

Distribution and XANES of Arsenic in Root of Hyperaccumulator Fern (*Pteris vittata* L.) measured by μ -SR-XRF analysis

Nobuyuki Kitajima¹, Ryoko Onuma¹, Akiko Hokura¹,
Izumi Nakai¹, Yasuko Terada²

1: Faculty of Science, Tokyo University of Science, 1-3 Kagurazaka Shinjyuku
Tokyo 162-8601 Japan 2: SPring-8, JASRI

Pteris vittata L. is known as an arsenic hyperaccumulating fern and expected as a strong candidate plant for a technology of Phytoremediation in order to remedy a polluted environment. Some researchers reported that a reduction of arsenic, arsenate ion (As^{5+}) to arsenite ion (As^{3+}), took place in a plant body[1][2][3]. These results are strange and interesting phenomenon, because arsenite is more toxic than arsenate.

In this study, we attempted to observe the distribution of arsenic in a horizontal cross-section of root by XRF imaging and to obtain the XANES spectra for the determination of a valence change from surface to centre of the root. XANES spectra were collected following the XRF imaging, these measurements were carried out using the μ -SR-XRF system at BL37XU in SPring-8 (JASRI, Japan). X-rays from the undulator were focused into a microbeam with beam-size of $1.5\mu\text{m}^2$ by the K-B mirror optics. Ferns were cultivated in hydroponics, and were transferred into the arsenate containing nutritional solution with concentration of 10mg As/L as KH_2AsO_4 . Each samples cut from a root system of fern were frozen rapidly and sliced. And then sliced root samples were freeze-dried and were subjected to the X-ray microbeam analysis.

In our experiment, the arsenic distributions of the cross-sections were successfully measured by the μ -SR-XRF analysis. A comparison of XANES spectra of the 6 points in the root tissue at high As level with those of the standard compounds(As_2O_3 , H_3AsO_4) has revealed that arsenic in root tissue exist as a mixture of As^{5+} and As^{3+} and their ratios changed markedly with reductive direction at the boundary area between a cortex and central cylinder.

References.

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