

Spectral and Biochemical Studies on Co (II), Ni (II) And Cu (II) Complexes with a Chelating BidentateDiaza Schiff Base Ligand Derived From Pyridin – 2-Al and Paratoluidine

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Abstract: A series of square planar complexes of Co (II), Ni (II) and Cu (II) of the type, $[M(PTSB)_2] X_2$ have been obtained. $X = Cl, Br$ and NO_3^- in the present case. PTSB is a Schiff base ligand derived from pyridin – 2- carboxaldehyde and para- toluidine in equimolar proportion. The ligand has been synthesized by two different routes, traditional method and green method, the later giving higher yield in lower reaction time. Metal complexes have also been synthesized by modern metal – ion- catalyzed template method. Characterization of the ligand as well as metal complexes has been done on the basis of elemental analysis, conductivity and magnetic susceptibility measurements. Bonding mode has been decided by I.R. spectra. Square planar stereochemistry has been proposed on the basis of electronic spectra and magnetic moment data. The ligand has been found to act as a bidentate chelate with both the azomethinic and pyridyl nitrogens for co-ordination. Biochemical screening of the ligand and complexes have been probed against bacteria and fungi. Complexes have been found to have superior biochemical activity than the ligand.

Keywords: Schiff-base, Co (II), Ni (II), Cu (II), Spectral, Biochemical Study.

1. Introduction

Schiff base ligands and their complexes have occupied the apex position in the field of coordination compounds due to versatility and useful applications in various field such as nano-medicines, catalysis and optoelectric materials [1 – 7]. Consequently in the present communication, synthesis and characterization of a series of metal complexes of the type, $[M(PTSB)_2] X_2$ is described. M stands for metal cations, Co (II), Ni (II) and Cu (II), PTSB is the bidentatediaza chelating ligand formed by the condensation of 2- formylpyridine and para-toluidine. X stands for Cl, Br and NO_3^- .

2. Experimental

There are many routes for the preparation of Schiff base ligands and their complexes such as: - traditional method, 'in situ' method, Solvent free green trituration method and metal ion catalyzed template method.

In the present case, the last method was used which gave better yield in smaller time in comparison to other methods. On the basis of elemental analysis (table 1) the formula of the complexes has been found to be the type, $[M(PTSB)_2] X_2$.

3. Spectral and Biochemical Study

I.R. Spectra of pyridin – 2- al, para-toluidine, (pyridin -2-yl) (4-methylanilino)methanimine and metal complexes (table - 2) on comparison provides evidence in favour of Schiff base condensation of (pyridin -2-al) with 4 methylaniline to give the ligand PTSB. The evidence for coordination of azomethinic as well as pyridyl nitrogen to the metal ions comes from disappearance of $\nu_{C=O}$ (1700 cm^{-1}) from spectra of pyridin – 2- al, ν_{N-H} (3000 cm^{-1}) from the spectra of 4- methylaniline. Appearance of a new band in the spectra of PTSB due to $\nu_{C=N}$ (1648 cm^{-1}) and shift of this $\nu_{C=N}$ ($1612-1624\text{ cm}^{-1}$) to lower region in the spectra of $[M(PTSB)_2] X_2$ along with appearance of a new band in the far I.R. region

due to ν_{M-N} ($460-485\text{ cm}^{-1}$) gave further support to the fact that coordination of the ligand takes place with the metal ions through pyridyl nitrogen and azomethinic nitrogen.

Table – 1

Compounds	C %	H %	N %	M %	X %	Yield %	Color	Λ_m S.m ⁻¹
C ₂₆ H ₂₄ N ₄)	79.59	6.12	14.28	-	-	88	Yellow	10
[Co(C ₂₆ H ₂₄ N ₄)]Cl ₂	59.21	4.57	10.68	11.28	13.52	82	Violet	145
[Co(C ₂₆ H ₂₄ N ₄)]Br ₂	52.02	3.93	9.18	9.58	25.88	81	Pink	140
[Co(C ₂₆ H ₂₄ N ₄)]I ₂	44.92	3.34	7.78	8.23	35.12	80	Blue	142
[Co(C ₂₆ H ₂₄ N ₄)](NO ₃) ₂	54.96	4.08	14.28	10.02	-	83	Rd	155
[Ni(C ₂₆ H ₂₄ N ₄)]Cl ₂	59.25	4.56	10.65	11.27	13.54	78	Blue	151
[Ni(C ₂₆ H ₂₄ N ₄)]Br ₂	52.04	3.90	9.12	9.56	25.92	75	Violet	150
[Ni(C ₂₆ H ₂₄ N ₄)]I ₂	44.98	3.32	7.79	8.24	35.14	80	Violet	136
[Ni(C ₂₆ H ₂₄ N ₄)](NO ₃) ₂	54.98	4.07	14.27	10.04	-	81	Pink	138
[Cu(C ₂₆ H ₂₄ N ₄)]Cl ₂	59.53	4.45	10.40	11.78	13.01	86	Green	146
[Cu(C ₂₆ H ₂₄ N ₄)]Br ₂	51.15	3.82	8.89	10.02	25.15	87	Green	147
[Cu(C ₂₆ H ₂₄ N ₄)](NO ₃) ₂	53.98	4.06	14.03	10.69	-	80	Pink	149

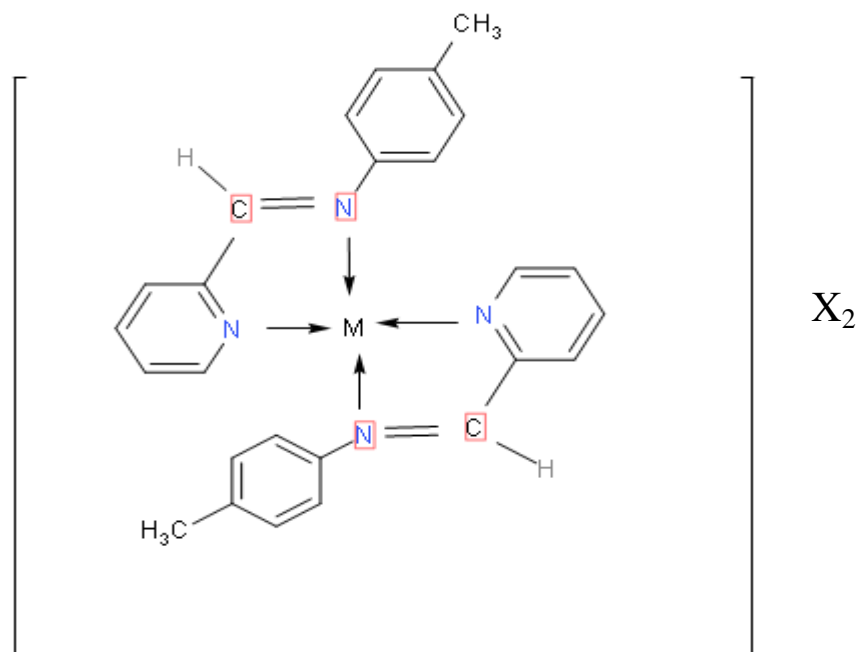
Table – 2

S.No	Compound	Frequency (cm ⁻¹)		
		$\nu(\text{C}=\text{N})$	$\nu(\text{C}=\text{C})$	$\nu(\text{M}-\text{N})$
01	C ₁₃ H ₁₂ N ₂	1648	1417	-
02	[Co(C ₂₆ H ₂₄ N ₄)]Cl ₂	1618	1415	485
03	[Co(C ₂₆ H ₂₄ N ₄)]Br ₂	1616	1412	482
04	[Co(C ₂₆ H ₂₄ N ₄)]I ₂	1622	1419	462
05	[Co(C ₂₆ H ₂₄ N ₄)](NO ₃) ₂	1620	1423	465
06	[Ni(C ₂₆ H ₂₄ N ₄)]Cl ₂	1624	1398	470
07	[Ni(C ₂₆ H ₂₄ N ₄)]Br ₂	1614	1406	468
08	[Ni(C ₂₆ H ₂₄ N ₄)]I ₂	1619	1408	471
09	[Ni(C ₂₆ H ₂₄ N ₄)](NO ₃) ₂	1612	1405	477
10	[Cu(C ₂₆ H ₂₄ N ₄)]Cl ₂	1618	1407	478
11	[Cu(C ₂₆ H ₂₄ N ₄)]Br ₂	1624	1411	460
12	[Cu(C ₂₆ H ₂₄ N ₄)](NO ₃) ₂	1626	1418	468

4. Conclusion

Magnetic moment, Λ_m (130-155 S.m⁻¹) and electronic spectra also support the outcome of IR spectra. A square planar structure has been proposed for the complexes (fig.1). Some of the complexes were also

biochemically activity whose activity was higher those ligands but lower in comprises to that of standard.



M= Co(II), Ni (II), Cu (II)

X= Cl⁻, Br⁻ NO₃⁻

(Figure: 1)

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