Dynamic Modeling of Advanced Wastewater Treatment Plants Using BioWin

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Abstract : Advanced wastewater treatment plants have complex biological kinetics, time variant influent flow rates and long processing times. Due to these factors, the modeling and operational control of advanced wastewater treatment plants become complicated. However, development of a robust model for advanced wastewater treatment plants has become necessary in order to increase the efficiency of the plants, reduce energy costs and meet the discharge limits set by the government. A dynamic model was designed using the Envirosim (Canada) platform software called BioWin for several wastewater treatment plants in Hillsborough County, Florida. Proper control strategies for various parameters such as mixed liquor suspended solids, recycle activated sludge and waste activated sludge were developed for models to match the plant performance. The models were tuned using both the influent and effluent data from the plant and their laboratories. The plant SCADA was used to predict the influent wastewater rates and concentration profiles as a function of time. The kinetic parameters were tuned based on sensitivity analysis and trial and error methods. The dynamic models were validated by using experimental data for influent and effluent parameters. The dissolved oxygen measurements were taken to validate the model by coupling them with Computational Fluid Dynamics (CFD) models. The Biowin models were able to exactly mimic the plant performance and predict effluent behavior for extended periods. The models are useful for plant engineers and operators as they can take decisions beforehand by predicting the plant performance with the use of BioWin models. One of the important findings from the model was the effects of recycle and wastage ratios on the mixed liquor suspended solids. The model was also useful in determining the significant kinetic parameters for biological wastewater treatment systems.

Keywords : BioWin, kinetic modeling, flowsheet simulation, dynamic modeling
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