CHAPTER V

CONCLUSIONS AND SUGGESTIONS FOR FUTURE WORK

5.1 Conclusions

A continuous flow alternating biological biofilters was operated with two biofilters in series for the biological removal of phosphorus. The condition of each biofilter was alternated between anaerobic and aerobic conditions and vice versa. The highest phosphorus removal was 87.5±0.2 % for a cycle duration (CD) of 24 hours and hydraulic retention time (HRT) of 6 hours. Maximum nitrogen removal was 72.1±0.6 % for a CD of 3 hours and HRT of 3 hours. The results of the experiments indicate that CD and HRT had a significant impact on the biological activity. The overall impact of the CD was to create the environmental conditions for enhanced or inhibited phosphorus release and uptake. For short CD, a shorter HRT would favor higher phosphorus percent removal and vice versa. The experimental results show that a CD:HRT ratio of less than 4:1 should be used. In addition, for a given CD, the lower the HRT the worse off is the COD and TP removal (increasing ratios of CD:HRT).

Increasing the COD:N and COD:P of the influent wastewater negatively affected phosphorus uptake as opposed to an increase of air:water ratio which was found to positively affect phosphorus removal. Experiments conducted at a low TP influent concentrations of 8 mg P/L indicated that percent removal was similar to that for an influent concentration of 16 mg P/L.

The alternating biofilters were found to be effective in the removal of the E2 with an overall removal of 96.5 %. For E2 removal, the efficiency declined for a decrease in HRT of the system and air:water ratio. For the anaerobic biofilter, the percent removal of E2 was found to decrease with shorter HRTs. In the case of aerobic biofilter, an HRT of 3 hours gave similar percent removal as for higher HRTs. E2 removal was found to increase with a decrease in COD:N. In all studies, the metabolite, E1, was found which subsequently degrade within the column. For batch sorption experiments, the sorption coefficient, K_F, of the Freundlich model was 8.43 ($\mu g^{1-1/n}.L^{1/n}.g^{-1}$) while the 1/n value was 0.664. Using mass balance, about 60 % of E2 was found to biodegrade and 14 % was adsorbed indicating that biodegradation may be the dominant removal mechanism.

5.2 Suggestions for Future Work

Based on the results of this study, several investigations are recommended for future research:

1. Research the temperature effect on the performance of enhanced biological phosphorus removal.

2. Develop a model for the alternating biofilters to better understand removal and prediction of the biofilter performance.

3. Identify E2 metabolites and degradation pathways.

4. Conduct adsorption studies on biomass and the degradation of other endocrine disrupting compounds.

5. Study the competition effects of other organic compounds such as humic materials on E2 adsorption onto the biomass.

6. The major mechanisms of removal of E2 are still not well understood. Further studies and careful experimentation are needed to properly quantify removal of E2 in biological systems and the fate of E2.