

Preparation and characterization of p-sulfonated calix[4]arene functionalized chitosan hydrogel beads and their preliminary adsorption study towards removal of lead(II) and zinc(II) ions

ABSTRACT

p-sulfonated calix[4]arene functionalized chitosan hydrogel beads have been successfully prepared by mixing p-sulfonated calix[4]arene and chitosan in dilute acetic acid solution (1% v/v), followed by dropping the mixture into sodium hydroxide solution to form beads with diameters of ~0.1 cm. The presence of the active sulfonate groups and the unique structure of calixarene render the material useful as an adsorbent for heavy metal ions. Metal adsorption on p-sulfonated calix[4]arene is possible through a combination of physical and ionic interactions. Atomic Absorption Spectroscopy (AAS) results showed that the amount of adsorbed metal ion is optimum at 10 ppm for all samples. The overall percentage of metal ion removal shows that p-sulfonated calix[4]arene modified chitosan is the best adsorbent with up to 98% removal achieved for Pb(II) and 90% removal for Zn(II). This is followed by p-sulfonated calix[4]arene and graphene oxide (GO) modified chitosan with up to 90% removal for Pb(II) and 89% removal for Zn(II) and pure chitosan hydrogel beads with up to 60% removal for both Pb(II) and Zn(II). The results clearly prove that the presence of p-sulfonated calix[4]arene can enhance the adsorption of heavy metal ions. In addition, the adsorbent shows higher Pb(II) removal compared to Zn(II).

Keyword: Calixarene; Chitosan; Graphene oxide; Hydrogel beads; Heavy metal ion removal