Preparation of modified cellulose acetate membranes using functionalized multi-walled carbon nanotubes for forward osmosis

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ABSTRACT

Novel modified cellulose acetate (CA) membranes using functionalized multi-walled carbon nanotubes (MWCNTs) were synthesized by phase inversion via immersion precipitation technique. Carboxylated functionalized MWCNTs (F-MWCNTs) were used as additives into the casting solution of CA, 1, 4-dioxane, acetone, lactic acid, and methanol to enhance the forward osmosis (FO) membranes performance. Different contents of F-MWCNTs (0.01, 0.05, and 0.1 wt.%) were added into the casting solution. The novel synthesized CA/F-MWCNTs membranes were characterized by various methods in terms of membranes structure and surface properties, as well as FO performance, and then compared with traditional CA membrane and commercial FO membrane. The surface hydrophilicity, porosity, and tensile strength of CA/F-MWCNTs membranes were improved with the increment of the content of F-MWCNTs in the casting solution. The morphological studies showed that the addition of F-MWCNTs significantly changed the surface properties of the modified CA membranes. The FO performance was evaluated using purified water as feed solution and 1 M NaCl solution as draw solution. The CA/F-MWCNTs membranes showed higher water permeability and salt rejection in the range of 0.01–0.1 wt.% F-MWCNTs content than CA membrane and the commercial FO membrane. These encouraging results suggested that CA/F-MWCNTs membranes showed superior potential to be further developed for FO applications.

Keywords: Carboxylated functionalized MWCNTs; Modified CA membrane; Forward osmosis