CHAPTER 5
CONCLUSIONS

A review of literatures found only few publications on in-line flocculation MBR system and no studies have been performed with polymer flocculant for membrane fouling reduction. This research preliminarily studies the effect of different kinds of polyacrylamide (cationic, anionic and nonionic charge) on MBR system performance. The performance of polyacrylamide for septic tank effluent and mixing liquid in MBR tank were assessed by jar test experiment with respect to turbidity removal efficiency and COD removal efficiency. In addition, a comparative assessment of the three flocculants was conducted and the results obtained from jar test were employed in the next phase of experimentation which involved MFI fouling index and subsequent in-line flocculation MBR system. The effects of flocculant on MBR system performances and membrane fouling potential were investigated. Based on the results of these experiments, the findings of this research can be summarized as follows;

5.1 Conclusions

5.1.1 Preliminary Study

The jar test experiments were performed by using PAM of different charges to study their effects on turbidity removal, TCOD removal and SCOD removal. The results show that C-PAM is more effective than A-PAM and Non-PAM. Moreover, the effectiveness of flocculant on the fouling propensity of sludge in MBR tank was studied. The fouling potential was characterized by the standard MFI. The results obtained from this study showed that the flocculation decreased the fouling propensity.

5.1.2 Effect of Flocculant Dosage on System Performance

1. Effect of Flocculant Dosage on Sludge in MBR tank

At the start of first stage, the MBR system was operated without flocculant addition. MLSS and MLVSS had no increase but decreased in the bioreactor. After 140 days both of them showed gradual rise in value up to about 5,000 mg/L for MLSS and about 4,000 mg/L for MLVSS. At the second stage after the flocculant was added into the system. MLSS and MLSS less decreased in a few days and then gradual increased. The phenomena of deceasing in MLSS and MLVSS had no significant effect when the dosage was changed from second stage to third stage.

2. Effect of Flocculant Dosage on COD Removal

It was found that after the dosages of C-PAM were added the removal efficiency of TCOD increased from 75±19% to 92±3% at second stage and from 92±3% to 95±1% at third stage. The removal efficiency of SCOD increased from 59±26% to 82±6% at second stage and from 82±6% to 88±3% at third stage, respectively. These were caused by chemical degradation.

3. Effect of Flocculant Dosage on Nitrogen Removal

The NH_4-H removal efficiency was 95±12% at the first stage of operation and it was increased higher than 99% removed at second stage and third stage, respectively. The removal efficiency of TKN was greater than 99% removed even non flocculant addition. It can be observed that there was no significant difference in TKN removal after flocculant was added. In case of TN removal efficiency, the removal efficiencies have been increased with dosage increased. It was 46±24% removed at the first stage, 59±11% removed at the second stage and 75±10% removed at the third stage. It was possibly due to agglomerated floc produced anoxic zone inside.

5.1.3 Effect of Flocculant Dosage on Fouling Potential

The total EPS primarily consisted of protein and carbohydrate were in the range from 40 to 50 mg/gVSS and from 25 to 35 mg/gVSS, respectively. In this research, the total EPS reduction was mainly caused by the protein reduction due to biological nitrogen removal. In case of TMP and permeate flux, they were monitored during the operation to detect how membrane fouling affects MBR performance. It was found that before flocculant was added to the system, TMP was increased rapidly and permeate flux was unstable during period. Floculant dosage could be improved TMP slowly increased and stable permeate flux. Due to the development of cake formation on the membrane surface, hence, the colloidal matter which can cause pore blockage, was trapped in the cake form and resulted in reduces membrane fouling.

5.2 Suggestions

The application of the combination of MBR and in-line flocculation system for treatment of septic tank effluent wastewater showed promising results. Recommendations for further study of the in-line flocculation MBR system include:

1. The effect of other parameter such as pH should be studied to investigate in the jar test experiment.
2. The sludge floc size and size distribution change after adding flocculant should be measured.
3. The flocculant addition should be tried at more dosages in order to investigate the effect of over dosing on system performance.

4. Other coagulant or flocculant should be tried to compare and investigate the efficiency.