Improved performance of "food waste only" anaerobic digestion

This study identifies methods for digestion of food waste with enhanced biogas production and process stability.

Background

Food waste (FW) is generated from residential, commercial and food processing sources, and more than 95% of this material is currently landfilled. While food waste can be utilized to produce compost, anaerobic digestion (AD) may be a pathway for faster conversion of FW to value-added products. In addition to reducing waste volume, AD provides high-value products like biogas and fertilizer. Biogas contains methane that can be converted to electricity and heat. Despite these benefits, "food waste only" digestion is challenging due to heterogeneous composition of the feedstock, high nitrogen content, accumulation of acids and lack of trace minerals, all of which can lead to process instability and reduction of biogas yield.

Research Overview

Additional AD feedstocks were investigated for their potential to improve FW only digestion, by monitoring volatile acid concentration, alkalinity, methane percentage of biogas and pH as indications of process stability. The feedstocks chosen in this study also originate from the New York State food sector and are classified as "food sector wastes". These wastes, including dairy whey, bread, paper napkins and sports drinks, have consistent nutrient quality and proved to help improve stability and biogas production of FW only digestion. Figure 1 shows a comparison FW only digestion and co-digestion with these other food sector wastes. There is clearly an advantage to using co-digestion to operate FW digesters, as seen in the potential for significantly higher electricity and heating output.

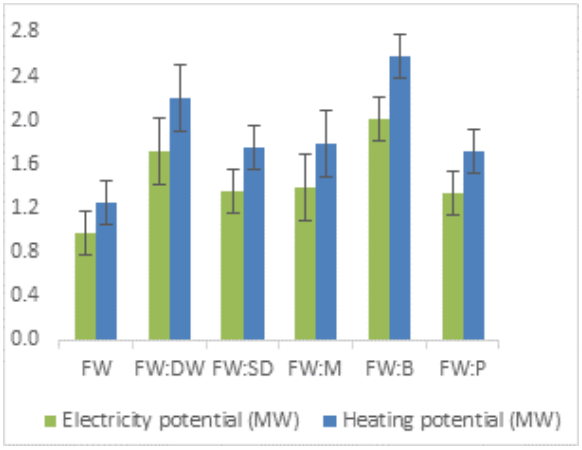

Fig 1: Electricity and heating potential comparison of FW only digestion and co-digestion (DW: dairy whey, SD: sports drink, M: manure, B: waste bread, P: paper napkins). Data are based on conversion of 50,000 tons of food waste per year. Error bars correspond to 1 standard deviation in methane measurements.

Impacts

It may not be practical to deploy "food waste only" digesters at a large enough scale needed for economic viability. However, when food waste is mixed with 10-30% of the other food sector wastes identified, improvements are achieved in the digestion process in terms of stability and biomethane yield. Co-digestion would therefore have beneficial impacts of reducing AD reactor volume, reducing water footprint of AD facilities and increasing electricity production. This research has evaluated certain co-substrates that are generated in large quantities in New York State. The use of other potential food sector feedstocks such as waste cooking oil, grease trap waste, paper products and fruit and vegetable processing waste water should also be evaluated.

[1]Defined here as pre- and post-consumer waste from institutions as a mixture of vegetables, fruits, bread, rice, pasta and cooked meat.

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