Arsenate Adsorption on Ordered Mesoporous Materials: Kinetics and Mass Transfer

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Removal of arsenic (As) from drinking water sources is much needed worldwide, and point-of-use (POU) treatment could be an effective solution for residential applications. Adopting existing removal technologies that are successful in large-scale treatment to POU units, however, is rather ineffective due to the short hydraulic residence time in POU systems. In this study, we investigated the use of iron-containing ordered mesoporous carbon (FeOMC) for rapid arsenate [As(V)] sorption in batch reactors. A rapid kinetics of As(V) adsorption was observed, showing that at an initial concentration of 52.1 μg As/L and solid loading of 2.0 g/L, 84.8% of As(V) was removed within 90 s at pH 6.1. The kinetics was satisfactorily modelled according to the mass transfer of As(V) in a single FeOMC grain; and the results suggested that the intraparticle diffusion along the mesoporous channels could be hindered by adsorption. This study has not only developed ordered mesoporous materials for rapid arsenic adsorption, but also gained insights into the factors controlling the sorption kinetics by evaluating the mass transfer inside the straight and uniform channels of surface-functionalized OMC. Approaches to use ordered structured materials for rapid arsenic sorption will also be explored.