

Surface complexation modeling for iodine (I^- and IO_3^-) adsorption on ferrihydrite

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Iodine is the micronutrient which is essential to the human and an animal as a constitution ingredient of the thyroid hormone, and the deficiency of the iodine causes goiter, fetal abnormality, mental disabilities. Therefore, assessing the behavior of iodine in the surface environment is a matter of urgency for these health problems. In addition, assessing the detailed behavior and developing the technology of shift delay of the iodine (^{129}I) which is long-half-life weak sorption characteristics negative ion nuclide are placed with a major problem in terms of the geological disposal of the TRU (TRans Uranic) waste which is low-level radioactive waste occurring by a reprocessing steps of the waste fuel (JAEA, 2007).

Depending on a redox state, iodine is in the form of iodide ion (I^-) or iodate ion (IO_3^-) in the surface environment. Ferrihydrite which is amorphous ferrioxide has huge specific surface area and the positive surface charge in natural aquatic systems. So it is known that ferrihydrite plays a very important role for the adsorption of many anions (Fukushi and Sato, 2003). Since ferrihydrite is presents throughout hydrosphere environment such as lakes, rivers and soil, ferrihydrite may affects the behavior of the iodine in the surface environment by adsorption process. Therefore, this study aims to evaluate quantitatively and predict iodine adsorption on ferrihydrite by acid/base titrimetry and analysis by the surface complex modeling. Furthermore, iodine K-edge XAFS spectra of iodide ion and iodate ion adsorbed on ferrihydrite were collected at the BL01B1 beamline of SPring-8. The binding structures of iodide ion and iodate ion on ferrihydrite determined by the spectrometry were compared to that determined by the surface complex modeling.

References

1 Japan Atomic Energy Agency and The Federation of Electric Power Companies of Japan: JAEA-Review, 2007-010 (2007), p.32.

2 K. Fukushi and T. Sato (2003) CLAY SCIENCE Vol.42 No.3 Formations of Ferrihydrite and Schwertmannite and Those Role for Environment-Friendly materials