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CHROMIUM SORPTION AND Cr(VI) REDUCTION TO Cr(III) BY *Litchi chinensis* SEEDS

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Abstract

Chromium [Cr] is among the most common heavy metal pollutants found in industrial wastewaters, and is exceedingly toxic to human health. Chromium is released to the environment by a large number of industrial operations, including the metallurgical, refractory and chemical industries. While hexavalent and trivalent species of chromium are prevalent in industrial wastewaters, the hexavalent form of chromium [Cr(VI)] is the most dangerous to public health due to its higher solubility in water, higher mobility in the environment, and to its toxic, mutagenic, and teratogenic traits. Therefore, the removal of Cr(VI) from the contaminated environments and industrial wastewaters is important. Biosorption has emerged as a promising bioremediation strategy for cleaning up water that has been contaminated with toxic metals by anthropogenic activities and/or by natural processes.

The main purpose of this work was to evaluate the potential of *Litchi chinensis* seeds to remove Cr(VI) and total chromium from aqueous solutions. Furthermore, the kinetics, isotherm and thermodynamics of total chromium biosorption by *Litchi chinensis* seeds are described herein.

It was found that acid-pretreated biomass showed higher chromium biosorption capacity than un-pretreated biomass at pH values ranging from 1 to 4, with an optimum pH of 2.5. The effects of other relevant environmental parameters, such as initial Cr(VI) concentration, shaking contact time and temperature, on chromium biosorption onto acid-pretreated *Litchi chinensis* seeds were evaluated. Significant enhancement of chromium biosorption capacity was observed by increasing initial metal concentration and temperature. Kinetic studies showed that the kinetic data were best described by a pseudo second-order kinetic model. Among the two-, three-, and four-parameter isotherm models tested, the Langmuir model exhibited the best fit to experimental data. Thermodynamic parameters revealed that the biosorption of chromium ions onto acid-pretreated biomass is an endothermic process. Throughout the experiments, Cr(VI) removal capacity was higher than total chromium removal capacity, and this was due to the amount of Cr(VI) which was reduced to Cr(III) by *Litchi chinensis* seeds and released into the aqueous solution.

The high sorption capacity (168 mg g^{-1} at 25ºC) exhibited by acid-pretreated *Litchi chinensis* seeds places this biosorbent among the best adsorbents currently available for removal of chromium ions from aqueous effluents.