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Removal of Hexavalent Chromium from Aqueous Solutions Using Eucalyptus Chips

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Removal of hexavalent chromium from aqueous solutions using Eucalyptus chips

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Abstract

This research aimed to investigate the kinetic equilibrium and thermodynamics involved in removing hexavalent chromium from aqueous solutions using Eucalyptus chips. Laboratory-scale experiments were conducted, exploring the impact of sorbent quantity, pH levels, and initial hexavalent chromium concentrations on biomass removal capacity within a 5-hour treatment period. Optimal conditions were identified as follows: a pH of 4.5, an initial chromium concentration of 100 mg/L and a biosorbent dose of 1 g/L, under these conditions, the biosorption capacity reached 69.46mg/g. The modeling study revealed that the pseudo-second-order model effectively described the adsorption kinetics, with external mass transfer identified as controlling the biosorption process in diffusion kinetics analysis. Data from the adsorption equilibrium were well-fitted by the isothermal models Dubinin-Radushkevich, Langmuir, and Temkin. The biosorption process was determined to be endothermic and spontaneous based on thermodynamic studies.

Desorption, a crucial aspect, has facilitated the recovery and reuse of eucalyptus chips for more than three cycles, with appreciable yield. The metal recovered in a reduced volume can then be reused or treated by physical or chemical means, which offers economic advantages. Significantly, eucalyptus chips, originally destined for incineration, have been reused as a potential biosorbent for heavy metals, without further treatment. This approach is in line with the principles of environmental protection and waste recovery, and is part of a sustainable development strategy. The adsorption of hexavalent chromium onto Eucalyptus chips presents a novel and sustainable approach for environmental remediation. This method utilizes a natural and abundant material to efficiently remove toxic chromium from water sources. By offering an eco-friendly alternative to conventional adsorbents, Eucalyptus chips contribute to mitigating water pollution and protecting ecosystems.

Key Words: *Hexavalent chromium; Biosorption; Eucalyptus chips; Waste water treatment*

Approach to Mechanical Recycling and Biorefinery.

- SDEWES2024-0852 The concept of a technological system for treatment and using rainwater in swimming pool installations
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Waste and wastewater treatment and reuse 4 (Wed 11/09 09:00)

- SDEWES2024-0810 Effect of residence time on hydrothermal carbonization of sewage sludge and fate of heavy metals
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- SDEWES2024-0741 Removal of hexavalent chromium from aqueous solutions using Eucalyptus chips.
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Water (Tue 10/09 13:30)

- SDEWES2024-1148 The Potential of Wood-based Hydrochar for Simultaneous Removal of Pharmaceuticals from Wastewater: Kinetics and Efficiency
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