Adsorption of Chromium (III) from Aqueous Solutions Using Activated Carbon Derived from Wood Waste of *Cinnamomum verum*

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Contamination of water by heavy metals has readily increased as a result of urbanization and industrialization. Among the available techniques of contaminant removal, adsorption has widely been used for the removal of various pollutants including heavy metals from water. Therefore, the present study was conducted to investigate the potential of utilizing an agricultural waste, *Cinnamomum verum* wood waste, as a precursor for the production of low-cost activated carbon (AC) to use as an adsorbent for the removal of Cr (III) from aqueous solutions. First, the effect of carbonization time on production of AC derived from wood waste of *Cinnamomum verum* and their Cr (III) removal potential was evaluated to determine the optimum carbonization time for AC production. Cleaned and dried powdered wood waste samples (20.00 g) were carbonized at 400 °C for 30-120 minutes (30 min, 60 min, 90 min, 120 min) and chemically activated by H_3PO_4. The yield of AC samples prepared at different carbonization time and their Cr removal percentages (% Cr) at pH 7 and at room temperature (30 ± 2 ^{0}C) were determined. As the highest % Cr removal (~ 90 %) was observed for the AC prepared by carbonization of wood waste at 400 °C for 60 minutes with H_3PO_4 activation, AC prepared under the given conditions were selected for batch adsorption and isotherm studies. The surface morphology and the elemental composition of the novel adsorbent was examined by Scanning Electron Microscopy & Energy Dispersive Spectroscopy (SEM/EDS). Further, the adsorbent was characterized by Fourier Transform Infrared Spectroscopy (FT-IR) and proximate analysis. The effect of initial Cr (III) concentration (1.00, 3.00, 5.00, 8.00, 9.00, 12.00 mg/L), shaking time (30, 60, 90, 120,150,180 min) and adsorbent dosage (0.05, 0.25, 0.50, 0.75, 1.00, 1.25 g) on adsorption of Cr onto AC was then investigated by conducting batch experiments at pH 7 and at room temperature (30 ± 2 ^{0}C). According to the results the highest % Cr removal of 92.5% was obtained at initial Cr (III) concentration of 2.00 mg L^{-1}, shaking time of 120 minutes and at adsorbent dosage of 0.05 g. The equilibrium data for the adsorption of Cr (III) on the AC derived from wood waste were tested with two adsorption isotherm models namely Freundlich isotherm and Langmuir isotherm and the results showed that the equilibrium data were better represented by the Langmuir isotherm model (R^2 = 0.998) with the maximum Cr adsorption capacity (q0) of 10.75 mg g^{-1}. Therefore, the results of the study revealed that the AC derived from wood waste of *Cinnamomum verum* could be considered as a promising and environmentally friendly novel adsorbent for the removal of Cr from aqueous solutions including wastewater.

Keywords: “Activated carbon; Cr(III); *Cinnamomum verum*; Adsorption; Iotherms”

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