Characterization of a Ca-Alginate Based Ion Exchange Resin and its Applications in Lead, Copper and Zinc Removal

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Characterization of a novel Ca-alginate based ion exchange resin and its application in the metal removal were investigated in this study. The metal removal percentages increased from almost 0 to a higher value (almost 100% for the metal concentrations < 0.1 mM) from pH 1.2 to 4 and a plateau was established at pH > 4. The removal percentages were in the following descending order: $Pb^{2+} > Cu^{2+} > Zn^{2+}$ at pH < 4. Lower initial concentration and ionic strength slightly enhanced the removal percentage. The maximum metal removal capacities (q_{max}) were 2.01 and 2.04 mmol/g for lead and copper, respectively, much higher than activated carbons and other reported biosorbents. Competitive effects were important for the zinc removal, but less significant for lead and copper uptake. The organic leaching from the resin was neglectable. The single- and multiple-species metal ions were removed completely within about 90 and 130 min, respectively. The lead removal became much faster when its concentration was decreased and in the absence of other metal ions. Presence of the competitive metal ions significantly reduced the metal uptake rate. The removal process kinetics were controlled by the mass transfer, while the local equilibrium followed an ion exchange relationship.