

## Bacteria-Induced Incorporation of Arsenic into Iron Mineral during Biotransformation of $\beta$ -FeOOH

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### Abstract

Adsorption of arsenic(III) on diverse iron minerals has been investigated<sup>1-3)</sup>. But this study was initiated from the hypothesis that there will be possibilities of incorporation of arsenic(III) into the structures of the iron minerals during the transformations of the iron minerals by bacteria. In order to examine if arsenic(III) could be incorporated into  $\beta$ -FeOOH (akaganeite) during the transformation by the microbial reduction, and to compare the abilities sorbing and holding As(III) between surface sorption of  $\beta$ -FeOOH and structural intake of biotransforming  $\beta$ -FeOOH by *Shewanella* sp. HN-41, arsenite (0.5 mM) was added to the  $\beta$ -FeOOH incubations with or without inoculation of HN-41. The final products of minerals were collected and analyzed for the As contents which were water-washable, acid-leachable, or totally-digested. When the particles were washed with water, arsenic(III) was released out more in control samples of abiotic incubations than in bacterially produced minerals. But As was eluted out more from the bacterially produced mineral particles than from the abiotic minerals, when digested with acids. These results partially explain that As just adsorbs at the surface of abiotic mineral products, while As is incorporated inside the structures of the minerals undergoing transformation by bacterial iron reduction. X-ray diffraction patterns of the abiotic and biotic product minerals after washing with water or acid-digestion partially explain that the biotic mineral form was changed after losing As which was inside the structure of the mineral by acid-digestion, while the changes are less in abiotic minerals because As mainly existed as adsorbate on the surface of  $\beta$ -FeOOH.

### References

1. Manning, B. A., S. E. Fendorf, and S. Goldberg. 1998. Surface structures and stability of arsenic(III) on goethite: spectroscopic evidence for inner-sphere complexes. *Environ. Sci. Technol.* 32:2383-2388.
2. Pierce, M. L., and C. B. Moore. 1982. Adsorption of arsenite and arsenate on amorphous iron hydroxide. *Water Res.* 16:1247-1253.
3. Raven, K. P., A. Jain, and R. H. Loeppert. 1998. Arsenite and arsenate adsorption on ferrihydrite: kinetics, equilibrium, and adsorption envelopes. *Environ. Sci. Technol.* 32:344-349.