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A Study of Enrichment Process of Rare Earth Elements from Tamagawa Hot Spring Water

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Tamagawa hot spring water (Akita, Japan) is naturally acidic (pH 1.2) and concentration of rare earth elements (REEs) were found to be very low (1-70 $\mu\text{g/L}$). In this study, an effective enrichment for recovery of the REEs from the acidic hot spring water using adsorption and precipitation methods was investigated. Three polymers, namely Strata-X-C, TE-07 and TE-08 were used for adsorption of REEs from hot spring water, and adsorption and desorption of the REEs were carried out using a column type reactor. A strong cation exchange polymer (Strata-X-C, Phenomenex) was found to have very high adsorption of REEs. It was found that over 99% of REEs were adsorbed by Strata X-C within 1 min when the flow rate of hot spring water was 1 mL/min. Hydrochloric acid (6M-HCl) was used for desorption of REEs from polymeric resins, and results revealed that 70% of REEs could be recovered from the adsorbent by desorption. For further enrichment of REEs from the concentrated solution, NaOH was added in the solution to generate REEs as hydroxide precipitate. Consequently, the precipitate found to contain 1,100 g/t of REEs and we could enrich the over 5,700 times higher concentration of REEs compared to original Tamagawa hot spring water.

Key Words : Rare earth elements, Hot spring water, Adsorption, Precipitation