

Application of a Micro Channel Device to Enrichment of Dilute Inorganic Ions

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Summary

Micro ion enrichment device falls in a class of micro chemical apparatus, and it can be used to enrich ions in an electrolyte solution. Since it does not require any ion exchange membranes or adsorbents, the cost associated with construction and operation is expected to be lower than that of conventional separation apparatuses. Our previous study showed that it can be used to enrich sodium and potassium ions. In this study, the micro ion enrichment device was applied to separation of dilute fluoride and bromide ions, and their enrichment behavior was examined.

The experiments were conducted using dilute solutions of potassium fluoride and potassium bromide. The concentration was varied from 5 to 300 ppm. Through a study on the effects of flow rates, it was shown that the enrichment factor lowered with decreasing the flow rate for both ions. This trend agrees with the results reported in our previous study on the enrichment of sodium and potassium ions. Under the current experimental conditions, the theoretical enrichment factor was calculated to be 2.0 from the mass balance. In the experiments on the fluoride ions, the largest measured enrichment factor reached 1.9 when the potential difference was 2.0V. Bromide ions were oxidized at such a high potential difference, thus the experiment for bromide ion was carried out at a lower potential difference. As a result, the enrichment factor of the bromide ions were less than 1.2.

The effect of an increase in the flow rate on the enrichment behavior was examined. The potential difference was raised in this study to promote separation under high flow rate conditions. The results revealed that a large potential difference was effective in suppressing the decrease in the enrichment factor caused by a rise in the flow rate.