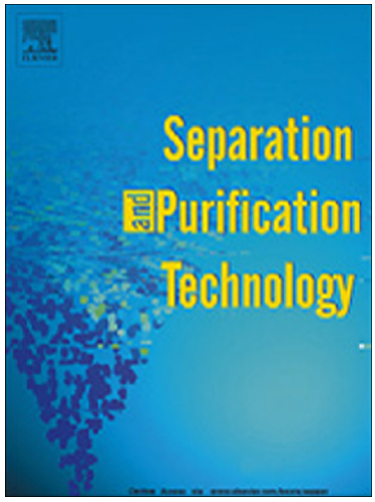

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Polyelectrolyte multilayer coated ultrafiltration membranes for wood extract fractionation

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Abstract

Recovery of hemicelluloses from wood extracts often requires membranes with molecular weight cutoffs (MWCO) below 5 kDa, but higher than 2 kDa. Both the availability of commercial membranes within that MWCO range and their performance in wood extract filtrations is limited. In this study polyelectrolyte multilayers (PEM) were deposited on a polyethersulfone (PES) membrane substrate to obtain ultrafiltration membranes within the desired MWCO range. PEM coated ultrafiltration membranes were prepared by depositing poly(diallyldimethylammonium chloride)/poly(sodium 4-styrenesulfonate) (PDADMAC/PSS) or poly(diallyldimethylammonium chloride)/poly(acrylic acid) (PDADMAC/PAA) multilayers on the PES membrane via dip-coating. The PEM coated membranes were compared to two commercial ultrafiltration membranes. The membranes were characterized via pure water permeability (PWP) measurements, polyethylene glycol (PEG) model compound rejections to obtain a molecular weight cutoff (MWCO), fourier transform infrared spectroscopy and electrokinetic surface potential measurements. The membranes were also characterized via the filtration of a birch wood extract. The PEM coated ultrafiltration membranes had significantly higher PWPs than a commercial membrane with a similar MWCO. The MWCO of the PEM coated membranes was successfully tuned to obtain advantageous ultrafiltration properties correlating to a narrower pore size distribution. The PEM coated membranes also exhibited improved performance during the wood extract filtration, but had comparably higher PWP reductions after the filtration experiment than the commercial ultrafiltration membranes due to increased electrostatic interaction between foulants and the membrane surface.