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MIXED LIGAND COMPLEXES OF Pb (II) WITH REACTIVE METHYLENE SERIES OF MALONAMIC ACID AND PHTHALIC ACID

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The mixed ligand complexes of N-(2-ethoxyl) phenyl Malonamale (EPM^-), N-(4-Methyl) phenyl Malonamale (MPM^-) and Phthalate ($Phth^{2-}$) with Pb (II) has been studied polarographically at m = 2.0 M ($NaNO_3$) and pH 6.0 at temp 25 ± 0.1°C. The reduction of simple and mixed complexes has been found to be reversible and diffusion-controlled. The stability constants of simple system has been determined before the study of mixed ligand complex by the method of De-ford and Hume [1]. The stability constants of the mixed ligand complexes $[Ph(Phth)(EPM)]^-$ and $[Pb(Phth)(MPM)]^-$ are found to be log β_{11} = 2.90 and log β_{11} = 3.55 respectively.

KEYWORDS : Polarographic technique-phthalic acid and malonamic acid.

INTRODUCTION

The use of polarographic data for the study of complexation is well known [1-19]. Reactive methylene compounds [7] have been found to be excellent starting materials for the synthesis of various types of chemotherapeutic and AnalR grade. It appears that polarographic studies of mixed complexes of Pb(II) with phthalic acid, N-(2-ethoxyl) phenyl Malonamale (EPM^-) and N-(4-Methyl) phenyl Malonamale (MPM^-) have not been studied so far. With this end in view the present study has been undertaken.

EXPERIMENTAL

All the chemicals used, were of the analytical Reagent grade. Their stock solutions were prepared in conductivity water. The ionic strength was maintained constant μ = 2.0 using $NaNO_3$ as supporting electrolyte and also to maintain a constant ionic strength μ = 2.0. The concentration of Pb(II) was maintained at 1.0×10^{-3} M. Polarograms were obtained by means of a manual polarograph (Toshniwal CLO-2A) with Toshniwal polyflex galvanometer (PL-50). Purified nitrogen was used for removing the dissolved oxygen. All the results were taken at temp. 25±0.1°C and pH = 6.0. Secondary calomel electrode (S.C.E.) was used as a

reference electrode. The d.m.e. had the following characteristics (in 2.0 M $NaNO_3$ open circuit); m = 2.637 mg/sec, t = 3.1 sec. $m^{2/3}t^{1/6}$ = 2.305 $m^{2/3}sec^{-1/2}$, h_{corr} = 62.5 cm. Triton X-100 was used as maxima suppressor.

Result and discussions

The reduction of Pb (II) $Phth^{2-}$, EPM^{-} and MPM^{-} separately were found to be reversible and diffusion-controlled. The slopes of linear plots of log $(i/i_d - 1)$ vs $E_{d.e}$ shows that these lie in the order 30-33 mV.

Polarographic Study of Phthalic Acid :

Pb(II)-$Phth^{2-}$ System : The plot of $E_{1/2}$ Vs log $[Phth^{2-}]$ is a straight line which indicating the formation of single complex. The composition and stability constant of the complex had been determined by Lingane's method [3]. Two complexes viz. $[Pb(Phth)_2]$ and $[Pb(Phth)_4]^{2-}$ with stability constant log β_1 = 2.43 and log β_2 = 3.34 were formed.

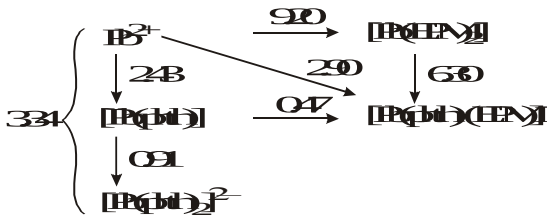
Polarographic Study of Malonamic Acid and Carboxylic Acid :

Pb(II)-$Phth^{2-}$-EPM– and Pb-(II)-$Phth^{2-}$-MPM^{-} mixed systems : In each case single well defined reversible and diffusion-controlled wave was obtained. The $E_{1/2}$ values were more negative than those obtained in the absence of EPM^{-} and MPM^{-} thereby indicating the formation of mixed complexes. Schaap and Mc Masters [9] method has been used to determine the composition and stability constants of mixed complexes.

Only one mixed complex as noted below is formed.

$$[Pb(Phth)EPM)]^{-}. \qquad \log \beta_{11} = 2.90$$

The result of the present study have been conveniently summarized in the following diagram, where the numerical values shown are the logarithams of the equilibrium constants for the reaction indicated.



The mixing constant K_M for the reaction

$$\frac{1}{2}[Pb(Phth)_2] + \frac{1}{2}[Pb(EPM)_2] \rightleftharpoons [Pb(Phth)(EPM)]^{-}$$

is given by the relation :

$$\log K_M = \log \beta_{11} - \frac{1}{2}(\log \beta_{20} + \log \beta_{02})$$

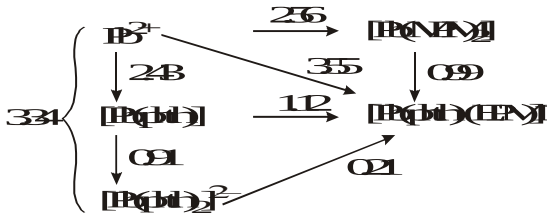
This works out to be + 0.22 A positive value of log K_M indicate that the mixed complex, $[Pb(Phth)(EPM)]^-$ is more stable than the binary complexes, $[Pb(Phth)_2]^{2-}$ and $[Pb(EPM)_2]$.

And

Only one mixed complex as noted below is formed.

$$[Pb(Phth)(MPM)]^-; \qquad \log \beta_{11} = 3.55$$

The result of the present study have been conventently summarized in the following diagram, where the numerical values shown are the logarithams of the equilibrium constants for the reaction indicated.



The mixing constant K_M for the reaction

$$\frac{1}{2}[Pb(Phth)_2] + \frac{1}{2}[Pb(MPM)_2] \rightleftharpoons [Pb(Phth)(MPM)]^-$$

is given by the relation :

$$\log K_M = \log \beta_{11} - \frac{1}{2}(\log \beta_{20} + \log \beta_{02})$$

Workout to be – 0.21. The negative log value showing that the formation of mixed complex species is favoured over the simple ones.

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