The adsorption of europium and cerium on a strong base anion exchange resin from dilute nitric acid solutions containing aliphatic alcohols

Although rare earths are not appreciably adsorbed by strong base anion exchangers from nitric acid solutions[1,2], adsorption from dilute nitric acid–ethanol[3] and dilute nitric acid–methanol[4] solutions has been reported. This note describes the adsorption of europium and cerium tracers on Dowex-1 (nitrate form) from dilute nitric acid solutions containing different alcohols of the aliphatic series, *viz.* methanol, ethanol, 1-propanol, 2-propanol, 1-butanol, 2-butanol and 1-pentanol.

Experimental

Materials. Air dried Dowex-1, 8 X, 50–100 mesh, in the nitrate form. Reagent grade methanol, ethanol, 1-propanol, 2-propanol, 1-butanol, 2-butanol and 1-pentanol. C.P. HNO_3 (s.g. 1.14). ^{144}Ce ($T_{\frac{1}{2}} = 290$ d) and $^{152}+^{154}Eu$ ($T_{\frac{1}{2}} = 16$ y) tracers were obtained from the Radiochemical Centre, Amersham, in a high state of purity as determined by their analyses.

Determination of rare earth adsorption. 0.5 g resin was shaken with 25 ml of the appropriate nitric acid–aliphatic alcohol solution containing ^{144}Ce or $^{152}+^{154}Eu$ tracer in a stoppered 100 ml Erlenmeyer flask for 24 h at 25° ± 1°.

5 *N* HNO_3 solutions containing 96, 88, 80 and 72 % of the respective aliphatic alcohols were investigated. (The preparation of these solutions is illustrated by the following example: 1 ml of 5 *N* HNO_3 and 24 ml alcohol gave a mixture which contained 96 % alcohol.) In the case of 1-pentanol two layers were formed at less than 88 % alcohol so that in this case rare earth adsorption was only recorded at 88 and 96 % alcohol concentration.

From radiometric analysis of the liquid phase before and after equilibration, the percentage rare earth activity adsorbed by the resin was computed.

Blank runs without added resin showed no significant tracer adsorption by the container walls. All equilibrations were carried out in duplicate, the average spread of the duplicate determinations was 15 %.

Results and discussion

Figs. 1 and 2 show respectively the percentage adsorption of europium and cerium tracers on Dowex-1 (nitrate form) from dilute nitric acid solutions containing aliphatic alcohols.

The curves show that the adsorption of the rare earths on the resin increases with increasing alcohol concentration. This effect is similar to that obtained for the adsorption of Y, Nd and La on Dowex-1 from dilute nitric acid (0.8 *N*) containing varying concentrations of ethanol (0, 20, 40 and 80 %)[3].

With the exception of the adsorption of Eu from methanol, it is clear from Figs. 1 and 2 that the rare earth adsorption from nitric acid–aliphatic alcohol solutions decreases with increasing length of the primary carbon chain in the alcohols concerned. TERA, KORKISCH AND HECHT[5] found that the adsorption of thorium on Dowex-1 (NO_3 form) from nitric acid–aliphatic alcohol solutions decreased with increasing length of the carbon chain in the alcohols concerned. Secondary alcohols such as

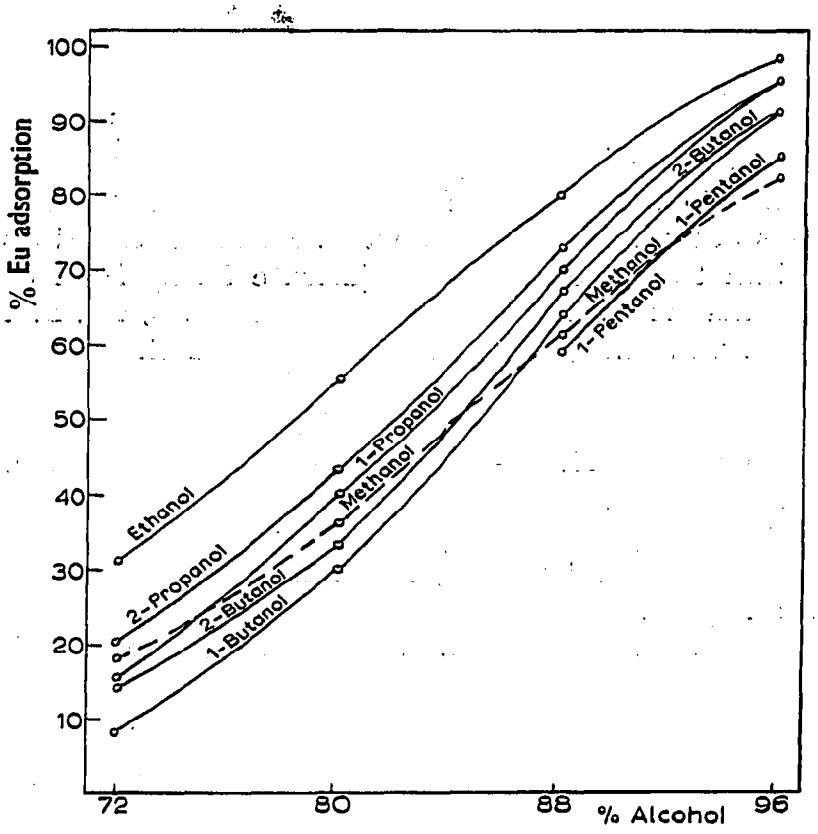

Fig. 1. Adsorption of europium by Dowex-1 from dilute nitric acid solutions containing aliphatic alcohols.

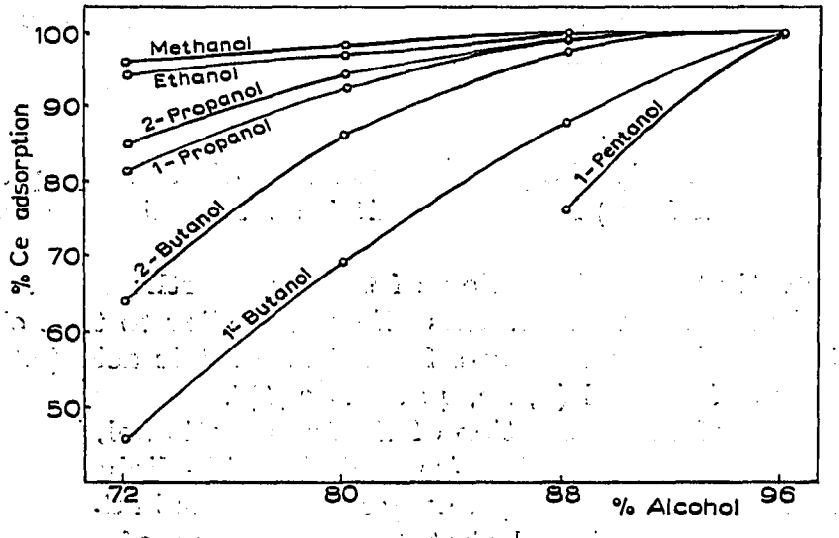

Fig. 2. Adsorption of cerium by Dowex-1 from dilute nitric acid solutions containing aliphatic alcohols.

2-propanol and 2-butanol, however, behaved like the corresponding normal alcohols.

At constant alcohol concentrations, the adsorption of Eu and Ce from all the nitric acid–aliphatic alcohol solutions examined was in the order Eu < Ce. The lighter rare earths were more strongly adsorbed than the heavier earths on strong-base anion exchange resins from dilute nitric acid–ethanol solutions[3].

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Department of Chemistry, R. A. EDGE
University of Cape Town, Rondebosch (South Africa)

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Eine neue Methode zur Sichtbarmachung der Säurehydrazide bei der Papierchromatographie

Zur Sichtbarmachung der Flecken der Säurehydrazide standen bisher nur einige Methoden zur Verfügung. SATAKE UND SEKI[1] schlugen zu diesem Zweck eine 10 %ige butanolische Silbernitratlösung vor und HINMAN[2] empfehlte *p*-Dimethylaminobenzaldehyd in saurer Lösung. Auch Ninhydrin konnte in bestimmten Fällen angewendet werden[2].

In unserem Laboratorium benützen wir zur Sichtbarmachung der Säurehydrazide die Reaktion mit Diazoniumsalzen[3]. Die Chromatogramme werden mit einer 0.5 % Lösung von 1-Diazo-4-nitrobenzol naphthalin-1,5-disulfonat[4] im 50 %igen wässrigen Alkohol besprüht. Dadurch erscheinen die Säurehydrazide als gelbliche Flecken, die durch weiteres Besprühen mit 5 %iger wässriger Natronlauge intensiv rotviolett gefärbt werden. Die Färbungen sind stabil, die Erfassungsgrenze ist für aliphatische Säurehydrazide 0.2 μg.

Durch Reaktion des Diazoniumsalzes mit den Säurehydraziden werden die entsprechenden Diazohydrazide gebildet, die unter Wasserabspaltung in die im alkalischen Medium intensiv gefärbten 1,2,3,4-Tetrazole überführt werden: