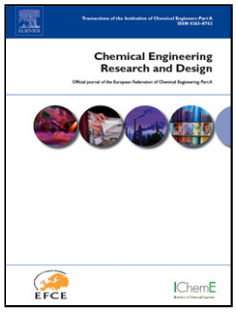

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Analysis of fouling mechanisms in TiO_2 embedded high density polyethylene membranes for collagen separation

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Abstract

In this study, the fouling behavior of TiO_2 -polyethylene hybrid membranes was analyzed. Initially, high density polyethylene (HDPE) membranes embedded with TiO_2 nanoparticles were fabricated via thermally induced phase separation (TIPS) method. FESEM images showed that the membranes had leafy structure indicating solid-liquid phase separation mechanism. The results of XRD analysis confirmed the presence of TiO_2 nanoparticles in the polymer matrix. AFM images showed that the surface roughness of TiO_2 embedded membranes were higher than that of neat HDPE membrane. Pure water flux of membranes improved as the TiO_2 content increased. The fouling behavior of membranes was investigated by filtration of collagen protein solution. The governing fouling mechanisms of membranes were also investigated using classic models as well as combined fouling models. The results showed that the best model fitted into the experimental data for 0.50, 0.75 and 1.0 wt. % TiO_2 embedded HDPE membranes was the cake filtration model. For neat and 0.25 wt. % TiO_2 embedded membranes, however, cake filtration-complete blockage model was in good agreement with the experimental data. Moreover, addition of TiO_2 nanoparticles increased reversible portion of fouling.

Keywords: Polyethylene, TiO_2, Fouling mechanism, Collagen protein, Membrane fouling.