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Modelling and prediction of organic solvent flux and retention of surfactants by organic solvent nanofiltration

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Abstract

A model that predicts the individual and mixed fluxes of pure solvent and surfactant through PDMS organic solvent nanofiltration membranes as well as the retention of the non-ionic surfactant Marlipal 24/70 from 1-dodecene was developed based on the solution diffusion model. In contrast to available models it requires only one fitting parameter that is independent of operating conditions. The other model parameters were estimated from detailed experimental observations independent from filtration data or literature values. Dependencies of the diffusion coefficients and molar volume on temperature and pressure, as well as membrane swelling and compaction were considered. Using the model fitted to filtration data at one operating condition it was possible to predict pure solvent flux with high accuracy for four different PDMS based membranes in a temperature range of 10 °C to 45 °C at pressures of 15 bar to 35 bar. Phenomenological behaviour of mixed solvent and surfactant flux were described accurately in every case. For temperature and membrane thickness variations, the model predicted solvent and surfactant flux within experimental uncertainty. Retentions, however, were accurately described.

Keywords: Organic solvent nanofiltration, 1-Dodecene, Marlipal 24/70,

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