

Removal of Hexavalent Chromium from Aqueous Solutions by Biosorption Using Macadamia Nutshells: Effect of Different Treatment Methods

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Abstract : Macadamia nutshell biosorbents treated in three different methods (raw Macadamia nutshell powder (RMN), acid-treated Macadamia nutshell (ATMN) and base-treated Macadamia nutshell (BTMN)) were investigated for the adsorption of Cr(VI) from aqueous solutions. Fourier transform infrared spectroscopy (FT-IR) spectra of free and Cr(VI)-loaded sorbents as well as thermogravimetric analysis (TGA) revealed that the acid and base treatments modified the surface properties of the sorbents. The optimum conditions for the adsorption of Cr(VI) by sorbents were pH 2, contact time 10 h, adsorbent dosage 0.2 g L⁻¹, and concentration 100 mg L⁻¹. The different treatment methods altered the surface characteristics of the sorbents and produced different maximum binding capacities of 42.5, 40.6 and 37.5 mg g⁻¹ for RMN, ATMN and BTMN, respectively. The data was fitted into the Langmuir, Freundlich, Redlich-Peterson and Sips isotherms. No single model could clearly explain the data perhaps due to the complexity of process taking place. The kinetic modeling results showed that the process of Cr(VI) biosorption with Macadamia sorbents was better described by a process of chemical sorption in pseudo-second order. These results showed that the three treatment methods yielded different surface properties which then influenced adsorption of Cr(VI) differently.

Keywords : biosorption, chromium(VI), isotherms, Macadamia, reduction, treatment

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