

Preparation and characterization of chitosan coated diatomaceous earth for hexavalent chromium removal

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Hexavalent chromium is not biodegradable in nature and has a great effect on ecosystem and human health. Batch and continuous fixed-bed column studies for Cr (VI) removal from aqueous solutions were carried out by using chitosan coated diatomaceous earth as an adsorbent. The adsorbents were characterized by FTIR, TGA, BET, XPS, SEM, EDS and zeta potential (located at University of Missouri-Columbia, Missouri). The effects of pH-solution, initial ion concentration, temperature, flow rate and the contact time were examined. Results revealed that Cr (VI) adsorption was found fitting well with Langmuir model indicating monolayer adsorption. The adsorption of Cr (VI) onto adsorbent behaves as a pseudo-second-order models rather than the pseudo-first order model and found to have fast kinetics in the first 60 min and then the rate slowed down as equilibrium was approached. The increase of temperature has a negative effect on chromium adsorption which decreases the Cr (VI) removal from 1.62 to 1.44 mmole/L when it rise from 283 to 313 K. Thermodynamic parameters such as ΔG° , ΔH° , ΔS° and ΔH_x indicated the suitability of adsorbent towards the removal of Cr (VI). The maximum chromium uptake in batch adsorption was 1.62 mmole/g or 84.23 mg Cr/g at pH 3, initial ion concentration 1000 ppm, and temperature 283 K. However, a forward breakthrough point is decreasing exhaustion time with increasing the flow rate of solution in dynamic process. Recovery of the Cr (VI) ions was made by passing 0.2 M NaOH solution through the exhausted columns and about 91.2% of chromium was de-adsorbed from the bed column. Results indicate that the sustainable, abundant, low-cost adsorbent, chitosan coated diatomaceous earth, can be considered as economically applicable for the removal of Cr (VI) from aqueous solutions.

Biography

Suhaib S Salih is currently pursuing PhD and is a Research Assistant at the University of Missouri-Columbia majoring in Chemical Engineering. His PhD work is on industrial wastewater treatment under the supervision of Dr. Tushar K Ghosh. He has received his BE and MSc degrees in Chemical Engineering from the University of Tikrit, Iraq. He later joined the Department of Chemical Engineering, University of Missouri-Columbia as a PhD Scholar. His current research interest is in Adsorption Processes. He has expertise in lab management, operation of atomic absorption spectrophotometer, infrared spectrophotometer, ultra violet spectrophotometer and HPLC spectrophotometer.

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