Determination of Sr and Zr Using Microextraction Chromatography

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1. Introduction

A microextraction chromatography system with a column containing Eichrom Sr Resin™ was used for separation of Sr and Zr. The mixture of Sr and Zr was injected into the column. Zirconium was passed through the column using 3 M HNO_3, otherwise, strontium was retained on the column with the same matrix. Then the strontium was eluted with 1% acetic acid with 270 microliters of the elution volume. Total flow rate was about 100 μL/min. The recoveries were 91.0% ± 0.7% and 96.1% ± 0.9% for Sr and Zr, respectably.

2. Materials and methods

2.1 Instrument

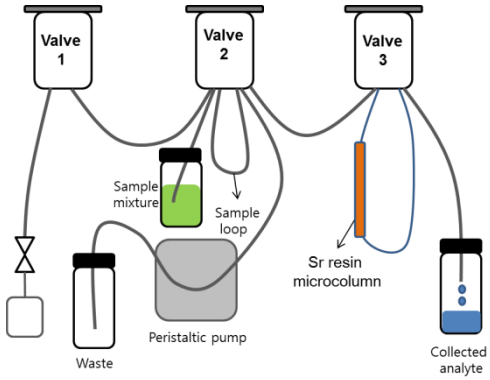

Fig. 1. Setup of microextraction chromatography.

2.2 Analytical procedure

2.2.1 Conditioning of Sr-resin.

- 1 cycle (1 cycle: 270 μL) of deionized water into the injection valve
- 1 cycle of 3 M HNO_3 into the injection valve
- 2 cycles of deionized water into the injection valve

2.2.2 Sample loading (Sr and Zr mixture in 3 M HNO_3).

- 1 cycle of sample is injected into the sample loop at a flow rate of 100 μL/min.

2.2.3 Collection of Zr. Zirconium from sample matrix (3M HNO_3) was passed through the column and collected at the collection vial.

2.2.4 Elution of Sr. The Sr was retained on the column from sample matrix (3M HNO_3). 270 μL of 1% acetic acid was into the sample loop and passed through the column at a flow rate of 100 μL/min.

3. Results and discussion

3.1 Effect of successive elution

The efficiency of successive elution on column from sample matrix was demonstrated the recovery (%) versus the number n of successive elution in Figure 2. The measured recovery in the residual Sr on the column decreased significantly during the first elution, clearly showing that the Sr was efficiently removed with 1% acetic acid.

3.2 Recovery

The calculated recoveries of MEC were 91.0% ± 0.7% and 96.1% ± 0.9% for Sr and Zr, respectably.

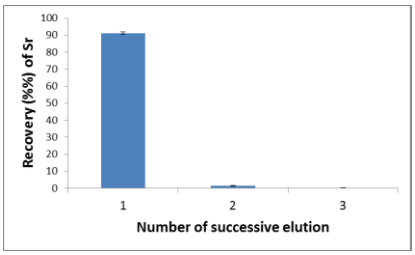

Fig. 2A. Effect of successive elution of Sr,

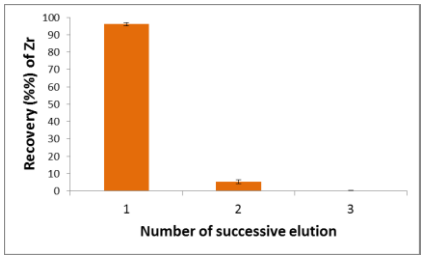

Fig. 2B. Effect of successive elution of Zr.

4. Conclusions

The microextraction chromatography was applied to separate the Sr and Zr mixture using Sr resin. The recoveries of sample were obtained 91% and 96% for Sr and Zr, respectably. Our method used the hundred microliter scaled sample volume, washing and elution solvent volume resulted in reducing the radionuclide waste significantly compared to traditional extraction chromatography.

REFERENCES

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[2] J. L. Steeb et. al., “Microseparations of cesium and barium in glass” J. Radioanal. Nucl. Chem. 292, 757-762 (2012).