

Studies on properties and adsorption ability of bilayer chitosan/PVA/PVDF electrospun nanofibrous

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ABSTRACT

In this new era of nanofiber industry, the practice of using electrospun nanofiber membrane technology for wastewater treatment is increasingly becoming common. However, there are lacks of studies in the aspect of mechanical properties, especially strength. Therefore, the bilayer nanofiber membranes were introduced in order to improve the strength of the membrane. A chitosan solution (7 wt.% chitosan in concentrated acetic acid) and polyvinyl alcohol (PVA) solution (8 wt.% PVA in distilled water) was blended for 24 h and the solution mixture was electrospun according to the optimized parameters to get a fine nanofiber. Then, the polyvinylidene fluoride (PVDF) solution was electrospun on top of chitosan/PVA nanofiber to make a bilayer nanofiber membrane. Crosslinking process were done in order to improve the wettability and mechanical properties. The chitosan/PVA-PVDF bilayer nanofiber was identified with field emission scanning electron microscopy, Fourier transform infrared, wettability, swelling, tensile, and adsorption tests. The nanofiber membrane was stable in the acidic, base, and neutral mediums for 20 d, and the tensile strength increased from 0.17 to 0.65 MPa. Additionally, the adsorption efficiency of the bilayer nanofiber membrane was investigated over Cr(VI) and Fe(III) ions using Langmuir and Freundlich isotherm. Kinetic parameters were evaluated using the first-order and pseudo-second-order models. Kinetic study showed that the adsorption rate was high at a lower concentration of the metal ion. Thus, the bilayer nanofiber membrane is highly potential to increase the mechanical properties of the nanofiber membrane while maintaining the adsorption efficiency.

Keywords: Chitosan; Polyvinyl alcohol; Polyvinylidene fluoride; Electrospun nanofibrous; Adsorption

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