Characterization and adsorption behavior of newly synthesized sodium bis(2-ethylhexyl)sulfosuccinate–cerium (IV) phosphate (AOT–CeP) cation exchanger

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A B S T R A C T

A new cationic exchange material, sodium bis(2-ethylhexyl) sulfosuccinate (AOT) with cerium (IV) phosphate (AOT–CeP) has been synthesized. The characterization of the ion exchanger was performed by infra red spectroscopy (IR), X-ray diffraction (XRD), scanning electron microscopy (SEM), thermo gravimetric analysis/differential thermo gravimetric analysis (TGA/DTA/DTG) and elemental analysis. The ion exchange properties like ion exchange capacity, elution and concentration behavior of AOT–CeP were determined by taking the material into a column and elution of H+ was done by NaNO3. The thermal stability of the ion exchanger was studied by determining ion exchange capacity after heating to different temperatures for one hour. The adsorption studies on AOT–CeP demonstrated that the material is selective for Cu2+, Pb2+, Cd2+, Zn2+ and Hg2+ ions. AOT–CeP was found to be effective for the separation of Cu2+, Pb2+, Cd2+, Zn2+ and Hg2+ ions in the presence of alkali metals/alkaline earth metals. This cationic exchanger was also effective for the removal of Cu2+, Pb2+, Cd2+, Zn2+ and Hg2+ ions in the presence of acid and other transition metals. Thus, AOT–CeP can be used for the removal of these ions from the waste water during its treatment.

Keywords: Fibrous ion exchanger; Ce (IV) phosphate; Sodium bis(2-ethylhexyl) sulfosuccinate; Adsorption studies; Environmental studies; Differential pulse polarography

1. Introduction

One of the significant adverse influences of industrial revolution is the fast and indiscriminate destruction of our flora and fauna. Different kinds of health problems are arising due to the heavy metals contamination in the food chain and drinking water. The heavy metals are non-biodegradable and may continue to increase on each successive level in food chain. The anthropogenic activities and industrial growths are responsible for the increased level of heavy metals. Some of the metals in the minute amounts are actually necessary for humans while others are carcinogenic or toxic. These metals/ions may affect central nervous system (e.g. Mn, Hg, Pb, etc.), the kidneys or liver (e.g. Hg, Pb, Cd, Cu, etc.) or skin, bones, or teeth (Ni, Cd, Cu, Cr, etc.) (Fowler and Mahaffey, 1978; Foulkes, 2000; Ercai et al., 2001). Many adsorption and bioadsorption techniques (Sari and Tuzen, 2008; Sari et al., 2008; Uluozlu et al., 2008) have been recently studied for the removal of heavy metal ions from waste water for recycling it at lower cost. Ananyurt et al. (2009) and Sari and Tuzen (2009) studied the removal of Pb2+ and Cd2+ from aqueous solution using macro-fungus biomass. The ion exchange method has been one of the most promising, simple and widely used chromatographic techniques employed for the purification of water. The ion exchangers remove the charged species including metal ions either by exchanging it from other mobile ions or by adsorbing it (Keary and Mortimer, 1996). The improvement in the properties of ion exchange materials has always been an objective.