Bio-medical application of Total reflection X-ray fluorescence analysis

Izumi NAKAI(3307)*[1], Noriaki OHTA(3309)[1], Masaya MATSUNAGA(3314)[1], Chiya NUMAKO(3327)[2], Kenji SAKURAI(1274)[3], Shunji Goto[4]

[1]Science University of Tokyo, [2]Tokushima University,[3]National Research Institute for Metals, [4]SPring-8

Trace element analysis of bio-medical samples will represent an important step in understanding the role of the elements in biological systems. SR induced TXRF analysis has high potential for this purpose.

We have constructed a new TXRF analysis system for biomedical and environmental samples. The characteristic of this system is vertical detector geometry with a horizontal sample holder and a vacuum chamber. The measurements were carried out using undulator beam of 17.5keV. Samples examined were selected from a viewpoint of preliminary analysis to clarify the potential of this system and the beam line as well. The biological samples were digested with acid while water samples were used without any pre-treatment.

Figure 1 shows a TXRF spectrum of the standard river water (10μl) (Analytical Society of Japan: JAC0031). The certified values for Pb, Se, Zn and Ca in 10μl sample solution are 0.26, 1, 7.9pg and 125ng, respectively. This result illustrates the high sensitivity of the technique in the fg region. Figure 2 shows a spectrum of the bovine liver (NIST SRM-1577B): the certified values for Pb, Br, Rb and Sr in the sample (360 μg) are 0.064, 3.5, 4.93 and 0.049ng, respectively. The amount of the sample required for the analysis is less than 1 mg. This enables us to carry out trace element analysis of biopsy samples, which will reveal the dynamical behavior of trace elements in carcinoma tissues, such as time dependent level of trace elements at different progress stages of carcinoma and the correlation among the various trace elements.

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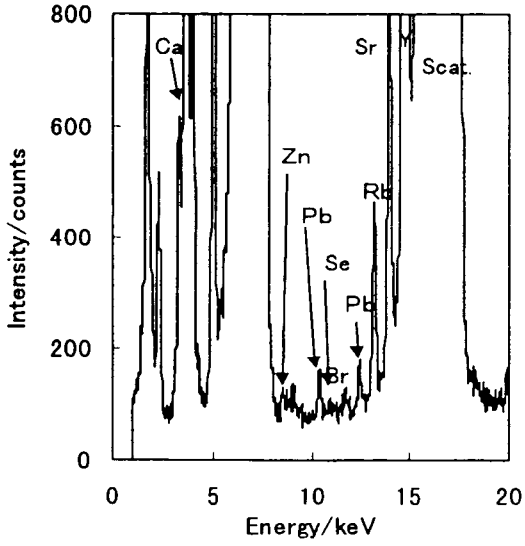

Fig. 1. TXRF spectrum of standard river water (JAC0031: sample 10μl)

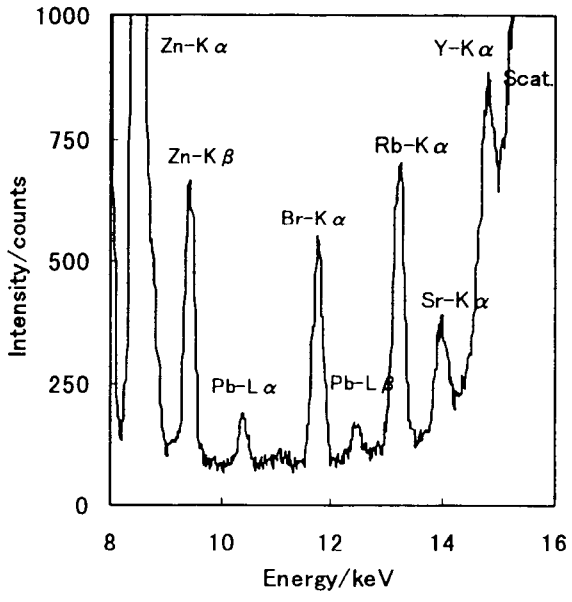

Fig. 2 TXRF spectrum of bovine liver (SRM1577b: sample 360μg)