Removing Chromium (VI) from Contaminated Water Using a Low-Cost Chitosan Coated Diatomaceous Earth

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Access to clean water is a major challenge in many developing counties partly due to municipal and industrial pollution. Thus, developing low-cost technologies to provide clean water is vital. Hexavalent chromium is a toxic substance that is not biodegradable and has a great effect on the ecosystem and human health. In this work, chitosan-coated diatomaceous earth (CCDE) granules were synthesized at 20 wt % and 30 wt % and characterized by Fourier transfer infrared, scanning electron microscopy, and thermogravimetric analysis. CCDE is used for Cr(VI) ion removal from aqueous solution in batch processes. Several parameters have been studied such as solution-pH, initial Cr(VI) ion concentration, the mass of adsorbent, and contact time to investigate the efficiency of Cr(VI) removal. In batch studies. CCDE achieved 99% removal efficiency of Cr(VI) and adsorption capacity was 18.69 mg Cr(VI)/g. Equilibrium adsorption data was well fitted to the Langmuir isotherm model, indicating monolayer adsorption behavior. Anions in the solution had an insignificant effect on Cr (VI) ion uptake by CCDE powder achieving clean water standard from initial Cr(VI) concentrations of 1 mg/L. The removal efficiency increased at lower pH and the optimal pH was 4. Adsorption equilibrium was reached after approximately 30 min, and the adsorption kinetics was well fit by a second-order model for Cr(VI). There was not measurable leaching of adsorbed Cr(VI) from used adsorbent. This study demonstrated that natural-based adsorbents could be employed as a low-cost, sustainable, and excellent alternative material for removing heavy metals from contaminated water

Awards Won:

U.S. Agency for International Development: USAID Science for Development First Award - Climate and Environmental Protection

Third Award of $1,000