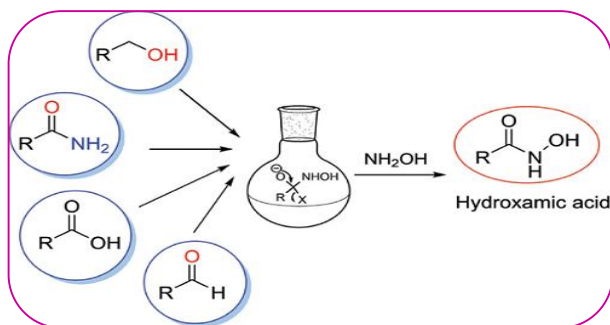




STUDY OF A FEW ASPECTS OF STRUCTURE, SYNTHESIS, SPECTRAL, ANTIMICROBIAL AND DOCKING OF Co(II), Ni(II), Cu(II) WITH SPECIFIC SCHIFF BASE LIGAND

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ABSTRACT:

Hydroxamic acid is classified as an important family of biomedical ligands with complex and also having a wide variety of pharmaceutical properties. Hydroxamic acid has exhibited many interesting facts of chemistry since oxyhy hydroxamic acid first discovered by H. Lossan in 1869. These compounds are of remarkable advancement in different dimensions of there research work, because of wide application in diverse areas and significance in today's life processes. Consequently, major aspects of each area are directly related to present investigation. This paper is an analysis of schiff base ligands and their Co (ii), Ni (ii) and Cu (ii) complexes. Schiff bases may be synthesized in some of approaches; however the maximum commonplace approach is the nucleophile. The quit end result of this reaction is a compound wherein C= O is replaced by C=N. Synthesis of the new ligand, pentane-2-one

was mentioned in keeping with this observe. These shift base type ligands had been received by means of reaction of salicylaldehyde, -3,4--diemino benzophenone, and acetyl acetone in a ratio of one: 1: 1, respectively. At the corresponding Co (ii), Ni (ii) and Cu (ii) complexes ratio 1: 1, the metal nitrate turned into mixed with the aid of the reaction of ligand with hexa hydrate. Chemical identity of ligands and related complexes were recorded by means of spectroscopic records. The ligand and complexes were non electrolytic in nature by conductivity measurement. The complexes were found to be octahedral in geometry by spectral data. The aim of literature survey is to present our investigation in proper manner.

KEYWORDS: Hydroxamic acid, Schiff base, Biomedical ligand, Pharmaceutical properties, Co (II), Ni(II), and Cu(II) complexes ,

INTRODUCTION:

Transition metals are metal components that have incomplete d or f shells in the neutral or capillary state. These incomplete valence shell orbitals allow electrons to be accepted from the Lewis base to form a coordinate complex compared to other groups of elements. Ligands must therefore have a Lewis base. They must have at least one unconnected electron that can be donated to a metal ion. The Schiff Base is named after Hugo Schiff and is a compound with a functional group that has a C-N double bond with nitrogen attached to the aryl or alkyl group. In the broadest sense the general formula in the Schiff base is $R^1CR^2=NR^3$ where R^1 R^2 & R^3 are an organic side chain. The Schiff base is synonymous with azomethine and can also be called imines.[1]

This paper includes the synthesis, spectroscopic and antimicrobial studies of Schiff's base and its cobalt (II), nickel (II) and copper (II) complexes.

1. Ligand Synthesis:

The ligand (L) mixture was made by reflux of a hot ethanolic solution of acetyl acetone, salicylaldehyde. They were mixed slowly, stirring constantly. An ethanolic solution of 3, 4-Dimino benzophenone was added to the above mixture. Their grain ratio is 1: 1: 1. The concentration was kept at 80°C for 2 hours in the presence of HCl. A white crystalline compound was separated after the material was cooled overnight at 0°C. It was filtered; ethanol washed several times, and dried in a vacuum decater compared to anhydrous calcium chloride. Yield 66%, m.pt. 246°C.

2. Complexity of Synthesis:

The hot ethanol solution of ligand and the hot ethanol solution of the given metal salts (cobalt nitrate, nickel nitrate and copper nitrate hexa hydrate) were mixed in a 1: 1 ratio by stirring continuously. The reaction mixture was refluxed at 80°C for 2 hours. The volume of the reaction mixture was reduced by 25-30%. The resulting precipitate was filtered, washed with ethanol, and dried under vacuum on anhydrous CaCl₂. It is partially soluble in water, chloroform, carbon tetrachloride, acetonitrile and ether, alcohol but freely soluble in DMF and DMSO.

3. Physical Method:

The infrared spectrum was recorded in the 4200-380 cm range using KBR pellets. The UV-visual spectra of the ligand and complex were recorded on the Perkin Elmer Lambda 3B spectrophotometer in the 300-1000 nm range. Molar carriers of ligands and complexes were measured using a 11-4MM solution of DMSO using ELICO CM-170 conductivity meter. The Joel 500 MHz NMR spectrometer (CD3) of ligand and complex was recorded using 2SO. The mass spectra of the complex were recorded by JOEL GC Sobti Mass Spectrophotometer. Magnetic sensitivity was measured on the Goi balance using CuSO₄ .5H₂O as colibrant. The EPR spectra of the complex was recorded as a crystalline sample and the use of DPPH as a G-marker was recorded in a DMF solution at the temperature of the JX-X3 series of systems using DPPH.[2,3]

RESULT AND DISCUSSION:

HPLC has been patterned pureness of the ligand (L) at 97.81%. The ESI-mass variety of the ligand (L) spectacles a paternal ion ultimate (M⁺) m/z = 386. The continuous shows ultimate at m/z = 361 is owed to C₂₃H₂₀N₂O₂ caution. A highest with great strength is extant at m/z = 326 (87%) is owed to base uttermost. This uttermost is parallel to cationic kinds with three aromatic rings.

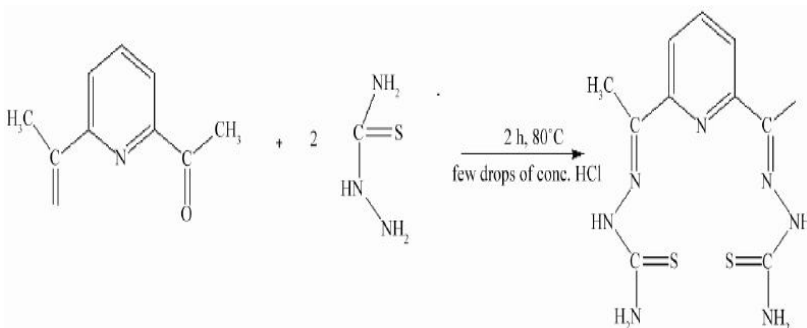


Figure 1 Ligand Structure

The figure 2. shows the ligand FTR spectrum at 1615 cm⁻¹ with reference to the ν (C=N) elongating trembling and 3321cm⁻¹ in the group of phenolic hydroxyl. The continuums of the ligand displayed group at 1301cm⁻¹ which is endorsed to the distending trembling of the phenolic pungent oxygen. The groups at 2687 cm⁻¹ and 3085 cm⁻¹ resemble to the fraught C-H of the pungent ring.

The electronic spectrum of the Schiff base ligand mainly shows two absorption bands at 275 and 386 nm. The first band arises from infection with the π - π^* azomethine chromosome. The second band at 365 nm is owed to the N- π^* conversion from the phenyl ring to the azomethine group scattered with intermolecular CT.

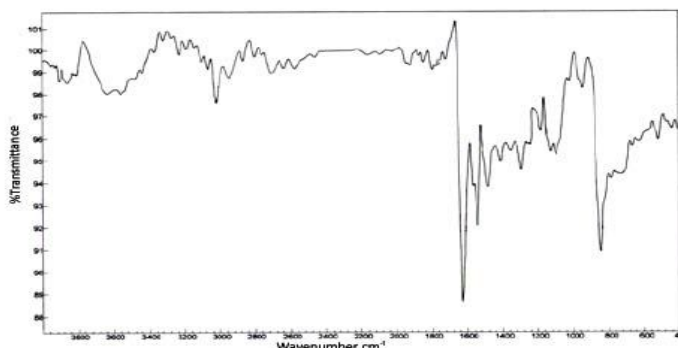


Figure 2. Ligand IR Spectrum

Metal Complex:

Based on the molar carrier measurements of the complexes in the DMSO, the complexes are part of the non-electrolytic form. Thus complexes $[M(L)(NO_3)_2] \cdot xH_2O$ can be formed where $M = Co(II)$, $Ni(II)$ and $Cu(II)$ and L is (E)-4-((5-Benzoyl-2-((E)-(2-hydroxybenzylidene) amino) phenyl) amino) pentane-2-one.[4]

Table 1. Molar conductance and electronic spectroscopic data of the ligand and its metal complex

Compound Name	Molar Conductivity	Colour	M.P. ($^{\circ}C$)	Yield	λ_{max} (nm)
Ligand		Off White	280	76	252681
$[Co(L)(NO_3)_2] \cdot xH_2O$	18.21	Brown	>325	53	271,352,445,523,783
$[Ni(L)(NO_3)_2] \cdot xH_2O$	10.10	Black Brown	>325	49	261,342,445,557,783
$[Cu(L)(NO_3)_2] \cdot xH_2O$	11.62	Dark Brown	302	56	294,374,446,672,744

Infra-red spectral band due to ions:

A comparative study of Ligand's FTIR spectra and its metal complexes has shown that some peaks are normal and, therefore, only significant peaks, which have either been moved or are newly seen, are discussed. The following table 1.2 shows that (C-O) and ν (C = N) modes appear at 1287-1327 cm^{-1} and 1607-1618 cm^{-1} , respectively. The higher frequency transfer (C-O) compared to ligands is due to the conversion of hydrogen bonded structures into covalent metal bonded structures. The confirmation of the metal-ligand bond is given by the appearance of the medium intensity band in the range of 486-97 and 538-553 cm^{-1} in the spectra of the complex given the stretching frequency of the (M-N) bond and the (M-O) bond formation, respectively. Shows three medium intensity bars $\sim 1402-1405$ cm^{-1} , indicating that both nitrate groups are coordinated with intermediate metal ions.[5,6]

Table 2 Infrared spectroscopic data of ligand and its metal complex

Compound Name	$\nu(C=N)$	$\nu(C-O)$	$\nu(M-N)$	$\nu(M-O)$	Ionic Nitrate
Ligand	1612	1301	-	-	-
$[Co(L)(NO_3)_2] \cdot xH_2O$	1625	1334	482	543	1394
$[Ni(L)(NO_3)_2] \cdot xH_2O$	1632	1329	480	541	1394
$[Cu(L)(NO_3)_2] \cdot xH_2O$	1614	1320	483	528	1996

Cobalt (II) Complex

Measurement of magnetic moment of cobalt (II) complex at room temperature 5.03-5.13 B.M is in range. The electronic spectrum of Co (complex) shows three bands (Figure 8). These bands can be assigned to ${}^4T_{1g} \rightarrow {}^4T_{2g}$ (F) (v1), ${}^4T_{1g} \rightarrow {}^4A_{2g}$ (F) (v2) and ${}^4T_{1g} \rightarrow {}^4T_{1g}$ (P) (v3) transitions, respectively. AR-H represents an acute multiplication of 7.32-8.03 ppm in the 1H NMR spectrum of the cobalt (II) complex. AR-OH has a singlet related to a proton seen at 12.50-14.60 ppm. Also ${}^{13}C$ NMR spectrum agrees with the expected absorption suggests that the new resonance 48.69 (C-CH₂-CO), 124-149 (C = C), 168.00 (C = N), 203.32 (pH-CO-PH) Are.

Nickel (II) Complex:

The magnetic moment of the Ni (II) complex at room temperature is 3.03-3.23 B.M is in range. These values indicate the presence of an octahedral configuration. This complex represents the three electronic spectral bands specified on the ${}^3A_{2g} \rightarrow {}^3T_{2g}$ (F) (v1), ${}^3A_{2g} \rightarrow {}^3T_{1g}$ (F) (v2) and ${}^3A_{2g} \rightarrow {}^3T_{1g}$ (P) (v3) transitions, respectively. These bands suggest that the complex also has octahedral geometry confirmed and may have D_{4h} symmetry, the 1H NMR and ${}^{13}C$ NMR spectra shown in Figs. These signals also confirm the hydrogen and carbon atmosphere of the complex.[7]

Table 3 Diameter (mm) of zone inhibition for skiff base ligand and its complex

Compound Name	Escherichia coli			Staphylococcus			Enterococci			Pseudomonas		
	25	50	100	25	50	100	25	50	100	25	50	100
Ligand	-	6mm	10mm	9mm	11mm	12mm	5mm	8mm	15mm	-	-	-
[Co(L)(NO ₃) ₂].xH ₂ O	-	9mm	11mm	-	-	-	6mm	8mm	10mm	-	5mm	10mm
[Ni(L)(NO ₃) ₂].xH ₂ O	-	6mm	9mm	7mm	9mm	11mm	8mm	10mm	14mm	-	-	9mm
[Cu(L)(NO ₃) ₂].xH ₂ O	-	-	-	-	-	-	-	-	7mm	-	-	6mm

Copper (II) Complex:

Measurement of the magnetic moment of the temperature copper (II) complex at room temperature 2.012-2.48 B.M is in. Three spin allowable transitions are expected in the visible region, and the e_g and T_{2g} levels of the 2D free ion will split into B_{1g}, A_{1g}, B_{2g}, and e_g levels, respectively. The following transitions correspond to the electronic spectrum of the six coordinated copper complex display bands at 728, 518 and 431nm corresponding to ${}^2B_{1g} \rightarrow {}^2B_{2g}$; ${}^2B_{1g} \rightarrow {}^2E_g$ and ${}^2B_{1g} \rightarrow 2A_{1g}$. The EPR spectrum of the Cu (II) complex is reported in DMF solution at room temperature, in the range of 2.1203-2.1236. The observed for the complex shows that the redundant electron is localized in the orbit of dx^2-y^2 of the solid (II) ion and is characteristic for axial symmetry. The size of the ESR line indicates that the current complex is deformed octahedral complex.[8]

Activity of Antimicrobial:

The antimicrobial activity was criticized by the proliferation of microbial inoculum on the entire agar surface, as described by the surface MHA. Then, a hole of 6 to 8 mm diameter was drilled aseptically through a sterile corn borer and the volume of the extract solution (20–1100 mL) at the desired concentration was brought into the wells. Thereafter, agar plates were incubated at 39°C for 20 hours. The antimicrobial agent dissolves in the agar medium and inhibits the growth of microbial strains that were prevented by measuring the area measured. Antimicrobial action of ligand and its Co (II), Ni (II) and Cu (II) metal complexes (i) Gram-positive bacteria: Staphylococcus aureus, Enterococci and (ii) Gram-negative bacteria: Escherichia coli, Pseudomonas aeruginosa.[10]

Study of Molecular Docking:

The biological significance of synthesized ligands is assessed by docking studies using AutoDock VinaPyRX software. The recovered PDB file (4S1V) is given as an input in AutoDock Vina and assigned as a

macromolecule which adds charge and hydrogen bonds to the molecules to form proteins. The preparation of the ligand was done with a generation of various tautomer's, including ordering bonds, ring conferences, and ligand stereo chemistry. All generated structures were used for further docking studies. A receptor grid was created around the protein activation site by selecting the active residue and run auto grid option. Docking was calculated using Run VinapyRX and binding affinity was used to determine the best dock structure from the output. The estimated binding affinity is in KCL / Mol. The PDB structure of human serum albumin 4s1y is used for docking studies that play an important role in increasing cell growth and productivity and enhancing cell health. The best dock complex selected has a binding score of -9.5 for the Cu (II) complex which predicts good resistance. PDB structure 4sy1 of human serum albumin is used for docking studies containing 2 different compounds containing copper and nickel complexes. [9]

Significance of the study

In stead of sophisticated chemistry of hydroxamic acid and their complexes , they show a wide range of applications in various fields of analytical pharmaceutical biological , docking chemistry. Hydroxamic acids and their complexes possess antibacterial and antifungal activities and are selective inhibitors of various enzymes. Hydroxamic acid and their metal complexes represents a wide spectrum of bioactive compounds, that have and anticancer and anti tumour properties. They have been found to be key functional groups of potential chemo therapeutics targeting cardiovascular disease. Moreover, there physiological effects have been attributed to there particular affinity for metals

CONCLUSION:

This paper concluded the synthesis and characterization of some new Schiff base ligands and their complexes. All complexes were versatile in nature. The binding intimacy value was determined by the dock study using the Auto Doc Vinapy Rex software. The antimicrobial activity of ligands and the metal complexes contained therein were assumed against Gram-positive and Gram-negative bacteria. The effect of antibiotic action shows that metal complexes are effective against bacteria.

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