CHAPTER V
CONCLUSIONS AND SUGGESTIONS

5.1 Conclusions

This study was conducted to evaluate methane production from food waste using a pilot-scale anaerobic digester operated in batch mode at ambient temperature. Based on the analysis and findings, the following conclusions were drawn:

1. The food waste from the UTHM cafeteria was successfully characterized as having high organic content, indicated by a VS/TS ratio of 0.94 and a COD of 37.35 g/L. The inoculum sourced from a POME-based biogas plant was also characterized and found to be suitable, with pH of 7.25;
2. The 110 L pilot-scale anaerobic digester was successfully operated in batch mode for 15 days at ambient temperature with a mixing speed of 120 rpm and an ISR of 2.0. Daily methane production was effectively monitored, showing immediate onset of gas production without any acclimatization period;
3. The performance of the anaerobic digester was confirmed to be effective, achieving substantial organic matter removal with efficiencies of 65.1% for Total Solids (TS) and 60.3% for Chemical Oxygen Demand (COD) by the end of the operation;
4. The ultimate cumulative methane yield from the anaerobic digestion of food waste was calculated to be 173.50 mL CH_4/g VS, demonstrating the energy potential of the substrate under the given conditions;
5. The evaluation of methane production kinetics confirmed that both the First-order ($k = 0.137\ day^{-1}$) and the Transference Function ($R_{max} = 27.036$ mL CH_4/g VS·d) models were highly reliable in describing the process, as evidenced by their best fit to the experimental data ($R^2 = 0.999$, RMSE = 1.198).

5.2 Suggestions

Based on the findings and limitations of this study, the following suggestions are:

1. Based on the variation in methane yields observed compared to the literature, it is recommended that future studies conduct a more detailed characterization of the chemical composition of food waste. Analysis of the specific proportions of

carbohydrates, proteins, and lipids is necessary to establish a strong correlation between substrate type and digester performance as well as methane yield. This will provide a more in-depth scientific explanation of why the methane potential of different samples can vary significantly;

2. Future study are suggest to apply more precise gas analysis techniques. The use of portable gas analyzers such as the Geotech Biogas 5000 (UK) is highly recommended to determine gas composition, especially the percentage of methane and carbon dioxide, in order to validate and improve data accuracy (Afiq et al., 2025).