

Synthesis of poly(hydroxamic acid) ligand from polymer grafted khaya cellulose for transition metals extraction

Abstract

A cellulose-graft-poly(methyl acrylate) was synthesized by free radical initiating process and the ester functional groups were converted into the hydroxamic acid ligand. The intermediate and final products are characterized by FT-IR, FE-SEM, HR-TEM and XPS technique. The pH of the solution acts as a key factor in achieving optical color signals of metalcomplexation. The reflectance spectra of the [Cu-ligand] n^+ complex was found to be a highest absorbance at 99.8 % at pH 6 and it was increased upon increasing of Cu^{2+} ion concentrations and a broad peak at 700 nm was observed which indicated the charge transfer ($n\text{-}n$ transition) metals-Cu complex. The adsorption capacity of copper was found to be superior (336 mg g^{-1}) rather than other transition metals such as Fe^{3+} , Co^{3+} , Cr^{3+} , Ni^{2+} , Mn^{2+} and Zn^{2+} were 310, 295, 288, 250, 248 and 225 mg g^{-1} , respectively at pH 6. The experimental data of all metal ions fitted significantly with the pseudo-second-order rate equation. The transition metal ions sorption onto ligand were well fitted with the Langmuir isotherm model ($R^2 > 0.99$), which suggested that the cellulose-based adsorbent known as poly(hydroxamic acid) ligand surface is homogenous and monolayer. The reusability of the poly(hydroxamic acid) ligand was checked by the sorption/desorption process up to ten cycles without any significant loss in its original sensing and removal performances.