CONTINUOUS ELECTROPHORETIC SEPARATIONS OF RADIOACTIVE RARE EARTH MIXTURES

II. SEPARATION OF ^{147}Nd–^{169}Er–^{177}Lu, ^{144}Ce–^{153}Gd–^{177}Lu, AND ^{144}Ce–^{147}Pm–^{160}Tb–^{169}Er–^{177}Lu IN 0.05 *M* LACTIC ACID

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INTRODUCTION

In a previous report[1] we tried to separate two rare earth mixtures, ^{144}Ce–^{160}Tb–^{170}Tm and ^{144}Ce–^{152}Eu–^{169}Yb, on a preparative scale by continuous electrophoresis using 0.05 *M* lactic acid as background electrolyte. Meanwhile a separation of the mixture ^{115}Cd–^{114}In, which served as a model mixture for a possible preparative continuous electrophoretic separation of ^{111}In together with ^{114}In from a Cd-cyclotron target, has also been reported[2]. In the present paper further separations of three-component rare earth mixtures are reported. To extend the possibilities of separation to mixtures of five components, it was necessary to enlarge the basic apparatus[3,4] in the horizontal direction and to introduce appropriate modifications.

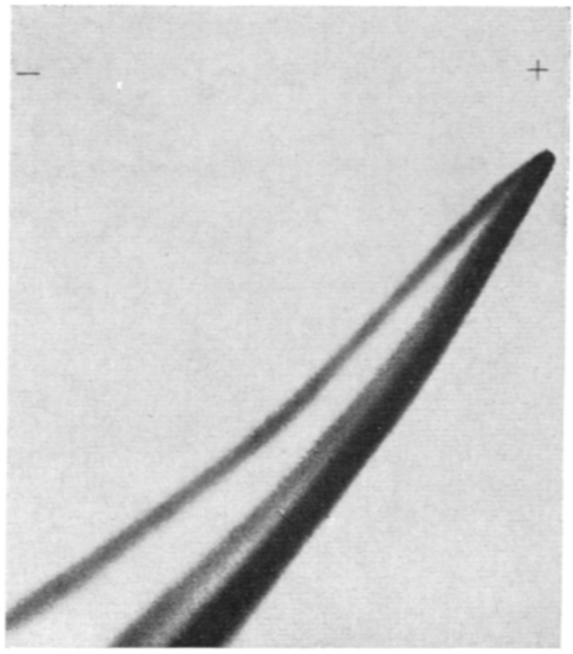
EXPERIMENTAL AND RESULTS

The apparatus[3,4] and experimental conditions[1] used for the separation of the two three-component mixtures Nd–Er–Lu and Ce–Gd–Lu (Figs. 1–4) have been described earlier. The activities represented in the diagrams below the radioautographs (Figs. 1 and 2) were collected during 0.5 hour.

Figs. 3 and 4 represent radioautographs of the discontinuous operation corresponding to Figs. 1 and 2. The spots of the mixtures were applied on the points marked on the radioautographs with ×. Ce and Gd, under given experimental conditions (concentration of lactic acid), show a considerable adsorption on filter paper with characteristic tailings.

For the separation of the five-component mixture the apparatus was enlarged in the horizontal direction from 29 to 64 drip points, which corresponds to an enlargement of the free width of the filter paper curtain from 30 to 65 cm (Fig. 5).

Because of the great width of the separation sheet, it was necessary to introduce a separate feeding sheet which supplies the separation sheet with the background



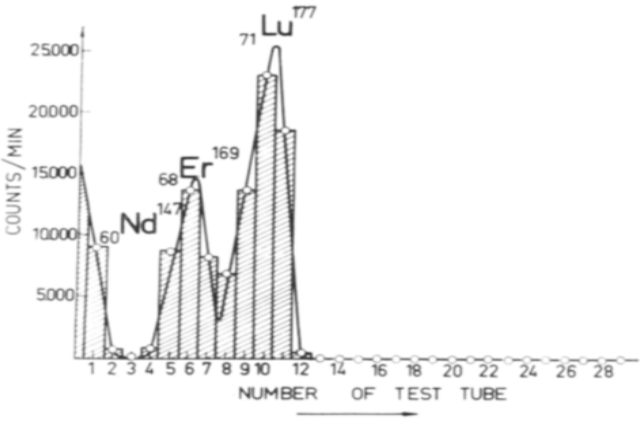
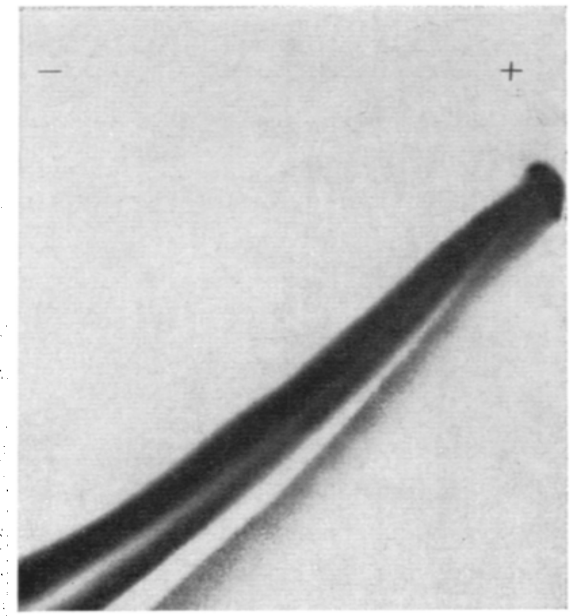


Fig. 1. Radioautograph of the continuous electrophoretic separation of ^{147}Nd–^{169}Er–^{177}Lu. The diagram below represents the activities of separated rare earths which were detected in the collecting glasses. Collecting time was 0.5 h. Electrolyte, 0.05 *M* lactic acid; paper, Munktell No. 20/250; voltage drop, 300 V; mean electrical field strength, 10 V/cm; current, 20 mA; pumping rate, 0.2 ml/h.



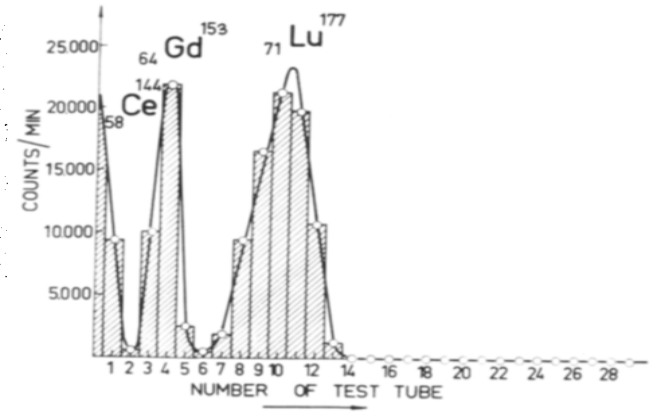


Fig. 2. Radioautograph of the continuous electrophoretic separation of ^{144}Ce–^{153}Gd–^{177}Lu. The diagram below represents the activities of separated rare earths which were detected in the collecting glasses. Collecting time was 0.5 h. Electrolyte, 0.05 *M* lactic acid; paper, Munktell No. 20/250; voltage drop, 300 V; mean electrical field strength, 10 V/cm; current, 20 mA; pumping rate, 0.2 ml/h.

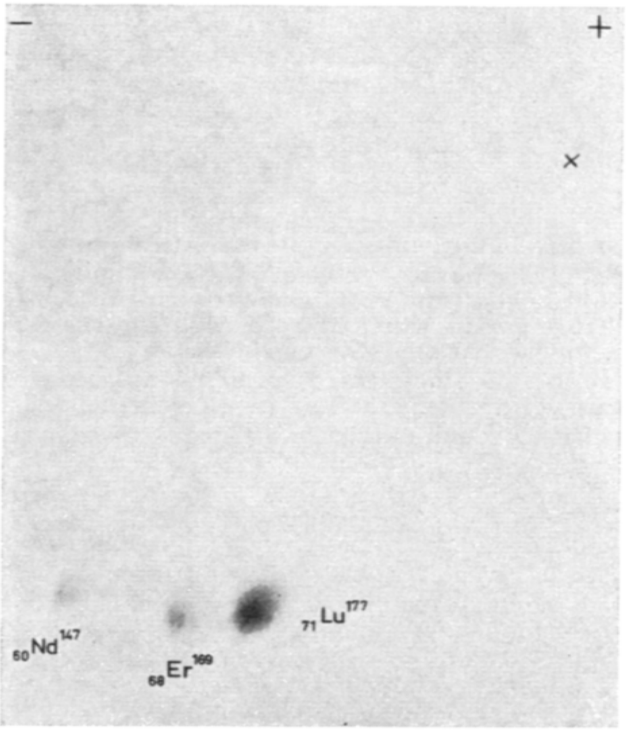


Fig. 3. Radioautograph of the two-dimensional electrochromatographic separation of ^{147}Nd–^{169}Er–^{177}Lu, corresponding to the experimental conditions of Fig. 1.

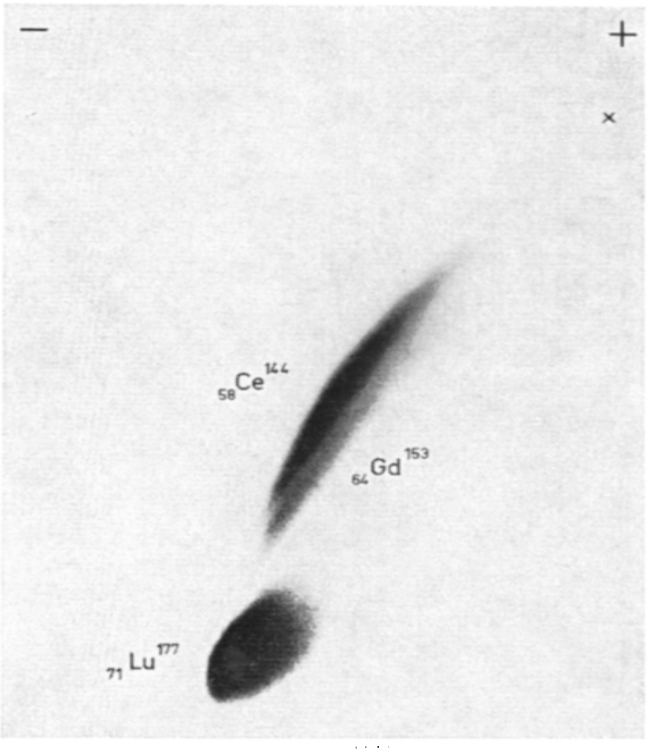


Fig. 4. Radioautograph of the two-dimensional electrochromatographic separation of ^{144}Ce–^{153}Gd–^{177}Lu, corresponding to the experimental conditions of Fig. 2. Note the relatively strong adsorption of Ce and Gd on filter paper.

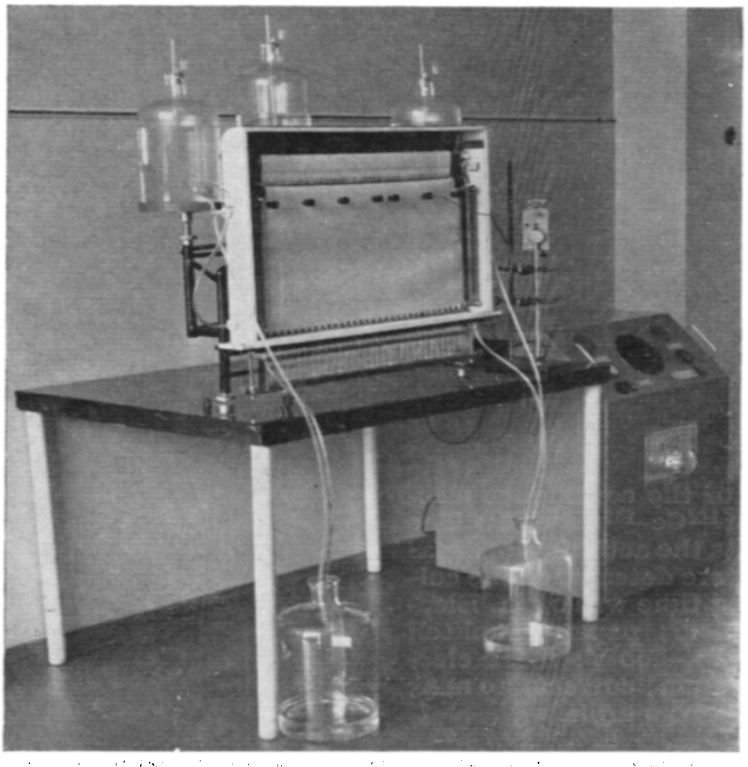
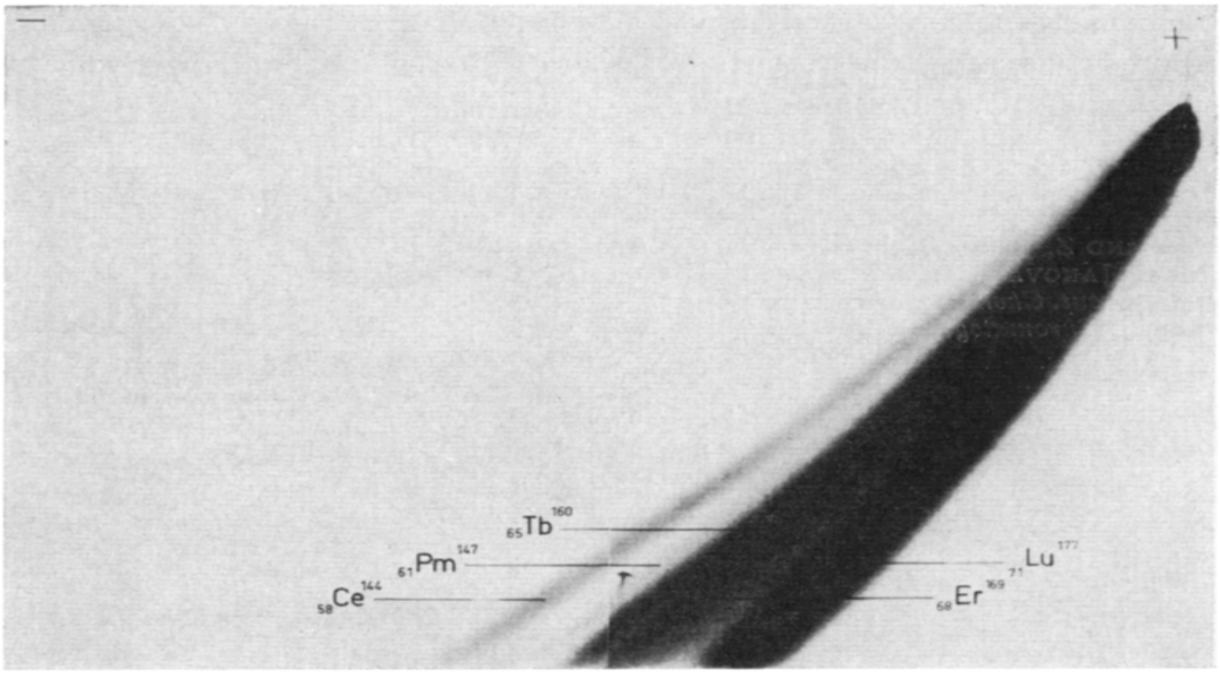


Fig. 5. General view of the separation unit.

electrolyte from the buffer trough. This feeding sheet is not in contact with the electrical current, and thus the shunt effect of the buffer trough is greatly reduced.

Fig. 6 represents the continuous separation of a five-component mixture of rare earths. The voltage drop between the electrodes was 1000 V, the mean electrical field strength 15.4 V/cm, and the current 40 mA. The pumping rate of the rare earth solution was 0.12 ml/h.



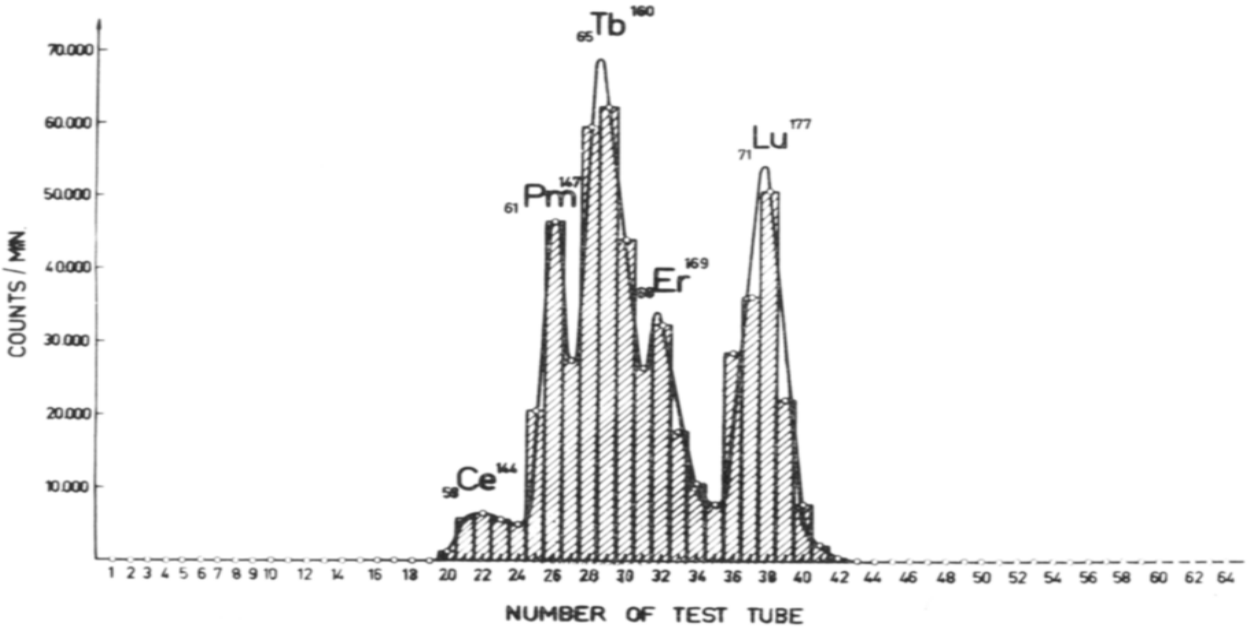


Fig. 6. Radioautograph of the continuous electrophoretic separation of ^{144}Ce–^{147}Pm–^{160}Tb–^{169}Er–^{177}Lu. The diagram below represents the activities of separated rare earths which were collected in the collecting glasses. Collecting time was 0.5 h. Electrolyte, 0.05 *M* lactic acid; paper, Munktell No. 20/250; voltage drop, 1000 V; mean electrical field strength, 15.4 V/cm; current, 40 mA; pumping rate, 0.12 ml/h.

SUMMARY

Radioautographs of the continuous electrophoretic separations of the rare earth mixtures ^{147}Nd–^{160}Er–^{177}Lu, ^{144}Ce–^{153}Gd–^{177}Lu and ^{144}Ce–^{147}Pm–^{160}Tb–^{169}Er–^{177}Lu in 0.05 *M* lactic acid are given. Below each radioautograph the activities of the separated rare earths, which correspond to a 0.5 hour run, are presented in a diagram. Radioautographs of the two-dimensional electrochromatographic separations of the two three-component mixtures are also given. The separation of the five-component mixture required an enlargement of the basic apparatus in the horizontal direction and appropriate modifications of the apparatus.

REFERENCES

1 Z. PUČAR AND Z. JAKOVAC, *J. Chromatog.*, 3 (1960) 477.
2 Z. KONRAD-JAKOVAC AND Z. PUCAR, *Croat. Chem. Acta*, 33 (1961) 33.
3 Z. PUČAR, *Croat. Chem. Acta*, 28 (1956) 195.
4 Z. PUČAR, *J. Chromatog.*, 4 (1960) 261.