Standard-free method for living plants in in-air PIXE

K. Sera[1], S. Goto[2], C. Takahashi[2] and Y. Saitoh[2]

[1]Cyclotron Research Center, Iwate Medical University,
Tomegamori, Takizawa 020-0173, Japan

[2]Nishina Memorial Cyclotron Center, Japan Radioisotope Association,
348-58 Tomegamori, Takizawa 020-0173, Japan

Abstract

A standard-free method for living plants in in-air PIXE has been developed in order to clarify mechanism of elemental transportation and movement in farm products. The components of the continuous X-rays originated from air and a backing film can be exactly subtracted using a blank spectrum after normalization by the yields of Ar K□ X-rays. It is found by observing the yield of continuous X-rays with passage of time that water content is continuously decreasing during irradiation with a proton beam in a case of pinched leaves. Contrary, it is kept almost constant during irradiation for the living plants to which water is continuously provided through the roots. Stability of the yield of continuous X-rays is a required condition for a standard-free method, which makes use of the yield of continuous X-rays mainly emitted from water content. It is confirmed that potassium concentration shows no large position dependence on a leaf, and it keeps almost constant during irradiation, which also indicates that regular metabolism is going on. As potassium is always contained in all kinds of plants in large amount, we designated it as an index element. As a result, it is found that the potassium concentration obtained by the present standard-free method shows quite consistent values with those obtained by the internal-standard method. The present method is confirmed to be quite useful for investigating movement not only of toxic elements but also of essential elements reflecting metabolism in plants.

Keywords : PIXE, Living plant, Standard-free, In-Air, Toxic element, Quantitative analysis