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Keynote Presentations

Green, Sustainable Process for Recovery of Cathode Active Metals from Spent Lithium-ion Batteries

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Abstract

As demand for lithium-ion batteries (LIBs) continues to grow rapidly, the handling of spent LIBs remains a significant challenge for environmental regulators, engineers, and scientists. To achieve a sustainable supply chain and adhere to circular economy principles, valuable metals in spent LIBs-primarily lithium, cobalt, nickel, and manganese-must be recovered and reused. Conventional LIB recovery methods, such as pyrometallurgy, hydrometallurgy, and biohydrometallurgy, have considerable drawbacks, including high energy consumption, the use of corrosive and toxic chemicals, and a low lithium recovery rate. We present an innovative process to recover lithium, cobalt, nickel, and manganese from spent LIBs with high purity (> 99%) while maintaining a low energy footprint and using mild organic solvents. This process employs a sequential and selective application of organic aqueous phase ligands to complex the metals in the spent LIB. The aqueous complex is then passed through a fixed bed of metal-selective ion exchange resins. The metal-ligand complex is cleaved, making the organic acid ligand available for the next recovery cycle. The exhausted ion-exchanger bed is regenerated with a suitable solution to yield a metal- rich aqueous solution, from which pure solutions of lithium, cobalt, manganese, and nickel are obtained. The ion exchanger bed can be reused across multiple cycles, enabling a nearly zero-waste, sustainable process.

Biography

Sukalyan Sengupta is a Professor in the Civil & Environmental Engineering Department at the University of Massachusetts Dartmouth. He has > 30 years' experience in green chemistry based sustainable environmental processes related to hazardous waste remediation, water treatment, wastewater treatment, and industrial waste treatment. His research has been funded by NSF, EPA, ONR, BARD, and other agencies.

Carbon Recycling in Ironmaking Integrated with Carbon Dioxide Capture and Electrochemical Conversion

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Abstract

Ironmaking is an energy-intensive process and significantly contributes to Carbon dioxide (CO_2) emissions, estimated at 1.85 tonnes of CO_2 emissions per tonne of steel produced from a conventional blast furnace (BF) – basic oxygen furnace (BOF) route. More than 70% of these CO_2 emissions resulted from the ironmaking BFs. Therefore, developing low-carbon ironmaking technology to reduce the CO_2 emissions of the BF-BOF process is essential in the sustainability of iron and steelmaking. The BF gas (BFG) contains high CO_2 and CO, which should be used as a good carbon resource. This paper briefs our recent research in low-carbon ironmaking and discusses the CO_2 capture and utilization opportunities in the ironmaking process. A feasibility study on the alternative BF top gas recycling by means of CO_2 capture and CO_2 electrochemical conversion is presented. As a result, a CO_2-to-CO electrolysis process integrated ironmaking technology is proposed, which could significantly reduce coke

consumption to 275 kg and achieve up to a 41% reduction in the CO_2 emissions per tonne of hot metal production through carbon recycling.

Biography

Professor Geoff Wang received his PhD in Metallurgical Engineering from Northeastern University, Shenyang, China in 1990, and then worked in Wuhan University of Science and Technology in China for 5 years and about 2 years at University of New South Wales, Australia. He joined the University of Queensland in 1996 unit now. His research activity and interests are directed towards developing energy and environmental technologies dealing with the steel industries. He has been active and performed many research programs in clean energy and low-carbon technologies such as pulverized coal injection into blast furnaces, hydrogen production through coal gasification, and chemical and electrochemical conversion of CO_2 to fuel or reusable chemicals.

The Effect of Materiality on Perceptions of Product Recyclability

Kiersten Muenchinger*

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Abstract

There is an increasing demand for "natural" products by consumers, businesses, scientists and product developers. Trends suggest that the term natural may be colloquially understood to be a plant-based material or ingredient. The studies that will be discussed investigate whether this trend applies to materials when the derivation of the material – plant or mineral – is known. A set of six drinking cups was given to research subjects to analyze. Each cup was made of a different material: aluminum, glass, and various polymers. The derivations of the materials used in the cups include ore, sand, petroleum, corn, sugar and trees. Participants evaluated the cups on six qualitative design strategies for sustainability, including natural-ness and recyclability. This work compares the perceived sustainable attributes of the cups and shows how materiality and recyclability influence each other. The most notable finding is how "natural" polymers are perceived to be more recyclable than other polymers.

Biography

Kiersten Muenchinger is a Professor of Product Design at the University of Oregon. Kiersten identifies intersection points where qualitative strategies and quantitative metrics used in sustainable product design meet. Kansei engineering is used to measure how consumers emotionally perceive the sustainability of polymer, glass and aluminum products. Kiersten has been a US Fulbright scholar specializing in sustainable product design with Polis University in Tirana, Albania, and Hong Kong Polytechnic University. Before joining UO, Kiersten was a practicing design engineer with IDEO, Fitch, Sottsass Associatti, Walt Disney Imagineering and Ford Motor Company.

How the Concept of Reduce, Reuse and Recycle of Waste Effects Climatic Change and Facilitate in Reduction/Elimination of Sanitary Landfills

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Abstract

The "Reduce, Reuse and Recycle" (3R's) principle is a cornerstone of sustainable waste management, advocating for minimizing consumption, repurposing items, and transforming waste into new resources, ultimately benefiting the environment and human health. Recycling (3R's) dates to ancient civilizations. Evidence of recycling can be traced back to ancient Rome and Greece, where metal scraps were melted and reused. Over time, recycling practices evolved to include a wider range of materials such as paper, plastics, and electronic waste. Today, recycling has become an integral part of waste management strategies worldwide, aiming to minimize waste sent to landfills and promote sustainable resource management. Recycling (3R's) significantly reduces the need for raw material extraction. Recycling helps conserve natural resources, reduce the environmental impact associated with extraction and processing, reduces greenhouse gas emissions and plays a vital role in improving air and water quality by reducing release of harmful pollutants. Landfills pose various capacity and space issues, including risk of groundwater contamination and emission of harmful gases. Recycling helps alleviate these concerns by reducing the amount of waste disposed and presents economic benefits, such as cost savings in waste management and potential revenue generation from sale of recycled materials. Recycling aligns with the concept of circular economy, which aims to minimize waste and promote continuous use of resources. In a circular economy, materials are reused, recycled, or repurposed to create a closed-loop system. By integrating recycling into the circular economy model, waste generated can be transformed into valuable resources, reducing reliance on finite raw materials.

Keywords

Sustainable resource management, Greenhouse emissions, Circular economy, Landfills, Ground water contamination

Biography

Satya Narayan Sharma, a seasoned waste management expert and mining engineer, started his career in 1982 with Cement Corporation of India. He traversed roles within Government and Multinational sectors, developing expertise in waste management, environment and mining.

A Sustainable Future: Leveraging Integrated Project Delivery and Building Information Modeling for Green Construction Success

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Abstract

In light of contemporary construction practices, the convergence of creative approaches has become crucial in addressing the evident environmental concerns during the life cycle of building construction including waste generation and management, material selection and the need of adopting sustainable methods to address the adverse effects of building infrastructure. Using a case study approach, this study focuses on the role of integrated project delivery (IPD) and building information modeling (BIM) on the implementation of sustainable practices for construction projects. Two construction activities on Georgia Tech campus: Kendeda Building and Science Square were investigated. The case study captured the view of general contractors (GCs) on energy consumption, material procurement and optimization, life-cycle assessment, life cycle cost analysis, project team participation, and other construction strategies to meet sustainability goals. Qualitative data were collated via site visits, user observations and retrospective interviews with the GCs and then analyzed to determine commonalities and thematic thinking on the role IPD and BIM has on sustainable construction. The study's end goal helps to understand the benefits and the challenges of integrating project delivery approaches as practiced by general contractors on achieving sustainability on typical construction projects. A case study approach also identifies areas for improvement to fully realize the potential of these methods and to ultimately improve the overall performance of construction projects. Overall, combining IPD with BIM has the potential to impact lean and sustainable practices in construction. By promoting material optimization, reduced waste, reduced construction schedules improved integration and communication among project team and the communities around these buildings.

Biography

Divisha Singh is a graduate student in building construction and facility management from Georgia Institute of Technology and currently working with Jacobs as construction management intern (Co-op). She is a methodist who believes in the process of things. She is an avid professional gaining expertise in project controls and construction delivery. Her niche lies in finding solutions to apply green strategies at small and big construction sites. Currently, she is working for 10 fulton county schools as a consultant. She also contributes to research and her interests are building materials and sustainable infrastructure. Ebenezer Fanijo is a professional engineer and an assistant professor at the School of Building Construction, Georgia Institute of Technology. Dr Fanijo's expertise centers around sustainable and resilient buildings/civil infrastructure with a particular interest in decarbonizing infrastructure using novel low-carbon construction materials and alternative energy sources. His work also includes cementitious and concrete composites, corrosion monitoring and mitigation, green concrete technology, 3D printing of cementitious materials, structural health monitoring and advanced sensing technologies. He has co-authored over 20 peer-reviewed articles and conference proceedings and teaches both undergraduate and graduate-level courses on construction materials and methods, green construction and issues in sustainable construction.

EPR in the United States: What Does Industry need to do to Get Ready for EPR?

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Abstract

The rollout of EPR regulation has now officially begun; in the Spring, "obligated" producers in Oregon will be reporting, and paying fees on the full year of sales data for 2024. Next in line, in the Summer, "obligated" producers in Colorado will be reporting and paying fees on the first six months of sales date for 2025. What are the obstacles that face brands? We will dive into the definitional structures (a "Producer" in OR may not necessarily be a "Producer" in CO), and how those definitions could impact both downstream and upstream suppliers. Further, all three of the leading Western States (OR, CO and CA) have different

material categories (for example, OR and CA have exempt deposit return system exemptions; CO does not) of various lengths, and therefore material differences in fee structures. We will unpack the barriers created by harmonization gaps, but also how producers can avail themselves of the areas that do align. The presentation list of discussion points are as follows:

- Present brief case studies that led to the current situation.
- Discuss the basic tenets of EPR.
- Present the current status of EPR in the US – adopter states and proposed states.
- Exploring significant challenges due to the complex political landscape in the U.S.
- Addressing the obstacles faced by plastic and packaging producers.
- Harmonization barriers and the impact of fragmentation within the EPR framework.
- Sharing best practices for EPR implementation to maximize environmental benefits.

Biography

Jason Bergquist is the Vice President of US Operations for RecycleMe, a division of ReclayStewardEdge. Jason brings over 35 years of experience in waste and recycling roles. He has managed commercial and municipal waste hauling divisions, single stream recycling hauling and material recovery facility operations, bottle bill redemption pickup and sorting operations among others, in Maine, New York and California. Additionally, Jason has significant international experience, having worked in the manufacturing industry in both Europe and Asia. He holds a Juris Doctor (JD) degree from John F. Kennedy University of Law and has provided counsel in the areas of superfund compliance, beverage container deposit law, and hazardous waste management. Jason and his wife live in Maine and are proud to have raised three children together.

Hydrodeoxygenation of bis(2-hydroxyethyl) terephthalate as a Model Compound of Polyethylene Terephthalate Waste using Spray Pyrolysis Synthesis of γ-Al_2O_3 Supported Ni-Fe Catalyst

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[3]*Department of Chemical and Materials Engineering, University of Kentucky, USA*

Abstract

The study focuses on the hydrodeoxygenation (HDO) of bis(2-hydroxyethyl) terephthalate (BHET) over monometallic and bimetallic catalysts supported on Al_2O_3, which were synthesized via spray pyrolysis. HDO of BHET was carried out in a fixed- bed reactor under atmospheric pressure using 2-ethylphenol as solvent and H2 donor. The catalysts exhibited remarkable BHET conversion rates, with the 5 wt% Ni - 15 wt% Fe/ γ -Al_2O_3 catalyst achieving the conversion rate of 99.79% and a deoxygenation degree of 76.03%. Comparative analysis showed that the bimetallic NiFe catalyst facilitated C-O bond cleavage, enhancing HDO conversion. The 5 wt% Ni - 15 wt% Fe/γ-Al_2O_3 catalyst produced the predominant selectivity of Benzene, Naphthalene and Benzoic Acid. Incorporation of Fe in the NiFe catalyst led to enhanced conversion rates, as a result of high acid density and formation of a NiFe alloy within the catalyst. The gas product analysis showed the existence of hydrocarbon gases C_1-C_3, suggesting extensive reaction pathways including decarboxylation, decarbonylation, and demethylation. The utilization of bimetallic catalysts resulted in a decline in CO selectivity and a rise in CO_2 selectivity, which may be attributed to the creation of a NiFe alloy inside the catalyst.

In-liquid Microwave Plasma Assisted Carbon Dioxide Conversion

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[3]*Institute for Aqua Regeneration, Shinshu University, Japan*
[4]*Asahi Diamond Industrial Co., Ltd., Japan*

Abstract

The interest in carbon dioxide (CO_2) conversion technology has been increasing in recent years. Atmospheric pressure plasma has emerged as a key method for CO_2 conversion. However, a limitation of this technique is the need for H_2 to produce hydrocarbons from CO_2. As a result, our focus shifted to a new technology known as the in-liquid microwave plasma method. The proposed method introduces microwaves through electrodes into the reactor solution, causing the solvent to form bubbles and

generating plasma within them. The solvent serves as a source of protons and electrons, eliminating the need for additional H_2 in the reactions required for hydrocarbon production. The aim of this study is to use the in-liquid plasma method to convert CO_2 into valuable chemicals, such as methanol, ethanol, and others. Plasma treatment was performed under various conditions. The results showed the formation of CO, H_2, O_2, and methanol in all tested scenarios. This study successfully achieved the high CO_2 conversion efficiency. The investigation showed that the conversion rate is influenced by factors such as reactor configuration, its conditions, and the type of solvent used. Our goal is to further improve the conversion rate and deepen our understanding of the underlying mechanism by studying the variations in microwave plasma under different conditions.

Biography

Chiaki Terashima received his Ph.D. degree (2003) in electrochemical analysis at the University of Tokyo under the supervision of Professors A. Fujishima and K. Hashimoto. His academic career started at Nagoya University as an associate professor (2010 - 2011) in Professor O. Takai's group and then moved to Tokyo University of Science in 2012. He is currently a professor at Tokyo University of Science starting at 2018. His research interests are focused on photocatalysts, diamond electrochemistry, CO_2 reduction, and plasma processing in liquid.

Recycling Technology for PV Module Waste and the Carbon Reduction Benefits

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Abstract

In 2024, the PV module accumulative installation is 16 GW in Taiwan and over 1 TW in worldwide. Estimated based on the weight of each 440W module being 23 kg, every 1 GW of PV modules can generate 57000 metric tons of waste in the end-of life. Traditionally the PV waste treatment methods were mostly based on crushing. However, the crushing will cause mixing of the materials and reduce the value of recycling. In this study the pyrolysis method was chosen for PV module recycle. The PV modules were removed the alumina frame, junction box, and back sheet at the beginning. The residual composite layer (glass/EVA/solar cells/ribbon) were heated in a high temperature furnace to decompose the encapsulating materials in the following step. The solar cell fragments and ribbons were detached from the glass plate after thermal decomposition process. Finally, a complete and clean glass plate was obtained. The carbon emissions of the pyrolysis recycle process was determined to 35 kg CO_2 e/kW, which was higher than that of the traditional crushing and sorting process. However, the carbon reduction of pyrolysis method could reach 250 - 320 kg CO_2 e/kW by reusing the recycle materials. The recycled glass plate could be reused as building materials, furniture or glass raw materials. The recycled solar cell fragments could be separated by further chemical processes to obtain high purity silicon and silver materials. The research results verify that they could be used as raw materials in PV industry for silicon ingot growth and silver paste manufacturing, respectively.

Biography

Teng-Yu Wang is a senior researcher in Industrial Technology Research Institute (ITRI) in Taiwan. His research topics are mainly in green energy and resource circulating process. He studied crystalline silicon solar and PV module manufacturing technology for more than ten years and has focused on the development of recycling technologies for PV module waste in recent years.

Cognitive Dimensions of Environmental Behavior: Enhancing Waste Separation and Public Health through Cognitive Awareness

Darja Kobal Grum[1]* and Bojan Grum[2]

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[2]*European Faculty of Law, New University Nova Gorica, Slovenia*

Abstract

This paper explores the cognitive dimensions that shape behavioral habits related to environmental protection, with a focus on waste separation practices and their impact on public health. Cognitive factors, including awareness, perception, and decision-making processes, play a critical role in how individuals engage with sustainable behaviors that contribute to a healthier environment. By examining the psychological mechanisms that underlie these behaviors, the study highlights how cognitive biases, social norms, and personal beliefs influence the effectiveness of waste separation initiatives. The paper also discusses strategies for enhancing environmental and health awareness through targeted cognitive interventions, which can lead to more consistent and widespread adoption of practices that not only protect the environment but also reduce health risks associated

with poor waste management. The findings underscore the importance of integrating cognitive psychology into environmental sustainability efforts, particularly in fostering long-term behavioral change within communities that directly benefit both environmental and human health.

Biography

Darja Kobal Grum, Ph.D., is a Full Professor of General Psychology at the University of Ljubljana, where she has been a faculty member since 1997. Her research centers on motivation, emotions, wellbeing, and personality, with a particular focus on their influence on human behavior in everyday experiences, including tourist behavior. She has published over 140 academic articles, chapters, and books, with her work appearing in prestigious journals such as Personality and Individual Differences, Frontiers in Psychology, and Environmental Health Perspectives. She is the co-editor of 10 books and has authored or co-authored nine, including perspectives on motivation (2009) and knowing, wanting, feeling (2021). Her work has garnered over 500 citations in WoS and Scopus. As a visiting professor, she has lectured at institutions like the University of Tsukuba and Eötvös Loránd University. She has mentored over 100 bachelor's and 10 doctoral students. She currently heads the Department of General Psychology at the University of Ljubljana.

Poster Presentations

Assessment of Green Microalgal Strains for Simultaneous Municipal Wastewater Treatment and Heavy Metal Bioremediation

Penny P. Govender[1*], Elvis K. Ahiahonu[1,2], William W. Anku[3], Ashira Roopnarain[4] and Mahloro H. Serepa- Dlamini[1]

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[2]*Environmental Protection Agency, Ghana*
[3]*CSIR-Water Research Institute, Ghana*
[4]*Agricultural Research Council, South Africa*

Abstract

Wastewater treatment is a global issue that has ramifications for the environment, human health and economy. Recently, reports have shown microalga-assisted wastewater treatment systems are noted for their efficiency in removing nutrients, COD, toxic heavy metals and other dissolved compounds, while also producing valuable biomass and demonstrating high CO_2 biofixation potential. This research focuses on investigating the municipal wastewater phycoremediation and heavy metal biosorption ability of three indigenous freshwater microalgal strains: *Tetradesmus reginae, Tetradesmus obliquus* and *Chlorella sorokiniana*. The research findings indicate that the microalgal strains *T. reginae, T. obliquus* and *C. sorokiniana* exhibited notable performance in biomass accumulation. Specifically, the biomass accumulations were 2.215 ± 0.002, 1.143 ± 0.006 and 0.856 ± 0.021 g L–1, respectively, with initial culture biomasses ranging from 0.5 to 0.6 g L–1. These strains significantly reduced toxic heavy metals (As, 46.86–60.12%; Cd, 52.96–83.18%; Cr, 73.49 - 82.18%; and Pb, 95.38 - 96.25%), nutrients (NH 4 + and NO_3 – 100% and PO43 – 78 - 86.41%) as well as chemical oxygen demand (46.02 - 67.35%), and biosequestered CO_2 (0.8 - 0.18g CO 2 L –1 d –1) during the growth period. Among the strains, *T. reginae* emerged as the top performer. This study has shown that the isolated wild microalgal strains have promising phycoremediation and heavy metal adsorption characteristics. Moreover, they exhibit promising rates of CO_2 bio sequestration. These findings underscore the potential of microalga-assisted wastewater treatment systems for efficient and eco-friendly wastewater remediation, as well as biomass generation and CO_2 mitigation.

The Physicochemical Characterisation and Computational Studies of Tilapia Fish Scales as a Green Inhibitor for Steel Corrosion

Krishna Kuben Govender[1*], Ntiyiso Faith Nyambi[2] and Kasturie Premlall[2]

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[2]*Department of Chemical, Metallurgical and Materials Engineering, Faculty of Engineering and Built Environment, Tshwane University of Technology, South Africa*

Abstract

The effect of increased corrosion in re-enforcement structures has led to the need to identify and develop more inexpensive, non-toxic, eco-friendly and readily available inhibitors from natural resources. In this work, Tilapia fish scales (FSs) were used as a green corrosion inhibitor as they are abundant in both organic components, such as collagen ($C_{12}H_{19}N_3O_5$), and inorgan-

ic components, such as hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$). The FSs were subjected to a maceration process to extract all the inorganic and organic compounds. The extract was characterised using an X-ray diffractometer (XRD), a scanning electron microscope (SEM) and fourier transform infra-red (FTIR). Quantum mechanical studies were conducted to determine parameters such as the highest occupied molecular orbital (EHOMO) and the lowest occupied molecular orbital (ELUMO). The B3LYP/6-311++G(d, p) simulations were run to investigate the interaction between the organic and inorganic molecules. The XRD results confirmed that a large amount of hydroxyapatite was present in the extract, with a high diffractive peak at 32θ and small amounts of collagen picked up between 13θ and 25θ. SEM results showed the percentage weight of atoms, such as carbon (19.8%), calcium (27%), oxygen (41.3%) and phosphate (11.9%), which were found to be present in both the organic and inorganic part of the FS sample. FTIR results confirmed the presence of hydroxyl (3200 - 3500 cm^{-1}), carbonate (1620 - 1700 cm^{-1}) and phosphate groups (1200 - 800 cm^{-1}). The computational studies showed that hydroxyapatite was the most reactive molecule, as it had the highest Egap of 0.0935 eV compared with that of collagen at 0.2705 eV. The interaction energy of the FS molecule was –615 kJ/mol.

Biography

Krishna Kuben Govender is a Senior Lecturer and head of the E = c2m2 research group in the Department of Chemical Sciences at the University of Johannesburg, South Africa. He lectures organic, inorganic and physical chemistry at the undergraduate and honours level. His research focus is on Computational Chemistry and Materials Modelling, specifically in the fields of drug design and battery technologies. He is chair and co-chair of the South African Chemical Institute Molecular Modelling and American Chemical Society divisions, respectively.

Keynote Presentations

Recycling of Composite Metallic Coatings

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Abstract

Recycling of bimetallic composite coatings presents challenging opportunities as both the alloy substrates and coatings contain valuable resources for recovery and reuse. Several composite bimetallic layers have been investigated and their separation processes optimized. Four such combinations include tantalum coated high temperature steel substrate, niobium coated tool steel, tin coated iron and nichrome coated stainless steel that have been investigated. Various combination of pyrometallurgical and hydrometallurgical techniques have been successfully applied to separate the composite layers. Optimized process conditions shall be presented for tantalum coated steel and tin coated iron. Tantalum is a refractory metal with low recycling rate of less than 1% because most tantalum secondary recovery techniques are primarily meant for recovery of other elements. The main factor for selecting the best recovery method is dependent on the materials which are mechanically or chemically bonded with tantalum. This paper summarizes various methods to recover tantalum from different secondary sources like tantalum capacitors, tantalum mill products, and tantalum in chemical processing industry. The best method to recover tantalum from tantalum coated steel has been discussed. One of the key secondary resources for metallic tin is tinplated cans, which account for 25% of the domestic apparent consumption of tin. The recovery processes for recovering tin from tinplated metal cans are primarily electrochemical (electroplating and electrowinning) and chemical (leaching) techniques. In this study, one-step electrolytic detinning and two-step leaching and electrowinning processes for tin extraction in alkaline based solvents are reviewed and optimized for several process parameters. The Anodic polarization behavior of pure bulk tin and tinplated steel anodes is studied for its active-passive characteristics in various alkaline based medium in the presence of oxidizing and reducing agents, and polarization parameters are summarized. Additives like potassium iodate as oxidizing agent increases the tin dissolution rate and metallic aluminum additive as reducing agent increases the electrodeposition rate in sodium hydroxide based medium.

AI-driven Integration of Decentralized Resource Recovery with Urban Precision Vertical Agriculture for Sustainability and Public Health

Yongsheng Chen*

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Abstract

As escalating urbanization causes significant gigaton related challenges, we advocate for transformative, artificial intelligence (AI)-driven strategy that integrates resource recovery, decentralized urban precision vertical farming, and AI-enabled digitali-

zation to redefine urban sustainability and resilience. This multidimensional approach directly addresses critical environmental degradation, resource scarcity, and food security concerns, positioning cities as dynamic, self-sustaining ecosystems. By harnessing cutting-edge AI technologies alongside innovative resource recovery and decentralized farming systems, cities can optimize resource utilization, reduce ecological footprints, and strengthen food-energy-water nexus synergies. This presentation delves into the intricate interplay of these strategies, illustrating how AI-driven analytics revolutionize resource recovery processes, enhance precision farming techniques, and drive systemic sustainability. Through detailed case studies, data-driven insights, and forward-thinking analysis, we showcase the transformative impact of this triad in shaping future-proof urban environments that are adaptive, regenerative, and resilient in the face of global change.

Biography

Yongsheng Chen is the Bonnie W. and Charles W. Moorman IV Professor in the School of Civil and Environmental Engineering at Georgia Institute of Technology and the Director of NEW Center for AgTech. Professor Chen's research interests include environmental nanotechnology, machine learning-assisted inverse design and discovery of novel materials for membrane material fabrication and resource recovery. He has received more than $18.5M grants and published over 220 refereed articles. He has received numerous accolades, including the CAPEES/Nanova Lifetime Achievement Award, Sigma Xi Best Ph.D. Student Dissertation Advisor Award, and AEESP Outstanding Ph.D. Student Advisor Award. His work has been recognized by many national and international media outlets including Forbes and The Atlanta Journal-Constitution.

Beyond Waste Recycling – The Circular Bioeconomy System (Online)

John Classen[1*], Lara Moody[2] and Alison Deviney[3]

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[2]Institite for Feed Education
[3]North Carolina State University, Biological and Agricultural Engineering

Abstract

The multiple interacting challenges presented by increasing demands of food, water, energy, and bioproducts in the face of a changing climate, disappearing farmland, and political uncertainty have not diminished in the > 40 years of focus on the environment. A new approach is needed. The American Society of Agricultural and Biological Engineers, in conjunction with other organizations, formed the Circular Bioeconomy Systems Institute s (CBSI) as an approach to environmental, social, and economic sustainability. The concept of the CBS is based is the intersection of nature's ecosystem, the human agrifood system, and our socioeconomic systems. The complex, adaptive, and interwoven nature of these systems requires a system of systems approach. The CBSI has adopted these five principles of circularity: increase input efficiency, design out waste-recover waste for productive use, keep products and materials in use as long as possible, generate natural systems, provide economic benefits. This presentation will describe details of the CBS and our approach to sustainability with the expectation that other professional societies and organizations will collaborate to reach our common goals.

Biography

John Classen is Professor and Director of Graduate Programs in Biological and Agricultural Engineering at North Carolina State University. He is a member of the American Society of Agricultural and Biological Engineers (ASABE) and the American Society for Engineering Education (ASEE). He has expertise in food animal production systems and nutrient management systems and is an advocate for collaborative interdisciplinary research and the need for graduate students to participate in such collaborations.

The Waste Paradox: How Perceptions of Value Shape Consumption and Disposal

Lainika E. Johnson[*]

TrashLogic, Sacramento

Abstract

What if waste isn't just a byproduct of consumption, but a reflection of deeper societal values? Our relationship with disposability reveals more than just environmental consequences-it exposes cultural, economic, and psychological patterns that shape how we assign worth. Through a personal yet universal lens, Lainika E. Johnson challenges the modern mindset of waste, contrasting past and present approaches to resourcefulness. This talk unpacks the hidden narratives within our trash and what they reveal about privilege, innovation, and sustainability. By rethinking what we discard, we can uncover new ways to design, consume, and create systems that prioritize long-term value over short-term convenience. Because waste isn't just about what we throw away-it's about what we fail to see.

Biography

Lainika E. Johnson is a leader in waste management and sustainability, specializing in transorming waste into economic opportunity. As founder of TrashLogic, she helps businesses and municipalities implement profitable, circular economy solutions.

A Harvard-certified Sustainability Leader, Lainika applies research-backed strategies to waste innovation, ensuring both environmental and financial impact. She also leads Wastepreneur Academy, equipping entrepreneurs to build waste-focused businesses. A sought-after speaker, she presents on waste entrepreneurship, sustainability policy, and rethinking disposability - challenging audiences to see waste not as a problem, but as a resource with untapped potential.

Oral Presentations

Assessing the Effectiveness of Free Nitrous Acids in Enhancing Organic Waste Treatment in Anaerobic Digestion: Controlling Problematic Microorganisms and Boosting Biogas Yield

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Abstract

Landfilled organic waste, such as food waste (FW), greatly contributes to methane emissions. Anaerobic digestion (AD) can repurpose organic wastes and generate value-added products like biogas, feedstocks, and fertilizers. However, practical challenges remain, such as odor problems and low biogas yield due to complexity of AD feed. In this work, a sustainable pretreatment method was investigated by using free nitrous acids (FNA), which can be recovered from nitrite in wastewater sidestream. The results indicated that FNA pretreatment can enhance soluble organic content and control H2S odor in tested organic wastes, including FW, sewage sludge, and their combination. However, a significant decrease (>50%) in FNA concentration was found in the reactors, possibly due to denitrifier-driven NO_2 – consumption. Biochemical methane potential (BMP) tests showed a 25 ± 8% enhancement in CH 4 production in the reactors fed with mixed substrate pretreated with 2.9 mg FNA-N/L. FNA was most effective at inhibiting sulfate-reducing bacteria (SRB) activities during the first 24 hr of pre-treatment, when FNA and/or nitrite concentration in the system was maintained. FNA's effectiveness can decrease due to consumption of nitrite by remaining active N-associated microorganisms (e.g., denitrifies). The highest reduction in pathogen number was found in the group with 5.0 mg-FNA/L (45% reduction in the first 4 hr, compared with the group without FNA addition (9% reduction). These results are expected to assist researchers and practitioners in managing waste treatment, offering insights for implementing FNA pretreatment to enhance the biodegradability of organic wastes in AD.

Biography

Guangbin Li is an Assistant Professor at Department of Civil and Environmental Engineering at University of Maryland, College Park. He holds a PhD and a MS degree in environmental engineering from the University of Arizona, and bachelor's degree in environmental engineering from the Harbin Engineering University, China. Dr. Li and his research team at the N.E.S. Lab (Nutrient, Energy, and Smart) focus on sustainable water/wastewater treatment, remediation of emerging contaminants, conversion of wastes to energy and resources, and bioreactors. His research has been sponsored by multiple federal/state funding agencies and state facilities, such as NSF, US DOD, US EPA.

Closing the Aluminum Loop: An Innovative Process for Black Dross Valorization

Diego Guerrero[1*], Denis Mangin[1], Didier Colson[1] and Jed Kraiem[2]

[1]Université de Lyon 1, France
[2]Novacium, France

Abstract

Black dross is a byproduct generated during the aluminum recycling process. This waste product presents significant economic and environmental challenges for aluminum producers. Poor dross management can lead to the release of noxious gases such as ammonia or phosphine and the leaching of toxic salts, which are considered water pollutants. Additionally, black dross is difficult to process using conventional pyrometallurgical methods due to its low metallic aluminum content. As a result, this byproduct is either landfilled under specific conditions or neutralized by external companies using outdated hydrometallurgical processes. In this study, we investigated an innovative hydrometallurgical reaction capable of neutralizing black dross while simultaneously producing green hydrogen and a usable solid byproduct. Traditional hydrometallurgical processes typically use

sodium hydroxide to accelerate the aluminum hydrolysis reaction. However, the hydrogen production yield is relatively low (usually between 40 and 60%), and the use of a highly alkaline environment increases equipment corrosion. For this innovative process, a low-cost and readily available additive was tested, which significantly increased the final conversion rate and operated within a milder pH range compared to the conventional process. Various acceleration mechanisms were studied, and the flexibility of the process was tested using different black dross samples with varying compositions. It was determined that the process could be fully integrated into most aluminum recycling plants and offers a promising potential solution for the black dross issue.

Biography

Diego Guerrero is a PhD student at Université de Lyon 1, currently working in partnership with Novacium, a French start-up. His PhD project focuses on developing a process capable of valorizing waste from the metallurgical industry through hydrogen production. He obtained his chemical engineering degree through a double-degree program between the National University of Colombia and the École Nationale Supérieure des Industries Chimiques in France. He also earned a Master degree in chemical and biochemical processes at ENSIC, financed by the Eiffel Excellence Scholarship. Diego has worked on multiple energy and waste-related projects in companies such as TotalEnergies and EDF.

Efficient Oil-water Separation with Coalescing Technology

Zhaoyang Liu*

Qatar Environment and Energy Research Institute, Hamad Bin Khalifa University (HBKU), Qatar

Abstract

The risk of oil pollution is increasing due to intensified oil and gas production activities, which can pollute the environment and damage the ecosystem. Among various oil/water separation methods, coalescence has gained prominence for its eco-friendly and efficient process. A critical component of this method is the coalescing medium, which relies on materials with specific structural and surface properties. Meanwhile, the healthcare sector produces significant quantities of disposable fiber-based plastic waste, which poses environmental challenges upon disposal. This study introduces a sustainable approach to address both issues by repurposing medical waste to create a hierarchical porous structure using a cost-effective modification technique. The resulting structure combines macropores from pristine fibers, ensuring high permeation rates, with micropores from a PVDF coating, enhancing oil removal capabilities. The simplicity of this design supports its potential for industrial scalability. When tested as a coalescing medium, the modified waste materials demonstrated an 85% oil removal efficiency under varying oil types and water salinity conditions. This work exemplifies the principles of the circular economy by converting waste into valuable resources, offering a practical solution for environmental sustainability.

Biography

Zhaoyang Liu is a Senior Scientist at Water Center at Qatar Environment and Energy Research Institute (QEERI). His expertise involves the development and optimization of advanced processes and materials for water treatment. His research work is frequently cited internationally (h-index 45, as of July 2023). To align with the nation and institute's vision for water security, Dr. Liu is currently leading the development of oil/water separation technology research project. The developed oil/water separation technology has multiple applications, including offshore oil spill cleanup, produced water treatment, and onshore seawater intake purification (in the event of oil spill) for desalination plants. He served as an Editorial Board Member for Scientific Reports – a Nature journal, as a result of his research standing within the global water treatment community.

Integration of a Solar Energy System for Powering an Industrial Prototype in Rare Earth Extraction

Wassila Ajbara[1*], Hajar Bellefqih[1], Essaid Bilal[1], Hamid Mazouz[2]

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[2]Expertise Center for Phosphate (CEPH), Mohammed VI Polytechnic University, Morocco

Abstract

The development of renewable energy systems and their integration into industrial processes are essential to meet the growing energy demand and reduce dependence on fossil fuels. This study focuses on improving the thermal efficiency of parabolic trough solar collectors (PTSC) to provide heat in the rare earth extraction process in the phosphate industry. Eight hybrid nanofluids were investigated, including 1.5% Cu-1.5% Al_2O_3/Syltherm 800, 1.5% Cu-1.5% TiO_2/Syltherm 800, 1.5% Cu-1.5% CuO/Syltherm 800, 1.5% Cu-1.5% MgO/Syltherm 800, 1.5% Ag-1.5% Al_2O_3/Syltherm 800, 1.5% Ag-1.5% TiO_2/Syltherm 800, among others. The results showed that the 1.5% Cu-1.5% MgO/Syltherm 800 hybrid nanofluid was the most

effective in improving the thermal efficiency of the PTSC, due to its high Nusselt number. Moreover, the use of hybrid nanofluids increased the thermal efficiency of the PTSC by 2.8% compared to the base fluid, with significant improvements in thermal conductivity and heat transfer coefficient. It is important to note that all simulation models were experimentally validated. These findings indicate that hybrid nanofluids represent a promising approach for improving PTSC performance and enabling thermal energy recycling in industrial applications. This approach improves not only the effectiveness of industrial processes but also promotes environmental sustainability by optimizing the use of thermal energy in the extraction of rare earths from phosphogypsum (considered to be waste from the fertilizer's industry), by reducing dependence on non-renewable energy sources and minimizing the environmental impact.

Biography

Wassila Ajbar is a researcher specializing in systems development through artificial intelligence. She holds a PhD from CIICAp- UAEM, Mexico, and completed a postdoctoral fellowship at IIUNAM funded by DGAPA. She is currently participating in the European project funded by ERAMIN3, titled 'Phosphogypsum Processing to Obtain Critical Raw Materials,' at Mines Saint Etienne. Her expertisefocuses on optimizing renewable energy systems, particularly solar energy, as well as monitoring and diagnosing engineering systems through neural networks. She has authored several scientific articles published in prominent journals, including Renewable and Sustainable Energy Reviews, Applied Thermal Engineering, and Sustainable Energy, Grids, and Networks.

Water Supply and Fluoride in the Canary Islands: Health Impact Analysis

Soraya Paz-Montelongo[1*], Samuel Alejandro-Vega[1], Javier Darias-Rosales[1], Natalia Pérez-Rodríguez[2], Carmen Rubio[1], Ángel J. Gutiérrez[1] and Arturo Hardisson[1]

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[2]Medical Oncology, University Hospital Nuestra Señora de Candelaria, Spain

Abstract

Fluoride, a halogen element presents in the earth's crust, especially in volcanic minerals, poses a challenge in the Canary Islands due to its mostly natural sources. While fluoride is known for its benefits in the prevention of dental caries, its excess can have serious health consequences. In toxicological terms, fluoride is an element that, at certain concentrations, can cause serious health effects. For example, several episodes of dental fluorosis and bone fluorosis have been reported throughout the world, the common cause of which was a high fluoride content in the water supply. Other studies carried out in recent years have supported the hypothesis that exposure to high concentrations of fluoride in drinking water is related to deficits in intelligence and intellectual aptitudes in children in clinical and psycho-pedagogical settings. From the legal point of view, only the fluoride content in the water supply is regulated. However, the literature shows us that food sources such as other beverages (tea, alcohol, soft drinks), fish, crustaceans, etc., can be important dietary sources and that fluoride exposure is underestimated. In this lecture we will discuss the most relevant aspects of this natural and anthropogenic contaminant, evaluate the exposure from water and other foods widely consumed in the Canary Islands that contain high concentrations of this ion, and conclude with the risks and preventive measures to reduce the current overexposure to fluoride.

Biography

Soraya Paz-Montelongo (Spain, 1993). She holds a PhD in Health Sciences (2018), a Degree in Chemistry (2015) and a Master's degree in Food Safety and Quality (2016). She has supervised two doctoral theses defended in 2023 and 2024 with the qualification of outstanding cumlaude. Her line of research focuses on the evaluation and monitoring of contaminants present in food, environmental and drug samples. Author of more than 100 articles in scientific journals indexed in JCR, as well as more than 10 book chapters published by prestigious international publishers. According to Scopus, she has an h-index of 17.

Sustainable non-VOC parts washing: compliant, high-performance solutions for waste and emission reduction the US EPA, and regulatory agencies around the world, seek better air quality standards in major cities to improve quality of life for human populations causing local administrative agencies to enact stricter VOC limits on industrial cleaning and degreasing processes requiring facilities to transition away from high-emission solvents toward compliant, low-impact alternatives that must meet new grams per liter thresholds in VOC content. These new rules target reductions in ozone-forming emissions, hazardous air pollutants (HAPs), and waste disposal risks, increasing regulatory pressure on industries relying on traditional petroleum- and chlorinated-based solvents to meet critical production processes. As a result, the demand for high-performance low or non-VOC solutions has never been more critical than now. This presentation will explore the technical and regulatory challenges associated with VOC-based degreasing agents and present a systematic approach to adopting non-VOC, non-HAP aqueous-based cleaning technologies that align with new air quality standards being implemented across the manufacturing landscape. The discussion will highlight the development of surfactant-enhanced hybrid-chemistry, which mimics the solvency of traditional organic degreasers while offering environmental compliance and operational safety. Attendees will gain a compre-

hensive understanding of the scientific principles behind non-VOC solvent development, practical insights into regulatory adaptation, and a structured approach for integrating VOC-compliant degreasing solutions into existing workflows. By leveraging non-hazardous, high-efficiency hybrid-chemistry alternatives, industries can achieve full compliance, improved worker safety, and enhanced environmental responsibility without sacrificing cleaning performance.

Understanding Household Food Waste in Ireland – Assessment, Environmental Burden, and Mitigation Strategies

Courage Y. Krah[1*], Vaishali Thaore[1], Paul Hynds[1] and Anushree Priyadarshini[1,2]

[1]Environmental Sustainability & Health Institute, Technological University Dublin, Ireland
[2]School of Business, Maynooth University, Ireland

Abstract

The Food and Agriculture Organisation (FAO) calculates those 1.3 billion tonnes of food is wasted globally per year, directly contributing to food shortages, water stress, biodiversity loss, up to 10% of greenhouse gas (GHG) emissions, and economic losses of €550 billion. Based on Irelands commitment to the UN sustainable development goals (SDGs), a 50% reduction in both food waste and emissions is required by 2030. Accordingly, it is crucial to accurately quantify volumes of food waste generated and identify the levels and characteristics of waste generators. A comprehensive survey on household food waste (HFW) generation was conducted across Irish households, 994 households representing 3,163 individuals completed surveys over a 14 month period in 2023/24. Preliminary statistical analysis indicated that HFW (g/capita/week) generation varied per capita across different age groups ($H = 13.28$, $p = 0.021$). Additionally, there is a significant variation in HFW per capita among high, low, and middle-income Irish households ($H = 16.65$, $p < 0.001$). Households with lower incomes in urban areas of Ireland tend to produce more food waste ($H = 18.35$, $p < 0.001$). Low-waste generators, with 84.71 g/capita/week, were predominantly male-dominated, multi-family households. Medium food wasters, with 208.68 g/capita/week, showed balanced gender composition, with middle-aged individuals prominent. High food wasters, generating 384.77 g/capita/week, were primarily young adults' households. Very high food wasters, at 1011.70 g/capita/week, were dominated by single households, predominantly young females. The work provides evidence based information to enable bespoke interventions, targeting critical demographic sections to effectively reduce food waste in the country.

Biography

Anushree Priyadarshini is an Assistant Professor in Management at Maynooth University, Ireland. She has over 12 years of teaching, research and industry experience in the area of Strategy, Waste Management, Sustainable Environment, Health and Food Innovations. Her interdisciplinary research strongly aligns with the UNSDGs specifically focusing on Responsible Consumption and Production (SDG 12), Climate Action (SDG 13) and Good Health and Well-Being (SDG 3). She leads the research group EcoLOGIC (Economics for Healthy Societies and Green Sustainable Communities) supervising a team of researchers including PhDs, MPhils, Postdoctoral Researchers and Research Assistants. She has published over 30 scientific articles and has secured ~8 million in European and National funding for her research.

Keynote Presentation

Landfill Mining of Legacy MSW from Old Dumps in India: Moving Towards Sustainability (Online)

Manoj Datta[1*], G.V. Ramana[1], M. Somani[2] and D. Parida[1]

[1]IIT Delhi, India
[2]IIT Bhubaneswar, India

Abstract

Municipal solid waste has accumulated in numerous large-sized waste dumps across major cities in India. These waste dumps have continued to grow larger as the country adopts new waste management practices laying emphasis on composting for material recovery and combustion for waste to energy. The problem of large space occupied by old MSW dumps and their negative impact on the environment is now being tackled by reducing their footprint using landfill mining techniques. The experience gained over the last 5 years of landfill mining at Delhi is presented and discussed. The major findings include characteristics of the segregated waste components – namely gravel and cobble sized C&D material, lightweight combustibles (including plastics & textile), soil-like material and miscellaneous rejects. The re-use of the recovered materials through C&D processing plants, through combustion in cement plants and waste-to-energy plants as well as through use of soil-like material in geotechnical applications such as filling low-lying areas and embankment construction are elaborated. The presence of contaminants in soil-like material and their impact on design measures for re-use are also discussed. The major challenges faced during landfill mining operations relate to low quality of segregation through rotating screens due to inadequate drying and pulverizing of excavated material as well as inadequate off-take of segregated soil-like material from the dump sites.

Biography

Manoj Datta is currently Emeritus Professor in the Department of Civil Engineering at IIT Delhi, India and conducts research in the areas of geotechnical, geoenvironmental and landfill engineering. He has published over 160 papers in journals and conferences He has edited three books in the areas of landfills, solid waste management and ash ponds. In 2010, Prof. Datta was bestowed the honor to be the Chairperson for the 6th International Congress on Environmental Geotechnology by the International Society for Soil Mechanics and Geotechnical Engineering. Prof. Datta has received six best-paper awards of the Indian Geotechnical Society. He has been awarded the Indian Geotechnical Society (Delhi Chapter) Lifetime Achievement Award.

Oral Presentations

The Role of Rural Communities in Sustainable Waste Management

Yareni Ramírez* and María Laura Sampedro

Autonomous University of Guerrero, Regional Development Science Center,

Abstract

Waste management is a great challenge for rural communities that lack public services and resources for its management. This study evaluates the perceptions of the inhabitants of four rural communities in the state of Guerrero, Mexico, where the objective was to know the attitudes and aptitudes of the population to generate community strategies for efficient waste management. Two instruments were applied, an interview with key actors and a survey directed to the population. The results indicate that localities with higher rates of marginalization and less access to services are the most affected by pollution, which has a negative impact on the quality of life and the environment, hindering socio-environmental development. The environmental problems that most affect the communities are solid waste and wastewater discharges. The population showed interest in participating in community recycling, but the lack of collection centers and other alternatives makes these actions difficult. This study provides evidence of the need for specific waste management strategies in rural communities to address environmental and socioeconomic challenges. Community participation in waste management must be facilitated through the implementation of participatory actions aimed at the recovery and recycling of materials.

Analysis of Factors Influencing the Recycling of Plastic and Composite Packaging Waste using the PESTEL Method

Arturas Torkelis*, Jolanta Dvarioniene and Gintaras Denafas

Kaunas University of Technology, Lithuania

Abstract

Packaging is the largest end-use sector for plastics, representing approximately 40% of total plastic consumption. In 2021, the average amount of plastic packaging waste generated per capita in the European Union was 35.9 kg, with 14.2 kg, or approximately 40%, being recycled. However, EU regulatory frameworks impose more stringent recycling targets, requiring 50% of plastic packaging waste to be recycled by 2025, and 55% by 2030. Achieving these ambitious targets necessitates a deeper understanding of the factors influencing recycling processes. This study employs the political, economic, social, technological, environmental, legal (PESTEL) analysis framework to identify and evaluate the key drivers that affect the recycling of plastic and composite packaging waste. The findings demonstrate that a complex interplay of factors influences the efficiency and effectiveness of recycling systems. Political and legal factors relate to the formulation, implementation, and enforcement of waste management policies, regulations, and international agreements. Economic factors encompass the economic dynamics impacting the recycling industry, including global market demand, cost structures, and financial incentives or disincentives for recycling. Social factors refer to societal behaviors and cultural norms that shape public participation in recycling initiatives, which can either enhance or hinder the recycling process. Technological factors assesses the technological capabilities and limitations within the recycling infrastructure, highlighting existing innovations as well as technological gaps. Environmental factors focus on the environmental impacts of recycling processes, including microplastic, greenhouse gas emissions, and life- cycle approach. The study provides a comprehensive overview of these factors from both a scientific and theoretical perspective while also addressing the practical challenges associated with each. By identifying the key barriers and enablers within each factor, the study aims to inform possibilities for improving the efficiency and sustainability of plastic packaging waste recycling.

Biography

Arturas Torkelis currently enrolled as a third-year doctoral candidate at Kaunas University of Technology in Kaunas, Lithuania. Under the guidance of Professor Jolanta Dvarioniene, my research focuses on analyzing the factors influencing the recycling of plastic and composite packaging waste. My areas of expertise and keen interests lie within the improving the circularity of the plastic and composite packaging system, analysing the various factors (political, economic, social, technological, environmental, legal), material recovery from composite packaging waste.

The Feasibility of Material Recovery from Processing the Entire Municipal Solid Waste Stream

Tommy John PE*

Tommy John Engineering, USA

Abstract

Recycling, or material recovery, is the key to sustainability. Processing the full municipal solid waste (MSW) stream through material recovery facilities (MRF) is a new paradigm for waste management that relies on process engineering. Depositing material in a landfill or combusting in a waste to energy (WTE) plant, as is a common practice for MSW, should be replaced with MRF. Sustainable material recovery from waste streams requires rigorous sorting and reliable, efficient processes for conversion of sorted streams into high value products. Plastic recycling is less developed than for other recyclables, but the Pyrolysis and Methanolysis processes extend the range of plastic that can be effectively recycled from waste streams. The remaining organic material following removal of all recyclables can be upcycled into valuable oxygenated chemicals by multiple options including oxygen blown, high pressure gasification and fermentation into carboxylate salts. A preliminary analysis demonstrates that a MRF system that recovers the highest value for recovered materials will produce revenue that is five to six times the revenue from typical landfill tipping fees, creating sustainable revenue to pay off the capital investment for the facilities. Maximizing the value of the recycled material aligns with environmental sustainability because, if a product has a high value, it is because it is a scarce resource and/or it requires a lot of energy to produce.

Biography

Tommy John is a Professional Engineer with a unique combination of a BS in Mechanical Engineering (Texas Tech) and a Master of Chemical Engineering (University of Houston) and broad experience in developing and implementing projects for the process, power, and waste disposal industries from conception through commissioning with focus on energy conservation and environmental improvements. His experience includes business development, litigation support, public relations, regulatory affairs, environmental management, and process technology licensing. He has been active in multiple professional and business organizations.

Investigation on the Stress-strain Relationship of Rubberized Geopolymer Concrete

Sunday U. Azunna*, Farah N. A. A. Aziz, Raizal S. M. Rashid and Ernaleza B. Mahsum

Housing Research Centre, Department of Civil Engineering, Faculty of Engineering, University Putra Malaysia (UPM), Malaysia

Abstract

Waste rubber that is not biodegradable might have a detrimental effect on the environment if it is buried in wet landfill soil or is never used. The sustainable method of recycling waste rubber into building materials is one excellent way to reduce the use of natural aggregates in construction material. While reducing the emission of CO_2 is to substitute Portland cement with an environmentally friendly geopolymer concrete. This research investigates the creation of geopolymer gel with recycled crumb rubber to create rubberized geopolymer concrete (RuGPC). Investigations were conducted on the workability, compressive strength, and stress-strain characteristics of RuGPC with rubber at 0%, 10%, and 20% fine aggregate replacement. In addition, the effect of rubber on energy dissipation at each stage of the stress-strain curve was examined. Thereafter energy absorption and ductile characteristics were evaluated through the concrete toughness and ductility index. At 20% crumb rubber aggregate replacement the workability, compressive strength, modulus of elasticity, peak stress and yield strain of RuGPC reduced by 8.33%, 34.67%, 38.77%, 40.1% and 26.20% while Poisson's ratio, peak and ultimate strain increased by 29.45%, 7.58%, 51.53%. The pre-crack energy, crack energy, and post-crack energy increased by 56.27%, 40.67%, 176.06%. Furthermore, the concrete toughness and ductility index increased by 22.4% and 101.57%. RuGPC demonstrates considerable promise in improving seismic behavior in earthquakes prone areas, enhancing structural design and tackling environmental concerns associated with waste tires disposal, harmonizing with sustainable development goals.

Biography

Azunna Sunday U. is a professional in the field of civil engineering, with a focus on structural engineering. He has pursued his academic and professional career with determination and excellence. He has demonstrated his expertise through various research publications on sustainable engineering and successful project executions, contributing significantly to the advancement of engineering practices. He holds a Master of Structural Engineering, and a bachelor's degree in civil engineering, and advanced diploma in civil engineering technology. He is currently running a Doctor of Philosophy program in Structural Engineering in University Putra Malaysia.

REEs Precipitation from Phosphogypsum Leachate: Impact of Temperature and Additives

Hajar Bellefqih*, Wassila Ajbar and Essaid Bilal

Ecole Nationale Supérieure des Mines de Saint Etienne, CNRS UMR, EVS, Saint Etienne, France

Abstract

Phosphogypsum (PG), a by-product of wet-phosphoric acid production, holds significant potential as a secondary source of rare earth elements (REEs) with regards to the concentrations of these elements as well as the overall production volumes. This study focused on PG from the Wizow chemical plant in Poland, revealing an initial REEs concentration of around 4296 mg/kg. To extract these elements, leaching was carried out using a 1 M solution of H_2SO_4 at 25 °C, with a solid/liquid (S/L) ratio of 1:8, for 1 hr. This process produced a leachate containing 368 mg/L of rare earths, with a final pH of 0.22, indicating successful extraction of REEs. After leaching, REEs precipitation was carried out with 1 M of $HO_2CCO_2H{\cdot}2H2O$. Oxalic acid was used at concentrations 5 and 18 times the stoichiometric requirements to achieve complete precipitation, with the pH of the leachate adjusted to 1.5 using NaOH to optimize the results. The study also examined the impact of additives and temperature on the efficiency and selectivity of REEs precipitation, testing NaCl and $(NH_4)_2SO_4$ at 25 °C and 75 °C. The most effective conditions, 5 times the stoichiometric amount of oxalic acid, a temperature of 75 °C and NaCl as an additive, resulted in a REEs precipitation rate of 93%, underlining the superiority of NaCl as an additive. In contrast, ammonium sulphate was less effective, confirming the ability of NaCl to improve precipitation efficiency. Additionally, the PG residue meets standards for use in building materials, supporting circular economy goals by promoting critical materials recovery and reducing waste.

Biography

Hajar Bellefqih is a researcher in materials science currently working on the European project funded by ERAMIN3 titled "Phosphogypsum Processing to Critical Raw Materials" at Mines Saint Etienne. She holds a PhD from Hassan II University. Her recent publications focus on the utilization of PG in construction materials, including a study titled "Effect of HPO_4^{2} and brushite on gypsum reactivity," published in the Journal of Cleaner Production in 2024. Additionally, she has researched circular economy strategies for PG and the environmental implications of REEs in phosphate fertilizers, in the Journal of Cleaner Production and Resources, Conservation and Recycling.

Virtual Presentations

Water-energy Nexus: Water Related Energy Efficiency, Production and Extraction

Catherine N. Mulligan*

Concordia University, Canada

Abstract

The challenges of sustainable development include a water supply for healthy people, efficient use of water and energy resources, and protection of the ecosystem and environment. All must be resilient under climate change. The nexus between water and energy is a highly important element. The water sector exerts a heavy energy footprint (4% of global electricity consumption). Therefore, to offset this, there is a strong need to research energy efficiency and energy recovery from water. Some methods are production of biogas, the energy efficient annamox treatment process and energy production from wastewater treatment such as pressure reduced osmosis (PRO) which will be the focus of this presentation. Up to 50% of the energy required for wastewater can be produced by biogas. Production of energy and waste management, improvement of the potential for water reuse, protection of the environment, reducing carbon emissions and enabling the improvement of their environmental practices are all objectives. These research orientations will contribute and foster an integrated approach for understanding the water-energy nexus and enabling the design of carbon neutral or negative water treatment facilities.

Biography

Catherine N. Mulligan, PhD. is a Distinguished Research Professor at Concordia University in Montreal. She is the founder and Director of the Concordia Institute of Water, Energy and Sustainable Systems. Her research involves the treatment of soil, water, sediments and mining wastes. She has published more than 135 refereed journal papers and 8 books, in addition to the recent published book on the Water-energy Nexus in 2024 by CRC Press. She has supervised more than 75 graduate students to completion. She is a Fellow of the Canadian Society for Civil Engineering, Engineering Institute of Canada, Canadian Academy of Engineering and Royal Society of Canada.

Oral Presentations

Assessing State Bio-energy Eco-system in India: A System Perspective

Perminder Jit Kaur[1]* and K. K. Pant[2]

[1]DST's Centre for Policy Research, IISc, India
[2]Department of Chemical Engineering, Indian Institute of Technology Delhi, India

Abstract

The global demand for clean energy is surging, driven by the ever-increasing needs of a growing population. In this dynamic landscape, India, a diverse nation, finds each state grappling with unique strengths and challenges in the energy sector. India's ambitious national goals – net-zero emissions by 2070, 50% reliance on renewable energy by 2030, including a 1-billion-ton CO_2 reduction and carbon intensity below 45% by 2030 – hinge on crafting state-level energy policies that align seamlessly with these objectives. India is setting a blazing trail in solar power, aiming for a mammoth 280 GW capacity by 2030. Meanwhile, Punjab (3000 MW) and Uttar Pradesh (2800 MW) have rich biomass resources for producing bioenergy (NIBE Report). Looking at the differences in resources and potential of all states in India, a comprehensive system framework is proposed to identify the most attractive state bioenergy markets. This framework utilizes four key indicators: Energy production, energy diffusion, producer-diffuser interaction and state-specific challenges and priorities to identify unique roadblocks and areas of focus for each state. This study delves into the development of this system framework, strategically divided into sections to comprehensively analyze all aspects of the state-level STI ecosystem. Additionally, the study explores the background of each state, encompassing demographics, economic factors, and social dimensions. Through this in-depth analysis, the study aims to unlock India's most attractive state bioenergy markets, paving the way for a collaborative federal-state approach towards a sustainable energy future.

PREFAB-GEN

Elzbieta Rynska*

Warsaw University of Technology, Poland

Abstract

In Poland there are approx. 60,000 large-panel buildings with around 4 million flats. Approximately the same number was built in the former Eastern European countries. Part of the stock was also built in Austria, Germany, Italy and even Spain. Most of them were built between 1960 and 1990. Due to the typology of structural assumptions made in non-demountable technologies with low design for deconstruction features, as well as low energy efficiency, it is extremely important to develop a comprehensive refurbishment/deconstruction methodology in line with the contemporary expectations of European legislation. So far, revitalization measures, mainly financed by European funds, have mainly concerned so-called degraded areas, such as industrial areas or city centers, and have 'insufficiently included housing projects.' These activities have been concentrated in larger cities with a lack of projects in smaller urban centers. Modernization measures did not include prefabricated buildings with public functions such as schools or hotels. Therefore, it is vital to develop a common road map for regenerative procedures which will include issues concerning circularity in construction sector, health and wellbeing issues and provide a management system improving the potential adaptability of this building stock in common with flexibility for future climatic and usability change.

Biography

Working at the Faculty of Architecture Warsaw University of Technology (WUT) for the past 35 years. Status of a professor since 2016. Currently Head of a Pro-environmental Design Team. Specialisation: sustainable architecture and urban planning, circular issues in building sector, environmental certification. BREEAM AP since 2012 and WELL AP. Interests: economy and management in the building sector within the scope of sustainable development. Author of several books and international scientific papers. Cooperation within several international interdisciplinary grants. Member of a Climatic Committee UN Global Compact Network Poland, member of a Sustainable Development Team Polish Association of Architects.

A Model for Strategic and Financial Valuation of a Waste to Energy Unit

Petros Theodorou*

Athens University of Economics and Business, Europe

Abstract

The financial valuation of a Waste-to-Energy (WtE) unit will be utilized to develop the pricing of refuse derived fuel (RDF) for a portfolio of relevant technologies. This process will identify the WtE business opportunities in the coming years using the strategic alignment model (Theodorou & Florou 2008, Theodorou & Apokoritis 2022, Theodorou and Theodorou 2024). These opportunities will be justified through the wider practices in Europe and specifically within Greece. The research will be focused on the exploitation of RDF/SRF to be produced through mechanical biological treatment (MBT) installations. By analyzing the economic feasibility of WtE units, the financial valuation will provide insights into the optimal pricing strategy for RDF, considering the technological and market dynamics. This will allow for a more strategic approach in maximizing the utilization of RDF, while addressing both the financial viability and the environmental impact of such projects in the context of the broader European and Greek waste management landscape. Through this analysis, the report aims to outline a path for the sustainable development of WtE projects, leveraging the available RDF/SRF resources effectively.

Keynote Presentation

Extend Fresh Produce Shelf Life with Revolutionary Technology

Bruce Roesner* and Matthew Michel

Green Life Tech Corporation, USA

Abstract

More than one-third of all produce grown is never consumed, costing more than $400B in losses annually just in the US, $2.6T worldwide. This waste accounts for 300,000,000 pounds of spoilage disposed daily in US landfills and generates 10% of all greenhouse gases. GreenLifeTech™ has developed a safe, cost-effective, patent pending technology to extend the shelf life of fruits and vegetables by up to 5x and is applicable across the entire food chain. By removing oxygen from a sealed container operating at atmospheric pressure (no vacuum) this environmentally friendly technology (no chemicals, low energy) creates an inert environment thereby extending the shelf life. The technology also offers ozone generation used in the destruction of bacteria. GLT's initial product the Fresh Defend Home TM (https://youtu.be/NdkFsMrslVA), recently introduced at the Consumer Electronics Show and successfully launched on Kickstarter, addresses the household market where more than 50% of annual US spoilage occurs. Additionally, GLT is in discussions with refrigerator OEMs to license the technology allowing for a significant extension in preserving fruits and vegetables in crispers, as well as pursuing a scaled version of the product for commercial use in the storage and shipping of fresh produce.

Biography

The President and CTO, Dr. Bruce Roesner (PhD., Purdue University, 1974), has founded three companies operating worldwide in which he was responsible for raising more than $48M in venture capital. He has proven expertise in developing high level products and subsequently moving those products to market. Dr. Roesner has authored more than forty (40) patents, He also has experience of growing a technology-based company from $18M valuation to the sale of $79M.

Oral Presentations

Workflows for Industrial Transition to Circular Economy

Patricia Kio*

University of Florida, USA

Abstract

Papers, plastics and metals were the first, third and fifth most common non-hazardous industrial byproducts reported by the United States environmental protection agency in 2018. This study presents alternate approaches of reusing these paper, plastic and metal industrial by-products to the current recycling practices which cause materials to change their physical state and contribute to delays in disposal. Approaches include students' course work comprising of novel case studies. Three case studies of novel workflows for reuse are presented and their environmental and economic impacts are evaluated comparing reuse to recycling, combustion and landfilling. Findings are reported in avoided energy and greenhouse gas emissions. The results provide workflows and practices to contribute towards a transition to a more circular economy.

Advancing Sustainable Construction with Bio-oil and Biochar: Innovations in Waste Utilization and Carbon Reduction

Sharareh Shirzad*

Department of Sustainable Technology and the Built Environment, Appalachian State University, USA

Abstract

Every year, a significant amount of waste is generated globally, much of which is sent to landfills, contributing to environmental challenges. However, through thermochemical processes such as pyrolysis, biomass can be transformed into valuable materials like bio-oil and biochar. Integrating these byproducts into construction materials offers a dual benefit: reducing the carbon footprint of construction while repurposing waste materials. Bio-oil, derived from the pyrolysis of various biomass sources - including wood and forestry residues, municipal waste, and agricultural byproducts - has physical and chemical properties similar to petroleum-based asphalt binders. This low-viscosity material is a promising candidate for replacing a portion of traditional

petroleum-based asphalt in pavement construction. However, bio-oil-modified asphalt binders have shown higher aging susceptibility and a decline in high- temperature performance, which limits their application to low replacement percentages. To address these challenges, a novel approach has been introduced involving the polyurethane (PU) modification of bio-asphalt. Biochar is a porous, carbon-rich material produced as a byproduct of biomass pyrolysis. It has a stable chemical structure, excellent carbon sequestration potential, and is increasingly being explored as a sustainable additive in concrete production. By partially replacing cement with biochar, the carbon footprint of concrete can be significantly reduced. Cement production is one of the largest contributors to carbon emissions in the construction industry, and biochar provides an environmentally friendly alternative that aligns with global efforts to mitigate climate change. Additionally, biochar's porous structure may contribute to improved durability and mechanical properties in concrete, enhancing its long-term sustainability.

Biography

Shirzad is an Assistant Professor at Appalachian State University, specializing in the field of sustainable construction materials. Holding a Ph.D. from Louisiana State University, Dr. Shirzad is a dedicated researcher with a passion for advancing sustainable practices in the construction industry. With a focus on innovative solutions, she has contributed significantly to the field through her research, which has been published in various peer-reviewed journals. Shirzad's expertise lies in exploring eco-friendly construction materials and techniques that minimize environmental impact while maximizing structural integrity. She is committed to shaping the future of sustainable construction through her academic contributions and active engagement in the academic community.

Cassava Wastewater Valorization for the Production of Biosurfactants

Cristiano José de Andrade*

Department of Chemical and Food Engineering, Federal University of Santa Catarina (UFSC), Brazil

Abstract

The global production of cassava was estimated at ca. 303 million tons. Due to this high production, the cassava processing industry (cassava four and starch) generates approximately ca. 0.65 kg of solid residue and ca. 25.3 l of wastewater per kg of fresh processed cassava root. The composition of the liquid efuent varies according to its origin; for example, the efuent from cassava four production, when compared to the wastewater from the starch processing, presents a higher organic load (ca. 12 times) and total cyanide (ca. 29 times). It is worthy to highlight the toxicity of cassava residues regarding cyanide presence, which could generate disorders with acute or chronic symptoms in humans and animals. In this sense, the development of simple and low-cost eco-friendly methods for the proper treatment or reuse of cassava wastewater is a challenging, but promising path. Cassava wastewater is rich in macro-nutrients (proteins, starch, sugars) and micro-nutrients (iron, magnesium), enabling its use as a low-cost culture medium for biotechnological processes, such as the production of biosurfactants. These compounds are amphipathic molecules synthesized by living cells and can be widely used in industries as pharmaceutical agents, for microbial-enhanced oil recovery, among others. Amongst these biosurfactants, surfactin, rhamnolipids, and mannosileritritol lipids show remarkable properties such as antimicrobial, biodegradability, demulsifying and emulsifying capacity. However, the high production cost restricts the massive biosurfactant applications. Therefore, this study aims to present the state of the art and challenges in the production of biosurfactants using cassava wastewater as an alternative culture medium.

Biography

Prof. Andrade has experience in the development of biotechnological processes related to bacteria; and micro and macroalgae, particularly metabolism (proteomics), bioproducts with high surfactant activity, purification processes (membranes and high pressure extraction) and identification of biomolecules by mass spectrometry. According to Research Gate "Your Research Interest Score is higher than 95% of ResearchGate members" and "Your Research Interest Score is higher than 99% of ResearchGate members who first published in 2013. Professor Andrade is permanent professor in the Graduate Program in Chemical Engineering at UFSC (PósEnq-UFSC – one of the finest ones). Professor Andrade is a CNPq researcher in productivity 2E - Engineering II - Chemical Engineering (award given to the most outstanding researchers in the field). Professor Andrade is the coordinator of PRH 11.1 – Sustainable Energy Development in the Oil, Gas and Biofuels Sector, promoted by ANP (National Agency of Petroleum, Natural Gas and Biofuels). In addition, currently, Professor Andrade has been doing research with Petrochemical companies (substantial budgets).

Bio Nanotechnology for Environmental Sustainability

Tatiana Cardoso e Bufalo[1*] and Joyce Dória[2]

[1]Department of Physics, Federal University of Lavras, Brazil
[2]Department of Agriculture, Federal University of Lavras, Brazil

Abstract

The bioeconomy is an industrial production model based on renewable biological resources, aimed at developing sustainable solutions to completely replace non-renewable resources used in traditional production systems. The implementation of the bioeconomy is made possible through the application of advanced technologies and the integration of various fields of knowledge and industrial sectors, with a focus on sustainability and scientific, economic, environmental, and social development. Our multidisciplinary research group develops innovative bionanomaterial solutions for renewable energy and sustainable agriculture. In particular, we focus on luminescent solar concentrator bio nanotechnology for agrivoltaic systems, which combine sun-loving crops with electricity generation, and bionanocoatings for microorganisms used in agriculture, enhancing their survival under solar radiation and enabling the controlled delivery of nutrients to plants.

Secondary Environmental Factors Affecting Traits in Plants with Potential for Revegetation of Areas Impacted by Iron Mining Tailings

Fabricio José Pereira*

Federal University of Alfenas, Institute of Natural Sciences, Brazil

Abstract

Mining tailings dam failures are catastrophic events that cause unparalleled environmental damage affecting large areas worldwide. Such failures cause economic and social impairment in affected regions and harm local flora and fauna. The Fundão dam failure from Mariana, Brazil, in November 2015 was one of the biggest dam failures ever, releasing 55 million cubic meters into the environment. Recovering of these affected areas depends on revegetation using plant species. Iron mining tailings are often polluted with potentially toxic elements such as As, Cd, Cr, Pb, and Al among others. Nonetheless, secondary environmental factors such as water and nutrient availability and pH cause additional limitations to plants. Our works investigated the effects of nutrient solution, pH variation, and water availability in plant species growing in iron mining tailings from Fundão dam failure. Results showed moderated toxicity to plants caused by iron mining tailings despite the presence of Al, Cd, Cr, and Pb. Tailings show macro and micronutrients, providing conditions for plant growth. However, modifications in water availability cause waterlogging harming plant growth. Alteration of the pH increases the toxicity of iron mining tailings driving the necessity to manage areas impacted. Thus, secondary environmental factors can alter the toxicity or revegetation viability of iron mining tailings, and managing impacted areas is important for the success of recovering such regions.

Biography

Graduated in Biology from the Universidade Federal de Alfenas in 2006, and Master's and Doctorate degrees in Plant Physiology from Universidade Federal de Lavras in 2008 and 2010 respectively. Professor of Plant Physiology and Plant Anatomy at Universidade Federal de Alfenas since 2011. CNPq Productivity Researcher since 2018. Member of Editorial Board from Journal of Plant Growth Regulation and PlosOne journals. Was adviser to 12 Doctorate and 17 Master's degree students. Published 87 works in scientific journals with H-index: 16 (Web of Science), 19 (Scopus), and 24 Google Scholars.

Phosphorus Release and Recovery from Simulated Ferric Wastewater Sludge

Aseel A. Alnimer[1*], D. Scott Smith[1] and Wayne J. Parker[2]

[1]*Wilfrid Laurier University, Canada*
[2]*University of Waterloo, Canada*

Abstract

Phosphorus (P) is a fundamental element necessary for all life forms and a key component in the fertilizer industry. Meanwhile, the excessive load of P to water bodies promotes eutrophication. Wastewater treatment plants remove P either biologically or chemically and produce P rich sludge which could be a potential renewable source for P. At present, commercial technologies exist for P recovery from biological wastewater sludge. However, P recovery from chemical sludge particularly iron(III)-phosphate (Fe-P) sludge generated in chemical P removal plants utilizing iron(III) salts remains a challenge. This study explored, in lab-bench scale, the influence of pH, competing anions, and Fe redox chemistry using reducing agents like ascorbic acid (AA) on direct P and Fe(III) release and recovery from simulated Fe-P sludge. Initial tests were performed in the absence of organic matter interferences followed up by tests in more realistic matrices where the effect of organic matter (OM) (carbonaceous and nitrogenous constituents) on chemical phosphorus removal and recovery is investigated. Results revealed that alkaline treatment had minimal effectiveness in releasing iron (>3%), but significantly facilitated P release, especially at a controlled pH of 10, where the percentage of phosphorus release reached (90 ± 2%). The chloride effect in releasing P from Fe-P sludge was negligible. At pH values of 3 and 4, and with Fe/AA molar ratios of 1:2 and 1:4, complete solubilization of Fe-P sludge and

reduction of Fe(III) were observed. Wet alkaline (Ph 10) and ascorbic acid treatments showed no influence of OM on P release from Fe-P sludge.

Biography

Alnimer earned a BSc. in Chemistry from Yarmouk University-Jordan in 1999, followed by an MSc. in Analytical Physical Chemistry from the University of Jordan in 2002. In 2023, she obtained a Ph.D. in Analytical Physical Chemistry from Wilfrid Laurier University, Canada. Currently, Alnimer serves as a Postdoctoral Fellow and Contract Teaching Faculty in the Department of Chemistry and Biochemistry at Wilfrid Laurier University. Her research focuses on environment, sustainability, and climate change including chemistry of aerosols and air quality, elemental speciation in geochemical media, phosphorus recovery from wastewater sludge, biosensors for lead detection, and selenium interferences in ICP-MS/MS analysis.

AI for ESG Reporting and Assurance in the Banking System

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[1]Torrens University, Australia
[2]IAAA Group PTY LTD, Australia

Abstract

The implementation of artificial intelligence (AI) technology in Environmental, Social, and Governance (ESG) reporting and assurance practices transforms how banking institutions maintain transparency and accountability. Financial institutions use AI technologies to meet rising regulatory requirements, and stakeholder demands by automating data collection and improving reporting precision and enabling real-time ESG metric tracking. This paper examines existing research to assess AI's transformative capabilities through machine learning predictive risk modeling and natural language processing (NLP) unstructured data analysis and generative AI dynamic report generation. The research demonstrates AI applications through automated TCFD framework compliance and AI-based ESG risk evaluation for credit assessments and sustainability disclosure anomaly detection. The main obstacles which remain include fragmented data sources and biased algorithms and ethical issues regarding transparency. The research demonstrates that AI technology both optimizes assurance procedures and transforms auditing practice by providing continuous verification through AI technology. This research evaluates technical systems and governance structures to create guidelines for maintaining innovation accountability within AI-based ESG environments.

Analysis of Decomposition of Bioplastic Bags in Compost: A Case Study for Environmental Sustainability

Crystal Cheng[1*], Bryan Huang[2], Alan Zhang[2], Max Yang[2], Jinze Zhu[2], Arwen Fu[3] and Linda Shi[4]

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[2]Canyon Crest Academy, San Diego, California
[3]Westview High School, San Diego, California
[4]University of California, San Diego, California

Abstract

A growing awareness of the environment has led to the emergence of biodegradability resources. Global issues such as sustainability and recyclability are major considerations. Governments such as the City of San Diego (SD) advocate organic waste recycling by distributing a kitchen waste pail. However, since compostable bioplastic bags are not allowed in kitchen waste pail, most SD households did not participate in kitchen waste recycling due to reasons such as odor, pests, and inconvenience. The primary objective of this project is to demonstrate compostable bioplastic bags are safely and fully compostable under SD local conditions. With remarkable outcomes, we will advocate the use of compostable bioplastic bags for kitchen waste recycling in SD. A survey was conducted to explore the root causes of underused kitchen waste pails. Analysis for the primary outcome is the process of compostable bioplastic bag decomposition based on repeated measures design with fixed effects of plastic type (PE vs bioplastic bag containing food scraps vs bioplastic bag cut into squares) and types of compost mixture used. Safety analysis will also be conducted using red worms. The analysis of survey data indicates that 106/110 (96.4%) of people would compost their kitchen waste if compostable bioplastic bags could be used. Analyses of experimental design for the compost process are ongoing and will be presented at the meeting. The outcome of composting data indicates that compostable bags can be safely and fully degraded into usable compost fulfilling the City of SD compost criteria.

Biography

Crystal Cheng, a rising junior at Torrey Pines High School and serves as student board member on San Diego Alliance for

Asian Pacific Islander Americans, is passionate to service her community. Crystal plans to major in environmental protection. She built a team of youth scientists with common interest, who are passionate learners, problem solvers to global issues such as sustainability, industrial ecology, biodegradability, and recyclability. Observing the underuse of kitchen waste pail, Crystal serves as youth ambassador to connect her peers, City Council, and advisors who are biodegradable industry professionals and Bioengineering scientists for in-depth research on kitchen waste recycling.

Transforming Polyethylene Terephthalate Glycol-modified Waste into Electrically Conductive Nanocomposites for Electromagnetic Interference Shielding Applications

Nadia Abdollahi G*, Ehsan Khoshbakhti, Mohammad Arjmand and Abbas S. Milani

School of Engineering, University of British Columbia, Canada

Abstract

The escalating environmental impact of plastic waste necessitates designed sustainable solutions, among which mechanical recycling offers practical means to repurpose many discarded polymer-based products. This study focuses on transforming polyethylene terephthalate glycol-modified (PET-G) waste, a widely used thermoplastic, into electrically conductive nanocomposite materials for electromagnetic interference (EMI) shielding to protect electronic devices. We utilized two grades of recycled PET-G and one virgin grade (as control) for comparisons, all sourced from industrial partners. Carbon nanotubes (CNTs) were chosen as the nanofillers. Using a twin-screw extruder, we fabricated the nanocomposites while optimizing processing parameters to ensure optimal CNT dispersion across five concentrations. The ensuing filaments were then compression molded into test specimens for characterization, including electrical, mechanical, rheological, morphological, and thermal properties. Results showed that adding CNTs to the PET-G polymers (both recycled and virgin) improved the elastic modulus (up to 42%) and ultimate strength (up to 31%). CNT addition also altered the material' sviscoelastic behavior, shifting it from a liquid-like to a solid-like regime. This change is evidenced by increased viscosity and storage modulus at lower frequencies, indicating strong CNT-CNT and CNT-polymer interactions and the formation of a percolated nanoparticle network. CNTs also enhanced the electrical conductivity of the PET-G considerably, while thermal properties remained mostly unchanged. Moreover, high CNT concentrations demonstrated promising EMI shielding effectiveness. Finally, to identify the optimal base polymer and CNT% combination, we employed the PROMETHEE method, a multi-criteria decision making (MCDM) approach, considering desirable properties for end use and manufacturing efficiency.

Biography

Nadia is pursuing her MASc degree in Mechanical Engineering at the University of British Columbia (UBC), Okanagan campus. She has served as a research assistant in the Composites Research Network (CRN) and Nanomaterials and Polymer Nanocomposites Laboratory (NPNL) at UBC, focusing on sustainable material development, mechanical recycling, and nanocomposite manufacturing. With a background in aerospace engineering, she is passionate about advancing sustainable practices in the aerospace industry by developing new composite material solutions.

Enhancing Carbon Trading Price Forecasting in China: A Comparative Analysis of Long Short-term Memory and Traditional Models

Hao Zheng*

University of Nottingham Ningbo China, China

Abstract

This research aims to forecast carbon trading prices in China using a long short-term memory (LSTM) network for time series forecasting. It utilizes a comprehensive dataset of daily carbon trading prices in China from 2021 to 2024. The study conducts experiments to compare the performance of LSTM with other forecasting models, such as autoregressive integrated moving average (ARIMA) and artificial neural network (ANN). During the experiments, root mean square error (RMSE) and mean absolute error (MAE) were adopted to evaluate the accuracy of the forecasting models. The findings highlight that the LSTM approach significantly improves the accuracy of carbon price forecasts compared to traditional econometric methods like ARIMA. The results demonstrate the effectiveness of this deep learning model in capturing complex temporal dependencies in carbon trading price data. These findings contribute to sustainability efforts by enabling more accurate carbon pricing, which is crucial for guiding investments in low-carbon technologies and promoting effective climate policies.

Biography

Hao Zheng is a PhD candidate at the University of Nottingham, with an impressive portfolio of scholarly work. His academic

journey is marked by numerous publications, showcasing his commitment to advancing knowledge in his field. Hao's research interests are diverse and forward-thinking, encompassing sustainability; artificial intelligence forecasting; blockchain applications; and supply chain optimization. This blend of interests highlights Hao's holistic approach to addressing complex challenges in today's dynamic environment, aiming to contribute significantly to his field through rigorous research and innovative solutions.

Poster Presentation

Revolutionizing Air Quality Prediction: A Gated Recurrent Unit-based Approachto PM2.5 Forecasting

Hao Zheng*

University of Nottingham, Ningbo, China

Abstract

PM2.5 is a major component of air pollution. Lowering PM2.5 levels aligns with the goals of sustainable development, including ensuring healthy lives and promoting well-being for all ages. Moreover, PM2.5 particles can influence climate change because they affect cloud formation and the radiation balance. Therefore, forecasting PM2.5 levels is essential, as it directly relates to a firm's sustainability initiatives. To forecast PM2.5 levels, numerous researchers have developed various models to improve accuracy. However, existing literature has primarily focused on econometric approaches, such as moving averages, exponential smoothing, and autoregressive integrated moving average. Because most of these econometric approaches rely on linear assumptions, they often struggle to capture the complexities of real-world changes. Deep learning models, on the other hand, offer a promising route to enhance forecasting accuracy. To address this gap, in this research, I apply a Gated Recurrent Unit model to forecast PM2.5 levels in Beijing, China. The results demonstrate that the Gated Recurrent Unit model outperforms other forecasting methods, suggesting its usefulness for improving air quality forecasts and supporting sustainability initiatives.

Biography

Hao Zheng is a PhD candidate at the University of Nottingham, with an impressive portfolio of scholarly work. His academic journey is marked by numerous publications, showcasing his commitment to advancing knowledge in his field. Hao's research interests are diverse and forward-thinking, encompassing sustainability; artificial intelligence forecasting; blockchain applications; and supply chain optimization. This blend of interests highlights Hao's holistic approach to addressing complex challenges in today's dynamic environment, aiming to contribute significantly to his field through rigorous research and innovative solutions.

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