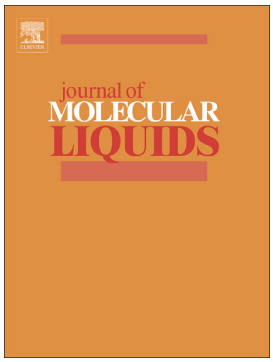

Microwave assisted economic synthesis of multi walled carbon nanotubes for arsenic species removal in water: Batch and column operations

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Microwave assisted economic synthesis of multi walled carbon nanotubes for arsenic species removal in water: Batch and column operations

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Abstract

Microwave assisted economic multi walled carbon nanotubes (MWCNTs) were synthesized with 10-40 nm diameter and 9.1 m^2/g surface area. CNTs were used to remove arsenite and arsenate in water with 60 minutes contact time, 40.0 µg/L concentration, 6.0 pH, 2.0 g/L dose and 25 ºC. The percentage removal of arsenate and arsenite were 92.0 and 91.0. The sorption data obeyed Tempkin, Dubinin-Radushkevich, Freundlich, and Langmuir models. The free energy values for aresenate and arsenite were -15.68 and -15.75 and -13.80 and -13.85 and -13.66 and -13.73 kJ/mol at 20, 25 and 30 °C. The values of enthalpy and entropy for aresenate and arsenite were -16.11 and -16.15 and -36.33 x 10^{-3} and -36.53 x 10^{-3} kJ/mol. The negative value of ΔG° showed spontaneous adsorption on CNTs. The sorption was exothermic and the kinetics was controlled by pseudo-first order. Arsenic species removal was occurred via liquid film diffusion mechanism. The column data followed Bohart and Adams and Thomas models. The removal amounts of arsenite and arsenate species in column operations were 13.5 and 14.0 µg/g. The reported method was low priced, quick and reproducible. The reported method is appropriate for the uptake of arsenic in ordinary water sources owing to its capability to work in normal water situations.

Keywords: Multi walled carbon nanotubes, Water treatment by batch and column operations, Arsenate, Arsenite, Modeling, Kinetics.

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