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Adsorption of rare earth metals from water using a kenaf cellulose-based poly(hydroxamic acid) ligand

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ABSTRACT

A kenaf cellulose-based poly(hydroxamic acid) ligand was synthesized from poly(methylacrylate) grafted cellulose and applied towards the adsorption of rare earth metals from aqueous media. The starting materials and final product were examined by FT-IR, FE-SEM, and ICP-MS. Remarkable maximum adsorption results were obtained for the earth metals La^{3+}, Ce^{3+}, Pr^{3+}, Gd^{3+}, Nd^{3+}, Eu^{3+}, and Sm^{3+}, with values of 260, 245, 235, 220, 210, 195, and 192 mg g^{-1}, respectively. The adsorption capacities of the ligand for adsorption of rare earth metals were well fitted with the pseudo-second-order rate equation. Further, the adsorption properties of the rare earth ions were nicely matched with the Langmuir isotherm model, ($R^2 > 0.99$), thus suggesting that the adsorbent surface of the ligand is monolayer and homogenous in nature. The reusability of the created ligand was evaluated by carrying out sequential sorption/desorption experiments, indicating that the developed adsorbent can be reused for at least 10 cycles without incurring any significant losses to its primary removal capabilities.