

Effects of particle size of food waste on methane gas production and dewaterability of digestate in co-digestion with dairy manure

Fred Owusu Agyeman
State University of New York

Dairy farming and food production operations are continuing to intensify worldwide and bring not only economic development, but also introduce environmental challenges including the disposal of waste from these operations. Land application of these sources of waste has been linked to nutrient contamination of surface water and groundwater. Biogas recovery systems exploit natural biodegradation of manure and other nutrient sources which would otherwise pollute these water sources, with the generated biogas potentially providing an energy source. Three 2-L complete-mix anaerobic digesters were operated for co-digestion of domestic food waste (FW) and dairy manure (DM) (50%: 50% by VS) at 36 ± 1 °C with organic loading rate (OLR) increased stepwise from 0.67 to 3 g VS/L/d. The FW was shredded through cutting plates with different hole diameters (2.5, 4 and 8 mm) for the three digesters, respectively. The digesters were seeded with municipal anaerobic digester sludge and anaerobically digested DM.

The pH values were maintained between 6.5 and 8.1 with the average biogas production rate being 1.85, 1.82 and 1.78 L/L/d at the maximum OLR of 3 g VS/L/d in the three digesters, respectively. Biogas yield increased with increasing OLR, being 0.75, 0.72 and 0.66 L/g VS, respectively. Biogas composition was analyzed by gas chromatography with methane content averaging 72%, 68% and 67%, respectively. The average total volatile solids destruction was 94.1%, 93.9% and 93.7%, respectively. Time-to-filter of the digestate decreased gradually from 201-141, 226-157 and 243-167 minutes in the three digesters, respectively, indicating improved dewaterability with time. These findings are expected to advance feasibility of co-digesting FW and DM as a sustainable waste management strategy.

Biography

Fred Owusu Agyeman was born in Odumasi in the Brong Ahafo Region of Ghana. He received his bachelor's degree in Agriculture Technology from the University for Development Studies in Tamale (Ghana). He won a scholarship from the Ford Foundation International Fellowship Program to pursue a masters degree in Environmental Engineering at the State University of New York, College of Environmental Science and Forestry. He returned to Ghana to work on an Agricultural/Ecotourism business

foagyeman@yahoo.com