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Synthesis, Characterization and biological activity of Schiff bases derived from aldehyde and their metal complexes of cobalt (II)

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ABSTRACT

A series of bidentate Schiff baseof bis (p-methoxybenzaldehyde) thiosemicarbazone (MBTSCZ), bis (N, N^1 - dimethyl -4- aminocinamaldehyde, thiosemicarbazone (DMACTSCZ), bis (N, N^1 - dimethyl -4- amino benzaldehyde) thiosemicarbazone (DMABTSCZ), bis (pyridine- 2 aldehyde) thiosemicarbazone (PATSCZ) and bis (p-chlorobenzaldehye)thiosemicarbazone and (CBTSCZ) have been prepared by condensation p – methoxybenzaldehyde, N, N^1 Dimethyl -4- amino cinnamaldehyde, N, N^1- Dimethyl -4- amino benzaldehyde, Pyridine -2- aldehyde & P-chlorobenzaldehyde with thiosemicarbazide. The Schiff bases were characterized by elemental analysis & spectroscopic method. The metal complexes of cobalt (II) have prepared by the reaction with Schiff bases. The analytical & spectral data supported the octahedral geometry Co (II) complexes. The biological activity of Schiff bases and their metal complexes have been studied by screening the compound against micro organism.

Key word: Thiosemicarbazone Schiff base, Biological activity.

INTRODUCTION

The Schiff bases have been remarkable properties of forming complexes. The Schiff bases & their metal complexes show a wide spectrum. of application such as biochemical[1] analytical[2] industrial[3]& antimicrobial

l agent. The paper describe the synthesis of cobalt (ii) complexes using Schiff bases derived form - p methoxybenzaldehyde, N, N^1 Dimethyl -4- amino cinnamaldehyde, N, N^1 Dimethyl-4-aminobenzaldehyde, Pyridin-2-aldehyde & p-methoxybenzaldehyde. Complex compound have been characterized by elemental analyses, electrical conductance, magnetic susceptibility I.R. spectra, Electronic spectral data & thermal Studies. Antimicrobial activity of the compound against selected organism also reported.

Material & Method

A.R. grade chemicals are used in the synthesis of Schiff bases & their metal complexes. The Schiff bases have been prepared by the condensation of different aldehyde with thiosemicarbazide. Above chemical were collected from different pharmaceutical such as Aldrich, Fluca, Sigma. Glaxo, BDH etc. In the preparation of complexes cobalt (II) chloride salt is used.

The I.R. Spectra of Schiff bases.& their metal complexes were recorded on a Perkin Perkin Elmer FTIR spectrophotometer model 1600 using KBR. The electronic spectra of Schiff bases in $CHCl_3$& Metal complexes in DMSO solution were recorded on a Perkin Elemer lambda 35 UV & Visible spectrophotometer, conductivity measurement were carried out by Philip conductivity bridge model PR 9500 with dip type conductivity cell. The conductance of complexes is measured in MeOH, DMF & DMSO at 10^{-3}dilution at 30^0C. The magnetic susceptibility of the complexes was determined by Gouy method. The sample tube was calibrated with $CuSO_4$. The diamagnetic correction was made for the Schiff bases. Thermogravimetrianalysis were carried out in G.N.D. University Amritsar.

Preparation of Schiff bases

The Schiff base prepared by the condensation of respective aldehyde with thiosemicarbazide is 2:1 ratio Thiosemicarbazide is dissolve in EtOH& refluxed for half an

hour. The requisite amount of respective aldehyde was added in the flask. The mixture was refluxed for six an hour. The reaction mixture was kept in 24 hours. The crystal of Schiff base were obtained which is purified by recrystallization. The purity of ligand checked by M.P. Determination, elemental analysis, Thin layer chromatography and spectroscopic studies also recorded.

H *S* *H*

I II I

Ar – C = O + H_2N NH C – NH_2 + O = C -Ar

condensation *-2H_2O*

H *S* *H*

I II I

Ar – C =N- NH – C – N = C – Ar

Schiff base

Preparation of Metal Complexes

The metal complexes were prepared by the adding cobalt (II) Chloride solution of the solution of Schiff bases. in 1:2 ratio. The precipitation of the complexes thus obtained was washed by THF, DMSO & DMF & dried fused $Cacl_2$.

H *S* *H*

I II I

2 Ar -C = N – NH – C – N = C - Ar+ $CoCl_2$

H *N=CH- Ar*

| |

Ar- C = N – NH – C = S

Cl Co Cl

S=C –NH – N = C –Ar

I I

Ar-HC=N H

Result & Discussion

All the complexes are stable crystalline intense colour& non- hygroscopic nature. They are insoluble in common organic solvent but soluble in DMSO. Metal content were determined by Standard literature method.[5]

On the basis of analytical data (table-1) The metal chelates were found to have 1:2 (metal: Schiff base) stoichiometry. The molecular weight of good agreement with molecular ion peak in mass spectra.

The molar conductance value of complexes in MeOH, DMF & DMSO at 10^{-3} M dilution are low range 0.10 – 0.25 ohm^1 cm^2 $mole^1$. These value are low suggesting that the metal complexes are non – electrolyte.[6]

The decomposition temperature of the complexes determined in the laboratory are recorded in table 1. The value are close to those observed in the thermal analysis and show the thermal stability of the metal complexes.

The electronic spectra of the complexes exhibit to band. at about 14390 & 23195 cm^{-1} indicate the $^4A_{2g}(F)^4T_{1g}$ (F) (V_2) &$^4T_{2g}$ (F) $^4T_{1g}$ (F) (V_3) Transition respectively which are consist in the octahedral geometry.[7]

The infra red Spectra.of complexes & ligand virtually identical except for the appearance of additional band due to co – ordination of onion. Appearance of a band in the region 311 CM^{-1} are assigned the ν (Co Cl).This band show the presence of co-ordinate chlorine molecule. The I.R. Spectra of Schiff base of thiosemicarbazide show a band b/w 750-920 cm^{-1} These band may be assigned the VC=S vibration This band is Shifted between 810 – 930 cm^{-1} in the spectra of complexes suggesting the co- ordination the S- atom of thio group.[9] The I.R. Spectra of Schiff bases show the absorption band of –HC=N azomethene group at around 1580 – 1630 region. This band is shifted in the region 1560 – 1660 cm^{-1} which is indicate the co – ordination of cobalt with azomethene group of Schiff base.

The magnetic momet value of all cobelt (ii) complexes come b/w 4.87 BM to 5.07 B.M. value indicate that the all cobalt (ii) complexes are Paramagnetic in nature.[10]

Table - 1

Sr. No	Name of Molecular formula	Colour	M.P.C	Elemental analyses					Molar Conductance			M. moment
				C%	H%	N%	S%	M%	MeOH	DMF	DMSO	BM.
1	$[Co\ (MBTSCZ)_2Cl_2]$ $[(C_{17}H_{17}N3O_2S)_2\ CoCl_2]$	Radish Yellow	298	52.0408 (51.99)	4.3367 (4..339)	10.7142 (9.7142)	9.0561 (10.039)	7.5255 (6.523)	0.11	.15	0.17	4.97
2	$[Co(DMACTSCZ)]Cl_2]$ $[(C_{23}H_{27}N_5S)_2\ CoCl_2]$	Dark Red	320	58.7234 (57.339)	5.7446 (6.003)	14.836 (13.009)	7.5531 (6.008)	6.2765 (5.006)	0.10	.24	0.23	4.93
3	$[Co(DMACTSCZ)]Cl_2]$ $[(C_{19}H_{23}N_5S)_2\ CoCl_2]$	Light Red	308^0C	54.5454 (53.558)	5.5023 (6.006)	16.7474 (16.009)	8.4928 (6.996)	7.0574 (8.006)	0.016	0.18	0.19	4.95
4	$[Co(PATSCZ)_2Cl_2]$ $[(C_{13}H_{11}N_5S)_2\ CoCl_2]$	Brown	270^0C	46.7065 (45.669)	3.2934 (2.999)	20.9580 (18.006)	10.6287 (9.006)	8.8323 (7.006)	0.12	0.19	0.16	5.07
5	$[Co(CBTSCZ)_2Cl_2]$ $[(C_{15}H_{11}N_3Cl_2S)_2CoCl_2]$	Yellow wish Brown	305^0C	44.8877 (46.009)	2.7431 (3.0669)	10.4738 11.689	26.5586 25.069	7.3566 6.009	013	0.23	0.17	4.87

Biological Activity

The Schiff bases & their metal complexes were screened for anitfungal activity, antiseptic & disinfectant. The metal complexes microbial activity Pechiney & Prugel[11] prepared the Schiff bases having phenolic& halogen group by condensation. Dicloro or dibromosalicyaldehyde-2-amino-2-ethyl-1,3- propane diol which were used as agriculture fungicide to prevent the growth of apendiculatus, PlasmoparaviticalaSeptoriaErysipegramini[12,13]

The Schiff base derived from thiosemicarbazide and their metal complexes were tested against various fungi. Antifungal solution of different Schiff bases & their metal

complexes were evaluated by determining complete suppression of the usual growth of micro organism. Certain Schiff bases containing - NH_2 group & d group were studied against A.niger&A.fumigates 50 mg concentration by single disc method.[14,15,16] In present paper mentioned Schiff bases & their metal complexes were tested against A.niger& A. fumigates and result in given table – 2

Table-2

Biological activity of Schiff bases & their cobalt (II) complexes

Sr. No	Name of Compound	A. niger		A. fumigates	
		0.02	**0.002**	**0.02**	**0.002**
1	Thiosemicarbazide	-	-	-	-
2	[MBTSCZ]	++	+++	++	++
3	[DMACTSCZ]	+++	+	++	+++
4	[DMABTSCZ]	++	+++	+	+++
5	[PATSCZ]	+++	+++	++	++
6	[CBTSCZ]	+++	+++	++	++
7	$[Co(MBTSCZ)_2Cl_2]$	++	+	++	++
8	$[Co(DMACTSCZ)_2Cl_2]$	++	++	+++	+
9	$[Co(DMABTSCZ)_2Cl_2]$	+++	+++	+++	+++
10	$[Co(PATSCZ)_2Cl_2]$	++	++	+++	+++
11	$[Co(CBTSCZ)_2Cl_2]$	++	++	+++	++

Inhibition Diameter of Zone.

-	less than 11MM	+++	19-22 MM
+	11-14 MM	++++	23-25 MM
++	15-18 MM	+++++	More than 25MM

References

1. Johnson D.K. etialInorg, chem. Acta 67 159 (1982).
2. Shahawi El-M-S Sci. 7 (3) 443 (1991)
3. Srinivason K., Parrier S., & Kochi J. Mol. Catal. 36 297 (1986).
4. Gonalkar M.C. Not Acad Sci. 8 (11) 343 (1985).
5. Vogal. A.I. A Text book of Quantitative inorganic analysis 3rd Edition (10 ngman ELBS Londaon)
6. Geary W.J CoordchemRew 7, 81 1971.
7. Lever A.B.P Inorganic electronic Spectroscopy. (Elesevieramstaardam) 1968, 317
8. Nakamoto K., Infra red Spectra. of Inorganic & Co – ordination compound. IIndEdn. (John Wiley new york) 1970, 167, 213, 222
9. R. Singh. & S.K. Dixit. Synth. react inorganic metal – org chem. 1992 -22, S.Pal, G Mukherjee. & S. Poddar. Transition Metal Chemistry. 1994. (19) 449.
10. Jena S., N. Rath& K.C. Das Indian Journal of Chemical Volume April 1999. (350 - 359)
11. Pechiney – Pragil, So cite pour le development at a vante de. Specialties Cheimiques. Fr. 91 617 1968
12. T. Punniyamurty, SJS Kalra. & J. Iqbal Tetrahedron left. 1995 36 (849)
13. B. Kalia, L Simon, R. Anne & C. Geyard el – al Inorq. Chem. 1996 35,
14. D.S Rao& M.C. Ganorkar J. Indian Chemical Society 1981 58 217
15. M. Athor N. Ahmad A.A. Gupta Indian Drugs 1993, 225
16. Y.K Choi K.H. Chjo. SM park et al. J. Electro Chemical Society 1995 142, 410