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Abstract of the conference presentation

Metataxonomic and predictive metabolic function analyses reveal the microbiota dynamics due to diverse organic feed in field-scale anaerobic digesters

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Abstract

The operational temperature and feed compositions are two critical parameters in determining the functional microbiota structure and influencing the biogas productivity of anaerobic digesters. Their impact is more significant on an industrial scale because of the volume and operational cost involved in the large-scale field anaerobic digesters. Understanding microbial dynamics and ecological niche because of parametric (temperature, pH, substrate variability etc.) variations is critical for efficient process management, improving the process stability and digestion efficiency of large field-scale anaerobic digesters. In this study, we studied seventeen field-scale digesters treating food waste leachate, municipal wastewater sludge (MWS), and manure at ten different locations in the Republic of Korea to determine how variations in feed composition, co-digestion of various substrates, and seasonal variation, affect compositional dynamics of the digester microbiota and consequently, the biogas productivity. The 16S rRNA metagene sequencing and predictive metabolic pathway profiling indicated substantial changes in the phylogenetic composition of the digester microbiota between digester types determined by the presence of MWS in the substrate ($p < 0.005$). The MWS and non-MWS substrate groups of the digesters showed a significant microbiota compositional divergence, with a high relative abundance of Firmicutes members and versatile organic matter-degrading genera in the non-MWS digesters, resulting in a considerably high biogas output. Acetoclastic methanogenesis was important in all the digester groups as suggested by predictive metabolic pathway profiling. This study suggested that metataxonomics and microbiota dynamics are good indicators of the process stability and efficiency across the parametric variations in field anaerobic digester systems.

Keywords: Anaerobic digestion, Metataxonomics, Metagenomics, Predictive metabolic pathway profiling

Brief Bio-sketch

	Prof. Byong-Hun Jeon is an eminent scientist and educator, currently working as a full Professor at the Department of Earth Resources and Environmental Engineering, Hanyang University (HYU), South Korea. He holds a distinguished recognition of the 'Highly Cited Researcher-2023' conferred by the Clarivate™ and has been consecutively placed in the World's Top 2% scientists' year wise and career wise list published by Standford University. He received his MS and PhD degrees in Environmental Engineering at Pennsylvania State University, USA. His work broadly focuses on environmental biotechnology including bioenergy and bioremediation, biogeochemistry, and electrochemical applications employing 2D materials and Metal-Organic Framework. He has authored/co-authored over 500 publications (Citations 23,600; h-index 78) in peer-reviewed journals, 30 patents, 4 technology transfers, and 2 books. He has been awarded the best Professor award, an outstanding researcher award in international research at HYU, and chair of the reviewer's board for the National Research Foundation of Korea.