

Adsorption characteristics of alginate bead for the various heavy metals

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Abstract

Precipitation, ion-exchange, reverse osmosis (RO) and electro dialysis (ED) are used or proposed for the treatment of wastewater containing heavy metals. However, precipitation produces large quantity of sludge and can not remove the heavy metals in dilute concentration. Even though ion-exchange, RO and ED show good removal efficiency, operation cost is relatively high. Biosorption process of heavy metal using alginate can be operated at room temperature and at atmosphere. It has quite a good efficiency for heavy metals in dilute concentration. Furthermore, the adsorbent material, alginate, which is abundant in marine algae, is cheap and biodegradable. Alginate in the form of bead was tested for the adsorption of 6 metal ions. In a single metal system, the adsorption capacity of alginate bead for Pb(II), Cu(II), Mn(II), Fe(III), Cd(II), and Zn(II) was 1.51, 1.50, 1.46, 1.38, 1.26, and 1.10 mmol metal per g bead, respectively. In the equimolar solution of Cd(II), Zn(II), and Cu(II), the order of adsorption was Cu(II) > Cd(II) > Zn(II). Langmuir and Freundlich model was applied and the model parameters were calculated for each metal ion. In the adsorption, Ca(II) concentration increased due to the ion-exchange between the Ca(II) in the alginate and heavy metals in solution. As a result, alginate bead had good adsorption capacity for various heavy metals, so it can be used in the treatment of wastewater or portable water.