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Synthesis of tapioca cellulose-based poly(hydroxamic acid) ligand for heavy metals removal from water

Md. Lutfor Rahman[a], Hira Bablu Mandal[a], Shaheen M. Sarkar[a], M. Nomani Kabir[b], Eddy M. Farid[c], Sazmal E. Arshad[c] and Baba Musta[c]

[a]Faculty of Industrial Sciences and Technology, University Malaysia Pahang, Pahang, Malaysia; [b]Faculty of Computer Systems and Software Engineering, University Malaysia Pahang, Pahang, Malaysia; [c]Faculty of Science and Natural Resources, Universiti Malaysia Sabah, Kota Kinabalu, Malaysia

ABSTRACT

A graft copolymerization was performed using free radical initiating process to prepare the poly(methyl acrylate) grafted copolymer from the tapioca cellulose. The desired material is poly(hydroxamic acid) ligand, which is synthesized from poly(methyl acrylate) grafted cellulose using hydroximation reaction. The tapioca cellulose, grafted cellulose and poly(hydroxamic acid) ligand were characterized by Infrared Spectroscopy and Field Emission Scanning Electron Microscope. The adsorption capacity with copper was found to be good, 210 mg g^{-1} with a faster adsorption rate ($t_{1/2} = 10.5$ min). The adsorption capacities for other heavy metal ions were also found to be strong such as Fe^{3+}, Cr^{3+}, Co^{3+} and Ni^{2+} were 191, 182, 202 and 173 mg g^{-1}, respectively at pH 6. To predict the adsorption behavior, the heavy metal ions sorption onto ligand were well-fitted with the Langmuir isotherm model ($R^2 > 0.99$), which suggest that the cellulose-based adsorbent i.e., poly(hydroxamic acid) ligand surface is homogenous and monolayer. The reusability was checked by the sorption/desorption process for six cycles and the sorption and extraction efficiency in each cycle was determined. This new adsorbent can be reused in many cycles without any significant loss in its original removal performances.

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