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Water pollution by arsenic has been a serious problem around the world. Its predominant source is naturally-derived inorganic arsenic compounds. In addition, organoarsenic species such as methyl and phenyl arsenic compounds are also distributed in environment since they have been used as pesticides and herbicides. Although organoarsenic compounds are thought to be less toxic than inorganic ones, a health hazard by phenyl derivative arsenic compounds was reported at Kamisu in Japan. Thus, the organoarsenic compounds should be considered as a pollution source. However, there have been few studies on the physicochemical processes of organoarsenic compounds in natural soil-water systems. Since the adsorption structures on the minerals are related to the stability of adsorbed species and their distribution between water and soil, it is important to study the adsorption structures of arsenic compounds on minerals to understand its migration processes in soils. In this study, the adsorption structure of organoarsenic compounds on minerals in soil were determined by extended X-ray absorption fine structure (EXAFS) spectra with the aid of quantum chemical calculations.

As K-edge EXAFS spectra for organoarsenic compounds, methylarsonic acid (MMA), dimethylarsenic acid (DMA), phenylarsonic acid (PAA), and diphenylarsenic acid (DPAA), in aqueous solution and adsorbed on ferrihydrite and gibbsite as well as soil were collected at SPring-8 BL01B1 and KEK Photon Factory BL-12C.

EXAFS analysis suggests that all organic arsenic compounds in this study form the inner-sphere complex with ferrihydrite and gibbsite regardless of the organic functional groups and the number of substitution. From the fitting, the As-Fe and As-Al distances are ca. 3.25 Å and 3.14 Å, respectively, which agree with the results of quantum chemical calculations. The radial structural functions for soil samples show the features of both ferrihydrite and gibbsite samples around $R+\Delta R = 2.6-3.0$ Å indicating the formation of inner-sphere complexes (Fig. 1). This fact suggests that organoarsenic compounds were mainly adsorbed on both Al- and Fe-(oxyhydr)oxides in the soil.

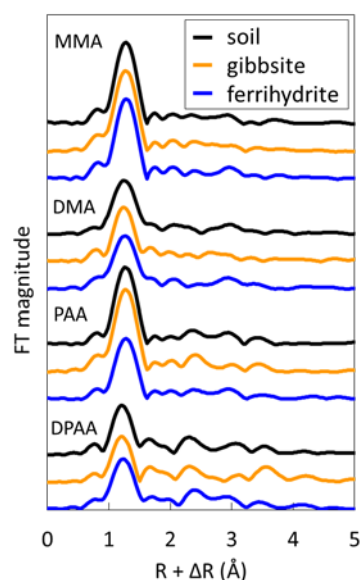


Fig. 1 Radial structural functions (phase shift uncorrected) for organoarsenic compounds adsorbed on ferrihydrite, gibbsite, and soil samples. The $R+\Delta R$ corresponds to the interatomic distance between central As atom and surrounding atoms.