

Finally the following consideration makes it possible to measure the interfering effects. When chromatography is carried out with distilled water, eqn. (6) will give $-\Delta\mu = 0$ and from eqn. (3) we obtain

$$\frac{1}{R_F} = \frac{A_s}{A_m} + 1 \quad (9)$$

i.e. R_F is independent of molecular volume and constant (≈ 0.88), which was found experimentally to be true for such widely differing compounds as: xanthine, coffeine, uric acid, tetramethyluric acid, urea, glycine, leucine, acetohydroxamic acid. We postulate that any deviation from this limit is a measure of the effect of adsorption, precipitation, etc.

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Chromatography on paper impregnated with ion exchange resins

IV. The adsorption of metal ions on Dowex-50 from dilute HF solution

In this note we wish to describe a simple method for determining whether a metal ion in a given solution adsorbs on a cation exchanger. For this purpose KRAUS¹ recommends running short column chromatograms. Ion exchange papers yield the same information and offer perhaps some advantages over both columns and equilibrium studies, since the bands can be detected on the paper after development by the use of

suitable spraying reagents. In the case of HF solutions it is also of advantage that only a minimum of equipment is required.

The distribution of cations between ether and aqueous HF solutions was studied by BOCK AND HERRMANN² and partition chromatographic studies with solvents and HF or solvents-HF-mineral acids were carried out in the author's laboratory by KERTES³, VERNOIS⁴ and others⁵. Also CROUTHAMEL AND FUDGE⁶ described some paper chromatographic studies with fission products. Anion exchange properties of numerous metal ions in HF were recorded by KRAUS and his coworkers⁷.

We shall report here the affinity of a number of metal ions in dilute HF to Dowex-50 as this was considered of interest for possible separations of protactinium from other elements. Dowex-50 paper was prepared as already described⁸ and developed in polythene containers by ascending development. As solvent a 2% v/v solutions of conc. HF (containing 40% HF) in water was used. The solutions of the metal ions were prepared by dissolving a salt which does not contain a complexing anion (usually the nitrate) or an oxide in 2% HF in small polythene beakers. Since in the cases where the metal ion is adsorbed, the anion moves near the liquid front, the anion does not interfere as would be the case in equilibrium studies.

The following metal ions were found to stay at the point of origin or move only a short distance (below R_F 0.1): Tl, Ag, Cd, Mn, Ni, Co, Cu and Zn. Numerous metal ions moved at or little below the liquid front: Fe(III), U(VI), Zr(IV), Pa(V) (as ²³³Pa tracer), Ta(V), Nb(V), Ti(IV), Be(II), Al(III), Mo(VI) and Cr(VI). Tetravalent vanadium (dissolved in HF as V(SO₄)₂) moves with an R_F 0.35. Metal ions such as alkaline earths and rare earths were not studied as they are rather insoluble in dilute HF.

Dowex-50 or Dowex-50 papers may thus be employed for separating a number of divalent transition elements from Pa(V) or any other of the fast-moving metal ions. Zn and Cd which complex readily in HCl are strongly adsorbed from HF solution.

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