Separation of Xylose Using a Thin-Film Composite Nanofiltration Membrane: Screening of Interfacial Polymerization Factors

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ABSTRACT

Most hydrolysis studies on biomass produce a high amount of xylose and glucose compared to other monosaccharides. A specially tailored thin-film composite (TFC) membrane prepared *via* interfacial polymerization (IP) using triethanolamine (TEOA) and trimesoyl chloride (TMC) as monomers on a polyethersulfone (PES) membrane was used to separate xylose from glucose. Differences between the support (PES) and TFC membrane in surface chemistry were probed using attenuated total reflectance-Fourier transform infrared (ATR-FTIR) spectroscopy and contact angle. Both membranes were also characterized by field emission scanning electron microscopy (FESEM) and pure water permeability to observe changes to membrane morphology and properties. The performance of the TFC membrane is highly stimulated by variation of preparative factors in IP. This study screens and reports the effect of five preparative factors, namely monomer concentrations (TEOA and TMC), pH of the aqueous phase, reaction time, and curing toward the performance of xylose separation from glucose. A 2^{5-1} fractional factorial design was used to narrow down significant preparative factors, saving lots of time and resources. It was found that curing and reaction time significantly affected the separation of xylose from glucose. High correlation (R^2 = 0.9998) between the experimental data and model data was obtained. The developed model in this study is adequate for predicting the xylose separation factor under different IP conditions within the range used. This study will provide valuable guidelines to develop membranes that are specially tailored for xylose separation from glucose as an alternative to the cost intensive chromatographic processes in use.

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