CHAPTER V

CONCLUSIONS

This study investigated the uses of $BDOC_5$ and UV_{254} for characterizing secondary treated wastewater quality and treatment performances of three common biological wastewater treatment processes, AS, TF and RBC. Bench-scale AS, TF and RBC were operated at different values of the control parameters, SRT for AS and HLR for TF and RBC. Primary treated wastewaters from two different WWTPs were used as influent of the biological treatment units. After the systems reached the steady state at each value of control parameter, effluent samples were collected and analyzed for $BDOC_{28}$, $BDOC_5$, DOC, $SBOD_5$, SCOD and UV_{254}. MLSS was measured for the AS system.

The primary wastewater with relatively low organic concentrations from the first treatment plant was used as influent for the TF and RBC systems. For the TF system, effluent $SBOD_5$, $BDOC_{28}$, $BDOC_5$ and DOC were not much different across different HLRs because of the relatively low values of the influent organic concentration; however, removal of all four parameters decreased with higher HLRs as expected. The TF unit removed minimal amounts of UV absorbing constituents and HLR showed no effect on the removal indicating the ability of TF to remove UV absorbing constituents. At all HLRs tested, effluent SUVA was higher than influent SUVA because only simple, low molecular weight and biodegradable organics were removed, while DOC remained in the effluent has higher proportions of hydrophobic, aromatic, high molecular weight. For the RBC system, only effluent $SBOD_5$ and $BDOC_5$, and their removal were higher and lower with increasing HLRs, respectively, as expected. The results of effluent $BDOC_{28}$ and DOC were not reasonable because the primary wastewater fluctuated dramatically in quality and had low organic concentrations. The effects of HLR on UV_{254} and SUVA and their removal were similar to those of TF.

The influent of the processes was switched to the primary treated wastewater from the second plant, which had 10 times higher and less fluctuating $SBOD_5$ concentration than that of the first plant. All three processes were experimented with the primary wastewater from the second plant. SCOD results were not reasonable mainly due to the imprecision of the parameter. Influent $BDOC_5$ and DOC were more precise than influent SCOD and $SBOD_5$, while the effect of SRT on effluent $SBOD_5$, $BDOC_5$, DOC could not be deduced since they were influenced by the organic concentration of influent. For TF, the effect of HLR on the effluent $SBOD_5$, $BDOC_5$ and DOC could not be clearly observed due to the inconsistency of the influent organic concentration; nevertheless, their removal tended to decrease at higher HLR. The study of RBC also obtained very similar results as those of TF. The results of UV_{254} suggested that SRT had no effect on the ability of AS to remove UV_{254} absorbing constituents, TF barely removed UV_{254} absorbing constituents and UV_{254} removal of RBC was in between those of AS and TF. The results complied with the known fact about the performance of biological wastewater treatment processes that AS > RBC > TF. Effluent SUVA of the three biological wastewater treatment systems were higher than that of influent because the systems mainly removed simple, low molecular weight, and biodegradable organics and DOC remaining in the effluent had higher proportions of hydrophobic, aromatic, high molecular weight, and biorefractory organics, which are the characteristics of water with high SUVA.

Relationships among SCOD, $SBOD_5$, $BDOC_5$, DOC, UV_{254}, and SUVA of the influent and effluent of AS, TF and RBC systems operated with the primary treated wastewater from the second plant were explored. Poor correlations of SCOD and other parameters observed were attributed to low precision of SCOD. Effluent $SBOD_5$ correlated strongly with effluent $BDOC_5$, DOC and UV_{254} whereas influent $SBOD_5$ only related well with influent UV_{254}. A fair relationship between $SBOD_5$ and SUVA was observed for the effluent, while that for the influent was weak. Relationships among $BDOC_5$, DOC and UV_{254} were strong as previously reported for drinking water samples. $BDOC_5$ and DOC also correlated well with SUVA. Good relationships of SUVA and UV_{254} with the other wastewater parameters suggested that SUVA and UV_{254} could indicate characteristic of organic contents in wastewater.

Although the primary wastewater from the second plant was more consistent and higher in organic concentrations than that of the first treatment plant, repeating the experiments with typical primary wastewater with extremely consistent organic concentrations and characteristics is suggested to verify the utility of $BDOC_5$. In order to confirm the relationships among $BDOC_5$, DOC, and UV_{254}, wastewater samples from several full scale treatment plants should be studied.

$BDOC_5$ exhibited higher precision when comparing with other wastewater quality parameters. The results of influent and effluent $SBOD_5$, $BDOC_5$ and DOC of AS, TF and RBC systems at different values of control parameters showed the utility of $BDOC_5$ in characterizing the effluent quality and performances of the three commonly used biological wastewater treatment processes and as a reliable wastewater quality parameter. UV_{254} can be used for indicating the quality of wastewater, but not for indicating wastewater treatment efficiency because UV_{254} could not differentiate the quality of effluent resulted from different values of the control parameters.