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Modeling the impact of membrane filtration on organic carbon removal by the activated sludge process for tannery wastewater

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ABSTRACT

The study emphasized a new approach for modeling the activated sludge process with a membrane separation (MASM) for organic carbon removal of tannery wastewaters. The new model, differing from the commonly used activated sludge models 1, relied on a modified chemical oxygen demand (COD) fractionation considering the particle size distribution of the organic matter. A new COD fraction, entrapped COD, was included into the model related to the effective filtration size of the membrane module. Modeling studies were conducted for high rate; conventional and extended aeration activated sludge systems operated at sludge age levels of 4, 8–12, and 15–18 d, respectively. Model simulations were carried out for parallel systems both with gravity settling and membrane filtration. Comparative evaluation reflected a better effluent quality for the activated sludge systems with membrane separation at all sludge ages when both systems were designed for the same reactor volume. At a high rate operation, the effluent soluble COD level was estimated as 198 mg/L for membrane separation, below the threshold of 200 mg/L and 63% lower than the conventional scheme. Even for conventional and extended type of operation, the effluent COD remained around 170 mg/L, where it fluctuated between 300–350 mg/L including the particulate COD in the supernatant for the conventional scheme.

Keywords: Tannery wastewater; MASM, new model for membrane activated sludge; MAS, membrane activated sludge; Particle size distribution; Modified COD fractionation; Captured COD fractions

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