Micro-XRF Analysis of Biological Materials

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In x-ray fluorescence analysis, a non-destructive elemental analysis is possible at ambient air pressure. That is a unique advantage because other instrumental analytical methods such as EPMA required special sample preparation or high vacuum condition. In addition, XRF analysis at small region, that is, micro-XRF (µ-XRF), has been possible by applying recent technological advances. For example, a polycapillary x-ray lens is useful for obtaining micro x-ray beam in laboratory. We have studied applications of µ-XRF with polycapillary x-ray lens. One of interesting samples is in vivo biological material such as seed and plants. It is difficult to measure them by other micro analytical methods, because they can not be usually put into a vacuum chamber. XRF at ambient air pressure will be the best method for them.

We have studied the growth of “Quinoa” seed by µ-XRF [1]. Elemental maps for specific elements for Quinoa suggested movement of elements as they grew up. To know elemental distributions as a function of time, we have developed a time-resolved µ-XRF system. A time-resolved MCA was newly introduced. This equipment enables continuous x-ray analysis as a function of time. After the micro x-ray beam is fixed on the Quinoa sample, x-ray fluorescence intensities of several elements are monitored. Micro XRF analysis of inside of biological materials is also under research.

Furthermore, we have studied combination of AFM (atomic force microscope) and µ-XRF [2]. A small pinhole was made on the AFM cantilever, and micro x-ray beam passed through it. X-ray fluorescence was detected at grazing-exit angles from a narrow gap between the cantilever and the sample. The AFM cantilever has been improved for this experiment.