Invited Speaker: Dr. Vanja Jurisic, University of Zagreb, Zagreb, Croatia

Title: Maximizing Biogas Yields *via* Targeted Bioaugmentation in Anaerobic Digesters

Abstract: Bioaugmentation of anaerobic digesters using lignocellulosic biomass as substrates is an important strategy to enhance biogas production. It involves adding specific microbial consortia to improve the breakdown of complex organic of the lignocellulosic biomass. Bioaugmentation enhances the degradation efficiency of the substrate, leading to increased biomethane yields. Studies have shown that bioaugmentation can improve microbial activity by introducing specialized microbes that accelerate hydrolysis and methanogenesis phases of anaerobic digestion. This results in higher biogas volumes and better process stability. Moreover, bioaugmentation can adapt the microbial community to better handle the complex structure of lignocellulosic substrates, optimizing energy recovery while reducing retention times.

Biography: Dr. Vanja Jurišić, Associate Professor at the University of Zagreb Faculty of Agriculture, Zagreb, Croatia. Her expertise is related to the field of RES from agriculture, especially the production of liquid (ethanol, biooil) and solid biofuels from lignocellulosic biomass (agricultural residues and dedicated energy crops). V. Jurisic has published 150+ scientific papers, of which 40+ papers are indexed in the WoS database, and has participated in 30+ scientific projects. She is currently coordinating the graduate study program "Renewable and Renewable Energy Sources in Agriculture" at the University of Zagreb Faculty of Agriculture and is acting as a president of the Danube region university network BIOEAST UniNET.

Invited Speaker: Dr. Douglas G. Hayes, University of Tennessee, Knoxville, USA

Title: Micro- and Nanoplastics: A Potential Threat to Agroecosystems

Abstract: Microplastics (MP) and Nanoplastics (NP) are an "emerging pollutant of concern" (European Environment Agency) that serve as a potential threat to food production and water systems globally, hence to human health. M/NPs reside in agricultural soils to a significant extent (~4400 particles/kg), where they reduce soil quality, harm soil biota, including microorganisms and plants, and serve as a reservoir of M/NPs, the latter of which can undergo transport into waterways and air. This presentation will focus upon our recent research involving NP behavior near water-soil interfaces. Using wet grinding as a surrogate method to mimic the low-energy processes that slowly degrade MPs in soil, we found that NPs formed are bimodal in their size distribution (500-1200 nm and < 200 nm, respectively) and that minor components in the M/NPs leach out. Our studies using small-angle neutron scattering (SANS) and batch tests demonstrate that collisions between soil particles and NPs reduce the occurrence of homoaggregation of NPs and the size of the larger NP subpopulation. Collectively, these results demonstrate the importance of electrostatic attractive and hydrophobic interactions in controlling the behavior of M/NP at interfaces and the complexity of the systems involved.

Biography: Dr. Douglas Hayes, Institute Professor of Biosystems Engineering at the University of Tennessee (UT), received his BS from Iowa State University in 1986 and his PhD in 1991 from the University of Michigan, both degrees in Chemical Engineering. He also earned an Executive MBA-Strategic Leadership degree from UT in 2022. He served as a postdoctoral research scientist for the US Department of Agriculture from 1991-1993 and then a Professor of Chemical Engineering at the University of Alabama in Huntsville from 1994-2003, before joining UT in 2004. He currently serves as Editor-in-Chief of *Journal of Surfactants and Detergents* and is on the editorial board for three other journals. He has received several awards, including being named Fellow of the American Oil Chemists' Society. He has co-authored over 115 journal articles, 24 book chapters and co-edited 3 books. His research interests include biodegradable plastics, environmental impacts of micro- and nanoplastics, surfactant self-assembly systems, and enzymatic reactions in nonaqueous media.

Invited Speaker: Dr. Davor Kralik, Josip Juraj Strossmayer University of Osijek, Osijek, Croatia

Title: Circular Food Management Models: Waste Prevention, Recycling and Reuse

Abstract: A new report by the United Nations Environment Programme has revealed the shocking extent of global food waste. Its Food Waste Index for 2021 estimates that people throw away 931 million tonnes of food annually, with an average of 74 kg of food waste per capita per household. 569 million tonnes falls into the household waste category. Supermarkets and other businesses are also guilty of disposing of significant amounts of food, and the total amount discarded also adds up to hundreds of millions of tonnes annually. The report estimates that food services waste 244 million tonnes annually, while retail wastes 118 million tonnes. Waste and by-products from food production have great potential for reuse across various production systems. Given the limitations in the industry, there is a strong tendency towards the possibility of using by-products and the use of essential food ingredients, as they can be an important source of compounds that can partially or completely replace certain raw materials.

Biography: Dr. Davor Kralik is a Full Professor in the Faculty of Agriculture of Josip Juraj Strossmayer University of Osijek, Croatia. He is a Croatian citizen, and during his professional and scientific career he has established himself as a prominent expert in the field of agricultural mechanization and renewable energy sources. His work is marked by his long-term engagement at the Faculty of Agriculture in Osijek, numerous scientific projects and publications, and his contribution to the development of sustainable technologies in agronomy. He received his master's degree from the Faculty of Agriculture in Zagreb in 1998 in the field of agricultural mechanization, and his doctorate in 2003 with the thesis focused on biogas production after separation from the liquid component of manure. He began his academic career in October 1994 at the Faculty of Agriculture in Osijek as a junior assistant in the field of mechanization in livestock farming. He was elected to the scientific and teaching title of assistant professor in November 2003 and was appointed the Head of the Department of Renewable Energy Sources in October 2005. Dr. Kralik has led many scientific and professional projects related to the application of renewable energy sources in agriculture. Since 2014, he has been the director of the company Obnovljivi izvori energije d.o.o. at the University of Osijek, where he leads and coordinates development projects related to energy efficiency and sustainable agriculture. Dr. Kralik has published more than 90 scientific papers, 11 of which are in the Current Contents database. His research interests include mechanization in livestock farming, biotechnological processes in agriculture, and the application of renewable energy sources, especially biogas. He has led several projects, among which the VIP project 'Biogas production on family farms' stands out. He actively participates in domestic and international professional organizations and is a member of the European Society of Agricultural Engineers. He is married and the father of two children. Throughout his career, he has strived to combine theoretical knowledge with practical application in agriculture, especially in the segment of energy efficiency and sustainable development.

Invited Speaker: Dr. José R. Fábrega, Technological University of Panama, Panama

Title: Research Opportunities in Water Resources and Their Nexus with Energy and Agriculture in Panama

Abstract: This presentation provides an overview of the primary challenges Panama faces regarding water use and examines their implications for national energy and food security. It also outlines the principal research topics currently pursued by the Center for Hydraulics and Hydrotechnical Research at the Technological University of Panama (UTP) and our Center's perspective for the future. Emphasis is placed on research related to the concept of a circular economy, specifically the transformation of wastewater into a resource generator.

Biography: Dr. José R. Fábrega graduated in Civil Engineering from the Santa María La Antigua University (USMA) of Panama. He obtained a Master's and Doctorate in Civil Engineering with a specialization in Environmental Engineering at Purdue University (Indiana, USA). He completed postdoctoral studies at Purdue University and the University of Connecticut. He is a Regular Full-Time Researcher at the Technological University of Panama (UTP), Director of the UTP Hydraulic and Hydrotechnical Research Center (since 2013), and President of the Board of Directors of the Panamanian Association for the Advancement of Science (APANAC) (since 2020). He has led the water program of Interamerican Network of Academy of Sciences (IANAS) (since 2013). Dr. Fábrega was a Member of the Board of Directors of the Global Water Partnership (GWP) (2019-2021) and is President of the Panama chapter of this association (2013-2017, 2021-present). He is President of the Panamanian chapter of the ASCE (2023-Present), Member of Panama's National Commission of Science, Technology and Innovation (CONACYT) (since 2020), Member of Panama's National Research System (SNI) (since 2014), and Fulbright Scholar (USA) (1992-1994), and Valedictorian of the USMA (class of 1990). He has (co)authored more than 30 publications in indexed scientific journals. He has also been PI and Co-PI of multiple international collaborative research projects and advisor of more than 25 undergraduate and graduate theses. Dr. Fábrega obtained professional licenses as a Civil Engineer in Panama, Costa Rica, and Indiana (USA).

Invited Speaker: Dr. Frank Löffler, University of Tennessee, Knoxville, USA

Title: Small Farm Circular Bioeconomy – A Roadmap for a Healthier Planet?

Abstract: Creating closed-loop systems in agricultural production promises a series of benefits including reduced reliance on synthetic fertilizers, soil health improvements, better-quality crops, and a reduced environmental footprint while maximizing farm profitability. The benefits of implementing circular bioeconomy principles at small farms are evident; however, knowledge gaps exist that can compromise the desired outcomes. For example, the unintended introduction of per- and polyfluoroalkyl substances (PFASs) into a circular system can compromise soil health and product quality. A circular bioeconomy system is expected to reduce waste and pollution; however, it is currently unclear if cycling of fixed nitrogen ultimately reduces or increases emissions of the greenhouse gas nitrous oxide (N_2O). These examples highlight the need for translational research to effectively address gaps in scientific understanding that may hinder rapid and widespread adoption of circular bioeconomy approaches.

Biography: Dr. Frank Löffler received a B.S. degree in Biology and an M.S. degree in microbiology from the University of Hohenheim in Stuttgart, Germany. He performed doctoral studies in biotechnology at the Technical University Hamburg-Harburg and received a Ph.D. degree (summa cum laude) in 1994. As an Alexander von Humboldt fellow, he conducted research in the NSF Center for Microbial Ecology at Michigan State University, before joining the School of Civil & Environmental Engineering at the Georgia Institute of Technology in Atlanta, GA as a faculty member. From 2010 to 2023, Dr. Loeffler served as Governor's Chair Professor at the University of Tennessee and Oak Ridge National Laboratory, and he directed the university's Center for Environmental Biotechnology. He currently holds the Goodrich Chair of Excellence in Civil Engineering and is professor in the Department of Civil & Environmental Engineering. The Löffler laboratory explores the physiology, diversity, distribution, and ecology of microorganisms that control nitrogen turnover, carbon cycling, and contaminant detoxification, with the goal to harness, manipulate, and predict microbiome functions in both natural and managed habitats. Dr. Löffler is a fellow of the American Academy of Microbiology, is listed among the world's top 2% scientists in his field, has a Google Scholar H-index of 73.