Public Abstract

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Title:MECHANISMS OF TRANSPARENT EXOPOLYMER PARTICLES (TEPs) FOULING ON ULTRA-FILTRATION AND ITS REDUCTION BY PVDF/N-TiO2

A critical issue for water treatment by membrane process is membrane fouling, which will result in rising hydraulic resistance, decreasing water permeability, and subsquenlty increasing the energy consumption and maintenance cost. Research was carried out on the mechanisms of membrane fouling. Among a variety of foulants, transparent exopolymer particles (TEPs), which play an important role in biofilm formation and membrane fouling, have been overlooked for many years due to their invisiblility. Here TEPs were first separated from Chlorella Vulgaris culture broth and quantified via Alcian Blue staining method as reported in the literature. Other characterizations included particle-size-distribution and zeta potential measurements.

Then the fouling characteristics of ultrafiltration membranes by TEPs were assessed. The fabricated and tested hollow fiber membranes included conventional polyvinylidene fluoride membrane (PVDF) and mixed matrix membranes with titanium dioxide (PVDF/P25) or nitrogen doped titanium dioxide (PVDF/N-TiO2) nanoparticles integrated into the PVDF matrix. Membranes were characterized by scanning electron microscopy (SEM) and fouling resistance evaluations were performed under dark or visible light irradiation conditions for comparison. The results demonstrated that rejections of TEPs by PVDF, PVDF/P25 and PVDF/N-TiO2 membrane were all above 85%, although the rejections by PVDF/P25 and PVDF/TiO2 membranes were about 7% and 10% lower than conventional PVDF membrane respectively. A significant enhancement of fouling resistance was observed for PVDF/N-TiO2 membrane under visible light irradiation. The addition of TiO2 nanoparticles into the PVDF matrix apparently improved surface hydrophilicity and the nanoparticles could be activated under light, which contributed to the enhanced anti-fouling properties of the membrane.