Preparation and Characterization of the TiO₂ Photocatalytic Membrane for the Degradation of Reactive Orange 16 Dye

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Abstract : Photocatalytic membranes have shown great potential for the removal of an organic and inorganic pollutant from wastewater as it combines the degradation and antibacterial properties from photocatalysis and physical separation by the membrane in a single unit. Incorporation of the semiconductor in membrane structure results in enhancing the performance and the properties of the membrane. In this study porous ultrafiltration polyvinylidene fluoride (PVDF) membranes with entrapped TiO_2 nanoparticle were prepared by phase inversion method and further used for the degradation of reactive orange 16 (RO16). Prepared photocatalytic membranes were characterized by the scanning electron microscope (SEM), energy dispersive spectroscopy (EDS), contact angle, and atomic force microscope (AFM). The addition of TiO_2 nanopartparticles improves the strength and thermal stability of the membrane. In particular hydrophilicity and permeability increases with the increase of TiO_2 nanoparticles into the membrane. The photocatalytic membrane achieves 80-85% degrdation of RO16. The impact of different parameters such as pH, concentration of photocatalyst, dye concentration and effect of H_2O_2 were analysed. The best conditions for dye degradation were an initial dye concentration of 50 mg/L, with a membrane containing TiO_2 loading of 2wt%. It was observed that in the presence of H_2O_2, degradation increases with increasing H_2O_2 concentration and reached up to 95-98%. The high quality permeates obtained from the photocatalytic membrane can be reused.
Keywords : photocatalytic membrane, TiO_2, PVDF, nanoparticles

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