Print ISSN: 0976-2876 **Online ISSN: 2250-0138**

Available online at: http://www.ijsr.in

INDIAN JOURNAL OF SCIENTIFIC RESEARCH

DOI:10.32606/IJSR.V13.I1.00013

Received: 14-04-2022 **Accepted: 22-07-2022** **Publication: 31-08-2022**

Indian J.Sci.Res. 13 (1): 101-103, 2022 **Original Research Article**

STUDIES OF Co (II) WITH SOME HETROCYCLIC N AND O DONOR LIGANDS

ANJANI KUMAR SHUKLA[1]

P.G. Department of Chemistry, R.D.S. College, Muzaffarpur, Bihar, India

ABSTRACT

In present paper ,synthesis of Co (II) complexes with 1,2,3-trioxo-1-phenylamine-2 -(thiazolehydazono) butane ($H_2(L_1)$), 1,2,3-trioxo-1-phenylamine-2 (-4-methyl thiazolylhydrazono) butane ($H_2(L_2)$), 5-(2-Thiazolylazo) thiouracil ($H_2(L_3)$), 5-(4-methyl-2-Thiazolylazo) Thiouracil ($H(L_4)$, 3-(acetyamino)-4-(2-Thiazolylazo)N, N-diethylaniline ($H(L_5)$) and 3-(acetylamino)-4-(4-methyl-2-Thiazolylazo) N, N-diethylaniline ($H(L_6)$). Characterisation of complexes has been done on the basis of elemental analysis, magnetic data and spectral studies. The structures of complexes was also suggested.

KEYWORDS: 2-Aminothiozole, Thiouracil, Diazotisation

The thiazole derivatives have been found their applications in sulpha drugs Biocides, fungicides colorantesetc the activities were reported to be enhanced by coordination with metal ions (Prasad *et al.*, 1992) (Srivastava, 1990). During present investigation, the diazotized solution of 2-aminothiozole were coupled with some active methylene compounds thiouracil and 3-acetylamino-N, N -diethyl amine. The isolated products were investigated for their coordinating behaviour towards Co (II) metal ion. In this paper the attempts were made to synthesis and characterisation of Cobalt (II) complexes with above mentioned ligands. The characterisation was done with help of elemental analysis, magnetic moment data, uv-visible spectra and IR spectral studies.

EXPERIMENTAL

The synthesized ligands (0.001 mole) and Cobalt (II) acetate (0.001mole) were refluxing in methanolic solution for 3-4 hours and brown precipitate obtained., were filtered out (Srivastava *et al.*, 2019) (Srivastava and Srivastava, 1994) (Srivastava *et al.*, 2014) (Shukla and Srivastava, 2021) (Shukla and Srivastava, 2021). The precipitates were washed with aqueous methanol to remove the unreacted ligands. The complexes were insoluble in water and in organic solvents also.

RESULTS AND DISCUSSION

The physical characteristics of the complexes and elemental analysis of Co, N and S atoms were presented in table -1.

Table 1: Physical and analytical data of Co (II) complexes

Complexes	Colour	% Yield	M.P °C	Magnetic Moment (BM)	Elemental Analysis (%)		
					Co	N	S
[Co (HL_1) (AC) H_2O]	Brown	55	200	4.15	15.61 (15.74)	15.32 (15.46)	8.85 (8.89)
[Co (HL_2) (AC) H_2O]	Brown	55	205	4.15	15.41 (15.54)	15.00 (15.26)	8.25 (8.49)
[Co L_3 H_2O]	Brown	45	240	5.00	18.00 (18.17)	22.00 (22.29)	10.10 (10.09)
[Co L_4 H_2O]	Brown	45	245	5.00	17.54 (18.05)	21.01 (22.02)	9.15 (9.45)
[Co $(L_5)_2$]	Brown	65	192	4.40	8.10 (8.27)	10.01 (10.15)	4.50 (4.64)
[Co $(L_6)_2$]	Brown	65	197	4.40	7.86 (8.07)	9.40 (9.85)	4.09 (4.44)

---

[1] **Corresponding author**

The magnetic moment of all complexes of cobalt were found in the range 4.35 to 4.50 BM, which is higher than spin magnetic moment. It means Cobalt present in +2 oxidation state and Cobalt complexes are octahedral and tetra coodinated.

IR SPECTRA

The ir spectra of Co (II) complexes have been recorded in Nujomul or KBr /Cesium iodide disk during Perkin Elmer 577 modal and given in table-2.

Table 2: Characteristics I.R Spectral Bands of Co(II) complexes

Complexes	I.R Spectral Bands (cm^{-1})					
	ν_{H_2O}	$\nu_{C=O}$	ν_{ac}	$\nu_{N=N}$	ν_{CSC}	$\nu_{N=C}$
[Co (HL$_1$) (AC) H$_2$O]	3490-3460	1635-1585	1415	---------	830	---------
[Co (HL$_2$) (AC) H$_2$O]	3492-3460	1630-1580	1415	---------	832	---------
[Co L$_3$ H$_2$O]	3510-3470	1580	---------	1542	830	1110
[Co L$_4$ H$_2$O]	3510-3470	1580	---------	1540	832	1110
[Co (L$_5$)$_2$]	---------	1585	---------	1535	832	---------
[Co (L$_6$)$_2$]	---------	1585	---------	1535	832	---------

On the basis of observations, clearly that no peak present around 3200 cm^{-1} in ir spectra in all complexes of cobalt (II) which was found in all ligands. The absence of this peak clearly indicated the deprotonation of amino group in all ligands. The absorption peak of C-S-C cyclic group remain unchanged. It means sulphur atom was not coordinated in all cobalt (II) complexes. The absence peak around 1510 cm^{-1} in the complexes clearly indicated that azo group not present in cobalt complexes with first two ligands and it was present in all other complexes.

ELECTRONIC SPECTRA

The electronic spectra of all Co (II) complexes have been recorded using diffuse reflectance techniques taking Barnum sulphate as a standard in the region 200-1100 nm. The band position are tabulated in table-3.

Table 3: Electronic spectra data of Co(II) complexes in nm

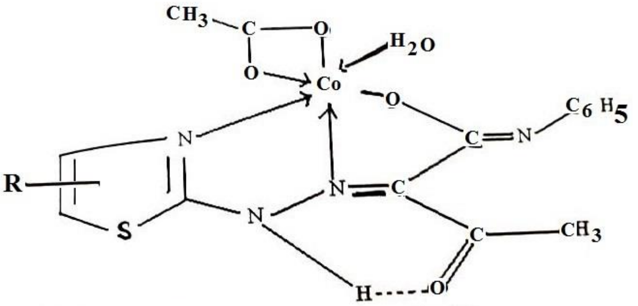
Complexes	$^4T_1g \rightarrow {}^4T_1g$	$^4A_2 \rightarrow {}^4T_1$ (F)	^4T_1g (F) $\rightarrow {}^4T_1g$ (P)	$^4A_2$ (F) $\rightarrow {}^4T_1$ (P)
[Co (HL$_1$) (AC) H$_2$O]	487	____	1080	____
[Co (HL$_2$) (AC) H$_2$O]	485	____	1078	____
[Co L$_3$ H$_2$O]	____	193	____	500
[Co L$_4$ H$_2$O]	____	193	____	500
[Co (L$_5$)$_2$]	482	____	1085	____
[Co (L$_6$)$_2$]	492	____	1075	____

On the basis of bands position, Cobalt (II) complexes may be octahedral and terahedral with ligands H$_2$ (L$_1$) H$_2$ (L$_2$), H(L$_5$), H(L$_6$) and H$_2$ (L$_3$), H$_2$ (L$_4$) respectively.

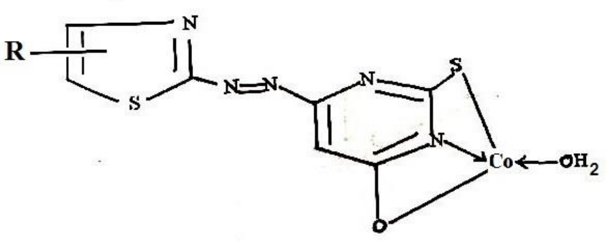
CONCLUSION

The above physicochemical evidences and discussion can be used to propose tentative structure of Co (II) complexes were assigned as [Co(HL$_1$)ac.H$_2$O] , [Co(HL$_2$) ac.H$_2$ O], [Co (L$_3$)H$_2$O], [Co(L$_4$)H$_2$O], [Co(L$_5$)$_2$] and [Co(L$_6$)$_2$]. The insolubility of complexes in polar and none polar solvents clearly indicated that the non electrolytic nature of complexes. Magnetic data clearly indicated that absence of any Co-Co bond and further it indicates the distorted octahedral geometry of of Co (II) ion with monomeric nature. From ir spectra it was concluded that all complexes are aquo complex except Co(L$_5$)$_2$ and Co(L$_6$)$_2$ and water molecule was coordinated with central metal ion. All complexes are octahedral but [Co (L$_3$)H$_2$O], [Co(L$_4$)H$_2$O] are tetrahedral.

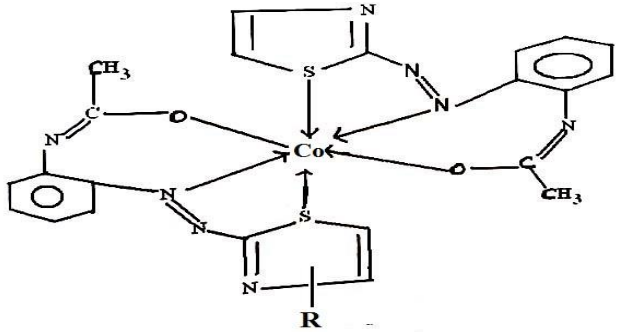
The tentative structure of the complexes may be given as:



[Co (HL$_1$) (AC) H$_2$O]
[Co (HL$_2$) (AC) H$_2$O]



[Co L$_3$ H$_2$O]
[Co L$_4$ H$_2$O]



[Co (L$_5$) $_2$]
[Co (L$_6$) $_2$]

ACKNOWLEDGEMENT

The authors very thankful to Head of the university department B.R.A.B.U, Muzaffarpur for providing laboratory facilities and also thankful to Dr. A.K. Srivastava (Retd.) Head of the University Department B.R.A.B.U, Muzaffarpur for valueable suggestions**.**

REFERENCES

Prasad N., Sahay A. and Shrivastava A.K., 1992. “Copper (II) complexex of aryl hydrazones” Asian J. Chem. Rev., **3**: 22-31.

Srivastava A.K., 1990. Ph.D., Thesis B R A Bihar University Muzaffarpur.

Srivastava A.K., Shukla A. and Srivastava N., 2019. “Synthesis and characterization of copper (ii) complexes of N, S donor ligands”. J-Chemtracks, **21**: 1-4.

Srivastava A.K. and Srivastava P.K., 1994. “Studies on aryl hydrazones part-IX”. Asian J. Chemistry, **6**: 901-910.

Srivastava A.K., Kumari S. and Srivastava N., 2014. “Studies on the copper (II) and cobalt (II) complexes with N,N’ bis(2-benzothiazolyl) -2,6- pyridinedithiocarboxamibe”. Oriental J. Chemistry, **30(4)**: 2065-68.

Shukla A.K. and Srivastava N., 2021. Synthesis of some N,N,O / N,N,S donor ligands and their metal complexes. Indian Journal of Scientific Research, **11(2)**: 47-51.

Shukla A.K. and Srivastava N., 2021. Synthesis and characterisation of Ni (II) complexes with some thiazole derivatives as ligands. Indian Journal of Scientific Research, **12(1)**: 51-54.