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ABSTRACT

Fullerenol $C_{60}(OH)_{22-24}$ was incorporated into the polyamide (PA) selective layer to develop novel thin film nanocomposite (TFN) hollow fiber membranes for low molecular weight cut-off ultrafiltration. TFN membranes were fabricated via interfacial polymerization technique by alternately pumping fullerenol dispersion in triethylenetetramine (TETA) aqueous solution and isophthaloyl chloride solution in hexane through polysulfone hollow fiber membranes. Developed TFN PA/fullerenol membranes were investigated by FTIR, Raman spectroscopy, SEM, TEM, AFM, contact angle measurements and evaluated by determining the permeability, rejection and antifouling performance. Introduction of fullerenol to the PA skin layer was revealed to yield in the decrease of pure water flux and slight increase of lysozyme rejection which is attributed to the increase of the thickness of PA layer. Water contact angle of the skin layer was found to decrease sharply from 34° to 21° when the concentration of fullerenol increased up to 0.5 wt.% in the TETA aqueous solution. Antifouling properties of the PA/fullerenol membranes were found to be superior to initial membrane. Fouling recovery ratio increased from 54% for pristine membrane to 93% for membrane with 0.5 wt.% of fullerenol in the TETA aqueous solution. Irrevesible fouling ratio was found to decrease from 38% to 6%, respectively. A correlation between surface properties and fouling behavior of TFN membranes upon increase of fullerenol concentration was established.

Key words: hollow fiber membrane, thin film nanocomposite membrane, fullerenol, interfacial polymerization, fouling