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A comparative study of As(III) and As(V) adsorption behaviors on different Fe-Mn based adsorbents

Jasmina Agbaba, Jasmina Nikic, Aleksandra Tubic, Malcolm Watson, Snezana Maletic and Bozo Dalmacija
University of Novi Sad, Serbia

This paper investigates the sorption behavior of As(III) and As(V) on granular activated carbon, quartz sand and zeolite impregnated with Fe–Mn binary oxide (GAC-FeMn, S-FeMn and Z-FeMn). The sorbents was prepared relatively simply by simultaneous oxidation and coprecipitation method. Brunauer-Emmett-Teller (BET) analysis showed that the surface areas of the GAC-FeMn, S-FeMn and Z-FeMn were 996 m²/g, 0.430 m²/g and 55.2 m²/g, respectively. Kinetic experiments (conventional batch technique) were performed with 10 mg of sorbent and 200 µg/l As(III) or As(V) solution at pH 7.0±0.2. In the sorption isotherm study, the adsorbent doses were varied from 0.5-25 g/L, with the same initial As(III) and As(V) concentrations. Pseudo-first order, pseudo-second order, Elovich and intraparticle diffusion models were employed to fit the kinetic data, in order to elucidate the sorption mechanism and potential rate controlling steps such as mass transport and diffusion control processes. The data from the adsorption kinetics best fit with the pseudo-second order model for both As(III) and As(V), suggesting chemical adsorption on the surface of the GAC-FeMn, S-FeMn and Z-FeMn. Intraparticle diffusion model data showed that diffusion was not the only rate-limiting step in the adsorption process. Langmuir and Freundlich models were employed to fit the equilibrium adsorption data, with the Freundlich model giving a better representation, possibly due to irreversible adsorption and the heterogeneous nature of the adsorbents. K_F values, rough indicators of sorption capacity, were in the following order: GAC-FeMn>Z-FeMn>S-FeMn for both As(III) and As(V).

Biography

Jasmina Agbaba is a full Professor and the Chair of Chemical Technology and Environmental Protection, University of Novi Sad, Faculty of Sciences. He has received his PhD in Chemistry in 2005; MSc in Chemistry in 2000 and BSc in Chemistry Education in 1997 from University of Novi Sad, Faculty of Sciences. His research interests include water analysis and drinking water treatment, and environmental protection and risk assessment. He has expertise in gas chromatography analysis of environmental samples for wide range of organic pollutants. He has experience of working in laboratory and pilot scale investigations, in particular, relating to applying various drinking water treatment processes. He is the Head of the Chair of Chemical Technology and Environmental Protection.

jasmina.agababa@dh.uns.ac.rs

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