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Enhanced bio-methanation in potato starch processing wastewater by digestion with zero valent iron: Impacts on methanation, process kinetics and microbial community shift

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Zero valent iron (Fe^o) was employed in potato starch processing wastewater digestion and the hydrolysis-acidification step, biomethane potential, microbial community distribution and related process kinetics were evaluated. Compared to non Fe^o dosed reactors, COD removal reached 97.51%. Notably, methane potential which increased by 64.7% could reach about 630.6 mLCH$_4$/gVSSadded when 10 g/L ZVI was applied. Modified Gompertz model exhibited smaller deviations (2.3-4.4%) from experimental values as oppose to first-order kinetic model (8.27%-11.79%). Lag phase (λ) obtained in batch assays R1, R2, R3, R4 and R5 were 6.24, 5.62, 4.46, 4.20, 4.59 days, respectively, indicating faster degradability in ZVI charged reactors. 32 different phyla and 163 different families were observed. Dominant phyla observed were Chloroflexi, Euryarchaeota and Spirochaetes, Firmicutes, Bacteroidetes, Synergistetes, Proteobacteria and Caldiserica. ZVI addition is suggested to have had impact on the biodegradability rate, methane potential and microbial community shift that is favorable to methane generation.
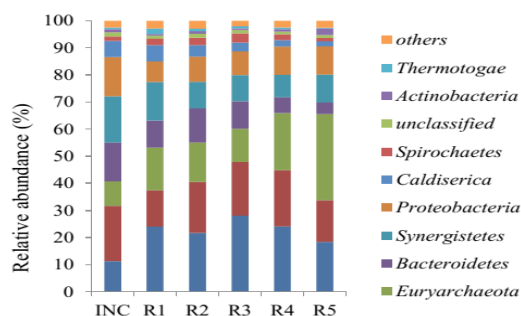

Figure-1: Distribution of bacterial community at phylum level, Inoculum sample (INC), reactor without ZVl dosage (R1), reactor dosed with 1g/L ZVl (R2), reactor dosed with 4g/L ZVl (R3), reactor dosed with 10g/L ZVl (R4), reactor dosed with 20 g/L ZVl (R5).

Recent Publications

1. Philip Antwi, Jianzheng Li, Portia Opoku Boadi, Jia Meng, En Shi, Kaiwen Deng, Francis Kwesi Bondinuba (2017) Estimation of biogas and methane yields in an UASB treating potato starch processing wastewater with backpropagation artificial neural network. *Bioresource Technology*; 228: 106-115.

2. Philip Antwi, Jianzheng Li, Portia Opoku Boadi, Jia Meng, En Shi, Chi Xue, Yupeng Zhang, Frederick Ayivi (2017) Functional bacterial and archaeal diversity revealed by 16S rRNA gene pyrosequencing during potato starch processing wastewater treatment in an UASB. *Bioresource Technology*; 235: 348-357.

Biography

Philip Antwi specializes in research and development in the field of microbiology, treatment of municipal, industrial and agricultural wastes and recovery of different bio-products, such as bioenergy (bioethanol, hydrogen and methane) and bio-resources (lactic acid, single cell protein). His areas of expertise include environmental engineering, microbiology, bioprocessing and conversion of wastes into high value-added products, control and disposal of sludge organic pollutants, and the development and transfer of technologies.

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