



Potentiometric studies of binary complexes of bivalent metal ions with 3, 5 dinitrosalicylic acid

Syed Hussain¹, Abdul Rahim² and Mazahar Farooqui³

¹P.G.Dept .of Chemistry, Sir Syed College, Aurangabad,

²Milliya Senior College, Beed (M.S.)

³Dr Rafiq Zakaria College for Women, Aurangabad.

ABSTRACT

The binary complexes of metal ions $Fe^{+3}, Co^{2+}, Ni^{2+}, Cu^{2+}, Zn^{2+}, Cd^{2+}$ with 3,5 Dinitrosalicylic acid as a ligand were studied in aqueous media using Irving Rosotti method. Acidity constant and stability constant were studied at 27°C at ionic strength 1N NaNO₃. Stability constants calculated by half integral method and point wise method were compared and found to follow Irving and Williams rule.

INTRODUCTION

Derivatives of salicylic acid are medicinally important .Due to biological importance of salicylic acid derivatives interest has been shown in the literature concerning bivalent metal ion binary complexes containing these ligands. Number of researchers worked on them.3, 5 dinitrosalicylic acid falls in an important group of organic compounds. It has two possible coordination sites –COOH and –OH groups. Literature survey revealed that some workers ¹⁻⁴ reported the complexation study of this ligand with transition metal ions .However no sufficient work has been done on complexation tendency of this ligand towards transition metal ions.

EXPERIMENTAL SECTION

For the present investigation, 3, 5 Dinitrosalicylic used as ligand was of AR Grade SD fine.Sodiumhydroxide, Sodium Nitrate, Metal nitrates, Nitric acid used of AR Grade SD fine and prepared in double distilled water. Buffer solution of pH=4 and pH=7 are used for calibration. The relative stabilities of the complexes formed were investigated potentiometrically adopting Irving and Rossotti⁷ pH –titration technique. PH metric measurements carried out using .Elico digital pH meter model L-120 with combined glass electrode. The ionic strength was maintained using 1N NaNO₃. Proton ligand and stability constant determined using SCOGS computer programme.

PROCEDURE

The following solutions were prepared (total volume 50ml) and titrated potentiometrically against standard NaOH (0.2N) solution.

- HNO₃ (2ml) + NaNO₃ (2ml)
- HNO₃ (2ml) +ligand (2ml) + NaNO₃ (2ml)
- HNO₃ (2ml) +ligand (2ml) +Metal solution (2ml) + NaNO₃ (2ml)

RESULTS AND DISCUSSION

The result obtained are analysed by the computer programme and the stability constant values were calculated. Graph of $\log K$ vs. pH for proton ligand system was plotted and found to extend between 0-2 indicates that ligand has two replaceable protons. Ligand titration curve had a lower pH value than acid titration curve. Displacement of ligand titration curve along volume axis with respect to acid titration curve is indication of proton dissociation. Value of n obtained was 1.2-1.8 and 0.2- 0.8 indicating formation of 1:2 and 1:1 complexes. Deviation of A+L curves from A+L+M curves indicates formation of complex. pK_1 corresponds to dissociation of $-\text{COOH}$ group and pK_2 corresponds to dissociation of $-\text{OH}$ group.

Proton Ligand Constants and Stability constants of binary complexes of bivalent metal ions with 3, 5 dinitrosalicylic acid

pk2	9.942(half integral)	9.888(point wise)
pk1	2.944(half integral)	2.627(point wise)

Metal ion	Logk1	Logk2
Cu ²⁺	10.56	6.917
Zn ²⁺	11.37	3.397
Ni ²⁺	10.22	4.525
Fe ²⁺	-	3.427
Co ²⁺	-	3.495
Cd ²⁺	8.925	3.542

The order of stability is $\text{Co}^{2+} < \text{Ni}^{2+} < \text{Cu}^{2+} > \text{Zn}^{2+}$ which is called as Irving –Williams order⁶ of stability and the order is observed by A.Gaber², Merce et al⁵. The additional high stability of the copper complex is due to unique electronic configuration which is capable of additional stabilization due to John-Teller effect.

REFERENCES

- [1] S.S Dube and Dhindsa, *Can J Chem*, 48, 1007-1011, 1970.
- [2] D.N.Shelke and D.V.Jahagirdar, *Bull Chem Soc Japan*, 49 (8), 2142-2147, 1976.
- [3] A.A.Gaber, A.M.Roudi, 291-296, *J.Communi.Fac.Sci.Uni Ank.Series B.*, 34,291-296, 1987.
- [4] Aishwarya Jain, Kartikey Yadav, *Spectrochimica Acta Part 72*, 1122-1126, 2009
- [5] Ana Lucia Ramlaho Merce, Simone Cristina Lombard, *J.Braz.Chem.Soc.* 9,(.3), 231-242, 1998.
- [6] H.Irving, R.J.P.Williams, *Nature-land*.162, 746, 1948.
- [7] H.Irving and H.S.Rossoti, *J.chem.soc*, 2904, 1954.