"Transition Metal Complexes of Urea & Substituted Area"

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Abstract:

pH-metric titrations are used for the formation of binary and ternary complexes using transition metals Fe(II), Co(II), Ni(II) with Nicotinamide, Thiourea, Urea. Stability constant are measured by using Irving-Rossotti method at 25 ± 0.5^0C. Ionic strength maintained by using 0.1M NaClO$_4$.

**Key words:** pH-metric, stability constant, Irving-Rossotti.

Introduction:

A metal-ligand complex is a species formed by the combination of two or more simple species. Almost all king of metal atom can serve as a central atom in a given molecule. Majority of Ligands is that of deprotonated organic compounds. The donor atoms are attached to the central metal ion in a form of cyclic ring structure called as chelating agent and the process of forming chelate is termed as chelation. A complex may be very stable and at the same time quite labile [1].

Schwarzenbech and Ackermann [2] found that the stability of chelate decreases as the size of ring increases. Mellor & Maley [3] studied the stability constant of salicyaldehyde complexes in 50% Dioxane-Water medium. The order of stability was:

$$Pa > Cu > Ni > Co > Zn > Cd > Fe > Mn > Mg$$
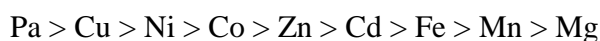
Irving – William [4] have correlated their data by plotting the stability constant against the atomic number of the metal ion. The order

$$Mn < Fe < Co < Ni < Cu < Zn$$
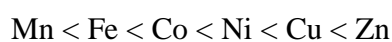
Bjerrum [5] introduced the concept of formation function for the determination of stability constants.

The study of Co(II), Ni(II) and Cu(II) transition metal complexes with 6-methoxy naphthaldehyde and Ranitidine was reported in aqueous solution [6].

Methods & Materials:

All the chemicals used were AR Grade. All the solutions were prepared in double distilled CO_2 free water. Concentrations of metal ions in the solution were determined by standard procedures [7]. All the pH-metric measurements and titrations were carried out on ELICO Digital Model L1 – 122 pH-meter (accuracy to .01 pH-unit) with a combined (glass and calomel electrode). The titrations were carried out with carbonate free 0.36M NaOH solution.

Results & Discussion:

Metal chelates play important role in biological system in which enzymes are known to be activated by metal ions. Mixed ligand complexes of transition metals are comparatively less studied than inner transition elements. Recently mixed ligand complexes of metal ions with a variety of Ligands have been exhaustively made [9-10]. Marcus and Elizer [11] Beck [12] and Sigel [13].

Protonation Constant of Ligands

Ligands	log k_1^H
Nicotinamide	3.77
Thiourea	3.72
Urea	3.820

Metal-Ligand Stability Constant

Metal ions	Ligands		
	Nicotinamide	**Thiourea**	**Urea**
Fe(II)	3.326	3.864	3.965
Co(II)	3.158	3.914	3.96
Ni(II)	2.712	3.786	4.96

The formation of bioligand [14] complexes of some medicinal ligand with rare-earth Lanthanide also reported.

The ternary complexes formed by Succinic acid [15]. Allopurinol with Fe(II), Co(II), Ni(II), Cu(II) and Zn(II) shows Δ log k values positive indicates that the ternary complexation is more favourable than binary.

Stability Constant of Mixed-Ligand Complexes

Metal ion	Mixed ligand	Log K_{MXY}	Δ log k
Fe(II)	Nicotinamide + Thiourea Nicotinamide + Urea	10.554 10332	- 0.9613 -1.967
Co(II)	Nicotinamide + Thiourea Nicotinamide + Urea	10.569 10.52	- 2.32 - 1.67
Ni(II)	Nicotinamide + Thiourea Nicotinamide + Urea	10.66 10.75	- 1.85 - 2.46

In present study ternary complexes shows log K_{MXY} and Δ log k values are negative indicating that the primary ligand anions preferentially form mixed ligand complexes.

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