

## **Standard-free method for body fluid samples such as saliva, sweat, snivel and tear and its application to simultaneous multi-element (including fluorine) analysis**

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### **Abstract**

We developed standard-free methods for PIXE analysis of hair, nail, urine and serum, and they have widely been applied to studies on human exposure to some toxic elements caused by pollution in many countries. Although these samples are known to be quite suited for evaluating human exposure to toxic elements, there is a case where it is required to quantitatively analyze other samples taken from people. In this study, we have examined sweat, saliva, snivel and tear, which are expected to be useful for estimating concentration of various elements in a human body. However, sufficient quantities of them are difficult to be taken from a human body and it is required to establish standard-free methods for these samples. In the present work, standard-free methods for sweat and saliva were established and its accuracy and reproducibility are confirmed. It becomes possible to quantitatively analyze only a drop of sweat and saliva by means of this method. For snivel and tear, potassium concentration is obtained by the internal-standard method for a small-spot sample and the conversion coefficient required for the standard-free method was evaluated. As the standard-free methods are free from dryness of samples, which becomes a serious problem in the case where the internal-standard method is applied, it is expected to give more essential information about elemental concentration in a human body.

We have also measured fluorine concentration in these samples taken from humans, together with those of other elements by means of a three-detector measuring system. Fluorine has been known as one of the most toxic elements as well as arsenic, lead, mercury and cadmium which contaminate environment over the wide area. This system allowed us to discuss about fluorine concentration related to other elements'. As one of the conclusion, sweat, snivel and tear give useful information in addition to the samples which have been traditionally analyzed. It is found that titanium concentration in a body is well estimated by analyses of sweat, snivel and saliva, arsenic concentration can be estimated by sweat analysis in addition to urine analysis, and nickel is well evaluated by sweat and tear. In this way, it is required to estimate elemental concentration in a human body by measuring various samples taken from a body. Especially, correlation between fluorine and arsenic is found in a few bio-medical samples.

*Keywords* : PIXE, exposure, standard-free, sweat, saliva, snivel, tear, small quantity, fluorine, toxic element