CHAPTER V
CONCLUSION AND RECOMMENDATION

5.1 Conclusion

All batch experiments were performed to evaluate the bio-hydrogen production from food waste and anaerobic sludge. The results could be concluded as follows:

5.1.1. In the experiment phase I, initial pH 4 to 12 (step I) were performed bio-hydrogen production under mesophilic (35±2°C) and thermophilic (55±2°C) conditions. Hydrogen production under initial pH 8 at 55°C was higher than it's under initial pH 8 at 35°C. The maximum cumulative hydrogen production and hydrogen yield were 767.64 ml H_2 and 30.69 ml H_2/g COD_{add}, respectively. Acetate, propionate and butyrate were mainly VFAs production which was 385.39, 5.67 and 758.56 mg/l, respectively and B/A ratio was 1.97. For initial F/M ratios (4, 6, 8, 10 and 12) (step II) were performed to enhance bio-hydrogen production under thermophilic condition that the optimal initial F/M ratio was 4. The maximum cumulative hydrogen production and hydrogen yield were 648.48 ml H_2 and 42.51 ml H_2/g COD_{add}, respectively. Acetate, propionate and butyrate were main VFAs production which was 402.97, 8.31 and 850.60 mg/l, respectively and B/A ratio was 2.11. For concentration ranges of initial $Fe2^+$ (100, 200, 300 and 400 mg Fe^{2+}/l) (step III) were effective on hydrogen production and the optimal Fe^{2+} concentration was achieved at 100 mg Fe^{2+}/l. The maximum cumulative hydrogen production and hydrogen yield were 543.97 ml H_2 and 44.83 ml H_2/g COD_{add}, respectively. Acetate, propionate and butyrate were main VFAs production which was 324.69, 5.15 and 765.66 mg/l, respectively and B/A ratio was 2.36.

The optimum of environmental condition was the initial pH 8, initial F/M ratio of 4 and initial Fe^{2+} concentration 100 mg Fe^{2+}/l under thermophilic (55±2°C) condition.

5.1.2. In the experimental phase II, it studied the effect of pretreatment methods (Heat, repeated heat, chloroform and ultrasonication) on bio-hydrogen production. The results showed that repeated heat method was the optimal method in this study. The maximum cumulative hydrogen production and hydrogen yield were 656.57 ml H_2 and 46.19 ml/g COD_{add}, respectively. The VFAs production (324.25, 2.65, 838.38 mg/l of acetate, propionate and butyrate, respectively) was observed in the batch reactor and the B/A ratio was 2.59.

5.2 Recommendation

The following aspects are recommended for further studies.

5.2.1. Optimal condition obtained from this study are helpful for design of bio-hydrogen production from food waste in a continuous fermentation process.

5.2.2. Pretreatment method shown the positive on H_2 production but it should consider the economic assessment of cost.

5.2.3. Bio-hydrogen production from other substrate (i.e., starch, organic waste, waste water etc.) should be more studied and applied for fuel cell as a clean energy.

5.2.4 Remaining COD (Effluent COD) of batch reactor should be analyzed total VFAs for conversion to percentage of COD removal.

5.2.5 Study more on the initial F/M ratio lower than 4 that may be the optimal condition.

5.2.6 Study more on the initial Fe^{2+} lower than 100 mg Fe^{2+}/l that may be the optimal condition.