

Benchtop TXRF spectrometer NANO HUNTER II

Analysis of Trace Elements in Environmental Water

Introduction

In the total reflection X-ray fluorescence (TXRF) method, simple sample preparation requires only pipetting the liquid sample onto a carrier. Multiple elements can be analyzed simultaneously using the internal standard method without preparing calibration curves. Compared to conventional analysis methods such as atomic absorption spectrometry (AAS) and induced coupled plasma optical emission spectrometry (ICP-OES), TXRF method has advantages in time and cost for analysis. In this report, trace elements in environmental water samples were analyzed by the TXRF method.

Measurement and results

NIST 1643f, a certified reference material of fresh water, was analyzed by Rigaku TXRF NANO HUNTER II and lower limits of detection (LLDs) of trace elements were evaluated. A solution of gallium was added to the NIST 1643f as an internal standard. Then, triple of 10 μL of the mixture (30 μL in total) was pipetted onto a quartz glass substrate (Fig. 1). Five measurement specimens were prepared to evaluate the reproducibility of sample preparation.

1: Sampling 2: Pipetted 10 μL 3: Measurement

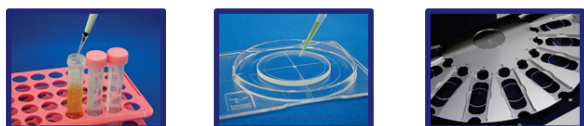


Fig. 1 Sample preparation for TXRF

The TXRF spectrum of the NIST 1643f is shown in Fig. 2. The Si peak in Fig.2 originates from the quartz glass substrate, and the Ga peak originates from the internal standard solution. Analytical results with the Ga internal standard are shown in Table 1.

The results show good agreement with certified values of NIST 1643f. LLDs of transition metals show low values from 0.5 to 1 $\mu\text{g/L}$ (ppb). This report demonstrates that the TXRF method can be used for the analysis of trace elements in water solutions.

Table 1 Analytical result of NIST 1643f (Unit: $\mu\text{g/L}$)

| Element | Certified value | Analytical value | Standard deviation* | LLD |
|---------|-----------------|------------------|---------------------|------|
| K | 1913 | 2081 | 58 | 10.6 |
| Ca | 29140 | 30902 | 1292 | 8.0 |
| V | 36 | 66 | 5.8 | 1.5 |
| Cr | 18 | 13.7 | 1.8 | 2.5 |
| Mn | 37 | 47.8 | 2.4 | 1.0 |
| Fe | 93 | 101 | 4.2 | 0.81 |
| Co | 25 | 24.5 | 0.5 | 0.75 |
| Cu | 21 | 22.3 | 2.9 | 0.55 |
| Zn | 74 | 74.7 | 5.6 | 0.52 |
| As | 57 | 60.7 | 1.2 | 0.36 |
| Se | 12 | 11.5 | 0.8 | 0.42 |
| Rb | 13 | 14.3 | 0.5 | 0.47 |
| Sr | 311 | 380 | 9.6 | 0.48 |
| Pb | 18 | 17.7 | 1.6 | 1.4 |

*: Standard deviation, n=5.

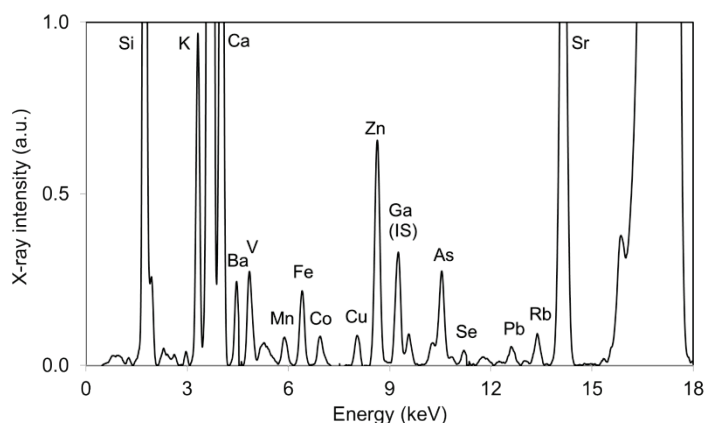


Fig. 2 TXRF spectrum of NIST 1643f

Recommended instrument

► Benchtop total reflection X-ray fluorescence spectrometer NANO HUNTER II