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Modelling soluble microbial products (SMPs) in a dynamic environment

A. Fenu*, T. Wambecq, C.Thoeye, G. De Gueldre, B. Van de Steene

Aquafin, Department of Research and Products Development, Dijkstraat 8, 2630 Aartselaar , Belgium
Tel. +32 3450-4511; Fax +33 383596285; email: alessio.fenu@aquafin.be

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ABSTRACT

A calibrated ASM_{2d} model of a full scale MBR is modified as to include the soluble microbial products (SMPs) fractions and study their dynamics in full scale. Batch tests were conducted to estimate the SMP kinetics. The biomass associated products (BAPs) kinetics were estimated with results in tune with previous experiments. The utilization associated products (UAP) kinetics estimation was instead complicated by two aspects which regularly occur when spiking readily biodegradable COD: storage phenomena (not accountable in ASM_{2d}); the non-uniformity between the polysaccharide fraction, easily biodegradable, and the protein fraction, which proved to be refractory to biodegradation. The procedure for UAP kinetics estimation would thus require further analysis. UAPs were found in full scale markedly predominant compared to the BAPs. The data analysis revealed that the membrane rejection mechanism was identified as SMP loading rate dependent, emphasizing the need of a more careful consideration towards this parameter when working in a dynamic environment. The work discusses the feasibility of the SMP extension studies in dynamic conditions. Fine tuning of the membrane rejection factor, the necessity of more frequent sampling, and experimental determination of the additional kinetics SMP parameters become necessary and burdensome adaptations of the ASM calibrations. However both nutrients removal, sludge production and energy consumption modelling were not improved by including the SMP fraction in the modelling. SMPs did not correlate with fouling rates in this full scale MBR, indicating a strong drawback, since the main drive for these models is thus not accomplished.

Keywords: Membrane bioreactor (MBR); Activated sludge model (ASM); Soluble microbial product (SMP); Full scale; Modelling

* Corresponding author.