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High-flux electrospun polyvinyl alcohol microfiltration nanofiber membranes for treatment of oil water emulsion

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ABSTRACT

In this work, a novel class of high-performance microfiltration membranes consisting of an electrospun polyvinyl alcohol (PVA) nanofiber top layer and a nonwoven polyester support was developed. To achieve water-insoluble PVA nanofiber membranes, two different cross-linking methods were used: (1) chemical cross-linking using citric acid as a cross-linking agent and subsequent thermal treatment of the prepared electrospun nanofibers and (2) photo-cross-linking of an ultraviolet (UV)-curable PVA polymer that was synthesized by adding C=C bonds to PVA. Effects of citric acid concentration on membrane properties and separation performance were investigated. The separation performance and antifouling properties of the membranes were studied for microfiltration treatment of an oil/water emulsion. The results showed that more concentration of citric acid in the specimens led to a lower swelling degree. The use of citric acid in combination with UV irradiation had a synergistic effect in the cross-linking reaction. The UV cross-linked electrospun membrane had uniform and finer fibers, which resulted in a membrane with small pore size and high porosity, while the chemical cross-linking reaction occurred between the polymer fibers and the fibers fused together during thermal treatment. Meanwhile, the most striking characteristic of the photo-cross-linked PVA nanofiber membranes was its high durability and mechanical strength.

Keywords: Polyvinyl alcohol membrane; Photo-cross-linking; Electrospinning; UV irradiation; Oil/water emulsion

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