Chloride Complexes of Tervalent Americium

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The behaviour of various actinides in hydrochloric acid solution has been the subject of several investigations *e.g.* [1-4]. In this study the stability constants of the americium(III) complexes present in a perchloric-hydrochloric acid medium with an acidity and ionic strength of 4 M were determined. The complexes were studied by the cation exchange method developed by Fronæus [5] with the ion exchanger (Dowex 50 W × 8, 50–100 mesh) in the hydrogen form. The experimental procedure was as follows:

0.100 ml of an americium(III)-stock solution was added to 5.00 ml of solutions of the composition:

$$C_{HCl} = a \text{ M}$$
$$C_{HClO_4} = 4.00 - a \text{ M}$$

The solution was then equilibrated with 250 mg ion exchanger in a thermostat at a temperature of 20°C. The americium concentration was determined radiometrically before and after equilibrium and from these data the distribution coefficient φ was computed. At each ligand concentration the distribution coefficient was determined at different values of the total americium concentration. In no case did the distribution coefficient vary with the americium concentration; the ion exchanger is thus monofunctional in the concentration range used here. The reproducibility of the measurements was within ± 2 %.

The φ-values and the functions necessary for the computation of the stability constants are given in Table 1. The notation and the method of calculation is described in an earlier communication [6]. From the experimental data given in the table it is possible to determine the stability constants of two complexes $AmCl^{2+}$ and $AmCl_2^+$. The following values were obtained:

$$\beta_1 = 0.69 \pm 0.03 \text{ M}^{-1}$$
$$\beta_2 = 0.18 \pm 0.04 \text{ M}^{-2}$$

The value of β_1 is in good agreement with previously determined values (*e.g.* Ref.[3]). No value of β_2 has so far appeared in the literature.

Table 1. Corresponding values of $[Cl^-]$, φ, φ_1, f and β_1 for the americium chloride system.

$[Cl^-]$ mM	$\varphi \times 10^3$ l. g^{-1}	φ_1 M^{-1}	f M^{-2}	β_1 M^{-1}
0	42.5	*0.66*	*0.275*	
100	39.6	0.73		
300	35.0	0.71	0.289	
500	31.0	0.74	0.324	
750	27.0	0.77	0.364	
1000	23.5	0.81	0.385	0.73
1250	20.6	0.85	0.409	0.71
1750	16.1	0.94	0.460	0.66
2000	14.3	0.99	0.488	0.65
2500	11.8	1.04	0.534	0.68
3000	10.0	1.08	0.574	0.71
3500	8.1	1.21	0.642	0.67

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