Short Communications

Paper chromatography of inorganic ions in nitrate solutions
I. Scandium, yttrium, actinium and the lanthanides

The separation of the rare earths by paper chromatography in nitric acid media and a number of organic solvents was investigated by LEDERER[1]. Under these conditions a slight difference between the individual R_F values was observed, but no separation could be achieved since considerable tailing occurred.

Analogous results were obtained in anion-exchange studies of the rare earths in HNO_3 media[2]. These elements are adsorbed to a slight extent by Dowex-1 from concentrated HNO_3 solutions, but the small differences between the values of the distribution coefficients do not allow efficient separations.

Further studies have shown that the adsorption of these elements by the resin is considerably enhanced when a soluble nitrate such as lithium nitrate is added to the HNO_3 solution[3]. Successful separations of Ac and La[3] and of the individual lanthanides[4] on Dowex-1 were obtained in this medium.

On the basis of these results we investigated the separation of Sc, Y, Ac and the lanthanides by paper chromatography in $LiNO_3$ solution. Since the rare earths are extracted by alcohols from concentrated nitrate solutions[5] we used this kind of solvent in our investigations. The results obtained in a typical experiment are given in Table I. These data were obtained by descending development during 72 hours

TABLE I

Element	R_F	*Element*	R_F	*Element*	R_F
La	0.40	Sm	0.55	Er	0.64
Ce	0.46	Eu	0.55	Y	0.58
Pr	0.51	Gd	0.56	Sc	1.00
Nd	0.54	Dy	0.62		

of a chromatogram in butanol previously saturated with a solution 7 M $LiNO_3$–2 M HNO_3, at room temperature (25° ± 3°). The rare earths were detected with 8-hydroxyquinoline followed by examination of the fluorescence of the spots in ultraviolet light. The R_F values obtained *under these conditions* are referred to the second (dark) front of the solvent.

In Fig. 1 a chromatogram obtained with La, Y and Sc under the same conditions is reproduced.

The separation of trace amounts of actinium from lanthanum was investigated with ^{228}Ac (MsTh II, β, γ, half-life 6.13 hours). This radioelement was extracted from

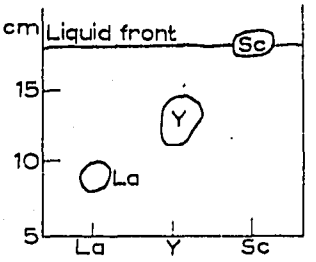

Fig. 1.

a ^{228}Ra source (MsTh I) and its purity was checked by half-life period measurements in a scintillation counter. The results obtained with a development period of 30 hours are shown in Fig. 2.

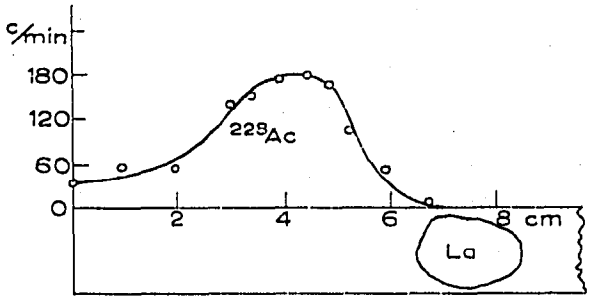

Fig. 2.

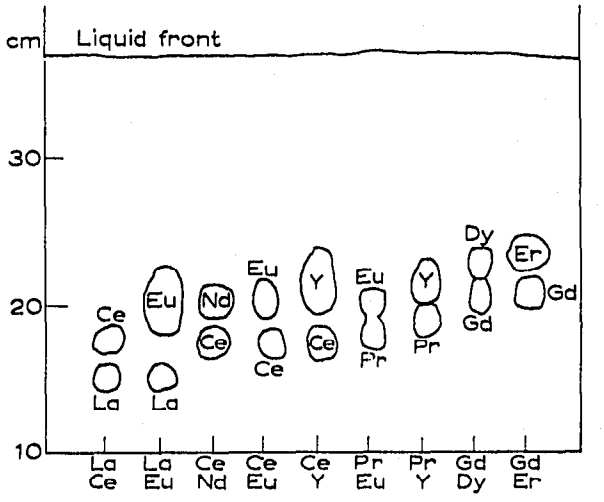

Fig. 3.

Fig. 3 illustrates a number of separations of the lanthanides.

The results given in Table I demonstrate that the experimental conditions are not suitable for the separation of adjacent lanthanides, except for La, Ce and Pr. No improvement in the separations was obtained by using other solvents such as ethyl, propyl, amyl and iso-amyl alcohol or by developing the chromatograms at higher temperatures.

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