For photography, the gels are rinsed with water and placed on a clean glass plate. They can be stored in plastic boxes in diluted acetic acid, or dried as described by WOODWORTH AND CLARK[3].

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Received April 25th, 1969

J. Chromatog., 43 (1969) 145–149

CHROM. 4141

Chromatography on ion exchange papers

XXIV. The adsorption of chlorocomplexes of metal ions on a carboxylic resin from HCl solutions

In this series of papers we have dealt repeatedly with adsorption effects other than actual "ion-exchange" on various resin and cellulose exchangers. While the work of NELSON *et al.*[1] shows adsorption of metal ions on a sulphonic acid resin from both HCl and $HClO_4$ solutions we were not aware of any data on the adsorption of chlorocomplexes on a carboxylic acid resin from relatively concentrated HCl solution *i.e.* under conditions where the carboxylic group must be considered as completely unionised.

Experimental

The metal ions were chromatographed, in the ascending manner, on washed Amberlite WA-2 paper strips in the H^+ form.

We found considerable variation of R_F values with the amount of the metal ion chromatographed, *i.e.*, a rather low capacity as would be expected in absence of ionised exchange groups. The R_F values are thus in most instances given as a range rather than precise values for an exact concentration. The results obtained with a number of chlorocomplexes is shown in Table I and compared with the adsorption on pure cellulose paper (second last column).

Strong adsorption was observed with Au(III), Bi(III), Pt(IV) and Tl(III). Only in the case of Bi(III) is the general trend of increased adsorption with increased HCl concentration reversed and Bi(III) is more strongly adsorbed in 2 *N* HCl than

TABLE I

R_F VALUES OF METAL IONS ON AMBERLITE WA-2 PAPER (CONTAINING 45% OF AMBERLITE IRC-50 AN ACRYLIC RESIN WITH CARBOXYL GROUPS) IN VARIOUS CONCENTRATIONS OF HCl

Metal ion	*2 N HCl*	*4 N HCl*	*6 N HCl*	*8 N HCl*	*On Whatman No. 1 paper with 6 N HCl*	*On Whatman AE 30 amino ethyl cellulose paper with 2 N HCl (ref. 2)*
Cd(II)	0.75–0.85	0.8–0.9	0.73	0.5 –0.65	0.6	0.6
Hg(II)	0.4 –0.6	0.6	0.58	0.5 –0.6	0.78	0.4
Au(III)	0.23	0.17	0.12	0.12	0.50	0.22
$PtCl_6^{2-}$	0.27	0.30	0.28	0.2 –0.3	0.71	0.35
$PdCl_4^{2-}$	0.46	0.52	0.51	0.4	0.70	0.4
As(III)	0.6 –0.8	0.6–0.75	Not detected	Not detected	0.80	
Fe(III)	0.9	0.9	0.7	0.35	0.80	0.8
UO_2^{2+}	0.9	0.9	0.7	0.35–0.5	0.73	0.9
Tl(III)	0.25–0.35	0.30	0.40	0.4	0.81	0.4
Ga(III)	Liquid front	0.85	0.5	0.15	0.88	0.7
Sb(III)	0.58	0.5–0.65	0.48	0.4–0.5	0.85	0.45
Bi(III)	0.13	0.21	0.32	0.3–0.35	0.81	0.38

in 4 *N* or higher concentrations. When the results obtained here are compared with adsorption on anion-exchangers it can be seen that the R_F values are almost identical with those obtained on Whatman AE aminoethylcellulose paper (results in 2 *N* HCl last column of Table I), Bi(III) being an exception.

It is remarkable that a carboxylic acid resin with an acrylic network and a cellulose with added aminoethyl groups can give such similar results with so obviously different adsorption mechanisms. It suggests also that adsorption systems are worthy of investigation even if the properties and exchange groups do not *a priori* promise results.

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Received May 2nd, 1969