SHORT COMMUNICATIONS

Rapid Separation of Nuclides in Fission Products and their Determinations by Focussing Chromatographic Method

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Although many procedures such as ion exchange, extraction, paper chromatographic and precipitation methods etc. have been applied to the separation of nuclides in fission products, the present focussing chromatographic method has been proved to be more rapid and convenient for their determinations comparing with other methods mentioned above.

The apparatus and its manipulation were the same as in previous paper[1]. As the complexing agent of cathodic solution, 0.1 M citric, oxalic, malonic, malic, maleic, lactic, succinic and tartaric acid, 0.05 M sodium triphosphate, 0.01 M EDTA and NTA were used and hydrochloric acid was used as cathodic solution in the present experiment.

The separation of several kinds of nuclide in fission products (imported from U. S. A.) were possible in a few minutes by the adjustment of pH value between both solutions of hydrochloric acid and complexing agent under suitable conditions of initial dipped width of sample solution (1~3 cm.) and applied voltage (750~1000 V./20 cm. of strip length). The autoradiographic method was used to decide the position of separated lines. Identification of nuclides was carried out by measuring their half-lives and energies.

Autoradiogram exemplified in Fig. 1, shows the situation of separation obtained by hydrochloric acid-citric acid system. Fig. 2 shows the general view of the separated patterns obtained with several complexing agents.

Separated lines of ^{137}Cs and ^{95}Zr in fission products were formed with the complexing agent without mutual contaminations. Quantitative determinations of ^{137}Cs and ^{95}Zr proved

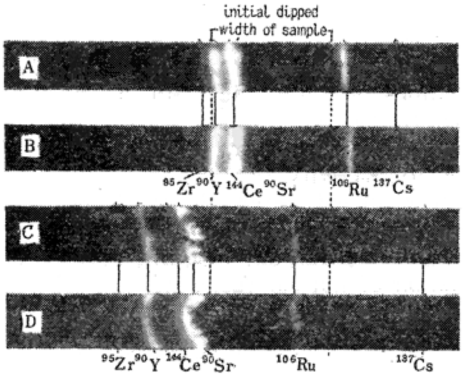

Fig. 1. Autoradiogram of separated lines of nuclides in fission product.
Complexing agent: 0.5 M citric acid (pH 4.5), hydrochloric acid: pH 1.5, initial dipped width of sample: 3 cm., sample volume: 0.05 ml. at A and B, 0.1 ml. at C and D, applied voltage: 1000 V./20 cm., duration time of applied voltage: 5 min. at A and B, 10 min. at C and D, autoradiographic exposure time: 2 hr., X-ray film: Fuji medical, 25 cm.×30 cm., paper strip: Toyo Roshi No. 50.

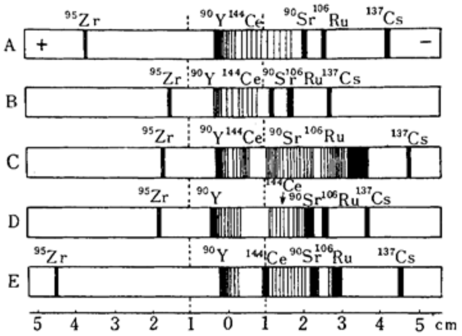

Fig. 2. General view of the separated pattern obtained with several complexing agents.
A: 0.1 M malonic acid, B: 0.1 M succinic acid, C: 0.1 M lactic acid, D: 0.1 M malic acid, E: 0.1 M maleic acid.
Anodic solution: 0.05 N hydrochloric acid and sodium chloride, cathodic solution: pH 7.0.
Applied voltage: 700 V./20 cm., duration time of applied voltage: 15 min., initial dipped width of sample: 2 cm., autoradiographic exposure time: 24 hr., paper strip: Toyo Roshi No. 50, X-ray film: Fuji medical, 25 cm.×30 cm.

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[1] *J. Chem. Soc. Japan, Pure Chem. Sec.* (*Nippon Kagaku Zasshi*), in press; (Presented at the 8th Annual Meeting of the Japan Society for Analytical Chemistry, Okayama, Oct., 1959).

to be effective by measuring γ-activity of their separated lines cut from the paper strip. The mean deviation rate of reproducibility of radioactivity obtained and recovery were found within ±5% and 95±5% respectively, from the result of blank test using the standard sample solution prepared by mixing with known amounts of ^{95}Zr (^{95}Nb), ^{144}Ce (^{144}Pr), ^{90}Sr (^{90}Y) and ^{106}Ru (^{106}Rh). Even when the closeness or overlapping of separated lines of ^{90}Y and ^{144}Ce, or ^{90}Sr and ^{106}Ru, the determinations of ^{144}Ce and ^{106}Ru by γ counting were feasible with an accuracy of the same order as ^{137}Cs and ^{95}Zr, because ^{90}Y and ^{90}Sr have no γ-activity.

The proposed method is considered to be a new rapid and simple method for analysis of product; i. e. fall-out analysis, burn-up determination of nuclear fuels, etc.

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