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Mixed lignad complex formation of Copper (II) with some Amino acids and Drug Propylparaben

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ABSTRACT

The stability constant of ternary metal complexes of Cu (II) ion with drug Propyl paraben as Primary ligand and some biological important ligand such as amino acids have been determined pH metrically in 20 % (V/V) ethanol water medium at 30^0 C.
Keyword :Stability constant, Δ log K, log K, Mixed ligand complex.

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INTRODUCTION

Propyl paraben is effective antimicrobial and antifungal agent which is most important preservative agent. [1] Commonly used in foods, beverages, cosmetic and pharmaceuticals [2] Literature survey reveals that no work reported on complex formation tendency of propylparaben with transition metal ion Cu (II) in ethanol water solution. Therefore to understand complex formation tendencies of Proplyaparben with copper (II) in presence of amino acids in 20 % ethanol - water mixture.

MATERIALS AND METHODS

All the reagents used were of A.R. grade and all the solutions were prepared in 20 % (v/v) ethanol - water mixture and standardized by known procedures. [3] Titrations were carried out using a digital pH meter (model Elico LI-127) in conjunction with combined electrode. All titrations were carried out at 30^0 C ± 0.1^0C temp. All sets of solutions were titrated against 0.2 N sodium hydroxide solutions. The titration curves were plotted by using the experimental data. On the basis of these plots, proton ligand and metal - ligand formation constants were calculated. Concentrations of total metal, total ligands, free metal, free ligands and various possible species that are formed during the complexation are calculated by using SCOGS computer program. [4-5]

RESULT AND DISCUTISSION

The proton legand constant and metal legand stability constant of propyl paraben and amino acids with copper (II) 20 % (v/v) ethanol - water mixture at 30^0C and ionic strength μ = 0.1M are given in table (1).

Table - 1

pK AND logK VALUES OF Cu (II) CHELATES OF AMINO ACIDS

Medium = 20 % (v/v) Ethanol - water Temp - 30^0 C

Ligand	pK_1	pK_2	$logK_1$	$logK_2$
Proplyparaben	---	6.41	2.96	2.82
Glycine	2.33	9.85	8.87	7.50

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Valine	2.46	9.74	9.28	7.18
Leucine	2.30	11.03	9.10	7.40
Isoleucine	2.55	9.70	8.78	7.23
Alanine	3.61	9.90	10.97	7.77
Phenyl alanine	2.34	9.21	8.39	6.90

PARAMETERS BASED ON SOME RELATIONSHIP BETWEEN THE FORMATION OF TERNARY COMPLEXES OF COPPER (II) METAL ION WITH PROPYLPARABEN IN THE PRESENCE OF AMINOACIDS (1:1:1) SYSTEM.

Temp = 30^0C μ= 0.1 M $NaClO_4$ Medium = 20 % (v/v) Ethanol - water mixture

Amino acids	β 111	β 02	β 20	K_L	K_R	K_r	Δ log K
Glycine	10.33	16.37	5.78	7.37	1.46	-1.49	-1.5
DL-Valine	12.2151	16.47	5.78	9.2551	2.9351	2.1802	-0.0249
L-Leucine	12.0599	16.5	5.78	9.0999	2.9599	1.8398	-1E-04
Iso -Leucine	10.7399	16.01	5.78	7.7799	1.9599	-0.3102	-01.0001
DL-Alanine	13.6412	18.74	5.78	10.681	2.6712	2.7624	-0.2888
DL-Phenyl alanine	8.3099	15.29	5.78	5.3499	-0.0801	-4.4502	-3.0401

BINARY METAL COMPLEXES :-

The basicities of the legand propyl paraben have been measured in terms of their proton legand stability constant. The determination of proton ligand stability constant of the ligand propylparaben is taken for determination of metl ligand stability constant. Therefore proton ligand stability constant of the ligand have been determine by Irving - Rossotti's pH metric titration technique. [6]

The titration curve for propyl paraben show buffer region in pH < 3. The release of proton indicate the dissociation of proton From protonated H^+ atom. From acid and ligand curve the value of nA have been calculated using Irving Rossotti method [7] and further determined by using computational programme.

The nA values ranged between 0.1 and 1 for propyl paraben indicating liberation of proton. The pk value for propyl paraben was determined pH metrically. The pK value of propylparaben is found to be acidic because in propyl paraben -OH group is directly attached to bezene ring. After donation of H^+ resonance stabilization taken place. Ester group stabilities the structure.

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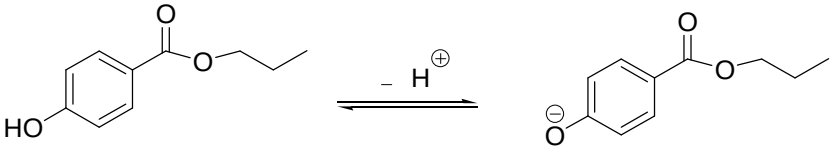

Mixed Ligand complexes

The primary ligand propyl paraben for 1:1 and secondary ligands such as amino acids form 1:2 complexes with Cu. It is evident - from the figure of the % of the concentration of species Cu (II) propyl paraben amino acids system, that the percentage distribution curve of free metal decreases sharply with increasing pH. This indicate involvement of metal ion in the complex formation process. Percentage concentration of free ligand propyl paraben and amino acids increases and this increase may be due to the dissociation of ligand present in the system as a function of pH.

Conclusion

Result of present investigation shows that, the stability constant of ternary complexes formed are less stable. The negative Δ log K value of this system indicates that the ternary complex is less stable than the binary. The negative value of Δ log K does not mean that the complex is not formed. The negative value may be due to the higher stability of it's binary complex.

In solution ternary complex forms as the titration curve run below the Cu (II) - propyl paraben curve. So it is evident that the entry of secondary ligand amino acid faces steric hindrance due to bigger size of the Cu (II) Propyl paraben complex as compare to aquo ion which tried to restrict the entry of the secondary ligand in the co-ordination sphere of Cu (II) metal ion and thus reduces the stability of ternary complexes.

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