ELECTROCHEMICAL BEHAVIOUR OF MIXED LIGAND EUROPIUM COMPLEX AT DME

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Author has studied the formation of mixed ligand complexes of Eu(III) with acrylic acid and crotonic acid using polarography and reported the results of the investigations.

EXPERIMENTAL

All the chemicals used were of analytical reagent grade and their Solutions were prepared in doubly distilled water. Eu(III) [1] solution was standardized using amperometric titrations. The pH measurements were made on Toshniwal-pH meter model (CL-46). The pH of the test solution was fixed at 4.5, the average pKa value of crotonic and acrylic acid. Ionic strength was kept constant at μ = 1.0 using potassium chloride solution. Gelatin was used as a maximum suppressor. Polarograms were obtained by means of a degital polarograph (Toshniwal CLO-2 B). Purified nitrogen was used to dearate the test solution.

All observations were made at 25 ± 1°C. The DME with a charecteristic of $m^{2/3}\ t^{1/6}$ = 2.31 $mg^{2/3}\ sec^{-1/2}$ was used throughout.

RESULTS AND DISCUSSIONS

Polarogram of Eu(III) in 1.0 M KCl is found to be quasireversible in nature [1] with $(E_{3/4} - E_{1/4})$ = 65. $E^{f}_{1/2}$was calculated by Gelling's treatment [2]. However the reduction of Eu(III) in crotonic and acrylic acid media is found to be reversible and diffusion controlled. The slopes of linear plots of log $[i/(i_d - i)]$ vs $-E_{de}$ were of the order of 60 mV and the plots of i_d vs. $h^{1/2}_{corr}$ were linear and pass through the origin.

Binary Systems

A plot of $E_{1/2}$vs log [crotomic acid] is found to be a smooth curve. This indicated the formation of successive complexes. De Ford and Hume's method [3] was applied to determine the stability constant of successive complexes.

Two complex species $[Eu(CA)]^{2+}$ and $[Eu(CA)_2]^{+}$ with stability constant of log β_{10} = 1.90 and log β_{20} = 2.71 are observed. Here it is assumed that Eu (II) does not form any complex. The degree of formation for each complex in the system have been calculated [4].

A plot of $E_{1/2}$vs log [acrylic acid] is found to be a straight line. Ligane's method [5] of complex study was applied.

$$-E_{1/2} = \frac{RT}{nF} \log \frac{\beta_{ox}}{\beta_{Red}} + (p-q)\ \frac{RT}{nF} \log Cx$$

Where β_{ox} and β_{Red} are the dissociation constants. p and q the number of ligand associated with Eu(III) and Eu(II) respectively. The slope gives the change in number of ligand bound to europium (p-q). It is found to be ≃1. The ratio of the constant was 1.62.

Eu(III) Crotonic acid Acrylic acid mixed System

In Eu(III)- Crotonate Acrylate system, the acrylic acid concentration was kept constant to 0.2 M and crotonic acid concentration was varied from 0 to 0 1 M. The polarogaphic characteristics are tabulated. The method of Schaap and Mc Masters [6] has been used to determine the value of stability constant of [Eu(III) (CA) (AA)] which comes out to be 3.81.

TABLE 1

POLAROGRAPHIC MEASUREMENTS AND F_{ij} FUNCTIONS OF Eu(III)-CA-AA SYSTEM

Temp. = 25 ± 1°C, μ = 1.0 M, (AA) = 0.2 M,

$E_{1/2}$ = 0.69 V vs. SCE, pH = 4.5

Cx [CA] mol/L	0.00	0.02	0.04	0.06	0.08	0.10
$-E_{1/2}$ V vs.SCE	0.770	0.782	0.790	0.796	0.801	0.805

A = 2.0, B = 700, C = 2 x 10^5

log β_{11} = 3.81 or β_{11} = 6457

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REFERENCES

1. S.C. Lavale and K.S. Pitre, *J. Electrochem. Soc. India* **32-3** (1983) 301.

2. P.J. Gelling, *Z. Electrochem.*, **66** (1962) 477, **67** (1963), 167

3. D.D. Deford, and D.N. Hume, *J. Amer. Chem. Soc.*, **73** (1951), 5321.

4. D.R. Coow, *Polarography of Metal Complexes* **Academic Press London** (1969) 5.

5. J.J. Lingane, *Chem. Rev.*, **29** (1941), 1.

6. W.B. Schaap and D.L. Mc Master, *J. Am. Chem Soc.* **81** (1962) 4699.

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