

Quantitative Analysis of Methane Gas Emissions From Paper Waste in UiTM Shah Alam

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Structured Abstract

Background: This study focuses on the quantitative analysis of methane gas emissions generated from paper waste in UiTM Shah Alam. The research specifically investigates two different types of paper waste which are mixed paper and cardboard by measuring their methane generation through anaerobic digestion.

Methods: The proximate and ultimate analysis were conducted to determine physical and chemical characterisations, and anaerobic digestion was then conducted for 48 days under mesophilic conditions. Then, the methane production was measured using a Gas Chromatography Flame Ionization Detector (GC-FID). The methane generation rate (k) and the ultimate methane potential (L_0) were calculated using the first-order kinetic equation for both mixed paper and cardboard.

Results: The results showed that mixed paper produced a higher cumulative methane yield (1.4365 L/kg) compared to cardboard (0.7459 L/kg). However, cardboard demonstrated a higher methane generation rate ($k = 0.0057 \text{ day}^{-1}$) and ultimate methane potential ($L_0 = 0.3891 \text{ L/kg}$). In contrast, mixed paper had a lower k value (0.0019 day^{-1}) and ultimate methane potential ($L_0 = 0.2924 \text{ L/kg}$), indicating a slower degradation rate.

Conclusion: In conclusion, the study highlights the potential of using paper-based waste for renewable energy recovery through anaerobic digestion. These findings have implications for waste management and co-digestion system optimization, contributing to more sustainable practices especially in institutional environments.

Keywords: Methane generation, anaerobic digestion, paper waste, biodegradability, UiTM Shah Alam

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