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Removal Efficiency of Some Heavy Metals from Aqueous Solution on Magnetic Nanoparticles

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Abstract : In this study, super paramagnetic iron-oxide nano- materials (SPMIN) were investigated for removal of toxic heavy metals from aqueous solution. The magnetic nanoparticles of 12 nm were synthesized using a co-precipitation method and characterized by transmission electron microscopy (TEM), transform infrared spectroscopy (FTIR), x-ray diffraction (XRD) and vibrating sample magnetometer (VSM). Batch experiments carried out to investigate the influence of different parameters such as contact time, initial concentration of metal ions, the dosage of SPMIN, desorption,pH value of solutions. The adsorption process was found to be highly pH dependent, which made the nanoparticles selectively adsorb these three metals from wastewater. Maximum sorption for all the studies cations obtained at the first half hour and reached equilibrium at one hour. The adsorption data of heavy metals studied were well fitted with the Langmuir isotherm and the equilibrium data show the percent removal of Ni2+, Zn2+ and Cd2+ were 96.5%, 80% and 75%, respectively. Desorption studies in acidic medium indicate that Zn2+, Ni2+ and Cd2+ were removed by 89%, 2% and 18% from the first cycle. Regeneration studies indicated that SPMIN nanoparticles undergoing successive adsorption–desorption processes for Zn2+ ions retained original metal removal capacity. The results revealed that the most prominent advantage of the prepared SPMIN adsorbent consisted in their separation convenience compared to the other adsorbents and SPMIN has high efficiency for removal the investigated metals from aqueous solution.

Keywords : heavy metals, magnetic nanoparticles, removal efficiency, Batch technique
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