Development of high energy micro-XRF analysis using fresnel zone plate optics

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High-energy (over 20 keV) microbeam is attractive technique for X-ray fluorescence (XRF) analysis. Recently, we have developed sputtered-sliced Fresnel zone plate (ss-FZP) as an X-ray focusing device and successfully obtained an X-ray mibrobeam at 100 keV [1]. In this study, XRF spectroscopy using a microbeam was applied for the first time to the hyperaccumulator plants of Cd in order to reveal the distribution of such toxic heavy elements in their tissues and cells.

The microbeam optics has constructed at BL37XU of SPring-8. A single-bounce monochromator with Si 111 reflection of Bragg angle of 1.5 degree provides 75.5 keV photons. A focused microbeam was evaluated by the knife-edge scan method. The beam size was estimated to be 2μm (V) x 5μm (H). The X-ray fluorescence intensities were measured by Ge-SSD. The plant samples cultivated with a medium containing Cd were subjected to the analysis. The samples were prepared as a slice of tissues by microtome for the organ analysis.

Figure 1 a) shows an optical microscope image of the sample. The two-dimensional distributions of the trace elements in the plant tissues were clarified. μ-XRF imaging of Cd and Mo are shown in Fig. 1 b) and c), respectively. It was found that Cd and Mo were accumulated in the sieve tissues of the plants. This study has demonstrated that high- energy microbeam is a new effective tool for ultra-sensitive analysis of trace heavy elements.

References

[1] N. Kamijo, Y. Suzuki, H. Takano, S. Tamura, M. Yasumoto, A. Takeuchi and M. Awaji, *Rev. Sci. Instrum.*, **74**, 5101 (2003).

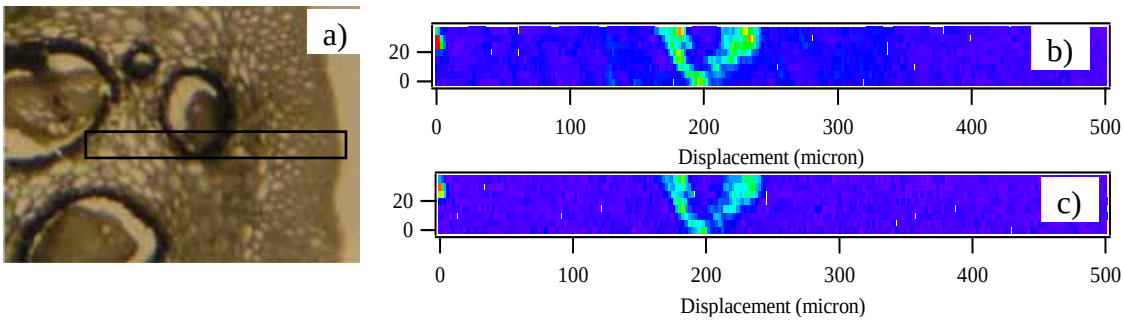

Fig.1 a) optical microscope image of sample, μ-XRF imaging of b) Cd, and c) Mo (pixel size: 2μm (V) x 5μm (H), dwell time: 1 sec.).