

## Quantitative analysis of small bio-samples of nearly 1 $\mu$ g

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### Abstract

We developed and reported standard-free methods for various bio-samples in both in-vacuum and in-air PIXE and they have been applied to quantitative analyses of traces of bio-samples whose weights are less than 0.1 mg. In this study, we established a method of quantitative analysis for bio-samples of nearly 1  $\mu$ g in in-vacuum PIXE. In order to improve sensitivity and accuracy of analysis for smaller samples on the basis of the standard-free method, which makes use of continuous X-rays emitted from the sample, it is essential to design appropriate backing materials for supporting the sample. In the present study, we have examined various backing materials such as thinner and threadlike backings. As a result, it was found that a threadlike backing made of extended adhesive, which contains almost no impurity, is the most suitable for bio-samples of extremely small quantities, since it produces no large amount of continuous X-rays. The method has been applied to quantitative analyses of small insects and plants. Moreover, the method was applied to analyses of small marine organisms such as opossum shrimps and squilla shrimps which are playing important roles in a food chain in marine ecosystem. The results gave us valuable information about regeneration of marine ecosystem in the Sanriku district attacked by the huge tsunami that occurred on March 11, 2011.