Core–shell polymer nanocomposite based on free radical copolymerization of anthranilic acid and o-amino phenol in the presence of copper hexacyanoferrates nanoparticles and its adsorption properties

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Abstract

Core–shell polymer nanocomposite (CSNC) of copper hexacyanoferrate-copolymer of anthranilic acid with o-aminophenol (CHCF-poly(AA-co-OAP)) was synthesized and used as ion exchanger for the sorption of cesium ions from aqueous solution. The nanocomposite was prepared by implantation of CHCF nanoparticles into copolymer of poly(AA-co-OAP) during the polymerization process. The surface morphology and the porous structure were investigated through transmission electron microscope (TEM), scanning electron microscope (SEM) and Brunauer–Emmett–Teller (BET). The characterization of the prepared (CSNC) was carried out by Fourier transform infrared spectroscopy (FT-IR), X-ray diffraction (XRD) and Thermogravimetric (TGA). Which SEM and TEM images confirmed the nano-size of the prepared CSNC. The values of adsorption capacity of CSNC towards cesium ions and the factors influence on the removal of cesium from solutions were investigated as function in pH, metal ion concentration, temperature and contact time. The results illustrated that the highest value of sorption capacity of the prepared CSNC towards Cs+ ions was 2.1 mmol g−1 at pH 11, 10 mmol L−1 Cs+ and 25 °C. Four modeling include on Langmuir, Freundlich, Temkin and Dubinin-Radushkevich (D-R) isotherms models were studied. According to the obtained data, Langmuir model considered the most suitable model, which suggest that the uptake of Cs+ was monolayer and homogeneous. Also, the adsorption kinetics data was fitted well to pseudo-second-order model. Thermodynamic parameters were calculated in the temperature from 25 to 60 °C and the data revealed that Cs+ sorption was endothermic, spontaneous, and more favorable at higher temperature. Up to 92% desorption of Cs+ was completed with 2 M KCl.