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ABSTRACT BOOK

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Venue

Four Points by Sheraton Boston- Newton

contact@uniscigroup.net
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KEYNOTE PRESENTATIONS

Frequentist and Bayesian BACI Analyses Determine that Climate Change but not the Massachusetts Bay Sewage Effluent Outfall Affects Massachusetts Bay Benthic Infaunal Biodiversity

Eugene D. Gallagher[1]*, Christopher R. Haak[2], Kenneth E. Keay[3], James A. Blake[4] and Nancy J. Maciolek[5]

[1]School for the Environment, UMass Boston;

[2]Urban Coast Institute, Monmouth University, West Long Branch, New Jersey, USA;

[3]Massachusetts Water Resources Authority, Boston MA (retired);

[4]Museum of Comparative Zoology, Harvard University, Cambridge, MA & Aquatic Research & Consulting, Duxbury, MA,

[5]Aquatic Research & Consulting, Duxbury, MA

Abstract:

Boston Harbor was among the nation's most polluted harbors in the 1980s. The centerpiece of the cleanup of Boston Harbor was the construction of the Deer Island Secondary Sewage Treatment plant, which daily treats approximately 1.3 million m3 of sewage effluent (4.8 million m3 peak flow) discharged through a 15-km-long outfall to a series of 17 risers and diffusers at about 35 m depth in Massachusetts (MA) Bay. Analyses of MA Bay's benthic communities began in August 1992, and the MWRA sewage effluent outfall began discharging secondarily treated sewage effluent to MA Bay on September 6, 2000. We report on the analyses of the infaunal benthos at 36 MA Bay stations during nine years of pre-outfall sampling and the first eight years of post-outfall sampling. We analyzed infaunal benthic biodiversity with both frequentist and Bayesian Before-After Control-Impact (BACI) multilevel models. Both frequentist and Bayesian methods revealed that infaunal benthic biodiversity measured near the outfall had nearly the same species richness as the infaunal benthos away from the outfall in both the pre- and post-discharge periods. While more computationally intensive, Bayesian methods provide a more sensible assessment of the outfall's effects. The major pattern during this period was a striking 17-year increase in species richness that is positively correlated with the Atlantic Multidecadal Oscillation (AMO), a climate change index based on North Atlantic sea surface temperatures

Biography:

Eugene Gallagher recently retired as an Associate Professor in the School for the Environment at UMass Boston. He earned his B.A. degree from Carleton College (Northfield MN) and M.Sc. & Ph.D. degrees in Oceanography at the University of Washington (Seattle). He was an independent scientist at the Woods Hole Marine Biological Laboratory. He was a founding faculty member of the first Ph.D. program at UMass Boston. He and his students have been studying the effects of pollution on Boston Harbor and Massachusetts Bay benthic communities for more than four decades, often using multivariate statistical methods. He taught oceanography, environmental science, and statistics.

Governing the System Change to Circular Economy

Jacqueline Cramer

Copernicus Institute of Sustainable Development, Utrecht University, Utrecht, The Netherlands

Abstract:

To keep up with the rapidly changing world, and moreover to face the challenges that come with it, major system changes are required. One of these major challenges is the overconsumption of our natural resources, some of which are scarce. To change course, time has come for a circular economy. This is an economy that, instead of discarding products after use, as in a linear economy, operates within a closed-loop system that keeps products, materials and resources circulating, uses renewable energy sources and safeguards the resilience of natural ecosystems. Recently, a growing number of publications has been issued about the need and definition of circular economy, but less about how circular economy can be implemented and become mainstream. This keynote lecture focuses on how the system change to a circular economy can be governed. It will be substantiated that public governance will not suffice. Complementary to the conventional role of government, network governance is considered crucial, as cooperation between partners in networks is what puts policy into practice. How network governance is put into practice, depends on the socio-cultural and political context. This will be illustrated by taking various examples. It will be concluded that the governance of a circular economy is country-specific but has many similar features. Ten general guiding principles will be presented that help implement circular economy.

Biography:

Jacqueline Cramer has always combined her academic career with being a change agent in sustainability. She has worked as a practitioner for more than 30 years with a great variety of companies on the implementation of sustainable entrepreneurship, corporate social responsibility and circular economy. She is part-time professor since 1990, presently professor of sustainable innovation at Utrecht University. Before she was Minister of Housing, Spatial Planning and the Environment (2007 –2010). She was member of about 120 Boards and still holds various Board memberships, among which Chairman of the Concrete Agreement, Building Agreement Steel and Dutch Circular Textile Valley.

ORAL PRESENTATIONS

Decentralized Municipal Wastewater Treatment to Recover Resources for Urban Food Production using Controlled Environment Agriculture

Yongsheng Chen

Bonnie W. and Charles W. Moorman IV Professor and Director School of Civil and Environmental Engineering Nutrients Energy Water Center for AGTECH (The N.E.W. Center) Georgia Institute of Technology, Atlanta, GA

Abstract:

In the era of rapid global urbanization and mounting challenges related to food and water resources, it is imperative to shift our perspective on municipal wastewater. This presentation emphasizes the importance of employing membrane-based processes to extract essential nutrients and resources from municipal wastewater, supporting urban Controlled Environment Agriculture (CEA) and enhancing food security. Through the synergistic use of technologies like Anerobic Membrane Bioreactors (AnMBRs), nanofiltration, and reverse osmosis, we can maximize nutrient recovery while selectively removing contaminants, ultimately obtaining concentrated nutrients from wastewater.

The treated effluents, ideal for hydroponic systems, enable efficient and sustainable food production. To enhance the selectivity of nanofiltration membranes, advanced synthesis techniques have been employed. Additionally, we've developed a machine learning approach to revolutionize membrane design, eliminating labor-intensive trial-and-error in future selective membrane fabrication. In the context of Controlled Environment Agriculture for food production, we've integrated robotics and digital twin modeling, unlocking potential in predicting plant productivity and nutritional content. Harnessing these technologies optimizes CEA systems, resulting in increased yields of nutrientrich produce. In summary, integrating membrane-based processes with urban CEA practices offers cities a unique opportunity to build resilience against food crises, reduce environmental impacts, and embrace a circular economy, promoting self-sufficiency and sustainable urban development. These practices address pressing resource challenges and pave the way for a greener, more sustainable future.

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 the Nutrients Energy Water Center for AgTech. His research focuses on environmental nanotechnology, membrane technology for sustainable energy and nutrients recovery, the FoodEnergy-Water Nexus, and machine learning for sustainable materials discovery. With over 200 published research articles, he has received accolades like the CAPEES/Nanova Lifetime Achievement Award, the American Chemical Society Editor's Award, and recognition from many national and international media outlets, including Forbes and The Atlanta Journal-Constitution (AJC).

Using Crumb Rubber as Modifiers in Dry Process for Open Graded Friction Course of Asphalt Mixtures

Junan Shen[1*], Riyadul Riyada[1], Zhaoxing Xie[2]

[1*]Georgia Southern University, USA,

[2]Maryland State Department of Transportation, USA

Abstract:

Crumb rubber particles (CRM), produced from scrap tires, have been used as a modifier for both asphalt binders and asphalt mixtures in either a wet (i.e., mixing CRM with asphalt binders) or a dry (i.e., mixing CRM with aggregates and asphalt binders) process. The dry process has been favored by the paving industry due to its advantages such as convenient construction and low cost. The big concern for the dry process to be used is the long-term durability. This project was to exam the macro-and micro-properties of CRM modified asphalt mixtures including the durability of long-term properties of the modified mixtures and micro-level properties. To this end, asphalt mixtures were designed and tested by means of Hamburg Wheel Tracking, and Asphalt Mixture Pavement Tester for evaluating the rutting resistance and fatigue properties as well. Fourier Transfer Infrared Spectrum tester was used to see the aging resistance of the asphalt mixtures as compared with the control samples. Results indicated that the properties of both macro- and micro- level are comparable to the control samples that were made using wet process.

Biography:

Junan Shen, professor of Civil Engineering and director of Asphalt Research Lab at Georgia Southern University, has been working on recycling wastes, mainly scrap tires in asphalt mixtures for more than 20 years. His research projects are funded by Georgia Department of Transportation

and department of Natural Resources and has resulted in more than 20 publications on this field of interests.

De-oxidation of Metal Powders using Non-thermal Hydrogen Plasma for Optimized Reuse in Additive Manufacturing

Devon Jensen[1] *, Mike Denchy[1], Josh Kintzer[1], Pradeep Kumar1, Mruthunjaya Uddi[1], Tim Schmitt[1], and Chien-Hua Chen[1]

[1]Advanced Cooling Technologies, Inc., Lancaster, PA

Abstract:

Additive manufacturing (AM) processes face a significant challenge with an increasing oxygen concentration (predominantly as surface oxides) in metal powders during reuse cycles. This increased oxidation, occurring at high temperatures encountered by powders during printing processes, ultimately surpasses the industry acceptable quality limits. Laser powder bed fusion (LPBF) AM processes, in particular, deposit metal powders layer by layer, resulting in feedstock waste, which can increase unit costs and have adverse environmental impacts. It is therefore essential to develop and optimize processes to enable the recycling and reuse of metal powders to establish sustainable AM processes. To address this challenge, we report the application of a novel low-temperature non-equilibrium hydrogen plasma-based deoxidation process for efficient recycling and reuse of metal AM powders. Our technique involves the highly reactive species generated in an H2-fed low pressure plasma discharge dynamically interacting with used (oxidized) powder in a quartz tube reactor, reducing oxygen content without adversely affecting particle size or morphology. This process is also free of corrosive chemicals, with water vapor being the major by-product of the reaction. In a pilot study using CuSn10 (0-25 micron) powder, we achieved over a 60% reduction in oxygen content using hydrogen plasma compared to the oxygen content in oxidized CuSn10 powder samples, which is a significant improvement and well below the measured oxygen content of the virgin CuSn10 powder. An in-depth systematic characterization study (XRD, XPS, PSD, and IGF) demonstrating powder morphology, bulk particle structure, and chemical composition following hydrogen plasma treatment will be presented.

Biography:

Devon has been with ACT since 2019 working on projects utilizing non-thermal plasmas. Nonthermal plasmas are highly reactive environments without large amounts of thermal energy. Due to this low-temperature characteristic, non-thermal plasmas open the way for many novel material processes in the fields of synthesis, manufacturing, and recycling. Education: Devon has an M.S. and a Ph.D. in Mechanical Engineering and a B.S. in Materials Science and Engineering from the University of Utah.

Advanced Approach to Closed Pulp Mill Water Circuits. Laboratory Results and Mill Experience

Janne Vehmaa

Andritz Oy, Finland

Abstract:

The pulp mill is very complex system which use lot of water in different departments and different functions including process water, steam generation and energy transportation, cooling, chemical

manufacturing, cleaning of process and sealing water in equipment. In traditional thinking the mill process water source is clean water and then process is optimized by using the mill internal circulations. Then the mill has the socalled clean circulations which are typicalyclean water like cooling circulation, and this water is clean in traditional thinking but can be warm and contaminated by inorganics.

Due the global warming and the increasing need of water in urban areas, there is much more pressure for industry to decrease environmental impact to the limited water resources by deceasing the process water intake, treating the effluent in proper way, closing the clean water circuits and limit the amount of the heat in effluent streams out from the mill. This need new type of mill concept where the useability of the different mill water streams is considered in newway.

A closed mill system has been one of the main targets in kraft mill development. The balance calculation however show that pulp mill process will never be Zero effluent, but core process will always produce water which will end up to effluent. When this kind of Zero water intake process is designed, the pulp manufacturing face issues which cause quality problems, more emissions based on new environmental permits and increased production costs. Therefore, the system needs the external water to decrease the problems, but not in traditional way. It has been proven that traditional effluent treatment in the mill produce such highquality water for themill that it can be used as raw water source in mill bleaching process and reach the same quality and economics than in case that external water is fresh water. The examples show that thiseffluent can replace the clean water and challenge the traditional thinking. Effluent characteristics of the final effluent were unchanged, and the final product was sufficient also to most demanding products as food packages.

These results show that also in very established industrial concepts there is room to challengethe traditions and reach significant savings of water but also chemicals and utilities which areused in the mill. Our example show that it was possible to solve most demanding water problem in mill. With open mind and analytical approach problem and consequences how to solve the issue can be method to solve analogical problems in industry. In this case the most contaminated waste stream was the perfect solution to replace the fresh the water in the process. This example is not only how we were able to challenge one problem in one industry, however it is example how we should challenge the traditional knowledge in many industrial areas not excluding the forest industry.

Economic and Environmental Assessment of using Solid Waste-based Electricity for Electric Vehicle Charging

Vinay Gonela

Texas A&M University – Central Texas

Abstract:

This paper focuses on evaluating the economic and environmental performance of electricity generation from solid waste and using this electricity for electric vehicle (EV) charging purposes. A multi-objective stochastic mixed integer linear programming model is developed that aims to determine strategic decision while designing sustainable electricity generation network under uncertainties. A real study is used to illustrate the efficiency and effectiveness of the proposed model. The results show that approximately 20% of the electricity needed for EV charging can be supplemented by using solid waste for electricity generation. In addition, factors such as electricity plant conversion rate as well as efficiency of EV vehicles shows the potential to simultaneously increase profitability and reduce GHG emissions.

Biography:

Vinay Gonela earned his Doctorate in Industrial Engineering with emphasis in Supply Chain Management from North Dakota State University. His research interests involve designing, assessing, and optimizing processes and systems to address societal problems in a wide variety of fields that include renewable and sustainable energy supply chains, rainwater harvesting, solid waste management, and healthcare engineering. He published several research articles in high-quality journal journals that include, but not limited to Applied Energy, Computer and Industrial Engineering, Journal of Cleaner Production, and international journal of Production Research. In addition, he serves as a reviewer for fifteen different journals such as Energy Policy, Sustainability, Applied Energy, and Transportation research Part E: Logistics and Transportation Review.

Keynote Presentation

Improving Enzymes and Bacteria for Bioremediation of Carcinogenic & Nuclear Waste

A.C.Matin

Stanford University, Stanford, CA

Abstract:

Contamination with toxic metals and radionuclides at the Department of Energy/Superfund and other waste sites world-over is a serious environmental problem, which is a clear and present danger to drinking water supplies. Most of these metals/radionuclides (referred to from here on as “metals”) can be rendered insoluble and immobile by bacterial reduction, thereby preventing their leaching from the contaminated sites. The membrane-located electron transport chain of certain bacteria can reduce many of these metals.

Examples are several iron and sulfate respiring bacteria, which can use these metals as terminal electron acceptors and are promising in bioremediation. However: a) Their respiration is inhibited by NO3 and O2, one or both of which are present at the waste sites. b) Like all bacteria, these respirers can also reduce the metals intracellularly by enzymes whose physiological role is energy generation and biosynthesis. But these enzymes reduce the metals by one-electron transfer, converting them into reactive valence states. Redox cycling of the latter generates severe oxidative stress, poisoning the cells and hampering bioremediation. c)

The metal respirators release the reduced product into the environment, where it is prone to re-oxidation by other bacteria, chemicals, and/or redox potential changes. We have discovered a family of soluble bacterial enzymes that have the capacity to reduce chromate [Cr(VI)] and uranyl [U(VI)], and likely other hazardous metals, to their non-reactive, stable and insoluble reduced state with little or no oxidative stress, as they are obligatory 2- or 4-e- transferers. Using directed evolution, rational design, and x-ray crystallography, we markedly improved the activity of one such enzyme. Its production in bacteria markedly increased their ‘safe’ metal reducing and immobilizing capability. Such intracellular reduction has the further advantage that the reduced species is sequestered inside the cells, and further stabilized by interacting with cell macromolecules, thus minimizing the chances of re-oxidation. Contaminated sites, like most natural environments, are nutrient poor. Under these conditions bacteria activate starvation promoters to synthesize starvation protection proteins and we have shown that remediating genes when linked to these promoters can be effective in bioremediation under starvation conditions. Linking the improved genes to such promoters is a promising approach for generating bacteria with superior bioremediation capability at contaminated sites. Several collaborators contributed to this work; they will be identified in the presentation.

Oral Presentation

Electrochemical Separation Technologies for Industrial Sustainability

Yupo J. Lin* and Thomas Lippert

Argonne National Laboratory, Argonne, USA

Abstract:

Electrochemical separations allow for selective capture of charged species and/or in-situ pH manipulation. By applying an electric current, ions can be separated from a liquid, while the number of ions removed is proportional to the invested electrical energy. Such selective separation of ions against other non-charged species enables a highly efficient "fit-for-purpose" operation, which has the potential to significantly reduce the costs for various "waste to energy" and desalination applications. Interest in "fit-for-purpose" separations has increased in recent years, and the application of selective separation technologies will become more important in the future to address the challenges of climate change and necessary technology adaptations. We will discuss the case studies of electrochemical process designs and material innovations that addressed the technical and economic challenges of separations in biochemical/ biofuel production, resource recovery and biogas production from wastewater and anaerobic digestion of solid food waste, product capture from CO2 utilization. If time permits, an example of impaired water treatment will be discussed.

Innovative electrochemical separations can provide transformational impacts toward decarbonization and resource recovery in circular economies. Its advanced selective separations enable highly energy-efficient separation, small carbon and water footprints, and low-cost operations to realize a paradigm shift toward sustainability in industrial sectors.

Biography:

Yupo Lin is a senior chemical/electrochemical engineer in Argonne National Laboratory located near Chicago, IL. At ANL, he leads the chemical and bioprocess developing team to advance separation technologies. His group has been working with industrial partners to develop bench-scale technology and scale-up for the pilot-scale technology demonstration in the field. 25 US patents were granted that provide engineering solutions to address the separation challenges in industrial sectors, e.g., produced water and brackish water desalination in energy production; chemical and biochemical productions from biomass; resource recovery from bioprocess wastewater treatment; energy and chemicals from waste and CO2.

Assessing the Cost and Environmental Benefits of Unit Pricing in Municipal Solid Waste Management: Insights in the Wake of New Regulations

Giacomo Di Foggia* and Massimo Beccarello

University of Milano - Bicocca, Department of Business and Law, Milan (IT)

Abstract:

Municipal solid waste management is a crucial and rapidly evolving municipal service, particularly in the context of circular economy goals. The cost-efficiency of waste management and the adoption of incentive-based pricing systems are critical issues attracting growing academic interest. A well-designed tariff system is essential for covering costs and promoting responsible waste disposal

behaviors.

This article explores the effects of such a tariff system, guided by the following research questions: How does the total cost per ton of municipal solid waste management evolve after implementing the new tariff method? Does the percentage of separate waste collection increase due to the regulatory changes in the sector? What is the impact of the unit pricing system on the total cost, the rate of separate collection, and the per capita waste generation?

This study significantly contributes to the existing literature by analyzing the impact of this regulation for several reasons. Firstly, it utilizes both economic and environmental data at the municipal level. Secondly, it enables the creation of temporal groups to compare scenarios before and after the new regulation's implementation. Lastly, it assesses the effectiveness of pay-as-you-throw tariffs in achieving environmental and economic objectives.

Towards IoT-enabled Sustainable and Resilient Smart Communities

Nalini Venkatasubramanian

University of California, Irvine, CA

Abstract Not Available!!!

Estimating Energy Consumption and GHG Emissions in the U.S. Food Supply

Kristina Armstrong [a], Wenquan Dong [b], Mingzhou Jin [c*], Sachin Nimbalkar a, and Joe Cresko [d]

[a]Manufacturing Energy Efficiency Research & Analysis, Oak Ridge National Laboratory, Oak Ridge, TN, USA

[b]Ingram School of Engineering, Texas State University, Kyle, TX, USA.

[c]Department of Industrial and Systems Engineering, the Institute for a Secure and Sustainable Environment, The University of Tennessee, Knoxville, TN, USA,

[d]Industrial Efficiency and Decarbonization Office, U.S. Department of Energy, Washington, DC, USA.

Abstract:

Quantifying the energy consumption and GHG emissions along the U.S. food supply chain (FSC) and identifying the high impact areas are crucial initial steps to transforming the U.S. food sector to net-zero emissions. This work provides a database of the energy consumption and GHG emissions from the U.S. food system at national and state level by FSC stage, fuel type, and food commodity. We estimate that the U.S. food system consumed a total 4,657 TBTU of site energy, 7,118 TBTU of primary energy, and generated 966.6 MMT of GHG emissions in 2016. Among all the FSC stages, on-farm production is the largest energy consumer (31% primary energy) and GHG emissions contributor (70%). Raising animals requires a large portion of the on-farm energy consumption and creates the largest portion GHG emissions. In addition, optimizing the U.S. food distribution system can directly reduce the distribution stage energy consumption and GHG emissions and increase products' shelf-life. Reducing food loss and waste is one of the best options for achieving the net-zero of the FSC, as it decreases the amount of food that is necessary to grow, and thus impacts the overall FSC. By utilizing the database, stakeholders can identify stage- and region-specific strategies and goals and explore other substantial measures to curtail the environmental footprint of the U.S. food system.

Biography:

Mingzhou Jin, John D. Tickle Professor, is the department head of Industrial and Systems Engineering at the University of Tennessee, Knoxville. He is also directing the Institute for a Secure and Sustainable Environment (ISSE) for UTK and the Center for Freight Transportation for Efficient & Resilient Supply Chain (FERSC), a DOT/UTC tier-1 center. His research interest includes sustainability, climate change, operations research, additive and smart manufacturing, clean energy and energy efficiency, supply chain, logistics, transportation, and data analytics. His research has been well sponsored with more than $20 million in grants and contracts from a broad spectrum of federal, and local government agencies and corporations. He is a fellow of the Institute of Industrial and Systems Engineers (and was IISE Regional Vice President from 2018 to 2020. Currently, he is Editor-in-Chief for Cleaner and Circular Bioeconomy and the executive editor of the Journal of Cleaner Production.

Upcycling Food Wastes to Cellulosic and Polysaccharide Advanced Materials

Takaomi Kobayashi*, Ayano Ibaraki and Tanpanee Chuenkaek

Nagaoka University of Technology/Department of Science of Technology Innovation, Japan

Abstract:

Upcycling technology to convert food waste into new materials is necessary to build a recycling-oriented society. In this study, food plant waste such as bagasse, which is relatively pure and contains a large amount of cellulose or polysaccharides, is used, as a functional material for biocompatible and less toxicity on skin cell, for hydrogel and film, and other applications such as cosmetic moisturizers and drug. The paper introduces upcycling for applications in matrices by using resource for such wastes. In particular, they are developing cellulose fibers made from lignocellulose derived from food waste bagasse for use in pharmaceutical and medical materials, and transparent film materials for substitution of petroleum-based ones. Although cellulose fibers are insoluble, we have succeeded in obtaining a transparent hydrogel by solvent exchange of DMAc/LiCl solution in alcohol vapor, and have recently succeeded in producing a highly transparent cellulose film, especially without chemical modification. A similar process can be applied to chitin films of animal origin. In addition, cosmetic applications such as moisturizing films made from citrus waste pectin are topics. Such upcycling of agro-waste originated from fruit products into advanced materials is developed at first on water soluble pectin purification for source and then conversion for biomass hydrogel agents and films. In this presentation, recent research results will be presented.

Biography:

Takaomi Kobayashi is a professor at Nagaoka University of Science and Technology and has been researching functional polymers and their practical applications for 40 years. In recent years, he has been developing materials that bring out the functionality of biomass polymers, especially those contained in biomass waste and unutilized waste. In particular, he has recently been conducting research and development on biomass materials that contribute to a sustainable society, such as cellulose, chitin, and pectin, with the aim of establishing upcycling technologies for these materials.

Valorization of Banana Peel into Spherical Magnetic Beads Particles for Remediation of Antibiotics and Heavy Metals

Olivia Boyle and Chirangano Mangwandi*

School of Chemistry & Chemical Engineering, David Kier Building, Queen's University Belfast, Northern Ireland, United Kingdom

Abstract:

The swift rise in industrialization has triggered a global crisis by intensifying the challenge of removing pollutants from wastewater. Addressing this pressing issue demands innovative, efficient, and cost-effective methods for ridding our environment of these perilous contaminants.

This study introduces a groundbreaking wastewater treatment approach, employing magnetic activated carbon derived from banana peels (Musa sapientum) encapsulated in calcium alginate beads (MAC@CaAlg). This material serves as an adsorbent, with a specific focus on removing two crucial pollutants: the broad-spectrum antibiotic Tetracycline (TC) and the highly toxic hexavalent Chromium, Cr (VI). The investigation is divided into four key areas: (1) Direct Tetracycline Removal, (2) Direct Chromium (VI) Removal, (3) TC-Loaded Materials for Cr (VI) Removal, and (4) Cr (VI)-Loaded Materials for TC Removal.

In each study, an array of materials, including raw banana powder, calcium alginate (CA), powdered banana peels encapsulated in calcium alginate beads (PBP@CaAlg), activated carbon encapsulated in calcium alginate beads (AC@CaAlg), and MAC@CaAlg, were analyzed alongside existing literature. These materials underwent testing across a range of pollutant concentrations, from 25ppm to 150ppm.

The results revealed the remarkable efficiency of MAC@CaAlg, achieving a 91% removal of Tetracycline after a 3-hour period, and a 66% removal of Chromium. In Study 3, the beads demonstrated a strong capacity, removing 64% of the target pollutant. Study 4 showcased beads loaded with Cr (VI) effectively eliminating 96% of Tetracycline. Furthermore, an in-depth exploration of adsorption capacities allowed for a quantitative assessment of MAC@CaAlg's reusability, while Isotherm Modeling laid the groundwork for potential upscaling in this novel wastewater treatment approach.

Biography:

Chirangano Mangwandi is a Senior Lecturer at the School of Chemistry and Chemical Engineering at Queen's University Belfast. He obtained his PhD in Chemical Engineering from The University of Sheffield in 2010. His research focuses on particle engineering to design systems and products for industries such as pharmaceutical, food, water treatment, and energy. He also contributes to the development of renewable energy and sustainable energy systems. He has a total of 76 peer reviewed publications. These publications reflect his extensive work in the field of Chemical Engineering, particularly in areas such as particle technology, clean energy production, and adsorption technologies.

Oil Contaminate Removal from Wastewater using Novel Filtration Membrane

Zhaoyang Liu

Qatar Environment & Energy Research Institute, Hamad Bin Khalifa University, Qatar

Abstract:

Oil pollution is typically caused by oil and gasrelated operations such as vessel accidents, which can pollute waterways as well as the environment and damage the ecosystem. Tanker ship cleaning contributes to oil spills, which have a negative impact on coastal countries due to protracted service disruption. It is critical for coastal countries to develop efficient oil taint cleanup technology. There are various oil/water separation technologies, such as gravity separation, hydrocyclone, air flotation, and membrane filtration, among others. Among these, membrane filtration has been shown to produce highquality effluent. Commercial membranes, on the other hand, nevertheless face significant practical challenges, such as a high susceptibility for membrane fouling when dealing with greasy effluent. We developed a unique anti-fouling filtering membrane for oil/water separation in this work. The membrane was made of inorganic nanofibers, which possesses the advantages of low membrane fouling, high permeation flux and longterm durability. This results from this study could facilitate to pave a new way for membranes filtration's practical applications in oil/gas industry.

Biography:

Zhaoyang Liu is a Senior Scientist at the Water Center at the 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 To align with the nation and institute's vision for water security, Dr. Liu is currently leading the development of oil/water separation technologies research project. He serves as an Editorial Board Member for Desalination and Scientific Reports.

CO_2 Photoreduction using Encapsulated Bismuth Halide Perovskites in Geopolymers Produced from Industrial By-products

Edith Luévano-Hipólito[1]*, Oscar L. Quintero-Lizárraga[1], Leticia M. Torres-Martínez[1]

[1]Universidad Autónoma de Nuevo León, Facultad de Ingeniería Civil - Departamento de Ecomateriales y Energía, Cd. Universitaria, C.P.San Nicolás de los Garza, NL, México.

Abstract:

CO2 photoreduction stands as a suitable option to obtain sustainable fuels using water as an oxidizing agent, solar light, and photocatalyst materials. Lead-free bismuth halide perovskites have been employed ever more often as photocatalysts for CO2 photoreduction, owing to their valuable optical properties that favored high efficiencies in this reaction, besides their easy obtention, and low cost. However, the low stability of these materials in aqueous medium and under irradiation limits their application at massive scale. One alternative to assure both good stability and efficiencies for CO2 photoreduction is the encapsulation of the perovskites in porous supports. Thus, this work proposes the encapsulation of bismuth halide perovskites in porous supports fabricated with industrial by-products, e.g., fly ashes and slags, to obtain a silicoaluminate matrix that provide adequate sites to host the perovskite particles, avoiding their degradation during the CO2 photoreduction. The proposed perovskite allowed the production of formic acid as alternative

fuel obtained from CO2 photoreduction with efficient energy conversion efficiency (>15%). Also, the stability of the perovskite was evidenced after 16 h of continuous visible-light irradiation.

Biography:

PhD in Materials Engineering, currently working as a professor at the Civil Engineering School of UANL. She is working on developing sustainable and technological strategies for environmental remediation, mainly focused on removing toxic pollutants from the air, e.g., CO2 and VOCs. She is also worked in designing alternative cementitious materials using industrial by-products and earth-abundant minerals in the northeast of Mexico.

Research Interests:

(i) Design and manufacture alternative photocatalytic cementitious materials with self-cleaning, air decontaminating, and antimicrobial properties.

(ii) Photoreduction of greenhouse gases (CO2, VOCs, NOx).

(iii) Synthesis of nanomaterials from earth-abundant materials and industrial by-products.

Characteristics of Organic Fertilizers used in Japanese Agriculture

Tran Quoc Thinh* and Kubo Motoki

Risumeikan University, Japan

Abstract:

Towards sustainable development goals (SDGs) and less dependence on chemical fertilizers in agriculture, recycling of local organic materials as fertilizers becomes an urgent issue. Proper amendment of organic fertilizers can improve soil fertility and plant yield. To propose appropriate application guidline of organic fertilizers, this study aims at investigating the physicochemical and biological properties of common organic fertilizers in Japan.

There were 456 organic fertilizer samples including cow manure fertilizers (113 samples), chicken manure fertilizers (69 samples), pig manure fertilizers (43 samples), horse manure fertilizers (23 samples), food waste fertilizers (14 samples), and other organic fertilizers (74 samples) investigated in this study. All samples were collected in over Japan from 2016 to 2021. Chemical properties (total carbon, total nitrogen, total phosphorus, total potassium), biological property (bacterial biomass), and physical property (water content) were analyzed. As a results, there was no significant difference of total carbon between types of organic fertilizers. Chicken manure fertilizers showed the highest content of total nitrogen. Total phosphorus content was highest in pig manure fertilizers, followed by chicken manure fertilizers. Meanwhile, cow manure and chicken manure had high content of total potassium. Bacterial biomass was relatively high in cow and pig manure fertilizers. Water contents were over 32% in all fertilizers (except for chicken manure fertilizers). Therefore, animal manure derived fertilizers (cow, chicken, and pig manure fertilizers) showed potential use as alternative fertilizer sources compared to the other organic fertilizers. However, reducing water content is recommended to reduce cost of transport and keep fertilizer quality stable.

Biography:

Tran Quoc Thinh received PhD degree of Environmental Science from Okayama University, Japan in 2018. From May 2018 to March 2022, I did postdoctoral program at Ritsumeikan University, Japan. I am Assistant Professor at Faculty of Life Science, Ritsumeikan University from April 2022

to present. My research themes are soil microorganisms, soil fertility, and organic fertilizers.

Machine Learning Based Optimization of Initial Cultivation Time for Agricultural Practices in the Blue Nile Basin of Ethiopia in the Context of Climate Change

Mohammad Reza Mazarei Behbahani

Uconn, Storrs, CT

Abstract:

Global food security is facing increasing challenges due to the impact of climate change. Agricultural regions, such as Ethiopia, rely heavily on their agricultural outputs, making it crucial to assess the potential effects of climate change on food security. This study aims to develop predictive understanding of the agricultural risks associated with climate change and explore potential mitigation strategies. The Decision Support System for Agrotechnology Transfer (DSSAT) model is employed to analyze the response of crop yield to projected climate changes in Ethiopia and identify the environmental stressors affecting crop productivity. The primary objective is to assess and address climate adaptation strategies. Specifically, this research focuses on optimizing the initial cultivation time as a means to alleviate heat-induced crop losses in a warmer climate. Machine Learning Data-Driven Models (ML-DDM) are utilized to forecast the best time for cultivation. These models incorporate various meteorological and soil moisture data, and different scenarios are considered to identify the most favorable cultivation initiation time. Additionally, Modflow is used to model groundwater flows in the basin, providing insights into soil moisture dynamics, which is further incorporated as a predictor in the ML-DDM. To enhance modeling accuracy, a deep learning model called Recurrent Graph Convolutional Network (RGCN) is employed. RGCN leverages both temporal and spatial data to improve the accuracy of the predictions. By integrating these approaches, this study aims to contribute to the development of effective strategies for adapting agricultural practices to climate change in the Blue Nile Basin of Ethiopia.

POSTER PRESENTATION

A Dark Side of Trust: Examining the Influence of Environmental Risk Perception on Citizens Plastic-avoiding Behavior

Bairong Wang[1]*, Bin Liu[2], Yong Li[1]

[1]Shanghai Maritime University, China;

[2]University of Shanghai for Science and Technology, China

Abstract:

This study explores the influencing dynamics of environmental risk perception on plastic-avoiding behavior by incorporating government trust and environmental locus of control within the influencing structure. Via an online survey, this study received 1126 valid responses and used partial least square-based structural equation modeling (PLS-SEM) techniques for data analysis. Three major findings are obtained. First, environmental risk perception positively impacts people's plastic avoiding behavior. Second, this relationship is partially mediated by environmental locus of control. Finally, government trust moderates the impact of environmental risk perception on both the environmental locus of control and plastic-avoiding behavior. When government trust is higher (lower), environmental risk perception has less (more) influence on the environmental

locus of control and plastic-avoiding behavior. Therefore, absolute high government trust is far from ideal in environmental management because it induces high government dependence, which stimulates people's "inertia" and makes them shirk their responsibilities for environmental protection. To reduce the dark side of government trust, it is suggested that the government shows some "weakness" and emphasizes its need for the public's support for plastic crisis management.

Biography:

Bairong Wang is an assistant professor with the School of Economics and Management, Shanghai Maritime University. She got her Ph.D from State University at Buffalo, SUNY. Her research interest lies in two aspects. The first one concerns sustainable practices, behaviors, and policies. The second one concerns risk communication and rumor management on social media. Her research papers have been published in Waste Management, IEEE Transactions on Computational Social Systems, Natural Hazards, etc.

Rare Earth Magnet Recycling using Advanced Distillation

Emmanuel Opoku[1]*, Ronan Flynn[2], Adam Powell[3]

Worcester Polytechnic Institute (WPI), United States

Abstract:

The need for rare earth metals in clean energy technologies such as wind turbines and electric vehicles has raised a threat to the supply and spurred researchers to look for sourcing alternatives, with recycling being one of the approaches. Many research investigations have demonstrated the magnet-to-metal approach, in which rare earth metals such as neodymium, praseodymium, dysprosium, and terbium, are leached from magnets by molten metals. These recycled metals can be involved in the production of rare earth magnets, providing an environmentally friendly source. This study provides an overview of this method of rare earth magnet recycling, which begins with demagnetization and coating removal. Leaching using liquid magnesium and bismuth, where distillation is done by a continuous gravity-driven multiple effect thermal system (G-METS). G-METS distillation can potentially improve the efficiency of rare earth metal extraction to help establish a sustainable supply chain for rare earth magnets.

Biography:

Emmanuel Opoku is a distinguished emerging professional in the field of Material Science and Engineering, currently pursuing his master's degree at Worcester Polytechnic Institute (WPI) in Worcester, Massachusetts. His academic journey began with a Bachelor of Science in Mechanical Engineering from the University of Energy and Natural Resources in Sunyani, Ghana.

Emmanuel has honed his expertise through various roles, including serving as a Research Assistant in the Energy Metal Research Group (EMRG) at WPI since 2023, where he engages in critical research activities such as leaching experiments on NdFeB magnets and Magnesium in the foundry and supporting the distillation team with Gravity Multiple Effects Thermal System (G-METS). His prior experience as a Research and Workshop Assistant at the Mechanical Engineering Department of Sunyani Technical University in Ghana and as an Intern at the Rural Technology Facility in Sunyani Ghana further underscores his practical and educational foundation in engineering.

Recycling of Magnesium alloy using G-METS Distillation

Daniel Mc Arthur Sehar[1]*, Artem Iurkovskyi[1], Cooper Langner[1], Adam Powell[1]

[1]Worcester Polytechnic Institute. Massachusetts, USA

Abstract:

Magnesium metal has been significantly used in commercial applications from automobiles to aluminum alloys to defense weaponry. The surge in structural usage of magnesium over the past years has been due to high strength and excellent stiffness-to-weight ratio. Recycling magnesium scrap is a crucial aspect of the sustainability of the economy and environmental welfare. G-METS is an advanced distillation system under development for the conversion of low-grade magnesium scrap into high-purity magnesium metal. This multiple-effect system uses the weight of magnesium as a compressor, to build pressure differences between each effect of the condenser-evaporator, modifying boiling points, and enabling transfer of vaporization enthalpy. This system is exceptionally efficient compared to the energy-intensive conventional distillation technique. This study compares experiments and models of 1 -effect distillers.

Biography:

Daniel McArthur Sehar currently enrolled as a third-year doctoral candidate at Worcester Polytechnic Institute in Massachusetts, USA. Under the guidance of Professor Adam Powell, my research focuses on the recycling of magnesium scraps and advancements in primary magnesium production. My areas of expertise and keen interests lie within the realms of electrochemistry, pyrometallurgy, and sustainable recycling practices.

Finite Element Analysis for Metal Purification with G-METS Distillation

Presenter* and Co-author names {Armaghan Telgerafchi [1]*, Carl Meinhart [2], Adam Powell

[1]) Worcester Polytechnic Institute (WPI), USA

2) University of California, Santa Barbara (UCSB), USA

Abstract:

Recycling metals is linked to a significant reduction in energy usage compared to primary production, resulting in a notable decrease in greenhouse gas emissions. One of the conventional methods for metal recycling is the distillation process. More specifically, gravity-driven multiple effect thermal system (G-METS) distillation process demonstrates an impressive 70-80% decrease in energy consumption compared to traditional metal distillation methods. This study introduces a comprehensive mathematical model of G-METS distillation including the kinetics of alloy evaporation, modeling the overall operation of a distiller using Finite Element Analysis (FEA). This model simulates fluid flow and heat and mass transfer in the solid distiller structure, liquid metal alloys flowing throughout the distiller, and vapor phase transport in each effect. Moreover, this model can indicate promising methods to improve volatile metal separation which decreases the energy consumption through a distillation process.

Keynote Presentation

Strategy to Control Photochemical Ozone Formation, What Could we do?

Yoshizumi Kajii

Graduate School of Global Environmental Studies, Kyoto University, Japan and also Graduate School of Environmental Science and Engineering, Qingdao University, China kajii.

Abstract:

Tropospheric ozone is harmful and has a potential to warm up the air due to the strong absorption of infrared radiations. We faced the photochemical smog problem in 1970 in Japan. The extensive investigation for the mechanism of ozone formation in the troposphere has been started and VOCs oxidation with NOx has been founded to be essential. To reduce ozone concentration, we must reduce the emission of NOx and man-made VOCs as much as possible. Owing to the great effort in industry mainly motor company, we were successful to reduce the atmospheric concentration of these precursors. Since then, mitigation of ozone problem was recognized in 1980s in Japan. However, we started having this ozone problem again in 1990 till now even though NOx and VOC concentrations have still negative trend. To control ozone concentration, the discussion of regime is very important. The question is the sensitivity of ozone formation depends on either VOC or NOx emission. If we know this, it seems easier to regulate ozone formation. However, the problem is this regime depends on the area where you are interested in. And not only man-made VOC and NOx but also the aerosols and un-known VOCs will contribute for ozone formation process. To minimize ozone formation, we must know more about the radical mechanism as well as the knowledge of precursors such as NOx and VOCs. The current understanding of photochemical ozone formation mechanism in urban area will be presented.

Biography:

PhD in chemistry Tokyo Institute of Technology (1987), Post Doc. Fellow, Max-Planck Institute for Radiation Chemistry (1987-88), Assistant Prof., Chemistry, Tokyo Institute of Technology (1988-1993), Associate Prof., RCAST, the Univ. of Tokyo (1993-2002), Prof. Applied Chemistry, Tokyo Metropolitan University (2002-2012), Prof. GSGES, Kyoto University (2012- present), Group leader, Nat. Inst. Environ. Studies (2012-present), Chief Prof. Qingdao University (2023-present).

Forecasting and Nowcasting COVID-19 Dynamics Powered by Wastewater Surveillance

Yongtao Cao[1]*, Mallory Lai[2], Shaun S Wulff[2], Timothy J Robinson[2], and Shunyu Tang[1]

[1]Indiana University of Pennsylvania, USA.

[2]University of Wyoming, USA.

Abstract:

Wastewater-based epidemiology (WBE) is a relatively quick and cost-effective way of anonymously monitoring infections, such as Coronavirus disease 2019 (COVID-19), in a population using wastewater data. However, despite the potential of WBE for monitoring COVID-19, it is still considered a complementary approach to traditional testing as standards for collection and analysis are still needed. Although much of the focus has been on developing methods for accurate forecasts, creating interpretable models with value for epidemiologists is just as important. The objective of this study is to intelligently incorporate WBE information to nowcast and forecast new weekly COVID-19 cases and to assess the efficacy of such WBE information for these tasks in an interpretable manner. The methodology consists of a time-series based machine learning (TSML) strategy and a Phenomenological Neural Network that can extract deeper knowledge and insights from temporal structured WBE data in the presence of other relevant temporal variables, such as minimum ambient temperature and water temperature, to boost the capability for predicting new weekly COVID-19 case numbers.

Biography:

Yongtao Cao is a professor in the Department of Mathematics and Computer Science at Indiana University of Pennsylvania. As a researcher and practitioner in statistics and data science, Dr. Cao has been involved in numerous research projects with collaborators from the areas of health and medical science, environmental science, computer science, education, and many others. One stream is focused on developing statistical tools and interpretable machine learning strategies for extracting knowledge or useful insights from wastewater data for better understanding infectious disease. Another ongoing stream with my collaborators is to investigate various issues between quantum science and data science.

County-level Dataset of Available Municipal Reclaimed Water: Addressing Freshwater Demands in Bioenergy Production

May Wu, Argonne National Laboratory

Cass Avenue, Lemont, IL

Abstract:

Water is indispensable in the production of bioenergy, particularly in cultivating feedstock. Achieving sustainable production requires tapping into non-traditional water sources, especially in regions with freshwater constraints. A comprehensive dataset of non-traditional water resources at the county level is essential for effective planning to address freshwater needs on a regional and local scale. This study focuses on providing up-to-date information on the use of reclaimed municipal wastewater in the United States. Water reuse surveys at the state and facility levels were conducted for 2019-2021, resulting in a county-level preliminary reclaimed water dataset for nine key bioenergy feedstock and reclaimed water states. The dataset is accessible through

the Water Analysis Tool in Energy Resources (WATER) at http://water.es.anl.gov. By applying the reclaimed water data in a future bioenergy production scenario, the study estimates the potential of untapped reclaimed municipal water for irrigating bioenergy feedstock and crops in six states: IL, IA, OH, LA, NY, and TX. The findings reveal significant reductions in freshwater needs, with the reclaimed water capable of supplying 225 billion gallons for irrigation in the six states. Freshwater use can be reduced by 0-100% at the county level, impacting 209 counties. This approach benefits both water-rich and water-scarce states.

Harnessing Public Waste Accountability to Mitigate Municipal Waste Generation: Lessons from an Empirical Cross-city Analysis

Seulki Lee-Geiller

Institution for Social and Policy Studies, Yale University, USA

Abstract:

The surge in private sector involvement in municipal solid waste management aligns with the prevailing neoliberal governance paradigm, emphasizing efficiency, cost-sharing, and resource optimization while minimizing government intervention. Despite its widespread adoption, increasing privatization has led to deteriorating waste conditions, posing substantial threats to the environment and public health. To address the complexities of municipal waste governance, this paper delves into the multifaceted factors influencing municipal waste generation, focusing on the role of public authority involvement. In doing so, the study employs a multi-model approach, using ordinary least squares and fixed effects regressions along with moderation analysis to analyze data from 125 capital cities around the world. Our results indicate a positive association between population size and the volume of municipal waste generation, even when controlling the municipal GDP and public authority involvement. We also found a positive association between municipal GDP and the generated waste volume; however, this link does not hold true when accounting for other factors. Notably, increased public authority involvement correlates with reduced municipal waste generation. Moreover, moderation analysis suggests a diminishing impact of population size on waste generation with higher levels of public authority involvement. In summary, as a city grows and its economy expands, more waste is likely to be generated. However, increased public authority involvement can mitigate the negative impacts of population growth on a city's waste generation. Consequently, this study urges researchers and practitioners to reassess public accountability in municipal waste governance.

Biography:

Seulki Lee-Geiller conducts interdisciplinary research at the nexus of governance, sustainable development, and technology. Employing qualitative, statistical, machine learning, and behavioral experiment approaches, she innovates public strategies to tackle complex societal issues. Dr. Lee-Geiller explores fundamental principles of interactions among social entities and technology within governance frameworks. With a diverse background in strategic planning and policy research across private and public sectors, she earned a Ph.D. in Global Affairs from Rutgers University–Newark, an MSc in Development Administration and Planning from University College London, and a BA in Political Science and Economics from Sookmyung Women's University.

Calculation of Spectral Radiative Forcing using the MODTRAN Atmospheric Radiative Transfer Model

Alexander Berk and Paul Corlies

Spectral Sciences, Inc., Burlington, MA

Abstract:

The MODTRAN6 Atmospheric Radiative Transfer (RT) Model serves as benchmark terrestrial software for prediction of narrow spectral bin transmittances, radiances and hemispherical fluxes in the microwave, infrared, visible and ultraviolet spectral ranges. MODTRAN is a 1D model, with the atmosphere defined using horizontally homogeneous spherical shell layering above the Earth surface. Atmospheric vertical profiles define the temperature, pressure, and densities of molecular and particulate (aerosol and cloud) constituents. The DISORT discrete ordinate method, modified for application to the spherical Earth, is used within MODTRAN to solve the 1D Radiative Transfer Equation (RTE). An application of MODTRAN important to Environmental Sustainability interest is the calculation of Radiative Forcing, defined in the IPCC Sixth Assessment Report as "The change in the net, downward minus upward, radiative flux (expressed in W/m2) due to a change in an external driver of climate change, such as a change in the concentration of carbon dioxide (CO2), the concentration of volcanic aerosols or the output of the Sun." MODTRAN can accurately predict the change that results in vertical fluxes when the defined atmosphere is perturbed, but MODTRAN must be run with appropriate model inputs. MODTRAN provides two statistical RT methods for computing narrow spectral band fluxes: band model (BM) and correlated-k (Ck) algorithms. Radiative Forcing calculations at elevated altitudes, such as the tropopause or top-of-atmosphere (TOA), requires use of the Ck method, as will be demonstrated and validated against MODTRAN line-by-line calculations.

Biography:

Alexander Berk is a Principal Scientist at Spectral Sciences, Inc. (SSI). His research activities focus on the modeling of radiative transfer (RT), the prediction of radiances that optical sensor measure when viewing structured backgrounds through the atmosphere. This work has included being the lead model developer for the MODTRAN and 3D MCScene atmospheric radiative transfer codes. His career has largely focused on developing first-principle algorithms for solving the radiative transfer equations over narrow spectral bins, using statistical methods to avoid the computational expense of line-by-line calculations.

Hybrid Green Composites using Waste Rice Straw, Jute Fibers and Soy Protein-based Resin

Anil N. Netravali* and Abdullah Alkandari

Cornell University, USA

Abstract:

'Green' biodegradable composites that combine plant fibers and plant-based resins have been slowly replacing conventional petroleum-based composites in many applications. The current trend in green composites is to use agricultural and food processing wastes rather than virgin materials. In this work, rice straw (RS), a waste commonly burnt in Asian countries, was combined with jute fabrics (JFa), creating semi-nonwoven reinforcement mats. The mats were impregnated with a soy protein isolate (SPI)-based resin and hot pressed under a pressure of 1 MPa at 140oC. Single-mat and triple-mat composites were produced with fiber loadings of 40, 50, and 60 by wt.

The hybrid green composites were characterized for their tensile and flexural properties. RS/SPI and JF/SPI interfacial shear strength (IFSS) was estimated by microbond test.Thermal stabilities of constituents and composites were determined through thermogravimetric analysis. Scanning electron microscopy was utilized to study fracture surfaces. Since fibers were not treated, IFSS values were low (4.25 MPa and 2.68 MPa for jute and rice, respectively). Tensile stress-strain plots of the composites showed step-wise load transfer indicating yarn breakage. It was noticed that at high fiber content of 60%, fiber wetting by the resin was insufficient resulting in lower mechanical properties. These hybrid green composites are well suited for low to medium strength applications, such as packaging, furniture, housing panels, etc., as replacement of wood and wood-based products which use carcinogenic formaldehyde-based resins. Their properties can be further enhanced with extra layering that reinforce interspatial defects and weak spots and optimizing the fiber content.

All-green Food Packaging Material Made with Chitosan and Cellulose Nanofibers

Jaehwan Kim*, Samia Adil, Yaohui Ci, Bokyung Kim

Creative Research Center for Nanocellulose Future Composites, Inha University, South Korea

Abstract:

Chitosan is a green, biodegradable and renewable material. It has been used for drug delivery, artificial skin, wound-covering, medical applications, water filtration, and food packaging. This paper reports extraction of chitosan nanofibers and its application for food packaging. The chitosan nanofiber (CTNF) was isolated by an aqueous counter collision (ACC) method. To further improve the physical properties of the food packaging material, cellulose nanofiber (CNF) was blended with CTNF so as to improve not only its biocompatibility and biodegradability, but also its physical properties. This presentation explains all about nanofiber isolations of cellulose and chitosan by means of chemical method, so called TEMPO oxidation and ACC. Cellulose and chitosan are recognized as the first and the second largest polymers available on earth, respectively. Thus, using both materials for food packaging offers a lot of benefits in terms of environmental protection and sustainable resources. In addition, chitosan is well-known for antibacterial properties, food preservation, and good antioxidant activity. The combination of CNF-CTNF composite could enhance the function of food packaging. The thermal stability, crystallinity, viscosity, antioxidant, and tensile strength of CNF-CTNF composites were investigated with the thermal analyzer, X-ray diffraction, Brookfield viscometer, antioxidant test, and tensile test, respectively. Tensile strength of CNF-CTNF composites shows great improvement and retained the usual Young's modulus. The antioxidant properties of the composites were investigated using ABTS. The composites show better antioxidant activity than pure CNF.

Biography:

Jaehwan Kim is an Inha Fellow Professor at Inha University. He earned his Ph.D. degree from Penn State University, USA. Dr. Kim is a fellow of The Korean Academy of Science and Technology, the National Academy of Engineering of Korea, and the Institute of Physics. He is the director of the Creative Research Center for Nanocellulose Future Composites, sponsored by the National Research Foundation of Korea since 2003. He first discovered cellulose as a smart material, which can be used for sensors, actuators, and electronic materials. His H-index is 62, and his research interests are smart materials and devices, including electroactive polymers, power harvesting, soft actuators, biosensors, flexible electronics, nanocellulose multifunctional composites, smart optics, space materials, and smart food packaging.

Robots in Ship Breaking and Waste Sorting

Berk Calli

Worcester Polytechnic Institute, Worcester, MA

Abstract:

In this talk, Berk will focus on two research projects from his lab: Robotic metal scrap cutting for ship breaking and robotic waste sorting for recycling. Metal recycling in ship breaking yards, where workers cut decommissioned structures using gas torches, is labor-intensive, difficult, and dangerous. As global metal scrap recycling demands are rising, robotics and automation technologies could play a significant role to address this demand. However, the unstructured nature of the scrap cutting problem—due to highly variable object shapes and environments—poses significant challenges to integrate robotic solutions. This talk will present a novel collaborative workflow for robotic metal cutting that combines worker expertise with robot autonomy. In addition, robotic solutions to municipal waste sorting will be discussed. Berk will present a summary of the research work he did in collaboration with industrial ecologist, occupational psychologists, and robotics scientists.

Biography:

Berk Calli is an assistant professor in Robotics Engineering Department and Computer Science Department at Worcester Polytechnic Institute (WPI). He is the director of the Manipulation and Environmental Robotics (MER) lab and conducts research on robotics solutions for environmental problems. His lab develops robotic manipulation algorithms by combining techniques in computer vision, control theory, and machine learning. Prior to WPI, He completed his PhD at Delft University of Technology in The Netherlands, and did his post-doc at Yale University. He had his MS and BS degrees in Mechatronics Engineering Program of Sabanci University, Turkey.

Optically Active Nanocellulose Coatings: From Agricultural Waste to Functional Layers

Rachel Yerushalmi – Rozen*

Dept. of Chem. Eng. Ben-Gurion University of the Negev Israel

Abstract:

Nanocellulose is a bio-based, non-toxic, degradable source for nano-structured functional materials. Cellulose nanocrystals (CNCs) can be derived from agricultural and industrial waste via mild-acid-hydrolysis. When dispersed in aqueous solutions CNCs self-assemble into a liquid crystalline phase and can be further used for preparation of large area, micro-to-nano-thick, chiral-nematic films that selectively reflect circularly polarized light at a wavelength that is determined by organization of the nanoparticles. These films show bright interference colors and can be used as components in active nano-devices and functional coatings. In the study presented here we describe the challenges and difficulties in controlling the processing deposition and structuring of the films. We report the utilization of a new approach, borrowed from polymer processing technology. We report structural and optical characterization of the CNCs on different substrates using Atomic Force Microscopy, Polarized Optical Microscopy (POM) and transmission electron microscopy (TEM). The results indicate the CNCs suspensions can serve as colloidal ink for printing of optically functional films on a variety of substrates, offering an alternative to synthetic nanocrystals in a variety of applications.

See for example: Attia D et.al Co-Existence of Single-Walled Carbon Nanotube Networks and

Cellulose Nanocrystal Mesophases. Nanomaterials 2021, 11(11), 3059.

Biography:

Rachel Yerushalmi – Rozen is a member of the Department of Chemical Engineering and the Ilze Katz Institute for Nanotechnology at the Ben-Gurion University of the Negev. Her main interests are experimental investigation of structure and properties of nano-structured materials and thin films.

Creating a Solid Waste Sustainability Hub to Enhance Reducing, Recycling, and Repurposing

Shenghua Wu[1]*, Melike Dizbay-Onat[2], Kaushik Venkiteshwaran[3], Mathew Patterson[4]

[1,2,3,4]University of South Alabama, USA

Abstract:

This project seeks to establish a Solid Waste Sustainability Hub at the University of South Alabama (USA), with a primary focus on promoting environmental stewardship and education through waste reduction, recycling, reuse, and innovative thinking. A collaborative effort involving faculty members from the Civil Engineering, Mechanical Engineering, Environmental Engineering, and Arts departments at USA has resulted in the design of four distinct learning modules. These modules are designed to empower students with the knowledge and skills necessary for effective solid waste management practices, as well as to enhance their career readiness. To further this initiative, sixteen college ambassadors, hailing from diverse academic backgrounds, were carefully recruited and meticulously trained. They actively engaged in a range of activities, including guided tours of glass studios, visits to recycling centers, and the creation of informative videos. Additionally, the project extended its impact to over twenty high school students who participated in a comprehensive two-day event. This event was designed to provide hands-on experiences and enhance awareness, particularly in the realms of two major solid waste categories—plastics and glass. These students learned firsthand how to recycle and repurpose these materials into infrastructure, promoting a sustainable and responsible approach to waste management.

Biography:

Shenghua Wu is an Associate Professor in the Department of Civil, Coastal, and Environmental Engineering at University of South Alabama. He is the director for Solid Waste Sustainability Hub, Sustainable Asphalt Materials Lab, and the Gulf Coast Center for Addressing Microplastics Pollution. His research areas include materials characterization, recycling, sustainability, and multidisciplinary approach to address emerging issues. He has published over 70 journal articles and reports, and has delivered numerous talks at international conferences and forums. He also serves as a founding faculty advisor for the Society of Sustainable Engineering. He is a registered professional engineer and LEED AP.

Plastic Bag usage and the Policies: A Case Study of China

Bairong Wang[1]*, Bin Liu[2], Yong Li[1]

[1]Shanghai Maritime University, China;

[2]University of Shanghai for Science and Technology, China

Abstract:

This study explores the influencing dynamics of environmental risk perception on plastic-avoiding behavior by incorporating government trust and environmental locus of control within the influencing structure. Via an online survey, this study received 1126 valid responses and used partial least square-based structural equation modeling (PLS-SEM) techniques for data analysis. Three major findings are obtained. First, environmental risk perception positively impacts people's plastic avoiding behavior. Second, this relationship is partially mediated by environmental locus of control. Finally, government trust moderates the impact of environmental risk perception on both the environmental locus of control and plastic-avoiding behavior. When government trust is higher (lower), environmental risk perception has less (more) influence on the environmental locus of control and plastic-avoiding behavior. Therefore, absolute high government trust is far from ideal in environmental management because it induces high government dependence, which stimulates people's "inertia" and makes them shirk their responsibilities for environmental protection. To reduce the dark side of government trust, it is suggested that the government shows some "weakness" and emphasizes its need for the public's support for plastic crisis management.

Biography:

Bairong Wang is an assistant professor with the School of Economics and Management, Shanghai Maritime University. She got her Ph. D from State University at Buffalo, SUNY. Her research interest lies in two aspects. The first one concerns sustainable practices, behaviors, and policies. The second one concerns risk communication and rumor management on social media. Her research papers have been published in Waste Management, IEEE Transactions on Computational Social Systems, Natural Hazards, etc.

The Center for Resource Recovery and Recycling (CR^3) at WPI Colorado School of Mines and KU Leuven

Adam C. Powell, IV*[1] and Brajendra Mishra[1]

[1]Worcester Polytechnic Institute,Institute Rd., Worcester, MA, USA

Abstract:

The Center for Resource Recovery and Recycling (CR^3) is committed to being the premier cooperative research center focused on sustainable stewardship of the earth's resources. Based at Worcester Polytechnic Institute, Colorado School of Mines and KU Leuven, our focus is on helping industry address a pivotal societal need – the need to create a sustainable future. CR^3 advances technologies that recover, recycle and reuse materials throughout the manufacturing process. These advancements help businesses reduce energy costs and increase profitability, while protecting our natural resources.

This talk will describe the primary CR^3 industries and companies, discuss the Center's collaborative R&D model, and enumerate key areas of impact. One of the most notable impacts the lithium battery recycling work of Ascend Elements, whose hydro-to-cathode process began as a CR^3 project. Others include bauxite residue ("red mud") remediation being commercialized at Global

Mineral Recovery, and advances in lead refining for battery recycling at multiple CR³ companies. Finally, the talk will discuss new work by the author on efficient metal distillation for recycling magnesium, rare earth magnets, lead, and other metals.

Biography:

Adam C. Powell, IV is an Associate Professor in the Mechanical & Materials Engineering department who joined the WPI faculty in August 2018. His field is materials processing, and research focuses on greenhouse gas emissions reduction, elimination, and drawdown. Current projects aim to reduce vehicle body weight, lower solar cell manufacturing energy use and cost, eliminate aviation greenhouse gas impact, power ships and trains with zero emissions, and improve grid stability driving toward 100% renewable electricity. Powell has authored 17 patents and 72 publications across materials classes: metal extraction/refining and product development, thin films, ceramic coatings, polymer membranes, and batteries.

Circular Economy Business Models within Wine and Olive Oil Sustainability Programs in Portugal

Maria Raquel Lucas[1] * and Ibrahim Prazeres[2]

[1]Department of Management and CEFAGE- CenterforAdvanced Studiesin Management and Economics – Évora University, Largo dos Colegiais, Évora, Évora, Portugal;

[2]CEFAGE- Centerfor Advanced Studiesin Management and Economics – Évora University, Largo dos Colegiais, Évora,Évora, Portugal

Abstract:

Despite the circular economy has become a focal point of discussion in the recent literature, enterprises face several difficulties to find transition pathways to implement it. Also, the transition is not easy, especially for those organizations that are based on the classic linear model. Additionally, to the various barriers that slow down the adoption of circular economy strategies within an organization's operations and processes, there is controversial in the concept and resistance to change and a lack of research on approaches for the successful implementation of Circular Economy Business Models (CEBM), existing a break between the theory and practices particularly in the field of agribusiness. Using a qualitative multiple-case study, this exploratory study aims to understand the backgrounds or antecedents of adoption circular economy in successful business cases. The data was collected through 12 firm's interviews that are among the leading wine and olive oil producers, using NVivo 12 for the analysis. The results highlight the significant contribution provided by information acquisition, assimilation, transformation and exploitation capabilities to the circular economy in firms belonging to the wine and olive oil sustainability programs. Also, the findings highlight several antecedents for adoption CEBM and, development its potential. The study contributes to the academic literature providing insights into the role of acquisition, assimilation, transformation and exploitation capabilities in the successful implementation of circular economy practices in wine and olive oil sectors. Also, it presents the current drivers and barriers to CEBM implementation and development and delineates research gaps and future research avenues for each thematic area and sectors.

Biography:

Maria Raquel Lucas is Associate Professor at the Department of Management, Universidade de Evora, visiting professor of Warsaw University and researcher in the Centre for Advanced Studies in Management and Economics (CEFAGE) and in Mediterranean Institute for Agriculture, Environment and Development (MED). Main areas of interest are agribusiness and sustainability,

agri-food marketing, consumer studies, value food chain and rural development. She has done extensive research in the area of management and marketing and has participated in diverse projects including transnational studies with Latin America, Asia and Africa.

National Baseline of Material Circularity to Measure Circular Economy Potential for Construction Materials

Nongnuch Poolsawad [1]*, Jantima Samneangngam [1], Tassaneewan Chom-in [1], Prakaytham Suksatit[1], Khaowpradabdin Songma [1], and Saowalak Thamnawat [1]

[1]Technology and Informatics Institute for Sustainability, National Metal and Materials Technology Center, National Science and Technology Development Agency, Thailand

Abstract:

A Circular Economy is a systematic approach to improving a product's overall sustainability. To achieve maximal circularity, methods to improve product life and material circularity are included. This research aims to measure circular economy transition potential through a Material Circularity Indicator (MCI) for representative construction materials. To be able to continuously monitor and improve the potential of CE transformation in Thailand's construction. Developed data and digital infrastructure for construction material, proven circularity scenario viability, developed networks to engage stakeholders, supported the development of ecofriendly innovation and technology for construction materials and practices, and proven circularity scenario viability. The results showed that the MCI of construction materials in 2020 was 0.24 and 0.26 in 2021, that is, the country's material circularity improved by 8.18%, classified as non-metallic products increased by 26.1%, plastic products increased by 4.19%, but wood and composite wood products showed no improvement, while construction steel products circularity rate decreased by 0.33%. These values are indicated as national baselines for monitoring CE performance that contribute to the industry's long-term viability and turn to sustainability in Thailand through the key strategic issues in Thailand's CE and low-carbon society. The GHG reduction effect can be estimated at approximately 5 million tons CO2eq. from increasing the rate of material recycling. It also affects the economic value of the Thai construction industry by approximately 35 million dollars by considering the value added from material reduction and the price of carbon credits from reducing waste from construction and demolition.

Biography:

Nongnuch is the Research Group Director of Technology and Informatics Institute for Sustainability (TIIS). She focuses on Life Cycle Assessment (LCA), Circular Economy (CE) and integrated data analytics for regenerative sustainability. She is particularly interested in predictive modelling, classification, and complex data handling. Her research interests include the multidisciplinary approach to environment and sustainability, mainly the multi-disciplinary analysis of circularity, material flow, and sustainability using computational and statistical techniques. Also, analytics to draw insights on SCP data and modelling in agriculture, building materials and construction, and environmental data including resource use, emissions profile, consumption pattern, and lifestyle behaviour.

Nanotechnology Meets Circular Economy

Steffen Foss Hansen[1], Rickard Arvidsson[2], Maria Bille Nielsen[1], Oliver Foss Hessner Hansen[1], Lauge Peter Westergaard Clausen[1], Anders Baun1, Alessio Boldrin[1]

[1]Department of Environmental and Resource Engineering, Technical University of Denmark, Bygningstorvet, Building, Kongens Lyngby, Denmark

[2]Division of Environmental Systems Analysis, Chalmers University of Technology, Vera Sandbergs Allé 8, Gothenburg, Sweden

Abstract:

The transition from a linear "take-make-dispose" economy to a circular economy is gaining momentum and now affects most aspects of nanotechnology. While there are many opportunities for using nanotechnology to enable circularity, the knowledge gaps related to (eco-)toxicological hazards and the presence of nanomaterials in waste streams constitute significant challenges that need to be addressed.

There are more than a hundred definitions of circular economy, most of which focus on reducing, reusing, and recycling1. Increasingly, countries around the world are developing strategies relevant to resource efficiency and circular economy2,3,4,5,6, with the EU having among the most elaborate plans when it comes to the circular economy and policy integration7. In an EU regulatory context, circular economy is defined as "…an economic system whereby the value of products, materials and other resources in the economy is maintained for as long as possible, enhancing their efficient use in production and consumption, thereby reducing the environmental impact of their use, minimising waste and the release of hazardous substances at all stages of their life cycle…"8. Nanotechnology is often - and has from the outset been - mentioned as a fast-moving technology and might thus help reach circularity by, for instance, securing resource efficiency and reduce humanity's environmental impacts9,10, 11. It is also often stressed that new technologies, which outpace policy and regulation and come with high uncertainty regarding risks, might increase public concern and even hostility towards them11.

In March 2020, the European Commission published a Circular Economy Action Plan that contains, among others, the aims to make sustainable products the norm, ensure less waste generation and specifically halve residual non-recycled municipal waste by 203012. The Action Plan's objectives are very relevant for nanotechnology because they include initiatives for circular electronics, batteries, textiles, construction, and buildings. These are all applications in which nanomaterials are increasingly applied. In order to deliver on the EU's Circular Economy Action Plan, the transformation is supported with € 95.5 billion by the EU's new Horizon European research and innovation funding program that runs until 202713.

The European Commission will also work to minimise the presence of harmful substances in recycled materials and harmonise the classification and management of hazardous waste. Thus, there is a strong link between the circular economy and chemicals management addressed in the Chemicals Strategy for Sustainability (CSS) published in October 202014. The CSS is highly pertinent for nanomaterials as these are considered chemical substances in the EU. The CSS introduces three new principles to address environmental and health concerns of chemicals: i) safe and sustainable by design, ii) phasing out the most harmful chemicals for non-essential uses, and iii) "one substance – one assessment"; referring to having one safety assessment for all uses of a given substance instead of having many European agencies assess the same substance for individual uses under their respective legal jurisdictions, such as industrial chemicals, food, toys, and cosmetics.

In this Comment, we discuss examples of how nanomaterials can be used to meet the ambitions of

the Circular Economy Action Plan and the CSS. As summarized in Figure 1, we furthermore reflect on the unique challenges that remain if nanomaterials are to become an integrated part of a future circular economy.

Advanced Treatment of Wastewater Containing Microcontaminants in a Novel Pilot-scale UV-LED Photoreactor

Alejandro Cabrera[1]*, Sara Miralles[1], Abdoulaye Thiam[1], Paulina Sierra[1] and Jorge Vidal[1]

Programa Institucional de Fomento a la Investigación, Desarrollo e Innovación, Universidad Tecnológica Metropolitana, Chile.

Abstract:

The presence of microcontaminants in various environmental matrices has raised significant attention due to their potential impacts on ecosystems and public health. Advanced oxidation processes (AOPs) offer a promising avenue for their effective removal from wastewater. Moreover, the convergence of AOPs with Light Emitting Diodes (LEDs) presents an emerging research frontier in rapid expansion.

This study centers on the development, construction, and commissioning of a cutting-edge photoreactor based on UV-LED technology. Initially, a comprehensive characterization of UV-LEDs encompassing emission spectra and attainable radiation levels was performed. Subsequently, model microcontaminants underwent treatment via the photo-Fenton process, assessed under both acidic and natural pH conditions. The investigation delved into essential parameters like catalyst concentration, LED power, and water matrix effects. Additionally, an economic assessment related to different operation strategies was also carried out.

The outcomes, notably achieving microcontaminants removal within minutes of reaction, underscore the potential potency of the combined approach (AOPs and LED technology) for advancing wastewater treatment capabilities. This research not only bolsters the fundamental understanding of the synergy between AOPs and LED technology but also paves the way for novel applications in the realm of advanced wastewater treatment.

Biography:

Alejandro Cabrera holds degrees in Chemical Engineering, MSc. in Industrial Computer Sciences, and a Ph.D. in Biotechnology and Industrial Bioprocesses, all from the University of Almería (Spain). He currently serves as a professor at Universidad Tecnológica Metropolitana (Chile). With over 40 published scientific documents and >50 communications at national and international conferences, he's a prolific contributor. Alejandro has led 3 national science projects in Chile, an international collaboration project, and a Collaborative Research Initiative with industry. His involvement spans over >25 R&D&I projects, collaborating with teams from Spain, the UK, Greece, Peru, Colombia, and more, which showcases his extensive expertise.

Nutrient Recovery from Recirculating Aquaculture Systems (RAS) Wastewater

Sukalyan Sengupta[1]*

Civil and Environmental Engineering Department, University of Massachusetts Dartmouth, USA

Abstract:

Recirculating Aquaculture Systems (RAS) have the potential to fill the ever-widening gap between

global fish demand and wild-fish capture rate. The major limitation, however, is the technical challenge associated with treating the waste streams that consist of excess fish feed and fish waste. Aquaculture waste streams have high nutrient loads that can impair the health of water-receiving bodies by causing anthropogenic eutrophication.

Nitrogen & phosphorus can be sustainably recovered from RAS waste using an innovative, selective ion-exchange process. When the selective ion exchangers are packed in a fixed bed and the RAS waste stream is passed through it, nitrogen (present as ammonium or nitrate) and phosphorus (present as orthophosphate-phosphorus) are selectively removed from the background of competing ions (sodium, calcium, chloride, sulfate, etc.). Regeneration of the exhausted ion-exchange bed results in stripping out of the nutrients in a concentrated solution, which is further manipulated to extract the high-purity fertilizers MgNH4PO4 (struvite); MgKPO4 (potassium struvite); K3PO4 (potassium phosphate); and KNO3 (potassium nitrate). By shifting nutrient loading issues into potential resource/revenue streams, thus allowing higher percentage of water reuse, we believe that RAS will become a more competitive technology that can fulfill the conditions of circular economy.

Biography:

Sukalyan Sengupta has experience in adsorption, membrane, and ion-exchange processes as used in drinking water treatment, wastewater treatment, and hazardous waste decontamination systems. His research interests cover the gamut of removing undesirable contaminants from an aqueous matrix to recovery of critical resources from various waste streams. His expertise in material characterization using Scanning Electron Microscopy/Energy Dispersive X-Ray Spectroscopy, X-ray Photoelectron Spectroscopy, X-Ray Diffraction, Fourier Transform Infra-Red Spectroscopy, chemical equilibrium modeling, and mass transfer kinetics results in the ability to provide comprehensive technical solutions to environmental challenges.

Policy Framework and Development of the Biogas Sector-lessons from Europe

Marcus Gustafsson*

Environmental Technology and Management, Department of Management and Engineering, Linköping University, Linköping, Sweden

Abstract:

The transition to a circular and fossil-free society entails numerous challenges, including renewable energy production, waste management and nutrient recycling. This calls for multi-functional solutions such as biogas systems based on anaerobic digestion of organic waste, which can contribute in several areas simultaneously. However, the backside of such cross-sectoral solutions is the complex policy landscape, involving a variety of policies on different administrative areas and levels. Mobilizing relevant actors and feedstock to realize the estimated potentials for biogas production requires favorable and foreseeable policy conditions, acknowledging the strengths and challenges of the whole system.

This study examines the biogas sector in Europe, linking policy development to the development of production and use of biogas, biofertilizers and carbon dioxide (CO_2) from anaerobic digestion. While some European countries have well-established policy frameworks for producing and using biogas, less attention has been given to recycling of nutrients and CO_2. France and Denmark stand out with biogas strategies centered on sustainable agriculture, while also displaying a strong development of biogas production. EU policies concerning biogas have become more strategic and

direct in recent years, acknowledging the role of biogas systems in the energy sector as well as in climate change mitigation and food production. Still, inconsistencies such as capped subsidies and a lack of life cycle perspective may hinder the full exploitation of the sector. Moreover, CO_2 from biogas is a largely unexploited resource, possibly due to a deficiency of policies and strategies dictating how to use it.

Biography:

Marcus Gustafsson is associate professor in environmental systems analysis at the division of Environmental Technology and Management at Linköping University, Sweden. His research interests include systems studies, biogas solutions, CO_2 utilization and life cycle assessments. Marcus is one of the research leaders in the Swedish Biogas Solutions Research Center, and is engaged in the European initiative Biomethane Industrial Partnership.

Techno-economic Feasibility and Environmental Footprints of Resource Recovery using Electrokinetic Separation with Heterogenous Ion Exchange Membranes Exemplified by Recycled Plastic Processes

Yu-I Lin

National Taiwan University, Taiwan

Abstract Not Available!!!

Solvent Extraction of Plastics from Municipal Solid Waste

Harrison Appiah[1*], Ezra Bar-Ziv[2], Jordan Klinger[3], Armando McDonald[1*]

[1]Department of Forest, Rangeland and Fire Sciences, University of Idaho, Moscow, ID.

[2]Department of Mechanical Engineering, Michigan Technological University, Houghton, MI.

[3]Idaho National Laboratory, Idaho Falls, ID.

Abstract:

Plastics have become ubiquitous in modern daily life, providing many benefits but also posing major waste management issues given low recycling rates. Landfilling and incineration of plastic waste represent wasted resources and environmental harm. Solvent-based extraction techniques present a promising route to recover and repurpose plastics from municipal solid waste (MSW) into value-added products, advancing circular economy goals. This study focused on the selective dissolution of plastics from shredded MSW samples (from Utah and Michigan) using xylene and toluene. MSW compositional analysis was performed by FTIR spectroscopy. Proof-of-concept extraction trials were initially performed using a small modified Soxhlet unit with toluene yielding 16% plastic from Utah MSW. Improvement in plastic yields were obtained using the higher boiling point solvent, xylene at 20% yield. A larger extraction system was constructed to extract ~300 g of MSW and the extraction process was optimized to yield 26% plastic from Utah MSW and 32% from Michigan MSW. The extracted plastic material was comprised mainly of polyethylene (PE) and polypropylene (PP) with some polystyrene (PS) as determined by DSC and FTIR spectroscopy. Pyrolysis GCMS of the extracted plastic showed the presence of phthalate ester plasticizers most probably from polyvinyl chloride (PVC). The rheological, mechanical (tensile), and thermal properties of the extracted plastics are determined and will be discussed. The tensile properties were between those of LDPE and HDPE. The extracted MSW (biogenic material) was shown to comprise of carbohydrates (52-60%), lignin (32-34%) and ash (11-14%) and can be converted

into biofuels and biochemicals. These results clearly demonstrate the potential to separate MSW into plastic and biogenic fractions which are value-added upcycled products for use in a circular economy.

Biography:

Harrison Appiah is a Ph.D. student at the University of Idaho researching municipal solid waste valorization. Originally from Ghana, he earned his B.S. in Chemistry from Kwame Nkrumah University of Science and Technology and his M.S. in Biomaterials Science at West Virginia University.

Armando McDonald is a Distinguished Professor of Forest and Sustainable Products, at the University of Idaho with over 37 years' experience in bioproducts and biomaterials research and development and has presented and published 230+ articles. Dr. McDonalds' group is currently investigating: (i) bioplastics from lignin and other waste streams, (ii) biocomposites/wood composites and additive manufacturing, (iii) sorghum and corn stalk chemistry and properties, (iv) biofuels from pyrolysis of biomass and plastics, (v) and (vi) natural products chemistry.

Ecological Impact of Stormwater Runoff on the Water Quality of Chelsea Creek and Constitution Beach

E. Smith[1], F. Peri[2], B. McKormack [2], S. Lussier[1], H. Scheibel[1]

[1]Program for Environmental Science and Studies, Suffolk University, Boston, MA, U.S.A

[2]School for the Environment, University of Massachusetts, Boston, MA, U.S.A

Abstract:

Wastewater and stormwater management has posed water quality issues for the city of Boston since the Industrial Revolution. In the 1980s, Boston Harbor was deemed as one of the dirtiest bodies of water in America, and in response the city of Boston created a $3.8 billion program with the Deer Island wastewater treatment plant as the centerpiece to reverse this ecological damage. The system has been successful, yet increased rainfall due to climate change is posing new challenges for Boston's Wastewater and stormwater management. High bacteria (Escherichia coli) levels have been recorded in several bodies of water surrounding Boston during the summer of 2023. It is assumed that Boston wastewater and stormwater management is the cause of this due to overflow from severe rain and lack of combined sewer overflows. We studied the influence of rainstorms on the water quality of Chelsea Creek and Constitution Beach via in situ sampling and bacterial counts. The goal was to quantify and understand the ecological effects of the failed stormwater management system in order to propose a feasible nature-based solution to the city of Boston.

Application of Pollutant Zeolite after the Adsorption of Heavy Metals and Dyes from Wastewater in Building Brick Construction

Meryem El rharib, Mohamed Azzi, Sanae El Ghachtouli, Zaina Zaroual

Laboratory of materials environment interface (LIME), Hassan II university of Casablanca, faculty of sciences Ain Chok, Maarif Casablanca, Morocco

Abstract:

Wastewater pollution, comes from industrial, agricultural, and domestic sources, has emerged as a global environmental concern, necessitating innovative and sustainable solutions for its

remediation. The main pollutants responsible for wastewater pollution and pose severe ecological and public health risks are heavy metals and dyes. Several methods have been proposed including adsorption which represents an effective and environmentally solution. The literature presents several adsorbents such as: activated carbon, silica and zeolites to treat heavy metals and dyes from wastewater.

Zeolites have gained significant attention as highly efficient adsorbents for the removal of heavy metals and dyes due to their unique porous structures, ion-exchange capacities, cost effectiveness and sustainability. After adsorption, polluted zeolite presents a solid waste that will further pollute the environment, hence the need to find a sustainable solution for zero waste. Among the proposed solution, the reuse of polluted zeolite in building bricks. This innovative approach not only mitigates environmental hazards but also reduces the demand for virgin raw materials.

The aim of this work is to evaluate the capabilities of natural Moroccan zeolite to eliminate heavy metals and dyes from wastewater and to reuse the polluted zeolite in building brick construction. The work highlights the significant factors influencing adsorption, kinetic, isothermal and thermodynamic study, preparation of bricks, and the study of various parameters influencing brick quality.

Biography:

Meryem El rharib, received his Master's degree in management and valorization of waste at Hassan II University, faculty of science Ain Chok-Casablanca. She is currently a PhD student in chemistry and valorization at Hassan II University, at the laboratory of Materials Environment Interface, under the direction of Dr.Zaina ZAROUAL. She is working on the characterization of new material, the study of adsorption to remove heavy metals and dyes from industrial wastewater, and reuse of this material for zero waste. The latest publication is: Characterization and application of natural Moroccan material for methyl violet 2B dye removal from aqueous solution.

Oral Presentations

Recycling of Manganese Mining Residues to SO2 Capture and Technosol Production

Margarita E. Gutierrez-Ruiz[1], Daniel Amaro-Ramirez[1], Fernando Pinon-Flores[1]

[1]Environmental Biogeochemistry Laboratory, School of Chemistry of National Autonomous University of Mexico

Abstract:

One of America's largest Mn ore reserves is in Molango, Mexico, where there is a mining-metallurgic complex formed by two mines, a metallurgic furnace to obtain MnO from $MnCO^3$, and a factory of MnO^2 commercial products. All those processes produce residues. Some are reused, but others are stored in the open air. Eolic transport of fine particles from those deposits to surrounding towns increases the population's health risk. Also, because $MnCO^3$ contains traces of sulfides, in the furnace, SO^2 is formed and released into the atmosphere. Stack emissions comply with Mexican guidelines for daily average air emissions; nevertheless, the SO^2 levels increase in the morning, and the population complains.

Given the inadequacy of existing SO^2 control technologies due to the low concentrations emitted and their high cost, a comprehensive study was undertaken. The aim was to explore the potential of using the complex's wastes for SO^2 retention, leveraging existing information on the adsorption capacity of Mn oxides. The wastes were thoroughly characterized using XRD, XRF, I.R, SEM-EDS, and ICP. We also measured environmental metal availabilities and conducted TGA analyses to quantify SO^2 retention.

Only wastes with MnO^2 successfully retained SO^2. After sorption, these wastes and those unused were mixed with compost to produce technosol. Domestic wastes of the mining-metallurgic complex and surrounding towns were used to elaborate compost. A greenhouse experiment with barley was carried out to select the most fertile substrate mixture.

In conclusion, this solution is a successful example of recycling of three wastes, controlling Mn-particles and SO^2-emissions.

Biography:

Education and Training: Ph.D., Environmental Geochemistry, UNAM, MSc (Honors). Inorganic Chemistry, UNAM, B.Sc. (Honors) Chemistry, UNAM Mexico.

Research field: Soil-Water Pollution and Hazardous Waste Management focuses on the reuse and recycling processes of the mining industry.

Professional Experience: Head of the Environmental Biogeochemistry Laboratory (School of Chemistry UNAM Mexico), Coordinator of the Hazardous Wastes Project Technical Cooperation Germany-México (UNAM-GTZ). Visiting Research fellow at the University of Maryland. Lecturer: Inorganic Chemistry and Environmental Soil Chemistry at UNAM.

Recycling and Reuse of Lithium-ion Batteries

Hosop Shin

IUPUI, Indianapolis, IN

Abstract:

Lithium-ion batteries (LIBs) have become ubiquitous in a broad range of applications, including consumer electronics, automotive, and stationary grid storage systems. The global demand for LIBs is surging, driven primarily by the worldwide commitment to decarbonizing the transportation sector through electrification, a crucial step in addressing climate change and establishing a clean-energy economy. However, the rapid expansion in LIB demand lacks a sustainable end-of-life strategy, raising concerns about the environmental impacts of discarded LIBs and the resilience of the critical battery material supply chain. In response to these challenges, there is an urgent need to develop green and cost-competitive recycling technologies for the effective recycling and reuse of LIBs. This not only helps alleviate materials scarcity and enhances environmental sustainability, but also contributes to building a more secure and resilient supply chain with a circular approach.

This presentation will delve into innovative processes for the recycling and reusing of cathode active materials, which represent the most valuable components of end-of-life LIBs. The presentation will highlight direct recycling approaches aimed at recovering and rejuvenating spent cathodes, ensuring their suitability for reuse in future battery manufacturing.

Biography:

Hosop Shin is an Assistant Professor in the Department of Mechanical Engineering at Indiana University-Purdue University Indianapolis (IUPUI). Prior to joining IUPUI, he worked as a research scientist at Nissan Technical Center North America and a postdoctoral research fellow in Mechanical Engineering at the University of Michigan-Ann Arbor. He holds Ph.D. and M.S. degrees in Mechanical Engineering from the University of Michigan-Ann Arbor and a B.S. degree in Automotive Engineering from Kookmin University in South Korea. His research has received funding from various federal and industrial grants, including NSF, Samsung, and Nissan.He was honored with the Ralph E. Powe Junior Faculty Enhancement Award and Samsung GRO Award.

Biowaste-derived 3D Sorous Carbon Foam for Selective CO_2 Capture

Rajasekhar Balasubramanian* and Bei Zhang

Department of Civil and Environmental Engineering, National University of Singapore, Singapore

Abstract:

Countries worldwide are now committed to moving to a lower-carbon economy in the context of global climate change mitigation. While renewable energy promises sources of power without carbon emissions, the development of abundant and inexpensive adsorbents for selective carbon capture from large point sources is still important because of the continued use of fossil fuels for energy production. In this regard, biomass-derived carbon materials provide environmentally benign and economically attractive solutions toward CO2 capture. Our novel technology facilitates the formation of carbon foam from waste biomass, yielding a unique three dimensional (3D) multi-porous structure with high surface area and enhanced physicochemical properties for effective and selective CO2 capture. Overall, this “trash to treasure” process provides a cost-effective strategy to recycle biowastes into hierarchical 3D porous carbon with high yield for high-performance carbon capture application. Carbon-rich natural resources such as biowaste residues have the potential

to serve as nontoxic and renewable precursors for generating functional 3D carbon materials. The circular economic impact of carbon foam production is further enhanced by its repeated use for CO2 adsorption without significant loss of adsorption capacity. In addition, our work has the potential to contribute to the conservation of our limited natural resources. The practical implications of our work will be discussed.

Biography:

Rajasekhar Balasubramanian (Bala) is a Provost's Chair Professor in the Department of Civil and Environmental Engineering at the National University of Singapore. He received his PhD from the University of Miami, USA. He has research experience and interests in Climate Change and Environmental Sustainability. He has authored refereed articles. He has been honored with numerous awards including the Alan Berman Research Publication Award, Research Project of the Year Award, Sustainable Technology Award, and Energy Award, Highly Cited Research Article Award, and Professional and Scholarly Excellence Award. He is an elected Fellow of the Royal Society of Chemistry.

Sustainability Benchmarks in the Olive Oil Sector

Ibrahim Prazeres[1] * and Maria Raquel Lucas[2]

[1] CEFAGE- CenterforAdvanced Studiesin Management and Economics – Évora University, Largo dos Colegiais, Évora,Évora, Portugal;

[2] Department of Management and CEFAGE- Centerfor Advanced Studiesin Management and Economics – Évora University, Largo dos Colegiais, Évora, Évora, Portugal

Abstract:

To reinforce the image and value of olive oils in a region, it is extremely important to offer olive oils produced in a sustainable way in its environmental, social and economic dimensions and involves the economic agents in improving their sustainable performance. For this it is necessary to know the sustainability references and certifications schemes existing in the olive oil sector, which is the objective of this work. The benchmark carried out by olive oil producing regions and country revealed six typologies of olive oil sustainability protocols supporting different companies, associations, endorsements and brands. Some are general and others more specific in products and brands. Not all codes and certifications found worldwide cover all dimensions of sustainability and, except for product/origin certifications, they are not exclusively to olive oil sector. The conclusions related to the typologies found: 1) common approach in the supply chain, origin, product quality and compliance with good practices and establishment objectives; 2) Management of certification by independent companies (Intertek in Deoleo; CSQA) or by Olive Oil Associations (Australia, Chile, USA); 3) Existence of private references (Deoleo) with commitment agreements between companies, whether national (DTP 125; APL), associative (AVI, Chileoliva, Alliance) or mixed (PMV), as a result of the official entities of the strategic support and/or partnerships; 4) oriented towards the specification of the product (alliance), the process (AVE) or both (DTP 125, Deoleo, Chileoliva, PMV), valuing sustainability practices; and 5) they can include the certification of foreign products (Spanish, Italian, Greek) as well as national ones (Alliance, USA).

Biography:

Ibrahim Prazeres has a degree in Communication from Universidade Lusófona, a Master in Management, specialization in Marketing from Universidade de Évora, is a PhD student in Agribusiness and Sustainability programme at Universidade de Évora and Universidade de Trás-os-

Montes e Alto Douro and is a student in Executive Master in Program and Project Management at ISCTE Executive Education. He is a collaborating member of CEFAGE- UE and CETRAD-UTAD and responsible for several agricultural entrepreneurship projects in São Tomé and Príncipe, including agriculture. He participates, as a team member, in projects and develops his research in agribusiness and sustainability, namely, in the sustainability and valorization of organic cocoa production in São Tomé and Príncipe and in the governance and performance of the respective value chain. He participates, as a team member, in PSAA - Alentejo Olive Oil Sustainable Plan and is a Invited Assistant, by grace, in the Management Department of the School of Science and Technology from Universidade de Évora.

E-waste Recycling: Achieving Profitability without Subsidy

Panayiotis T. Manolakos[1], D.R. Cairns1, Mostafizur Rahman[1], Robert Bennett[1], Cesar Gonzalez[2], Jack Cooney[2] and A.N. Caruso[1]*

[1]University of Missouri, USA;

[2]Green Stream Royalties

Abstract:

Material flow, shipping, hazardous material transportation compliance and trade management are burdens of decentralized e-waste recycling. The balance of centralization-decentralization has been a natural evolution of maximizing efficiency within the available capital, land, recovery-methods, air/water quality permitting, legislation, culture and more. Here, we present a comparison of centralized e-waste recycling models as a function of state-of-the-art technology/expertise integration/cooperation, up-/down-stream symbiosis and legislation, that seek to maximize the margins and create resilience/robustness in the face of volatility in currency value, trained workforce and feedstock type over the order of a ten-year scale.

Biography:

Cesar Gonzalez and Jack Cooney are the managing partners of Green Stream Royalties who are actively seeking opportunities to finance e-waste recycling projects and existing operations via streams, royalties and traditional forms of debt and equity. Anthony Caruso is Curators' Professor of Physics and Electrical Engineering and Strategic Innovation Research administrator, representing the University of Missouri.

From Waste to Porous Alkali-activated Construction Material with Unique Properties

Lubica Kriskova* and Roberto Eduardo Murillo Alarcon[1], Efthymios Tatsis[1], Yakinthi Avtzi[1], Yiannis Pontikes[1]

[1]KU Leuven, Belgium

Abstract:

Globally, millions of tons of industrial waste are generated every year, often managed only through methods like landfilling or low-value applications (e.g. landscaping). Over the past decades, the trend in minimization of waste production, and conservation of resources via waste utilization has gained momentum. The later frequently addresses alkali activation technology as a promising approach for the valorization of diverse waste materials. This paper is in line with the above, by showcasing a successful transformation of three distinct industrial byproducts/waste materials

into a porous alkali-activated binders based construction material with unique properties, i.e. fire-resistance.

For this purpose, three waste streams, i.e. construction and demolition waste, bauxite residue and non-ferrous metallurgy slag were finely milled and blended with other supplementary cementitious materials, such as ground granulated slag or metakaolin, and activated with alkalis. The foaming of the alkali activated binders was performed by means of foaming agent and subsequent vigorous mixing, i.e. employing the mechanical foaming approach. The produced foams were cured at 50 °C and characterized with respect to their physical and mechanical properties, including compressive strength and fire-resistance according to ISO 834.

Mix-designs that fulfilled the requested product requirements were up-scaled to a real-size pilot product, e.g. porous fire resistant panel of (1x1x0,04)m3.

Biography:

Lubica Kriskova has experience in the field of residue valorization. She has obtained her PhD at the Department of Materials Engineering at KU Leuven in 2013 and continued her carrier as post-doctoral researcher in the SREMat research group. She has been involved in numerous Belgian and European research projects focused on valorization of ferrous and non-ferrous metallurgical residues towards alternative binders and construction products. She has about 30 publications and conference appearances. she is a research manager in the SREMat group at the Department of Materials Engineering at KU Leuven.

Full Scale Anaerobic Digestion: Methacules™ -- Kajima's Sustainable Solution for Organic Waste Management

Yishuai Jiang

Kajima Corporation, Singapore

Abstract Not Available!!!

Waste Samling: Balancing Act Between Bias, Accuracy, and Cost

Mohammad A. Alolayan

Department of Life Sciences/ College of Life Sciences/ Kuwait University, State of Kuwait

Abstract:

The increase in population and living standards were accompanied by an increase in the generation rate of waste. Studies ascertained the impact of waste on the environment and provided information for the decision-makers toward adopting the most cost-effective approach for managing waste. Collecting waste from selected houses, or houses and the use of landfill records are known approaches for estimating the generation rate, composition, physical, and chemical properties. The conventional approach is to use landfill records due to simplicity, low cost, and accuracy. On the other hand, if there is large variability in household size or socioeconomic, then it is better to use house or truck sampling to capture the bias in estimating the generation rate per capita and composition per capita. Nevertheless, estimating the generation rate is more desirable than per capita. Moreover, the seasonal effect is controlled in the landfill approach only, unless sampling in the other approaches is conducted in all seasons. House and Truck sampling are usually used if estimating sorting efficiency is required. However, truck sampling is preferred over houses for a

limited budget, accuracy, and lack of information about the household size or socioeconomic per house.

Green Future: Exploring Seaweed as a Sustainable Food Source

Soraya Paz-Montelongo

University of La Laguna, Spain

Abstract Not Available!!!

Is Female a More Pro-environmental Gender? Evidence from China

Yong Li [1] and Bairong Wang [2*]

[1] School of Marxism, Shanghai Maritime University, Shanghai, China

[2] School of Economics and Management, Shanghai Maritime University, Shanghai, China

Abstract:

Environmentalism has gained more and more attention given the increasingly severe environmental problems in recent years. One possible way to expand environmentalism is to encourage green psychology and behaviors at the individual level. Efforts are extensive in examining the relationship between gender and pro-environmental psychology and behaviors. The purpose of this study is to determine whether there are gender differences in people's pro-environmental psychology and behaviors in China. An online survey was conducted with the snowball sampling technique, and a sample of 532 Chinese respondents was obtained for the research. This study finds that gender does affect green psychology and behaviors, with females reporting a higher level of environmentalism in China. Specifically, females are more concerned with environmental problems, more supportive of plastic ban policies, more positive towards reducing plastics (reduce), and have stronger intention to bring a reusable bag for shopping (reuse and recycle). Moreover, females use fewer disposable toiletries when checking in a hotel and require less disposable tableware when ordering takeout. This study contributes to the current literature by identifying the relationship between gender and environmentalism in China. Implications for anti-plastic policy design and environmental management are also presented.

Biography:

Yong Li received the bachelor's and Ph.D. degrees from Zhejiang University, Hangzhou, China, and June, respectively. She is currently a Lecturer with the School of Marxism, Shanghai Maritime University, Shanghai, China. Her recent publications appear in Waste Management, Environmental Research Communications, China Information, Current Psychology, and Public Performance & Management Review. Her research interests include encompasses environmental protection, political trust, and NPO management.

Bairong Wang received the B.S. degree from Northeastern University at Qinhuangdao, Qinhuangdao, China, and the Ph.D. degree from the State University of New York at Buffalo, Buffalo, NY, USA. Her main research interests include pro-environmental behavior, environmental policy, crisis communication, big data analysis, and disaster management.

Keynote Presentations

Harnessing Eutrophication for Integrated Water-Energy-Food (IWEF) Products

Gang Pan

York St John University, UK

Abstract:

Terrestrial phosphorus run off to natural waters can cause aquatic ecological destruction (e.g. eutrophication and harmful algal blooms (HABs)) and crisis of fertilizers for food shortage. New integrated technologies are important for the breakthrough in efficiency/cost and sustainability. A combined strategy of in-situ and ex-situ methods are developed to meet these targets.

For the in-situ technical system, oxygen nanobubble modified local soil materials can be delivered into lakes and coastal waters through mechanical (ships and planes) or natural means (e.g. rivers) in order to remove the HABs and remediate hypoxic or anoxic sediments to reduce the release of internal pollutants, and for the restoration of macrophyte and biodiversity. By changing the physical, chemical and microbial processes at the sediment-water interface, oxygen nanobubbles provide a sustainable in-situ means through which to manipulate the fluxes of nutrients (N, P) and greenhouse gases (C) as well as the speciation of metals (As, Hg) at the sediment-water interfaces. The water and sediment environment change caused by the in-situ technology will lead to the long-term ecological restoration in shallow water system. For the ex-situ technical system, a flocculation-flotation method is developed to harvest HAB and the nutrients in water column and return them to the land, where the harvested algal cells are used for industrial wastewater treatment, production of agricultural fertilizers and soil improvers (e.g. algal hydro-biochar), and green energies such as biofuel and electricity. The technical framework to turn harmful algal blooms into cascaded products is essential for the cost-efficiency, sustainability and low carbon aspects of environmental technologies.

Biography:

Gang Pan works on management of natural waters including nutrient cycling, pollution control, and pollutants reutilization technologies. He has a track record in multidisciplinary studies in chemical, environmental, ecological, water, nano, algal biotechnology, and geoengineering areas. He pioneers in developing cost-effective and safe technologies for harmful algal bloom control and aquatic ecological restoration, fundamental surface adsorption theories and the application of synchrotron techniques in environmental and geochemical sciences. He also pioneers in the study of nanobubbles and its application in environmental protection. His current research focused on the establishment of iWEF framework (Integrated Water-Energy-Food studies), where pollutants in water and soil can be cleaned up and turned into biofuel, electricity, anti-toxin biochar (for agricultural grain safety) through innovative technologies.

Recent Advances in Circular and Sustainable Closed-loop Agriculture Supply Chains

Mostafa Hajiaghaei-Keshteli* and Fatemeh Gholian-Jouybari

Tecnologico de Monterrey, School of Engineering and Science, Mexico

Abstract:

Recently, Agricultural Supply Chain (ASC) has received attention due to the problems happening for climate and also population growth, both by academia and industrial practitioners. On the other hand, thanks to the recent trends and technologies, this area has been changed massively, especially in supply chain design and optimization. In this talk, considering the recent both academic and real-world applications, we want to introduce some new possible areas for the upcoming researcher or graduate students to start to work on knowledge edge. The main aspects are considering circular economy, sustainability, carbon credit, etc to design optimizal closed-loop agriculture supply chains.

Biography:

Mostafa Hahiaghaei-Keshteli is an Associate Professor at the Dept. of Industrial Engineering at Tecnológico de Monterrey, Mexico. He is a senior researcher at the Center of Sustainable Smart Logistics. His main research areas are Sustainable and Smart Logistics, Supply Chain Integration and Optimization, sustainability, and Circular economy. He has first designed and developed some food and agricultural supply chains such as Citrus, Rice, Sugarcane, Avocado, Walnut, etc. He was ranked as the top 1% of scientists in the area of Supply Chain, and also one of the top 2% scientists, according to the SciVal and Scopus reports.

Sludge Management: Can the Circular Economy always be Sustainable?

Ludovico Spinosa[1]* and Puja Doshi[2]

[1]CEN/ISO Expert, EuroTecnoService consultant, Italy; [2]Engineers without borders, Germany.

Abstract:

The concept of Circular Economy (CE) has nowadays won in popularity and can certainly contribute to the sustainable use of resources. CE can generally be defined as an economic system designed to regenerate itself without escaping the respect of both physical principles, such as the laws of thermodynamics, and boundary limits. The concept of CE is often represented by a fully closed circle, but this is a misrepresentation since it doesn't consider that each system/cycle is inevitably characterized by "losses" which need to be replaced by "new resources". Any system can include several processes/sub-processes, hence the challenge is to reduce the total amount of "losses" as well as the "need of new resources" while maintaining the correct "mass/energy balance". It should also be considered that recycling flows generally have different dynamics from those acquiring new natural resources and/or producing new waste. Further, CE must be seen from a "relative, not absolute" point of view, because it strictly depends on the boundary conditions of the system, included all the processes/sub-processes composing it as a whole. CE appears to be more sustainable than a linear economic system. However, in practical reality, circularity can only be approached with a series of linear processes converging into a circular system or, in other words, by approximating a circle with an n-sided polygon: the greater the number of sides, the greater the approximation to a circle. Further, the social dimension is only marginally addressed in CE. In this paper, the interdependence between CE and Sustainability referred to water/wastewater systems is discussed, together with a holistic approach of how the Digital transformation can support CE systems towards the system's optimization.

Biography:

Ludovico Spinosa He has been Senior Scientist at National Research Council in Italy, Assistant Professor in Agricultural Hydraulics, Contract Professor in Ecology, and Contract Professor in Waste Engineering (Italian Universities), and Guest Professor at Harbin Institute of Technology (China). He has been Delegate at the European COST Action on Sludge, and Chair of the IWA Specialist Group on Sludge Management. Now Expert Member at CEN/TC308 and ISO/TC275 on Sludge Management, and Scientific Consultant at Euro Tecno Service s.r.l. Awarded of the IWA-SGSM Specialist Medal in Residuals Research and nominated as IWA Fellow . Co-editor of books, and author of more than 250 publications.

ORAL PRESENTATIONS

The use of Date Waste into Solar Absorber for Water Desalination

Ghinwa Harik*[1], Ashraf Aly Hassan[2]

[1]American University of Beirut, Lebanon;

[2]UAE University, UAE

Abstract:

The United Arab Emirates (UAE) is highly vulnerable in the face of challenges when it comes to achieving sustainable development goals (SDGs) and staying within planetary boundaries (PBs), particularly under the context of climate change and water scarcity. The country has limited freshwater resources and relies heavily on desalination plants for its water supply. However, this process requires its large amounts of energy, and emits excessive greenhouse gas (GHG) adding further stress on PBs. Several attempts are being proposed lately to improve desalination technologies for reaching more SDGs within PBs especially under the context of solar stills; yet these attempts have raised several environmental concerns particularly when targeting nanoparticles synthesis. Accordingly, there is an urgent need to use low-cost alternatives with low environmental impact for the use of nanoparticles in solar still. In UAE, the cultivation of date palm has been historically very prominent and result significant amount of organic waste. This cultivation generates a large quantity of lignocellulosic waste, which is hygroscopic and has an affinity for water, making it appropriate for activated carbon synthesis. Therefore, date palm waste is a suitable candidate as a solar desalination water yield enhancer due to its availability in abundance and low cost. Under this context, this study focuses on the utilization of solar absorber using activated carbon nanoparticles synthesized from date palm waste for the performance improvement of solar desalination units. This study will provide a desalination technology that reduces energy consumption and GHG emissions, reuses waste products and reduces desalination cost.

Biography:

Harik has a PhD in Civil and Environmental Engineering from the American University of Beirut with substantial experience in environmental and water related projects throughout 13 years. Some of the research accomplishments covered Aquifers Recharge, Climate Change, Agent Based modelling, Land sustainability, WEF and SDGs.

Carbon Footprint Associated with Two Organic Waste Management: Tunnel Composting System Versus Landfill

Giampiero Grossi[1]*, Roberta Bernini[1], Nicola Lacetera[1], Tiziana Vona[2], Francesca Papaleo[2], Andrea Vitali1

[1]Department of Agriculture and Forest Sciences (DAFNE), University of Tuscia, Viterbo, Italy

[2]Self Garden S.r.l., Via Frassineto n. 1, 04011 Aprilia, Italy

Abstract:

The environmental impact of a tunnel composting system was evaluated in this study. Greenhouse gas (GHG) emissions and compost's carbon sinks were accounted throughout its lifecycle, and results were compared against a landfill scenario. A carbon footprint approach, integrating the burden of waste input biomass, was utilized. This approach aligns with circular economy perspectives, viewing organic waste as a crucial resource. The analysis focused on one ton of unpackaged compost. GHG emissions were calculated using SimaPro and the Ecoinvent database, with additional literature data filling database gaps. Uncertainty and sensitivity analyses were deployed to validate the results and pinpoint key study drivers. Biological variances like composting and soil emissions were omitted in the uncertainty phase, steered by Monte Carlo simulations, but tackled separately in the sensitivity phase. Emissions of 453 ± 18 kg of CO2 equivalents (CO2eq) were associated with one ton of compost, excluding soil sinks (-8%). Monte Carlo results suggested a 4.08% variation, while post-compost nitrous oxide emissions were singled out as the key footprint variable (±14%) in the sensitivity analysis. The environmental sustainability of composting becomes apparent when compared to landfilling; each ton of biomass waste composted instead of landfilled reduces approximately 110 kg of CO2eq. The study underscores composting's eco-advantages over landfilling and stresses the need to account for the environmental burden of waste input biomass, notably food waste, in compost carbon footprint evaluations.

Biography:

Giampiero Grossi, based at the Department of Agriculture and Forest Sciences at the University of Tuscia, Italy, holds a Ph.D. in Plant and Animal Science. His research delves into the intricate relationship between livestock production and environmental sustainability. Throughout his work, Dr. Grossi has extensively utilized Life Cycle Assessment (LCA) as a tool to quantify the environmental impacts of animal products. His commitment to merging theoretical insights with tangible applications has led him to participate in numerous projects, making contributions to environmental impact assessment.

Environmental Assessment of Strawberry Supply Chain and Comparison of Different Packaging Materials

Hong-Minh Hoang[1]* and Anthony Delahaye[1], Yasmine Salehy[1], Evelyne Derens-Bertheau[1], Steven Duret[1], Sophie Annibal[2], Malou Mireur[2], Valérie Merendet[2]

[1]Université Paris-Saclay, INRAE, FRISE, Antony, France

[2]Ctifl, 1 Rue de Perpignan, Rungis Cedex, France

Abstract:

Most fresh fruits and vegetables are highly perishable and require both low temperature storage and suitable packaging. However, the energy consumption for refrigerated equipment and the use of materials for packaging, plastic in particular, generate important environmental impacts.

Moreover, recent laws limit more and more the use of plastic for fruit and vegetable packaging. The aim of the current work is to analyze the environmental performance of strawberry supply chain while considering different packaging. Various cold chain steps (packing station, platform, supermarket, refrigerated vehicles...) were modelled using data from interviews of stakeholders, experts and literature. Life Cycle Assessment (LCA) was performed for the strawberry cold chain. Different materials for packaging (plastic, recycled paper and cardboard) were compared.

Biography:

Hong-Minh Hoang is the leader of the Energy and environmental impact of refrigeration systems team of the Refrigerating Process Research Unit (FRISE) at the French National Research Institute for Agriculture, Food and Environment (INRAE). Her activities aim to develop efficient and environmentally friendly refrigeration systems in food supply chains, in particular by lowering the impact of these systems on climate change and global warming while maintain food quality and safety, through the reduction of greenhouse gas emissions and energy consumption.

The Quantity and Composition of Supermarket Food Waste: A Direct Measurement in KSD Local Municipality, Eastern Cape Province, South Africa

Grace Okuthe[1]*, Noluyolo Vundisa[1] , Mourine achieng[2] , Jactone Ogejo[3]

[1]Freshwater Laboratory, Department of Biological & Environmental Sciences, Walter Sisulu University, P/B X1 Mthatha,South Africa

[2] Digital Transformation and Innovation Department, Graduate School of Business Leadership, University of South Africa

[3]Biological Systems Engineering Department, Virginia Tech, Blacksburg, VA.

Abstract:

Food wastage is expensive and places logistical and financial burdens on waste management facilities, the environment, and resources such as water and land. While it can be challenging to quantify the exact value of food waste (FW), it is estimated that the food wasted globally is approximately USD 1 trillion annually. Little is known about the food wasted in the retail sector regionally. A better understanding of retail FW is needed to improve waste management and develop best practices for FW management initiatives. This study aimed to characterise FW from a supermarket and determine their composition and temporal variation as raw materials for aquafeed. A waste composition study was undertaken in one supermarket, one of the major retail stores locally, to determine the quantity and composition of FW disposed of annually and identify key drivers. Our study focused on waste generated by five departments: fruits, vegetables, bakery, cereals, and flour. Data was collected once a week for 12 months. Waste products presumed to be unfit for human consumption or other reasons were removed from shelves and transferred to the laboratory for analysis. Results indicate that fruits (citrus) were the most common types of FW; this was the case throughout the year. The other kinds of FW were relatively common during spring. The quantity and composition of FW were strongly influenced by the season. The rejected FW was fit for animal use (carbohydrates). FW generated was discarded without recording, confirming that gaps exist in the FW recording procedure at retail stores.

Biography:

Grace Okuthe is an Associate Professor in the Department of Biological & Environmental Sciences at Walter Sisulu University. She earned her PhD at the University of the Witwatersrand. Before this, she was a lecturer at Egerton University. She has published widely in international journals and

presented papers at scientific conferences. Her research interests include ecotoxicology, focusing on EDCs and emerging pollutants in aquatic organisms. Recently, her research shifted to valorising food waste into aquafeed. She is a technical expert for reviews of research proposals (NRF, SA), a reviewer, and a member of the editorial board of international academic journals

BTEX Valorization into PHAs by Pseudomonas Putida

Nicolás Díaz-Moreno* [1], **Sara Cantera**[1] , **Raquel Lebrero**[1]

[1] Institute of Sustainable Processes, University of Valladolid, Dr. Mergelina s/n., Valladolid, Spain

Abstract:

VOCs are a range of compounds emitted from several industrial processes that are highly polluting due to their hazardous properties for health and the environment. Some of the most common VOCs include benzene, toluene, ethylbenzene, and xylene (BTEX). Traditional techniques for BTEX abatement rely on their removal by physical-chemical or biological processes. However, the current transition towards a sustainable circular economy promotes alternatives where pollutants are rather seen as a source for the production of valuable products. In this context, we report here for the first time the bioconversion of a mixture of toluene and ethylbenzene as a sole carbon source to produce PHAs using a Pseudomonas putida KT2440 culture. The experiment was carried out in a 2.0 L fermenter continuously supplemented with a mixture of toluene and ethylbenzene of 50% (v/v) at an inlet concentration of 3 g m-3 . Under N sufficient conditions, biomass concentration of 1.5 g L -1 and a removal efficiency > 95% for both pollutants were achieved. For the synthesis of PHAs, a N limitation stage was carried out for several days to optimize PHAs productivity. After the extraction of the PHAs by acid digestion, the samples analyzed by GC-MS revealed a mixture of medium and long chain acid esters, including butanedioic, pentanoic, pentadecanoic and hexadecanoic acids. Quantification of the PHAs and optimization of continuous production are currently being carried out. In summary, an innovative process that allows the concomitant elimination of VOCs and the synthesis of PHAs has been demonstrated, approaching the principles of biorefinery and circular bioeconomy.

Biography:

Nicolas Díaz is MSc in Circular Bioeconomy and Sustainability and graduated in Biotechnology. At present, he is a PhD student of the Chemical Engineering and Environmental Technology Department at the University of Valladolid (Spain). Nicolás has experience in the optimization of bioreactors for the valorization of organic compounds, working as a researcher at the Institute of Sustainable Processes (ISP). He also holds expertise in topics related to biorefineries, industrial sustainability and bioblocks production.

Economy and Sustainability of Waste to Energy Plant in India: Case Study

Perminder Jit Kaur

DST's CPR, Indian Institute of Science, Bangalore, India

Abstract:

India is an agriculture-extensive nation, with wheat, millet, and sugarcane being the major grown crops. As per information from the Ministry of New and Renewable Energy (MNRE), this leads to the annual production of 500 Mt of crop residues, which needs stringent management practices.

As agro-residue like wheat straw, rice straw, and sugarcane bagasse is a rich sources of lignin and cellulose, researchers across the globe are investigating valorization technologies. Waste can be treated through biological or thermo-chemical pathways to produce different forms of energy like biogas, bio-oil, biochar, syn-gas, and green hydrogen. Valorizing such kinds of waste can add value to waste, becoming an additional source of income for farmers and start-ups, providing energy security, and contributing to keeping the environment clean. Howbeit, the industry has not picked up sufficiently despite economic and environmental promises.

Thus, this research describes the potential and challenges for generating valuable chemicals & energy from agro residue of different chemical compositions. Telangana state of India has been chosen for the case study. A systems-based analysis using institutional, technical, and economic factors is performed for the state's sustainable and green waste management. The anticipated contribution of the research study is to evaluate the bioenergy's sustainability, technology, and financial viability of the selected region in India. The study tries to understand the challenges and barriers in the sector and, thus, provide policy-level recommendations to augment waste valorization techniques in India.

Biography:

Perminder Jit Kaur is a Chemical Engineer working as a Senior Policy Fellow at the Department of Science and Technology (DST), Centre for Policy Research, Indian Institute of Science (IISc), Bangalore. She has completed graduation and post-graduation in chemical engineering from Panjab University, Chandigarh. Her work on Biomass characterization has been awarded the "Professor Meera Madan Best Ph.D. Thesis" from IIT, Delhi, India. She has co-authored one book, "Sustainable metal extraction from the waste stream," and has published more than 40 research articles. Presently, she is working on policy-level research for clean energy technologies, sustainable development, and circular bioeconomy.

POSTER PRESENTATION

Simultaneous Removal of Microcontaminants and Microorganisms Inactivation through Sulphate Radical Advanced Oxidation Processes: Comparison of Solar Radiation and UV-LED Technology as Activation Method

Sara Miralles[1]*, Alejandro Cabrera[1], Manuela García[1] and Selene Arsenault[1]

Programa Institucional de Fomento a la Investigación, Desarrollo e Innovación, Universidad Tecnológica Metropolitana, Chile.

Abstract:

Sulfate radical advanced oxidation processes (SR-AOPs) are extensively studied for wastewater treatment. Through the utilization of diverse activation methods and thanks to the high reactivity of sulphate radicals, these processes hold significant potential to address the challenges posed by emerging pollutants in aqueous environments, which include both chemicals and microorganisms.

The objective of this work was to investigate the efficacy of SR-AOPs combined with Light Emitting Diodes (LEDs) technology or solar energy for the concurrent elimination of microcontaminants and microorganisms in wastewater treatment. Through a comprehensive analysis of reaction kinetics and disinfection mechanisms, this study aimed to elucidate the potential of SR-AOPs as an integrated approach for addressing the challenge of waterborne pollutants. Different activation methods such as pH, natural/artificial UV radiation and transition metals were studied.

The experiments demonstrated that employing UV radiation levels below 10 W/m², along with an alkaline pH, yields inefficient activation methods resulting in low efficiencies. Conversely, synergizing iron concentrations exceeding 0.05 mM with UV irradiances surpassing 20 W/m² enables the attainment of over 80% microcontaminant removal within approximately 30 minutes. 5-log reduction of E. coli in simple water matrix was obtained in less than 60 min.

Biography:

Sara Miralles holds degrees in Chemical Engineering, MSc. in Solar Energy, and a Ph.D. in Biotechnology and Industrial Bioprocesses, all from the University of Almería (Spain). She currently works as professor at Universidad Tecnológica Metropolitana (Chile). With over 55 published scientific documents and communications at national and international conferences, she is a prolific contributor. Sara Miralles has led 2 national science projects, she is the responsible researcher (Chile) of a Latin-American network, and she is also de principle investigator of a Collaborative Research Initiative with industry. Her involvement spans over R&D&I projects.

ORAL PRESENTATIONS

Establishing Effective Scenarios to Reduce Plastic Waste, a Case Study of Norway

Golnoush Abbasi* [a], Miguel lars Heras Hernandez [a], Marina Hauser [a], Cornelis Peter Baldé [b], Evert A. Bouman [a]

[a] Environmental Impacts & Sustainability, NILU – Norwegian Institute for Air Research, Instituttveien, Kjeller, Norway

[b] Sustainable Cycles Programme, United Nations Institute for Training and Research, Platz der Vereinten Nationen, Bonn, Germany

Abstract:

Plastic pollution is one of the biggest challenges of the 21st century. To tackle this problem, governments are setting stringent recycling targets to keep plastics in a closed loop. Yet, knowledge of the stocks and flows of plastic has not been integrated into policies. This study presents a dynamic probabilistic economy-wide material flow analysis (MFA) of seven plastic polymers (HDPE, LDPE, PP, PS, PVC, EPS, and PET) in Norway from 2000 to 2050. A total of 40 individual product categories aggregated into nine industrial sectors were examined. An estimated 620 ± 23 kt or 114 kg/capita of these polymers was put on the market (POM) in 2020. Packaging products contributed to the largest share of POM plastic (~40%). In 2020, about 460 ± 22 kt of plastic waste was generated in Norway, with half originating from packaging. Although ~50% of all plastic waste is collected separately from the waste stream, only around 25% is sorted for recycling. Under a business-as-usual scenario, the plastic put on the market, in-use stock, and waste generation will increase by 65%, 140%, and 90%, respectively by 2050. Several scenarios for plastic waste reduction have been defined. The outcomes of this work can be used as a guideline to establish the systematic classification of products suitable for recycling or be made of recyclate to facilitate the safe and sustainable reuse of plastic recyclates into new products. This framework can be applied by policymakers to devise effective mitigation strategies to cap production, lower consumption, and prevent waste generation.

Biography:

Golnoush Abbasi research interest focuses on challenges at the interface of policy and science concerning anthropogenic activities, and environmental issues at the Environmental and Climate

Research Institute-NILU. She has been working on scientific methodologies in the past decade to better understand the challenges in the governance and management of waste that may lead to the emission of pollutants to the environment, and the loss of valuable resources. She is leading several projects, including PLASTCYCLE, mapping the stock and flows of plastics, REWARD, establishing an integrated information system for the management of electronic waste, and CE-RISE, establishing circular economy resource information system through the application of digital product passport in resource-intensive supply chains.

Troubleshooting Dioxins Stack Emissions in an Industrial Waste Gas Incinerator

Amiram Bar Or [1,3 ¥*], Roberto Palazzolo [2¥], Amir Kaplan [1], Smadar Attia [1], Nitsa Haikin [1] and David Katoshevski[3]

[1] Nuclear Research Center Negev (NRCN), Beer-Sheva, Israel

[2] VTU Engineering, Schweiz AG,Winterthur, Switzerland

[3]Dept of Civil and Environmental Engineering, Ben-Gurion University of the Negev, Beer-Sheva, Israel

Abstract:

In this study, we provide a troubleshooting methodology developed during campaign program at pharmaceutical industrial waste incinerator experiencing various dioxins and furans emissions which are very toxic pollutant. The major source of dioxins at present is waste incineration, utmost formed during combustion processes and emitted to the environment without being fully captured by waste-gas treatment equipment. The measurement of dioxins emission is conducted via stack sampling and analysis, whereby the evaluation of the causes for dioxin emission on-site is generally performed via a stepwise procedure approach. Many experimental studies carried out at industrial waste incinerator put forward this one-at-a-time (OAT) approach, including variations in either the feed compositions or the combustion parameters, however, phenomenon of memory effect and significant emission time lag preclude a detailed understanding of the correlation with dioxins concentrations.

To approach this goal, we studied correlation between combustion parameters and feed composition with potential dioxins emissions at pharmaceutical industrial waste incinerator by employing a combination of Principal Component Analysis (PCA), Computational Fluid Dynamics (CFD) simulation and analytical techniques. Based on SEM-EDS analysis preformed on the bag filter upstream the feed, showing large amount of iron, we conclude that its present in the waste gas feed served as a metal catalytic source for dioxin formation. Additionally, we show that high values in dioxins emission correlate with short residence time of the flue gas in the furnace as well as low oxygen concentration. These operating conditions were further investigated by simulating the temperature profiles along the furnace.

A Multi-criteria Decision-making Framework towards Achieving Zero Waste in the Iron and Steel Industry of Developing Nations in Southern Africa: A Case Study

Yolandi Schoeman[1*], Paul Johan Oberholster[1]

[1]University of the Free State, Centre for Environmental Management, Bloemfontein, South Africa

Abstract:

The South African Iron and Steel Industry faces significant economic hurdles due to rising

operational costs, global economic volatility, demand fluctuations, trade limitations, local socio-economic challenges, facility aging, and structural integrity issues. This industry generates a range of industrial waste forms—solids, liquids, and gases—resulting in historical waste sites, suboptimal waste handling practices, environmental discharges, and contamination, all contributing to ecological deterioration. The complex landscape of industrial waste in South Africa's Iron and Steel Industry calls for a zero-waste management approach. This study introduces the innovative i-ZEWATA (Industrial Zero Waste Tiered Analysis), a hybrid four-step multi-criteria decision-making model. i-ZEWATA acts as a navigational framework for understanding, designing, evaluating, and improving waste systems in the Iron and Steel sector, aiming to achieve zero waste. The i-ZEWATA model provides tailored tools for industry professionals, sustainability managers, and environmental advocates to visualize waste flows, integrate socio-economic and environmental aspects, compare waste management options, prioritize waste strategies, involve stakeholders, effectively communicate findings, and advance towards zero waste. By leveraging the i-ZEWATA methodology, a comprehensive decision-support tool emerges, facilitating the transformative journey towards zero waste in the Iron and Steel Industry.

Biography:

Yolandi Schoeman, an ecological engineer, is dedicated to demonstrating the feasibility of creating bio-intelligent ecosystems for planetary health in ecological engineering. As part of Stellenbosch University's Brightest Young Minds initiative in 2006, she contributed to a book chapter for "Engineering Engineering," fostering Ecological Engineering in Africa. Schoeman led a team developing a global sustainability strategy for the Evraz Group in Moscow and established the National Association for Clean Air Mpumalanga Branch, promoting air quality transparency.

Founder of the Ecological Engineering Institute of Africa in 2014, she garnered awards, including the 2016 Global Cleantech Innovation Program for "awetbox." Schoeman's research is internationally recognized, with multiple awards and published works. Holding a master's degree in environmental management and integrated water management, she completed a Ph.D. at the University of the Free State in 2022 and is pursuing another Ph.D. in Economic and Management Sciences at North-West University.

The Role of Materials Management in Mitigating Greenhouse Gas Emissions

Frank Princiotta

Retired, USEPA Research Director

Abstract:

Humanity continues on an unsustainable trajectory. Greenhouse gas emissions, driven by population growth and an increasing demand for resource intensive goods, foods and services, are altering the planet's climate in ways that threaten the habitability of the planet. Model results identify mitigation actions needed to have a chance of limiting global warming to 2 C, and how difficult it will be to limit warming to 1.5 C. Since a recent study, concluded there could be "runaway", irreversible warming when global temperatures reach 2 C or higher. 1.5 C maximum warming would be a safer target. For either target, serious emission reductions must start as soon as possible. How humanity manages materials can play an important role in mitigating greenhouse gas emissions. These approaches compliment and support end-of-pipe controls and sector based and other mitigation strategies. Materials management should seek the most productive use of resources and focus broadly on impacts and policies relating to all stages of material flow. Key stages include: Renew, Recycle, Remanufacture, Reuse, Collection/ Processing and Disposal. By considering the impacts

throughout the entire life cycle, materials management can work to reduce environmental impacts both directly at each stage and by reducing the quantity of materials used.

Biography:

Frank Princiotta retired as Director of the Air Pollution Prevention and Control Division, USEPA, in 2016. He has a degree in Chemical Engineering from City University of NY and a Nuclear Engineering Certificate from the Oak Ridge School of Reactor Technology. His division was responsible for R,D&D on technologies for controlling air pollution from major pollution sources. He has been a key agency expert re. air pollution control for over 40 years. He has been the recipient of an EPA gold medal, and received the President's Meritorious Executive Award on two separate occasions (Presidents Carter and H.W. Bush). He played the leadership role in the development and demonstration of sulfur dioxide pollution control technology for coal-fired boilers, which has been the mainstay of SO2 control worldwide. In recent years, he has focused on climate change mitigation, editing two books and authoring five papers on this subject. He has given presentations on this issue to universities, technical societies and environmental groups.

Water Management within the Context of Environmental Emergency Regions in the State of Zacatecas, Mexico

Edith Olmos Trujillo[1], Rene Fernando Lara Cervantes[2*], Claudia Ivette Avila Sandoval[1], Anuard Pacheco Guerrero[1], Angel Alfonso Villalobos de Alba1 and Juan Ernesto Ramírez[1]

[1]Maestría en Ingeniería Aplicada con Orientación en Recursos Hidráulicos (MIAORH), Universidad Autónoma de Zacatecas (UAZ), Zacatecas, México,

[2]Universidad Internacional Ignacio Castro Pérez (UNICAP), C. del Ángel, Centro, Guadalupe, Zacatecas, México

Abstract:

This research consists of an analysis of development planning and water policy in the state of Zacatecas, Mexico, with the aim of evaluating their relationship and effects on water resources from the perspective of Environmental Emergency Regions (EER). The factors suggested to define REA in the area of interest were mining, water quality and consumption, as well as agriculture. While the correlation between these factors varies in the territories, it is of particular interest in arid and semi-arid regions. This cross-referencing of information allowed for the creation of a thematic map where EER were identified, and areas for improvement in water and environmental policy in the region were also identified.

Biography:

Edith Olmos Trujillo, she graduated from the Autonomous University of Zacatecas (UAZ), Mexico, with a bachelor's degree in environmental sciences. She pursued her postgraduate studies, obtaining a Master's degree in Applied Engineering with a focus on Water Resources and a Doctorate in Engineering Sciences. Her areas of work and research are centered on Water Resources Management, Satellite imagery using Landsat, and Vegetation Indices in arid and semi-arid regions, primarily. Currently, she works as a professor-researcher at UAZ and collaborates academically as a guest researcher at the Ignacio Castro Pérez International University (UNICAP).

Rene Fernando Lara Cervantes: Experience in the academic, public, and private sectors. Involvement in various research projects has enabled to develop skills for crafting scientific articles, journalistic pieces, and technical documents for decision-making, on topics related to the environment and natural resources, sustainable development, and other areas of interest within the realm of public

administration. Additionally, he possesses a strong capacity for self-learning, adaptability, analysis, communication, and teamwork. Professor- researcher at the Ignacio Castro Pérez International University (UNICAP).

Evaluation of New Life Potential in Buildings

Lizeth Rodríguez[1]*, Oriol Paris[2], Adrian Muros[2], Luis Martínez[1]

[1]Central America University, El Salvador;

[2]Polytechnic University of Catalonia, Spain

Abstract:

Theoretically, Life Cycle Assessment LCA, states that, the total environmental impact of a building is the sum of the environmental impacts, which include; the input of resources and the output of waste during the different phases of the life cycle, mathematically it can be expressed through the summation of the impacts in the life cycle assessed under the "cradle to grave" approach:

I= Iextraction + Imanufacture + Iconstruction + Ioperation + Idemolition + Irecycling + Idisposition

Through LCA, impacts are accounted for in 4 phases; materials, construction, service life and post-service life scenarios. The impacts of the pre-construction phase are incorporated impacts. Most LCA studies yield results in the design process of a building, which are predictive and the building is expected to perform as well as it was designed to do. However, the end-of-life impact and the assessment of the potential for reversibility and recyclability of the most important building components such as the structure and envelope are not considered. The goal of efficient use of raw materials can be achieved by avoiding and reducing waste, repairing and ensuring durability and reuse and recycling. To this end, 9 buildings have been analyzed under ISO regulations and the European Union sustainability framework Level(s), in the present study the potential for end-of-life material recovery as benefits beyond the System boundaries which is LCA stage D has been evaluated. It has been found that the design of articulated assembly mechanisms is more efficient for the disassembly of the building. The conclusion leads to establish a new LCA equation, which introduces the concept of "new life" environmental assessment within the life cycle:

I life cycle = I fabrication + I construction + I operability + I new life

Biography:

Lecturer researcher at DOE-UCA. She obtained a degree in Architecture from Central America University (UCA) and a Master's Degree in Structural Engineering in Architecture, as well as a Master's Degree in Advanced Architecture from (UPC) and is currently a Doctoral Candidate in Technology in Architecture at the Polytechnic University of Catalonia (UPC), Barcelona, Spain. Postgraduate studies in Energy Efficiency and Scientific Research at UCA, Risk Management at Pontifical Catholic University in Chile and Earthquake Resistant Building Technologies at International Institute of Seismology and Earthquake Engineering, Japan.

Insect Farming - A New Vertical in Waste Management

Yuval Gilad

FreezeM Cryogenics Ltd. - Spinoff from Weizmann Institute of Science, Israel

Abstract:

Insect farming is gaining prominence as an innovative solution for organic waste management, particularly through the utilization of Black Soldier Fly (BSF) larvae. These larvae are adept at efficiently consuming various organic waste types and producing valuable byproducts like protein meal, oil for animal feed, and agricultural fertilizer. This approach has the potential to revolutionize traditional waste management practices, contributing to a more circular economy and generating new revenue streams. The presentation delves into the transformative impact of bioconversion through insects, emphasizing the significant opportunities it offers for waste management companies. By seamlessly integrating insect farming into existing operations, waste management industry players can establish a synergistic relationship between waste management and insect farming. The talk outlines key steps and strategies for successfully venturing into the insect farming industry. In conclusion, insect farming emerges as a transformative addition to the waste management sector, providing a sustainable and eco-friendly solution to the challenges of organic waste disposal. The presentation invites stakeholders to envision a future where insect farming plays a central role in waste management, fostering a more circular and prosperous economy.

Biography:

Yuval Gilad is the CEO and Co-founder of FreezeM, a biotech startup that was established as a spin-off from the Weizmann Institute of Science in 2018. Focused on the field of insect protein as alternative and sustainable animal feed, FreezeM is developing novel technologies for Black Soldier Fly (BSF) breeding. Prior to establishing FreezeM, Yuval completed a master's and PhD at the Weizmann Institute of Science studying molecular mechanisms of programmed cell death. Yuval is a co-author of 9 academic papers and co-inventor of 3 patents.

Phosphorus Release and Recovery by Reductive Dissolution of Chemically Precipitated Phosphorus from Simulated Wastewater

Aseel A. Alnimera*, D. Scott Smitha, Wayne J. Parkerb.

[a]Department of Chemistry and Biochemistry, Wilfrid Laurier University, University Ave. W., Waterloo, Canada.

[b]Department of Civil and Environmental Engineering, University of Waterloo, University Ave. W., Waterloo, Canada.

Abstract:

Chemically mediated recovery of phosphorous(P) as vivianite from the sludges generated by chemical phosphorus removal (CPR) is a potential means of enhancing sustainability of wastewater treatment. This study marks an initial attempt to explore direct P release and recovery from lab simulated Fe-P sludge via reductive dissolution using ascorbic acid (AA) under acidic conditions. The effects of AA/Fe molar ratio, age of Fe-P sludge and pH were examined to find the optimum conditions for Fe-P reductive solubilization and vivianite precipitation. The performance of the reductive, chelating, and acidic effects of AA toward Fe -P sludge were evaluated by comparison with hydroxylamine (reducing agent), oxalic acid (chelating agent), and inorganic acids (pH effect) including HNO3, HCl, and H2SO4. Full solubilization of Fe-P sludge and reduction of Fe3+were

observed at pH values 3 and 4 for two Fe/AA molar ratios of 1:2 and 1:4. Sludge age (up to 11 days) did not affect the reductive solubilization of Fe-P with AA addition. The reductive dissolution of Fe-P sludge with hydroxylamine was negligible, while both P (95±2%) and Fe3+ (90±1%) were solubilized through non-reductive dissolution by oxalic acid treatment at an Fe/oxalic acid molar ratio 1:2 and a pH 3. With sludge treatment with inorganic acids at pH 3, P and Fe release was very low (10%) compared to AA and oxalic acid treatment.

After full solubilization of Fe-P sludge by AA treatment at pH 3 it was possible to recover the phosphorus and iron as vivianite by simple pH adjustment to pH 7; P and Fe recoveries of 88±2% and 90±1% respectively were achieved in this manner. XRD analysis, Fe/P molar ratio measurements, and magnetic attraction confirmed vivianite formation. PHREEQC modeling showed a reasonable agreement with the measured release of P and Fe from Fe -P sludge and vivianite formation.

Water-Energy Nexus Considerations for Mining Wastewater

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. In 2015, the UN adopted the Sustainable Development Goals (SDGs). SDG6 is focused on the clean water and sanitation while Goal 7 is related to affordable and clean energy, Goal 13 for climate, Goal 3 for good health and well-being and Goal 9 for industry, innovation and infrastructure. While the SDG goals are a priority for many, tools and approaches to address them properly are lacking. Innovations are needed in all sectors to reduce the carbon footprint in lieu of climate change.

The nexus between water and energy is a highly important element. The water sector (treatment, production and distribution) exerts a heavy energy footprint (4% of global electricity consumption). Therefore, there is a strong need to research this subject. High levels of contamination with nitrogen and other components and high salinity are particularly problematic in mining wastewater. Low energy water treatment systems (such as annamox) and energy production from wastewater treatment such as pressure reduced osmosis (PRO) will be the focus of this presentation. Reduction of operating costs as well as energy and sludge requirements, improvement of the potential for water reuse, protection of the environment 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.

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 130 refereed journal papers and 8 books, in addition to Water-Energy Nexus to be published in 2024. 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.

Characterization of atmospheric aerosol sources in a suburban area of NW Spain

Fernanda Oduber[1]*, Ana I. Calvo[1], Carlos del Blanco-Alegre[1], Amaya Castro[1], Teresa Nunes[2], Célia Alves[2], Franco Lucarelli[3], Silvia Nava[3], Giuliana Calzolai[3], Joana Barata[2], Roberto Fraile1

[1]Department of Physics, IMARENAB University of León, León, Spain.

[2]Centre for Environmental and Marine Studies, Department of Environment, University of Aveiro, Aveiro, Portugal.

[3]Department of Physics and Astronomy, University of Florence and INFN-Florence, Florence, Italy

Abstract:

The physical, chemical and optical properties of atmospheric aerosols are highly dependent on their sources and formation processes. In order to develop mitigation strategies to improve air quality, the identification and distribution of aerosol emission sources is essential. In this study, the main sources of aerosols were identified by Positive Matrix Factorization, through the chemical composition of samples collected in a one-year campaign in the city of León, Spain.

The best fit allowed to identify the following sources: mineral, marine, traffic, secondary aerosols, biomass burning and aged sea salt. In summer, the mineral factor has the highest contribution (23%), mainly due to the high occurrence of African dust intrusion. The marine factor has the largest contribution in winter (14%), due to humid air masses laden with sea salts from the Atlantic Ocean. Traffic is the main source of aerosols in the city throughout the year (29%). Secondary aerosols contribute 16% and remain constant in all seasons, while the contribution of biomass burning increases to 4% in winter due to emissions from heating systems. Aged sea salt is the second largest contributor (26%). This factor is characterized by a Cl- deficit, mixed with the contribution of dust particles. Hsu et al. (2007) observed a Cl- deficit only in the polluted summer and not in the clean winter, showing that it is strongly related to air pollution.

The study of aerosol sources in León shows a high impact of anthropogenic sources on the air quality of the city throughout the year.

Biography:

Hsu, S.C., Liu, S.C., Kao, S.J., Jeng, W.L., Huang, Y.T., Tseng, C.M., Tsai, F., Tu, J.Y., Yang, Y. (2007). Water-soluble species in the marine aerosol from the northern South China Sea: High chloride depletion related to air pollution. J. Geophys. Res. Atmos. 112.

A Mix of Ingredients to Reduce Plastic Pollution

María del Rosario Calderón, Senior Communication Officer WWF Mesoamerica

World Wildlife Fund Mesoamerica (WWF Mesoamerica)

Abstract:

Plastic pollution in developing countries is a complex problem that can be addressed through different means and with the commitment from all sectors: governments, local authorities, companies and civil society. Aspects such as behavior change strategies, law enforcement, extended producer responsibility, solid technologies to ensure an adequate collection and disposal of solid wastes are part of the solution. At this point in time, with the magnitude of the problem, where humans could easily be ingesting the equivalent of a credit card of plastics per week, we should not be limiting the possibilities of an integral and strategic solution to end plastic pollution.

Biography:

María del Rosario Calderón is a Guatemalan national with a degree in Communication Sciences with an emphasis in Advertising and a Sworn Translator English-Spanish, with more than 20 years of experience in communication for development and public relations. She also has experience in behavioral change and education. She has worked for the United Nations Development Programme (UNDP), the International Organization for Migration (IOM), The Nature Conservancy (TNC), and the United States Agency for International Development (USAID) as well as for the private sector. She currently serves as Senior Communications Officer for the World Wildlife Fund (WWF) in Mesoamerica.

How can we make the best use of Limited Battery Materials to Minimize CO_2 Emissions?

Linda Gaines and Jarod Kelly

Argonne National Laboratory, USA

Abstract:

Rapid growth of lithium-ion battery use is projected to continue in the transportation sector, leading to concomitant growth in demand for the constituent materials. But experts foresee imminent shortages in key materials, such as lithium, nickel, and cobalt. To what extent can recycling alleviate these looming supply constraints? What other materials can be used if key material supplies prove insufficient or too expensive? How can technological options reduce material demand and enable the US to supply continued mobility for both people and the goods they require?

Biography:

Linda Gaines is a Transportation Systems Analyst in the Energy Systems and Infrastructure Analysis Division at Argonne National Laboratory. She holds a BA in Chemistry and Physics from Harvard, and a Ph.D. in Physics from Columbia. Her primary interest is problem solving, applied to efficient use of resources. Her most recent work has involved studying ways to reduce impacts from transport by more efficient materials use and recycling of lithium-ion batteries. She was the founding Chief Scientist of the ReCell Center, a founding editor of the journal Sustainable Materials and Technologies, and serves on the Editorial Board of Scientific Reports.

POSTER PRESENTATION

Use Crushed Waste Glass (CWG) as a Potential Sand Substitute for Geotechnical Applications

Xinran Zhang

University College London, UK

Abstract:

Natural sand (NS) is a widely used construction material. Waste glass is a derivative of natural sand, which may show similar geotechnical mechanical behavior. Using crushed waste glass (CWG) as a substitute for sand can effectively solve the problem of natural sand consumption with the continuous growth of population and urbanization and industrialization, and can also solve the environmental problems caused by broken glass. This project, together with Dr. Kazmi of the University of Queensland, studied the geotechnical mechanics, mineralogy and morphology

characteristics of CWG. The results of Dr. Kazmi's study show that the geotechnical mechanical behavior and chemical composition of CWG are similar to those of NS. Threedimensional X-ray tomography was performed on the experimental samples of Dr. Kazmi. The results showed that CWG in different size ranges has different morphological characteristics Smaller particle CWG (less than 0.6 mm) exhibited significantly greater variability. NS is different from CWG in convexity and sphericity. Real 3D particle shape was subsequently introduced into PFC3D for repose angle simulation to study microscopic response.

Biography:

Xinran Zhang is a second-year PhD student in the Dept of Civil, Environ &Geomatic Eng at UCL. Her current research interests are to explore the possibility of using crushed waste glass (CWG) in a certain size range as a potential substitute for sand in the geotechnical engineering of particle columns. This includes multi-scale morphological scanning , experiments on macroscopic geotechnical properties of CWG column-clay composites materials and DEM simulation. She has received a Master's degree from UCL (with distinction) and a Bachelor's degree from the University of Liverpool (with first class honours). Supervisor: Dr.Helen Y.P.Cheng and Prof. Beatrice Baudet.

ORAL PRESENTATIONS

Building Material Recirculation Concept as a Sustainable and Economically Efficient Way for Modern Design Process

Elzbieta Ryńska

[1]Warsaw University of Technology, Faculty of Architecture, Poland

Abstract:

Urbanization and economic growth are the main factors in increasing waste generation. Specially in western, developed countries inhabitants are used to linear economy often called "take-make-waste". From 2004 to 2018, the amount of waste generated in EU increased by an average of 2.9% per year and this trend is expected to growth in the future. Each year EU countries produce 2,5 billion of tons of waste where Construction industry has the biggest share and it is responsible for 36.4%. Nowadays most of new construction materials are unrelated to the place, predominantly come from all over the world. Shorter life cycle of buildings has a direct impact not only on increasing amount of waste and extraction but also on global carbon footprint where construction industry is responsible for 40% of global CO2 emissions. In response to these challenges, the European Union has prepared a long-term strategy for decarbonization until 2050 called the European Green Deal. In 2020, the European Commission presented a Circular Economy Action Plan that supports sustainable consumption and waste reduction. The plan also refers directly to the construction sector as one of the key areas for change. This presentation will analyze the construction processes from the perspective of waste generation and their categories. Developing a list of categorized waste based on technical documentation and on-site assessments will enable the creation of a demolition plan that considers a waste hierarchy. Presentation will include a detailed case study of a 3R building and analysis of potential benefits and problems.

Biography:

Elzbieta Rynska, PhD. Arch. Eng. – professor at Faculty of Architecture Warsaw University of Technology, Poland. Currently, Head of the Pro-environmental Design Team. Has been working at WUT since 1989. Author of international scientific papers and books on sustainability and promoter

of 9 PhD dissertations. Member of a Climatic Committee UN Global Compact Network Poland. Main research areas: sustainable and circular development of urban areas, economy of design, building waste management. Acting as a freelancer consultant within sustainable development areas, BREEAM International New Construction Assessor, BREEAM International In-Use Assessor, WELL AP.

Spatiotemporal Changes in Trace Metal Bioavailability in the Sediment Porewater of a Constructed Wetland using Passive Porewater Samplers

Zeinah Elhaj Baddar [1], Breann Spencer[1], and Xiaoyu Xu[1],[2]*

[1] Savannah River Ecology Lab, University of Georgia, PO Drawer E, Aiken, SC, USA

[2]Warnell School of Forestry and Natural Resources, University of Georgia, University of Georgia, Athens, GA, 30605, USA

Abstract:

Sediments in aquatic systems often act as a major sink for contaminants. Diffusive gradient in thin films (DGTs) and in situ equilibrium dialysis samplers (peepers) are two major in situ porewater sampling devices that overcome the problems associated with conventional porewater sampling methods. In this study, DGTs and peepers were used to study the spatial and seasonal effects (cool months: October-February, warm months: May-September) on metal bioavailability in the H-02 constructed wetland, and the sink vs. source role of the sediments by calculating the metal resupply capacity (R). Data showed similar seasonal trends in metal concentrations using both passive samplers, peepers and DGTs. Pooled Cu and Zn concentrations measured using DGTs were lower in warm months (1.67 ± 1.50 and 2.62 ± 0.68 µg.L-1, respectively, $p < 0.001$) vs. (2.12 ± 0.65 and 5.58 ± 1.33 µg.L-1, respectively, $p < 0.001$) in cool months (mean ± 95% Confidence Intervals). Sulfate (SO42-) concentrations were significantly ($p = 0.0139$) lower in warm months (averaged at 0.22 ± 0.05 mg.L-1) compared to (0.16 ± 0.05 mg.L-1) in cool months. The increase in SO42- concentration is an indicator of the lower activity of sulfate reducing bacteria (SRB) which need SO42- during the anaerobic respiration, in which SO42- is reduced to sulfide (S2-) which forms insoluble salts with Cu and Zn, which could partially explain higher bioavailability of these metals in the cool season. Metal resupply capacity of the sediments was mostly < 0.2 for Cu and Zn. Taken together, the H0-2 wetland sediments mostly acted as a sink to both Cu and Zn over the course of this study.

Biography:

Xiaoyu Xu is an Assistant Research Scientist at the University of Georgia (UGA) Savannah River Ecology Laboratory (SREL). Dr. Xu has accumulated experience in trace element biogeochemistry and ecotoxicology, especially the study in treatment wetland. Dr. Xu is especially interested in the geochemical influences on metal speciation and bioavailability, toxic effects of metals and emerging contaminants (such as PFAS) on individuals and populations,source tracking of mercury globally, environmental fate and health impacts of PFAS, and human/ecological exposure modeling and risk assessment of chemical mixtures.

Examining the Impact of Environmental Technologies, Environmental Taxes, Energy Consumption, and Natural Resources on GHG Emissions in G7 Economies

Matarr Manjang[1] Xiao Hao[2]

[1]School of Economics and Trade, Hunan University; Changsha, Hunan, China

[2]School of Economics and Trade, Hunan University, Changsha, Hunan, China
Muhammad Ali Husnain School of Economics and Trade, Hunan University, Changsha, Hunan China

Abstract:

The focus areas for COP-27 include fast-tracking our worldwide evolution to decarbonization in the energy industry and clean energy as the stockholder's effort to restrict global warming to 1.5 °C (2.7 °F) above the levels of pre-industrial. After this COP-27 summit, most of the developing countries will provoke challenges in accomplishing their targets of a carbon neutrality and sustainable economy with the minimum possible greenhouse gas (GHG) emissions. In this regard, the G-7 countries, despite being prosperous cautiously, have not prospered in certifying ecological welfare in tandem. Nevertheless, these economies cannot endure their green growth attainments without instantaneously safeguarding their ecological features. To do this, green technologies and environmental taxes are vital apparatuses that can assist in accomplishing carbon neutrality objectives. Consequently, the current study investigates the influence of green technologies, environmental taxes, natural resources, and renewable, and fossil fuel energy on GHG emissions in G-7 nations from 1994 to 2020. After confirming the cross-sectional dependency issue, this study uses a battery of second-generation panel methods to estimate the empirical findings. The estimated evidence discovered that green technologies, environmental taxes, and renewable protect environmental quality in the long run. However, natural resources and fossil fuel energy increase the GHG emissions levels. Furthermore, this study suggests that G-7 economies should be more focused on green technologies, imposing environmental taxes on eco-innovation-related developments, and promoting renewable energy projects through the sustainable alteration of their consumption and production processes.

Keywords: COP-28 conference; GHG emissions; Green technologies; Environmental taxes; Natural resources; Renewable and fossil fuels energy; G-7 countries.

Sustainable Cotton Gin Byproducts Treatment and Utilization

Femi Peter Alege

USDA ARS Cotton Ginning Research Unit, Stoneville, Mississippi, United States.

Abstract:

Cotton Gin Byproducts (CGB) (aka 'gin trash') are generated in large quantities with broad variability in properties and composition. These attributes complicate the treatment and utilization, and therefore necessitate continued improvements in methods and technologiesadopted. Aerobic composting of CGB in static piles is one of the most common practices in theindustry. However, there is relatively limited information on the physical and biochemical transformations that occur during the CGB composting process. This presentation covers the changes in nutrient composition and feed properties of CGB at multiple sampling points on a static compost pile over nine months. The properties investigated include the main macronutrients (total nitrogen, phosphorus, potassium), as well as measures of feed digestibility and nutritional value (crude protein, ash, fibers, total digestible nutrients, and estimated energies). In addition to the property changes during the composting, the presentation will cover options for enhancing the sustainable utilization of CGB,

such as co-treatment with other agricultural residues and byproducts from animal production. From a circularity perspective, this work suggests potential to predict CGB composting for improved utilization in crop production and animal feeding.

Biography:

Femi Peter Alege is a Research Agricultural Engineer at the USDA-ARS Cotton Ginning Research Unit, Stoneville MS. He earned his Ph.D. in Agricultural/Biosystems Engineering from Washington State University and M.S. in Agricultural/Environmental Engineering from University of Ibadan. His research interests include Sustainable Agriculture, Cotton Ginning and Utilization Systems, Circular Bioeconomy, Agricultural Byproducts Valorization, Waste/Wastewater Treatment, Technoeconomic Analysis and Life Cycle Environmental Impact Assessment of Agricultural Systems. He is a member of the ASABE and the US Composting Council. He is also a Research Officer/Fellow with E8 Cleantech Angel Investors and Global Alliance for Sustainable Planet (GASP).

Reuse of Available Garbage for Shelter and Light

Toby Cumberbatch

The Cooper Union, USA

Abstract:

This talk will describe two student projects, one in which commonly available garbage was used to design and build a year-round habitat, the other to provide housings for solar powered lanterns for impoverished, marginalized communities in sub-Saharan Africa.

Garbage for RAGS (Reuse of Available Garbage for Shelter) was limited to paper, plastic bottles and bags, cardboard and plasticized containers. These materials were used to construct the functional elements such as windows, beams and bricks, necessary to build an enclosed structure able to withstand the weather. Included, were facilities for the collection, purification and storage of water, for the collection and disposal of human waste, and means to provide a comfortable interior environment using passive heating and cooling.

Principal constraints for the lighting system were cost and durability. From the outset, a used transparent container was used for the light diffuser. More challenging was material to house the battery and circuit. Mindful of culture and local resources we investigated used cans, bamboo and clay but all proved unsuitable. A used hair relaxer container proved ideal. The combination, easily adapted to changing container availability, has proved successful in providing a housing that is very durable, easily repairable and extremely functional.

Biography:

Toby Cumberbatch was professor of Electrical Engineering at The Cooper Union from 1994 to 2018. His principal research interests were developing engineering practices to address the needs of impoverished, marginalized communities. From student trips to West Africa and other classes emerged SociaLite Lighting Systems, a small nonprofit that manufactures and installs pico-grids and lighting systems in impoverished communities. Dr.Cumberbatch, now retired, continues to light, and advocate for, these forgotten communities, and frequently lectures on the topic. He also Chairs various IEEE committees

Could urea Recovery from Fresh urine be a Sustainable Alternative to NH4 + Recovery from Hydrolyzed urine?

Haotian Wu[1,2] , Xavier Foster[1,2] , Hossein Kazemian[3,4] , Igor Cauphy Peggy Diby[5] , Serge Kaliaguine[5] , and Céline Vaneeckhaute[1,2,*]

[1] BioEngine, Research Team on Green Process Engineering and Biorefineries, Chemical Engineering Department, Université Laval,avenue de la Médecine, Québec, QC, Canada;

[2] CentrEau, Centre de recherche sur l'eau, Université Laval,avenue de la Médecine, Québec, QC, Canada;

[3] Northern Analytical Lab Services, University of Northern British Columbia, Prince George, BC, Canada;

[4] Chemistry Department, Faculty of Science and Engineering, University of Northern British Columbia, Canada;

[5] Chemical Engineering Department, Université Laval, avenue de la Médecine, Québec, QC, G1V, Canada

Abstract:

Nitrogen (N), phosphorus (P) and potassium (K) recovery from source-separated urine is an area of increased interest. K+ can get recovered efficiently through cation exchange, but this process is severely hindered by the high molarity of NH4 + in hydrolyzed urine. This study proposed recovering K^+ and urea from fresh urine before urea hydrolysis to prevent competition between NH_4^+ and K^+, enabling efficient recovery of all three macronutrients. Na-chabazite was found to as both a K^+ adsorbent and urease inhibitor, reducing urea hydrolysis rate from 51.1% to 26.8% in two hours. Additionally, it exhibited a K^+ recovery capacity of 26.8 mg/g through cation exchange. Wood-based biochar, with its high porosity (308.0 m^2/g) and polar functional groups, shows superior urea adsorption capacity (25.4 mg/g) compared to almond-shell biochar. The high fitness to the modified Langmuir model suggests a multilayer adsorption process. Furthermore, steam activation provided a greater increase of urea adsorption capacity than H2O2 modification.

Biography:

Haotian Wu as a PhD candidate at Université Laval,focuses on nutrient recovery from urine through ammonia stripping, struvite precipitation and biochar adsorption. During his post-graduate study, he has published three scientific articles in Chemical Engineering Journal and The Science of The Total Environment. His critical review "Nutrient Recovery from Wastewater: A Review on the Integrated Physiochemical Technologies of Ammonia Stripping, Adsorption and Struvite Precipitation" has been cited 58 times since it was published in November 2021.

Technologies and innovations for organic food at the Brazilian savanna

Sanderson César Macêdo Barbalho[1*], Guilherme Tabatinga Medeiros[1], Giovanna Marques Pereira, Maiara Cristina Abreu Cirineu Martins, Juan Diego Trullo Medina

University of Brasilia, Brazil

Abstract:

Except for the Amazon River, the Brazilian savanna is the main source of Brazilian hydrographic potential. Otherwise, the main agribusiness areas for soya, cotton, and corn are in this fragile ecosystem. Moreover, small farm holders in the whole country rely on organic food production and socio-biodiversity products to get higher revenues and make viable their familiar businesses. In this context, we designed a project where mechanical, mechatronics, production, and agronomic engineers worked to develop new products to increase small farm holders´ productivity. The project mapped the value chain for the main products in three territories in Federal District and

Goias state, Brazil. Through interviewing small farm holders and performing direct and participant observation, the researchers identified the main bottlenecks in these value chains that could be solved by new appropriate equipment. An entire cycle of design-build-test was performed with the producers. For vegetable garden leaves, the results were higher productivity and more ergonomic daily activities. For tubercular vegetables, higher productivity and ergonomics, and socio-biodiversity nuts from the Brazilian savanna, a road of improvement is necessary to increase both productivity and ergonomics.

Biography:

Sanderson C. M. Barbalho. Received a bachelor's degree in electrical engineering and a master's degree in operations management from the Federal University of Rio Grande do Norte, Natal, Brazil, and a Ph.D. degree in new product development from the University of Sao Paulo, Brazil, in 2006. Prof. Barbalho is a Full Professor at the University of Brasilia, Brazil, and a former Project Management Professional (PMP) at the Project Management Institute.

Magnetically Enhanced Arc Plasma (MEAP) Destruction of Per- and Polyfluoroalkyl Substances (PFAS) in Leachates and Wastewater

Ming Xu[1], Qi Hua Fan[1]*, Keliang Wang[2]*

[1]Michigan State University, USA;

[2]Fraunhofer USA Inc., USA.

Abstract:

Per- and polyfluoroalkyl substances (PFAS), commonly known as "forever chemicals", are a group of human-made chemicals widely used in various industrial and consumer products. Because of its strong C-F bonds (bonding emery up to 485 kJ/mol), they are super persistent and cannot be destroyed in conventional degradation methods. However, plasma, as the fourth state of substance, consisting of varieties of high energy particles, ions, free radicals, etc., has the potential to destruct PFAS molecular. Herein, we introduce an innovative magnetically enhanced arc plasma technology to destruct PFAS in landfill leachate. Under the assistance of magnetic field confinement, a stable and continuous plasma discharge was achieved and a Magnetically Enhanced Arc Plasma (MEAP) reactor was developed. This configuration enables effective PFAS capture at the liquid-gas interface through bubbling, followed by plasma destruction. As evidenced by Eurofins Scientific test results, most of the PFAS can be destroyed down to 70 ppt within 10 minutes, with an overall efficiency of ≥ 99%. Long-chain PFAS, such as Perfluorooctanoic acids (PFOAs, fluorocarbon chain of ≥6) were broken down to short-chain PFAS, while the short chain PFAS (e.g., PFBA) were gradually destructed into fluorides. Overall, the developed technology has exhibited a significant effectiveness in PFAS treatment, enabling a promising application potential in addressing PFAS contamination challenges.

Biography:

Ming Xu is a master student in the Department of Chemical Engineering and Material Science at Michigan State University. She received her B.S. in chemical engineering from the Northwest Normal University, China. Currently, she is focusing on water treatment/purification, including plasma destruction of PFAS in landfill leachates/wastewater.

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