CHAPTER V

CONCLUSIONS

5.1 Summary

This thesis has focus on mixing ratio and nutrients optimizations for biohydrogen potential (BHP) from batch thermophilic anaerobic dark co-fermentation of skim latex serum (SLS) and palm oil mill effluent (POME) using thermophilic anaerobic mixed cultures. Therefore, the biomethane potential (BMP) using effluents achieved from hydrogen stage under the optimal conditions was also investigated. Moreover, in this thesis has also investigated the effect of hydraulic retention times (HRTs) on the sequential productivity of biohydrogen and biomethane from the optimal mixing ratio of SLS and POME in a lab-scale reactor for a period longer than 90 days and 70 days, respectively for hydrogen and methane stages operation. The main outputs of this thesis work can be summarized as follow.

- The generating of biohydrogen and biomethane from batch two-stage dark co-digestion of SLS and POME was successfully achieved. Satisfactory hydrogen and methane production yields of 85.7±4.9 mL H_2/g-VS_{added} and 418±10 mL CH_4/g-VS_{added}, respectively were achieved from the mixing ratio of SLS to POME at 50:50 (%v/v) with 7 g-VS_{added}/L. The response surface methodology (RSM) results indicated that only $NaHCO_3$ concentration had significant individual effect on hydrogen production yield. The maximal hydrogen production yield achieved from moderate condition with the hydrogen production yield was 91.7±3.9 mL H_2/g-VS_{added}.

- In this research, the hydrogen generated in H_2-CSTR reactor is still low with the hydrogen production yield was 34±2 mL H_2/g-VS_{added} due to overload the process has occurred, leading to metabolic pathway shift to lactate formation pathway. At the same time, relatively high acetate concentration produced and accumulated in CH_4-UASB reactor, resulting in low methane production yield was 87±11 mL CH_4/g-VS_{added}. Although, the energy production yield achieved in this process was still low of 3917.30 kJ/kg-VS, this study provides valuable information in order to further define the optimal conditions for acidogenic and methanogenic stages operation.

5.2 Suggestions

1. Finding the optimal conditions for acidogenic stage operation including OLR, HRT, mixing intensity and maintain process under low hydrogen partial pressure condition.

2. Finding the optimal conditions for methanogenic stage operation including biomass concentration, OLR, HRT, re-circulating flow rate and maintain process under low hydrogen partial pressure condition.

3. Monitoring of H_2S gas produced in both H_2-CSTR and CH_4-UASB reactors as well as microbial community analysis to derive the relationships of their.

4. Identification of sugars composition contained in both skim latex serum and palm oil mill effluent to classify metabolic pathway will be incurred through anaerobic dark co-digestion of SLS and POME by thermophilic mixed cultures.