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Nanocomposites of nanosilica-immobilized-nanopolyaniline and crosslinked nanopolyaniline for removal of heavy metals

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Abstract

Two novel nanocomposites have been designed and synthesized using simple and green functionalization of nanosilica sorbent with nanopolyaniline and crosslinked nanopolyaniline, [Sil-Phy-NPANI] and [Sil-Phy-CrossNPANI]. The images of scanning electron microscopy (SEM) and high resolution transmission electron microscope (HR-TEM) confirmed the immobilization process and particle size in the range of 7.14-23.91 nm. The two novel nano-structured silica composites have been further confirmed and evaluated by determination of surface area, Fourier transform-infrared (FT-IR) study and thermal gravimetric analysis (TGA). The sorption characteristics of [Sil-Phy-NPANI] and [Sil-Phy-CrossNPANI] versus nanosilica were compared toward Cu(II), Cd(II), Hg(II) and Pb(II) ions and investigated by the batch technique in presence of different pH values, contact times, composite dosages, initial metal ion concentrations and interfering ions. The optimum sorption conditions of these metal ions were identified in pH 6.0 or 7.0 as a result of complexation or ion exchange of the metal ions by surface amine and/or hydroxyl groups. The highest metal capacity values of Cu(II), Pb(II), Hg(II) and Cd(II) were characterized in the ranges 1650-1700, 900-1450, 800-1050 and 600-1350 $\mu\text{mol g}^{-1}$, respectively. Fast equilibrium time was obtained (15-20 min) for sorption of the target metal ions. The sorption behaviors of metal ions by [Sil-

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