

Abstract

Effects of pretreatment on the anaerobic digestion of waste fruit and vegetable market waste were investigated in biogas production by batch experiments. The pretreatment was NaOH and HCl thermochemical, thermal and chemical methods. The wastes were chopped and blended before loading to the digester. Acid hydrolysis was done by adding 20ml 0.1M HCl with thorough mixing before purging with CO₂ and sealing. Alkaline pretreatment was done using 1M NaOH. In both cases, the setups were exposed to heat at 100°C for 12 hours, after which they were allowed to cool for 3 hours. The pH was modified to 6.7 – 7.2 before loading the inoculum and studying biogas generation. The large-scale setups with 1.0l, 1.5l, 5l and 10l capacity were studied for biogas generation. The results obtained show that thermochemical pretreatment results in more cumulative biogas production at 6200ml, followed by thermal at 4900ml and then chemical pretreatments at 3750ml for 500g mixed fruits and vegetable market wastes. Alkaline pretreatment is more efficient compared to acidic hydrolysis though highly influenced by proximate properties of the wastes and operation pH. The large-scale pretreatment resulted in 34500ml and 31400ml cumulative biogas from HCl and NaOH pretreatment. In conclusion, thermochemical pretreatment of market waste results in increased biogas generation resulting from hemicellulose breakdown and disrupting lignin-hemicellulose ether bonds in acid hydrolysis. In contrast, alkaline pretreatment leads to swelling of lignocelluloses and partial lignin solubilization lignin breakdown. The overall biogas generation depends on proximate waste matter and digester operation pH.