

Arsenic removal from phosphate-bearing solutions using struvite and hydroxylapatite

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Arsenic (As) in groundwater and drinking water is a global concern [1]. Different absorbents have been developed to remove As from groundwater and drinking water through the years [2]. However, orthophosphate, if present in the aqueous phase, could compete with As during the adsorption process and decrease removal efficiency. In order to explore the impact of orthophosphate on As sorption, struvite ($\text{MgNH}_4\text{PO}_4 \cdot 6\text{H}_2\text{O}$, MAP), a mineral that can be found in nutrient-rich solutions such as wastewaters, and hydroxylapatite ($\text{Ca}_5(\text{PO}_4)_3\text{OH}$, HAP), were used to remove As from solutions at pH 8-11. More As was removed as the pH was increased from 8 to 11 for both MAP and HAP in the form of pentavalent As, As(V). For pH 10 and 11, the As concentration of the solids were 237, 374 and 70, 74 ppm for MAP and HAP, respectively. Using a ³³P radiotracer, it was revealed that MAP and HAP both possessed two types of active sites at pH 10 and 11. The coordination environment for As was determined by X-ray absorption fine structure spectroscopy (XAFS). For MAP, the bond distance and coordination number (CN) for the first As-O shell did not change from pH 10 to 11. However, the As-Mg distance and CN increased from pH 10 to 11, which indicated that both monodentate and bidentate surface complexes were formed and more bidentate surface complexes were formed at pH 11. For HAP, both bidentate and multidentate surface complexes were formed based on the fitting results of the first As-O shell and the first and second As-Mg shells.

[1] Smedley & Kinniburgh (2002), *Appl. Geochem.* **17**, 517-568 [2] Mohan & Pittman (2007), *J. Hazard. Mater.* **142**, 1-53