Recent advances in alginate-based adsorbents for heavy metal retention from water: a review

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Abstract

Heavy metal pollution has become a major environmental concern because modern industries produce heavy metals in their effluents. Adsorption is regarded as an environmentally friendly way to clear industrial effluents from heavy metals because of its simplicity and low cost. As a natural polysaccharide containing abundant hydroxyl and carboxyl groups, sodium alginate has been widely reported to be a useful raw material for the adsorption of heavy metals from aqueous solutions. Alginate-based materials have been limited in their industrial application because of their poor physical strength and thermostability. However, adsorbents synthesized from sodium alginate exhibit large uptake capacities as well as high removal rates of heavy metal ions following surface grafting and cross-linking. Specifically, this paper summarizes the development of sodium alginate-based composite materials, including their polymeric properties, modification, and their adsorption behaviors. The work investigated the adsorption mechanisms of different alginate-based composites for the removal of heavy metals such as Cu(II), Pb(II), and Cd(II). Alginate-based composites typically exhibit enhanced adsorption performance. The physical and chemical properties of alginate-based composites determine their effectiveness under different application conditions. A series of alginate-based composites and their physicochemical and adsorptive properties have been summarized. Finally, the limitations of sodium alginate-based adsorbents were discussed along with suggestions for future research.

Keywords: Alginate composites; Adsorption; Metal ion removal; Functionalization

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