

Effect of Humic Substances on Arsenic Release from Sediments into Groundwater of Bangladesh and Taiwan

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X-ray absorption near-edge structure (XANES) spectroscopy and extended x-ray absorption fine-structure (EXAFS) fluorescence spectra were used to elucidate oxidation and chemical states of arsenic at the National Synchrotron Radiation Research, Hsinchu Taiwan. For sediments samples, the position and shape of the absorption edge in the XANES Spectra suggest that arsenic in both sediments such as southwest, northeast Taiwan and Bangladesh is in the form of As (V). Humic substances act as a binding agent As (V) into solid rock surface. The assignment of As in the oxidation states is supported by EXAFS data, which shows that the first coordination state around the central arsenic atom contains of 4 oxygen atom at a distance of 1.69 Å. The valence state of arsenic is not clear in Beitow hot spring (Hell Valley). Probably As (-3) is the dominant species in Beitow hot spring because it does not match with arsenate standard (As V).

XANES spectra of sediments, which collected from different depth of the Holocene aquifer, were shown in Fig.1. Sediment samples contain arsenate-like phases such as arsenic (V) comparing with arsenate (AsO₄) standards, which are depicted at 11,874 eV.

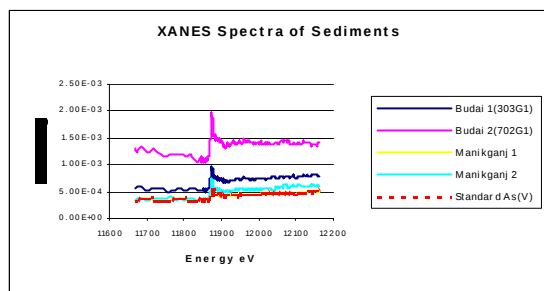


Figure 1. XANES spectra for sediment samples, which collected from core samples of Budai (in Blue and pink and Manikganj (in yellow and green) and compared with arsenate standard (in red).

The valence state of arsenic is not clear in Beitow hot spring (Hell Valley). Fig. 2 shows that probably As (-3) is the dominant species in Beitow hot spring because it does not match with arsenate standard. The EXAFS spectra of the sediment shows that the As-O distance is about 1.69 Å (Fig. 3). This bond length is characteristic of the As-O bond length in arsenate complexes (Randall et al., 2001; Farquhar et al., 2002) wholly consistent with

the As in the sediments being present as As(V). Arsenic share with another As atom at a relatively short distance of 3.3 Å.

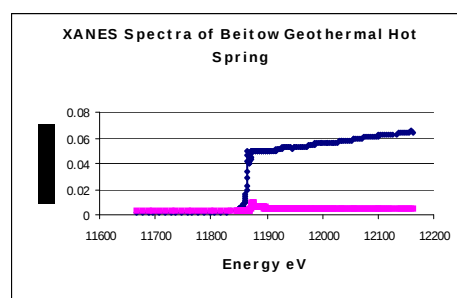


Figure 2. XANES spectra for sediment samples (in blue), which collected from Beitow Geothermal Hot Spring and compared with arsenate standard (in pink).

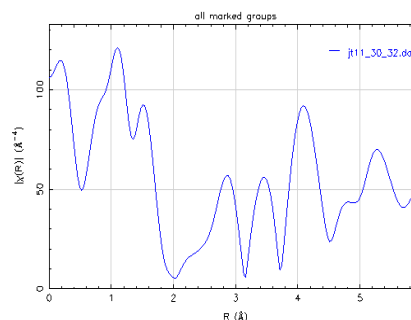


Figure 3. Arsenic K-edge x-ray absorption spectra; EXAFS spectra and corresponding Fourier transforms for sediment sample.

References

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