Preparation of a Some Complexes of Copper with Schiff Base ligand, 5-bromo salicylidine-o-hydroxy phenyl hydrazone

Amit
University Department of Chemistry
J. P. University, Chapra-841301 (BIHAR)

Abstract : The complexes of copper(II) metals have been obtained with Schiff base ligand, 5-bromo salicylidine-*o*-hydroxy phenyl hydrazone in presence of some bases containing oxygen and nitrogen atoms as their donor sites. The ligand and the complexes on characterisation by usual physico-chemical methods, indicate that all the complexes are monomeric, non-electrolyte, paramagnetic having octahedral geometry with general formula $[Cu(L)(B)_3]$ where L=ligand and B=bases.

Key-words : Solution, Compound, Condition, Filteration, Separation, Reaction, Shaking, Water-bath, Ice-bath.

I. INTRODUCTION

Schiff base as ligand has wide range for the formation of complexes with transition metals. In absence of Schiff base as ligand, the field of coordination chemistry is shortened. So, large number of research work has been done for the formation of complexes of transition metals with Schiff base. But at least work has been done with the Schiff base containing *o*-hydroxy phenyl hydrazine in its moiety. So, in this paper, I report the formation of transition metal complexes with the Schiff base containing *o*-hydroxy phenyl hydrazine in its moiety due to their major applications in the field of medicines, industry and fertiliser.

In this paper, I report the formation of complexes of Co(II), Ni(II) and Cu(II) cations with 5-bromo salicylidine-o-hydroxy phenyl hydrazone.

II. PREPARATION OF COMPLEXES

0.24g (0.001 mole) of copper(II) chloridehexahydrate was dissolved in minimum volume of water. 0.3g (0.001 mole) of the ligand was dissolved in aqueous-ethanolic solution. Both the solutions were mixed together with regular shaking. Then the resulting solution was refluxed on water-bath for one and half an hour at room temperature. During the course of reflux, the colour of the solution was gradually changed and crystals of green colour and in some cases light and dirty green colour were obtained by allowing the solution to stand overnight. The compound was filtered, washed with a small amount of acetone and dried over KOH pellets placed in desiccator.

The complexes of copper(II) metal with the ligand have been prepared separately with ammonia, quinolone, phenyl-isocyanide, pyridine and α-picoline. In each case, the ratio of metal and ligand was always kept into 1:1 respectively. The colour of the compound was obtained with slight variation due to the presence of different bases.

The compound was further analysed and found to containwhich corresponds to the molecular formula $[Cu(L)B)_3]$ where L = ligand and B = bases.

Table-1

calculated→% (Found →%)

S.N.	Compounds	Metal	Carbon	Hydrogen	Nitrogen	Bromine
1.	$[Cu(C_{13}H_9N_2O_2Br)(H_2O)_3]$	15.02 (14.62)	36.92 (36.56)	3.55 (3.56)	6.62 (6.70)	18.93 (18.50)
2.	$[Cu(C_{13}H_9N_2O_2Br)(NH_3)_3]$	15.13 (14.74)	37.18 (36.84)	4.29 (4.30)	16.68 (16.72)	19.07 (18.76)
3.	$[Cu(C_{13}H_9N_2O_2Br)(C_9H_7N)_3]$	8.40 (8.12)	63.53 (63.22)	3.97 (4.00)	9.26 (9.30)	10.58 (10.24)
4.	$[Cu(C_{13}H_9N_2O_2Br)(C_6H_5NC)_3]$	9.37 (9.13)	60.22 (59.78)	3.54 (3.56)	10.33 (10.40)	11.80 (11.40)
5.	$[Cu(C_{13}H_9N_2O_2Br)(C_6H_5N)_3]$	10.48 (10.12)	55.49 (55.10)	3.95 (3.94)	11.56 (11.60)	13.21 (12.90)
6.	$[Cu(C_{13}H_9N_2O_2Br)(C_5H_4NCH_3)_3]$	9.80 (9.40)	57.45 (57.08)	4.63 (4.62)	10.81 (10.85)	12.35 (12.10)

CHEMICALS REQUIRED:copper(II) chloride hexahydrate, ethyl alcohol, 5-Bromo salicylaldehyde, *o*-hydroxy phenyl hydrazine, acetone, ethyl alcohol, ether, ammonia, quinoline, phenyl isocyanide, pyridine, α-picolineetc.

ANALYTICAL METHODS: Metal and non-metals present in the complexes have been estimated by standard method:-

(i) Hydrogen, Carbon and Nitrogen:- Hydrogen, carbon and nitrogen have been estimated by semi-micro combustion method.

(ii) Bromine:- Bromine is gravimetrically estimated as silver bromide.

(iii) Copper:- Copper is volumetrically estimated by iodometrically.

MAGNETIC SUSCEPTIBILITY: Magnetic susceptibility of the complexes has been measure by Gouy's method in which $[HgCO(SCN)_4]$ has been used as calibrant.

I.R.: Measurement of infrared of the ligand and the complexes has been recorded on Perkin Elemer 577 spectrophotomter.

U.V.: Visible spectrophotometric measurement:-

The electronic spectra of the complexes were recorded by using Hitachi-320 spectrophotometer.

ELECTRICAL CONDUCTIVITY: Conductivity meter bridgemanufactured by Wiss-TechenWearchStathen type – LBR has been used to measure the electrical conductivity of the solution of the complexes.

III. RESULT AND DISCUSSION

The values of electrical conductivity has been obtained in the range of 16-24 which indicates non-electrolyte nature of the complexes.

The values of magnetic moment obtained in the range of 1.88-1.98 B.M. clearly indicates paramagnetic nature of the complexes.

A broad and strong band obtained in the range of 15,550-15,950cm^{-1}indicates distorted octahedral structure for copper(II) complexes.

COMPARISON OF I.R. SPECTRA OF THE LIGAND AND THE COMPLEXES:

There are so many bands in the ligand molecule but most of them have no importance during the course of complex formation. The band positions obtained due to the vibrations of phenolic –OH, azomethine>C=N- and N-N groups are deciding factors of bonding sites of the ligand. A strong and sharp band obtained at 3480cm^{-1}in the ligand molecule due to the vibration of (N-H) group remains intact after complex formation. This indicates that hydrogen atom attached to (N-H) group was not deprotonated.

A strong and sharp band obtained at 3420cm^{-1} in the ligand molecule due to the vibration of phenolic –OH group, disappears in all the complexes indicating the deprotonation of phenolic –OH group. A medium and sharp band obtained at 1510cm^{-1} has been assigned due to the vibration of phenolic C-O group in the ligand molecule. This band position has been shifted to 1540cm^{-1} suggesting increase of bond order of (C-O) group in the complexes. This means that oxygen atom of phenolic –OH group takes part in the bond formation with the metal cations.

A sharp and medium band obtained in the range of 480-490cm^{-1} in the complexes due to the vibration of (M-O) bond further confirms the participation of phenolic oxygen atom in the bond formation with the metal cation.

A broad and sharp band obtained at 1640cm^{-1} due to the vibration of azomethine (>C=N-) group in the ligand molecules has been redueed to 1580cm^{-1} in the complexes indicating the participation of nitrogen atom of azomethine group in the bond formation with the metal cations.

A sharp and medium band obtained at 650cm^{-1} in the ligand due to vibration of (N-N) group has been shifted towards higher frequency in the complexes indicating that aldimino nitrogen atom takes part in the bond formation.

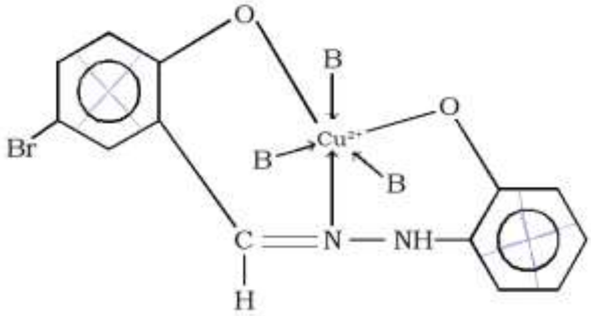
A sharp and medium band obtained in the range of 390-405cm^{-1} in the complexes due (M-N) vibrations further confirms the coordination of N-atom of azomethine group in the bond formation with the metal cations.

It means that one nitrogen atom of azomethine group and two oxygen atoms of phenolic –OH group are the bonding sites of the ligand molecule. Thus ligand molecule behaves as bi-anionic tridentate molecule.

In case of aquo and amine complexes, a broad and strong band was obtained at 3380cm^{-1} due to the overlapping of the bands of coordinated H_2O and NH_3 molecules. In case of phenyl isocyanide, the band position obtained in the ligand (2170cm^{-1}) increases in the complexes (2220cm^{-1}) indicating the participation of N-nitrogen atom of isocyanide group in the bond formation with the metal cation. A broad and medium band obtained around 1450cm^{-1} due to ring vibration indicates the involvement of N-atom of quinolone in the complex formation.

Broad and medium bands obtained in finger print and far infrared region in the complexes indicates the participation of N-atom of pyridine and picoline in the bond formation with the metal cation.

Thus on the basis of elemental analysis, measurement of electrical conductance, magnetic moment, electronic and IR spectra of the ligand and the complexes, for the complexes of copper(II) metal with the ligand in the presence of bases, octahedral geometry has been proposed. The complexes have been found to be non-electrolyte, mono-meric and paramagnetic with general formula $[Cu(L)(B)_3]$ where L=ligand and B=bases.



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