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Synthesis of Poly(hydroxamic acid) Ligand from Polymer Grafted Khaya Cellulose for Transition Metals Extraction

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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 metal-complexation. The reflectance spectra of the $[Cu\text{-ligand}]^{n+}$ 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 (π-π 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.

Keywords: Adsorption, Khaya cellulose, Poly(hydroxamic acid), Transition metals, Extraction