CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The overall results of this study clearly revealed that the biological hydrogen production by dark fermentation process using ASBR system was found to be dependent on several factors, including COD loading rate, pH, and COD:N ratio. For the ASBR system with pH control at 5.5, the results showed that pH control could enhance the hydrogen production by reducing the toxicity from both excess amount of glucose in wastewater and accumulation of VFA produced from acidogenesis process. The maximum hydrogen production was achieved at COD loading rate of 40 kg m^{-3} d^{-1} under pH control at 5.5, 37°C, and 24 h HRT. The main components of the produced gas were hydrogen and carbon dioxide. Additionally, the main components of effluent liquid were acetic and butyric acids. The effect of nutrient supplementation was also investigated to find the optimum point. From the results, nitrogen content in feed solution more significantly affected the hydrogen production than COD loading rate. Insufficient amount of nitrogen in feed can cause the decrease in COD removal because nitrogen was necessary for bacterial growth and metabolism. The COD:N ratio of 100:2.4 was found to be optimum for the hydrogen production. At this condition, the hydrogen yield was 1.46 mol H_2/mol glucose consumed, and the highest hydrogen production rate was 1.24 L h^{-1}.

5.2 Recommendations

Upon completion of the study, although several conclusions can be drawn, there are still few issues needed to be further investigated, especially the morphology and species of hydrogen-producing bacteria, which can be used to explain the reaction pathway of hydrogen and VFA formation.

It would also be interesting to use real wastewaters, i.e. cassava wastewater, rice winery wastewater, and biodiesel wastewater, as a carbon source in order to compare the efficiency with the synthetic wastewater.