CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The effects of microaeration on separate hydrogen and methane production from ethanol wastewater, was investigated in the two-stage UASB system consisting of 4 and 24 litter hydrogen and methane working volume, respectively. The system was operated at a mesophillic temperature and a recycle ratio of 1:1, with controlling pH of 5.5 in hydrogen production tank and without pH control in methane production tank.

The scope of research was separated into two parts. The first part was to study the optimum COD loading rate for separate hydrogen and methane production in two-stage UASB system. The result showed the optimal COD loading rate was obtained at 6.0 kg/m^3 d based on methane working volume (or 36.0 kg/m^3 d based on hydrogen working volume), which is the most suitable condition for microbial growth. At an optimal COD loading rate, the hydrogen composition (41 %), gas production rate (4.5 l/d), COD removal (36.0 %), hydrogen yield (33.5 ml H_2/g COD removed or 12.0 ml H_2/g COD applied), SHPR (460.8 ml H_2/L_R d and 79.3 ml H_2/g MLVSS d) and total VFA (9,400 mg/l as acetic acid) were maximized. At the same optimal COD loading rate, the performance of methane production reached methane composition (69.6 %), gas production rate (27.5 l/d), COD removal (55.0 %), methane yield (165.5 ml CH_4/g COD removed or 62.5 ml CH_4/g COD applied), SMPR (797.5 ml CH_4/L_R d and 98.0 ml CH_4/g MLVSS d) and total VFA (226.9 mg/l as acetic acid)

Secondly, the system was operated at an optimum condition (at 6.0 kg/m^3 d based on methane working volume) with varied oxygen supply load in methane UASB unit (3.0 – 6.0 ml O_2/L_R d). The optimal oxygen supply load for methane production was obtained at 4.0 ml O_2/L_R d which maximized gas production rate (45.5), COD removal (62.4 %), methane production rate (32.85 l/d), methane content (72.5 %), SMPR (1,400 ml CH_4/L_R d or 168.5 ml CH_4/ g MLVSS d), methane yield (171.6 ml CH_4/g COD removed or 107.2 ml CH4/g COD applied) and total (VFA 324.6 mg/l).

Furthermore, the hydrogen sulphide generated in methane tank at 6.0 kg/m^3 d was 0.13 % which was totally eliminated at an optimum oxygen supply load

5.2 Recommendations

It is interesting to study effects of microaeration on hydrogen production using ethanol wastewater under the dark fermentation by two-stage UASB system. In addition, microaeration technique may be applied to other systems, such as anaerobic sludge blanket reactor (ASBR) or continuous stirred tank reactor (CSTR), or photo fermentation including the various types of wastewater.