

Removal of Cu(II) with hydroxyapatite (animal bone) as an inorganic ion exchanger

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ABSTRACT

A bone from a vertebrate has a hydroxyapatite ($\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$) structure which is well known as an excellent inorganic ion exchanger for various heavy metal ions in solution. In order to evaluate the reusability of cow, pig and fish bones as removal material for heavy metals in wastewater, the ionic substitution properties and the removal capacities of these bones for the Cu ion were investigated. The results of X-ray diffraction and FT-IR spectra analyses showed that the surface of the three different bones was irregularly modified as increasing temperature and Cu ions were exchanged in the Ca part of bones. The removal capacity of the three different bones decreased with increasing temperature when the solution pHs were not controlled. Cu ion was removed almost 100% at over pH 7 while 20–60% was removed at pH 4. It is worth noting that bones calcined at 700°C have an ability of pH control of the solution where the reaction was from acidic to alkaline, although its mechanism is not yet clearly understood and thus further study is necessary. The extraction experiment for three different bones which fully reacted with Cu ion shows no significantly re-extracted Cu ion even at pH 3.

Keywords: Adsorption; Hydroxyapatite; Ionic exchanger; Animal bone; Copper removal

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