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Anaerobic Digestion of Organic Wastes for Biogas Production

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Abstract : Due to the depletion of fossil fuels and climate change, there is a rising interest in renewable energy sources. In this concept, a wide range of biomass (energy crops, animal manure, solid wastes, etc.) are used for energy production. There has been a growing interest in biomethane production from biomass. Biomethane production from organic wastes is a promising alternative for waste management by providing organic matter stabilization. Anaerobic digestion of organic material produces biogas, and organic substrate is degraded into a more stable material. Therefore, anaerobic digestion technology helps reduction of carbon emissions and produces renewable energy. The hydraulic retention time (HRT) and organic loading rate (OLR), as well as TS (VS) loadings, influences the anaerobic digestion of organic wastes significantly. The optimum range for HRT varies between 15 days to 30 days, whereas OLR differs between 0.5 to 5 g/L.d depending on the substrate type and its lipid, protein and carbohydrate contents. The organic wastes have biogas production potential through anaerobic digestion. In this study, biomethane production potential of wastes like sugar beet bagasse, agricultural residues, food wastes, olive mill pulp, and dairy manure having different characteristics was investigated in mesophilic CSTR reactor, and their performances were compared. The reactor was mixed in order to provide homogenized content at a rate of 80 rpm. The organic matter content of these wastes was between 85 to 94 % with 61% (olive pulp) to 22 % (food waste) dry matter content. The hydraulic retention time changed between 20-30 days. High biogas productions, 13.45 to 5.70 mL/day, were achieved from the wastes studied when operated at 9 to 10.5% TS loadings where OLR varied between 2.92 and 3.95 gVS/L.day. The results showed that food wastes have higher specific methane production rate and volumetric methane production potential than the other wastes studied, under the similar OLR values. The SBP was 680, 585, 540, 390 and 295 mL/g VS for food waste, agricultural residues, sugar beet bagasse, olive pulp and dairy manure respectively. The methane content of the biogas varied between 72 and 60 %. The volatile solids conversion rate for food waste was 62%.

Keywords : biogas production, organic wastes, biomethane, anaerobic digestion
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