World Academy of Science, Engineering and Technology
International Journal of Biotechnology and Bioengineering
Vol:14, No:07, 2020

Application of Customized Bioaugmentation Inocula to Alleviate Ammonia Toxicity in CSTR Anaerobic Digesters

Authors : Yixin Yan, Miao Yan, Irini Angelidaki, Ioannis Fotidis

Abstract : Ammonia, which derives from the degradation of urea and protein-substrates, is the major toxicant of the commercial anaerobic digestion reactors causing loses of up to 1/3 of their practical biogas production, which reflects directly on the overall revenue of the plants. The current experimental work is aiming to alleviate the ammonia inhibition in anaerobic digestion (AD) process by developing an innovative bioaugmentation method of ammonia tolerant methanogenic consortia. The ammonia tolerant consortia were cultured in batch reactors and immobilized together with biochar in agar (customized inocula). Three continuous stirred-tank reactors (CSTR), fed with the organic fraction of municipal solid waste at a hydraulic retention time of 15 days and operated at thermophilic (55°C) conditions were assessed. After an ammonia shock of 4 g NH4+-N L-1, the customized inocula were bioaugmented into the CSTR reactors to alleviate ammonia toxicity effect on AD process. Recovery rate of methane production and methanogenic activity will be assessed to evaluate the bioaugmentation performance, while 16s rRNA gene sequence will be used to reveal the difference of microbial community changes through bioaugmentation. At the microbial level, the microbial community structures of the four reactors will be analysed to find the mechanism of bioaugmentation. Changes in hydrogen formation potential will be used to predict direct interspecies electron transfer (DIET) between ammonia tolerant methanogens and syntrophic bacteria. This experimental work is expected to create bioaugmentation inocula that will be easy to obtain, transport, handled and bioaugment in AD reactors to efficiently alleviate the ammonia toxicity, without alternating any of the other operational parameters including the ammonia-rich feedstocks.

Keywords : artisanal fishing waste, acidogenesis, volatile fatty acids, pH, inoculum/substrate ratio
Conference Title : ICADB 2020 : International Conference on Anaerobic Digestion and Biogas
Conference Location : Berlin, Germany
Conference Dates : July 23-24, 2020