Title:	Polyphenylsulfone-based solvent resistant nanofiltration (SRNF) membrane incorporated with copper-1,3,5-benzenetricarboxylate (Cu-BTC) nanoparticles for methanol separation
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Abstract:	Mixed matrix membranes (MMMs) of various properties were prepared for a solvent resistant nanofiltration (SRNF) process by incorporating polyphenylsulfone (PPSU) membranes with self-synthesized copper-1,3,5-benzenetricarboxylate (Cu-BTC) nanoparticles at different loadings. Cu-BTC nanoparticles were homogeneously dispersed in PPSU dope solution prior to the casting process, and their subsequent presence in the PPSU membrane was inferred by a combination of FTIR spectroscopy, TGA, SEM, EDX and AFM analyses. These analyses confirmed the existence of Cu-BTC particles and their distribution pattern in the membrane matrix. Membrane performance in organic solvent nanofiltration was evaluated on the basis of methanol permeance and dye–methanol separation. Results showed that membrane pure methanol flux was significantly improved from 102 L m-2 h-1 in the pristine PPSU membrane to >135 L m-2 h-1 in the 3 wt% Cu-BTC incorporated into PPSU membrane when both membranes were tested at 14 bar. Apart from preferential channels created by Cu-BTC, the existence of interfacial voids in MMMs also contributes to the flux improvement owing to the formation of alternative paths for solvent transportation. Results also showed that the membranes incorporated with low loadings of Cu-BTC (ranging between 0.5 and 1.0 wt%) tended to have smaller molecular weight cut-off (MWCO) than that of pristine PPSU and PPSU incorporated with 3 wt% nanoparticles, leading to smaller surface pore size but better separation efficiency. The improvement in membrane flux and dye rejection at low Cu-BTC loadings could be attributed to the good dispersion of the nanoparticles in the membrane matrix coupled with their improved interfacial contact with the membrane. The newly developed membrane also showed a great improvement in terms of resistance to compaction, suggesting Cu-BTC particles are of importance in increasing membrane rigidity and strength.