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06

# Synthesis and Biological Activity of Metal Complexes Derrived from Schiff's Bases.

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**ABSTRACT :**

Synthesis of the Schiff base derived from p-dimethylamino benzaldehyde and m-aminobenzoic acid. Co(II), Ni(II), Cu(II) complexes were prepared from Schiff base .The synthesized TRANSITION metal complexes were characterized by elemental analysis, IR, UV–Vis,. The IR results reveals the bidentate binding mode of the ligand involving azomethine nitrogen and carboxylate oxygen atoms. The antimicrobial activity of the synthesized ligand and its metal complexes were screened by disc diffusion method. The results show that the metal complexes were found to be more active than the ligand.

**Key words:** Schiff's base, ligands, transition metal complexes, anti-microbial activity.

## 1. INTRODUCTION

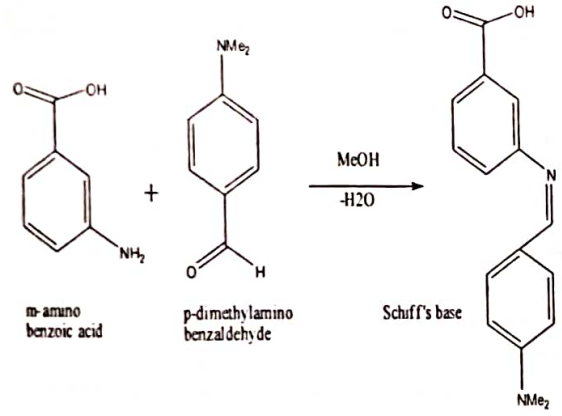
There is wide range of applications of Schiff bases ligands and transition metal complexes in biological, clinical, analytical and industrial area [1]. The heterocyclic Schiff base ligands and their metal complexes are more important due to their pharmacological properties [2]. nowadays, they are extensively being used for their promising applications in the treatment of several diseases and also been used as synthetic and analytical reagents [3], Currently researchers take towards the study of Schiff bases and their transition metal complexes due to the synthetic flexibilities and approach of ligands towards transition metal ions [4]. Due to keto-enol tautomerism ligand show unusual

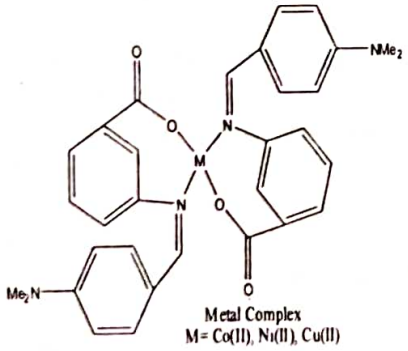
coordination numbers. [5–9].

## 2. EXPERIMENTAL

### 2.1. Materials:

The chemicals, metal chloride i.e. Co(II)/ Ni(II)/Cu(II) chlorides and solvent was purchased from Thomas Baker, and the solvents were purified by standard methods. Solvents were purified and distilled before use. The metal content present in the complexes was determined by EDTA titration [10-13]




### 2.2. Preparation of Schiff base ligand:

2 mmol solution of m-aminobenzoic acid in methanol, 2 mmol solution of Substituted benzaldehyde in methanol was added dropwise. The above mixture was magnetically stirred and refluxed for about 8 hrs. Then the reaction mixture solvent was evaporated and cooled at room temperature. The crystals were separated out. It was washed with alcohol, ether and recrystallized from ethanol and finally dried under vacuum (yield: 75%). [10-13]

### 2.3. Preparation of metal Schiff base complexes:

2 mmol solution of Schiff base ligand dissolved in methanol and 1mmol solution of Co(II),Ni(II),Cu(II) chloride dissolved in methanol was added dropwise. The above mixture was magnetically stirred and refluxed for 1 hr. The obtained complexes were filtered, washed with ethanol and finally dried under vacuum (yield: 73–82%).[10-13]

### 2.4. Physical measurements:

The IR spectra was measured by Nicolet 380 FT-IR spectrometer using KBr pellet having range 4000-400 $cm^{-1}$.

Electronic spectra also recorded by Perkin Elmer Lambda-25 UV/ VIS spectrometer having range 200–900 nm. Magnetic measurements carried out using Guoy balance at room temperature. [12-16]

### 2.5. Anti-bacterial Study:

The antibacterial activity of synthesized Schiff base and their transition metal complexes was studied by well diffusion method. By dissolving the compounds in DMSO to form 0.001 mol stock solution , and the solutions were serially diluted and check minimum inhibitory concentration (MIC) values ($\mu gmL^{-1}$).Thebacterial stains (Staphylococcus aureus and Escherichia coli) were incubated for 24 h at 37æ%C. Streptomycin was used for comparison under similar conditions. Antimicrobial activity studies were performed in triplicate, and the average was taken as the final reading. [12-17]

## 3. RESULTS AND DISCUSSION

The analytical data and physical properties of the ligand and transition metal complexes are listed in Table 1. The Schiff base ligand (L) is soluble in common organic solvents. The resultant Schiff base complexes are soluble in DMF and DMSO and insoluble in other common organic solvents. The analytical data (Table 1) indicate that the metal to ligand ratio is 1:2 for all the complex systems. The molar conductance of all the complexes was measured in DMSO using 103 M solutions at room temperature. The low molar conductivity values of the metal complexes (Table 1) suggest the non-electrolytic nature [12-15, 18]

**Table 1: Analytical data and physical properties of the ligand and metal complexes.**

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**Table 2: Infrared spectral data of ligand and its complexes ($cm^{-1}$ v).**

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### 3.1. Infrared spectra:

The IR spectral data of the ligand and its complexes were given in Table 2.The free ligand exhibits IR bands at 3420 $cm^{-1}$ v (N– H), 1680 $cm^{-1}$ v (C=O), and 1620 $cm^{-1}$ v (C=N). The bands at 3450 and 2940 $cm^{-1}$ in the free ligand are attributed to the free OH stretching of phenolic moiety [19]. The IR spectrum of the free ligand exhibits a sharp band at 1675 $cm^{-1}$ v, due to the azomethine group vibration. On complexation this band was shifted to lower frequency in the 1660–1630 $cm^{-1}$ v range indicating the coordination of the azomethine nitrogen atom to the metal ion. [12,13,15] For the free ligand, the observed bands at 1545 and 1360 $cm^{-1}$ v can be respectively ascribed to asymmetric carboxyl mas($COO^-$) and symmetric carboxyl ms ($COO^-$) groups [20]. During complexation these bands were shifted to higher frequency by 5–16 $cm^{-1}$ v range indicating the linkage between the metal ion and carboxylato oxygen atom.[12-13, 15] The large difference between the mas ($COO^-$) and ms($COO^-$) value of 200 $cm^{-1}$ v indicates the monodentate binding nature of the carboxylato group [20] in the complexes. In the lower frequency region the weak bands observed at 580–554 and 460– 420 $cm^{-1}$ v have been assigned respectively to the m(M–O) and m(M–N) vibrations [20-24], one can deduce that the ligand binds the metal ion as bidentate fashion (NO). The bonding sites are the azomethine nitrogen and the carboxylato oxygen atoms. In the complexes, the band due to phenolic OH vibrations remained unaltered, suggesting the non involvement of the phenolic proton in the complex formation. [12-13, 25-26]

### 3.2. Electronic Spectra and Magnetic Moment: (in Table 1)

The electronic spectrum of free Schiff base ligand shows abroad band at 348 nm, which is assigned to $\pi$ '! $\pi^*$ transition of the C.N chromophore. On complexation this band was shifted to lower wavelength region suggesting the coordination of azomethine nitrogen to the central metal ion [18, 27]. The Co(II) complex has the magnetic moment value shows Co(II) complex h as tetrahedral (4.63 BM) which is in agreement with the reported value for tetrahedral. Ni(II) complexes is tetrahedral its range 3.2–4.1 BM. And Cu (II) complex is monomeric and paramagnetic (1.79 BM) [12-13, 15, 28-30]

### 3.3. Anti bacterial activities:

The Synthesized transition metal complexes were screening for their antibacterial activity and this is done with the help of disc diffusion method. Microorganism like gram positive bacteria and Gram negative bacteria respectively as Staphylococcus aurous and Escherichia coli. The results reveal that as compare to Ni(II) complex the Cu(II) and Co(II) complex have better activity against bacterial strains. the activity of metal complexes as Cu(II) >Co(II) >Ni(II) >L. High activity owing the metal ions on the normal cell membrane [31]. Due to the combination of polar and non-polar properties permeable into cells and tissues. Also chelation enhance or lower the biopotency of them. The properties like lipophilicity influence the antimicrobial. The mixed-ligand complexes are more beneficial than free ligands. [12-13, 15-17, 28]

**Table 3: Minimum inhibitory concentration of the synthesized compounds against the growth of bacteria ( µg/mL )**

| Compounds | E. coli | S. aureus |
|---|---|---|
| L | 100 | 180 |
| [CoL2] | 30 | 27 |
| [NiL2] | 42 | 69 |
| [CuL2] | 51 | 35 |

## 4. CONCLUSION

The coordination capabilities of the synthesized Schiff base has been confirmed by complexation reaction with Co(II), Ni(II) ions Cu(II) ions. The newly synthesized schiff's base and their metal complexes are characterized using electronic and infrared spectral data which shows bidentate ligands which co-ordinate through azomethine nitrogen and carboxylate oxygen atoms. Geometry also determined with the help of conductometric, electronic and magnetic studies as Co (II) and Ni(II) complexes have tetrahedral geometry while Cu(II) complex is square planar geometry. The metal complexes show high antimicrobial activity free ligand and the order as Cu (II) >Co(II) > Ni(II) >L.

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