A Study on Anion Exchange Separation of Neptunium from Irradiated Uranium

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Phillips and Jenkins[1] reported the removal of plutonium by nitrate-form anion exchanger before the analysis of fission products. According to their study, plutonium (IV) is adsorbed onto an anion exchange resin from 7.5 N nitric acid solution forming nitrate complex, but fission products and uranium pass through the column and are separated from plutonium. This method is used in a separating plant of plutonium fuel[2].

In the present communication, the adsorption of neptunium is studied in a similar way and a good separation of neptunium from fission products and uranium is found. Neptunium-239 obtained by the following way is used as a tracer.

Distribution coefficient (K_d) of neptunium is measured in systems of nitric acid and nitrate-form anion exchanger (Dowex 1, 100~200 mesh) by batch method. Figure 1 shows the acid dependence of the K_d value. In the concentration range from 1 to 10 N nitric acid, K_d value shows a linear relationship toward the concentration of nitric acid on a logarithmic scale. The maximum value is about 10^3 at 10 N nitric acid and beyond this normality the K_d value decreases suddenly.

The separation study is carried out as follows. Uranium nitrate (10 mg. U) is irradiated in J.R.R.-1 Reactor for two hours at a flux of 10^{11} neutrons/cm^2/sec.

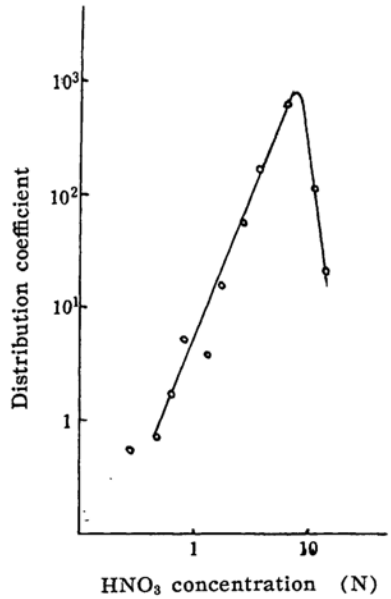

Fig. 1. The acid dependence of the distribution coefficient of Np.

The irradiated sample is dissolved in 1 N hydrochloric acid. A few mg of ascorbic acid is added to the solution in order to keep neptunium at a reduced state. After drying up the solution, the residue is taken up by 7.5 N nitric acid and then neptunium is eluted with 0.7 N nitric acid. Figure 2 shows the elution curve. According to the γ-ray spectrometry, no neptunium is found in 7.5 N nitric acid fraction. On the other hand, a spectrograph of pure ^{239}Np is obtained in 0.7 N nitric acid fraction. When the reduction procedure is omitted, the elution peaks of neptunium and fission products appear very closely in 7.5 N nitric acid and the separation is unsatisfactory.

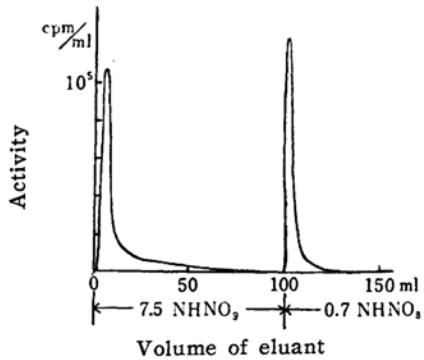

Fig. 2. The elution curve of Neptunium and fission products.

1) G. Phillips and E. N. Jenkins, *J. Inorg. Nucl. Chem.*, 4, 220 (1957).
2) W. M. Campbell, *Nucleonics*, No. 9, 92 (1956).

From these facts, it is likely that neptunium forms a nitrate complex at a lower oxidation state in 7.5 N nitric acid and is adsorbed onto an anion exchanger, but a higher oxidation state the complex formation is very weak.

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