Targeted Arsenic Sequestration from Natural Waters with a Functionalized Adsorbent

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Abstract:

Groundwater contamination by arsenic is widespread, with arsenite [As(III)] prevailing as the dominant—and most toxic—redox species. A two-stage treatment train was evaluated, comprising pre-oxidation of As(III) to arsenate [As(V)] followed by adsorption onto surface-modified activated carbon. Equilibrium sorption on the unmodified carbon was well described by the Langmuir isotherm q_{max} = 1.99 mg g^{-1},, whereas the modified carbon exhibited Freundlich behavior, K = 0.49055 L mg^{-1}, consistent with a heterogeneous surface. Time-dependent uptake for both sorbents was best represented by the pseudo-first-order kinetic model. Relative to direct adsorption alone, coupling oxidation with adsorption significantly enhanced overall arsenic removal, 34.68%. These results indicate that integrating an oxidation step with adsorption on modified carbon provides an efficient, environmentally benign, and cost-effective approach for treating waters containing elevated As(III)/As(V).

Keywords:

Arsenic, arsenite oxidation, modified activated carbon, adsorption isotherms, pseudo-first-order kinetics, water treatment.