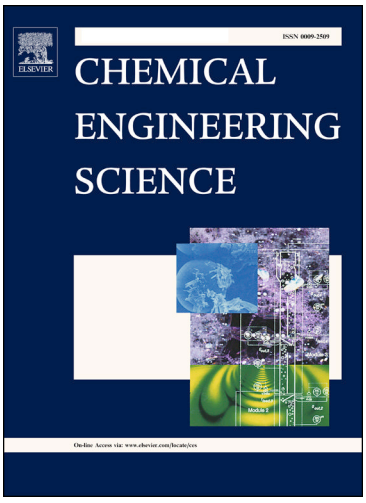

Modeling of transitional pore blockage to cake filtration and modified fouling index – Dynamical surface phenomena in membrane filtration

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Modeling of transitional pore blockage to cake filtration and modified fouling index – Dynamical surface phenomena in membrane filtration.

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Abstract

The objective of this study was to optimize and to model the membrane fouling process. The modeling was based on two approaches, dynamical and phenomenological with the combination of surface phenomena. The established model was a transitional pore blockage model towards cake fouling through new characteristic parameters and a modified fouling index.

The characteristic parameters developed in this study described the effect of cake restructuring, the shear, the mass of the cake, the filtered fluid recirculation according to the effective thickness Z_c in the membrane fouling mechanism. The Modified fouling index – Dynamical surface phenomena (MFI- DSP) was developed by characteristics of multiple interactions forces ratio and mechanical forces in the transition of the regime.

The membrane fouling was carried out according to the membrane compressibility factor m = 1, the cake n = [0 - 1] and the kinetics of the fouling process corresponding to the partial orders ω = [0 - 4]. The new model was validated based on experimental data in tangential and frontal filtration, using PES-10, UE-100 and NF-270 membranes with the prediction of the transitional blockage. Statistical analyzes at CI $\geq$ 95% showed better performance and efficiency of the new model compared to the existing models focused on the absolute relative error, the correlation coefficient, the number of characteristic parameters in the prediction, the characterization of the fouling process, as well as in the transition from pore blockage to cake filtration.

Keywords: membrane filtration; fouling process; blocking pore; surface phenomena; Modified-fouling-index; modeling; optimization.