

Optimizing Biotreatment: Integrated Process Models and Control Strategies

The overall objective of this research project is to develop and implement model-based control strategies for improving biological treatment and document the methodology, benefits, and effort required. The project phase documented in this report include performing a literature review, installing extensive instrumentation at a full-scale advanced wastewater treatment facility, and developing real-time, dynamic models for biological nutrient removal that are suitable for control.

The literature review was published as a separate report entitled Model-Based Control: Literature Review and Primer. It provides a detailed description of model predictive control and examines case studies from the process industries and the environment utility industry.

Considerable on-line analytical instrumentation was installed at the Stamford WPCA wastewater treatment plant where all the full-scale experimental work was performed. The instrumentation includes five ammonia, six nitrate/nitrite, one suspended solids, four dissolved oxygen, and two ORP analyzers. The analyzers have performed reliably and accurately with minimal periodic maintenance.

Artificial neural network models were developed for the nitrification and denitrification processes. These models provide adequately accurate results for the purpose of control. However, additional field work will be required to collect data with sufficient variability to include the effects of some parameters known to affect the nitrification and denitrification processes.

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