Kwame Nkrumah University of Science and Technology

Journal of Science and Technology

BOOK OF ABSTRACTS

Mineral Waste Valorization Research Conference 2026

MWVRC 2026

Guest Editors

Prof. K. Mensah-Darkwa
JUST Section Editor, CoE, KNUST Liaison & Technical Editor
Dept. of Materials & Metallurgical Engineering, KNUST

Dr. Bennetta Koomson
Conference Committee Chair
Dept. Materials and Metallurgical Engineering, Kwame Nkrumah University of Science and Technology

BOOK OF ABSTRACTS

Mineral Waste Valorization Research Conference 2026

"Valorizing Mineral Waste through Engineering Innovations and Policy Advocacy"

Organised by

Department of Materials and Metallurgical Engineering,
Faculty of Mechanical and Chemical Engineering, College of Engineering, Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana

In Collaboration with

Organisation for Women in Science for the Developing World (OWSD)

Under the Dr. Bennetta Koomson OWSD Fellowship Initiative

Thursday, 25th June, 2026

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The Secretary,

Journal of Science and Technology
Books and Publications Committee,
Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
Email: just@knust.edu.gh/secretary.just@knust.edu.gh

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About the Conference

The Mineral Waste Valorization Research Conference 2026 (MWVRC 2026) is organized by the Department of Materials and Metallurgical Engineering, KNUST, in partnership with OWSD under the theme "Valorizing Mineral Waste through Engineering Innovations and Policy Advocacy." The conference is an outcome of Dr. Bennetta Koomson's OWSD Early Career Fellowship and aims to bridge research, industry, and policy to advance sustainable mineral waste management.

MWVRC 2026 provides a unique platform for researchers, industry professionals, and policymakers to discuss innovative solutions for transforming mineral waste into valuable resources while addressing environmental challenges. The one-day hybrid conference will feature keynote presentations, technical sessions, poster exhibitions, panel discussions, and industry exhibitions, fostering collaboration and knowledge exchange across Ghana and Africa.

Message from the Conference Chair

Prof. Kwabena Biritwum Nyarko

Provost, College of Engineering, KNUST

The Ashanti Regional Director of the Environmental Protection Agency, Honourable provosts, deans, and heads of departments, Leaders from industries and institutions, Esteemed presidents and executives of professional and scientific organizations, and allied bodies, Distinguished fellows, professors, researchers, and colleagues, Invited guests joining us both in person and online, members of the media, and valued stakeholders, My dear students, ladies and gentlemen, Good day.

On behalf of the College of Engineering, Kwame Nkrumah University of Science and Technology, KNUST I am pleased to welcome all participants, keynote speakers, industry representatives, policymakers, researchers, and partners to the Mineral Waste Valorization Research Conference 2026.

This conference reflects the commitment of the College of Engineering to advancing research that addresses pressing environmental and industrial challenges through innovation, scientific excellence, and practical application. The sustainable management and valorization of mineral waste have become increasingly important, particularly for resource rich countries such as Ghana, where responsible stewardship of mineral resources is essential for environmental sustainability and economic development.

I am particularly delighted that this conference has emerged from the work supported by Dr. Bennetta Koomson's OWSD Early Career Fellowship. This achievement demonstrates the value of investing in research capacity and providing opportunities for early career researchers to contribute meaningfully to scientific advancement and national development. I commend the Department of Materials and Metallurgical Engineering and the organizing committee for their dedication in bringing this important initiative to fruition.

The College of Engineering remains committed to fostering research, innovation, and collaboration that contribute to sustainable development across Africa and beyond. Conferences such as MWVRC 2026 provide an important platform for knowledge exchange, partnership building, and the translation of research into solutions that benefit society.

I wish you all a successful and productive conference.

Message from the Head of Department

Prof. Emmanuel Gikunoo

Head, Department of Materials and Metallurgical Engineering, KNUST

The Conference Chair, Ashanti Regional Director of the Environmental Protection Agency, Honourable provosts, deans and heads of departments, distinguished leaders from industry and partner institutions, esteemed presidents and executives of professional and scientific organizations and allied bodies, distinguished fellows, professors, researchers and colleagues, invited guests joining us both in person and online, members of the media and valued stakeholders, my dear students, ladies and gentlemen,

On behalf of the Department of Materials and Metallurgical Engineering, I am delighted to welcome you to the 2026 Mineral Waste Valorization Research Conference. As a department dedicated to excellence in materials, minerals, and metallurgical engineering, we recognize the growing need for sustainable solutions to mineral and industrial waste management. The conference theme, "*Valorizing Mineral Waste through Engineering Innovations and Policy Advocacy*," highlights the importance of research, innovation, industry collaboration, and policy in transforming waste into valuable resources.

This conference provides a platform for researchers, industry professionals, policymakers, and students to exchange knowledge, showcase emerging technologies, and explore solutions that promote environmental sustainability and the circular economy. The presentations and discussions in this programme demonstrate the potential of engineering innovations to address challenges within the minerals sector.

I commend Dr. Bennetta Koomson, the organizing committee, our partners, sponsors, and all contributors for their dedication in making this conference possible. This initiative underscores the value of scientific research, collaboration, and capacity building in addressing environmental and industrial challenges.

I encourage all participants to engage actively, share ideas, and build collaborations that will advance sustainable mineral resource development in Ghana, across Africa, and beyond.

On behalf of the Department of Materials and Metallurgical Engineering, I wish you a successful and rewarding conference.

Thank you.

Message from Committee Chair

Dr. (Mrs.) Bennetta Koomson
Department of Materials and Metallurgical Engineering, KNUST

The Conference Chair, Ashanti Regional Director of the Environmental Protection Agency, Honourable provosts, deans and heads of departments, distinguished leaders from industry and partner institutions, esteemed presidents and executives of professional and scientific organizations and allied bodies, distinguished fellows, professors, researchers and colleagues, invited guests joining us both in person and online, members of the media and valued stakeholders, my dear students, ladies and gentlemen, it is my pleasure to welcome you to the Mineral Waste Valorization Research Conference 2026 (MWVRC 2026).

This conference forms part of the outcomes of my Organisation for Women in Science for the Developing World (OWSD) Early Career Fellowship project, which focuses on urban mining and the sustainable recovery of valuable resources from mineral waste streams. Specifically, the project explores the recovery of lead from spent cupels and the utilization of the resulting residues, together with locally available materials, for the production of new cupels. This work contributes to ongoing efforts to promote resource efficiency, waste reduction, and circular economy practices within the minerals sector.

The theme of this conference reflects the growing importance of developing innovative and sustainable approaches to mineral waste management. Across Ghana and many other resource producing countries, significant quantities of mineral waste are generated annually. However, these materials often contain valuable resources that can be recovered and transformed into useful products through scientific and engineering innovations.

As researchers, industry professionals, policymakers, and students, we have a shared responsibility to advance solutions that promote environmental sustainability while creating economic opportunities. I therefore hope that this conference will provide a valuable platform for knowledge exchange, interdisciplinary collaboration, and meaningful discussions on the future of mineral waste valorization.

I sincerely thank the Organisation for Women in Science for the Developing World (OWSD), Kwame Nkrumah University of Science and Technology, our sponsors, partners, speakers, and members of the organizing committee for their support in making this conference possible.

I wish all participants a successful, engaging, and productive conference.

Profiles

Conference Chair

Prof. Kwabena Biritwum Nyarko

Provost, College of Engineering, KNUST

Prof. Kwabena Biritwum Nyarko is a Ghanaian engineer, academic, and researcher who currently serves as the Provost of the College of Engineering, KNUST. He is a Professor in the Department of Civil Engineering with more than three decades of experience in teaching, research, and engineering leadership.

A specialist in Water, Sanitation and Hygiene (WASH), his research focuses on water supply systems, sanitation technologies, water distribution modelling, and sustainable service delivery. He has authored over 100 scholarly publications and has led several major research and capacity-building initiatives.

Prof. Nyarko is an alumnus of KNUST, where he obtained a BSc in Civil Engineering. He later earned both his MSc in Sanitary Engineering and PhD through the UNESCO-IHE Institute for Water Education and the Institute of Social Studies. Before becoming Provost in 2022, he served in several leadership positions, including Head of the Department of Petroleum Engineering, Vice Dean of the Faculty of Civil and Geo-Engineering, and Project Lead of the KNUST Engineering Education Project.

His leadership at the College has been associated with expanding research funding, strengthening alumni engagement, enhancing industry partnerships, and promoting impactful engineering education across Africa. In 2026, he was appointed Chair of the Engineering Education Committee of the Federation of African Engineering Organisations, a role that places him at the forefront of shaping engineering education policy and practice on the continent.

Beyond KNUST, he serves on the Governing Board of the Engineering Council of Ghana and is a Council Member of the Ghana Institution of Engineering.

In summary, Prof. Biritwum Nyarko is widely recognized for his contributions to engineering education, water and sanitation research, institutional leadership, and the advancement of engineering practice in Ghana and across Africa.

Head of Department

Prof. Emmanuel Gikunoo

Dept. of Materials and Metallurgical Engineering, KNUST

Prof. Emmanuel Gikunoo is an academic, engineer, and researcher and Head of Department of Materials and Metallurgical Engineering at KNUST, Kumasi, Ghana. As an Associate Professor, he has made notable contributions to engineering education, research, and institutional leadership.

His research focuses on materials engineering and environmental sustainability, particularly nanomaterials, biosensors, composite and biomaterials, mineral processing, environmental remediation, and solid waste management. He has contributed to advances in materials development, diagnostic technologies, resource recovery, and sustainable environmental systems, and has published widely in reputable international peer-reviewed journals while supervising numerous undergraduate and postgraduate research projects.

Prof. Gikunoo earned his Bachelor of Science degree from KNUST before pursuing graduate studies in North America. He holds a Master of Science in Mechanical Engineering from the University of Saskatchewan, Canada, and a Doctor of Philosophy in Mechanical Engineering from Louisiana State University, USA. His doctoral research examined the application of carbon nanofibers in biosensor technologies for rapid disease detection.

Since joining KNUST in 2006, he has contributed significantly to teaching, research, mentorship, and institutional development. He has held several academic and administrative positions and is currently serving his second term as Head of the Department of Materials and Metallurgical Engineering.

His leadership has strengthened research capacity, modernised laboratories, and forged stronger links between academia and industry, advancing engineering education, sustainable materials research, and technological innovation in Ghana and beyond.

OWSD 2023 Fellow

Dr. (Mrs.) Bennetta Koomson

Dept. of Materials and Metallurgical Engineering, KNUST

Dr. (Mrs.) Bennetta Koomson is a distinguished Ghanaian Minerals Engineer, Senior Lecturer, and Consulting Engineer at KNUST. Her work focuses on urban mining, mineral waste valorization, and circular economy solutions, transforming hazardous mining and metallurgical waste into safe, value added materials that support sustainable mining and environmental protection. With strong experience across academia, industry, and research, she develops practical, scalable solutions in metallurgical waste upcycling, heavy metal remediation, wastewater treatment, and mine waste management. As a 2023 OWSD Early Career Fellow (UNESCO), she leads pioneering research on recovering valuable materials from lead-bearing assay waste while advancing circular manufacturing systems.

Dr. Koomson has secured competitive funding from international and national organizations, published in peer-reviewed journals, and contributed to advancing innovation in mineral processing and environmental sustainability. She holds a PhD, MPhil, and BSc in Minerals Engineering from UMaT and KNUST, with international research experience in Canada and Australia. She currently serves as the first female Vice Chairperson of the Ghana Institution of Engineering (Ashanti Region, Branch 1) and is an active member of several professional networks, where she mentors young engineers and promotes gender inclusion in STEM.

She is also the founder of the Luv-Ebeneta Career Fair, a national STEM outreach initiative equipping young people, especially girls, with leadership, technical, and career development skills. Dr. Koomson is widely recognized for her commitment to sustainable engineering, innovation, and youth empowerment, driving impact across Ghana's mining and environmental landscape.

Keynote Speakers

Mr. Sampson Gyasi Koduah

Business Line Leader, Minerals Sub-Saharan Africa | Intertek Ghana Minerals

Talk Title: Waste Valorization Technologies and Circular Economy Strategies

Sampson has held various positions in Intertek Minerals across different parts of Africa and was the General Manger of the West/Central Africa region prior to his current role. With over a decade of experience in Geochemistry, his technical achievements include designing, commissioning and operating both commercial and on-site geo-chem laboratories. Under Sampson's leadership, the Minerals Ghana business transformed from a struggling operation in 2015 into one of the company's strongest performing businesses in the region. This growth-driven approach has since been replicated across West and Central Africa, with notable successes in Burkina Faso, Côte d'Ivoire, and Gabon, among others. With the move to SSA now, the passion, pace and precision with which he works has impacted East & southern Africa. Sampson is also a strong advocate for gender inclusion, having increased female participation in his teams by over 30% in the last 5 years. He is passionate about sustainability and actively supports community impact through corporate social responsibility initiatives. As a leader, Sampson is 100% dedicated to his core team, championing their growth, motivation and reward. He leaves no one behind. He is recognized for his strategic leadership, operational excellence and focus on sustainable growth.

Passion: Ensuring Africa stays a key business growth driver through relevant industry strategy, nurturing a high performing team, being a poster for exemplary leadership and good business practice and an employer of choice.

Dr. Jackson Adiyiah Nyantakyi

Regional Director of the Environmental Protection Agency, Ashanti

Talk Title: Policy, Regulation and Industry Practice in Mineral Waste Management

Dr. Jackson Adiyiah Nyantakyi is an Environmental Scientist and a researcher with over 29 publications in peer reviewed Journals. His research area is Environmental Toxicology. He hails from Mpobi in the Effigya Kwabre District South of the Ashanti Region. He is the Ashanti Regional Director of the Environmental Protection Authority

- He had his Secondary Education at Mim Senior High School
- Advanced Level Education at Prempeh College, Kumasi
- First Degree at Kwame Nkrumah University of Science and Technology, Kumasi
- Post Graduate Degree from China Agricultural University, Beijing, China
- Master's Degree from the Netherlands
- A Doctorate Degree in Environmental Science from Kwame Nkrumah University of Science and Technology, Kumasi

He is emotionally stable individual, and possesses strong Leadership skills, excellent communication and technological skills. He has strong analytical and critical thinking skills and passion for excellence. He is results oriented person who thrives in competitive and challenging working environments. He is a team player with strong interpersonal relationships and aspires to always brighten in the corner where he finds himself. Jackson has over 25 years experience in leadership. He is a transformational Leader who loves the Lord Jesus Christ and His work

He is a Member of the International Association of Impact Assessment (IAIA) and a staunch Methodist. He is the Vice Chairman of the Tano Basin Board of Water Resources Commission and a Part time Lecturer at the University of Energy and Natural Resources (UENR), Sunyani, Fiapre. He has attended many National and International Conferences Worldwide including Scotland, UK, USA, Canada, Europe etc.

He is married to Mrs. Vida Catherina Nyantakyi and they are blessed with 3 children: Namely: Elvis, Joshualyn and Estella. His hobbies are reading, writing, watching and playing Football. He is staunch supporter of Kumasi Asante Kotoko in Ghana, Chelsae Football club in EPL and Real Madrid Football Club in the LaLiga.

Innovative Pathways in Mineral Waste Valorization: Driving Scientific Discovery for Environmental and Economic Impact.

Technical Session Chairs

Dr. (Mrs.) Efiba Vidda Senkyire, Kwarteng

Dept. of Geomatic Engineering, KNUST

Dr. Efiba Vidda Senkyire Kwarteng is a Lecturer in the Department of Geomatic Engineering at KNUST, Ghana, and a specialist in Spatial Epidemiology, Geospatial Analytics, and Disease Distribution Modelling.

Her research focuses on leveraging geospatial technologies, spatial epidemiological methods, and environmental intelligence to address complex public health challenges, particularly the environmental and geographical drivers of infectious diseases. She has extensive experience in the application of Geographic Information Systems (GIS), Remote Sensing, spatial statistics, and predictive modelling to investigate disease transmission dynamics, healthcare accessibility, environmental exposures, and health inequalities.

Dr. Kwarteng's work spans neglected tropical diseases, environmental health, healthcare accessibility, and geospatial decision support systems. She has led and collaborated on multidisciplinary projects integrating geospatial, clinical, environmental, and molecular datasets to support evidence-based public health interventions.

Prior to joining academia, she worked in the mining industry across the West African sub-region, gaining extensive expertise in geospatial data acquisition, spatial analysis, and environmental assessment. She currently collaborates with national and international partners, including researchers from the University of Winnipeg, Canada, and Oregon State University, USA, on projects addressing geohealth, environmental sustainability, and disease surveillance.

At this conference, she serves as Technical Chair, bringing her expertise in geospatial science, spatial analytics, and interdisciplinary research to support scientific excellence and knowledge exchange.

Dr. Emmanuel Kwesi Arthur

Dept. of Materials and Metallurgical Engineering
KNUST

Dr. Arthur is a Materials Scientist and Engineer with extensive research experience in environmental remediation, materials selection, and industrial waste utilization. He holds a PhD in Materials Science and Engineering from the African University of Technology, Abuja (with a PhD exchange at Arizona State University, USA), and a BSc in Materials Engineering from KNUST, Ghana. Dr. Arthur has been actively teaching and researching in university environments. His work directly relevant to mineral waste management includes investigating hazardous cyanide contamination in soils and groundwater (a common issue in gold mining areas), as well as transforming industrial by-products like spent pot lining into porous electrode materials for supercapacitors – demonstrating a clear waste-to-resource approach.

Dr. Arthur's broader research spans mechanical metallurgy, surface engineering, and advanced nano/micro-mechanical characterization of metals, ceramics, and composites. He has collaborated internationally with metallurgy and chemical engineering scholars, and is proficient in advanced materials characterization techniques. His expertise offers practical insights into sustainable mineral waste management, tailings remediation, and resource recovery from mining-related wastes.

Dr. (Mrs.) Miriam Appiah Brempong

Dept. of Civil Engineering
KNUST

Dr. Mrs. Miriam Appiah-Brempong is a Lecturer at the Department of Civil Engineering at KNUST. She holds a PhD. in Environmental Sanitation and Waste Management. Being a Water and Sanitary Engineer, she has thirteen (13) years of experience in the Water, Sanitation and Hygiene (WASH) sector. Her research focuses on water quality monitoring, solid waste management as well as the development of adsorbents and filters for water and wastewater treatment. She has several publications in reputable peer-reviewed journals.

Dr. Appiah-Brempong undertakes consultancies in water quality analysis; training and capacity building in WASH related issues; WASH behavioural change and curriculum development. She has rendered services to a number organization and agencies including WaterAid Ghana, International Water Management Institute, Ghana Tertiary Education Commission, Kumasi Metropolitan Assembly, DANIDA and the French Embassy in Ghana.

She is currently the Deputy Postgraduate Coordinator at the Regional Water and Environmental Sanitation Centre, KNUST and a member of the African Membrane Society.

Dr. Henry Agbe

Dept. of Materials and Metallurgical Engineering
KNUST

Dr. Henry Agbe is a multidisciplinary Materials Engineering researcher at the Department of Materials and Metallurgical Engineering, KNUST, Ghana. He is widely recognized for his contributions to innovative and applied research across the Biomedical, Environmental, and Water purification domains. His work is driven by a strong commitment to developing Advanced Material-based solutions to contemporary global challenges, with particular emphasis on Sustainability, Functionality, and Technological impact.

Dr. Agbe's research expertise encompasses Antimicrobial Biomaterials Engineering, where he designs and develops Advanced Materials capable of preventing or eliminating microbial contamination. He also conducts research in Mechanobiology and Three-Dimensional (3D) Scaffold Engineering, focusing on understanding and optimizing material–cell interactions to enhance tissue regeneration outcomes. In addition, he is actively engaged in 3D printing technologies, where he develops and fabricates functional biodegradable scaffolds for applications in Regenerative Medicine.

Furthermore, Dr. Agbe's work extends to bioleaching and bioflotation, where he integrates principles of Microbiology and Materials Science to develop environmentally sustainable and efficient approaches for metal recovery and the valorization of mineral waste.

Dr. (Mrs.) Mizpah Ama Dziedzorm Rockson

Dept. of Chemical Engineering
KNUST

Ing. Dr. Mizpah Ama Dziedzorm Rockson is a senior lecturer at the Department of Chemical Engineering, KNUST, Kumasi. She holds BSc. and PhD in Chemical Engineering, and MEd. in Higher Education Pedagogy all from the KNUST.

She is a fellow of the Brew-Hammond Energy Center, KNUST and a Certified Master Trainer in disability inclusion in higher education institutions. She is an active researcher in municipal solid waste management, recycling, waste-to-energy systems, environment and sustainability, and process development and plant design for the conversion of local raw materials into useful products, with a strong record of peer-reviewed publications and contributions to multidisciplinary research projects.

She has supervised and assessed several undergraduate and postgraduate students for over 15 years. She is a member of Ghana Institution of Engineering (GhIE) and Ghana Science Association (GSA).

Dr. (Mrs.) Emmanuela Kwao-Boateng

Dept. of Chemical Engineering, KNUST

Dr. (Mrs.) Emmanuela Kwao-Boateng is a self-motivating young Chemical/ Petrochemical Engineer who aspires to positively impart the lives of the many people she encounters.

She holds a BSc. in Chemical Engineering from KNUST. After National Service, she had Lukoil Overseas Scholarship through the Ministry of Energy to pursue a Postgraduate degree in Chemical Engineering at the Gubkin Russian State University of Oil and Gas, Moscow – Russia, and graduated with specialty in the Technology of Petroleum Refining. She holds PhD Chemical Engineering at KNUST with a research focus on using microorganisms to reduce high sulphur content of crude oil and diesel fuel to obtain low and ultra-low sulphur levels. She also has Master of Education in Higher Education Pedagogy.

She is currently lecturing in both the Chemical and Petrochemical programmes at the KNUST Department of Chemical Engineering. She is passionate about bringing out not just brilliant engineers but also diligent and committed engineers who have a high sense of integrity. She focuses on building the content of students through her commitment, integrity and professionalism.

She is a corporate member of the Ghana Institution of Engineers (GHIE) and is the current patron of the Women in Engineering (WinE), KNUST Chapter and the Ashanti Regional Branch Coordinator for Women in Engineering. Mentoring students is her passion and she hopes to be an icon to female student engineers. Her values are to excel in all endeavours by improving herself to be better at whatever she does.

Invited Guests

Provosts

Prof. Dadson Awunyo-Vitor	*College of Agriculture and Natural Resources*
Prof. Philip Antwi-Agyei	*College of Science*
Prof. Christian Agyare	*College of Health Science*
Prof. Charles Ofosu Marfo	*College of Humanitites and Social Science*
Prof. Christian Koranteng	*College of Art and Built*

Industries

- Mining Process and Project Engineering (MPPE)
- Intertek Minerals Limited
- Environmental Protection Agency (EPA)
- SGS
- Australian Laboratory Services (ALS)
- Imperial College of Mines and Safety

Organizations

- Organization for Women in Science for the Developing World (OWSD Global)
- Organization for Women in Science for the Developing World (OWSD Ghana)
- Ladies in Mining and Allied Professions in Ghana (LiMAP-GH)
- Women in Mining (WiM)
- Ghana Institution of Engineerig (GhIE)
- Women in Engineering (WINE)
- Women in Science Technology Engineering and Mathematics (WISTEM)
- The Brew Hammond Energy Center (TBHEC)

Schools

- Otumfuo Osei Tutu II Technical Institute
- St. Louis Senior High School
- KNUST Senior High School
- Kumasi Senior High School

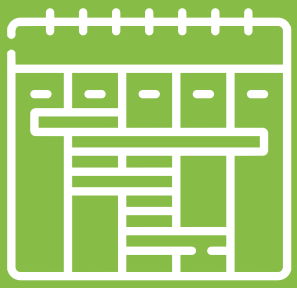
Programme Outline

JUST KNUST

Moderator: Prof. Kwadwo Mensah-Darkwa

Time	Session
08:30am	**Arrival and Registration**
09:00am	**Opening Prayer** Dr. Henry Agbe
09:05am	**Singing of the National Anthem**
09:10am	**Introduction of Dignitaries** Moderator —- Prof. Kwadwo Mensah Darkwa
09:20am	**Welcome and Opening Address** Conference Chair — Prof. Kwabena Biritwum Nyarko
09:35am	**Keynote Address 1** Mr. Sampson Gyasi Koduah Business Line Leader, Minerals Sub-Saharan Africa Topic: Waste Valorization Technologies and Circular Economy Strategies
10:05am	**Poetry Recitals** St. Louis Senior High School
10:10am	**Keynote Address 2** Dr. Jackson Adiyiah Nyantakyi Ashanti Regional Director, EPA Topic: Policy, Regulation and Industry Practice in Mineral Waste Management
10:40am	**OWSD Documentary Show**
10:50am	**Keynote Address 3** Dr. Mrs. Bennetta Koomson OWSD Fellow 2023 Topic: Urban Mining: The Needful Strategy for Sustainable Metal Recovery

Time	Session
11:20am	**Morning Refreshments + Poster Viewing & Exhibition**
12:05pm	**Panel Discussion** Panelist: »» SGS »» Intertek »» ALS »» EPA »» ICMS Theme: Valorizing Mineral Waste through Engineering Innovations and Policy Advocacy
1:00pm	**Technical Breakout Sessions** **Room A** T1: Characterization & Processing of Mineral and Industrial Waste T4: Policy & Regulatory Frameworks for Mineral Waste Management in Industry **Room B** T2: Environmental Impact, Remediation & Sustainable Management of Mineral Waste **Room C** T3: Waste Valorization Technologies & Circular Economy Strategies
3:00pm	**Closing Ceremony & Awards** Messages from Sponsors & Organizations (2 minutes each) »» Intertek »» MPPE »» WISTEM »» WiM »» TBHEC »» ALS »» ICMS »» GhIE »» LiMAP-GH »» SGS »» OWSD GH »» EPA »» WINE Presentation of Awards and Certificates Closing Remarks — Prof. Kwabena Biritwum Nyarko
3:45pm	**Singing of "Yen Ara Asaase Ni"**
3:50pm	**Closing Prayer** Dr. Henry Agbe
3:55pm	**Group Photography & Lunch**



Oral Presentations Schedule

Room A

Theme 1: Characterization and Processing of Mineral and Industrial Waste

Theme 4: Policy and Regulatory Frameworks for Mineral Waste Management in Industry

Technical Chairs:
Dr. Efiba Vidda Senkyire Kwarteng
Dr. Emmanuel Kwesi Arthur

Rapporteur:
Mrs. Elizabeth Henewaa Akoto

Paper ID	Presentation Title	Presenting Author
MWV-020	Python-Based Process Modelling and Optimization of Pyrolysis Valorization of Palm Kernel Shells and Empty Fruit Bunches for Biochar Production	Turkson Jesse Takyi
MWV-023	Suitability of Charred Corn Cob and its Blends with End-of-Life HDPE as Reductants for Iron and Steelmaking Technologies	Prof. James Ransford Dankwah
MWV-025	Electrowinning of Metallic Iron from Non-Circulated Sulphate Electrolyte using Graphite Rods Recovered from Spent Zinc Carbon Batteries as Electrodes	Prof. James Ransford Dankwah
MWV-032	Synthesis and Characterization of Perovskite nanocrystals using lead from spent cupels	Lilian Akpene Diaba

Room B

Theme 2: Environmental Impact, Remediation and Sustainable Management of Mineral Waste

Technical Chairs:
Dr. Miriam Appiah-Brempong
Dr. Henry Agbe

Rapporteur:
Mr. Daniel Ocloo

Paper ID	Presentation Title	Presenting Author
MWV-022	Characterization of Physicochemical Properties and Environmental Risk Assessment of Mined Tailings: A Case Study for Sustainable Waste Management	George Dzidefo Torku
MWV-024	Synthesis and Characterization of Kaolin-Biochar Composites from Agricultural Waste for Environmental Remediation	John Boateng Nkansah
MWV-027	Response Surface Optimization and Kinetics Studies of Lead Leaching from Fire Assay Slag with Acetic Acid	Vincent Appiah
MWV-034	Valorization of Granite Quarry Dust as Mineral Filler in Portland Cement: Mechanical Performance and Durability Assessment	Delali Adjei

Room C

Theme 3: Waste Valorization Technologies & Circular Economy Strategies

Technical Chair:
Dr. Mizpah Ama Dziedzorm Rockson
Dr. Emmanuela Kwao-Boateng

Rapporteur:
Mr. Richmond Donkor

Paper ID	Presentation Title	Presenting Author
MWV-017	Bio-Based Facade Composites from Agro-Industrial and Textile Fibre Waste: A Scoping Review	Margaret Baamah Patterson
MWV-026	Utilisation of End-of-Life Plastics as Reductant for the Production of Metallic Copper from Tenorite (CuO) Ore	Jessica Dankwah
MWV-029	Nanofiltration-Based Treatment of Mine Water: Lessons from Germany and South Africa under the MAMDIWAS Project	Hasan Idrees
MWV-035	Europe's Thirst for Activated Carbon and A Potential Answer? Dual-Use Adsorbents from Drinking Water Treatment Sludge	Lucas Landwehrkamp

Poster Presentations

The poster viewing session is scheduled from 11:20am to 12:05pm. All presenters are expected to be present at their posters throughout the viewing period.

Poster ID	Title	Lead Author
MWV-009	Strengthening Policy and Regulatory Frameworks for Sustainable Mineral Waste Management in Industry	Bright Amankwah Wilson
MWV-015	Recovery of Potassium from Spent Alkaline Batteries Using Water	Dr. Bennetta Koomson
MWV-017	Bio-Based Facade Composites from Agro-Industrial and Textile Fibre Waste: A Scoping Review	Margaret Baamah Patterson
MWV-018	Bridging the Remediation Gap: A Comparative Analysis and Strategic Roadmap for Mineral Waste Valorization in Nigeria through Phytoremediation	Okesola Abayomi Adeyemo
MWV-019	Regeneration of Spent Bleaching Earth: Optimization and Reusability Studies	Gideon Owusu
MWV-020	Python-Based Process Modelling and Optimization of Pyrolysis Valorization of Palm Kernel Shells and Empty Fruit Bunches for Biochar Production	Turkson Jesse Takyi
MWV-022	Characterization of Physicochemical Properties and Environmental Risk Assessment of Mined Tailings: A Case Study for Sustainable Waste Management	George Dzidefo Torku
MWV-023	Suitability of Charred Corn Cob and its Blends with End-of-Life HDPE as Reductants for Iron and Steelmaking Technologies	Prof. James Ransford Dankwah

Poster ID	Title	Lead Author
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MWV-025	Electrowinning of Metallic Iron from Non-Circulated Sulphate Electrolyte using Graphite Rods Recovered from Spent Zinc Carbon Batteries as Electrodes	Prof. James Ransford Dankwah
MWV-026	Utilisation of End-of-Life Plastics as Reductant for the Production of Metallic Copper from Tenorite (CuO) Ore	Jessica Dankwah
MWV-027	Response Surface Optimization and Kinetics Studies of Lead Leaching from Fire Assay Slag with Acetic Acid	Vincent Appiah
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MWV-031	Vegetation-Based Valorization of Degraded Mine Soils: A Density-Optimized Mucuna Pruriens Approach for Sustainable Mineral Waste Remediation	Priscilla Badaweh Coffie
MWV-032	Synthesis and Characterization of Perovskite nanocrystals using lead from spent cupels	Lilian Akpene Diaba

Poster ID	Title	Lead Author
MWV-033	Sustainable Reuse of Heap Leach Mine Waste as Construction Material	Kwabena Boakye
MWV-034	Valorization of Granite Quarry Dust as Mineral Filler in Portland Cement: Mechanical Performance and Durability Assessment	Delali Adjei
MWV-035	Europe's Thirst for Activated Carbon and A Potential Answer? Dual-Use Adsorbents from Drinking Water Treatment Sludge	Lucas Landwehrkamp
MWV-036	Sustainable Ternary Binders: Evaluating the Performance of Low-Grade Kaolinitic Clay in Limestone Calcined Clay Cement (LC3)	Lord Addo Hanson

Technical Abstracts

The following abstracts have been reviewed and accepted for presentation at MWVRC 2026.

STRENGTHENING POLICY AND REGULATORY FRAMEWORKS FOR SUSTAINABLE MINERAL WASTE MANAGEMENT IN INDUSTRY

MWV-009

https://dx.doi.org/10.4314/just.v44i2.1s

Bright Amankwah Wilson

Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

Abstract

Mineral waste management is a key concern of the mining industry and remains an important challenge for developing economies. This study reviews existing policy and regulatory frameworks that govern mineral waste; identifies gaps with a focus on implementation efforts; and recommends pathways to enhance sustainable practices throughout the industry. A mixed-methods approach was used, combining a review of national and international regulatory instruments with case studies from selected mining operations. The assessment included the participation of key stakeholders such as industry professionals and regulatory bodies to interpret levels of compliance and enforcement issues. Findings show comprehensive policies are in place but are ineffective due to insufficient monitoring systems, weak technical capacity, and poor institutional coordination. The study highlights the need for improved regulatory enforcement, stronger institutional capacity, and the incorporation of sustainable waste management solutions in policy frameworks. It further recommends incorporating clear compliance mechanisms, periodic reviews of policy positioning, and greater accountability for the industry.

Keywords: Mineral waste management, regulatory frameworks, sustainable mining, tailings management, environmental impacts.

RECOVERY OF POTASSIUM FROM SPENT ALKALINE BATTERIES USING WATER

MWV-015

https://dx.doi.org/10.4314/just.v44i2.2s

Bennetta Koomson, Abubakar Osafo Kantanka, Prince Owusu

Department of Materials and Metallurgical Engineering, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

Abstract

Potassium recovery from spent alkaline battery (SAB) black mass is rarely pursued as an independent process objective, despite its occurrence as highly soluble KCl phases thermodynamically distinct from the refractory MnO_2 and ZnO matrix. In this work, we propose a selective aqueous leaching process for potassium recovery from SAB black mass using water as the only leaching agent at ambient conditions. The phase selectivity basis for the process was confirmed by physicochemical characterization using XRF, XRD, SEM–EDX and ATR-FTIR. The optimization of leaching time and solid-to-liquid ratio was carried out using Response Surface Methodology (RSM) based on Central Composite Design (CCD), which resulted in optimum conditions of 60.75 min and 0.311 g mL^{-1} with a predicted potassium concentration of 11,024 mg/L. The potassium-rich leachate was then precipitated with NH_4Cl and crystallized with ethanol as antisolvent to yield high-purity KCl (K: 52.4 wt.%, Cl: 47.6 wt.%), which represents a clean and resource-efficient route for valorization of potassium from battery waste.

Keywords: Leaching, hydrometallurgy, Spent Alkaline Battery, water.

BIO-BASED FACADE COMPOSITES FROM AGRO-INDUSTRIAL AND TEXTILE FIBRE WASTE: A SCOPING REVIEW

MWV-017

https://dx.doi.org/10.4314/just.v44i2.3s

Margaret Baamah Patterson[1], Alexander Boakye Marful[1], Moritz Dörstelmann[2], Isaac Egyir Kwofie[1]

[1]College of Art and Built Environment, Department of Architecture, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

[2]Digital Design and Fabrication, Karlsruhe Institute of Technology, Karlsruhe, Germany

Abstract

The construction industry faces increasing pressure to adopt sustainable materials that reduce carbon footprints and utilize waste streams. This scoping review synthesizes global literature on the development of bio-based facade composites derived from agro-industrial and textile fibre waste, with a focus on material performance, processing methods, and environmental benefits. Agro-industrial residues such as coir, jute, sisal, bagasse, and rice husks, combined with recycled textile fibres, have been demonstrated as viable reinforcements in polymer and cement-based matrices for facade applications. Key performance parameters reviewed include tensile and flexural strength, thermal insulation, moisture resistance, fire retardancy, and durability under UV exposure. The review identifies research gaps in the standardization of bio-composite testing protocols for tropical climates and recommends pathways for the industrialization of these materials in the West African construction sector.

Keywords: Mineral waste valorisation, bio-based composites, facade cladding, agro industrial waste, hot humid climate.

BRIDGING THE REMEDIATION GAP: A COMPARATIVE ANALYSIS AND STRATEGIC ROADMAP FOR MINERAL WASTE VALORIZATION IN NIGERIA THROUGH PHYTOREMEDIATION

MWV-018

https://dx.doi.org/10.4314/just.v44i2.4s

Abayomi A. Okesola; Folashade T. Folaranmi

National Agency for Science and Engineering Infrastructure (NASENI), Abuja, Nigeria

Abstract

In Nigeria, the escalation of both industrial and artisanal mining has led to pronounced land degradation and the accumulation of heavy metals in soils and surrounding ecosystems. Contamination hotspots have been repeatedly reported on the Jos Plateau and in the Zamfara region, where mining and ore processing activities have continuously led to environmental degradation, posing serious public-health and livelihood risks to nearby communities. This paper conducts a systematic meta-analysis of extant soil contamination datasets, appraising phytoremediation as a sustainable approach for mineral-waste valorization. Findings synthesized from existing literature indicate that indigenous hyper-accumulators can achieve significant toxicity reduction while providing pathways for a circular economy through bio-ore recovery. The analysis draws comparisons between Nigerian mining realities and intervention frameworks documented in South Africa. Building on these cross-country insights, the study proposes a strategic roadmap to integrate biological remediation within national policy, supporting both environmental recovery and resource valorization.

Keywords: Mining, valorization, phytoremediation, mineral-waste, contamination.

REGENERATION OF SPENT BLEACHING EARTH: OPTIMIZATION AND REUSABILITY STUDIES

MWV-019

https://dx.doi.org/10.4314/just.v44i2.5s

Gideon Owusu, Godfred Ohemeng-Boahen, Jude Kwaku Bonsu, Patrick Boakye

Department of Chemical Engineering, Kwame Nkrumah University of Science and Technology

Abstract

Spent bleaching earth (SBE) generated from edible oil refining is classified as hazardous waste due to its residual oil content and adsorbed impurities, yet it retains significant adsorptive capacity. This study investigates thermal and solvent-based regeneration methods to restore the adsorptive performance of SBE and extend its service life. SBE samples were characterized before and after regeneration using BET surface area analysis, thermogravimetric analysis (TGA), FTIR, and SEM. Regeneration efficiency was assessed by measuring re-adsorption performance against a standard chlorophyll solution. Results show that thermal regeneration at 350°C under controlled atmosphere restores 80–90% of original adsorptive capacity, while solvent washing followed by mild thermal treatment achieves comparable results at lower energy cost. Multiple regeneration cycles were evaluated, confirming that SBE can be reused at least five times without significant performance loss, offering substantial cost and environmental benefits for edible oil refiners.

Keywords: Spent bleaching earth, optimization, solvent extraction, regeneration, acid activation, residual oil recovery.

PYTHON-BASED PROCESS MODELLING AND OPTIMIZATION OF PYROLYSIS VALORIZATION OF PALM KERNEL SHELLS AND EMPTY FRUIT BUNCHES FOR BIOCHAR PRODUCTION

MWV-020

https://dx.doi.org/10.4314/just.v44i2.6s

Jesse T. Turkson, Perfect M. Keti

Department of Chemical Engineering, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

Abstract

The valorization of palm oil processing residues — particularly palm kernel shells (PKS) and empty fruit bunches (EFB) — through pyrolysis offers a dual benefit of waste reduction and bioenergy/biochar production. This study develops a Python-based process model to simulate and optimize the pyrolysis of PKS and EFB under varying temperature profiles (350–700°C), residence times, and heating rates. The model integrates kinetic data derived from TGA experiments with mass and energy balance calculations to predict biochar yield, calorific value, and carbon content as functions of process parameters. Sensitivity analysis identifies temperature and feedstock moisture content as the dominant variables affecting biochar quality. Model-predicted optima were validated experimentally, showing close agreement (less than 5% deviation). The biochar produced at optimized conditions met ASTM standards for soil amendment applications. This computational tool provides a scalable framework for pyrolysis process design applicable to other agro-industrial residues.

Keywords: Pyrolysis, palm kernel shells (PKS), empty fruit bunches (EFB), fresh fruit bunches (FFB), process optimization, circular economy.

CHARACTERIZATION OF PHYSICOCHEMICAL PROPERTIES AND ENVIRONMENTAL RISK ASSESSMENT OF MINED TAILINGS: A CASE STUDY FOR SUSTAINABLE WASTE MANAGEMENT

MWV-022

https://dx.doi.org/10.4314/just.v44i2.7s

GEORGE DZIDEFO TORKU

Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

Abstract

Mine tailings constitute the largest waste stream in the mining industry and present significant environmental and public health challenges, particularly in gold-producing regions such as Ghana. This study investigates the physicochemical properties and environmental risk of tailings from Asante Gold Bibiani Limited (AGBL) to support sustainable waste management and valorization strategies. A multi-analytical approach was employed, including X-ray fluorescence (XRF), X-ray diffraction (XRD), inductively coupled plasma mass spectrometry (ICP-MS), and acid-base accounting (ABA) to characterize elemental composition, mineralogy, and acid generation potential. Environmental risk was evaluated using Ecological Risk Assessment (ERA) and Human Health Risk Assessment (HHRA) models based on measured contaminant concentrations in tailings-associated water systems. Results reveal elevated levels of cyanide, arsenic, and iron, with notable temporal and spatial variability. Ecological risk assessment identified cyanide (RQ > 1) and copper (RQ > 1) as major drivers of acute toxicity to aquatic systems. Although non-carcinogenic risks remained within acceptable limits (HI < 1), carcinogenic risk exceeded international thresholds (TCR > 10-6), primarily due to arsenic exposure. The study advocates for risk-based, data-driven management approaches and proposes engineering and nature-based solutions alongside circular economy strategies to transform mine waste into valuable resources.

Keywords: Mined tailing, Human Health Risk Assessment (HHRA), Ecological Risk Assessment (ERA)

SUITABILITY OF CHARRED CORN COB AND ITS BLENDS WITH END-OF-LIFE HIGH DENSITY POLYETHYLENE AS REDUCTANTS FOR IRON AND STEELMAKING TECHNOLOGIES

MWV-023

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James R. Dankwah, Richlove Forson

Department of Minerals Engineering, University of Mines and Technology, Tarkwa, Ghana

Abstract

The Government of Ghana proposed a bill in 2019 for establishing an integrated Iron and Steel Corporation, aimed at exploiting the country's commercial iron ore resources for job creation. In this work, the potential for using waste materials as feedstock in the production of high-grade iron nuggets from the Pudo iron ore in the Upper East Region of Ghana is investigated. Carbonaceous materials generated from charred corn cob (CCC) and its blends with end-of-life high density polyethylene (HDPE) were used as reductants. Corn cob was charred and pulverised in a laboratory ball mill to -106 µm, followed by mixing with pulverised HDPE samples. The generated carbonaceous materials were characterised by XRD, SEM/EDS and FTIR analyses. Reduction studies were conducted on composite pellets of the ore in a domestic microwave oven (AKAI brand, 2400 MW, 2.45 GHz). It was observed that iron nuggets can be produced from the Pudo iron ore using CCC, HDPE and their blends. The measured extent of reduction was up to 98.7%, attained for a CCC-HDPE blend ratio of 2:3, providing a sustainable and locally sourced path for iron nugget production aligned with Ghana's industrial development goals.

Keywords: Reduction, Pudo Iron Ore, charred corn cob, high density polyethylene, extent of reduction.

SYNTHESIS AND CHARACTERIZATION OF KAOLIN-BIOCHAR COMPOSITES FROM AGRICULTURAL WASTE FOR ENVIRONMENTAL REMEDIATION

MWV-024

https://dx.doi.org/10.4314/just.v44i2.9s

John B. Nkansah[1], Eugene Appiah-Effah[1], Patrick Boakye[2], Michael Owusu[1]

[1]Regional Water and Environmental Sanitation Centre, Kumasi (RWESCK), Department of Civil Engineering, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

[2]Department of Chemical Engineering, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

Abstract

The rising demand for environmentally friendly and economically viable adsorbents has increased interest in the valorization of waste-derived materials. A low-cost kaolin-biochar composite adsorbent was successfully developed by distributing clay particles on the carbon surfaces within the biochar matrix. Two locally sourced agricultural residues were pretreated with wet-beneficiated kaolin suspensions and subsequently pyrolyzed at 500 and 600°C for 2 hours under a nitrogen atmosphere. Scanning Electron Microscopy (SEM), FTIR, and XRD analyses confirmed the successful incorporation and uniform distribution of clay particles within the biochar matrix. XRD results further indicated that the purity of kaolin increased from 55% to 87%, while its surface area increased by over 200% following wet beneficiation. Modified clay-biochar composites showed higher surface area, proximate, and ultimate characteristics compared to unmodified biochar. The findings indicate that modified biochar prepared from clay and biochar is a promising adsorbent with significant potential for the removal of heavy metals from aqueous solutions.

Keywords: Kaolin, biomass, clay-biochar composite, pyrolysis, circular economy.

ELECTROWINNING OF METALLIC IRON FROM NON-CIRCULATED SULPHATE ELECTROLYTE USING GRAPHITE RODS RECOVERED FROM SPENT ZINC CARBON BATTERIES AS ELECTRODES

MWV-025

https://dx.doi.org/10.4314/just.v44i2.10s

James R. Dankwah, Alfred A. Amesimeku, Wisdom W. Sejarah, Esther Coleman, Sarah Cobbina

Department of Minerals Engineering, University of Mines and Technology, Tarkwa, Ghana

Abstract

The electrowinning of metallic iron from non-circulated aqueous iron (II) sulphate electrolytic bath was investigated using cylindrical graphite rods recovered from spent zinc carbon batteries as electrodes. The effects of current density, temperature, concentration of Fe2+ ions in the electrolyte, and inorganic additives (ammonium sulphate and sodium sulphate) on product quality, current efficiency, and specific energy consumption were investigated at voltages ranging from 2.8 to 3.0 V and Fe2+ ion concentrations of 20, 40, and 60 g/L. Results indicated that graphite rods recovered from spent zinc carbon batteries function effectively as electrodes even at room temperatures. Increasing the current density resulted in increased current efficiency, increased energy consumption, and deterioration in product quality evidenced by dendritic cathode deposits. Current efficiency increased with increasing Fe2+ concentration. Incorporation of inorganic additives improved product quality for both ammonium sulphate and sodium sulphate. Increasing the temperature from room temperature to approximately 40°C significantly improved current efficiency; however, deterioration was observed above 40°C due to a sharp increase in the hydrogen emission reaction (HER) at the cathode.

Keywords: Electrowinning, current density, current efficiency, specific energy consumption, inorganic additives.

UTILISATION OF END-OF-LIFE PLASTICS AS REDUCTANT FOR THE PRODUCTION OF METALLIC COPPER FROM TENORITE (CuO) ORE

MWV-026

https://dx.doi.org/10.4314/just.v44i2.11s

Jessica Dankwah, Wilfred Barnes, James R. Dankwah

Department of Minerals Engineering, University of Mines and Technology, Tarkwa, Ghana

Abstract

The production of metallic copper from Tenorite (CuO) ore using carbonaceous material generated from end-of-life high density polyethylene (HDPE) has been investigated through experiments conducted in a domestic microwave oven and a laboratory-scale horizontal tube furnace (HTF) coupled with an infrared (IR) gas analyser. Composite pellets of reagent-grade Tenorite ore with HDPE at carbon-oxygen ratios of 1.5, 2.0 and 2.5 were irradiated in a domestic microwave oven (AKAI brand, 700 watts and 2.5 GHz frequency) for 10 minutes. Reaction products were submitted for SEM/EDS analyses. Cylindrical pellets of the mixture were also rapidly heated at 1100°C under pure argon gas, and off-gas was continuously measured by an online infrared gas analyser for CO and CO2. The rate and extent of reduction of CuO are highest at a C/O ratio of 2.0. Results from microwave irradiation confirm that CuO-HDPE blends can absorb sufficient microwave radiation for nearly complete reduction of CuO to Cu, evidenced by numerous spherical copper particles in the reduced pellet. This work demonstrates that waste plastics can serve as effective industrial reductants for copper ore processing.

Keywords: End-of-Life Plastics, Tenorite ore, CuO, Extent of reduction, C/O ratio.

RESPONSE SURFACE OPTIMIZATION AND KINETICS STUDIES OF LEAD LEACHING FROM FIRE ASSAY SLAG WITH ACETIC ACID

MWV-027

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Vincent Appiah[1], Bennetta Koomson[1], Lahoucine Atourki[2]

[1]Department of Materials and Metallurgical Engineering, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

[2]Department of Physics at Mohammed V University, Morocco

Abstract

This work studies lead recovery from fire assay slag using acetic acid as a green lixiviant through process optimization and kinetic analysis. The slag was highly amorphous and predominantly aluminosilicate, with approximately 9 wt.% PbO. Response surface methodology with a central composite design was applied to investigate the effects of lixiviant concentration (0.5–2.5 mol/L), leaching time (60–240 minutes), and solid-to-liquid ratio (100–200 g/L) on lead leaching efficiency. The developed quadratic model was statistically significant and accurately predicted experimental responses. Optimal conditions of 2.1 mol/L acetic acid, 96 minutes, and 120 g/L solid-to-liquid ratio yielded 73.40% lead recovery. Kinetic evaluation using shrinking core models indicated that porous product layer diffusion control is the dominant rate-controlling step under the studied conditions. This work advances previous studies by integrating statistical optimization and kinetics studies for acetic-acid-based lead leaching from fire assay slag, providing a reliable approach for sustainable use of slag.

Keywords: Fire assay slag, leaching, Acetic Acid, Response Surface Methodology.

GOLD, GOVERNANCE, AND ILLEGALITY: RETHINKING THE HISTORICAL FOUNDATIONS OF ENVIRONMENTAL CRIME IN GHANA

MWV-021

https://dx.doi.org/10.4314/just.v44i2.13s

Michael Olawale

Department of History and Political Studies, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

Abstract

Between 1870 and 1900, British colonial authorities expanded mining in Ghana to meet rising global demand for minerals. This expansion introduced mechanised technologies that displaced indigenous mining systems and reorganised local economies around extractive production. While economically driven, these policies produced severe environmental consequences, including the release of toxic effluents into rivers and farmlands. Mining communities bore these costs, as colonial responses remained limited and prioritised short-term economic gains over long-term environmental sustainability. This paper situates contemporary environmental crime and mineral exploitation in Ghana within this historical trajectory. Drawing on a colonial political economy framework, it examines how early mining policies institutionalised patterns of environmental degradation, weak regulation, and uneven power relations. Focusing on a critical juncture in colonial mining governance, the study analyses how policy choices reshaped interactions among the state, local communities, and external economic actors, laying the foundations for enduring governance challenges. By tracing these evolving dynamics, the paper offers a historically grounded explanation for persistent environmental and resource management problems in Ghana. It argues that present-day environmental crimes are not merely regulatory failures but are embedded in inherited extractive structures with both local and global implications. This perspective contributes to broader debates on resource governance, sustainability, and the political economy of extraction in Africa.

Keywords: Environmental crime, mining, mineral waste.

NANOFILTRATION-BASED TREATMENT OF MINE WATER: LESSONS FROM GERMANY AND SOUTH AFRICA UNDER THE MAMDIWAS PROJECT

MWV-029

https://dx.doi.org/10.4314/just.v44i2.14s

Hasan Idrees

Department of Mechanical Process Engineering and Water Technology, University of Duisburg-Essen, Germany

Abstract:

Mining-influenced water (MIW), particularly acid mine drainage, presents significant environmental and economic challenges in mining and post-mining regions. The MAMDIWAS project addresses these issues through the application of innovative treatment technologies, with a strong focus on nanofiltration (NF) membranes as an efficient solution for water purification and resource recovery. This study primarily focuses on case studies in South Africa, where MIW is a critical concern, while also exploring the transferability of the developed approaches to other contexts, particularly Ghana. Nanofiltration offers a selective and energy-efficient method for removing dissolved contaminants such as heavy metals and sulfates, while enabling water reuse. Within MAMDIWAS, NF membrane systems are developed and optimized to enhance performance under challenging MIW conditions. Key aspects include mitigating membrane fouling and scaling, as well as designing suitable pre-treatment strategies to improve long-term operation. In addition to water treatment, the project investigates the potential for recovering valuable materials from MIW streams, contributing to circular economy principles. The technological work is embedded within a broader framework of Integrated Water Resources Management (IWRM), including stakeholder engagement, governance considerations, and capacity building. First results demonstrate the effectiveness of NF-based systems in improving water quality and enabling resource recovery. At the same time, similarities in mining-related challenges highlight strong potential for transferring these solutions to countries such as Ghana. Overall, MAMDIWAS provides a scalable and adaptable framework for sustainable MIW management across different regional contexts.

Keywords: Mining-Influenced Water, Nanofiltration Membranes, Resource Recovery.

VEGETATION-BASED VALORIZATION OF DEGRADED MINE SOILS: A DENSITY-OPTIMIZED MUCUNA PRURIENS APPROACH FOR SUSTAINABLE MINERAL WASTE REMEDIATION

MWV-031

https://dx.doi.org/10.4314/just.v44i2.15s

Priscilla Badaweh Coffie

University of Energy and Natural Resources, Sunyani, Ghana

Abstract:

Mineral waste generated from artisanal and small-scale mining presents a major environmental challenge across sub-Saharan Africa, often resulting in degraded soils with low fertility and elevated concentrations of potentially toxic elements. Developing cost-effective and scalable strategies for transforming such waste into functional substrates is critical for sustainable land management. This study evaluates the potential of Mucuna pruriens as a biological tool for the valorization of degraded mine soils through density-optimized remediation. The study was conducted on an abandoned mined site characterized by strong acidity (pH 4.95), low available phosphorus (5.24 mg kg^{-1}), low total nitrogen (0.05%), and very low organic carbon (0.09%), alongside elevated exchangeable aluminium (0.97 cmolc kg^{-1}). A randomized complete block design with five planting density treatments (T1–T5) was implemented over two cropping cycles. Significant improvements ($P \leq 0.05$) in soil properties were observed. Soil pH increased by 10–15%, while exchangeable aluminium and hydrogen decreased by up to 30% and 25%, respectively. Nutrient recovery was substantial, with available phosphorus increasing to moderate levels, total nitrogen increasing by 80–200%, and organic carbon improving by up to 70%. Concurrently, trace and potentially toxic elements declined significantly across treatments. Arsenic and cadmium decreased by 20–36% and 25–35%, respectively, with consistent reductions in lead and mercury. Moderate to wider planting densities (T3–T5) achieved the greatest improvements. The findings demonstrate that Mucuna pruriens can effectively transform degraded mine soils into more functional substrates, providing a low-cost and scalable pathway for sustainable mineral waste remediation and land reuse.

Keywords: Mine Soil Remediation, Mucuna pruriens, Mineral Waste Valorization.

SYNTHESIS AND CHARACTERIZATION OF PEROVSKITE NANOCRYSTALS USING LEAD FROM SPENT CUPELS

MWV-032

https://dx.doi.org/10.4314/just.v44i2.16s

Lilian Akpene Diaba, Bennetta Koomson, Kwadwo Mensah Darkwa

Department of Materials Engineering, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

Abstract:

Lead halide perovskites have attracted wide interests for their excellent optoelectronic properties in solar cells and light-emitting devices. However, their synthesis commonly depends on high-purity commercial lead salts, which are costly and raise environmental concerns associated with lead mining and processing. Meanwhile, spent fire assay cupels produced from fire assay contains high amount of lead oxide and is regarded as dangerous waste, which can cause environmental pollution. Here, a sustainable waste to resource strategy was designed for the recovery of lead from the spent fire assay cupels to prepare lead halide perovskites. XRF and XRD revealed that spent fire assay cupels contain 45.1 wt.% of PbO and lead exists as litharge and massicot phase. The lead recovery from the cupels was done via leaching using 4 M acetic acid at solid/liquid ratio of 1:4 with an 88% recovery. The recovered lead was precipitated as PbCO3 and calcined at high temperature into PbO. The obtained lead precursor then used with Cs2CO3 and methanol as solvent in a ligand-free, room-temperature solvent evaporation technique for the preparation of perovskite nanocrystals. XRD revealed that the perovskites synthesized using commercial PbBr produced CsPbBr3 and Cs4PbBr6 phases, while the derived lead precursor gives the multi-phase composite including CaTiO3, MgSiO3 and Cs4PbBr6 perovskite structures. Bright green fluorescence is emitted when UV light is irradiated to the material. This research demonstrates that the hazardous waste cupels can be recycled as the secondary lead resource to prepare the perovskite nanocrystals.

Keywords: Perovskite nanocrystals, spent cupels, lead, acetic acid leaching.

SUSTAINABLE REUSE OF HEAP LEACH MINE WASTE AS CONSTRUCTION MATERIAL

MWV-033

https://dx.doi.org/10.4314/just.v44i2.17s

Kwabena Boakye, Delali Adjei, Samuel Obiri, Mawuli Kofi Djokoto, Abigail Menson

CSIR-Building and Road Research Institute, P. O. Box 40, KNUST, Kumasi, Ghana

Abstract:

The closure of the South and North Heap Leach Facilities at Gold Fields Ghana Limited created an opportunity to evaluate the reuse potential of heap leach residues as sustainable construction materials rather than adopting conventional reclamation approaches. This study presents a comprehensive assessment of heap leach materials sampled from multiple pad locations within the Tarkwa Mine. Laboratory investigations included X-ray fluorescence (XRF), compressive strength testing, sodium sulphate soundness, and alkali-silica reactivity analyses to determine the engineering and environmental suitability of the materials for construction applications. Results showed that the combined SiO2 + Al2O3 + Fe2O3 contents of all samples exceeded the ASTM C618 minimum requirement for natural pozzolans, indicating potential suitability as supplementary cementitious materials. Residual cyanide concentrations ranged from 0.14 to 0.30 mg/kg, significantly below internationally accepted limits, while heavy metal concentrations, including arsenic, chromium, and lead, remained within permissible environmental thresholds. Concrete specimens produced using the heap leach materials as aggregates achieved compressive strengths corresponding to concrete classes C7.5–C30 after 28 days of curing, with cement additions equivalent to 50–100% of the cement content required for conventional 1:2:4 concrete mixes. The findings demonstrate the feasibility of repurposing heap leach residues as alternative construction aggregates and supplementary cementitious materials, providing a sustainable mine closure strategy that supports waste valorization, resource efficiency, and circular economy practices in the construction and mining sectors.

Keywords: Heap leach waste, construction aggregates, pozzolan, compressive strength, alkali-silica reactivity, sustainable mining.

VALORIZATION OF GRANITE QUARRY DUST AS MINERAL FILLER IN PORTLAND CEMENT: MECHANICAL PERFORMANCE AND DURABILITY ASSESSMENT

MWV-034

https://dx.doi.org/10.4314/just.v44i2.18s

Delali Adjei

CSIR-Building and Road Research Institute, P. O. Box 40, KNUST, Kumasi, Ghana

Abstract:

Granite dust, a fine-grained by-product of quarry processing operations, is generated in large volumes with limited reuse pathways, contributing to land degradation and disposal pressures in resource-extraction regions. This study evaluates its potential as a partial fine aggregate replacement in Portland cement mortar, targeting both performance optimization and industrial waste reduction. Granite dust sourced from a commercial quarry processing plant was characterized by X-ray fluorescence (XRF) and X-ray diffraction (XRD), revealing a silica-dominated composition (SiO_2 = 71.22%, Al_2O_3 = 19.84%, Fe_2O_3 = 2.75%) with quartz, feldspar, and mica as the principal phases. Mortar mixes were designed at a water-cement ratio of 0.5, with granite dust replacing fine aggregates at 0%, 5%, 10%, 15%, 20% and 25% by weight. Fresh properties, compressive strength at 3, 7 and 28 days, alkali-silica reactivity (ASTM C1260), sodium sulphate soundness (ASTM C88), and resistance to sulphuric acid and sodium chloride exposure were assessed. Compressive strength peaked at 10% replacement (41.6 MPa vs. 38.9 MPa for the control; approximately 7% increase), attributable to enhanced particle packing density. Beyond 10%, strength declined progressively, though mixes up to 15% replacement retained superior durability under aggressive chemical exposure relative to the control. ASR expansion values remained below the ASTM C1260 threshold of 0.10% across all mixes, and soundness losses satisfied ASTM C88 limits. These results establish 10–15% granite dust replacement as a technically viable and sustainable substitution range, offering a scalable strategy for quarry waste valorization without compromising structural concrete performance.

Keywords: Granite dust, waste valorization, Portland cement, compressive strength, mortar, alkali-silica reactivity.

EUROPE'S THIRST FOR ACTIVATED CARBON AND A POTENTIAL ANSWER? DUAL-USE ADSORBENTS FROM DRINKING WATER TREATMENT SLUDGE

MWV-035

https://dx.doi.org/10.4314/just.v44i2.19s

Lucas Landwehrkamp, Stefan Panglisch

Mechanical Process Engineering / Water Technology, University of Duisburg-Essen, Germany

Abstract

Due to increasingly stringent environmental regulations combined with strong anthropogenic impacts on water bodies, the demand for activated carbon in Europe is continuously increasing. At the same time, activated carbon used in Germany is still almost exclusively imported. Although activated carbons based on renewable resources are in principle available, competition for these raw materials in Europe is high, resulting in elevated production costs. Sludge from water treatment processes represents a locally available and abundant feedstock; however, the production of adsorbents from this material is often hindered by its high content of inorganic clay minerals. While these minerals are commonly regarded as a disadvantage in activated carbon manufacturing, they may also provide adsorption capacity for cationic heavy metals. This could enable the development of dual-use adsorbents capable of simultaneously removing heavy metals and organic micropollutants. In this study, the production of clay–carbon composite adsorbents from drinking water treatment sludge was investigated using a specially developed laboratory-scale rotary furnace. To optimize the thermal activation process, statistical design of experiments was applied, enabling a systematic evaluation of the most relevant process parameters. Depending on the activation conditions, thermal treatment substantially increased the specific surface area of the produced materials, reaching values between 112 and 201 m^2/g. Response surface analysis identified heating rate and ramp duration as significant factors influencing adsorption performance for various organic micropollutants. In addition to organic micropollutant removal, the produced materials exhibited a substantially higher adsorption capacity for chromium compared to a conventional activated carbon.

Keywords: Activated carbon, sustainable adsorbents, activation, drinking water treatment residues, adsorption.

SUSTAINABLE TERNARY BINDERS: EVALUATING THE PERFORMANCE OF LOW-GRADE KAOLINITIC CLAY IN LIMESTONE CALCINED CLAY CEMENT (LC3)

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Kwesi Appiah Boakye, Kofi Sokoto, Lord Addo Hanson

CSIR-Building and Road Research Institute, P. O. Box 40, KNUST, Kumasi, Ghana

Abstract

The carbon intensity of Ordinary Portland Cement (OPC) has necessitated the development of eco-efficient alternatives like Limestone Calcined Clay Cement (LC3). While LC3 typically relies on high-grade kaolinitic clays (>40% kaolinite), industrial competition for high-purity resources limits scalability. This study investigates the technical viability of utilizing a low-grade kaolinitic clay (~17% kaolinite), calcined at 900 °C, as a sustainable substitute in ternary blended systems.

Four LC3 formulations were developed with calcined clay substitution levels ranging from 20% to 50% by weight of cement, while maintaining constant limestone (15%) and gypsum (5%) content. Characterization via XRD, TGA, and Isothermal Calorimetry monitored hydration kinetics and mineralogical phase development. Mechanical and durability assessments included compressive strength, water absorption, and drying shrinkage up to 91 days.

Results indicate that while LC3 blends exhibit higher water demand and lower early-age strength compared to an OPC control, pozzolanic activity significantly bridges the strength gap by 28 and 91 days. The LC20% mix achieved approximately 95% of the control's strength at 91 days. Crucially, LC3 blends demonstrated superior durability, characterized by reduced water absorption and permeable porosity due to microstructural refinement from carboaluminate formation. This study concludes that low-grade clays are technically feasible for LC3 production, offering a pathway to reduce clinker factors by up to 50% without compromising long-term performance.

Keywords: Geopolymer and sustainable material.