Fabrication of Electrospun Carbon Nanofibers-Reinforced Chitosan-Based Hydrogel for Environmental Applications

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Abstract : The use of hydrogels as adsorbents for pollutants removal from wastewater is limited due to their high swelling properties and the difficulty in recovering them after the adsorption process. To overcome these problems, a new hydrogel nanocomposite based on chitosan-g-polyacrylic acid/oxidized electrospun carbon nanofibers (CT-g-PAA/O-ECNFs) was prepared by in-situ grafting polymerization process. The prepared hydrogel nanocomposite was used as a novel effective and highly reusable adsorbent for the removal of methylene blue (MB) from polluted water with low cost. The morphology and the structure of CT-g-PAA/O-ECNFs were investigated by numerous techniques. The effect of incorporating O-ECNFs on the swelling capability of the prepared hydrogel was explored in distillated water and MB solution at normal pH. The effect of parameters including the ratio of O-ECNFs, contact time, pH, initial concentration, and temperature on the adsorption process were explored. The adsorption isotherm and kinetic were studied by numerous non-linear models. The obtained results confirmed that the incorporation of O-ECNFs into the hydrogel network improved its ability towards MB dye removal with decreasing their swelling capacity. The adsorption process depends on the pH value of the dye solution. Additionally, the adsorption and kinetic results were fitted using the Freundlich isotherm model and pseudo second order model (PSO), respectively. Moreover, the new adsorbents can be recycled for at least five cycles keeping its adsorption capacity and can be easily recovered without loss in its initial weight.

Keywords : carbon nanofibers, hydrogels, nanocomposites, water treatment
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