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Antifouling polysulfone ultrafiltration membranes with sulfobetaine polyimides as novel additive for the enhancement of both water flux and protein rejection

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Abstract

In this study, the preparation and properties of polysulfone (PSf) ultrafiltration (UF) membranes with sulfobetaine polyimides (PIs) as blending additive were reported. Three molecular weights sulfobetaine PIs were synthesized and blended with PSf to fabricate UF membranes via non-solvent induced phase separation process. It was proved that membrane hydrophilicity, porosity and antifouling properties were significantly enhanced due to the introduction of sulfobetaine PI. More importantly, these sulfobetaine PI/PSf blend membranes exhibited extraordinary thermal stability. It showed that surface hydrophilicity and chemical structures of the blend membranes remain stable after being kept in 90 ^{o}C water bath for 3 h. Experimental results indicated that the addition of sulfobetaine PI substantially promoted the overall performances of PSf membranes, such as pure water fluxes (PWF) (270.2 vs. 140.4 L m^{-2} h^{-1}), bovine serum albumin (BSA) rejection (95.2% vs. 86.9%), flux recovery ratio (FRR) (93.3% vs 60.4%), etc.

Keywords: Antifouling; Polysulfone; Ultrafiltration membrane; Sulfobetaine polyimide

List of symbols

W_w	wet membrane's weight (g)
W_d	dry membrane's weight (g)
d	density of water in wet membrane at the measured temperature (g cm^{-3})
A	area of membrane in wet state (cm^2)
δ	thickness of membrane in wet state (cm)
J_w	PWF of pristine membrane (L m^{-2} h^{-1}),