Applications of Carbon Nanotube Based Sorbents for Removal of Arsenic from Polluted Well Water

Nguyen, Linh (School: Deering High School)

There is a growing need for a cost-effective arsenic treatment. Historical and current industrial use of arsenic have resulted in soil and groundwater contamination, leading to polluted well water. The presence of arsenic in the environment can pose a public health issue, contributing to concerns such as development problems in children, heart disease, and eventually even cancer. Current arsenic removal methods consist of costly systems, which disproportionately impacts underserved communities first. The rationale of this research is to find a cost-efficient and effective sorbent that can remove arsenic from water to meet the lower arsenic drinking water standards. The composition of the sorbents consisted of Carbon Nanotubes (CNT) encapsulated in Calcium Alginate beads. In order to increase the absorption characteristics of the sorbents, the CNT-Calcium Alginate beads were modified through impregnating the beads with Titanium Dioxide and Iron Oxide. Filtration experiments were conducted using an inexpensive self-made column filtration system designed from house-hold items, such as travel-size shampoo bottles, cotton balls, and duct tape. The arsenic concentration was determined using an arsenic colorimetric testing kit and the filtration experiments revealed that the Fe-CNT-alginate beads, Ti-CNT-alginate beads, Fe/Ti-CNT-alginate beads, and CNT-alginate beads removed 67%, 47%, 33%, and 17% of arsenic respectively. Statistical analysis found CV values of 7-12% for all the samples, which conveyed low variability between samples—reinforcing the precision of arsenic test kit. The research findings of this can be a baseline for future scaled-up CNT-based sorbents production for commercial use and within water-remediation systems.

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