CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

Based on this investigation it appears that the use of Laboratory-scale upflow anaerobic sludge blanket (UASB) reactor process for treating dairy wastewater is feasible, although generally the effluent may not achieve the industrial effluent standard. Other types of wastewater treatment process should, accordingly be followed, such as aerobic treatment, wetland, land treatment process and etc. Based on the extensive investigations the following conclusions can be drawn from this investigation.

5.1.1 General Conclusions from this Investigation

The reactor was operated with the 4 HRTs of 12 hours, 16 hours, 20 hours and 24 hours at the various organic loading rates of 0.6 kg COD/m$^3$.d to 7.2 kg COD/m$^3$.d but the reactor gives the optimal result only when operating the reactor at 20 hours HRT further increasing the HRT above 20 hours doesn’t improve the efficiency of the reactor and thus can be interpreted that the organism reached the decline phase at HRT of 24 hours. The estimation of biogas production by using computer simulations of SPSS and ANN softwares were indicated that the estimated values agreed with the results obtained from laboratory by using validation analysis.
5.1.2 Specific Conclusions Derived from this Investigation

- The maximum removal efficiency of COD obtained from this investigation is 94.33% at an OLR of 2.16 kg COD/m$^3$/d for the HRT of 20 hours.

- The maximum removal efficiency of TN obtained from this investigation is 86.67% at NLR of 0.036 g N/m$^3$/d for the HRT of 20 hours.

- The maximum removal efficiency of TP obtained from this investigation is 94% at PLR of 0.0072 g P/m$^3$/d for the HRT of 20 hours.

- The maximum production of biogas obtained from this investigation is 9.6 L/d at an OLR of 4.32 kg COD/m$^3$/d for the HRT of 20 hours. The maximum bio gas production rate was 383 L/kg COD removed for 24 - h HRT with the OLR of 3 kg COD/m$^3$/d, with 260 L of methane gas.

- The suitable F/M ratios for high COD removal were found to be in the range of 0.18 to 0.32 g COD/g VS$_d$ and it can be used as one parameter for testing the reactor performance.

- The increasing of OLR caused the decrease of removal efficiencies of all solids for 12 to 24 hours HRT.

- The reactor appear capable of treating the dairy wastewater with high degree of consistency even when the influent strength may vary due to across the week flow variations, shock loads, etc.

- The estimation of biogas production by using computer simulations of SPSS and ANN softwares (Feed Forward Back Propagation, Radial basis function and Generalized
Regression Neural Networks) were performed. The simulations of ANN software of Radial basis function gives the best estimated values agreed with the results obtained from laboratory by using validation analysis.

5.2 RECOMMENDATIONS FOR FUTURE WORKS

From the available literatures of UASB process treating dairy wastewater and based on the findings in this research, following works are recommended for future research.

- The effluents of this UASB process at various HRT did not meet the industrial effluent standard, therefore if the influent concentrations are in the range similar this investigation, there should be some tertiary treatment processes following this system.

- The characteristics of dairy wastewater contains high content of protein and lipid, therefore, there should be a retreatment process to trap oil and grease, prior to UASB process. This will be beneficial to the performance of UASB reactor in the long run.

- The hydrogen content in effluent should also be investigated in details the relationships of related parameters.

- As the effluent in this investigation was found to contain a higher concentration of phosphorus and nitrogen, it is recommended that some way of nutrient recovery should be explored.