Integrating ultrasonic disintegration in activated sludge wastewater treatment plant modeling

H.H. Pham[a], N. Lambert[b], P. Buffel[b], K. Van Eyck[b], R. Van den Broeck[b], R. Dewil[b], I. Smets[a],*

[a]*Chemical and Biochemical Process Technology and Control (BioTeC) Section, Department of Chemical Engineering, KU Leuven, Willem de Croylaan 46, 3001 Leuven, Belgium, Tel. +32 16 3 22705; email:* huyhoang.pham@cit.kuleuven.be *(H.H. Pham), Tel. +32 16 32 26 87; email:* ilse.smets@cit.kuleuven.be *(I. Smets)*
[b]*Laboratory for Environmental and Process Technology, Department of Chemical Engineering, KU Leuven - Campus De Nayer, 2860 Sint-Katelijne-Waver, Belgium, Tel. +32 15 31 69 44; emails:* Nico.Lambert@cit.kuleuven.be *(N. Lambert),* pieter.buffel@gmail.com *(P. Buffel), Tel. +32 16 32 16 94; email:* kwinten.vaneyck@cit.kuleuven.be *(K. Van Eyck), Tel. +32 16 32 16 80; email:* rob.vandenbroeck@cit.kuleuven.be *(R. Van den Broeck), Tel. +32 496 074 990; email:* raf.dewil@cit.kuleuven.be *(R. Dewil)*

ABSTRACT

This paper presents an integrated mathematical model that is capable of predicting and assessing the impact of ultrasonic (US) treatment on the excess activated sludge production in an activated sludge wastewater treatment system. Biological processes in the reactor are simulated in Matlab®/Simulink by the ASM1 model into which two algebraic equations, which capture the US treatment, are integrated. Calibration and validation data series come from a pilot plant installed at two locations, i.e. at a communal wastewater treatment plant (Mechelen-Noord) and at an industrial food flavor production site Haasrode, both located in the Flanders region of Belgium. The results show that the built-up model is capable of correctly predicting excess sludge reduction in the treatment system (which is a sequencing batch reactor in both cases). A reduction of approximately 42% for the communal case study can be reported, while the result obtained for the industrial case study, characterized by a very high organic loading, is quite comparable, i.e. about 38%. The latter represents a huge amount of excess sludge avoided given the nominally very high sludge production rate. The model can now be exploited to maximize the excess sludge reduction while minimizing the US operational costs.

Keywords: Wastewater treatment modeling; Ultrasonic disintegration; Excess activated sludge reduction

*Corresponding author.