Sludge production in aerobic and anaerobic membrane bioreactors

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Coupling membrane filtration with aerobic/anaerobic processes for wastewater treatment offers advantages in terms of effluent quality, reduced footprint, lower sludge production. After the introduction of cheaper polymeric membranes, an increasing interest in the MBR technology spread throughout practitioners and scientists over last 15 years, as confirmed by the exponential trend of MBR-related papers and/or technical reports published. The excellent and bacteria-free effluent makes the process very attractive for all the contexts in which a sustainable us of the water is needed, including both industrialised and middle/low-income countries, thus supporting the achievement of MDG (UN, 2000) on water supply and basic sanitation.

This paper focuses on the application of steady-state equations and dynamic models to predict the surplus sludge production in membrane bioreactors.

In the first part a three-fold approach has been applied for aerobic MBRs for municipal wastewater treatment. Two models are based on COD and VSS mass balances, take into account the influent COD fractionation carried out by respirometric tests and have been calibrated and validated on a large pilot scale installed at the University of Trento. The models have been further applied on data from two full-scale installations to check their predicting capability in terms of excess sludge production. A third approach has been also adopted, which is based on an extended version of the well-known ASM3: the model has bees successfully calibrated for main biokinetics and stoichiometric coefficients and then validated with on-line measurement of MLSS in a large pilot scale installation.

In the second part, a steady-state model is presented to analyze the sludge production in a membrane-assisted ABR (Anaerobic Baffled Reactor). The model assumes that sludge built-up leaves with the effluent and then predict the sludge production comparing the non-sludge effluent and the non-sludge COD to experimental data.