

Methane Emission Quantification From Food Waste in UiTM Shah Alam

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Structured Abstract

Background: UiTM Shah Alam generates large amounts of food waste daily, especially from cafeterias and coffee shops. Poor management leads to methane emissions, a potent greenhouse gas and renewable energy source. Converting food waste into biogas through anaerobic digestion supports sustainability and the circular economy. However, lack of data on methane production and generation rates (k -values) limits assessment. This study analyses food waste composition to determine methane potential and k -values. Understanding estimation methods improves biogas yield predictions and supports the institution's environmental and renewable energy goals.

Methods: Waste characterization was carried out on food waste and coffee powder waste collected at Faculty of Applied Science, UiTM Shah Alam. Followed by anaerobic digestion phase for 42 days using laboratory reactor setup. Cumulative methane yields were recorded, and the first-order kinetic model is used to calculate parameters, determining methane generation rate (k) and ultimate methane potential (L_0).

Results: This study found that food waste from UiTM Shah Alam, especially from the cafeteria, produced more methane (0.5809 L/kg) than coffee waste (0.0412 L/kg) after 42 days of anaerobic digestion. Food waste had a better balance of nutrients with a C/N ratio of 17:1, supporting microbial growth. Coffee waste, although rich in carbon, was harder to break down due to its fibrous content. Food waste had a lower methane potential ($L_0 = 2.645$ L/kg VS) but was more biodegradable, while coffee waste had a higher L_0 (86.617 L/kg VS) and faster reaction rate ($k = 0.0458 \text{ day}^{-1}$).

Conclusion: In conclusion, the study shows that food waste is more suitable for methane production than coffee waste due to its easier breakdown and better nutrient balance. Coffee waste, while having higher methane potential, degraded slowly and produced less gas. The results suggest food waste can be effectively used in biogas systems, while coffee waste may require pretreatment or mixing with other materials. Understanding waste composition helps improve methane production and supports sustainable energy efforts in institutions like UiTM Shah Alam.

Keywords: Methane yield, anaerobic digestion, food waste, coffee waste, biodegradability

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