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Enhanced performance of poly(m-phenylene isophthalamide) (PMIA) composite hollow fiber ultrafiltration membranes by O-MoS_2 nanosheets modification

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ABSTRACT

Poly (m-phenylene isophthalamide) (PMIA) has been widely used for membrane preparation due to its excellent mechanical properties. However, the poor hydrophilicity and inferior antifouling ability has limited its application. To address these problems, the two-dimensional (2D) oxidized molybdenum disulfide (O-MoS_2) nanosheets were synthesized as a modifier to fabricate a novel PMIA/O-MoS_2 composite hollow fiber ultrafiltration membranes (HFUFMs) by blending O-MoS_2 nanosheets in the dope solution. The prepared O-MoS_2 nanosheets were subsequently characterized by X-ray diffraction, Raman spectroscopy, thermogravimetric analysis (TGA), energy dispersive spectroscopy, zeta potential. The effects of O-MoS_2 nanosheets on membrane properties, including morphology, hydrophilicity, mechanical strength, surface zeta potential, ultrafiltration performance and antifouling characteristics, were also evaluated. The results indicated that the unique properties of O-MoS_2 nanosheets endowed the membrane with improved hydrophilicity (contact angle: 55.3° ± 1.2°), electro-negativity (–34.6 ± 2.5 mV, pH = 6.5) and mechanical strength (4.2 ± 0.1 MPa). The composite HFUFMs exhibited enhanced pure water flux (209.0 ± 3.4 L m^{-2} h^{-1} bar^{-1}) and BSA rejection up to 98.0% ± 0.2% which result in a higher flux recovery ratio (90.8% ± 1.5%) than the pristine membrane (60.4% ± 1.2%). This study shows that O-MoS_2 nanosheets could be an effective modifier to enhance the performance of PMIA membranes.

Keywords: Enhanced performance; Poly(m-phenylene isophthalamide); Hollow fiber; Ultrafiltration; O-MoS_2

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