# Ultrafiltration of surface water by poly(vinylidene fluoride) (PVDF)/$TiO_2$ mixed matrix hollow fiber membranes (HFMs) with advanced antifouling properties under visible light irradiation

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## ABSTRACT

Nitrogen doped $TiO_2$ (N-$TiO_2$), a hydrophilic and visible light-active photocatalyst, was applied to prepare poly(vinylidene fluoride) (PVDF)/N-$TiO_2$ mixed matrix hollow fiber membranes (HFMs) by the phase inversion method. The membranes were characterized by scanning electron microscopy (SEM), contact angle measurement and UV-Vis absorbance. The membrane performances for treating surface water were evaluated based on the water flux, humic acid (HA) rejection and total organic carbon (TOC) rejection in surface water. Different water samples were collected from Eagle Bluffs, Missouri River and McBaine Water Treatment Plant in Columbia, MO. The results showed the pure water flux of PVDF-N$TiO_2$ membranes, which was about $28.5 \pm 0.3$ L/$m^2$h at the transmembrane pressure (TMP) of 8 psi under visible light which was slightly higher than the flux of pure PVDF membranes around $25.6 \pm 0.4$ L/$m^2$h. The contact angle of the PVDF-N$TiO_2$ membranes (about 43 °) was smaller than the pure membranes' contact angle (about 55 °), suggesting that the membrane hydrophilicity was significantly improved by incorporating $TiO_2$ nanoparticles into the PVDF HFMs. The as-prepared PVDF-N$TiO_2$ mixed matrix membranes removed over 40% of humic acid and 20% of TOC in the water samples collected from the Eagle Bluffs and Missouri River and rejected 20% of HA and TOC in water from the McBaine Water Treatment Plant, which were comparable to pure PVDF membranes. The mixed matrix membrane with N-$TiO_2$, however, showed much better resistance to membrane fouling.