The Removal of Hexavalent Chromium by a Novel Single – Step Chemically Activated Biocarbon

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ABSTRACT

Heavy metal pollution in the environment has drastically increased to alarming levels worldwide because of reckless urbanization and industrialization and is expected to be worse in the projected future. Cr (III) is naturally present and crucial in certain metabolic pathways while Cr (VI) pollution exists mainly due to manmade industries other than natural causes like sewage leachates. Even at minute levels, Cr (VI) is highy hazardous to human health due to its extreme mobility and solubility in water which exists in anion form, powerfully oxidative, and 100 to 1000 times more poisonous than Cr (III). Current heavy metal remediation methods are based on physico-chemical approaches that are very expensive, energy-demanding, produces a new type of waste (sludge), requires complicated management, and the technology is limited to developed countries. Functional groups on the biocarbon's cell wall polysaccharides, proteins and lipids can bind to metal ions. The novel biocarbon with single-step chemical activation had a maximum adsorption capacity, Q_{max} of 14.286 mg/g with an optimum pH at 2. Cr (VI) removal was 92.33% for 100 mg/L of initial Cr (VI) concentration at a contact time of 30 minutes. Optimum biocarbon dosage used was 0.125 g at 25°C r.t. and the pH_{pzc} value was 2.3. Langmuir isotherm type-1 had the best fit to the available data with a R^2 of 0.994 and Langmuir affinity constant, b of 5.385 L/g.

Keywords: Anion, biocarbon, waste, pollution, groundwater, Cr (VI), remediation, activation, adsorption capacity, Langmuir, pH, dosage, contact time, functional groups.