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Adsorption of Arsenic Species from Ground Water onto Cupric Oxide (CuO) Nanoparticles Across a Wide Range of Natural Conditions

Carol Martinson and K.J. Reddy

Abstract Text:

Due to the severe health effects of chronic arsenic exposure, the EPA, in collaboration with the National Academy of Sciences, has set the arsenic drinking water limit to 10 µg/L in order to protect the public health. The objective of this study is to evaluate cupric oxide (CuO) nanoparticles in the removal of arsenic species from ground water across a wide range of natural conditions. Bench studies were conducted to determine the effects of reaction time, pH, oxidation state, adsorption capacity, and competing anion concentation. Ground water samples containing high levels of arsenic were collected from CO, WY, UT, MT, ND, SD, NE, MN, and NH and reacted with CuO nanoparticles. The arsenic concentrations of all samples were reduced to below 10 µg/L indicating that CuO nanoparticles are applicable over a wide range of natural conditions. The CuO nanoparticles have also shown to effectively remove high levels of arsenic. Results of this study will benefit municipalities as well as private well owners in the removal of arsenic from ground water.

Impact Statement:

The danger of arsenic exposure became a global concern in 1990's when over 70 million people in Bangladesh and India were inadvertently poisoned by drinking arsenic contaminated water. High levels of dissolved arsenic in ground water have been detected all over the world. Thus, novel arsenic removal methods which are efficient across a wide range of natural water conditions will be useful. Some existing arsenic removal methods require pH and oxidation adjustments, or are influenced by the presence of competing anions. Our study could help develop a simple and effective arsenic removal method which would improve the health of people worldwide by improving drinking water quality.