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Strategies for Efficient Microfiltration of Oil-in-Water Emulsions TOHID DARVISHZADEH, NIKOLAI PRIEZJEV, Dept. of Mechanical Engineering, Michigan State University — This study addresses the issue of the separation of oil droplets from water for oil spill mitigation and produced water treatment. The effective separation of oil-in-water dispersions involves high flux of water through a membrane and, at the same time, high rejection rate of oil droplets, while avoiding membrane fouling. In this study, the effects of transmembrane pressure and crossflow velocity on rejection of oil droplets by pores of different cross-section are investigated numerically by solving the Navier-Stokes equation. We found that in the absence of crossflow, the critical transmembrane pressure, which is required for the oil droplet entry into a circular pore of given surface hydrophobicity, agrees well with analytical predictions based on the Young-Laplace equation. With increasing crossflow velocity, the shape of the oil droplet residing at the pore entrance is elongated along the flow and the critical pressure increases. In the case of pores with an elliptical cross-section, the water flux through the membrane is enhanced, in agreement with simple analytical considerations. The results of the numerical simulations are used to outline strategies for the experimental design of porous filters for oil spill remediation and produced water treatment applications.

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