy and Fourier-transform infrared spectroscopy (FTIR) were used to characterize the extracted microplastics. The pH values ranged between 7,73 and 9,83; dissolved oxygen was between 2,4 and 11,8 mg/L; redox potential (ORP) values ranged from -125,5 and 119,0 mV, and temperature values ranged between 15,8 and 23,2 ºC. The results revealed that the Diep River water physico-chemical parameters were within the South African Water Quality Standards with a few exceptions. There was a positive correlation ($r=0.488$) between ORP and 250 µm mesh samples. Fibres were the most abundant microplastic found under microscopy, and polyethylene and polypropylene were the most predominant polymers identified in water and sediment samples, respectively, under FTIR. Significant differences were shown in spatial and temporal microplastic distribution based on the proximity to urban/industrial areas and wastewater treatment plants. This study provided insights into policy development and implementation, and management strategies for the Diep River.

3.05.P-Mo024 Meso- and Macroplastic Pollution on Two Coastal Beaches of Ghana

Pearl Sakyi-Djan[1], Joseph Aggrey-Fynn[1], Emmanuel Acheampong[1], Bhavani E. Narayanaswamy[2]

[1]University of Cape Coast, Ghana. [2]The Scottish Association for Marine Science (SAMS), United Kingdom

Abstract

Human activity has led to the appearance of marine debris on beaches. Unfortunately, plastic and other non-biodegradable synthetic materials are the most common marine debris responsible for damaging marine habitats and biota. This study was conducted along Ghana's beaches to investigate the marine environment's pollution level. This study examined mesoplastic and macroplastic debris distribution, abundance, types and effects on two coastal beaches at Tema Fishing Harbour and Elmina Beach in Ghana. The OSPAR guideline for plastic monitoring was adopted with slight modifications for this study. This investigation focused on the debris around beaches and economical fishing activities with high human interactions. The findings indicated that plastic pollution affected both coasts, with an average of 400 debris items per 100 meters of shoreline at Tema and Elmina. The most common forms of debris were plastic bags, pure water sachet, refrigerator insulators and hard plastic. Fragments were the primary physical characteristic of mesoplastic, whilst Styrofoam and film were the primary physical characteristics of macroplastic. White, transparent and black were the most prevalent colours for macro- and meso- plastics. The findings further indicated that both beaches were dirty, subject to the Clean Coast Index (CCI). The study also revealed buried macroplastic due to continuous sand deposition. The polymer types were polystyrene, high-density and low-density polyethylene and polyurethane. The study, therefore, recommends a comprehensive approach to addressing plastic pollution in Ghana, including cleaning using enhanced waste management techniques and tools, public education, and policy and regulatory enforcement to help salvage the beaches.

3.05.P-Mo025 Occurrence and Characteristics of Microplastics in the Visceral Tissues of Four Commercial Fish Species in the Lagos Lagoon, Nigeria

Fadekemi Akinhanmi[1], Opeyemi Ayanda[1], Gabriel Dedeke[2]

[1]Covenant University, Ota, Nigeria. [2]Federal University of Agriculture, Abeokuta, Nigeria

Abstract

The incidence of pollutants of emerging concern such as microplastics (MPs) in the Nigerian aquatic environment has been on the increase in recent times. The occurrence of microplastics in the largest lagoonal system in Lagos, the Lagos Lagoon, raises concerns about potential effects on the biota. This research is aimed at providing information on the presence and highlighting the characteristics of microplastics in the visceral tissues of four commercial fish species; Tilapia (*Orechromis niloticus*), Silver catfish (*Chrysichthys nigrodigitatus*) African catfish (*Clarias gariepinus*), and African knifefish (*Gymnarchus niloticus*). Fish were purchased from local fishermen at the Epe, Makoko, SagboKoji, and Badagry areas of the lagoon. They were dissected and their gills, stomach, and liver were examined for microplastics' presence. Potassium hydroxide was utilized for tissue digestion with subsequent filtration. Extracted microplastics were characterized using Attenuated Total Reflectance-Fourier transform infrared (ATR-FTIR) spectrophotometer. Microplastics were found in all the fish species, at least in one of the tissues. Gymnarchus niloticus had the highest number of MPs (125 particles/fish), followed by Clarias gariepinus (98 particles/fish) and Oreochromis niloticus (82 particles/fish), indicating the presence of MPs in the dominant commercial species in the Lagos lagoon. The dominant color observed was black (51%) and the most abundant MP type was fiber (61%) followed by fragment (39%); MPs in the range of 100 – 150 µm were detected in size. Predominant plastic polymers identified were Polyethylene and Polychloroprene. While further research needs to be conducted on the potential impacts of MPs on biota and public health, urgent cleanup and remediation strategies are necessary to mitigate MP pollution in the Lagos Lagoon.

3.05.P-Mo026 In Vitro Exposure of Polystyrene Nanoparticles and Co-exposure with North Sea Marine Oil: Assessing Sensitive Endpoints of Toxicity.

Marianne Brookman-Amissah, Monica Olsson, Joachim Sturve

University of Gothenburg, Sweden

Abstract

Over the last decade, there has been increased interest in the impact of micro and nano plastic pollution on the aquatic ecosystem. However, little attention has been given to interactions of these particles with other environment pollutants found in the aquatic environment. This study aims to gain knowledge on the possible toxic effects associated with single and combined exposure of Polystyrene nanoparticles (PsNPs) and water accommodated fractions (WAF) of North Sea marine oil on fish in vitro models and explore more sensitive in vitro assays for the overall assessment of nanoparticle toxicity.

Rainbow trout (Oncorhynchus mykiss) cell lines were exposed to a range of concentrations and sizes of PsNPs alone or in combination with WAF. Endpoints measured included multitarget cytotoxicity, potential to induce CYP1A enzymes (EROD), the generation of intracellular reactive oxygen species (ROS) as well as toxicity and behavioural effects in Zebrafish embryos

Exposure to PsNPs alone demonstrated significant changes in cellular metabolic activity, membrane stability and generation of ROS in rainbow trout gill and liver cells that were observed to be particle size and concentration dependent, an increasing trend of ROS generation was observed in 25 and 100nm PsNPs exposures only and with WAF alone.

Pilot studies investigating the combined exposure of similar oil: water fractions and 100nm PsNPs demonstrated reduced cytotoxicity by 25-40% at select concentrations in rainbow trout gill and liver cells. Further studies into interactions with other sizes of PsNPs will be conducted to gain an overall assessment of the risks associated with these mixtures.

3.05.P-Mo027 Monitoring Microplastics in South Africa: An Issue of Methodology

Marco Worship[1], Titus Msagati[2], Carlos Bezuidenhout[3], Adil Bakir[4], Keshnee Pillay[1]

[1]Department of Forestry Fisheries and the Environment, South Africa. [2]University of South Africa, South Africa. [3]North West University, South Africa. [4]Centre for Environment, Fisheries and Aquaculture Science, United Kingdom

Abstract

Microplastic pollution of the ocean has fast become a priority issue for the 21st century with the United Nations (UN) highlighting it under Sustainable Development Goal (SDG) 14. An internet search will result in hundreds, if not thousands of articles and publications on microplastics in the country. With this much effort, we should have the baseline information required for monitoring – how much microplastics are in our ocean? Where? Type? Inland sources? While South Africa does have some answers, having a complete baseline is a matter of comparable methodology. The Department of Forestry, Fisheries and the Environment (DFFE) has the mandate to monitor pollution so that present and future generations have a healthy environment. To this end, the DFFE, through desktop research and a roadshow to potential collaborators, has partnered with key institutions to develop or instate methods that are of relevance and easily reproducible by many to ensure the generation of comparable datasets. Presented here will be the range of methodology currently in use by DFFE, the publications thereof, and the data stream to SDG goal 14. A simple methodology as proposed by the UK's Commonwealth Litter Programme (CLiP) has been instated. This is a cost-effective method that can be used by many to cheaply give scientifically valid and comparable data. This method is in place in the UK, Belize, Sri Lanka, Solomon Islands, Vanuatu, and South Africa. A complex method to determine the microplastic in zooplankton was developed through the University of South Africa in partnership with the DFFE. This method is complete and will be applied to the DFFE's decades-long samples of zooplankton to determine a timeseries for microplastics possibly infiltrating the foodweb at this trophic level. A DFFE-supported project of Northwest University to determine the biofilms around the microplastics has turned into a potential partnership to put in place a buoy system monitoring for microplastics at a fixed point over a given time period. This additional collection method will use a harmonized laboratory analysis method and will give better-resolution data. The DFFE is also a partner in the intergovernmental organization, the International Atomic Energy Agency (IAEA) project to consolidate and harmonise microplastics methodology across 14 African countries. This data will filter into the DFFE's Marine Management Information System (MIMS) which is the official UN reporting data portal for SDG 14.

3.05.P-Mo030 Characterization of Microplastics from the Hennops River, Gauteng: South Africa

Phedisho Mphahlele[1], Ntebogeng Mokgalaka-Fleischmann[2,1], Emomotimi Bamuza-Pemu[3]

[1]Tshwane University of Technology, South Africa. [2]University of Pretoria, South Africa. [3]Optimal Enviro, South Africa

Abstract

Plastics are versatile and complex synthetic, semi synthetic or naturally occurring polymers. They are lightweight materials with distinct advantages especially resistance to degradation and malleability, making them a preferred material of choice for wide range of applications providing value across several industries. Unfortunately, these same qualities impart durability resulting in their persistence in the environment posing significant risk to human and environmental health. Due to their high demand and ease of production, tons of plastics are produced annually with estimated global production of 367 million tons in 2020, and 1.74 million tons in South Africa. Slightly higher than 50% of plastics used in South Africa are are often single use plastics. This is a major source of plastic leakage often ending up in marine environments. Other sources of pollution result from poor waste management systems resulting in significant pollution of rivers across South Africa. Plastics in the environment slowly photodegrade on exposure to sunlight, temperature variations and anthropogenic processes over long periods of time. Plastics in marine environments are also broken into smaller pieces by mechanical abrasion from wind, waves or abrasive actions from sand or rocks. These macro, micro and nano plastics remain in the environment and are posing increasing health hazards to aquatic animals with studies reporting microplastics (MPs) found in the gastrointestinal tract, gills and dorsal muscle of fishes. The health risk to humans is also heightened with the possibilities of microplastics consumption through the food chain and from water supplies and a recent study reported isolating microplastics in human placenta. These health dangers make it imperative to better understand the types and toxicity of microplastics in the environment. The current study was embarked upon to characterise MPs from the heavily polluted 91 km long Hennops River in the Gauteng province of South Africa. A stacked sieve method was used for collection of microplastics from five sampling points along the Hennops river followed by their isolation after acid digestion to remove organic matter present. Characterization is in progress using FTIR Imaging system. Results are expected to give insights into the types of microplastics in the Hennops river and the parent source plastics which could add valuable data for policy formation in the attempts to reduce plastic pollution in the environment.

3.06 - E-Waste in Africa: Challenges and Opportunities for Sustainable Management

3.06.T-01 Health Risk Assessment of Polycyclic Aromatic Hydrocarbons among Informal Electronic Waste Recyclers at Agbogbloshie in Ghana

Lawrencia Kwarteng[1,2], John Arko-Mensah[2,3], Stuart Batterman[4], Julius Fobil[2,3]

[1]Biomedical and Public Health Research Division, CSIR-Water Research Institute, Ghana. [2]Department of Biological, Environmental & Occupational Health Sciences, School of Public Health, University of Ghana, Ghana. [3]West Africa Center for Global Environmental & Occupational Health, College of Health Sciences, University of Ghana, Ghana. [4]School of Public Health, University of Michigan, USA

Abstract

Informal electronic waste (e-waste) recycling activities result in the release of polycyclic aromatic hydrocarbons (PAHs) and other pollutants into the ambient environment. PAHs, often absorbed onto fine inhalable particulate matter (PM), have both mutagenic and carcinogenic properties and therefore present considerable health risks to e-waste workers and the general population. Data on e-waste worker exposure to PAHs and associated health risk at the Agbogbloshie e-waste site are limited. This study characterized PM2.5 associated PAH levels in the breathing zone of e-waste workers as compared to a reference population and estimated the associated health risk. Thirty-one e-waste workers and ten individuals from a reference population at Madina-Zongo were recruited and given gravimetric samplers to collect two to four-hour shift of PM for PAH analysis. Following the USEPA guidelines, health (cancer and non-cancer) risk attributable to PAH exposures were estimated. Data were summarized using descriptive statistics. Mann-Whitney and two-tailed t-tests, at a significance level of p = 0.05, were used to describe the differences in concentrations and risks between groups. Naphthalene was the most abundant PAH measured at both the e-waste (83 ng/m3) and reference (73 ng/m3) sites. Median concentrations of the sum of all PAHs were higher at the e-waste site (88.4 ng/m3) than the reference (67.7 ng/m3) community, although the difference was not statistically significant (p = 0.17). The median of Benzo(a)pyrene equivalent concentration ranged from 4.0 x 10-5 to 3.1 x 10-2 ng/m3 and from 3.7 x 10-5 to 2.6 x 10-2 ng/m3 among exposed and reference groups respectively. Hazard quotients (HQs) were below 1, indicating minimal likelihood of adverse health effects. Also, the median and maximum cancer risk due to exposure to all measured PAHs were 3.4 x 10-6 and 1.5 x 10-5 respectively, thus exceeding the USEPA lifetime excess cancer risks criterion of 10 -6. Estimated worker exposure to PAH exceeding the risk criterion level at the e-waste site indicates chronic exposures to PAHs at Agbogbloshie. Measures to reduce PAH emissions and inhalational exposures among e-waste workers are needed to reduce the chance of adverse health outcomes.

3.06.T-02 Effects of Biochar Amendment in E-Waste Contaminated Soil on the Survival and Growth of *Alma nilotica*, an indigenous Earthworm Species

Sophie Rella Tenonfo Ngouefack[1], Patricia Bi Asanga Fai[1,2]

[1]University of Dschang, Cameroon. [2]The University of Bamenda, Cameroon

Abstract

Waste electrical and electronic devices (e-wastes) are generated in huge amounts around the world today, and has become a global environmental issue. Due to the lack of a precise management and disposal approach, e-wastes are discarded in mass and dumped in an inapt landfill or stowed where large soil areas are available while some are routinely drenched or flooded by rain fall, producing run-off from storage sites to waterways. They are considered dangerous, as certain components contain materials that are harmful, including heavy metals, which pose risks to the environment. Biochar is increasingly recognized as a promising, effective material that can be used to remediate various contaminants, including excessive heavy metals, by disrupting the exposure pathway and reducing risk. It is known to stabilize heavy metals and reduce their bioavailability through enhanced sorption. However, the effects of biochar application on fish and earthworm reproduction, growth and survival are unknown. We assessed the effect of biochar amendment ranging from 1% to 5% in e-waste contaminated soils on an indigenous earthworm species, *Alma nilotica*, growth and survival using standard OECD test methods. Earthworm survival and burrowing activity was unaffected. However, biochar amendments significantly inhibited *Alma nilotica* growth in a dose-dependent manner giving growth IC50 (95% CI) of 1.93 (0.18-5.79) % and IC20 of 0.62 (0.01-2.77) %. In addition, earthworm length proved to be a more sensitive growth parameter compared to weight as the length more than trippled (increased 3.6 times) during the test period while the weight just doubled (2.3 times increase). Given the negative effects observed on earthworms, it is necessary to exercise caution when using biochar soil amendments.

3.06.T-03 Effectiveness of an Activated Charcoal-fabricated Furnace in Air Pollution Reduction During Resource Recovery Practices in Ibadan, Nigeria

Abiola Olushola, Oyewale Morakinyo, Mumuni Adejumo, Elizabeth Oloruntoba

University of Ibadan, Nigeria

Abstract

In Nigeria, the environmental and human health implications of informal e-waste recycling practices such burning of e-waste for resource recovery are becoming a cause for concern owing to its toxic components such as heavy metals and brominated flame retardants. Therefore, this study assessed the effectiveness of a locally fabricated e-waste recycling furnace in reducing pollution from open burning of E-waste during resource recovery. An experimental study design that involved the fabrication of recycling furnace embedded with an artificial charcoal was done. Samples of particulate matter collected on a filter paper using a single-stage air sampler were analysed, and the efficiency of the furnace evaluated by contrasting the levels of PM2.5, PM10 and heavy metals released during burning in open flames with those produced by the artificially embedded furnace. The concentration of PM2.5 (568.5±7.78µg/m3) and PM10 (1749.5 ± 0.71µg/m3) during open burning of E-waste were higher than USEPA standards. Also, the concentration of Pb, As, Ni and Mn from open burning were 0.001453 mg/L, 0.016002 mg/L, 0.003399 mg/L, respectively. After treatment of the pollutant in the artificial charcoal embedded furnace, there was a 64.0% and 40.0% reduction in the concentration of PM2.5 and PM10, respectively. Moreover, some levels of reduction in the concentration of heavy metals before and after treatment in the furnace were recorded. This study shows the effectiveness of the furnace in reducing PM2.5 and PM10 concentration. Further study should be conducted to evaluate the efficiency of the furnace with different activated options. This is key to dipping the levels of airborne pollutants and possible reduction in the prevalence of poor health outcomes associated with informal E-waste recycling practices.

3.06.T-04 Mechanical Properties of Concrete incorporated with E-Waste Plastics as Coarse Aggregate

Oluseun Popoola, Idowu Adebakin, Babawale Oladitan, Aderonke Oloidi

Yaba College of Technology, Nigeria

Abstract

E-wastes plastics are the plastic components from electronic devices that have reached the end of their useful life and are thus discarded. The disposal of these plastics which contains toxic compounds- PCBs, BFRs, possess an environmental challenge. The mechanical properties of the e-waste plastic as a construction material when used as partial replacement for coarse aggregate in concrete was evaluated in this study. M20 concrete was made with 0%, 5%, 10%, 15% and 20% replacement of natural coarse aggregate with e-plastic aggregate, at 0.55 water/cement. The mechanical properties evaluated included compressive strength, flexural strength, and splitting tensile strength after 7, 14, 21 and 28 days curing. Though, results indicated that e-plastic wastes had a higher bulk density, crushing and impact strengths than traditional coarse aggregates. However, the presence of e-plastic wastes in concrete caused between 20 - 30% reductions in the overall compressive strengths of the concrete compared to concrete without e-plastic wastes as percentage of replacement increases. This could be due to reduced bonding between aggregates due to smoothness of the surface of the e-plastic aggregates. But less reduction was observed in both splitting and flexural strengths. Additionally, tests of the water absorption of concretes with e-plastic aggregates showed that their absorption capacity was about 20% higher than that with conventional coarse aggregates. The results of this study show that the substitution of electronic plastic waste for coarse aggregates is a viable option for lightweight concrete. Furthermore, the use of electronic waste plastic in concrete also reduces the carbon footprint of the construction, resulting in a more sustainable structure.

3.06.T-05 Perceived Stress at Work and Associated Factors among E-Waste Workers in French-Speaking West Africa

Marius Nonvignon Kedote, Ghislain Emmanuel Sopoh, Steve Biko Tobada, Aymeric Joaquin Darboux

University of Abomey-Calavi, Benin

Abstract

Perceived stress at work is an important risk factor that affects the mental and physical health of workers. This study aims to determine the prevalence and factors associated with perceived stress in the informal electronic and electrical equipment waste processing sector in French-speaking West Africa. From 14 to 21 November 2019, a cross-sectional survey was carried out among e-waste workers in five countries in the French-speaking West African region, and participants were selected by stratified random sampling. Participants were interviewed on socio-demographic variables and characteristics related to e-waste management activities using a questionnaire incorporating Cohen's Perceived Stress Scale (10-item version). Factors associated with perceived stress were determined by multivariate logistic regression. A total of 740 e-waste workers were interviewed.

The mean age of the workers was 34.59 _ 11.65 years, with extremes of 14 and 74 years. Most of the interviewees were repairers (43.11%). The prevalence of perceived stress among the e-waste workers was 76.76%. Insufficient income, number of working days per week, perceived violence at work, and the interference of work with family responsibilities or leisure were the risk factors that were the most associated with perceived stress. The high prevalence of perceived stress and its associated factors call for consideration and improvement of the working conditions of e-waste workers

3.06.P-We006 Assessment of Air and Dust from Electronic Waste Recycling Sites in Lagos, Nigeria for Potentially Toxic Metals

Omolola Adeyeye, Oluwatoyin Fatunsin, Kehinde Olayinka

University of Lagos, Nigeria

Abstract

The electronic industry is the largest and fastest growing manufacturing industry currently in global economy. Leading to generation of large amount of obsolete or outdated electronic, old and spoilt electronic are usually recycled. However, the recycling and improper disposal of electronic gadgets releases toxic metal into the environment. The aim of this study is to evaluate the concentration of potentially toxic metal in dust and air of formal and informal e-waste recycling and electronic repair sites in Lagos, Nigeria. Fifty repairer and recyclers shops were sampled for dust. The dust samples were sieved through a <0.8mm sieve.The air was sampled using atmospheric depositions of outdoor air in dry and raining season (December 2022 to May 2023) at four electronic handling (recycling and repair) site and a control within Lagos State. They were Alaba international market dumpsite (informal recycling site), Alaba international market electronic repair shop, Computer Village electronic sales and repair shop, A formal recycling company and a Botanical Garden serves as control. The Bargerhoff collector method was used for sampling atmospheric deposition. The atmospheric deposition samples and dust samples were digested using nitric acid and hydrochloric acid mixtures and then filtered. The digests will be analysed for arsenic, cadmium, chromium, copper, lead, nickel and zinc using Inductively Coupled Plasma- Optical Emission Spectrometry (ICP-OES).

Results will reveal the concentrations of potentially toxic metals in dust and in air over the observed period. It will also show the seasonal variation and how the effect of activities at the different sampling site affects the concentration of the potentially toxic metals. The risk associated with the metal concentration in the samples to occupants of those vicinities will be estimated.

KEY WORD: electronic waste, potentially toxic metals, dust, atmospheric deposition, ICP-OES

3.06.P-We007 Characterization and Toxic Potency of Airborne Particles Formed upon Recycling Waste from Electrical and Electronic Equipment (WEEE) – A Case Study.

Marianne Brookman-Amissah

University of Gothenburg, Sweden

Abstract

Manual dismantling, shredding and mechanical grinding of Waste from Electrical and Electronic Equipment (WEEE) at recycling facilities inevitably leads to the accidental formation and release of both coarse and fine particles into the ambient air, and thus to a risk for inhalation or skin contact during processing. Since WEEE recycling plants are typically open spaces, the emitted WEEE particles can spread diffusely to the adjacent environment. The aim of this interdisciplinary project was to collect and characterize WEEE particle aerosols generated at a Nordic open waste recycling facility from a particle concentration, shape, bulk- and surface composition perspective, and to assess if such particles would pose a risk to induce adverse effects on aquatic organisms given a scenario of their non-intentional environmental dispersion in realistic particle concentrations.

Most of the formed particles (by number) were smaller than 100 nm (77%), and nearly all particles were of inhalable sizes (<1 µm). They were confirmed to have long residence time in the atmosphere and are small enough to risk being diffusively dispersed to the environment potentially causing harm.

The inherent risk associated with WEEE exposure was confirmed by the increased tendency towards cytotoxic effects on fish gill cell lines after 48h at the highest concentration tested (200mg/L) although the exposure resulted in ROS formation that may induce adverse effects over time. However, WEEE particles were found to have detrimental effects in the crustacean zooplankton Daphnia magna, with no individual surviving 40h of exposure at the highest concentration and about 50% of individuals survived the 80h exposure. The zooplankton bioassay shows that the WEEE particles were toxic to D. magna in a concentration dependent way.

3.06.P-We008 Awareness and Knowledge Level of E-Waste Among Students of Higher Educational Institutions (HEIs) in Lagos, Nigeria

Oluseun Popoola, Adebowale Adebagbo, Aderonke Oloidi

Yaba College of Technology, Nigeria

Abstract

The management of Electronic Waste (e-waste) poses a challenge in Nigeria, primarily due to the generation of substantial volumes and the lack of adequate infrastructure for its proper disposal. The aim of this study is to assess the knowledge and awareness of the disposal and safe handling of e-waste among students of three HEIs (University of Lagos, Yaba College of Technology and Federal College of Education (Technical)). HEIs generate significant amount of e-waste and could be a channel for solving the problem of e-waste management, as students are digitally literate and are expected to be aware of the dangers of e-waste. However, what is observed among students is contrary to this expectation. Therefore, empirical data on the awareness and knowledge of e-waste among students is needed in order to provide necessary intervention. The descriptive survey research data for the study were obtained through the distribution of 915 well-structured validated questionnaires with reliability coefficient of 0.82, on a 4-point Likert scale. Descriptive statistics of frequency count, percentage and charts were used for data analysis. This study found that there is a very high knowledge deficiency and knowledge gap on the management of electronic waste among the digitally literate generation. This deficiency and gap suggest that there is limited understanding of how to protect the environment sustainably from the large volume of e-waste generated by this population group. Based on the findings of this study, it was recommended, among others, that an instructional resource on e-waste should be specifically developed, and produced, and made accessible to the HEIs students to ensure best practices in e-waste management in Nigeria.

3.06.P-We009 Advocacy for the Implementation of Biomonitoring in Benin

Marius Nonvignon Kedote

University of Abomey-Calavi, Benin. Community of Practice Ecohealth for West and Central Africa, Benin

Abstract

In the current global context, where emerging threats to human and environmental health are of growing concern, biomonitoring is emerging as an important tool for addressing threats. Despite good knowledge of biodiversity patterns in Africa, there are persistent challenges in monitoring species and communities. In most African countries, for example, there is no systemic human biomonitoring or research into environmental exposure and its impact on the health of the African population. In tropical Africa, for example, there is no decision-making process to support biological monitoring, and no state-supported research. In sub-Saharan Africa, the very high cost of applying biomonitoring to assess contaminant exposure in cohort studies, and the consequent limited amount of data. In East Africa, the lack of development of quantitative tools adapted to the region to diagnose ecosystem health and the non-existence of specific legislation and the provision of mandated agencies with appropriate training and funding to implement biomonitoring.

Benin faces major challenges in setting up a robust surveillance system essential to protecting human, animal and environmental health. The country lacks an integrated surveillance system capable of rapidly detecting health and environmental threats. This situation exposes the population to increased risks of emerging diseases, food contamination and environmental degradation.

In this context, it is essential to set up a surveillance system, in particular biomonitoring. Such a system would make it possible to :

- systematically collect and analyze data on human, animal and environmental health in order to detect signs of emerging threats at an early stage.
- ensure coordination between the various players involved in public health, agriculture, the environment and other relevant sectors.
- facilitate the identification of environmental risk factors and the implementation of effective preventive measures.

It is important to mobilize the necessary resources and strengthen national capacities to implement this surveillance system.

3.07 - Natural Resources Exploitation, Ecological Consequences and Remediation/Restoration for Sustainability

3.07.T-01 Fixing Failures or Re-thinking Futures? From Resilient Remedies to Resilient Land- and Water-Scapes

Sabine Apitz

SEA Environmental Decisions Ltd, United Kingdom. Integrated Environmental Assessment and Management, USA

Abstract

Remediation and site re-use, including restoration and redevelopment activities, are intrinsically linked, although a disconnect between these two remains. A sustainable conceptual site, system, or basin model (SustCSM or SustCBM, depending on the scope and scale of the assessment and the degree of inter-site consideration) for remediation or restoration projects considers traditional CSM elements, as well as resource inputs and outputs, land re-use and restoration goals, stakeholder well-being, and resilience; it should include desirable and undesirable pathways of environmental, economic and social impact of remedial alternatives, both during and after the project completion. Resilience considerations can include potential effects of re-contamination or recovery from point and non-point sources; erosional, depositional or disturbance events from ongoing, changing or extreme natural or anthropogenic processes; and potential impacts from changing socio-economic, political and infrastructure changes. Indicators for resilience should be driven by the desired stakeholder values which are to be restored or enhanced.

Remedial alternatives are dictated by site conditions. They are also affected by the use envisioned for a site. Remediation choices may limit site re-use, and how we re-use a site may affect the resilience of the remedial alternative. While, in general, remedial technologies for soils and sediments may look more similar to each other than those for groundwater, many of the site characteristics that drive remedial alternative selections may be more similar for sediments and groundwater/NAPL – both have greater accessibility and feasibility challenges than do most soil sites, and both are more strongly affected by source control issues that may drive long-term resilience. An holistic approach brings together remediation and reuse to achieve whole-system sustainability benefits, exploit synergies and minimize the costs and environmental impacts associated with bringing land back into beneficial use. Ideally, resources used for remediation, restoration or development can be used to support better futures, not just restoring but enhancing sites, if stakeholders are engaged up front. Potential indicators and metrics of remedy resilience, in a dynamic and increasingly unpredictable world, will be reviewed, and strategies for expanding the scope of remedial sustainability assessment, to better effect more resilient futures, will be explored.

3.07.T-02 Just Energy Transition From Coal In South Africa: A Scoping Review

Sean Patrick[1], Joyce Shirinde[1], Kabelo Kgarosi[1], Takalani Makinthisa[1], Rico Euripidou[2], Victor Munnik[3]

[1]University of Pretoria,, South Africa. [2]Ground Work, South Africa. [3]Life After Coal, South Africa

Abstract

Background: Climate change and the Just Transition need a forward-thinking health service able to cope with what is anticipated and what is already happening. Some countries and health activists are developing healthcare plans that deal with climate change impacts alongside activities to decarbonize the health system. However, in South Africa, the health sector does not play a leading role in the national discussion on climate change. Moreover, there is currently no health plan for the people of the Mpumalanga Highveld, who continue to suffer the health consequences of coal-fired electricity and coal mining. There is a dire need to synthesize the strategies and progress in advancing the Just Transition globally and assess the applicability and relevance of these findings to the South African context, particularly Mpumalanga in the Highveld Priority Area.

Methods: We conducted a systematic search of Scopus, Medline, Web of Science, and PubMed. We used broad search terms to capture literature on energy transitioning to low/non-carbon energy sources or related technologies, combined with terms relevant to measuring or estimating health outcomes/impacts and associated policies and frameworks. In addition, we included original discussion papers, case studies, and scenario modeling papers that examined a just transition from coal.

Results: The search identified 1931 papers, of which 26 original research and review papers were included in the review. Most studies were reviews and discussion papers, with a select few based on modeling scenarios. The principal foci of the studies were: alternative energy scenario modeling; legal, ethical, and policy-related issues of a just transition.

Conclusion: Findings show two distinct post-carbon imaginaries: social justice and restorative justice. It is important to balance cost, health, and climate, which will then yield additional benefits. There are cultural politics of coal in diverse regional contexts. It is vital to understand how individuals and communities lived experiences are needed but should be considered when designing and operationalizing a just transition agenda. South Africa must view the just transition framework through a Social Innovation Lens to address restorative justice in the Mpumalanga high-priority area.

3.07.T-03 Tolerance Effects and Biodegradability of Oil-Based Drilling Fluids in Diverse Soil Types

Chukwuka Ogobnna[1,2], Ikechukwu Onwurah[1]

[1]University of Nigeria, Nsukka, Nigeria. [2]Federal University of Agriculture, Abeokuta, Nigeria

Abstract

Keeping our environment sustainable is currently an overwhelming global challenge. The continued oil-based drilling fluid (ODF) waste disposal by oil exploration firms in Nigeria has contributed immensely to the decline in the ecological diversity of our terrestrial and aquatic ecosystems. This study aimed to investigate the differential biodegradability of drilling fluids in diverse soil types. Soil samples were collected from different locations and grouped according to soil types, guided by their physical properties. The ODF's varying concentrations (%, w/w) were applied to the soil types, and the total hydrocarbons were assayed using the Gas Chromatography Flame Ionization Detector (GC-FID). Soil enzymes (peroxidase, catalase, urease, and lipase) were also assayed (time t = 0). The total microbial population in each soil sample was also evaluated using Mac-conkey and potato dextrose agar as well as heavy metals. The soil samples lasted for 14 days. The total microbial isolates were quantified as heterotrophic counts and identified using physico-morphological features. Results show that the sandy loam had a mixed diversity of organisms, with the identification of Mucor spp., Saccharomyces spp., Aspergillus spp., Penicillium spp., and Deutromycete spp. There was a significant reduction in the total hydrocarbons in the sandy-loamy soil samples compared to the clayey-loamy soil. There was also a marked reduction in Catalase and Peroxidase activity across all soil types between days 0 and 14. Lipase and urease activity increased gradually in sandy-loamy soil types, but the decrease in clayey-loamy soils was insignificant. These results raised different questions that have stirred us to seek more insights into the biodegradative activity of the native microbial population. We are currently studying the alkane hydroxylase, soil phosphatase activities, total organic carbon, and soil nitrogen effects over a 28-day exposure period. We are also querying the biochemodynamics of the biodegradation of the aliphatic and aromatic hydrocarbons over the exposure period using GCMS and heavy metal analysis using Inductively Coupled Optical Emission Spectroscopy in order to characterize the metabolites (omics). The hypothesis, is that (with the requisite collaborations), metagenomic analysis of the microbial diversity will narrow down to the microbial strains whose metabolic activities drive the biochemodynamics of the ODF's degradation, aided by the soils' varied features

3.07.T-04 Environmental Assessment of Sub-Soil Around a Mechanic Village in Effurun Community, Delta State Nigeria

Godwin Etuk-Udo[1,2], Voke Owarieta Urhibo[2], Laurelta Tudararo-Aherobo[2]

[1]Sheda Science and Technology Complex (SHESTCO), Nigeria [2]Federal University of Petroleum Resources (FUPRE), Nigeria

Abstract

The prolonged exposure of leached auto-motive metals alongside spent hydrocarbons on soil microbial community structure in Effurun spare-parts market, Delta State, Nigeria, was evaluated to assess the effect of the pollutants to the biodiversity of the environment. Soil samples from damaged engine heaps and residential soils were collected approximately 0-30cm in depth using a soil auger for biogeochemical analysis. Aliphatic petroleum hydrocarbons and polycyclic aromatic hydrocarbons were determined using gas chromatograph–flame ionization detector and mass spectrophotometer (GC-FID/MS). The soil microbiome was determined using the Illumina MiSeq platform. Approximately 0.5g of each soil sample was digested, filtered and diluted prior to analysis using the inductive coupled plasma optic emission spectrometer (ICP-OES). Total aliphatic petroleum hydrocarbons in the used engine heap soil and residential soils were 43.288 mg/kg and 7.752 mg/kg respectively, while the polycyclic aromatic hydrocarbons were 0.465 mg/kg and 0.287 mg/kg respectively. Selected heavy metals detected were lithium (4.5030 mg/kg, 1.5760 mg/kg), Chromium (29.6106 mg/kg, 7.0608 mg/kg), Nickel (18.9106 mg/kg, 3.2128 mg/kg), Copper (276.8351 mg/kg, 3.0219 mg/kg), Cadmium (3.2218 mg/kg, 0.3539 mg/kg), lead (290.5955 mg/kg, 5.3489 mg/kg) and Arsenic (1.6545 mg/kg, 1.0804 mg/kg) for the study and residential sites respectively. The number of 16S rRNA gene-based operational taxonomic units (OTUs) in the study site was 6760, revealing the dominance Chloroflexi > Proteobacteria > Actinobacteria > Firmicutes > Deferribacteria > Bacteriota while the OTUs of the residential soil was 855, showcasing a dominance of Proteobacteria > Chloroflexi >Firmicutes > Actinobacteria > Acidobacteria > Nitrospinota. The data obtained in this study revealed the bacterial community exhibited a strong dependence of heavy metals and that bacterial species belonging to the Chloroflexi and Proteobacteria phylum can contribute towards the biodegradation in the study and residential sites. Extensive research on the Effurun automotive spare parts sites will expose a gamut of novel enzymes as well as functional pathways towards microbial based eco-restoration.

3.07.T-05 Bacteria-Mediated Treatment of Synthetic Textile Waste Water and Bioelectricity Generation Using a Microbial Fuel Cell

Jude Echejiuba, Chimezie Ogugbue

University of Port Harcourt, Nigeria

Abstract

Wastewater is a major environmental impediment for the growth of textile industries which use many kinds of synthetic dyes as the uptake of these dyes by fabrics is very poor. Hence, coloured textile wastewater must be treated before their discharge into water bodies. In this study, textile wastewater was collected from Sunflag Nigeria Limited in Iganmu, Illupeji Lagos State, Nigeria and analyzed for baseline physicochemical and microbiological indices. Dye decolorizing bacteria isolated from the wastewater include Pseudomonas aeruginosa (MW584987), Enterobacter hormaechei (MW584986), Providencia stuarti (MW584987), Escherichia coli and Pseudomonas xiamenensis (MW585052) and they were identified using biochemical and molecular approaches. Dye decolourizing capabilities of the isolates were optimized using the OFAT method and the central composite design of the Response Surface Methodology with temperature, pH, salinity, glucose concentration as the factors and percentage decolourization and microbial growth as the responses. The highest decourization extent of 88.89% was obtained with Sudan Orange after 48 hours of incubation. Enhanced dye decolourization and bioelectricity generation were obtained when axenic cultures or consortia were grown on azo dyes in a microbial fuel cell (MFC). A total of 2076.9mv of electric power was generated in the MFC hosting Sudan Orange G and a consortium of the isolates. GC-MS analyses of the decolourized broth suggest that the azo dyes were degraded into simpler substances by the bacterial isolates. This study thus reports an efficient, cheap and environmentally safe textile wastewater treatment strategy with simultaneous electricity generation, which is in line with the UN sustainable developmental goals.

3.07.T-06 Utilisation of Naphthalene and Dibenzofuran by *Stenotrophomonas* sp. Isolated from a Hydrocarbon-Impacted Site in Nigeria

Habiba Atta[1,2], Igor Ivanovski[2], Gerben Zylstra[2]

[1]Ahmadu Bello University, Nigeria. [2]Rutgers University, USA

Abstract

Petroleum exploration activities in Nigeria is concentrated in the geographical zone called the South-South. Bacteria dwelling in soils and sediments contaminated with industrial wastes typically adapt to these toxic compounds and use them as a source of energy and carbon. Naphthalene is a three-ringed polycyclic aromatic hydrocarbon (PAH) which is a common constituent of petroleum and is one of the most studied PAHs and is considered a priority pollutant. Dibenzofuran belongs to the group of compounds called dioxins, which are regarded as one of the “persistent organic pollutants”. They are often found in wastes generated by anthropogenic activities and are considered to be very toxic. In this study, the ability of bacteria isolated from contaminated soil in Nigeria to utilise naphthalene and dibenzofuran was studied. Soil collected from a site contaminated with petroleum was subjected to enrichment culture method using naphthalene as the sole carbon source. Diluted aliquots from the enrichment culture were streaked on solid culture media using the spread plate technique. Growth on naphthalene and dibenzofuran was determined by introducing both compounds in the vapour phase in solid media inoculated with pure isolates from the soil enrichment. The resulting colonies which grew in the presence of either naphthalene or dibenzofuran, were preserved for further identification. The isolate labelled with the code 13MND was observed to grow proficiently in the presence of naphthalene and dibenzofuran respectively. Its genomic DNA was extracted and the 16S ribosomal RNA amplified using the universal eubacterial primers 27F and 1522R, the amplicons were purified and subjected to sequencing. The 16S nucleotide sequences were identified as *Stenotrophomonas* based on similarity searches in the Genbank of the National Centre for Biotechnology Institute (NCBI) website. Even though members of the phylum, Proteobacteria are commonly isolated in similar studies in Nigeria however, the genus, *Stenotrophomonas* has not been reported in most studies. The findings of this study reveal the potential diversity of bacteria in petroleum-polluted soils and their potential role in bioremediation of contaminated soils.

3.07.T-07 Biodegradation of Petroleum Hydrocarbon in Soils Co-Contaminated with Heavy Metals and Petroleum Hydrocarbon

Obioma Mejeha[1], Ian Head[2], Martin Jones[2], Neil Gray[2]

[1]Federal University of Technology, Owerri, Nigeria. [2]Newcastle University, Newcastle upon Tyne, United Kingdom

Abstract

Contamination of agricultural soils by organic and inorganic contaminants can result to a drastic change to the soil microbial communities. Hence, understanding the dynamics of soil microbial community becomes important for an informed remediation technique using biological systems such as bioremediation and phytoremediation. This research aimed at understanding the microbial activities and the dynamics of community diversity in agricultural soils co-contaminated with heavy metals (Ni and Cd) and petroleum hydrocarbons. Heavy metal-petroleum hydrocarbon co-contaminated soils were simulated in soil microcosms such that heavy metals were varied in chemical forms and concentrations. Molecular microbiological techniques (including ion torrent sequencing and qPCR) and geochemical approaches such as GC-MS and GC-FID were used for this study. Results indicated that Ni had stimulatory, inhibitory or no effect on biodegradations of petroleum hydrocarbon. On the contrary, cadmium had an inhibitory effect irrespective of chemical forms or concentrations. In both soils, the microbial diversity study of the microbial soil community indicated that there was a selective enrichment of species in the soil communities. Phylogenetic study indicated that the most abundant microorganism in the communities resemble a strain of *Rhodococcus* isolated from hydrocarbon- contaminated environments, metal contaminated environments and extreme environments. Other microorganisms that were enriched included species of *Nocardia*, *Mycobacterium* and *Pseudomonas*.

3.07.T-08 Metal Pollution and Fish Edibility: The Status of the Olifants and Umgeni River Systems in South Africa

Jeffrey Lebepe[1,2], Callies Selala[1]

[1]Sefako Makgatho Health Sciences University, South Africa. [2]University of KwaZulu-Natal, South Africa

Abstract

Metal pollution has become a cause for concern in freshwater bodies as it compromises the health of aquatic biota and the edibility of fish. The Olifants River receives acid mine drainage coal mining area and Umgeni River drains a highly industrialized catchment. The two rivers are classified among the most polluted river systems in South Africa. These rivers are flowing through rural communities which are dominated by unemployed rural people who opt for fish as their protein sources. The edibility of various fish species in these rivers and most have shown unsafe concentration when consumed by an adult weighing 70kg and consuming 150g portion once a week. Oreochromis mossambicus and Labeo rosae showed concentration exceeding acceptable level for human consumption for As, Sb, Se and Cr at the Phalaborwa Barrage, Flag Boshielo Dam and Loskop Dam in the Olifants River whereas Sb, Cr, Mo and Pb were found to be not safe in O. mossambicus and Coptodon rendalli in the Nagle and Inanda dams in the Umgeni River. Moreover, Clarias gariepinus showed unsafe concentrations for Sb, Co, Cr and Pd at the Phalabora Barrage in the Olifants River whereas Clarias gariepinus, Labeobarbus natalensis, Micropterus salmoides, O. mossambicus, C. rendalli and Cyprinus carpio exhibited unsafe concentration of As and Hg in the Inanda and Nagle dams of the Umgeni River system. Although the two river system are showing an overwhelming evidence on the risks associated with the consumption of fish from these impoundments, no remedial actions have been implemented to mitigate the pollution status in these rivers. Metal pollution in these two rivers continue to become a threat to the well-being local communities.

3.07.P-Tu015 Ornamental Plants As Sustainable Candidates For Remediation Of Polluted Environment: A Review

Yvonne Adaobi Onmonya[1], Lilian Ozor[1], Funmilayo Raji[1], Elizabeth Odebode[1], Beatrice Opeolu[2]

[1]National Biotechnology Development Agency, Abuja, Nigeria. [2]BEE Solutions and Consultancy, South Africa

Abstract

Ornamental plants are a promising option for phytoremediation because of their aesthetic value, which makes it possible to incorporate them into urban areas. Phytoremediation is the use of plants to remove or detoxify pollutants in the environment. This process is cost-effective and eco-friendly compared to traditional methods of pollution remediation. In this review, we discussed some of the ornamental plants that have been implicated in the remediation of polluted environments. Using a natural approach for the prevention and restoration of environmental quality is the focus of this review. The study methodology was a survey of existing research results in many countries, and a selection of up-to-date, current data. The results of the literature research obtained suggest that ornamental plants are good candidates for the remediation of contaminated soil and air. Twenty six plant species were identified and reported, some of which include Iris lactea , Iris tectorum , Iris pseudacorus , Zantedeschia aethiopica , Nerium oleander, Helianthus annus , Syngonium podophyllum , Chlorophytum comosum , Ficus elastica , Spathiphyllum, Dypsis lutescens, Epipremnum aureum , Dracaena trifasciata e.tc. It is important to note that the effectiveness of any given plant for phytoremediation can vary, depending on factors such as the specific contaminants present, the environmental conditions, and the plant's growth characteristics and habits.

Keywords: sustainable environment, natural approach, phytoremediation, Biodiversity, ornamental plants, VOCs (volatile organic compounds), heavy metals.

3.07.P-Tu016 Mapping Land Use Change Impacts of Artisanal Small-Scale Cobalt Mining Using Satellite Image Analysis (SIA) in Lualaba and Haut-Katanga in the Democratic Republic of Congo (DRC).

Mohammed Engha Isah, Junbin Xiao, Zhang Zhengyang, Matsubae Kazuyo

Graduate School of Environmental Studies (GSES), Tohoku University, Japan

Abstract

The world currently faces a dual challenge; the need for more energy/resources and less carbon. Renewable energy sources and electric vehicles (EVs) have been proposed as solutions to our dilemma and they look promising. However, the proposed solutions require minerals that need to be mined from the earth's crust, one of such minerals is cobalt. Cobalt is an invaluable component and critical metal in the global renewable energy transition, manufacture, and use of electric vehicles (EVs) and military applications – strategic and critical. If the world is to meet the Paris Agreement, the cobalt market will need a minimum of 3% annual supply growth. The Democratic Republic of Congo (DRC) currently supplied 60% of the global cobalt demand most of which comes from Artisanal and Small-Scale Mining (ASM) activities with deleterious impacts on the health and well-being of the local communities, and the ecosystem. This work aims to map the land use change and the associated impact of ASM of cobalt in Lualaba and Haut-Katanga (the biggest cobalt mining district in the DRC) within the lens of Life Cycle Impact Assessment (LCIA). The outcome of the study will serve as a basis for the development of an integrated plan to protect the environment and sensitive environmental receptors by ASM miners and companies operating within the jurisdiction of the study area, and is part of a broader project of greening the critical metal supply chain through machine learning and SIA.

Track 4. Environmental and Analytical Chemistry

4.01 - Environmental Occurrence, Risk Assessment and Regulation of Organic Contaminants in Africa

4.01.T-01 Spatial-Temporal Occurrence of Pesticides and Pharmaceuticals from Selected Water Systems within Western Kenya

Faith Kandie[1], Isaac Tanui[2], Martin Krauss[2], Werner Brack[2]

[1]Moi University, Kenya. [2]Helmholtz Center for Environmental Research, Germany

Abstract

Global concerns on the environmental occurrence of organic micropollutants (OMPs) have been on the rise due to their potential adverse effects. These OMPs include pesticides, pharmaceuticals, personal care products, industrial chemicals, and hormones. These chemicals have been shown to cause adverse effects on aquatic organisms including feminization of fish and amphibians leading to changes in ecosystem structure and function. Data on the occurrence and risk assessment of these compounds are limited in developing countries including Africa. Therefore, our study aimed to narrow this knowledge gap by investigating the spatial-temporal distribution of pesticides and pharmaceuticals in surface water systems within rural western Kenya. Water samples were collected from 25 sites distributed among five rivers selected from Homabay, Kisumu, Kisii, and Migori Counties. Sampling was carried out in February 2022 during the dry season and May 2022 during the wet season. Water samples (350 mL) were filtered through 55mm Whatman filters and thereafter solid phase extraction performed prior to analysis using the Liquid Chromatography-High Resolution Mass Spectrometry.

Of the 810 target compounds, 281 were detected during the dry season and 219 in the wet season with pesticides being the most commonly detected chemical class. During the dry season, acetyl-sulfamethoxazole, trimethoprim, amantadine and nicosulfuron were detected in all the sites while amantadine, trimethoprim, atrazine, nicosulfuron and imidacloprid were present in all the sites during the wet season. Trimethoprim is an antibiotic used in treatment common bacterial infection and is sometimes combined with sulfamethoxazole as Trimethoprim/sulfamethoxazole for synergistic results in maximum antibacterial activity. Individual compound concentrations were found up to 3.7 µg/L (imidacloprid) and 0.9 µg/L (trimethoprim) during the dry season. For the wet season, concentrations of up to 138 ng/L was found for the neonicotinoid clothianidin and up to 1967 ng/L for dehydroabietic acid which is used to treat treatment for obesity and metabolic syndrome.

This study builds on the previous research on multi-compartment analysis of organic micropollutants in surface water systems within rural western Kenya. It provides comprehensive data focusing the geographical and temporal distribution of pharmaceuticals and pesticides in a rather data limited region. Further research will focus on ecological risk assessment.

4.01.T-02 Model Based Risk Assessment of Pesticides and its Regulatory Implications in Ethiopia

Berhan Teklu[1], Sevil Yakan[2], Paul Van den Brink[3]

[1]Ethiopian Agricultural Authority, Ethiopia. [2]Istanbul Technical University, Turkey. [3]Wageningen University, Netherlands

Abstract

The use of model based risk assessment for pesticide registration and monitoring activities in Africa is often considered as non-existent. Even though so far many attempts are done, their implementation requires further attention and commitment by the concerned regulatory bodies. As a startup, we evaluated PRIMET (Pesticide Risks in the Tropics for Man, Environment and Trade) Registration_Ethiopia_1.1 model, which is a tool developed to assess the risks to non-target and early prioritized protection goals in order to assist the pesticide registration and monitoring activities in Ethiopia. Environmental risks of all the 103 registered active ingredients (a.i.) in Ethiopia, except those used for flower and storage pest control purposes were assessed. Source of necessary data was either from the information given in the dossier or public databases. Results indicated that tools like PRIMET can be used to support the pesticide regulatory activity in Ethiopia as a support to other types of gears like the FAO pesticide registration toolkit. Future studies are needed to make this tool functional as an approved national registration apparatus. Gradual banning and restriction of Highly Hazardous Pesticides and comparison of model prediction values with actual concentration measurements or effects observed in the field also needs due consideration.

4.01.T-05 Towards Sustainable Cocoa Production: Assessing the Impact of Pesticides on Pollinators

Phebe Tagbor[1], Enock Dankyi[2]

[1]Cocoa Research Institute of Ghana, Ghana. [2]University of Ghana, Ghana

Abstract

For several decades, the use of pesticides has been an integral part of Ghana's pest management in cocoa. However, both economic and environmental sustainability are still lacking in the industry. Studies show that less than 10% of applied pesticides reach the target pests, while the remaining 90% contaminate ecosystems causing harm to beneficial insects and earthworms. Of huge concern are findings on pollination deficits resulting in significant yield gaps in cocoa. Although natural pollinators of cocoa are believed to be threatened by pesticides used in farms, not much data exists to support this claim. This study presents data from a single application study on the potential impact of a recommended pesticide product on the health of midges, which are the primary pollinators of cocoa. The study was supplemented by a literature review of relevant data on the survival of cocoa midges with and without pesticide exposure. The pilot study revealed a significant reduction in midge population days after the application of a recommended pesticide product. Based on the review of the literature, we conclude that "no observable adverse effects level" (NOAEL) endpoints are insufficient for making meaningful contributions to policies on pest management in the cocoa industry and recommend the inclusion of sublethal exposure as well as additional toxicology studies. More importantly, cocoa midges should be considered as key non-target species during the environmental risk assessment processes for cocoa pesticide approval. Our findings suggest that pollinators may be negatively impacted by the current insect pest management regime, potentially leading to population declines with associated yield deficits.

4.01.T-06 Occurrence of Biocides, Pesticides, and Pharmaceuticals in Rivers Near Agricultural Fields

Chepchirchir Ruth[1], Cheruiyot Isaac[2,1], Werner Brack[2], Kandie Faith[1], Kosgei Viola[1]

[1]Moi University, Kenya. [2]Helmholtz center for environmental research UFZ, Germany

Abstract

Surface water has suffered pollution from various sources including agriculture and poor disposal of pharmaceuticals. For instance, the advancement in the agricultural sector to increase production has led to the incorporation of chemicals in the practice. However, these chemicals have had a negative impact on the aquatic environment especially when it is used and discharged near rivers. This study aimed at evaluating the contribution of agricultural practices in specific crop types toward the introduction of these chemicals in surface water. Water samples were collected from 5 rivers in western Kenya covering different crop types including rice, maize, tea, wheat, and flower plantations. Solid phase extraction was used to concentrate the analytes and ultra-high pressure liquid chromatography coupled to mass spectrometry was used for chemical analysis.

From the 260 targeted compounds 38 biocides, 76 pesticides, and 18 pharmaceuticals were detected. Water samples from the river within the maize plantation had the highest number of compounds, (34 biocides, and 71 pesticides) followed by those within the wheat farms (19 biocides and 35 pesticides), and the river near the flower farm (17 biocides and 36 pesticides). For rice and tea plantation (19 biocides and 33 pesticides) and (17 biocides and 20 pesticides). The most abundant compound was acetyl-sulfamethoxazole, a veterinary pharmaceutical, with a concentration of 1.24 µg/L. Diuron, a biocide, and metolachlor, a pesticide, followed with concentrations of 2.33 µg/L and 1.06 µg/L respectively. Pharmaceuticals, such as fluconazole and trimethoprim, were also found in high amounts, with concentrations of 1.04 µg/L and 9.90 µg/L respectively. The risk assessment for the three tropic levels (green algae, crustacean, and fish) was performed using the risk quotient index and it showed varying risks in the assessed tropic levels.

Sustainable development goals aim at ensuring clean water and sanitation for all, this study forms the basis for monitoring these chemicals in surface water and formulating the policies that may help in monitoring the above sources of pollution.

4.01.P-We010 Influence of Beers of Different Alcohol Concentration on Haematological Indices of Male Albino Rats

Chinedu Imo, Michael Abu, Nkeiruka Imo

Federal University Wukari, Nigeria

Abstract

This study investigated the influence of beers of different alcohol concentration on haematological indices of male albino rats. Three brands of beers commonly consumed within Nigeria were purchased and administered to the experimental animals for 21 days. The alcohol concentrations of beer A, B and C were 2%, 5.2% and 7.5% respectively. Group 1 was the control. Group 2 and group 3 were administered 10 mL/kg bw and 20 mL/kg bw of beer A respectively. Group 4 and group 5 were administered 10 mL/kg bw and 20 mL/kg bw of beer B respectively, while group 6 and group 7 were administered 10 mL/kg bw and 20 mL/kg bw of beer C respectively. The haematological analysis was carried out using haematological auto-analyzer (Abacus 380). Result showed that white blood cell count increased in all the test groups compared with the control and was significant ($P<0.05$) in groups 3, 5, 6 and 7. Red blood cell (RBC), haemoglobin (Hb) and packed cell volume (PCV) showed no significant alteration ($P>0.05$) in all the test groups compared to the control. Platelet (PLT) and plateletcrit (PCT) increased significantly ($P<0.05$) in groups 2, 3, 4, 5 and 7 compared to the control. In conclusion, the result showed that consumption of these beers with different alcohol concentrations as used in this study may influence certain immune index, but may not induce anaemia. It also encourages the production of platelets and may promote stoppage of bleeding resulting from injury.

4.02 - Sources, Distribution, and Remediation of Anthropogenic Pollutants in Sub-Sahara Africa's Environment

4.02.T-01 Assessment of Iron (III) Removal in Aqueous Solution by Mycofiltration, Through a Fixed-Bed Column Biosorption Approach

Sanele Mnkandla[1,2], Norah Basopo[2], Patricks Voua Otomo[1]

[1]University of the Free State, South Africa. [2]National University of Science & Technology, Zimbabwe

Abstract

Mycofiltration is an environment-friendly technology involving the treatment of contaminated water by passing it through a network of saprophytic fungal mycelium. Mycelia use biosorption for remediation. Biosorption can be studied through the continuous fixed-bed column mode, providing information on the viability and operational lifespan of biosorbent under continuous loading with a contaminated solution. Fixed-bed columns are widely applied for treating industrial pollution thus merging mycofiltration with column studies could potentially create a system that may be applied at industrial scales. The current study sought to use the removal of iron (III) from an aqueous solution to assess the performance of mycofiltration in a fixed-bed system. A Pleurotus fungal species mycofilter was cultured. To optimise experimental conditions, batch mycofiltration was performed, at a dosage of 1g / 50 ml. Initial metal concentration and solution pH were varied. For column mycofiltration, mycofilter fixed-bed columns were prepared by packing mycofilters into pyrex columns (3.3 x 15 cm) to bed height of 8 cm. The iron (III) solution was filtered for 120 hours at 0.45 ml/min. The filtrate was collected at time intervals and iron (III) was quantified. Helisoma duryi snails were acutely exposed (96 hours) to non-mycofiltered or mycofiltered iron (III) media. Catalase and acetylcholinesterase enzyme activities were assessed. Mycofilters were characterised by Fourier Transform Infrared Spectrophotometry (FTIR). Concerning batch mycofiltration, high iron (III) removal (85%) was observed with an initial concentration of 22.9 mg/L and solution pH = 7. Column mycofiltration showed 94% removal of iron (III) and the mycofilter never reached saturation. Catalase activity was significantly reduced ($p < 0.05$) in the snails exposed to mycofiltered iron (III) compared to those exposed to non-mycofiltered media. Regarding acetylcholinesterase activity, the snails exposed to mycofiltered iron (III) showed significantly higher activity ($p < 0.05$) in comparison with those exposed to non-mycofiltered media. The FTIR spectra revealed significant changes in transmittance intensity in the iron (III) vs the control mycofilter. The findings suggest that the Pleurotus mycofilter effectively removes iron (III) and improves water quality. The mycofilter column not reaching saturation after running for 5 days, signifies a relatively long lifespan, ideal for industrial applications once upscaled.

4.02.T-02 Impacts, Contamination Pathways, Risks, and Remediation of Chemical Pollution within a Wetland System Following of One of Africa's Largest Agrochemical Spills

P. Mark Graham[1,2], Busisa S. R. Ntshangase[1], Adrienne J. Talbot[1], Sarah J. Pickford[1]

[1]GroundTruth, South Africa. [2]University of Kwa-Zulu Natal, South Africa

Abstract

Worldwide, thousands of chemical spills occur per year, posing a constant acute threat to ecosystems and human health. On the 13th of July 2021, rioters in South Africa arbitrarily set fire to a United Phosphorous Limited (UPL) chemical storage warehouse that contained several thousand tonnes of agrochemicals, primarily pesticides. Misguided and poor emergency response unfortunately led to the blaze being put out using thousands of litres of water, considerably worsening the spill. Ultimately, massive amounts of agrochemicals were flushed into the Ohlanga River catchment, causing catastrophic contamination of the downstream aquatic and estuarine environment where the Ohlanga River drains into the Indian Ocean at the port city of Durban. The incident stands as one of the largest known and most devastating agrochemical pesticide spills in Africa's history. As part of the pollution evaluation, a wetland, connected with the contaminated river system, was identified as an important secondary reservoir of the spill's contaminants. More than a year after the spill, soils within the wetland were sampled to determine the extent of the remaining pollution, potential exposure pathways, and risk of ongoing chemical leaching into the Ohlanga River and estuarine environment. Soil analyses showed that the soil profile was highly disturbed, primarily related to historical cultivation through the area. The chemical distribution, combined with information from innovative digital terrain modelling using drone based Light Detection and Ranging (LiDAR) and hydrological modelling, suggested that historical drainage lines across the wetland played a crucial role in the preferential settling and concentration of contaminants within the wetland. Wetland-associated biota were determined to still face high risk due to the spill, given the significant contamination remaining. After two years of remediation efforts, the persistent adverse effects on the ecosystem are still evident. Based on the risk assessment, and guided by the soil analyses, LiDAR, and hydrological modelling outcomes, various remediation actions have been proposed. Monitoring is ongoing to inform an adaptive management approach. This study forms part of a larger endeavour that has yielded innovative methodological approaches and analytical methods for preventing, managing, or remediating environmental risks related to chemical spills in terrestrial riverine and wetland systems in Africa.

4.02.T-03 The Exposure of Metal(loid)s in Top Soils from Gold-Mining Activities in Ghana

Peter Osei[1,2], Enoch Dankyi[1], Matt Dodd[3]

[1]University of Ghana, Legon, Ghana. [2]Wisconsin International University College, Ghana. [3]Royal Roads University, Victoria, Canada

Abstract

Ghana's environment is substantially being impacted by artisanal and small-scale gold mining activities leading to significant damage to farmlands, forests, and water bodies. Heavy metal exposure may markedly increase as a result of these mining activities. Given the scale and indiscriminate nature of small-scale illegal mining activities in Ghana, there is a high potential for environmental and human exposure to a wide range of metals. This study was therefore conducted to contribute to understanding the potential exposure and health risks associated with indiscriminate small-scale mining activities in Ghana. The spatial distribution of 21 metal(loid)s in soils from 70 mining in Ghana and the potential human health risk associated with exposure are reported in this study. Elemental concentrations were determined using an X-ray fluorescence (XRF) analyser and were in the following order: Fe > Mn > Zr > As > V > Cr > W > Ni > Zn > Cu > Te > Pb > Hg > Au > Sb > Cd > Ag > Sn > Pd > Th > U. Of the 70 locations, As was detected at 60 (86%) locations; Cr, 57 (81%) locations; Hg, 20 (29%) locations; Ni, 63 (90%) locations. The concentration of 12 heavy metals (Cd, Cr, Au, Hg, Ni, Pd, Sn, Te, U, V, W, and Zr) at selected locations exceeded the recommended permitted levels in soil established by regulatory bodies. A comparison of the top soils from mining sites to pristine soils indicated that significantly higher elemental concentrations occurred at mining sites suggesting mining activities as the likely source of these elements. Thus people in mining communities may be exposed to potentially high levels of metal(loid)s, some of which may be potentially toxic.

4.02.T-05 Potentials of Indigenous Plants (tree crops/shrubs) for Remediation of Major Metals in Mining Impacted Soils from North Central, Nigeria.

Yvonne Adaobi Onmonya[1], Adewole M. Gbadebo[2], Toyin A. Arowolo[2], Johnson K. Adesodun[3], Beatrice Opeolu[4]

[1]National Biotechnology Development Agency, Abuja, Nigeria. [2]Federal University of Agriculture, Abeokuta, Nigeria. [3]Ekiti State Polytechnic, Nigeria. [4]BEE Solutions and Consultancy, South Africa

Abstract

The uptake and bioaccumulation of metals in plants are influenced by many factors such as climate, atmospheric depositions, and the concentration of heavy metals in soils, the nature of soil, and the degree of maturity of the plants at the time of the harvest. The aim of the study was to determine the potential of indigenous plant species for phytoremediation of these metals in mining sites of Nasarawa state, Nigeria. The plant samples were collected from nine (9) mining sites in Nasarawa state, using a stratified random sampling method. A global positioning system (GPS) was used to geo-reference the area sampled. A total of 34 plant samples were collected in replicate and subjected to metal analysis using inductively coupled plasma/mass spectrometry (ICP/MS). The average metal concentrations in the plants were as follows; Cr ranged from 5mg/kg in most sites to 27.50mg/kg, 275.75 – 3418mg/kg Mn , 2.28 – 17.78mg/kg Co, 9.6 – 54.25mg/kg Ni, 71.70 – 159.50mg/kg Cu, 180.66 – 2163.66mg/kg Zn, 10.50 – 17.25mg/kg As, 0.13 – 3.45 mg/kg Cd and 5.72 – 490.00mg/kg Pb across the nine locations. Bioaccumulation factor (BAF) ranged from 0.01 – 1.21, 0.25 – 14.57, 0.06 – 9.10, 0.21 – 2.78, 0.12 - 12.89, 0.39 – 65.09, 0.22 – 37.40, and 0.15 – 2.87for Cr, Mn, Co, Ni, Cu, Zn, Cd and Pb. The concentrations recorded for Co, Cr, Cu, Ni, Se, Zn, in all the plants exceeded the typical background concentration (mg/kg) of toxic elements in plants, as stated by Ward (1995). In general, although the results indicated that none of the plant species were identified as hyperaccumulators (because all species accumulated Pb, Cu, Zn, Ni, Co, and Cr less than 1000 mg/kg), plants with the potential for phytoextraction of specific metals were identified. There is a need for further research on the identified plants to understand the internal mechanisms and genetic characteristics which confer on them the ability for phytoextraction of metals.

4.02.T-06 Spatial Distribution, Fate, and Source of Microplastics in the Water Systems in Botswana.

Sylwia Oleszek[1,2], Serwalo Mercy Mokgosi[3], Baatshwana Caroline Ditlhakanyane[3], Ishmael Gorata[3], Katumelo Gajaje[3], Trust Manyiwa[3], Venecio U Ultra Jr.[3], Junyeong Yoo[1], Kazuyuki Oshita[1], Masaki Takaoka[1]

[1]Kyoto University, Japan. [2]Institute of Environmental Engineering of the Polish Academy of Sciences, Poland. [3]Botswana International University of Science and Technology, Botswana

Abstract

Contamination of freshwater systems by plastic waste is a serious problem in African countries, due to, mismanagement of the waste and uncontrolled dumping. Plastic material once enters to environment undergoes various degradation processes and fragmentation into smaller particles, so-called microplastics (MPs). The MPs can be transported for long distances within water-soil systems and enter the food chain. As the MPs may contain various toxic additives (e.g., heavy metals, plasticizers, etc.) they may have an adverse impact on human health and threaten ecosystems in all of Africa's land.

In this study, we concentrated on MPs' spatial distribution and their source identification in the freshwater systems in Botswana.

The water samples (23 in total) were collected in October 2022, at three different places: (1) Boro and Thamalakane Rivers of the Okavango Delta (north-western Botswana) known as a natural inlet wetland and wildlife area; (2) Motloutse riverbed and borehole (central Botswana) in the surroundings of Selebi-Phikwe city; and (3) at the outlet from the Selebi-Phikwe post-mining wastewater treatment plant (WWTP) that flows to Motloutse river. After sample collection (25 L) and pre-treatment in the laboratory (oxidation, density separation, filtration), the MPs were characterized using Micro-Fourier Transform Infrared Spectroscopy.

The results indicated, that among the identified MPs, the dominants were polyethylene terephthalate (PET), polypropylene (PP), and polymethyl methacrylate (PMMA). The last one was mainly in the form of small particles attached to cotton fibers. These plastics are representatives of household waste and domestic wastewater. The largest amounts of MPs and the greatest variety of MPs (17 types) were identified in surface water samples collected in the rivers of the Okavango Delta. The 12 types of MPs were found in the Letsibogo, with the maximum number of PET in the riverbed and PMMA in the borehole. In the outlet of WWTP among 12 types of MPs, the PP was dominated.

As freshwater systems are used in irrigation for domestic crops and are drinking water for cattle, the MPs may bioaccumulate in animal fat and enter the human food chain. Therefore, recognizing the scale of MPs contamination in freshwater systems and identifying their sources is essential to enforcing appropriate plastic waste management strategies in Botswana and other African countries.

4.02.P-Tu019 Sequestration of Methylene Blue in Single and Binary Solution by Biochar from Moringa Oleifera Seed Husk

Deborah Aderibigbe[1], Abdur-Rahim Giwa[2], Isah Bello[2]

[1]Nigeria Maritime University, Delta State, Nigeria. [2]Ladoke Akintola University of Technology, Ogbomoso, Nigeria

Abstract

Advancement in technology, industrial processes, activities involving intensive energy use, use of chemicals in agricultural activities, rapid urbanization, population, and economic growth, among others, have all, individually and collectively, led to the enormous release of a myriad of organic and inorganic pollutants into the environment. In this work, the removal of methylene blue dye (organic pollutant) alone in solution and in combination with another dye (Malachite green) using an adsorbent prepared from Moringa oleifera seed husk was studied. The seed husks were collected, pulverized, washed and dried before it was treated with concentrated tetraoxosulphate (VI) acid to convert it to a biochar after which it was dried and stored as Biochar of Moringa oleifera seed husk (BMOH). BMOH was characterized using FT-IR, SEM and pHpzc. Batch adsorption experiments were conducted to know the effects of adsorbent dose, solution pH, contact time, initial dye concentration and temperature on the adsorption efficiency of BMOH. Equilibrium data were subjected to seven isotherm models and the kinetic data to six models. The results showed that there was roughness on the surface of BMOH and also large pores that could facilitate the adsorption process. It was also observed that the process was dependent on all the factors studied. The isotherm followed Langmuir model closely in both the single and binary solutions showing homogeneity of the dye on the surface of BMOH. The monolayer adsorption capacity (qm) was 188.68 and 41.67 mg/g in the single and binary solution respectively. The dynamics of the dye can best be explained by Pseudo-second order model suggesting that the process is more of chemisorption. The thermodynamic parameters showed that the process was spontaneous and endothermic in single solution while it was less spontaneous and exothermic in binary solution. Finally, the result revealed that the introduction of another dye was antagonistic to Methylene blue adsorption process reducing the capacity. Moringa oleifera seed husk-based adsorbent can be employed in reducing the concentration of Methylene blue dye in the aquatic environment.

Keywords: Adsorption, Isotherm, Kinetics, Thermodynamic, Methylene blue, Moringa oleifera

4.02.P-Tu020 The Use of Modified Ceramic Water Filter for Arsenic and Mercury Removal

Lydia Senanu[1], Doris van Halem[2], Gordana Kranjac-Berisavljevic[1], Sebastiaan Heijman[2], Samuel Cobbina[1]

[1]University for Development Studies, Ghana. [2]Delft University of Technology, Netherlands

Abstract

Safe and clean drinking water availability has become a challenge for most communities in rural and urban Ghana. This has resulted in the high cost of water treatment. Many water bodies which serve as sources of drinking water have been polluted due to the menace of unregulated mining activities. These activities release toxic heavy metals into the water bodies making them unsafe for domestic use. Mercury and arsenic which are found in polluted waters in illegal mining areas are known to cause neuromuscular disorders and skin lesions among inhabitants. This research sought to design a technology which is affordable and effective in removing mercury and arsenic from polluted waters for domestic use. Six ceramic water filter (CWF) designs were manufactured to test their ability in removing mercury and arsenic. The CWFs were made from clay and different biosorbents and zeolite. The designs were; RNZ (with rice husks and no zeolite), RZ (with rice husks and zeolite), SNZ (with sheanut shells and no zeolite), SZ (with sheanut shells and zeolite), GNZ (with groundnut shells and no zeolite) and GZ (with groundnut shells and zeolite). At a concentration of 0.5 mg/L and pH of 7, the removal efficiency of mercury was as follows; SZ>SNZ>GZ>GNZ>RZ>RNZ with SZ recording 81.6% and RNZ with 41.2% removal efficiency. At increased concentration of 5 mg/L at pH 7, the trend was similar, however, the removal efficiency reduced with SZ recording 61.6% and RNZ with 29%. For arsenic, the removal efficiency was rather low with the highest removal being SZ with 31% and the least removed being RNZ with 20.7%. The reason for low arsenic removal efficiency could be attributed to the pH of the reaction experiment being near neutral since arsenic removal mostly occurs at acidic media. The kinetic model for the reaction experiments fitted into the pseudo-second order reaction. This suggests that the adsorption reaction was chemisorption. The results showed that sheanut shells have the potential for higher removal of mercury, however addition of zeolite provided a synergistic effect on the removal of mercury with all the different biosorbents. The relevance of this study is to support efforts to address drinking water challenges in meeting SDG 6.1.

4.02.P-Tu021 Optimization of Sorption of Phenol and its Congeners in Aqueous Solution by Biomass of African Breadfruit (Treculia africana) Hull

Adaora Oguejiofor[1,2], Ikechukwu Onwurah[2], Bennett Nwanguma[2], Chukwudi Onwosi[2]

[1]National Agency for Science and Engineering Infrastructure (NASENI), Nigeria. [2]University of Nigeria, Nsukka (UNN), Nigeria

Abstract

Phenols are common pollutants present in industrial wastewaters since they are widely used by many industries in their manufacturing processes. Industrial wastes containing these phenols and its' congeners are directly discharged into wastewaters thereby contaminating both surface and ground waters. However, water is essential for food security, human health, energy supply, industrial growth, urban development and biodiversity, hence the need for this research to mitigate the rate of pollution and damage to the environment. The optimization and sorption characteristics of phenol and its congeners in aqueous solution by *Treculia africana* hull powder (ABHP) was investigated under various operating variables like pH, biosorbent dose (BD), contact time (CT), initial contaminant concentration (ICC) and temperature at 30°C, 35°C and 40°C. The FTIR- spectra of ABHP showed the participation of carboxylic acid (C-O), carbonyl (C=O), nitrile (C≡N), amine (N-H) and halo compound (C-Br). Optimum phenol sorption of ABHP was at pH 6, BD of 1.0g, with CT of 20 mins. Kinetic studies revealed a non linear regression that suggests a pseudo first order reaction. The Langmuir, Freundlich and Sips isotherm models was applied to describe the biosorption processes. The Sips model gave the best fit correlation coefficient of 0.9288, 0.8733 and 0.9699. Thermodynamic parameters revealed a spontaneous, favourable and exothermic biosorption process. However, immobilizing *Serratia marcescens* on African breadfruit hull powder resulted in enhanced removal of phenol and its' congeners, suggesting their potential utility in activated sludge process for the removal of phenols from industrial wastewater effluents.

4.02.P-Tu023 Smartphone-Enabled Turbidity Measurements for Environmental and Medical Monitoring in Africa

Harison Rozak[1], Achmad Syarif Hidayat[2], Sylwia Oleszek[3], Izabela Rzeznicka[1]

[1]Shibaura Institute of Technology, College of Engineering, Japan. [2]Nagoya University, Graduate School of Engineering, Japan. [3]Kyoto University, Department of Environmental Engineering, Japan

Abstract

In many African countries access to expensive analytical instruments used in the medical and environmental monitoring is limited. A doctor in a hospital in Malawi, in a nephrology department, posted a distressing note that he could not get a basic analysis of potassium in a patient blood. On the other hand, in the Copper-Belt region, people living in the metal mining areas are exposed to excess of heavy metals in drinking water and soil. To address these challenges, here we introduced a new smartphone-enabled analytical method that is based on the measurements of turbidity changes of solutions containing potassium and copper ions. The images of the blood plasma or water samples in the presence of a metal-selective precipitating agent are captured by a smartphone camera and analyzed by a custom image-processing algorithm which enables the transformation of the image data from RGB to HSV color space and calculation of a mean value of the light-intensity component (V value). Standard calibration curves were established to find the correlation between the V value and the concentration of metal ions and used to determine the concentration of unknown samples. The method can be used to detect potassium ions within 1.5-7.5 mM and copper (II) ions within the 2-20 mg/L concentration range. The advantage of the method is low cost and its integration with a smartphone offers the possibility to measure potassium, copper, and also other metal ions on demand in remote areas where the access to analytical instruments is limited.

4.02.P-Tu024 Heavy Metal Accumulation of Aquatic Plant Species from Metaleferous Environment in Botswana: Their Potential for Rhizofiltration of Acid Mine Drainage

Gorata Ishmael, Venecio U Ultra

Botswana International University of Science and Technology (BIUST), Botswana

Abstract

The mining industry had produced an enormous environmental footprint on its resources especially on the levels of heavy metal on the ecosystem such as the generation of acid mine drainage from mine waste which deteriorate the adjacent ecosystem and the ground water reserves. Rhizofiltration system is one of the promising technologies that can mitigate the problems of heavy metal contamination associated with AMD and the best candidate for this method is the use of existing plant species with exceptional ability to remove heavy metals from AMD and associated sediments. To develop this technology specific to the problems in Botswana, the potential of different aquatic species from metaliferous environment were assessed. Survey and analyses had identified four exceptional plants species: Cyperus Papyrus, Phragmites austrilis, Carex Paniculate and Baumea Rubiginosa as potential for rhizofiltration of AMD. All these plant species can accumulate high levels of Co, Cr, Cu, Ni and Zn on the roots and shoots. C. papyrus had the highest bioaccumulation factor as compared to other plant species across all analyzed elements with average values of Co (4.75), Cr (242.03), Cu (31.99), Ni (8.55) and Zn (40.52). While with other plant species the C. paniculata recorded the lowest bioaccumulation factor more than once compared to other plant species Cr (4.54) and Cu (22.54). Furthermore C. papyrus showed the highest TF for Cr (3.97) Zn (3.96) as compared to other species which where <1. These results revealed that C. papyrus has the best adaptive mechanisms in heavy metal contaminated areas because it was able to accumulate and distribute heavy metals across other compartments as compared to the other plant species. The differences in the accumulation patterns between these four species could be attributed to their ability to re-distribute some of the elements from the roots to the shoots which is dependent on their plant structure and the mobility of these elements in soil-plant continuum as well as the different absorptive capability and extensive stem and leaf surface area of these plants. This study demonstrated that although all the plant species have shown the potential to accumulate heavy metals from the AMD and distribute them to other compartments, C. papyrus is considered more superior in terms of their rhizofiltration potential.

Keywords: bioaccumulation factor, rhizofiltration, heavy metals contamination, translocation factor

4.02.P-Tu025 Heavy Metal Contamination in Food Crops Grown in Farmlands near Cu-Ni Mine in Central Botswana

Koziba Gaotlhobogwe, Venecio Ultra.Jr, Gaolathe Rantong, Trust Manyiwa, Serwalo Mercy Mokgosi, Katumelo Gajaje, Willie Marenga, Katlarelo Sefatlhi, Oakantse Dineo, Katlego Makale, Batendi Nduna

Botswana International University of Science and Technology (BIUST), Botswana

Abstract

The BCL Cu-Ni mine contributed to Botswana's economic growth as well as the advancement of modern technology prior to its closure, but it had generated serious environmental problems directly related to poor mine waste management. More importantly, agricultural production near BCL mines is confronted with major problems owing to heavy metal transfer into crops and subsequently into the food chain, which could affect human health. Hence, this study was carried out to investigate the heavy metal accumulation in different farmland soils and food crops collected near Cu-Ni Mine in Central Botswana. Soil samples alongside with various vegetable samples were taken from farms located at different distances (within 2.5 to 15km) from the mining site, with each collected item subsequently tested for the presence of As, Cr , Cu , Mn , Ni , Pb and Zn. The bio-concentration factor (BCF), daily intake of metals (DIM), and human risk index (HRI) were assessed to determine the potential for heavy metal accumulation by food crops. The results revealed that the level of As ranged from 4.5 to 20.0mg/kg, Cr 44-139mg/kg, Cu 100-859mg/kg , Mn 214-1014mg/kg, Ni 60-1081mg/kg , Pb 50-119mg/kg, and Zn 25.9- 43.5mg/kg in soil samples. Food crop samples (tomato, rape,maize,sweet potato, beans, butternut and beetroot) showed elevated concentrations of Cu, Mn, Ni and Zn which were above the WHO/FAO acceptable limit. Some of the crop species and varieties largely differed in heavy metal concentrations as beetroot, sweet potato and butternut exhibited higher Cu concentrations at the range of 166,101 and 352mg/kg compared to beans and maize which had low Cu concentrations of about 7 and 18.1mg/kg mainly because legumes and cereals have low transfer factors. The results demonstrated that heavy metals are more concentrated in areas that are closer to the mine and that the concentrations of heavy metals in soil and food crops decreased with increasing distance from the mine site. The findings of the study indicate that the communities residing in the study area are at risk of developing both carcinogenic and non-carcinogenic effects as a result of prolonged consumption of food items that contain high levels of trace elements. The results provides valuable insights for farmers, policymakers, and environmental agencies to develop sustainable and safe agricultural practices in these affected areas.

Keywords: food chain contamination, heavy metal accumulation, bio-concentration factor

4.02.P-Tu027 Bacterial Community Composition, Quantification of Antibiotic Resistance Genes and Antibiotic Residues in Wastewater Effluent and Receiving Rivers

Karabo Tsholo, Lesego Molale-Tom, Suranie Horn, Carlos Bezuidenhout

North-West University, South Africa

Abstract

Antibiotic resistance threatens human and animal lives. Mitigation of antibiotic resistance is often based on clinical settings, paying no heed to environmental ones. This leads to unknown amounts of antibiotic resistance determinants disseminated in environmental settings. Hence, the present study focused on determining bacterial community composition, antibiotic residue and antibiotic resistance gene (ARG) patterns in wastewater effluent and rivers in North West (NW-E and NW-C), South Africa. Methods performed included (i) measuring physicochemical parameters. (ii) Screening and quantification of ARGs by using the end-point and real-time PCR. (iii) quantification of antibiotic and fluconazole residues by chemical analysis and determining their risk quotient. (iv) high-throughput 16S rRNA sequencing for bacterial identification and correlating them with physicochemical parameters, ARGs, antibiotics and fluconazole. Based on the physicochemical parameters, the water quality of NW-E and NW-C was suitable for irrigation and livestock watering. Unassigned groups, Comamonas and Dickeya were the most prevalent genera in NW-E and NW-C. Higher ARGs, antibiotic and fluconazole residues were anticipated in wastewater effluent. However, this was not the case in NW-E for (i) the detection of sul1, sul2 and MOX genes. (ii) quantification of sul1 EBC, CIT and FOX. NW-C abnormalities were for (i) detecting MOX ACC, CIT, FOX, sul1, sul2 and ampC genes. (ii) quantifying ampicillin residues, CIT, MOX, FOX and ACC genes. Furthermore, antibiotics were shown to pose low to high environmental risks. Bacterial communities correlated with physicochemical parameters, ARGs and antibiotics. However, ARGs, fluconazole and antibiotics are not routinely monitored and regulated in water environments. As a result, unknown amounts of ARGs and antibiotics are ubiquitous in water, making it a suitable vector for antibiotic resistance. Hence, using environmental studies such as this one is of utmost importance for policymaking to assess water quality and combat antibiotic resistance.

4.03 - Contaminants in Unusual Urban Environments

4.03.T-01 Indoor Particulate Matter and Gaseous Pollution of High School Kitchens in the Kumasi Metropolis

Boansi Adu Ababio, Marian Asantewah Nkansah, Thomas Peprah Agyekum, Jonathan Nartey Hogarh, Michael Kweku Commeh

Kwame Nkrumah University of Science and Technology, Ghana

Abstract

Indoor air pollution resulting from the use of solid fuels for cooking in household and commercial kitchens is a leading risk factor for premature mortality in developing nations like Ghana. Kitchens of High Schools in Ghana undertake large-scale cooking to take care of a large number of students. Depending on the fuel that is used in these kitchens, indoor air quality may be compromised with its attendant environmental health concerns. The present study monitored the levels of indoor gaseous (SO_2, NO_2 and CO) and particulate pollutants (PM_{10} and $PM_{2.5}$) during an 8-hour occupational exposure period in 14 High School Kitchens located in the Kumasi Metropolis in the Ashanti Region of Ghana. The findings revealed that the levels of these pollutants exceeded the permissible daily exposure limits in kitchens that applied traditional and briquette cookstoves. The levels of the pollutants were found to be potentially harmful to human health. Overall, the indoor air quality in the school kitchens was poor. The school kitchens urgently need to transition to the application of cleaner fuels and cookstoves.

KEYWORDS: cooking, particulate matter (PM), Indoor air quality (IAQ), indoor air pollution (IAP), kitchen

4.03.T-02 Toxicological Impact of Gasoline Generator Emissions on Occupationally Exposed Workers in A Nigerian Business Cluster Environment

Ifeoma Ijeh[1], Promise Obeten[1], Ijeoma Nina Eke-Ogaranya[2]

[1]1. Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. [2]PAMO University of Meducal Sciences, Port Harcourt Rivers state, Nigeria

Abstract

The use of multiple gasoline generator is a common feature that characterize small and medium scale business clusters in Nigeria. The effects of gasoline generator exhaust fumes exposure on liver function parameters, hematological indices and 1-hydroxylpyrene concentration were assessed in forty-one (41) shop owners in the Michael Okpara University of Agriculture computer village, Abia State. The test groups consisted of generator users, while thirty (30) healthy residents of areas where generators were not frequently used, were included as control. The test groups were further categorized into type of business, duration of stay, hours spent daily, proximity of generator set to business space. Blood samples were collected from participants and each sample was analyzed for total bilirubin concentration. (TB), alkaline amino phosphate (ALP), aspartate amino transferase (AST), alanine amino transferase (ALT), albumin concentration (Alb.), 1-Hydroxylpyrene concentration, methaemoglobin (MetHb), total white blood count (TWBC) and differential leucocyte count using standard methods. Results revealed that AST, ALT activities and 1-Hydroxylpyrene, TB, MetHb, TWBC, neutrophil and monocyte concentration of the test group were significantly ($P<0.05$) increased when compared to the control group, while, a non-significant ($P>0.05$) decrease was observed in ALP activity, Alb, lymphocytes, eosinophil concentration of the test group. Increase in these markers of toxicity correlated positively with type of business (computer operator), daily duration of exposure and length of time spent in the business (≥ 4years). These results suggest that chronic exposure to generator exhaust fumes may be potentially toxic to the liver and blood profile of individuals using generating sets for business purposes as major source of power and calls for regulatory agencies to address issues relating to constant exposure to generator fumes.

4.03.T-03 Ecological and Human Health Impact of Car Washing Bay on the Quality of Receiving Surface Water and Fish in Obuasi Municipal of Ghana

David Azanu[1], John Coffie[2], Enerstina Nkrumah[1], Belinda Quayson[1]

[1]Kwame Nkrumah University of Science And Technology, Ghana. [2]Kumasi Technical University, Ghana

Abstract

Commercial car washing bays produces large quantity of toxic wastewater which contains contaminants such as petroleum hydrocarbon wastes, nutrients, surfactants and heavy metals. The release of such wastewater into surface water bodies degrade water quality which in turn affect aquatic life. The main objective of this study is to assess the impact of car washing bay on the quality of receiving streams and fish in Obuasi Municipality. Specifically, pH, electrical conductivity, total dissolved solids, turbidity, dissolved oxygen, chloride, hardness, phosphate, nitrate, grease and oil, iron, lead, cadmium, mercury, aluminium and copper in surface water samples were determined. Additionally, concentration of iron, lead, cadmium, mercury, aluminium and copper in fish samples collected in the study area were determined using ICP- MS following USEPA method 200.8. Human health risk associated with consumption of fish collected in the study area was estimated. A total of 57 samples comprising 30 water samples and 27 catfish were collected the study area in accordance to procedure described by American Public Health Association (APHA). pH of all the surface water samples ranged from 5.4 to 6.5. Turbidity values recorded ranged from 5.4 to 128 NTU. Lead concentration in all the water samples were above the permissible range for effluent discharge by the Environmental Protection Agency (EPA) of Ghana. Likewise, Pb concentration in some of the fish samples were above reocommended levels to be in food set by European Union and Ghana Standard Authority. With the increasing number of car washing bay along stream in Ghana, its wastewater is becoming a serious issue. Therefore, effective and efficient measures like constructed wetland, constructions of wastewater treatment facilities should be considered for protecting Ghana's surface water resources and aquatic ecosystems.

4.03.T-04 Assessment of Human Health Risks of Groundwaters Close to Electrical Waste Dumpsites in Lagos, Nigeria

Oluwatoyin Fatunsin[1], Kehinde Olayinka[1], Silva Takyi[2], Serwaa Bawua[2], Duah Dwomoh[2], John Arko-Mensah[2], Julius Fobil[2]

[1]University of Lagos, Nigeria. [2]University of Ghana, Ghana

Abstract

Groundwater is the major source of portable water in Nigeria. Thus, they must meet the required standard to be suitable for consumption. Groundwaters near the Alaba and Olusosun e-waste dumpsites in Lagos, Nigeria, was analyzed and accessed for associated human health risks. The samples were collected and analysed for their physicochemical properties and potentially toxic metals (PTMs). PTMs were measured using the Agilent Microwave-Induced Plasma Optical Emission Spectrophotometer (MPOES). The electrical conductivity, of aluminium, arsenic, cadmium, chromium, copper, nickel, and lead were all evaluated for the groundwater samples. The quality, heavy metal pollution, heavy metal evaluation, and ecological risk indices for the samples ranged from 97 to 1049, 162 to 3936, 24.4 to 120.6, and 490 to 1391, respectively. These values showed that 75% of the groundwater samples were unfit for drinking. Children and adults who consume these groundwater samples containing heavy metals run the risk of developing cancer ($CR_{Children}$ and CR_{Adult} had a range of 10.7×10^{-1} to 1783.3×10^{-1} and 3.7×10^{-1} to 3371.7×10^{-1}, respectively). The cancer risks in this study are unacceptable because they were above the 1 in 10,000 chance of developing cancer. This study demonstrated that there are ecological and human health problems associated with the groundwater near e-waste dumpsites. Policies should be put in place to avoid or control where boreholes and wells are sited, especially in vicinities with dumpsites. Engineered solid waste land fill should be constructed, and the use of dumpsites should be discontinued.

4.03.T-06 Potentially Toxic Metals in Roadside Soils and Himalayan Blackberries in Vancouver and Victoria, BC, Canada

Matt Dodd, Steve Grundy

Royal Roads University, Canada

Abstract

The Himalayan blackberry (*Rubus Armeniacus*) is a very robust perennial invasive plant that is well established in the Pacific Northwest and generally found in disturbed areas including roadsides, riparian areas, urban parks, and trails. The collection of the delicious blackberry fruits in the late summer from plants growing along easily accessible roadsides is common in the Pacific Northwest. This study was conducted to assess the potential effect of traffic volume on the distribution of potentially toxic metals including As, Cd, Cr, Cu, Ni, Pb, and Zn in roadside soils and blackberries in Greater Vancouver and Victoria. Soil and berry samples were collected from 29 locations along high traffic corridors, medium traffic areas and rural roads with minor traffic. Total metal concentrations were analyzed by x-ray fluorescence and inductively coupled plasma mass spectrometry. As, Pb and Zn concentrations in soil samples collected from roadsides in high traffic corridors were relatively elevated compared to the concentrations in soils from lower traffic areas while other metals such as Ba, Cu, Cr, Fe and Ni did not show discernable differences among the locations. Mobility ratios (concentration in berries/concentration in soil) were all <1 suggesting minimal metal uptake by the berries from the soils, however As, Cd, Pb and Zn levels in the berries from the high traffic corridors were much higher compared to the low traffic areas. The detailed results of the investigation and the implications of the collection and consumption of roadside blackberry fruits along easily accessible traffic corridors will be presented.

4.03.P-Tu027 The Influx of Foreign Herbal Medicines: Regulatory and Risk Assessment Perspective

Eva Gyamfi, Alfred Anim, Michael Ackah, Daniel Sarfo, Akwasi Agyekum

Ghana Atomic Energy Commission, Ghana

Abstract

The influx of poor-quality foreign herbal medicines (HM) into the Ghanaian market through porous borders is a source of concern for regulators and general public. Some of these herbal formulations do not have the requisite labelling information which specifies the testing and approval by appropriate regulatory authorities. As some HM contains different metals at varying concentrations, their intake may pose potential health risks to consumers. Information on bioaccessibility of metals in HM is rare though such data is crucial for accurate assessment of human exposure risks. This study analysed 23 foreign HM for their total and bioaccessible metal concentrations using Physiologically Based Extraction Test (PBET). Total concentrations (mg/kg) were up to 932, 741 and 68508 for Arsenic (As), Chromium (Cr) and Iron (Fe) respectively. Lead (Pb) and Mercury (Hg) were less than Limits of Detection (LOD). Bioaccessible concentrations were generally < 1% of the total concentrations. Apart from Cr, maximum gastric concentrations were relatively higher; As (0.89 mg/kg), Cr (0.60 mg/kg) and Fe (0.92 mg/kg) in comparison to intestinal concentrations of; As (0.443 mg/kg), (0.95 mg/kg), Fe (0.8 mg/kg). Estimated Health risks based on metalloids bioaccessibility adjusted concentrations were within limits of United States Environmental Protection Agency (USEPA) Reference Dose (RfD) with hazard quotients (HQ) < 1, which suggests non-carcinogenic risks upon exposure. The findings in this study supports the need to periodically monitor potential heavy metals in HM to assure public safety.

Track 5. Social Issues, Policy and Communication

5.01 - Education for Sustainable Development and Open Science Platforms in Africa

5.01.T-01 How to Improve Diversity in Research and Science Education

Gertie Arts[1], Chioma Blaise Chikere[2,3], Chidinma Okafor[4], Eka Essien[2], Udeme Georgewill[2], Laura Nwogu-Chigozie[2], Elizabeth Ihuoma Amadi[2]

[1]Wageningen University and Research, Netherlands. [2]University of Port Harcourt, Nigeria. [3]University of South Africa, South Africa. [4]Imo State University, Nigeria

Abstract

The 2030 Agenda for Sustainable Development was adopted by all United Nations Member States in 2015. 17 Sustainable Development Goals (SDGs) form the basis for this agenda. These SDGs are sets of goals with actionable plans geared towards a holistic and sustainable transformation of the world (www.sdgs.un.org) and haven been elaborated in goals for 2063 by the African Union (https://au.int/en/agenda2063/sdgs. The 2030 agenda clearly shows that partnerships are needed to solve world-wide problems. Besides, solving these problems should be approached in a holistic way, as improving health and education, reducing inequality, stimulating economic growth, tackling climate change and protecting biodiversity must go hand-in-hand. In the past five years, countries have made very little progress in reaching gender equality. As the past has shown us, gender and other inequalities do not fix themselves, and have even deepened during the Covid pandemics. Adopting the SDGs means finding ways how to reach these goals. Here we focus on Diversity in Research and Education which is narrowly lined to the United Nations Sustainable Development Goals 4 (Quality education), Goal 5 (Achieve Gender Equality and empower all women and girls), Goal 10 (Reduced Inequalities) and Goal 17 (Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development). These SDGs are closely interrelated as e.g. closing gender gaps is necessary to ensure inclusive and equitable quality education. There is a need for a complete cultural change, systematic and coordinated actions, education and strong political commitment by all actors involved. Gender equality is not only a matter of concern for women; it must matter to all of us. We need all talents. Mixed, non-homogenous teams, with a good representation of a broad range of competences and background are more productive, more innovative, smarter and more collaboration-oriented. Such collaborations enhance the quality of our teaching and research, better contribute to social needs and help in the development of new business. For this reason, an action plan for gender balance and enhancement of cultural and other diversities is needed. Ensuring diversity, equity, inclusion and belonging (DEIB) in organisations, networks, consortia, collaborations and global science projects and programs is critically important to improve diversity in research and in science education. These latter two reinforce each other.

5.01.T-02 Managing and Mitigating Environmental Pollution Through Action Research: Experiences from South Africa

Jon McCosh[1], Simone Murugan[1], Isabella Gosetto[2], Sershen n[3]

[1]Institute of Natural Resources, South Africa. [2]Joint Nature Conservation Committee, United Kingdom. [3]University of Western Cape, South Africa

Abstract

Management and mitigation of environmental pollution is critical to maintaining environmental quality and sustaining livelihoods. Using project examplars from the Department for Environment, Food and Rural Affairs (UK)-funded Environmental Pollution Programme in South Africa we discuss how pollution can hinder development outcomes. Furthermore, we use our learnings gained during implementing the projects to show how cost-effective, pragmatic and context-suitable solutions are required to address pollution challenges in resource-limited settings. We highlight how we are working with local partners to reduce the impacts of environmental pollution. This presentation highlights two projects that are highly relevant to the South African pollution context - solid waste and dairy wastewater management.

In South Africa, the absence of municipal waste collection services and proper recycling programmes/infrastructure in many rural and peri-urban areas, have led to a rising domestic waste burden that threatens human and environmental health. In the presentation we show how establishing and supporting community-led waste management programmes can help in addressing the threats posed by solid waste pollution and create opportunities for development. More specifically, we share our learnings gained while applying a participatory approach to solid waste management within three communities along a rural-urban gradient in KwaZulu-Natal, South Africa. We also share some of our findings from a project that aims to develop low-cost biological treatment solutions for dairy wastewater streams to mitigate the negative environmental impacts of this wastewater and/or promote its reuse. We believe the findings to be of global relevance, given that the agricultural sector uses the highest volume of freshwater resources worldwide. Dairy is the fourth largest agro-industry in South Africa. Although it is a significant contributor to the economy it also generates large volumes of wastewater along the value chain. Using a mixed-methods approach, this study is determining the phsyico-chemical characteristics of different wastewater streams from selected milking parlours and dairy processing plants, and exploring the feasibility and efficacy of treating these wastewater streams with microalgal consortia in a laboratory-scale bioreactor to inform potential upscaling of this application in farm and factory settings.

5.01.T-03 Building Science-Action Partnerships to Manage and Mitigate the Impacts of Pollution: Learnings From the Environmental Pollution Programme in South Africa

Isabella Gosetto[1], Jason Weeks[1], Nicholas Rivers-Moore[2], Sershen Naidoo[3], Jon McCosh[3], Muthukrishnavellaisamy Kumarasamy[4], Alexandra Cunha[1], Saskia Mori[1], Natasha Hunt[1], Emily Forbes[1], Jack Wilkinson[1]

[1]Joint Nature Conservation Committee, United Kingdom. [2]Independent Researcher, South Africa. [3]Institute of Natural Resources, South Africa. [4]University of KwaZulu-Natal, South Africa

Abstract

Environmental pollution is one of the more pressing global challenges of the Anthropocene, affecting the natural environments, humans and their interactions. Pollution disproportionately affects the most vulnerable groups, with a higher proportion of annual pollution-related deaths occurring in low- to middle-income countries (LMICs). This motivated the UK's Department for Environment, Food and Rural Affairs (Defra) and the Joint Nature Conservation Committee (JNCC) to collaborate with partners across Africa and Asia on an Environmental Pollution Programme, funded by Official Development Assistance (ODA), that aims to build science-action partnerships for knowledge generation on managing and mitigating environmental pollution through investments in human resources and action research. For this purpose, the JNCC developed a Pollution Global Analysis tool using species data and pollution threat categories from the International Union for Conservation of Nature (IUCN) Red List Assessment, which was piloted in six LMICs during the scoping year. The scoping phase established an evidence base and intervention options to shape the action research-based intervention phase (multi-year programme). This presentation focuses on the lessons learned through implementing ten research projects in South Africa through partnerships with local partners. Projects range from community-led management of solid waste, to developing biological solutions to treating dairy wastewater. We also touch on a series of projects that are being delivered in Vietnam on the use of chemicals and open burning in agriculture through similar partnerships. The learnings gained to date justify the replicability of the programme, particularly in neighbouring countries to increase the programme's footprint and ensure its legacy. This presentation will be used to increase the visibility of the programme in the hope of creating synergies with similar efforts globally.

5.01.T-04 Using Open-Source Software to Develop a Geographic Information System-Based Knowledge Hub for Contaminants of Emerging Concern in South African Water Resources

Tarryn Lee Botha[1,2], Emomotimi Bamuza-Pemu[3], Ashira Roopnarain[4], Zibusiso Ncube[4], Gert De Nysschen[4], Busiswa Ndaba[4], Ntebogeng Mokgalaka-Fleischmann[5,6], Maryam Bello-Akinosho[7], Rasheed Adeleke[2], Michael van der Laan[5], Phedisho Mphahlele[6], Fanelesibonge Vilakazi[4], Eunice Ubomba-Jaswa[8]

[1]University of Johannesburg, South Africa. [2]North-West University, Potchefstroom, South Africa. [3]OptimalEnviro, Queenswood, South Africa. [4]Agricultural Research Council - Natural Resources and Engineering, Pretoria, South Africa. [5]University of Venda Faculty of Science, South Africa. [6]Tshwane University of Technology, South Africa. [7]University of the Free State, South Africa. [8]Water Research Commission, South Africa

Abstract

Protecting freshwater sources is now a top priority in water resource management due to population increase and diminishing water quality. In the past, society has responded to issues based on professional niche, the availability of research funding, the gravity of the threat, and the level of public outrage. The ability to identify the state of our water bodies is crucial for adequate management. These elements are continually shifting as new pollutants are released to sources of surface water. The interest in contaminants of emerging concern (CEC) is growing as we move deeper into the digital age with technological advancement for detection. While studies are being done to determine which pollutants are present in South African water sources, the results of these studies and the information that is currently available are not compiled and provided to the scientific community and stakeholders in publicly accessible formats. In order to create environmental regulations, authorities must be informed of recent study findings. We aimed to compile data from the literature and present it to regulatory bodies and researchers in a user-friendly online format by using 4IR technology. To enable visualization on an interactive map that can be continuously updated, a standard Excel spreadsheet was developed, uploaded to a PostgreSQL database running a PostGIS extension, and then processed in the GeoServer. The ability to access the most recent CEC information will facilitate collaboration, lessen the likelihood of redundant research efforts, and serve as an early warning system for aquatic pollution.

Track 6. Special Session

6.02 - Late Breaking Science

6.02.P-Mo032 Mercury in the Ghanaian Environment: Environmental Concentrations, Fate, Human Exposure and Health Risk Assessment

Opoku Gyamfi

Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development, Ghana

Abstract

Mercury (Hg) is a persistent and bioaccumulative toxicant of global concern, which could be emitted to the environment from both anthropogenic and natural sources. Pollution status, human exposure, ecological and human health risk of mercury in soil and air of artisanal and small-scale gold mining communities in Ghana were assessed using Lumex Zeeman Mercury Analyzer for the determination of mercury concentration in soil and air. Exposure concentrations ranging from 500 mg/m3 were observed. The concentration of mercury in air was also measured inside and outside households with active sampler and was related to human health risk standards. About 91% of the households where amalgam burning was reported had concentrations higher than the USEPA reference dose of 300 ng m-3 whereas 64% of the households where amalgam burning was not reported exceeded the reference dose above. The upper 97.5% concentration was estimated, using censored statistics, to exceed 800,000 ng m -3 for the fireplaces. Estimated hazard quotients were found to range from <1 to 108 within the households that are reported not to burn amalgam. Mercury concentrations measured in households with reported amalgam burning are approximately ten times higher than households with no reported burning of amalgam. The censored data predicted hazard quotients up to 966. This study also evaluated the potential risk of mercury pollution in soils in two, an artisanal gold mining areas in Ghana. Two hundred and thirty-seven soil samples were collected from within 0-10 cm depth, from active mining sites near residences, two transects in the community, waste soil from mining processing and the surroundings of one community. The measured mean mercury soil concentrations were 71 mg Hg/kg in active mining sites, and more moderate (2.7 mg Hg/kg) along transects through the community. Hazard quotients for non-cancer effects identified air-borne exposure pathways for humans to pose the largest risk, including the inhalation of vapour. The model predicts that topsoil Hg concentrations may more than double in the next 50 years. Soil Hg is currently a source of mercury to the atmosphere and water but the leaching flux is less than the evasion flux. The soil would accumulate mercury until emission is ceased and may require more than 500 years for levels to decrease to background values. The inhabitants are at risk of non-cancer effects of mercury as the hazard quotients and hazard index exceeded thresholds (HI > 1).

6.02.P-Mo034 Atrazine-Induced Intestinal Histopathology in Juvenile African catfish, Clarias gariepinus (Burchell, 1822)

Prosper Ashibudike Opute[1,2], Felix Ejikeme Mbajiorgu[2]

[1]University of Benin, Nigeria. [2]University of the Witwatersrand, Johannesburg, South Africa

Abstract

Atrazine is a frequently detectable, persistent, and ubiquitous pesticide that could negatively impact the survival of aquatic life, including fish. Therefore, understanding its likely impact on aquatic organisms is now a critical research priority. Juveniles of Clarias gariepinus were exposed to sub-lethal concentrations of atrazine in a controlled semi-renewal assay. The sub-chronic experiment lasted for 28 days using 2.5, 25, 250, and 500 µg L-1 of atrazine exposure. The study attempted to determine its impacts on tissues responsible for dietary intake, an area of study that is rarely investigated in water pollution research. The histopathological effects of atrazine were studied using a combination of both quantifiable and qualitative histomorphology-based health diagnostic tools. The pathological relevance of a lesion is dependent on the severity of its impact on organ function relative to the species survival. The control group showed normal structure, indicating no injury or alteration. However, the different concentrations revealed varying degrees of alteration. Morphometric analysis of the intestine showed significant architectural alterations, including loss of normal architecture, observed only in 250 and 500 µg L-1 atrazine treatments with 25.00% and 89.58% of occurrence, respectively. Other alterations in this category that were observed only in the 500 µg L-1 treatment group are: completely damaged epithelium (91.67%), leakage of cells into the lumen (79.17%), advanced epithelial hyperplasia (79.17%), massive dis-epithelialization (66.67%), and completely degenerated tunica muscularis (95.83%). The results provide invaluable data for ecological risk assessments of atrazine and perhaps other current-use pesticides in freshwater environments.

6.02.P-Tu031 A Comparative Qualitative Assessment of Water Quality Index Using Physicochemical Parameters of Selected Rivers in Rivers State, Nigeria

Sandra Okere[1,2], Florence Nduka[1], Kome Otokunefor[1]

[1]University of Port Harcourt, Nigeria. [2]Federal University of Technology Owerri, Nigeria

Abstract

Water is an essential resource of life and people need water to survive, because it plays an important role in almost every aspect of life, especially for physiological activities such as the maintenance of body fluids balance. The physicochemical parameters of water samples were collected from 5 rivers in Omuchi Aluu, Choba, Chokocho, Oyigbo, and Agbonchia communities, in Rivers State, Nigeria. These rivers are located at coordinates between N 4.81971 / E 7.14131 and N 4.99586 / E 7.06179, and locals use water collected from these rivers for activities such as washing, bathing, fishing, and dredging. Water samples were collected every month from various sampling stations (of each community for 6 months) between March, 2021 and September, 2021 and, transported to the laboratory, Aegis One Consultant Limited, Port Harcourt to analyze ex-situ physicochemical parameters, while insitu parameters were measured during sampling. This study aimed at assessing the quality of water collected from these rivers using weighted arithmetic water quality index (WAWQI), to check for portability and purity of water. Nine parameters were evaluated which included pH, temperature, electrical conductivity (EC), total dissolved solids (TDS), salinity, turbidity, dissolved oxygen (DO), total suspended solids (TSS), and biochemical oxygen demand (BOD). The WAWQI was calculated using mean values of the selected nine parameters and the World Health Organization (WHO) standard for drinking water. The results showed that the WAWQI of water from stations 1, 2, 3, 4, and 5 were 199.4, 358.8, 121.6, 2838.6, and 555.0 respectively; and categorized as unfit for consumption because these values exceeded the acceptable standard limit set by WHO. The study showed that EC and TDS parameters contributed to the high value of the WAWQI from Omuchi Aluu, Choba, and Agbonchia which were due to tidal fluctuations and salinity. It was concluded that water collected from these rivers is unsuitable for drinking. Based on the outcome of the research, there will be advocacy visits to the community (by the researcher) to share relevant information and sensitize community locals to embark on good water sanitary and hygiene (WASH) practices, for a healthy and sustainable environment. However, I recommend that groundwater boreholes should be dug to the acceptable depth set by the Ministry of Environment and used as a source of drinking water, to promote the good and healthier lives of the locals.

6.02.P-Tu032 Evaluation of the Cyanobacterial Toxin and a Volatile Organic Compound in Galleria Mellonella: A Case for a Cheap Model for Undergraduate Toxicology Teaching and Research

Babasola Fateye[1], John Appiah Kubi[1], Esther Idowu[2]

[1]Grand Valley State University, USA. [2]Calvin University, USA

Abstract

Background.

Problem: The traditional model for preclinical and toxicological study of drugs and toxicants has been vertebrate models (rodents and higher). However, there are ethical issues regarding the use of vertebrates on the 3R principles (replacement, reduction, and replacement of vertebrates with less sentient organisms), it is increasingly more difficult to justify the use of vertebrates solely for educational purposes.

The Galleria mellonella is a pest that infests honey combs of bees, across Africa and worldwide. G. mellonella larvae has increasingly been used as a surrogate invertebrate model for biomedical assays. We ask, "is this a feasible model for undergraduate research and teaching"? This 3-part project

1. assesses the acute toxicity of the cyanobacterial toxin - Microcystin-LR (MCLR) - and of a small molecule - linalool (LIN)
2. determines the pharmaco-/toxicokinetic (PK) indices of linalool
3. compares the indices in G mellonella with values in rodent studies from literature.

Finally, we reflect on the use of Galleria to teach an undergraduate lab that is aligned with the Society of Toxicology's learning framework for undergraduate toxicology

Method. We assessed acute toxicity MCLR and Linalool. Biochemical toxicity of MCLR was assessed by Hematoxylin and Eosin (H&E), TUNEL and trichome staining. LIN was extracted using liquid/liquid extraction from the hemolymph between 0 – 72hr and concentration was determined with GC/MS. Pharmacokinetic (PK) parameters were calculated using PKSolver® and an in-house R program.

Results. Acute toxicity: Median lethal dose (LD50) was 1mg/kg and 5.85g/kg for MCLR and LIN, respectively. Histopathology: In larvae injected MCLR by oral gavage, there was a dose dependent disruption of GI mucosal ultrastructure, with positive TUNEL staining. Histopathologic analysis was not done with LIN, since LIN was relatively non-toxic. PK: half-life of LIN in galleria were comparable to values reported in rats (1.84hr).

Conclusion: toxicity of MCLR and LIN were comparable to, or within 1 order of magnitude of doses reported in rodents in literature as was the PK parameters of LIN. Students found Galleria easy to work with. We posit that this cheap model may be a feasible alternative for teaching undergraduate toxicology and pharmacology.

6.02.P-Tu033 Biodegradation of Polystyrene by Bacteria Isolated from the Gut of *Rhynchophorous phoenicis* Larvae

Omega Immanuel, Idumanu Isaiah

University of Africa Toru-orua, Nigeria

Abstract

Background: Biodegradation of polystyrene (PS) by insect larvae with chewing mouthparts has been confirmed in different insect species, and have been linked to the activities of intestinal microorganisms. Materials and Methods: In this study, larvae of the African palm weevil (*Rhynchophorus phoenicis*) were fed with PS foam for 21 days, and the gut microbiota was investigated afterward by dissecting and plating out in mineral salt medium. Bacteria isolated from the gut were screened for PS biodegradation in Erlenmeyer flask using PS film incubated in MSM at 30°C and pH of 7, for 28 days. PS degradation was confirmed by weight loss and Fourier Transform Infrared (FTIR) spectroscopy. Results and Conclusion: Two bacterial species capable of PS degradation were isolated from the gut of the *R*. *phoenicis* and were identified on the basis of their 16S rRNA sequences as *Pantoea dispersa* and *Lysinibacillus macriodes*, with accession numbers OQ652023 and OQ652017 respectively. After incubation for 28 days, the isolates caused 8.8% reduction in weight of PS film from its initial mass of 3 g. FTIR spectroscopy results confirmed the formation of groups suggestive of degradation products. The presence of carbonyl group shows up as absorption peaks in the range of 1640-1760 cm^{-1} and hydroxylic group at 3000-3700 cm^{-1} The isolates were able to accumulate polyhydroxyalkanoate (using sodium hypochloritechloroform method) equivalent to 44% of their dry cell weight. Coupling biodegration of PS with PHA production shows promise for PS waste management and product recovery.

6.02.P-Tu036 Assessment of Potentially Vulnerable Use Areas in Western Africa

Mark Thomas[1], Amy Ritter[2], Gerco Hoogeweg[2], Naresh Pai[1], Godwin Lemgo[3]

[1]Bayer Crop Science, USA. [2]Waterborne Environmental, Inc., USA. [3]Bayer Crop Science, Kenya

Abstract

The Acetochlor Registration Partnership (ARP; Monsanto Company[1] and Dow Agriscience[2]) developed voluntary acetochlor Best Management Practices (BMPs) to reduce the potential for the active substance to reach ground water and surface water. As part of an ongoing global acetochlor stewardship support, a study has been conducted to determine the co-occurrence between acetochlor use on crops and potentially vulnerable soils in the Permanent Interstate Committee for Drought Control in the Sahel (French: Comité permanent inter-État de lutte contre la sécheresse au Sahel, aka CILSS) countries. The assessment was focused on high potential use areas of acetochlor, within the CILSS, for two representative crops (corn and cotton).

The geospatial analysis performed identified approximately 462 million hectares (ha) of potentially vulnerable soils in the CILSS of which 65.7 million ha of soils are within agricultural areas. Acetochlor product labels approved in the US by the US Environmental Protection Agency, restrict applications on vulnerable soils within 50 feet of any well where depth to ground water is ≤ 9 m. Other agricultural BMPs for applying acetochlor products in the US are designed to minimize run-off to surface water. Approximately 0.24% of agricultural fields (0.159 million ha of soils) in the CILSS are in areas of shallow groundwater. In addition, 0.02 % (0.0128 million ha) were determined to be adjacent to surface water bodies.

The analysis provides evidence that only small portions of vulnerable agricultural soils in the CILSS may be at risk for acetochlor contamination by means of leaching to groundwater or surface runoff. The approach could be expanded to other regions to inform water quality management decisions for products containing acetochlor.

[1]Monsanto Company remains a legal entity in the US but is now wholly owned by Bayer Crop Science.

[2]Dow AgroSciences remains a legal entity in the US until final legal separation from DowDuPont as Corteva Agriscience.

6.02.P-Tu039 Application Of Geospatial Tools for Monitoring Wetland Degradation In Rwanda

Fayola Autry[1], Mekonnen Gebremichael[2], Abraham Ekperusi[3]

[1]California State University Dominguez Hills, USA. [2]University of California, Los Angeles, USA. [3]Nigeria Maritime University, Nigeria

Abstract

Wetlands provide a variety of ecosystem services fundamental for the well-being of individuals, communities, and the national economy. Wetlands serve as 'water towers' for Rwanda's diverse ecosystems. They reduce the risk of flooding during the rainy season, replenish rivers and streams during the dry season, and protect water quality, year-round. Wetlands are fundamental for biodiversity, as healthy catchment areas provide a critical habitat for a variety of wildlife and indigenous vegetation. Rwanda has 860 wetlands (278,536 ha) representing nearly 11 percent of the country's total surface area. While wetlands play a pivotal role in the sustainability of Rwanda's ecosystems, they are facing increasing anthropogenic pressures from unsustainable agriculture, peat mining, industrial waste, urban settlements, infrastructure development, dam construction, and sand mining activities. An estimated 53 percent of wetlands in Rwanda are currently under cultivation. Agriculture is the main economic activity in Rwanda with 70 percent of the population engaged in the sector, and approximately 92,000 hectares of wetlands being used for traditional subsistence farming. Large wetland irrigation schemes can alter the water balance of the entire catchment. This study seeks to create a robust tool for wetland management and water quality risk assessments by coupling geospatial data on wetland distribution in Rwanda with data on: (1) agricultural activity in irrigated wetlands and buffer zones; (2) incidence of water borne illnesses within catchment areas; (3) water quality parameters such as dissolved inorganic nitrogen, dissolved inorganic phosphorus, dissolved oxygen, pH, salinity, Escherichia coli and turbidity. We hope to provide recommendations to catchment management teams that will enhance the sustainable utilization of wetlands for the overall development of Rwanda.

6.02.P-Tu040 Diversity of Sandstone Cave-Dwelling Bats in Enugu State, Nigeria

Elijah Okwuonu, Ikem Okoye

University of Nigeria, Nsukka, Nigeria

Abstract

Bats are the second largest order, Chiroptera, within the Mammalia having a high degree of ecological diversification due to their morphological, physiological, and behavioural adaptations. Only bats among mammals have truly sustained flight. They play many ecosystem services including pollination, seed dispersal as well as agricultural insects' pests control. There are three different types of bats namely nectarivorous, insectivorous and fruitigivorous bats. There is about one-fifth of all species of bats including 13 families, 70 genera, and more than 340 species in Africa. In Nigeria, bats use multiple types of caves including limestone karst systems, boulder systems and sandstone caves. Opposite to karst systems, sandstone caves may be dry and lack complexity and their impact on bat diversity is poorly understood. Enugu State has arguably the largest concentration of sandstone caves in Nigeria. This study investigated diversity of cave-roosting bats in Enugu State, Nigeria between January 2020 and March 2023. Bats were surveyed using harp traps and mist nets at cave entrances. Bats were trapped at emergence (6:30 – 8 pm) and routine bat biometrics including age, sex, and measured forearm, tibia, and ear lengths of captured individuals used in identification were taken. Cave microclimatic conditions and dimensions were quantified. A total of 20 caves were surveyed across nine communities. 387 bat individuals were captured belonging to 6 families and 15 species. Hipposideros abae was the most abundant species. Bat species richness across caves varied between 1 – 8, which is potentially explained by cave dimensions and microclimatic conditions. Understanding the role of sandstone caves on bat diversity will inform conservation strategy and reduce environmental stress on bats in the area.

6.02.P-We013 Isolation, Identification and Characterization of Heavy Metal Resistant Bacteria from Soil Samples Collected in /Around Benue Cement Company, Nigeria

L.M. Ayantse[1], V.S. Tatah[2], I.N.E. Onwurah[1], O Otitoju[3], O.E. Yakubu[2]

[1]University of Nigeria Nsukka, Nigeria. [2]Federal University Wukari, Taraba State Nigeria, Nigeria. [3]Federal University Wukari, Nigeria

Abstract

Cement production is a significant source of heavy metal emissions, including Cd, Cr, Cu, Pb, and Zn, which are known to be toxic to humans and plants even at low concentrations. The accumulation of these pollutants in plants and water can pose a danger to exposed populations, including children, adults, and the elderly, depending on the exposure pathway and vulnerability. Bacteria have developed various coping mechanisms to survive and tolerate the uptake of heavy metals, making them potential bio-indicators for detecting environmental heavy metal pollution.This study aimed to analyze the presence of heavy metals in collected samples and isolate and identify heavy metal-resistant bacteria from soil in the vicinity of Benue Cement Plc, Gboko plant, Nigeria. The analysis of soil samples from the cement factory revealed contamination with Cd, Zn, Cr, Cu, and Pb. Copper and Zinc were found to be particularly abundant across all sites compared to other metals (Pb, Cr, and Cd), and all elements exceeded the permissible limits set by the WHO in 2012. After screening, 20 bacterial isolates were obtained from metal-supplemented nutrient agar medium. Five bacterial isolates (Staphylococcus aureus, Escherichia coli, Proteus species, Bacillus cereus, and Lactobacillus) were selected in the secondary screening due to their high levels of heavy metal resistance. Identification was performed using morphological and biochemical techniques. The resistant isolates exhibited significant resistance to various heavy metals, with MIC (Minimum Inhibitory Concentration) values ranging from 12 to 16 mg/l for Staphylococcus aureus, 20 to 50 mg/l for Escherichia coli, 15 to 64 mg/l for Proteus species, and 10 to 18 mg/l for Bacillus cereus against different metals. Escherichia coli demonstrated the highest resistance among the tested bacteria, while Bacillus cereus exhibited the lowest resistance. The bacterial strains also displayed substantial resistance to the ten tested antibiotics, with Escherichia coli being the most resistant and Proteus species the least. In conclusion, this study provides valuable insights into the presence of heavy metals and the prevalence of heavy metal-resistant bacteria in the soil around the Benue Cement Company in Nigeria. These findings contribute to the understanding of environmental pollution and bacterial resistance mechanisms, which can be beneficial for developing strategies to mitigate the impact of heavy metal pollution.

6.02.P-We014 Assessment of the Material Value of Precious Metals in End-of-Life Mobile Phones in Accra-Ghana

Karikari Williams[1,2], Samuel Bamford[2], Samson Atiemo[1], Owiredu Gyampo[3], Archibold Buah-Kwofie[3]

[1]Mountain Research Institute, Ghana. [2]University of Ghana, Ghana. [3]Ghana Atomic Energy Commission, Ghana

Abstract

Mobile phone use has surged over the last few decades all around the world, and Ghana is no exception. This surge in mobile phones has significantly contributed to the generation of large volumes of electronic waste (e-waste). Globally, about 10% of waste mobile phones are recycled. However, in Ghana, e-waste recycled, particularly in the informal sector, does not include mobile phones. Rather, end-of-life (EoL) mobile phones in Ghana are exported to developed countries for material recovery. However, not enough knowledge is available on the material value of the precious metal content of EoL mobile phones in Ghana, and hence export to developed countries is done without any material-benefit analysis. Consequently, Ghana is losing on the wealth and secondary mineral resources that could be harnessed from EoL mobile phones by proper recovery and process efficiencies. To address this challenge, the study identified precious metals available in EoL mobile phones in Ghana and quantified them. The wealth that could be harnessed from the EoL mobile phones was estimated to provide a basis for material benefit analysis before export or inform policy decisions on recycling the waste stream in Ghana. EoL mobile phones from brands that dominated the Ghanaian market were sampled for the research. X-ray Fluorescence (XRF) spectrometry was engaged in identifying and quantifying precious metals available in the EoL mobile phones. Data was obtained from the National Communications Authority (NCA) to have an estimate of the mobile subscriptions in Ghana. Afterwards, the rates of the metals were obtained from the London Metal Exchange (LME) to estimate the wealth that could be harnessed should all the mobile phones in the NCA data come to their EoL. Ti, Fe, Ni, Cu, Zn, Ag, Sn, W, Pt, Au, etc. were discovered in EoL mobile phones following XRF examination. From the study, gold, copper, nickel, and zinc will each yield USD 120,318,782.40, USD 119,065,461.80, USD 42,195,128.55, and USD 835,547.10, respectively. These metals potentially create a total revenue of USD 282,414,919.90 (With labor, utilities, and relevant costs included). While attention on e-waste recycling in Ghana has focused on other products like computers, television sets, monitors, among others, there is no published work on assessing the economic value of EoL mobile phones in the country. Consequently, steps must be taken in order for Ghana to benefit from the wealth that is embedded in EoL mobile phones.

6.02.P-We019 Non-aqueous Reversed Liquid Chromatography Separation Technique to Monitor Fullerene Congeners-Colloidal Nanoparticles in the Environment

Nokwanda Hendricks, Bhekumuzi Gumbi, Olatunde Olatunji

University KwaZulu-Natal, South Africa

Abstract

This work presents a cheap and simple analytical method for the quantification of fullerenes in surface waters by ultrasonic dispersive liquid – liquid extraction (UADLLE) and high performance liquid chromatography ultraviolet-visible spectroscopy (HPLC-UV-vis). Fullerene colloidal nanoparticles were synthesized and characterized by high resolution transmission electron microscopy (HRTEM) and ultraviolet-visible spectroscopy. Non-aqueous mobile phase was developed for separation of pristine and derivative fullerene in reversed C18 column. UV-vis detector coupled to HPLC was used for quantification of fullerene congeners-colloidal nanoparticles in environmental samples. During extraction, accelerating the mass transfer of fullerene colloidal nanoparticles from aqueous matrixes into the organic phase was done by the ultrasonication and it resulted in a short extraction duration. Also, the addition of dispersive solvent, and addition of sodium chloride salt destabilized fullerene derivative aggregates and promoted mass transfer into the organic phase. The mean absolute recoveries established in surface waters were within the acceptable range by IUPAC of 60 – 120%. The developed analytical method was validated based on the linearity, precision and accuracy, detection for a signal-to-noise ratio of 3 and 10. The developed analytical method was applied in surface waters, for the detection and quantification of fullerene colloidal nanoparticles. This method provides the rapid identification of pristine and derivatives fullerene separately, which allowed prediction of ecological risk with certain in the environment. Determination of the environmental relevant concentration levels of fullerene colloidal-congeners and their monitoring in the environment is necessary to safeguard public health.

Key words: Fullerenes, environmental monitoring, surface waters, UADLLE, HPLC-UV-vis, non-aqueous reserved chromatography

6.02.P-We020 Tripartite Magnetic Montmorillonite Nanocomposite for Semi-Onsite Removal of Bisphenol A from Industrial Effluents

Okon Okon[1,2], Edu Inam[1,2], Ukana Akpabio[1], NnanakeAbasi Offiong[3]

[1]University of Uyo, Nigeria. [2]International Center for Energy and Environmental Sustainability Research (ICEESR), University of Uyo, Nigeria. [3]Topfaith University, Mkpatak, Nigeria

Abstract

There is a growing concern about emerging contaminants in developing countries due to lack of regulatory guidelines. Bisphenol A (BPA) is an EPA classified emerging contaminant- an endocrine disrupting chemical (EDC) known to cause hormonal and reproductive health disorder in living things. BPA is found in some plastics and papers- being major packaging materials in developing countries, they percolate our environment through solid waste and effluent disposal and defy conventional treatment materials. This study sets to fabricate a novel magnetic polymer-clay nanocomposite (TMC) from cycledextrin and montmorillonite for semi on-site removal of BPA from industrial effluents. The nanocomposites were prepared by in-situ reduction with iron salts followed by chemical impregnation by Sol-Gel method and subsequently coupled by chemical precipitation to form the TMC. Relevant spectroscopic methods were also employed for characterization. The modified clays showed magnetic properties with FTIR result, revealing new reflections at 1990 cm-1 for –NCS (isocyanate). The tripartite magnetic nanocomposite had new reflections at 1032 cm-1 for cyanide (-OCN), 1625 cm-1 for open chain azo (-N=N-), and 2050 cm-1 for transition metal carbonyl (–M=CO-). XRD analysis revealed interlayer spacing (1.67-1.71 nm). Following the modification, BET surface area increases from 90.39 to 288.08 m2/g. In a continuous plug flow column, the tripartite magnetic composite demonstrated longer breakthrough and exhaustion time (19, 45 hours respectively) with bed volume of 57 litres over 4 consecutive cycles, compared to activated carbon and sand as conventional adsorbents (2, 21 and 5, 29 hours respectively) with bed volume of 12 and 6 litres. Adams-Bohart isotherm showed highest adsorption capacity of 120.28 mg/g. Consequently, the longer breakthrough time and bed volume of TMC makes it suitable for treatment of large volume of effluent. Hence, an efficient alternative for semi on-site BPA effluent treatment in associated industries to reduce its levels in the environment and mitigate its associated health, social and environmental impacts.

6.02.P-We021 Alterations of Physiological, Behavioural and Reproduction of *Daphnia magna* Exposed to Functional Groups of Nanogold

Avela Mbangatha[1], Victor Wepener[1], Tarryn Botha[2]

[1]North West University, South Africa. [2]University of South Africa, South Africa

Abstract

Nanotechnology has advanced into almost all aspects of technology, science and everyday life and is a promising field for future advancements. Gold nanomaterials (nAu) have been developed for applications in the biomedical field for imaging and as a drug delivery vector. To ensure the effective dispersion of nanomaterials in biological media, the materials are manufactured in different shapes and have different functionalized groups attached. The release of nanomaterials into the environment has a potentially hazardous effect on the aquatic ecosystem. An invertebrate crustacean *D. magna* is an important source of food for fish and other aquatic organisms in an ecosystem. *D. magna* were exposed to sub-lethal concentrations of CTAB capped rod-shaped nAu [LC10 (2 µg/L) & LC20 (4 µg/L)] and citrate capped nAu [LC10 (2 mg/L) & LC20 (20 mg/L)] and ionic gold [LC10 (1 µg/L) & LC20 (4 µg/L)], following OECD protocol. After 48 h exposure, video recordings were taken and the heartbeat of *D. magna* was counted manually by playing the video clip in slow motion including the use of a pen and paper to tap the beats, respiration was measured using a 24-well sealed Loligo Systems® microplate chamber with PreSens precision sensing to measure oxygen consumption. Swimming behaviour recordings were taken at 0 h and at 48 h with 10-minute dark/light intervals using a Basler monochrome GigE video camera and videos were analyzed using Ethiovision X14 software. The reproduction test of *D. magna* was conducted following an OECD211 guideline for 28 days. The concentrations were as follows: for CTAB capped rod-shaped nAu (0.5, 10, 40, 50, 100 and 500 ng/L), for citrate capped nAu (0.5, 1, 5, 10, 25 and 50 mg/L) and for ionic Au (0.125, 0.25, 0.5, 1, 2 and 4 µg/L). The study revealed different physiological responses between exposure groups compared to the control and reproduction being affected.

6.02.P-We023 Concentrations of Organophosphate Pesticides In Dust And Soil From Urban, Semi-Urban And Rural Areas Of Delta State, Nigeria

Ethel Okocha

Delta state University, Abraka, Nigeria

Abstract

Environmental pollution by pesticides is a universal challenge due to its devitalizing effects on humans and the environment. Its impacts are often studied within the context of agricultural uses but are also commonly applied in non-agricultural settings. Organophosphate pesticides are esters of phosphoric acid, occurring in diverse ranges. Its low price and efficacy in the control of pests, weeds, and diseases have made it a desirable product. Considering the erroneous usage of OPPs and its persistent nature, population-based studies have revealed possible relations between exposure to OPPs and serious health effects. OPPs accumulation in the environment, has led to a substantial soil health hazard, as soil is a major sink for organic pollutants. Also, dust is considered a marker of indoor and outdoor pollution by organic compounds and can be contaminated in diverse ways. Pesticide residues in indoor environments are not subject to degradative environmental processes and may thus persist longer than in outdoor environments. In order to reduce human exposure to these pesticides and the related health effects for the residents, it is critical to characterize the levels of pesticides in dust and soil. Information on pesticide exposure of rural, semi-urban and urban residents is extremely limited in Africa, particularly in dust samples. Soil, indoor and outdoor samples have been collected to assess the presence, and concentration of OPPs in selected rural, semi-urban and urban environments in Delta State, Nigeria. The OPPs in the sample will be analyzed using the gas chromatographic method. Comparison of concentrations of OPPs in selected areas will allow for a better understanding of risk and health-related exposures associated.

6.02.P-We024 Influence of Fertilizers and Herbicides on Aflatoxin Concentrations in Sesame Grains Across Some Selected States in Nigeria

Nkechinyere Isienyi[1,2], Olubumni Fadina[1], Olajumoke Fayinminnu[1], Abdullahi Ndarubu[3], Jacob Akintunde[4]

[1]University of Ibadan, Nigeria. [2]Forestry Research Institute of Nigeria, Nigeria. [3]Harvestfield Industries Limited, Lagos, Nigeria. [4]College of Biosciences, Federal University of Agriculture, Abeokuta, Nigeria

Abstract

There is a global concern for food safety and security as well as the increase in the economy through the exportation of sesame grains due to their high nutritive value. Nonetheless, the most common practice is the use of inorganic fertilizers and herbicides by farmers, which build up often leaves toxic effects on the crop and soil, hence could lead to bioaccumulation in human when consumed such crop. Aflatoxins are toxic chemicals produced by Aspergillus flavus and A. parasiticus (molds). The molds reside in the soil and dead, as a decaying organic matter. Aflatoxin is a potent-mycotoxins found in food crops and mostly in sesame, and its contamination in food has been linked with immune suppression and cancer in human. This current study assessed the effects of fertilizers and herbicides on Aflatoxin concentrations in sesame grains across some selected States in Nigeria. Therefore, the objective of this study was to determine the aflatoxin concentrations in sesame grains from sixteen selected Local Government Areas (LGAs) from prominent state producers in Nigeria. Purposeful selection was used in selecting the sixteen LGAs (Lafia, Awe, Keana, Shamdan, Quan-Pan, Langtang South, Giyade, Shira, Kafin Madaki, Lapai, Bida, Agaie, Lavun and Katcha) from Nasarawa, Plateau, Bauchi and Niger States. Sesame grains of I kg obtained from each LGAs were bulked as composite samples and were taken to Aflatoxin Analytical Laboratory of Harvest Field Company, Ogun State, Nigeria for determination of Aflatoxins using standard procedures. The results showed that highest aflatoxin concentrations >30 and 29 µg/kg in sesame grains were from Agaie and Lafia LGAs in Niger and Nasarawa States, respectively which exceeded the values of 4 µg /kg and 15-20 µg / kg for EU and Nigeria standards. However, the lowest concentration >1.2 µg/kg was recorded across the LGAs in Plateau and Bauchi States, which was below the acceptable limit. Implications of the results presented here, suggested that future research is needed to minimise the aflatoxin concentrations in sesame grains through the use of organic agronomic practices of this valuable crop in order to enhance and promote food safety.

6.02.P-We025 Nutrient Leaching Dynamics in Light Textured Calcareous Soil Treated with Common Chemical Fertilizers and Mitigation by Tithonia Biochar

Yetunde Oyeyiola[1,2], Beatrice Opeolu[1], Francis Lewu[1], Omoniyi Pereao[1]

[1]Cape Peninsula University of Technology, South Africa. [2]Ladoke Akintola University of Technology, Nigeria

Abstract

Leaching is an important nutrient loss channel for chemical fertilizers (CF) in soils which confers hazards on water quality and fertilizer use efficiency. Understanding of the contributions of CF to leachate losses in soils is crucial for proper selection of CF type and rate for optimal crop production and environmental safety. The study aimed at quantifying nutrient leachate losses from common CF and their relationship with selected soil parameters. Leaching columns (23 cm long and 5cm inner diameter) furnished with leachate collection cups containing 300g soil were treated with NPK 15:15:15 (NPK), urea and single superphosphate (SSP), each applied at 30, 60, 90 and 120 kg/ha. Two control treatments: tithonia biochar applied at 5 t/ha mixed with 60 kg/ha Urea and 60 kg NPK (BC+CF) and an absolute control (AC) soil that received neither CF nor biochar were compared. Each treated soil was moistened to field capacity with 85 ml distilled water, planted with Amaranthus hybridus seedlings and thereafter leached with 50 ml artificial rain weekly for four weeks. Leachate collected were analyzed for NH4-N, NO3-N and PO4 contents and post-harvest soils analyzed for available P, total organic carbon (TOC) and inorganic carbon (TIC). Nutrient leached were in decreasing order of NO3-N > NH4-N > PO4 and NPK contributed highest total mean nitrogen (1.53 mg N/300g soil) and phosphorus (0.25 mg P/300g soil) leached across the application rates. Increasing fertilizer application rate significantly increased NH4-N leached in all the CF treated soil. The BC+CF soil significantly reduced NH4-N, NO3-N and PO4 leached by 72.2, 58.2 and 7.7% respectively compared to NPK alone. Fresh biomass weight of A. hybridus was higher in the CF treated soils in the order of NPK > urea > SSP compared to BC+CF and AC soils despite the highest TOC (8.043%) and TIC (3.647%) from BC+CF soil. Total leachate volume had positive correlation with PO4 leached from all the CF treated soils and with NH4-N and NO3-N in only urea treated soil. There was negative correlation between TIC and NH4-N, NO3-N and PO4 leached in NPK treated soil while it was positive in urea treated soil. The study underscores the complexity of nutrient leaching dynamics in calcareous soils. It offers insights into biochar use as a potential strategy to mitigate nutrient loss and an approach to nutrient management that considers both crop productivity and environmental sustainability.

Author List

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N

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Author List

S

T

U

V

W

X

Y

Z

*If no program code was given for a submission then this will show the submission serial number

Society of Environmental Toxicology and Chemistry

SETAC Africa, Europe
Avenue des Arts 53
1000 Brussels
Belgium
T +32 2 772 72 81

SETAC Americas
712 H Street NE, Suite 1889
Washington, DC 20002
United States
T +1 202 677 3001

SETAC Asia-Pacific
27/2 Masthead Drive
Cleveland, Qld 4163
Australia
T +61 7 3821 1452

setac.org
setac@setac.org