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Development of upflow multi-layer anaerobic reactor (UMAR) treating high-solids organic wastes and bacterial community analysis

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In this study, a novel anaerobic treatment system, named as an upflow multi-layer anaerobic reactor (UMAR), was developed for high-solids organic wastes treatment and system performance was successfully demonstrated during continuous operation. The average methane (CH₄) yield, CH₄ production rate, and chemical oxygen demand (COD) removal rate were 280 mL CH₄/g COD, 2.10 L CH₄/L/day, and 89%, respectively, at 7.5 kg COD/m³/day of organic loading rate. To analyze the bacterial community, 454 pyrosequencing technique was applied. The experimental results clearly indicated that the upward plug-flow stream led to spatial distribution of bacterial communities at different vertical locations (upper, middle, bottom) of the UMAR. Firmicutes was predominantly detected in the middle and bottom parts, while Deltaproteobacteria and Chloroflexi were, interestingly, only found in the upper part. To speculate on the reason for vertical spatial distribution, their morphologies, functions, syntrophic reactions, and thermodynamics were widely discussed. In short, generation of multifunctions and/or layers in UMAR seems capable of allowing various bacteria to live in their preferable conditions, presumably resulting in higher anaerobic performance.

Biography

Si-Kyung Cho has worked on bioenergy production from organic wastes. He has experience in operating various reactor configurations (UASBr, dry anaerobic digester, and temperature phased anaerobic digester, etc.), physico-chemical and biological analyses using various equipment, and mathematical/statistical analysis using computer programs. With his various research backgrounds, he has published 19 international papers and received 5 presentation awards from both domestic and international conferences.

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