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Influence of Feedstock Variability and Pre-treatment Strategies on the Biomethane Potential of Source-Separated Organic Waste

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ABSTRACT

The diversion of source-separated organic waste streams, including food organics and garden organics (FOGO), from landfill presents a significant opportunity for renewable energy production through anaerobic digestion. However, seasonal and location variability in feedstock composition can significantly influence digestion performance and biomethane yield. Understanding and managing this variability is essential for the reliable design and operation of biomethane production systems. This study investigates the effects of feedstock variability and pre-treatment strategies on biomethane potential (BMP) of FOGO-derived substrates. FOGO samples will be collected across multiple time points to capture seasonal variability in composition, including moisture content, volatile solids, and carbon-to-nitrogen ratios. Laboratory-scale biochemical methane potential (BMP) assays will be conducted to determine methane yield and digestion kinetics under controlled conditions.

In parallel, a range of mechanical and physicochemical pre-treatment approaches will be evaluated to enhance substrate biodegradability and methane production. These include particle size reduction and size separation, as well as chemical, biochemical and thermal treatments designed to improve hydrolysis of lignocellulosic fractions present in garden organics. The results will establish a baseline dataset linking feedstock characteristics to biomethane yield and process performance. This work aims to inform strategies for feedstock management and pre-treatment that improve process stability and maximise energy recovery from heterogeneous municipal organic waste streams. The findings will support the design and scale-up of anaerobic digestion systems for reliable biomethane production from FOGO.

KEY WORDS

Anaerobic digestion, Biomethane potential (BMP), FOGO waste (food and garden organics), Feedstock variability, Pre-treatment strategies

BIOGRAPHY

Dr Joanne Tanner is a Senior Lecturer in the Department of Chemical and Biological Engineering at Monash University and Director of SAMPL, the Student Analytical Makerspace and Pilot Laboratories, which include the Monash Engineering Pilot Plant. Her work focuses on sustainable chemical processing, biorefinery systems, and process scale-up, supporting the development of cleaner industrial technologies. She works closely with industry and research partners to translate laboratory innovations into real-world engineering applications while advancing experiential learning opportunities for engineering students.

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