

## Adsorption and removal of arsenite on ordered mesoporous Fe-modified ZrO<sub>2</sub>

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### ABSTRACT

A new adsorbent, ordered mesoporous Fe-modified ZrO<sub>2</sub>, was prepared and applied for the adsorption of arsenite [As(III)] and arsenate [As(V)] from water. The adsorbent showed higher efficiency for the removal of As(III) and As(V) than that of unmodified mesoporous ZrO<sub>2</sub>, especially of As(III) without pre-oxidation. The maximum uptake at pH 7.0 was 80 mg g<sup>-1</sup> for As(III) and 45 mg g<sup>-1</sup> for As(V). The behavior of arsenic adsorption onto Fe-modified ZrO<sub>2</sub> was investigated by adsorption isotherms, adsorption kinetics, and the effect of pH on adsorption. The adsorption equilibrium of arsenite was rapid, with 90% adsorption within 1 h. Furthermore, the interactions of As(V) and As(III) with adsorbent were investigated using electrophoretic mobility (EM) measurements and Fourier transform infrared (FTIR) spectroscopy. The adsorption of As(V) and As(III) decreased the isoelectric point of Fe-modified ZrO<sub>2</sub> from 6.00 to 3.00 and 4.51, respectively, suggesting the formation of negatively charged inner-sphere complexes for both arsenic species. The results of FTIR suggested that the –OH band on the surface was the adsorption sites. The more adsorption sites were formed on mesoporous ZrO<sub>2</sub> modified with Fe, which possessed abundant surface hydroxyl groups, resulting higher efficiency for arsenic removal.

*Keywords:* Mesoporous zirconia; Fe-modified; Adsorption; Arsenic; Mechanism

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