

Removal of heavy metal ions from mixed solutions via polymer-enhanced ultrafiltration using starch as a water-soluble biopolymer

Abstract

In this study, aqueous solutions containing mixtures of heavy metals namely Zn (II), Pb (II), Cr (III), and Cr (VI) were treated by polymer-enhanced ultrafiltration (PEUF) using unmodified starch as binding biopolymer. The performance of starch in removing these heavy metals was compared with that of polyethylene glycol (PEG) a commonly used polymer in PEUF processes. Rejection coefficients and flux were studied under different values of pH solution and metal ion concentrations maintaining the transmembrane pressure constant at 1.5 bar. At pH 7, and starch concentration of 0.05%, the rejection was the highest at around 90%. As metal ion concentration increased from 10 to 50 mg/L, the rejection of metal ions decreased. It was found that starch gave higher rejection for Zn (II) and Cr (III) at 0.05 g/L of polymer concentration, whereas 1 g/L of PEG concentration gave higher rejection for Cr (VI) at 10 mg/L. The influence of metal ion concentration on Pb (II) rejection is not significant for the two selected polymers. The rejection of these metal ions by starch in this study is found to be influenced by granule structure that generally behaved in a non-ionic manner.

Keywords

Complexing agents; Multivalent metal ions removal; Polyethylene glycol; Polymer-enhanced ultrafiltration; Unmodified starch