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Remarking
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Study of Copper (II) Complex with Semicarbazide

Abstract

The complexes of copper (II) with semicarbazide of the formula (CuL_2) ($L=NH\ NH.CO.NH_2$), has been prepared and characterised. The structure of the complex has been established on the basis of its elemental analysis, ir, uv and magnetic moment studies. The complex is paramagnetic and square planar.

Keywords: Semicarbazide, Ligand, Spectra, Semicarbazide, Enolic Ligand, Band, Stretch, Attributed, Sharp, Repertionin, Enolisation, Subsequent Chelation, Attributed, Corresponding, Symmetry, Obviously, Regarding, Semicarb-Azone, Enolic Content.

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Introduction

A brief survey of torture showed numerous organic reagent – 6] containing nitrogen and oxygen, which form four co-ordinated copper (II) complexes, but no mention has been made of the formation of copper (II) complex with semicarbazide. The present work shows complex, bissemicarbazide Cu (II) of the formula, $[Cu\ (CH_4ON_3)2]$.

Preparation of Complex

Copper (II) complex was prepared by taking 30 c.c. of cu (II) solution (1% $CuSO45H_2O$ solution) and treating it with 1-2 drops of conc. H_2SO_2 and slight excess of aq. Or aq, alcoholic ligand, followed by an immediate addition of 0.1 (N) NaOH or Na_2CO_2 solution in cold. The orange yellow complex was washed with cold water and dried in air.

Results and Discussion

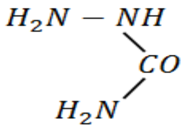
On analysis, it was found: Cu 30.03, C 11.30, H 3.72 and N 39.5 percent. For $[Cu(CH_4ON_3)_2]$ calculated: Cu 30.04, C H. 34, H. 3.72 and N 39.70 Percent.

Infra-Red spectra

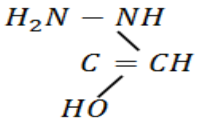
I.R. spectra of ligand and complex in range 200-4000 cm^{-1} along with the assign ments of few important bands are given in (table 1).

The band at 3400-20 cm^{-1} due to (NH_2) in the ligand lowered to 2930cm^{-1} in the complex, shows co-ordination to Cu through N atom of NH_2Goel and Gupta [7] suggested $v(NH_2)$ at 3480-3500 cm^{-1}. Jensen [8] established co – ordination through nitrogen in M (II) -semicarbazide complexes. Furthermore, Cu- O bond be formed either by donation of lone pair by oxygen of CO or by replacement of H of enolic ligand.

The latter possibility is supported by the presence of a clear band at 1140 cm^{-1} due to (C-o) bond in the spetra of complex which has been earlier confirmed by of Goel and Gupta [7], who reported bands at 1040-1120 cm^{-1} and 1170-1190 cm^{-1} for (C-O). Singh



(Keto form)



(Enol form)

Table 1

$CH_4ON_3HCl.cm^{-1}$	Cu $(CH_4ON_3)_2$ cm^{-1}	Assignments
3400-3420 w	………………………	- $CONH_2$, CONH, -OH stretch
	2930 vs	-OH. =NH or v (NH_2)
2840-50 bs	2860 vs	-N-C=, -O-H, or=NH or overtones
2300-40 w	…………………….	NH_2 or –N-C=O
1990-2000 ms	…………………….	C=N and NH_2+ combination.
1900-50 ms	…………………….	……………………..
1650 s	1640 s	Amide I, δ $(NH)_1$ $CONH_2C$=N or NH_2 bend.
1420-50 s	1450—60 s	C=N, δ (N-H) or =OH bend.
1340-65 ms	1370 vs	δ(NH). –OH bend; =NH bend or C-N
1200-20 vs	……………………..	OH bend.
1180-90 ms	1140 ms	(C-O) of =C-OH
750-60 s	620 ms	NH rocking or deform.
700-10 s	……………………..	Y (-OH)
	500-20 ms	Cu-N
	460-80 ws	Cu-N+Cu-O
	430 ws	Cu-O
	300 w	

Srivastava and Prakash [9] reported 1170 cm^{-1} for C-N stretch. and 758 cm^{-1} for NH rock-ing. The bands at 1340-65 and 1370 and 750-60 and 620 cm^{-1}in the ligand and com-plex may be attributed to C-N and NH rock-ing. Sharp band at 1650 and 1640 cm^{-1} in the ligand and complex are due to C=N which are in accord with the values reperatioion the literab by Goel and Gupta. The bands at 284-50 and 2860 cm^{-1} and 1420-50 and 1450-60 cm^{-1} and 2860 cm^{-1} may be due γ(NH) and NH or δ(NH) respectiuey.

Slight differences in the band positions of ligand and complex are due to enolisation and subsequent chelation.

Some new bands at 500-20 cm^{-1} and 430cm^{-1} in the spectra of complex may be attributed to Cu-N and Cu-O bond vibrations.

U.V. Spectra

Compound	λMax, mμ
CH_5 ON_3	400-390 s
	380-360 o
$Cu(CH_4$ $ON_3)_2$	430-360 b sh
	360-300 b sh
	290 w

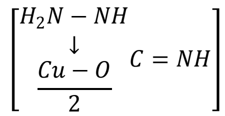
Broad sholder band at 430-360 m may byattributed to the splitting of orbital corresponding to 2B2→E δ in D_4h symmetry. The orange yellow colour of complex may be due to charge transfer band tailing off into the blue end of visible spectra. Other bands are too weak to be detected. No clear indication about geometry of complex has been obtained.

Magnetic moment:

Magnetic moment has been found to be 2.01 BM, a value obviously greater than 1.732 BM corresponding to spin only value but less than 2.82 BM, which amounted for two unpaired electrons. Thus although actual geometry seems to be vague but interpretation regarding considerable distortion of octahedral or tetrahedral geometry leading to square planar geometry can be made. High value of μeff may be due to moment corresponding to one unpaired electron plus orbital contribution. The square planar complex may envolve dsp^2hybridisation.

Structure of Semicarbazide Copper (II) Complex

Like other nitrogen oxygen containing ligands such as Benz aldehyde, semicarbazone 10, etc, semicarbazide co-ordinates to Cu through N atom of NH_2. The hydrogen of enolic ligand is replaced by Cu. 1680-1750 cm^{-1} inligand or complex further confirms ex stence of enolic content of ligand Moreover the clear banddue to (C-O) has been observed in the complex the structure can be represented as follows: Dipheny1 semicarbazide [11] forms Mg (II)-complex in NaOH medium in similar manner.



$$\left[\begin{array}{l} H_2N-NH \\ \quad\downarrow \\ \dfrac{Cu-O}{2} \end{array} \; C=NH\right]$$

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