CHAPTER V

CONCLUSIONS

Conclusions

In this study, lab scale anaerobic digestion of food waste operating in thermophilic condition and mesophilic condition. The bioreactor volume is 70 liters and the water contained within the water jacket is 35 liters. The flow rate of water was 15 liters /hour (force circulation) and 1°C temperature difference between the water jacket inlet and outlet. The following conclusions can be drawn from this study:

Determine the biogas tank temperature that suitable for biogas production.

The biogas generation from reactors incubated at mesophilic temperature (20-40°C) and thermophilic temperature (50-65°C). Maximum biogas production occurred at 55°C (38.14 L. of biogas) for a period of 11 days when compared to the other temperatures. Second best was at 50°C (37.44 L. of biogas) for a period of 12 days, followed by 40°C (35.36 L. of biogas) for a period of 15 days respectively

The biogas composition from reactors incubated at 40°C. Maximum methane of the biogas production was 57%. Second carbon dioxide was 35%, followed other gas was 8% respectively.

The biogas composition from reactors incubated at 55°C. Maximum methane of the biogas production was 60%. Second carbon dioxide was 32%, followed other gas was 8% respectively.

The day digestion from reactors incubated at mesophilic temperature (20-40°C) and thermophilic temperature (50-65°C). Minimum day digestion of the biogas production occurred at 55°C (11 days) when compared to the other temperatures. Second best was at 50°C (12 days), followed by 35 and 40°C (15 days) respectively. This lower days digestion, when compared to the other temperatures, is attributed to a temperature of about 55°C is important for bacteria's growth and activity.

Develop the temperature control system for biogas production.

The heating required for the bioreactor was performed using a solar collector combined with biogas energy. Water contained within the jacket of the bioreactor was 35 liters and the bioreactor volume was 70 liters. Heating this volume of water to 35-60°C for the solar collector design.

The solar collector consists of a galvanized steel flat plate of 4.98 m^2 dimensions. The absorber was insulated with a glass wool layer of 4 cm thickness at the bottom. All of these parts were arranged within a box of galvanized steel base and glass top.

The heat exchanger consists of a cylindrical storage tank of 35 L. The storage tank is wrapped with glass wool of 5 cm thickness. Cold water is supplied through the bottom of the flat plate collector and the hot water is retained in the storage tank of the heat exchanger. The outlet water from the bioreactor is fed back to the heat exchanger where it is reheated and then pumped back to the water jacket of the bioreactor.

Heating the bioreactor using solar energy can be approximated by first order dynamics and the night using biogas energy burn hot water. Two types of controllers were an on–off controller, and an analog PID controller. The on–off controller sensor was sensitive to small temperature variations.

Economics analysis temperature controls for biogas production

Economics analysis in this research will be study temperature control system for biogas production cost that the economics analysis consist of evaluation expenses side the other yearly both biogas production system and find out payback period in case.

Payback period of temperature control system for biogas production system was 5.88 year. Consideration total expenses cost per rate of system production and expense cost operating per rate of system production. The evaluation economic analysis of temperature control system for biogas production system was long time payback period because of the hot water system is very expensive. If free the hot water system, payback period of biogas production system was 0.66 year.

Recommendations

Anaerobic digestion is interesting option for treating organic waste. It gives biogas production. However, an experiment on the optimization of continuous process for this experiment was not completely achieved. Therefore, the new concept may be improved the process for further study.

1. The BMP test should be conducted to fresh digestion obtained from the experiments to assess the biodegradability.

2. The AD system should be operated into other system in order to get higher methane yield and to control the process effectively.

3. The hot water system should be used heat waste in order to discount cost.