iEMSs 2008: International Congress on Environmental Modelling and Software
Integrating Sciences and Information Technology for Environmental Assessment and Decision Making
4th Biennial Meeting of iEMSs, http://www.iemss.org/iemss2008/index.php?n=Main.Proceedings
M. Sànchez-Marrè, J. Béjar, J. Comas, A. Rizzoli and G. Guariso (Eds.)
International Environmental Modelling and Software Society (iEMSs), 2008

Risk Assessment Module of the IWA/COST Simulation Benchmark: Validation and Extension Proposal

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Keywords: ADM1; Benchmark; BSM2; Modelling; Solid Separation Problems; Validation.

The IWA/COST simulation benchmark platform has been widely used to evaluate and compare different activated sludge control strategies. The IWA/COST simulation benchmark provides performance indices like the effluent water quality, operating costs and controller performance [Copp, 2002], all of them quantitative. In order to provide a qualitative performance index that could take into account the biomass separation related problems, a Risk Assessment Module proposal, adapted to any simulation benchmark platform, has been developed for the activated sludge system. Once developed, it is necessary to validate the Risk Assessment Module with pilot plant data and full-scale data. Since the anaerobic digestion model number 1 (ADM1) has recently been implemented in the benchmark platform, BSM2, by Jeppsson et al. [2006] to provide a plant-wide model for simulation, the Risk Assessment Module is being extended to also cope with those anaerobic digestion problems of qualitative nature. The proposal and preliminary intentions are discussed.

The activated sludge process constitutes a complex system since consisting of a multi-specific microorganism population that often evolves to imbalances causing severe operational problems. The absence of basic knowledge about the interactions mechanisms between the microorganism communities and operational parameters, which are not described by standard models, is an obvious limitation when evaluating control strategies via simulation. Experience show that mechanistic models sometimes have limitations at predicting some real behaviours of the process once the model is confronted with reality [Sin et al., 2005]. For this reason, an extension of the IWA/COST simulation benchmark was developed, which includes expert reasoning for the system performance evaluation. In this context, an expert reasoning module called Risk Assessment Module was developed to detect favouring conditions for filamentous bulking, foaming, rising and, later, deflocculation in Comas et al. [2006].

Plant wide modelling in the wastewater treatment field is attractive to many researchers as it provides a holistic view of the process and it allows for a more comprehensive understanding of the interactions between the various unit processes. Plant-wide modelling is an important tool for development and testing of new control and monitoring schemes for wastewater treatment [Rosen et al., 2005]. So, ADM1 by Batstone et al. [2002], is included in BSM2 to provide a model which also considers a primary and secondary settlers, thickener, and anaerobic digester [Jeppsson et al., 2006].

This continuous evolution of the IWA/COST simulation benchmark and the several platforms (BioWinTM, EFORTM, GPS-XTM, Matlab/SimulinkTM, Simba®, STOATTM, WEST® and user defined FORTRAN code), where it can be implemented, provokes that

more operational conditions and control strategies have to be qualitatively evaluated, in addition to the existing quantitative evaluation. Therefore, it was necessary to develop a proposal to implement the Risk Assesment Module to the rest of platforms where the IWA/COST simulation benchmark is implemented. Moreover, the Risk Assessment Module has to be validated in order to ensure its reliability for the activated sludge systems. Finally, an extension for the Risk Assessment Module considering anaerobic digestion model has to be proposed, according to the inclusion of ADM1 to the BSM2.

The *Risk Assessment Module* has been developed following the basis set in Cortés *et al.* [2000] and Poch *et al.* [2004].

ACKNOWLEDGEMENTS

The authors wish to thank the Spanish Ministry of Science and Technology for the financial support of the project DPI2003-09392-C02-01. The authors also want to acknowledge to Dr. Ulf Jeppsson (IEA, Lund University) for providing the ASM1 benchmark MatLab/Simulink© code to carry out the simulations and Dr Gurkan Sin and Kris Villez (from BIOTMATH,Ghent University) for providing data that will be used for validation for the Risk Assessment Module.

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