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PPI/CNT nanocomposite for novel high capacity removal of the toxic heavy metals, Hg, Pb and Ni from water

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ABSTRACT

In this study, a new methodology is reported for the preparation of polypropylene imine dendrimer functionalized carbon nanotubes and a PPI/CNT nanocomposite. The PPI/CNT nanocomposite was characterized by Fourier-transform infrared spectroscopy, scanning electron microscopy, transmission electron microscopy, Raman spectroscopy, Brunauer–Emmett–Teller surface area and thermogravimetric analysis and this product has been applied to water pollution treatment for heavy metal removal and found to possess uniquely high adsorption capacities for Hg(II), Pb(II) and Ni(II). The effects of various parameters such as initial metal ion concentration, solution pH, PPI/CNT dosage and contact time have been studied. The data were analyzed by equilibrium isotherm relationships (Langmuir and Freundlich) and the exceptional high adsorption capacities (Hg = 2,000 mg/g; Pb = 1,750 mg/g; Ni = 1,650 mg/g) and adsorption rates were correlated by the pseudo-first-order, intraparticle diffusion and pseudo-second-order adsorption kinetics models. The results showed that the maximum adsorption occurred at pH = 7 and that the Langmuir isotherm and pseudo-second-order kinetics are the most favorable models for Hg(II), Pb(II) and Ni(II) ions adsorption onto PPI/CNT.

Keywords: PPI/CNT Nanocomposite; Novel synthesis route; Heavy metal ion adsorption; Kinetics and isotherm studies; Super-high capacities

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