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"Potentiometric Determination of Stability Constant"

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Abstract:

Formation of Binary and Ternary complexes of Fe(III) with Ligands Nicotinamide, Penicilliamine, Cysteine was studied by potentiometric technique at 25 ± 0.1^0C and 0.1M ($NaClO_4$) ionic strength. The ternary complex formation was found to take place in a stepwise manner. The stability constant of binary and ternary complexes was calculated by using SCOG Programme. The Nicotinamide is used as primary ligand and Penicillamine and Cysteine as secondary ligand.

Key words: Stability constant, Nictominamide, cysteine, penicilliamine, potentiometric technique.

Introduction:

As the present investigation deals with the study of stability constant of various binary as well as ternary complexes of Nicotinamide, Cysteine and Penicilliamine with Fe (III) in aqueous medium. The determination of stability constant is of paramount importance in the knowledge of chelates. The work of J. Bjerrum[1] has enlightened and enhance the investigation of equilibria of metal chelates.

Nicotinamide is a pyridine derivative and important for human health, is present in plant and animal tissue.

Nicotinamide is exist in a form of NAD. The bimetallic complexes of Nicotinamide studied because of biological importance of NA [2-4]. Cu (II) forms binary and ternary complexes with glycine alanine, valine, cystine, penicillamine[5].

The development in the study of mixed-ligand complexes has been very fast in recent year [6-7]. The study of mixed ligand complex formation is of interest to the analytical chemists [8], and to the bioinorganic researchers [9].

Experimental:

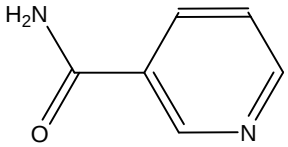
Nicotinamide, penicilliamide, cysteine, NaoH, $NaClO_4$, $HClO_4$ and metal nitrate were of Analar grade. The solutions used in the potentiometric titrations were prepared in double distilled water. The pH-meter was calibrated before each titration with standard buffer solution of 4:0, 7:0 and 9.2. The pH-meter (Ellco, L1.120) was used with a combined glass electrode.

pH-metric titration data of the solution are according to Irving and Rossotti method[10].

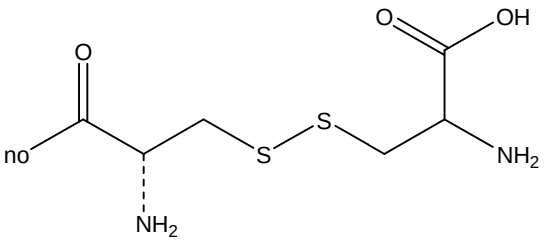
Results & Discussion:

The dissociation contant of NA, penicillamine, cysteine of the associated proton Pka[11].

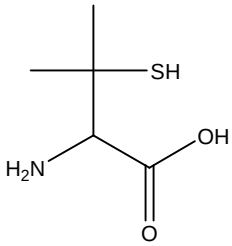
Complex formation of metal ions of biological importance with amino acids. Small peptides and their derivatives are of great significance. Chakarborty studied the effect of a sulfonamide group at a chelating position on the modes of Cu (II) ions co-ordination with a series of N-benzene sulfonyl derivatives [12].



Nicotinamide



Cysteine



Penicillamine

The Cu (II) carboxylic and amino group NA system taken as representative[13]. The mixed-ligand system was found to deviate considerably from the resultant composite curve indicating the formation of a ternary complex. The ternary complex formation could be considered in stepwise equilibria equations.

$$M + Lp \rightleftharpoons MLp$$

$$MLp + Ls \rightleftharpoons MLpLs$$

Where Lp = Carboxylic and amino group

Ls = Neutral ligand nicotinamide

For the present work nicotinamide is taken as primary ligand and penicillamine and cysteine as secondary ligand. The results are shown in tabular form.

Protonation Constant of Ligands

Ligands	$\mathbf{P}k_1^H$	$\mathbf{P}k_2^H$
Nicotinamide	3.48	--
Penicillamine	1.8	10.7
Cysteine	1.9	8.18

Mixed-Ligand Complexes of Fe(III) with Different Ligand

Ligands	$\mathbf{P}k_1^H$
Nicotinamide + Penicillamine	10.46
Nicotinamide + Cysteine	10.05

The present work shows the complex formation equilibria and stability of the complexes.

The stability constant values of the following Ligands were determined and reported by various workers earlier which encloses metformin, mandetes acid, adenosive and many more biologically active drugs[14-15].

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