Synthesis of magnetic alginate beads based on maghemite nanoparticles for Pb(II) removal in aqueous solution

Abstract :

Magnetic alginate beads were successfully synthesized by incorporating ferrofluids based on maghemite nanoparticles (?-Fe 2O 3) and sodium alginate. The as-obtained dried sample characterized by X-ray diffraction (XRD) and transmission electron microscopy (TEM) showed that the size of uncoated and citrate coated ?-Fe 2O 3 to be 15nm and 9nm respectively. Fourier transform infrared (FTIR) was performed so as to ensure successful coating process. The specific saturation magnetization (s s) value of coated particles was found to be lower than the uncoated particles. Zero coercivity of the magnetization curve indicated that the particles were superparamagnetic in nature. By using a ratio 1:10 of ferrofluids and alginate solution respectively, magnetic beads were prepared and the ability of magnetic beads to remove Pb(II) ion from aqueous solutions in batch media was investigated. Various physico-chemical parameters such as pH, initial metal ion concentration, and equilibrium contact time were also studied. The results revealed that 95.2% of the Pb(II) was removed within 2h at pH 7. The equilibrium amount of Pb(II) adsorbed onto the magnetic beads approached a constant value with increasing concentrations suggesting that the uptake of Pb(II) followed a Langmuir-type adsorption equation with q max of 50mg/g. Moreover, the presence of the magnetic particles in the beads allowed easy isolation of the beads from the aqueous solutions after the sorption process. In order to determine the reusability potential of the adsorbent, the isolated beads were used as a regenerated sorbent in repeated sorption-desorption cycles. Results revealed that the magnetic beads produced can be potentially used for the treatment of waste water contaminated with heavy metals and regenerated at least five times before losing their activity.