

Comparison of the Effects of Continuous Flow Microwave Pre-Treatment with Different Intensities on the Anaerobic Digestion of Sewage Sludge for Sustainable Energy Recovery from Sewage Treatment Plant

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Abstract : Anaerobic digestion is a well-known technique for sustainable energy recovery from sewage sludge. However, sewage sludge digestion is restricted due to certain factors. Pre-treatment methods have been established in various publications as a promising technique to improve the digestibility of the sewage sludge and to enhance the biogas generated which can be used for energy recovery. In this study, continuous flow microwave (MW) pre-treatment with different intensities were compared by using 5 L semi-continuous digesters at a hydraulic retention time of 27 days. We focused on the effects of MW at different intensities on the sludge solubilization, sludge digestibility, and biogas production of the untreated and MW pre-treated sludge. The MW pre-treatment demonstrated an increase in the ratio of soluble chemical oxygen demand to total chemical oxygen demand (sCOD/tCOD) and volatile fatty acid (VFA) concentration. Besides that, the total volatile solid (TVS) removal efficiency and tCOD removal efficiency also increased during the digestion of the MW pre-treated sewage sludge compared to the untreated sewage sludge. Furthermore, the biogas yield also subsequently increases due to the pre-treatment effect. A higher MW power level and irradiation time generally enhanced the biogas generation which has potential for sustainable energy recovery from sewage treatment plant. However, the net energy balance tabulation shows that the MW pre-treatment leads to negative net energy production.

Keywords : anaerobic digestion, biogas, microwave pre-treatment, sewage sludge

Conference Title : ICREE 2015 : International Conference on Renewable Energy and Environment

Conference Location : Penang, Malaysia

Conference Dates : December 03-04, 2015