



SYNTHESIS, CHARACTERISTICS AND BIOLOGICAL ACTIVITY OF POLYDENTATE SCHIFF BASE COMPLEXES OF DI & TRI VALENT TRANSITION METAL IONS

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Abstract

Trivalent chromium and divalent copper complexes with mixed ligands such as terephthalaldehyde bis (semicarbazone L¹, terephthalaldehyde bis (4-phenyl thio semicarbazone L², 2-Hydroxy 1,2 diphenyl ethane semicarbazone L³, 5-bromo-o-anisaldehyde bis (semicarbazone) L⁴ and tribuline bis (Semicarbazone L⁵) have been prepared in neutral and basic medium. The obtained complexes have been characterized by using magnetic moment, IR spectra, electronic spectra, molar conductance measurement, elemental analyses, relative molecular weight determination. The study suggested that above ligands from positive ionic complexes have general formula $[ML'_x]^n (NO_3)_n$ M=Cr, Cu, L-bidentate ligand x =3, L''- n = +3, + 2 OR $[Cr L'_3] (NO_3)_3$ in neutral (slightly acidic) medium. The ligands terephthalaldehyde bis (semicarbazone), terephthalaldehyde bis (4-phenyl thiosemicarbazone), 2-hydroxy 1,2 di phenyl ethane semicarbazone, 5-bromo-o-anisaldehyde bis (semicarbazone and tribuline bis (smicarbazone), acted as neutral or anionic in neutral (slightly acidic) or basic medium, respectively. All the investigated complexes have octahedral geometry. The synthesized ligand and metal complexes were subjected to antibacterial studies. The studies showed the enhance activity of metal complexes again one or more species as compared to the uncomplexed ligand.

Introduction

A survey of literature reveals that amongst the different class of $-N = N-$ containing ligand plays an important role in the determination of Cr III and Cu II metals. Attempts were made to improve upon the selectivity and sensitivity of the reactions of azomethine linkage with these metals. Present work has been reported preparation of ligand and their structure as well as spectral investigation of above azo-methine ligands with their complexes. So many complexes with polydentate ligands have been reported.¹⁻⁴ But ligand with azomethine linkage and their complexes had important analytical applications such as biological activities⁵⁻⁶, pharmaceutical, solar cell and photosensitizes etc. large no. of semicarbazone complexes have been reported⁷⁻¹¹. In addition to their ligational properties, semicarbazone formed an important class of biologically active compounds and they were also used as pigment,¹²⁻¹⁴ mixed ligand complexes were of considerable important in the field of an artificial metalloenzyme, a broad group of enzymes that use a metal cation as a cofactor in the enzyme active site and other biological activities.¹⁵⁻¹⁷ Therefore, a large no. of mixed ligand complexes with transition and non-transition metal ions have been reported.¹⁸⁻²⁰ These ligands and mixed ligand complexes have greater importance in different field, so we look a modest part in chemistry of mixed ligands and some manuscripts have been published on their coordination chemistry with transition or non-transition metal ions.²¹⁻²⁴

In the present work some new Cr III & Cu II complexes with mixed ligand tere phthalaldehyde bis (semicarbazone), terephthalaldehyde bis (4-phenylthio semicarbazone), 2-hydroxy, 1,2 diphenyl ethane semicarbazone, 5-bromo-o-anisaldehyde bis (semicarbazone) and Tribulin bis (semicarbazone) have been prepared and characterized physico-chemically with biological activity. Semicarbazone, 4-phenylthio-semicarbazone with other ligands have considerable intense in the field of chemistry and biology due to their antibacterial, antifungal, antimalarial and antiviral activities through binding to metals vacant orbital giving complexes. The complexes can exhibit bioactivities which are not shown by the free ligands. Accordingly by considering the biological potential of semicarbazone, 4-phenylthiosemicarbazone and their derivatives of transition metal complexes, herein the synthesis route of some these derivatives is reviewed for the same activity and having sound scope in research and developing process in pharmaceutical and medicinal chemistry for biological system.

Experimental

All the chemicals used were supplied from CDH, Adrich, sigma. Samples of terephthalaldehyde, Tribuline, 2-hydroxy-1, 2-di phenyl ethane, semicarbazide, 4-phenylthio semicarbazide 5-bromo-o-anisaldehyde (Fluka) were employed, solvent used were of reagent grade.

Terephthalaldehyde bis (semicarbazone) L¹, Terephthalaldehydes-(4-phenyl thiosemi-carbazone)L², 2-hydroxy 1, 2 di phenylethane semicarbazone L³, 5-bromo-o-anisaldehyde bis (semicarbazone) L⁴ and Tribulin bis (semicarbazone) L⁴ and Tribulin bis (semicarbazone) L⁵ ligands have been prepared according to literature method.²⁵⁻²⁶

A general procedure has been adopted for the preparation of the complexes in neutral and alkaline medium.

In a neutral medium, a solution of 0.5 gm (2.10×10^{-3} mol) of Cr (NO₃)₃ 9H₂O or Cu (NO₃)₂ 3 H₂O in 10 ml of water has been added to the solution 0.5 or 0.6, 0.65 gm of L¹ (2.10×10^{-3}), L^{II} (2.5×10^{-3} mol), L^{III} (3×10^{-3} mol) of the semicarbazone ligand in small amount of EtOH and water with heating until a clear solution has been resulted. The amount in gms were listed in the Table 1. Obtained mixture have been refluxed for four hours followed by evaporation to half their volumes then cooled.²⁸ The product were separated by filtration wash with petroleum benzene and dried at under the reduced pressure over calcium chloride yield (73-90%)

All are insoluble in water and other common organic solvent but highly soluble in DMF, DMSO. The complexes have been prepared by applying the same amount used for neutral medium and after mixed the metal salt with the ligand and heating, Sod. Hydroxide solution (1N) has been added until pH of the solution have been adjusted to about 7.5-8. The mixture have been heated on a water bath for about half an hour then allowed to stand for cooling. The product were filtered off and washed with petroleum benzene and dried at 80°C.

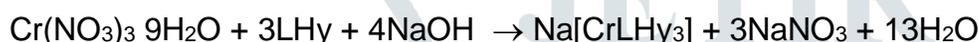
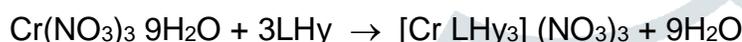
Copper contents have determined by atomic absorption spectroscopy and chromium contents by applying precipitation method after the decomposition of the complexes with concentrated HNO₃.²⁵ Relative molecular weight of the ligand and their complexes have been determined cryoscopically.²⁷ Molar diffraction measurement have been carried out with Alago illumination, Alago Co. Ltd. Japan using 10^{-3} M DMFO solvent. Conductivity measurement have been carried out with an electrolytic conductivity measuring Toshiwal conductivity bridge type CL01/02 A using 10^{-3} M DMF solvent at 27°C. The IR spectra of the compounds have been recorded as nujal mulls on a pye unicom Sp-3-300 spectrophotometer in the range 200-4000 cm⁻¹ using KBr disc. Electronic spectra has been recorded on pye Unicam SP-5-560 visible spectrophotometer for 10^{-3} M solution of the ligands and their complexes in DMFO at 27°C, using a 1 cm cell. Magnetic susceptibility of the complexes have been measured at room temperature by Gouy's balance method using Co Hg(SCN)₄ as standard.

The biological activities of synthesized schiff base and their metal complexes have been studied for their antibacterial and antifungal activities (Benson, 1990) by well diffusion method³⁴ and the stock solution (0.001 mol) was prepared by dissolving the compounds in DMSO and the solution was serially diluted to find the minimum inhibition concentration MIC values(μ g/ml). Four bacterial

strains *Escherichia Coli*, *Enterobacter aerogenes*, *Staphylococcus aureus*, *Bacillus pumilus* and *Klebsiella Oxyloca* were incubated for two days at 35°C and fungal strains (*Aspergillus niger*, *Candida albicans* and *Rhizoctonia bataticolo*) were incubated for 2 days at 35°C, standard antimicrobial activity were performed in triplicate and the average was taken as a final reading.

Results & Discussion

The reaction of Cr III or Cu II nitrate terephthalaldehyde, 2-Hydroxy 1, 2 phenyl ethane, Tribulin (Isatin) with semicarbazone, 4-phenyl thiosemicarbazide ligands in 1:2 & 1:3 molar ratio in both neutral and basic medium can be prepared by the following equation



Where M = Cr⁺³, Cu⁺²

LH_y = L¹, L², L³, L⁴, L⁵ (Ligands)

n = 3, 2, Z = 9, 3, x = 3, 2

The resulting complexes were coloured. Chromium and Copper contents and molecular weight revealed that the complexes in neutral or slightly acidic medium had a composition of 1:2, 1:3 electrolyte Table 1. The value of molar conductance ranges 217-272, 119-180 cm² mol⁻¹ approached those expected for 1:3 (complex I, II, III, IV, V), 1:2 complexes (VI, VII, VIII, IX, X) is electrolytic nature of the complexes. The magnetic moment 1.61-1.88 and 3.43-3.80 BM indicated the presence of one unpaired and three unpaired electrons for Cu II & Cr II complexes^{3, 30} assign to a monomeric structure having octahedral geometry Table 1 & Table 2.

Table -1 : Amount and Medium for the preparation of the complexes

S.No. complexes	L ¹ wt	L ² wt	L ³ wt	L ⁴ Wt	L ⁵ wt	%yield	Complex	Electrolytic nature of complexes
1.	0.41				0.46	73.46	[Cr L ₃ ¹](NO ₃) ₃ / [Cr L ₃ ¹]3NO ₃	1:3
2.	0.43				0.47	74.12	[Cr L ₃ ²](NO ₃) ₃ / [Cr L ₃ ²]3NO ₃	1:3
3.		0.38			0.46	80.12	[Cr L ₃ ³](NO ₃) ₃ / [Cr L ₃ ³]3NO ₃	1:3
4.		0.38			0.46	79.13	[Cr L ₃ ⁴](NO ₃) ₃ / [Cr L ₃ ⁴]3NO ₃	1:3
5.			0.57		0.46	73.6	[Cr L ₃ ⁵](NO ₃) ₃ / [Cr L ₃ ⁵]3NO ₃	1:3

6.			0.58		0.59	82.4	$[Cu L_3^1](NO_3)_2 / [Cu L_3^1]2NO_3$	1:2
7.	0.54				0.59	85.4	$[Cu L_3^2](NO_3)_2 / [Cu L_3^2]2NO_3$	1:2
8.	0.53				0.59	90.78	$[Cu L_3^3](NO_3)_2 / [Cu L_3^3]2NO_3$	1:2
9.		0.46			0.60	71.85	$[Cu L_3^4](NO_3)_2 / [Cu L_3^4]2NO_3$	1:2
10.		0.45			0.60	81.01	$[Cu L_3^5](NO_3)_2 / [Cu L_3^5]2NO_3$	1:2

Table 2 : Some analytical & Physical properties

S.N. Comp- plexes	Colour	MP °C	Ω^{-1} cm ² mol ⁻¹ ΔM	Metal% Cal. (Obs.)	Mol. Weight Cal. (Obs.)	Ref. x 10 ⁻⁴	μ eff BM
1	Yellowish orange	132	247	5.80 (5.78)	898 (823)	1.425570	3.58
2	Yellow cannery	146	272	5.05 (5.13)	1030(997)	1.435670	3.43
3	Dark Brown	172	230	7.62 (7.53)	682 (674)	1.425120	3.1
4	Radish Brown	120	217	9.58 (9.63)	543 (552)	1.425334	3.74
5	Buff colour	151	220	7.45 (7.53)	698 (709)	1.425302	3.80
6	Pale Yellow	138	180	5.72 (5.75)	909.5(1030)	1.425133	1.61
7	Red Brown	128	156	5.00 (4.96)	1041.5(1002)	1.425289	1.74
8	Light Brown	201	132	7.50 (7.39)	693.5(714)	1.425310	1.82
9	Greenish Brown	183	127	9.39 (9.31)	554.5 (539)	1.425701	1.70
10	Blue green	165	168	7.33	709.5 (698)	1.425632	1.88

ΔM : Molar Conductance in $\Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$, μ_{eff} : Magnetic moment in B.M

The refraction of the complexes in 10^{-3} M DMFO solvent were in the range 1.425128×10^{-4} – 1.435670×10^{-4} . The molar refraction is an additive and constitutive property. It has been used to construct the correct structure of the compound³¹. The IR spectra of 1 : 2 and 1:3 type (Aldehyde & Ketone carbazide) indicated from analyses. The presence of an aromatic type structure is recognized^{4,5} the presence of = C-H stretching vibrations near 3030 cm^{-1} and C=C vibrations in the range $1590 - 1500 \text{ cm}^{-1}$. The absorption bands observed near $3440-3340 \text{ cm}^{-1}$ and 1645 cm^{-1} correspond to N-H stretching and NH_2 deformation, respectively. The sharp absorption peak at 1680 cm^{-1} to 1480 cm^{-1} in the spectra (1, 2, 3, 4, 6, 7, 8, 9) is due to the presence of C = O group and C = S group is indicated by the peak at 1495 cm^{-1} . The C = N linkage of schiff base type IV, V confirmed by the bands near 2330 cm^{-1} at 1340 cm^{-1} , in the spectra of the compound (V) shows the C-N

stretching of Ar – N type. The C=N-N and N-C-N type linkage are shown by peak near 1530 cm^{-1} and 1500 cm^{-1} . All the schiff bases showed two strong bands at 1655 cm^{-1} - 1697 cm^{-1} attributed to the C=O group this value shifted towards a lower frequency on coordination in neutral medium indicate the formation of a chelation between the oxygen of C=O group and the metal ion²⁹, mean while in basic medium thio band was disappeared in the complexes and a new band was disappeared in the complexes and a new band has been absorbed at 1190 - 1207 cm^{-1} due to C-O group, thereby establishing co-ordination of the ligand through the enolic oxygen atom.^{3, 29} The next strong band 1621.81 - 1639.03 cm^{-1} attributed to C = N group²⁹ shifted towards lower frequency on co-ordination due to the decrease of the band order as a result of metal-N band formation.³² The appearance of a strong band at 1628 - 1638 cm^{-1} and 1570 - 1580 cm^{-1} attributed to $\gamma_{(C=N)} + \gamma_{(O-C=N)}$ and azomethine chromophor $\gamma_{(C=N,N=C)}$, respectively. It supported the formation of enolic structure in basic medium.

The position band of the ligands in the range 3234.31 - 3255.66 cm^{-1} remain unaltered in the complexes prepared in neutral medium indicating that there is not coordination through the N-N group^{21, 29}, whereas in the basic medium this band was disappeared due to the enolic form.

The order of band observed³⁷ at 1330 cm^{-1} attributed to the bending vibration of phenolic OH shift towards a lower frequency on complexation ²⁹ indicates the

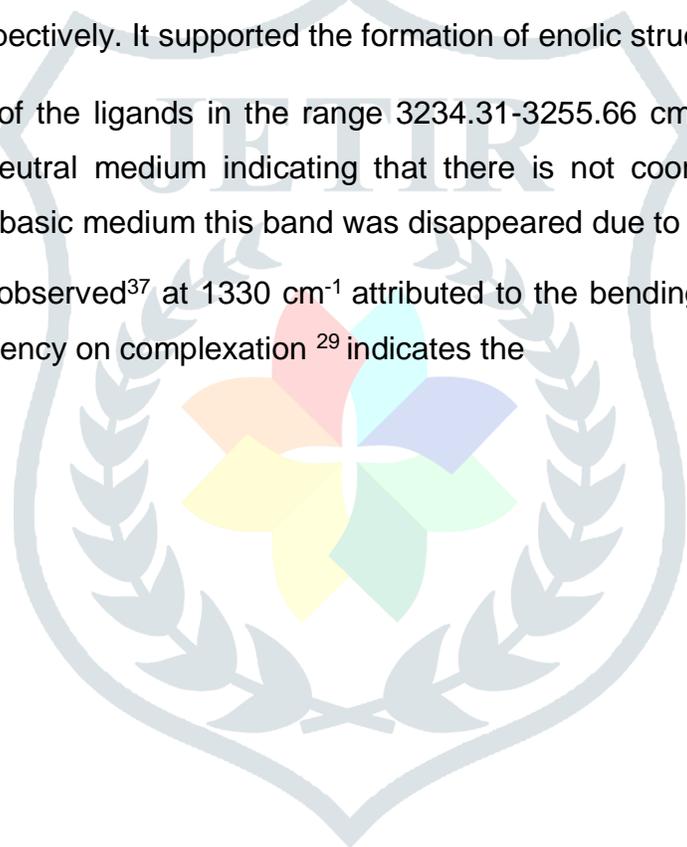


Table 3 Some important bands in IR spectra of ligands and their complexes

	$\gamma_{C=N}$	$\gamma_{C=O}$	$\gamma_{C=S}$	γ_{C-O}	$\gamma_{C=N}$	$\gamma_{C=O}$	γ_{C-O}	γ_{N-N}	$\gamma_{NO_3^{ionic}}$	$\gamma_{NO_3^{(S)}}$	γ_{M-N}	γ_{M-O}	other bands	
1.	1639.83	1680			1637.96	1687.14		95					γ_{C-H}	1598
2	1570.14	1686.15	1480		1632.9									1550
3	1635.91	1697.5												1531
4	1621.81	1697.5		1399.82	1630.1									1546 1500
5	1629.15	1657.5											γ_{C-O}	1119.6
1	1617.32	1628.04	-	-	1599.01 1638.12	1638.04		984.27	1384.94		405 400	474.62 481.31	γ_{O-H}	3552.2
2	1551.43		1152.80 1207.29	1152.80 1207.29	1616.64 1638.30		4155.91 1167.31	981.87			445.60 400.03	481.37 492.33	$\gamma_{C=O}$	1720.37
3	1616.30	1638.11		-	1598.31 1637.96	1652.30		981.87	1390.45	1340.61	405.12 443.00	505.61 521.32	$\gamma_{C=C}$ $\gamma_{C=O}$	3440 1720.35
4	1556.09		1110.64 1163.43	1110.64 1163.43	1607.33 1638.13		1188.87	982.90			400.00 445.83	502.11 534.48	$\gamma_{C=C}$	34340
5	1563.12	1617.08			1599.11 1638.40	1638.40		990.02	1385.25	1285.51	410.21 401.32	474.87 451.03	γ_{CO}	1720.53
6	1552.53		1191.31 1111.81	1991.31 1111.80	1617.44 1639.10		1159.32	981.96			444.32 400.00	452.12 481.21	$\gamma_{C=C}$ γ_{NH}	34410 1450
7	1617.67	1638.05			1599.00 1638.00	1638.05		982.31	1384.90	1315.20	443.21 400.00	452.12 481.21	γ_{CO} γ_{OH}	1133.56 3547.21
8	1615.94		1185.27	1485.27	1598.32 1637.71		1160.29	918.30			412.01 400.00	471.94 492.33	$\gamma_{C=C}$	34350
9	1616.96	1638.10	7187.24		1596.31 1628.15	1630.92		979.93	1386.70	1338.55	470.47 400.00	474.64 492.13	$\gamma_{C=O}$	1707.03
10	1605.43	1637.12	1192.83	1192.83	1599.70		1146.27	979.31			409.12 400.05	490.64 501.32	γ_{NH}	3410

coordination of the group with the metal ion move over the appearance of a band at 1119 Cm^{-1} which belongs to the $\gamma_{\text{C-O}}$ shift to higher frequency $1130.79\text{-}1135.56 \text{ cm}^{-1}$ on complexation indicate the coordination of oxygen atom²⁹. The IR spectra of complex 3 & 2 showed a band at 1720 cm^{-1} attributed to $\gamma_{\text{C=O}}$ observed in the same position in complexes ³⁵ 2 and 7 indicating the uncoordination of this group to the metal ion³⁰, whereas in basic medium this band was disappeared due to the formation of the enol isomers which was supported by the appearance of a band Table 3 assign to $\gamma_{\text{C-O}}$.^{21,22,29}.

The IR spectra of ligand 2, 4, 5 showed a band at range $1630\text{-}1637 \text{ cm}^{-1}$ due to $\gamma_{\text{C=N}}$. On coordination this band was splitted in two bands one appeared in same position and other band observed at low frequency. This demonstrated that only one N-atom was coordinated to metal ion.^{1, 29, 30} More over the position shift in N-N vibration on complexatoin can be added as a further support to the coordination of a azomethine Nitrogen to the metal ion.^{30,22} The next band at 1687 cm^{-1} attributed to $\gamma_{\text{C-O}}$ shifted to lower frequency. Table 3 Fig. A for complexes prepared in neutral medium³². In basic medium this band disappeared in the complexes and a new band was observed at $1146\text{-}1188.87 \text{ cm}^{-1}$ due to the $\gamma_{\text{C-O}}$ thereby establishing coordination of ligand through enolic oxygen atom.²⁹

On the other hand the spectra of the complex prepared in neutral medium (slightly acidic) showed now band around $1384 \text{ cm}^{-1} - 1390.45 \text{ cm}^{-1}$ due to ionic nitrite, In addition complexes 3, 5, 7, 9 and 10 showed band at $1400.51\text{-} 1455.95 \text{ cm}^{-1}$, $1285.51 - 1340.61 \text{ cm}^{-1}$ and $900.75 - 1005 \text{ cm}^{-1}$ due to $\gamma_{\text{s}}(\text{NO}_3)$, $\gamma_{\text{as}}(\text{NO}_3)$ and $\gamma_{\text{NO}}(\gamma_2, \gamma_1, \gamma_5)$, respectively.

The difference between $\gamma_1 - \gamma_1$ equal to the $115\text{-}115.14 \text{ cm}^{-1}$ which supported the bonding of Nitrogen group as monodentate ligand through the oxygen ation. The spectra of all the complexes showed new bands at $400\text{-}470 \text{ cm}^{-1}$ and $451\text{-}534.48 \text{ cm}^{-1}$ due to $\gamma_{\text{M-N}}$ and $\gamma_{\text{M-O}}$ respectively^{27, 29, 30} The presence of these bands supported the formation of the complexes under investigation.

The electronic spectra in the UV region Table 4 of the ligands showed two bands in region $40000\text{-}38085 \text{ cm}^{-1}$ and $30172.48 - 34325.58 \text{ cm}^{-1}$ corresponding to $\pi\text{-}\pi^*$ and $n \rightarrow \pi^*$ transition³³. On complexation a blue shift was observed due to the polarization in the C=N band caused by the elemental ligand electron interaction during the chelation. The electronic spectra of Cr III complexes Table 5. showed band γ_1 , γ_2 , and γ_3 at $10511.08 - 11511.71 \text{ cm}^{-1}$, $12617\text{-}25410.20 \text{ cm}^{-1}$ and $25410.20 - 29617 \text{ cm}^{-1}$ due to the transition ${}^4\text{A}_{2g}(\text{F}) \rightarrow {}^4\text{T}_{2g}(\text{F})$, ${}^4\text{A}_{2g}(\text{F}) \rightarrow {}^4\text{T}_{1g}(\text{F})$ and ${}^4\text{A}_{2g}(\text{F}) \rightarrow {}^3\text{T}_{1g}(\text{P})$, respectively.^{32, 33}

Table-4: Electronic Spectral data in the UV vis of ligands and their complexes

S.No. Ligand complexes	$n \rightarrow \pi^* \text{cm}^{-1}$	$\pi \rightarrow \pi^* \text{cm}^{-1}$
1	34325	40000.00
2	31256	38085.17
3	32275	41516.12
4	30472	43080.00
5	31623	40000.00
1	25513	29416
2	25300	28163
3	24890	28910
4	24850	30416
5	26210	32416
6	27711	31609
7	28313	31790
8	25521	31678
9	25210	32613
10	26360	33917

Table 5 : Electronic spectral data of chromium III complexes

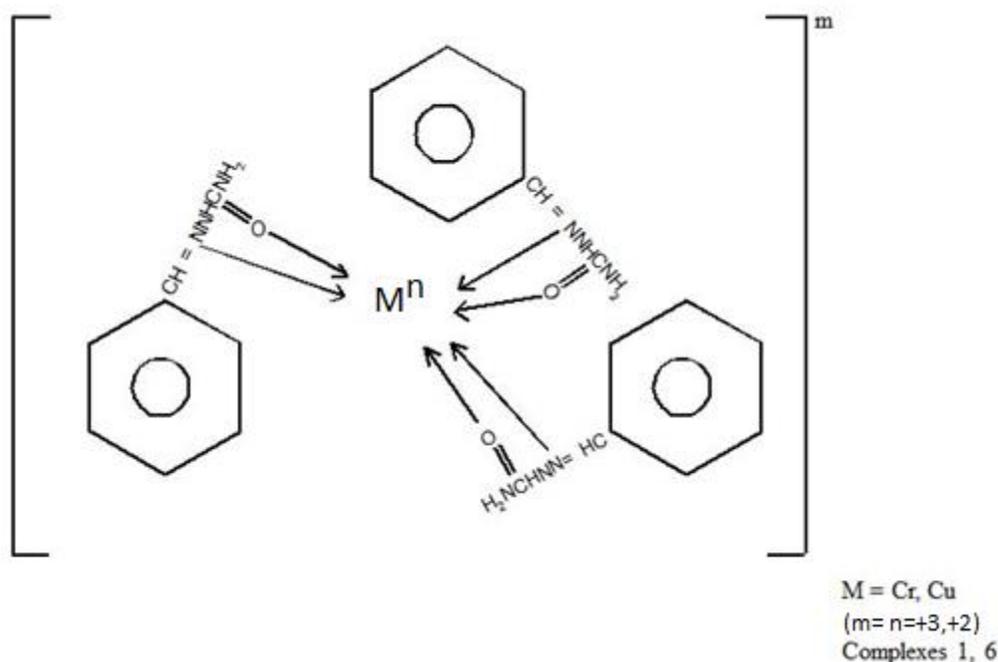
	γ_1	γ_2	γ_3	β	$\gamma_{3/\beta}$	Dq	10Dq	β	CT. ₀₀₀	CFSE
1	11709	25410	29617	892.124	33.12	1150.21	11502.1	.92	31610	13050
2	10511	13120	25647	880.146	29.14	1013.61	10136.1	.94	28412	11214
3	11316	23540	28472	780.134	36.50	1162.12	11621.2	.86	32142	13260
4	10670	12617	27697	820.631	33.75	1050.24	10502.4	.84	40135	12155
5	11511	23416	29500	835.214	35.32	1755.11	17551.1	.97	32133	11620

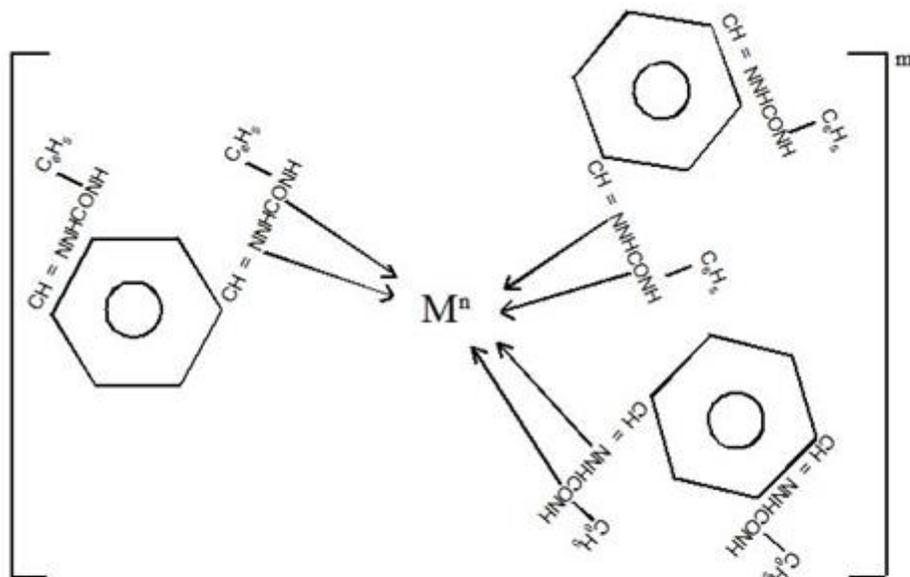
Table 6 : Electronic Spectral data of Copper II complexes

S.No.	γ_1	γ_2	γ_3	CT
6	10512	14627	23575	29213
7	10002	11910	23517	31617
8	10212	13697	24510	33147
9	11917	13970	23170	31513
10	12120	11690	24521	29634

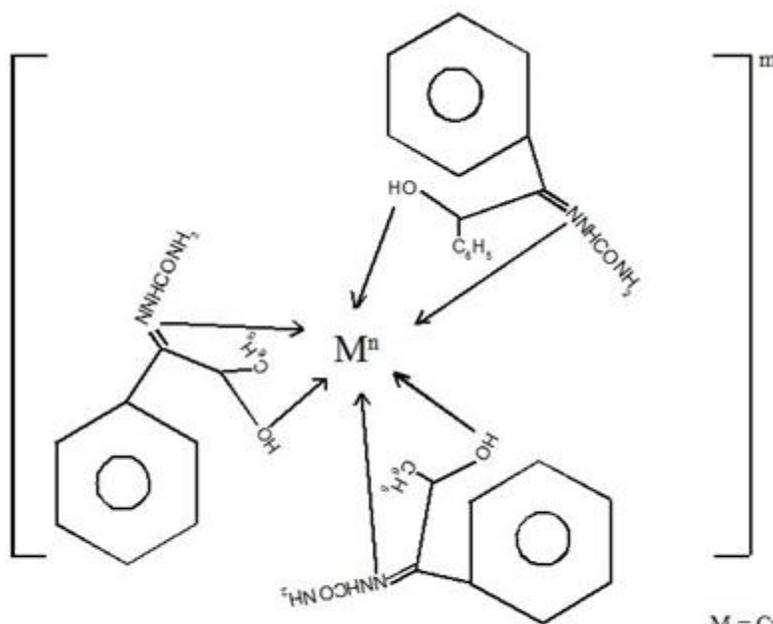
The ligand field parameter and the ligand field splitting energy ($10Dq$) in case of Cr III complexes have been calculated.^{32,33} The value of β of Cr III complexes were 0.84- 0.97 clearly indicated the covalent character of the bond concerned. The value of $Dq/6$ which were in the range 1.145-1.490 suggested octa-hedral geometry for all the Cr III complexes.

The electronic spectra of Cu II complexes Table 6 showed band (γ_1 , γ_2 , and γ_3) at 10000-12120 cm^{-1} , 11910-11690 cm^{-1} and 24521.14 \rightarrow 24510.84 cm^{-1} due to the transition^{32,33}. The value of CFSE of Cr III complexes have been also determined which were in the range 12215-13260 cm^{-1} . However, the electronic spectral data suggested octahedral geometry for all complexes.

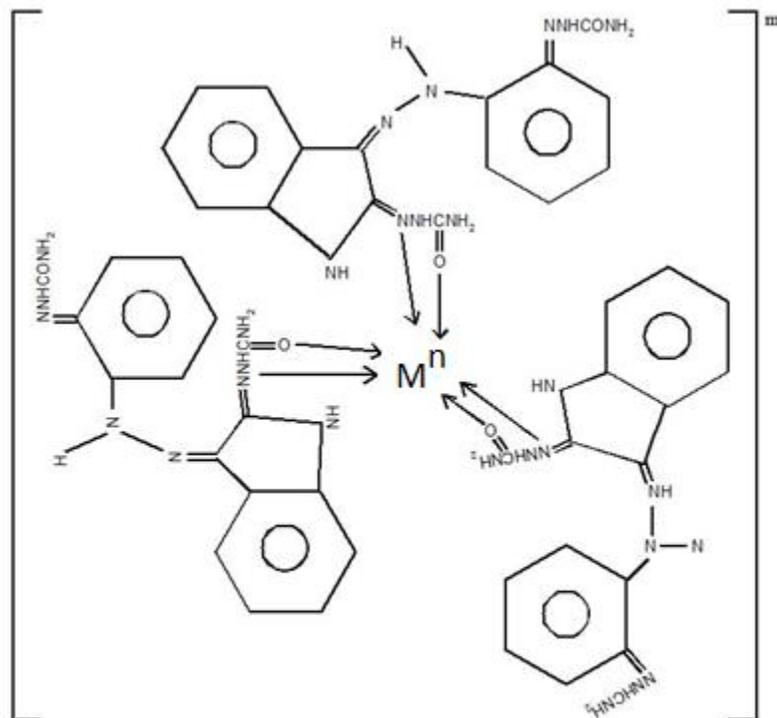




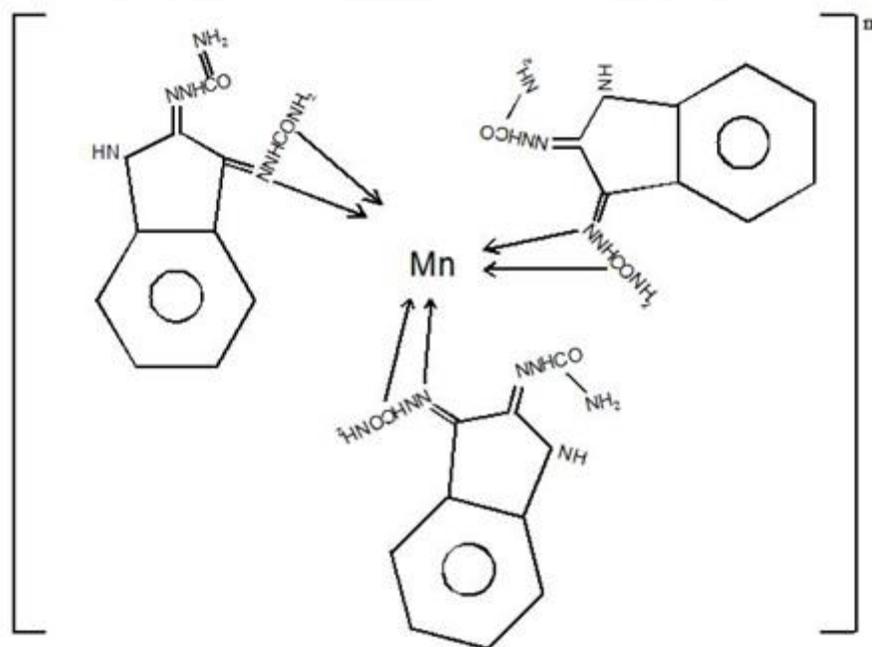
M = Cr, Cu
 (m=n+3, +2)
 Complexes 2, 7



M = Cr, Cu
 (m=n+3, +2)
 Complexes 3, 8



M=Cr, Cu
 m=n=+3, +2
 Complex 4,9



M=Cr, Cu
 m=n=+3, +2
 Complex 5, 10

Table 7 : Antibacterial Activity of Schiff base and their complexes

Schiffbase compound 300µg/ml	E.Coli	Eaerogenes	S. aureus	B. Pumilus	K Oxytoca
L ₁	15 ±0.10	11 ±0.10	13 ±0.24	10 ±0.12	10 ±0.10
L ₂	11 ±0.12	13 ±0.24	12 ±0.30	11 ±0.15	11 ±0.20
L ₃	13 ±0.13	12 ±0.13	13 ±0.10	11 ±0.21	11 ±0.16
L ₄	15 ±0.10	11 ±0.10	13 ±0.24	10 ±0.12	10 ±0.10
L ₅	11 ±0.10	11 ±0.32	12 ±0.10	10 ±0.11	10 ±0.21
Drug	10 ±0.10	8 ±0.10	9 ±0.21	8 ±0.14	8 ±0.20
Complex					
1	30 ±0.12	20 ±0.23	32 ±	18 ±0.10	28 ±0.11
2	31 ±0.21	17 ±0.21	28 ±	18 ±0.13	23 ±0.24
3	28 ±0.22	18 ±0.12	33 ±	16 ±0.16	25 ±0.22
4	24 ±0.14	17 ±0.14	24 ±	17 ±0.21	30 ±0.10
5	30 ±0.13	19 ±0.21	30 ±	19 ±0.17	26 ±0.13
6	22 ±0.10	12 ±0.23	24 ±	20 ±0.13	30 ±0.17
7	18 ±0.12	11 ±0.19	21 ±	21 ±0.11	22 ±0.10
8	19 ±0.30	13 ±0.20	23 ±	16 ±0.21	21 ±0.17
9	12 ±0.19	12 ±0.13	25 ±	14 ±0.24	31 ±0.23
10	13 ±0.22	13 ±0.14	22 ±	19 ±0.13	18 ±0.18

Zone of inhibition data was shown as mean ±SD
each experiment was repeated three times

The antimicrobial activity results in Table 7 reveals that the Cr III & Cu II complexes show fairly good activity against all tested bacterial strains and in general activity order of synthesized compounds can be proposed as Cu > Cr. The higher activity of the metal complexes may be owing to effect of metal ions on the normal cell membrane.³⁵ Metals complexes bear polar & non polar properties together, which makes them suitable for permeation to the cell and times and may enhance the bio-chemical potential of bioactive organic species. Further lipophilicity, which controls the rate of entry of molecular into the cell, is modified by coordination. So these metal complexes can become more active that of the free ligands. Therefore, metal complexes show greater antimicrobial activity then that of uncoordinated ligands and free metal ions. This mixed ligand complexes have an advantage in that of respective bioactivity of uncoordinated ligands and metal ions are combined, which could be make their more potent antimicrobial agents.

Conclusion

The coordinated ability of the newly synthesized schiff has been proved in complexation reaction with Cr III & Cu II ion : IR, UV-vis spectra, molar conductance measurement elemental analyses etc. of the ligand and its metal complexes confirmed the suggestion of the ligand through phenolic carbonyl oxygen, oxygen of –OH group and nitrogen of the azomethine group as bi & tridentate. All the synthesised complexes demonstrated octahedral geometry.

The transition metal complexes are far biologically active than uncoordinated semicarbazone, 4-phenyl thio-semicarbazone. On the premise of result got after antimicrobial studies it is obvious that all the synthesised metal complexes enhanced antibacterial properties against selected microbes. These observations in accordance with different studies, recommended that metal based drugs have potential as therapeutics.

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