Removal of hexavalent chromium using polyacrylonitrile/titanium dioxide nanofiber membrane

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Abstract

Polyacrylonitrile/titanium dioxide nanofiber (PAN/T-nF) membrane was prepared with TiO₂ nanoparticles which dispersed into polyacrylonitrile (PAN) matrix with ultrasonic probe in ultrasonic bath. The amount of TiO₂ loaded in the membrane was 1 and 3 wt% to explore the activity of membranes in the adsorption process. PAN/T-nF membrane was prepared by electrospinning technique. The potential of the prepared PAN/T-nF membrane was investigated for the removal of Cr(VI) from aqueous solutions. The adsorption equilibrium was investigated in the batch process. The adsorption process displayed pH dependence and the maximum Cr(VI) adsorption took place at pH 2. The equilibrium was attained at a contact time of 180 min and Langmuir adsorption model was suitable for the adsorption isotherms. Maximum adsorption capacities 245.3 and 280.4 mg Cr(VI)/g were calculated for 1 and 3% PAN/T-nF membrane, respectively. The adsorption of Cr(VI) on PAN/T-nF was related to the mechanism of surface complexation, coordination, and electrostatic attraction. This new fabrication method for PAN/T-nF membranes showed an excellent thermal stability that can persist up to 400°C and has a big capacity for Cr(VI) ion.

Keywords: Mixed matrix membrane; Electrospinning; Hexavalent chromium; Equilibrium