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Numerical Study of Crossflow Enhanced Microfiltration of Oil-in-Water Emulsions TOHID DARVISHZADEH, Graduate Student, Department of Mechanical Engineering, Michigan State University, NIKOLAI PRIEZJEV, Assistant Professor, Department of Mechanical Engineering, Michigan State University, VOLODYMYR TARABARA, Associate Professor, Department of Civil and Environmental Engineering, Michigan State University — The effective separation of dilute oil-in-water mixtures involves high flux of water through a porous membrane while maintaining high rejection rate of the oil phase. In this study, the effects of transmembrane pressure and crossflow velocity on rejection of oil droplets and thin oil films by pores of different cross-section are investigated numerically by solving the Navier-Stokes equation. We found that the presence of crossflow increases the efficiency of microfiltration by sweeping the dispersed phase away from the pore entrance at the membrane surface and thus enhancing overall water flux. With further increasing crossflow velocity, however, the shape of the droplet becomes strongly deformed near the pore entrance; and, at sufficiently high transmembrane pressures, the droplet breaks up into two fragments, one of which penetrates into the pore. The dynamics of an oil droplet near the pore entrance and the critical pressure of permeation are studied as a function of the oil viscosity, ratio of drop to pore radii, surface tension, and contact angle.

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