TECHNICAL REPORT

INTERACTION OF Cd^{++} WITH PROPYLENEDIAMINE

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**Present Add* — *Rajasthan State Board for Prevention and Control of Water Pollution, Jaipur*

(Received Nov. 1976; accepted Dec. 1977)

The complexes of Cadmium with Propylenediamine in n-propanol have been studied by polarographic method using the Deford-Hume treatment as extended by Irving. The percentage distribution of Cadmium in various forms as a function of the ligand concentration in 25% and 50% n- propanol are presented.

Propylenediamine finds uses in medicinal preparations, dyes, rubber accelerator, electroplating and analytical test reagent, and its metal complexes have been studies by many [1—5].

Present paper deals with polarographic behaviour of the complexes formed by Cd (II) with propylenediamine aqueous-n-propanol mixtures. The experimental details are described in an earlier communication[5].

Results and discussion

The polarograms of Cd in aqueous-n-propanol mixtures were distinct, without maxima. The slopes of the straight lines given by the plot of $E_{d.e.}$ Vs. $\log \frac{i}{(i_d - i)}$ in all the solutions studied (0.028—0.035 V) show that the reduction process is reversible. The limiting current is a diffusion current, since its value is proportional to the square root of the height of Hg reservoir.

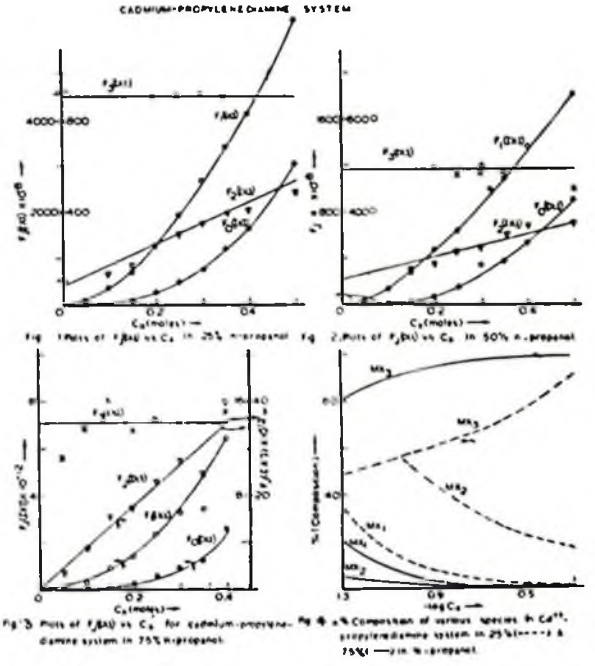
For all aqueous n-propanol mixtures, the relationship between the half-wave potential and the logarithm of the ligand concentration was found to be straight line. The co-ordination number (p) was found to be 3, which was determined from

$$\frac{\Delta E}{\Delta \log C_x} = \frac{-p}{n} \times 0.06$$

where ΔE is shift in half wave potential, C_x is ligand concentration and n is number of electrons involved in reaction

The value of stability constants (log β_3) comes to 7.23, 7.36 and 8.05 in 25%, 50% and 75% aqueous-propanol mixtures as determined by Lingane's method[6].

As the complexation occurs in steps, DeFord and Hume's[7] treatment as modified by Irving[8] was applied to determine the composition and stepwise formation constants of the complexes. The plots of F_0 ([X]) vs C_x resulted into a smooth curve confirming the formation of two or more complex species which are in equilibrium.



The analysis of F_j ([x]) vs C_x shows the formation of three complex species (Fig. 1—3). The values of overall formation constants are summarised as below :

Stability constants	25%	50%	75%
β_1	8.0×10^8	8.0×10^8	2.0×10^{10}
β_2	4.0×10^{10}	1.1×10^{11}	1.0×10^{11}
β_3	4.5×10^{11}	5.8×10^{11}	35.5×10^{12}

It is clear that in aqueous propanol mixture, the number of complex species remain to be three (25%—75%), but the overall stability constants increases with the percentage of propanol.

The percentage distribution of cadmium present in various forms as a function of the logarithm of ligand concentration was calculated by the equations

$$\frac{[M]}{C_M} = \frac{1}{F_0([X])} \text{ and } \frac{[MX_j]}{C_M} = \frac{B_j([X])_j}{F_0([X])}$$

where [M] denotes the concentration of uncomplexed metal ions, $[MX_j]$ is the concentration of jth complex species and C_M, the total metal ions added to the system. The results are shown in Fig. 4.

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