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Ultrafiltration of municipal wastewater: study on fouling models and fouling mechanisms

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ABSTRACT

Ultrafiltration (UF) with hollow fiber membranes is a proven membrane technique that can achieve high water quality standards as a tertiary treatment in municipal wastewater treatment plants. However, UF has a major drawback, membrane fouling, which causes losses of productivity and increases operation costs. Thus, the aim of this work is to model membrane fouling in the UF of a secondary treatment effluent. The tests were carried out with a model wastewater solution that consisted of bovine serum albumin and dextran. Three different transmembrane pressures and three different crossflow velocities were tested. Several fouling models available in the literature, and new models proposed, were fitted to permeate flux decline experimental data. The models studied by other authors and considered in this study were: Hermia's models (complete, intermediate, standard pore blocking and gel layer) and Belfort's model. The new models proposed in this work were: modified Belfort's model, quadratic exponential model, logarithmic inversed model, double exponential model and tangent inversed model. The fitting accuracy of the models was determined in terms of the *R*-squared and standard deviation. The results showed that the model that had the higher fitting accuracy was the logarithmic inversed model. Among the Hermia's models, the model that had the higher fitting accuracy was the intermediate pore blocking model. Therefore, the predominant fouling mechanism was determined and it was the intermediate pore blocking model.

Keywords: Ultrafiltration; Fouling; Modeling; Hollow fiber; Simulated wastewater

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