Efficient and Economical Removal of Wastewater Pollutants via Modified Nanocomposite Ultrafiltration Membrane with Green Additives

By

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Abstract

Pollutants are inflicting significant damage to the environment and, of course, human health. Dyes, as colored compounds, are one of the most significant water pollutants, and the textile industry is a major producer of these pollutants. This study describes the modification of a Polyethersulfone (PES)-based membrane with dimethylformamide (DMF) as a solvent by embedding Propolis (PRS) green nanoparticles. PRS, a recently prepared, as a green resinous addition, has been effectively manufactured and used as a pore forming to modified a polyethersulfone ultrafiltration membrane for the toxic dyes removing. In order to closely examine its effects on membrane surface properties, morphological structure, and overall performance, the PRS content in the PES polymeric matrix was changed. Additionally, a proposed method of interaction between Eriochrome Black T (EBT) and Congo red (CR) dye using a PES membrane was provided. According to the findings, using a 3 Wt.% PRS enhanced the unique membrane's hydrophilicity and porosity by 37 and 25%, respectively. Meanwhile, the presence of PRS in the prepared membrane caused significant structural alterations. A sponge-like zone appeared toward the bottom surface as well. The membrane's pure water flux (PWF) prepared with 62.5 mg PRS measured 63.28 LMH, which is expected to be 67% mor than the pristine membrane. The rejection rate for EBT and CR dyes was 98 and

99%, respectively. The PES/PRS membranes' enhanced surface hydrophilicity resulted in improved antifouling performance and a 96.8% flux recovery ratio (FRR). Based on the findings of this study, PRS could be employed as a novel green addition with significant application potential in the manufacturing of UF membranes for wastewater treatment. This green additive PRS was first used in membrane technology in this study.