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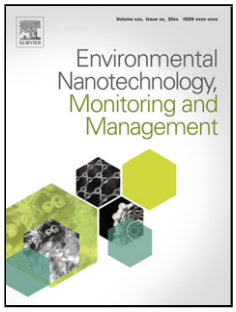

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Electrospun Carbon Nanofibers/TiO_2-PAN Hybrid Membranes for Effective Removal of Metal Ions and Cationic Dye

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Research Highlights:

- Hybrid (CNFs/TiO_2-PAN) membranes were synthesized through electrospinning and carbonization process
- The hybrid membranes exhibited a wettability of 18^o at 6wt% of CNFs/TiO_2.
- XPS and FTIR confirmed the presence of functional groups in membranes.
- Developed CNFs/TiO_2 –PAN hybrid membranes exhibited a maximum rejection of 87%, 73%, 66%, for Pb^{2+}, Cu^{2+}, Cd^{2+} and 84% for methylene blue dye.

Abstract

Hybrid (CNFs/TiO_2-PAN) membrane was synthesized by electrospinning the polyacrylonitrile (PAN) polymer with carbon nanofibers (CNF) /TiO_2 nanoparticles at different weight percentage (%). SEM images evidently showed the formation of PAN nanofiber membrane with diameter ranging from 200 nm to 260 nm after incorporation of CNFs/TiO_2 nanoparticles. Fourier transform infrared (FTIR) spectra showed the presence of functional groups confirming the successful incorporation of CNFs/TiO_2 in PAN nanofiber membranes. The water contact angle (WCA) of CNFs/TiO_2-PAN hybrid membrane decreased from 38^o to 18^o by addition of different concentration CNFs/TiO_2 (0.5 wt% to 6 wt %). The rejection performance of hybrid CNFs/TiO_2-PAN membrane was evaluated with different heavy metal ions (such as Pb^{2+}, Cu^{2+}, Cd^{2+}) and cationic dye (such as methylene blue (MB)) from wastewater. The adsorption studies of the heavy metal ions were performed at different pH (3-7), metal ion concentrations (50 ppm to 300 ppm) and time (48 hrs). CNFs/TiO_2 –PAN hybrid membranes exhibited a maximum rejection around 87%, 73%, 66%, for Pb^{2+}, Cu^{2+}, Cd^{2+} metal ions and 84% for methylene blue dye, respectively. The developed electrospun CNFs/TiO_2-PAN hybrid membranes can be possibly practical for the removal of heavy metal ions and dyes from drinking water source.

Keywords: Electrospinning, carbon nanofibers, hybrid membrane, heavy metal ion, dye removal, wastewater treatment.