SP6 USING A BIO-DERIVED SOLVENT TO CAST POLYSULFONE ULTRAFILTRATION MEMBRANES

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Organic solvents derived from petroleum sources, such as N-methyl-2-pyrrolidone (NMP) and dimethylacetamide (DMAc), have been traditionally used to fabricate polymeric membranes. These solvents have a negative impact on the environment and human health since most of them are volatile and hazardous; therefore, using renewable solvents derived from biomass is of great interest in order to make membrane fabrication sustainable. In this study, methyl-5-(dimethylamino)-2-methyl-5-oxopentanoate (Rhodiasolv PolarClean) was used because it is a bio-derived, biodegradable, nonflammable and nonvolatile solvent. Polysulfone was chosen as the polymer to fabricate membranes due to its thermal stability, strong mechanical strength, good chemical resistance, and antifouling properties. The thermodynamics aspects of the polysulfone/PolarClean/water system were investigated. From cloud point curves and theoretical predictions, PolarClean showed the potential to be a better solvent for polysulfone, and dope solutions could be prepared at a reasonable temperature of 65 ℃. Polysulfone (PSf) membranes prepared with PolarClean were also investigated in terms of their morphology, porosity, water permeability, protein rejection and compared with the membranes prepared with traditional solvents. The pores of polysulfone/PolarClean membranes were sponge-like, which led to low water flux and high solute rejection, while those of polysulfone /NMP or polysulfone /DMAc membranes were finger-like macrovoids that led to high water flux and low solute rejection. The water flux of polysulfone/PolarClean membranes was 26.2 LMH, which was lower than polysulfone/DMAc membranes (146.9 LMH) and polysulfone/NMP membranes (48.9 LMH). However, BSA rejection rate using polysulfone/PolarClean membranes reached 92%, which was similar to polysulfone/NMP membranes (93%) and higher than polysulfone/DMAc membranes (86%). The difference of water flux and the solute rejection rate data likely corresponded to their morphologies. In conclusion, bio-derived solvents should be investigated further and may become promising replacements to traditional solvents.