"SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL ACTIVITY OF SCHIFF BASE AND ITS TRANSITION METAL COMPLEXES"

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ABSTRACT

A new Schiff base, salicyalidene – 3,4 – dimethyl aniline has been synthesized from salicyaldehyde and 3,4 – dimethyle aniline metal complexes of the Schiff base were prepared from metal salts of Co(II) and Cu(II) in an alcoholic medium. The complexes were non – electrolytes in DMSO. The chemical structures of the Schiff base ligand and its metal complexes were confirmed by various spectroscopic studies like IR, UV – VIS, HNMR, elemental analysis molar conductance and magnetic susceptibility measurements. On the basis of elemental and spectral studies square planar geometry was assigned to these complexes in the light of these results. It is suggested that this ligand acts as bidentate and coordinates to each metal ion by azomethine nitrogen and phenolic oxygen atom. The Schiff base and its complexes have been tested for their antimicrobial activity by using disc diffusion method.

Keywords :- Schiffbase, metal salts, salicyaldehyde, antimicrobial activity.

INTRODUCTION

Schiffbases are the condensation products of carbonyle compounds with primary amines in acidic medium and are important class of ligand in the field of coordination chemistry that coordinates to metal ions via azomethine nitrogen ( ). The presence of azomethine group that contain nitrogen atom as donar site is extreamly important for chemical and pharmaceutical industries for chemical and pharmaceutical industries. Metal chelation is involved in many important biological process. Where the coordination can occur between a variety of the metal ions and a wide range of ligands. Schiff base metal complexes have been widely studied because they have industrial, antifungal and biological applications. Chelating ligands containing O and N donar atoms show broad biological activity of ways in whichthey are bonded to metal ions. Transition metal complexes of Schiff bases have expanded enormously and embraced wide and diversified subjects

comprising vast areas of organometallic compounds. The metal chelates derived from Schiff bases exhibit versatile medicinal properties like antibacterial, anticancer, antifungal, antiviral etc. Schiff bases are also used as an efficient reagent in trace analysis of some metal cations. Transition Schiff base derived from aromatic amines and aromatic aldehydes have a wide variety of applications in many fields like biological chemistry. I report here the synthesis and characterization of transition metal complexes of Co(II), Ni(II) and Cu(II) containing bidentals Schiff base, derived from the condensation of 3,4 – dimethylaniline and 2 – hydroxyl – benzaldehyde.

MATERIALS AND METHODS

All the starting materials solicyaldehyde 3,4 - dimethyl aniline, metal salts and solvents involves in this work were of used without further purification. All the metal salts and regents used for the preparation of Schiff base were obtained from loba. Elemental analysis data were obtained from using a perkin – elmer elements auto analyzer. The IR spectra of ligand and metal complexes were recorded on FTIR – Shimadzu – 8400 spectrophotometer using KBR discs. The electronic absorption spectra of the complexes were recorded on perkin – elmer UV – Vis spectrophotometer using DMSO as solvent. The molar conductivity of the complexes in DMSO solvtion (10^{-3}M) were measured using DI – 909 digital Conductometer. The measurement of magnetic susceptibility were made by the Gouy's method using $Hg[Co(SCN)_4]$ as a calibrant.

SYNTHESIS OF SCHIFF BASE LIGAND

The schiff base were synthesized by the condensation of 1:1 ratio of salicyaldehyde with 314 – dimethyl aniline dissolved in ethanol. The resulting reaction mixture was refluxed for 4 – 5 h and then allowed to cool overnight. The brown coloured solid precipitate was obtained and washed with cold ethanol and finally recrystallized from ethanol and ether and dried in air at room temperature and preserved in a $CaCl_2$ desiccator.

SYNTHESIS OF METAL COMPLEXES

A mixture of schiff base under investigation (0.02 mol) in 25 ml ethanol and 0.01 mol of metal salts in 25 ml ethanol in 2:1 (ligand;metal) ratio. The resulting mixture were refluxed for 5 – 6 h. on cooling, coloured solid product was collected by filtration and then washed several times with hot ethanol and dried under the reduced pressure over $CaCl_2$ in desiccators.

RESULTS AND DISCUSSION

The metal complexes are soluble in DMF and DMSO. The analytical data and physical properties of the ligand and metal complexes are given in table 1. All the metal complexes have 1:2 (metal : Ligand) stoichiometry. The lower molar conductance values of the complexes in DMSO (10^{-3} M) suggest their non – electrolytic nature. Elemental analysis revealed the observed and calculated values for O, H and N composition of the Schiff base and its metal complexes are in good agreement with the proposed structure.

INFRARED SPECTRA OF THE SCHIFF BASE AND ITS COMPLEXES

The IR spectra bands of the Schiff base and its metal complexes are given in table -2. A band at 1620 cm^{-1} in free Schiff base is due to r(C=N) vibration.

The schiffing of this group to lower frequency (1500 – 1590cm^{-1}) in the metal complexes. Suggests the coordination of metal ion through nitrogen atom of azomethine group. A medium intensity ligand band at 1240cm^{-1} (phenolic r(c – o)) which gets shifted to a higher frequencies (1275 – 1270 cm^{-1}) in the complexes, which suggests the participation of phenolic oxygen in the coordination with the metal ions. The new bands appearing at 490 – 498cm^{-1} and 538 – 548 cm^{-1} are assigned to r(M – N) and r(M – O) respectively. The IR spectra of the ligand having phenolic OH gropu showed a broad band at 3300 cm – 1, the disappearance pof this band in metal complexes suggests deprotonation of the phenolic – OH group after its chelation with the metal ions. A band at 810 cm – 1 in cobalt complexes, suggest the presence of coordinated water molecules in the complex. Thus the IR spectrum indicates that the ligand in the metal complexes behaves as bidentate and coordinating through oxygen of phenolic C – O group and nitrogen of C = N group.

ELECTRONIC SPECTRA AND MAGNETIC MOMENT

The electronic absorption spectra of metal complexes were recorded in DMSO solvent. The electronic spectrum of the $[Co(L)_2(H_2O)_2]$ showed three absorption bands around 9400, 15250 and 19510cm – 1, which assigned to the transition ^4T_1g ^4T_2g, ^4T_1g ^4Azg and ^4T_1g $^4T_1g(p)$. the magnetic moment of the the complex was 5068 B.M., octahedral geometry has been suggested. The absorption spectra of the Ni complex 12105 and 21630 cm^{-1}, which assigned to the transition ^1A_1g ^1Eg and ^1A_1g ^1B_2g it is diamagnetic complex and square planar geometry has been suggested. The absorption spectra of the Cu – complex showed bands at 12825 and 18480 cm^{-1}, which assigned to the ^2B_1g ^2B_2g and ^2B_1g ^2Bg. The

magnetic moment of the complex was found 1.89B.M., square planar geometry has been suggested.

ANTIMICROBIAL ACTIVITY

The antimicrobial activity of the ligand and its metal complexes were tested against E coli. S –aures, A. Niger and F. Oxysporum using disc diffusion method. The results show that metal complexes were more active than the free ligand and can be explained by overtones concept and tweedy's chelation theory. The mode of action of the compounds may involve formation of a H – bond through the azomethine group with the active centers of cell constituents, resulting in an interference with normal cell process.

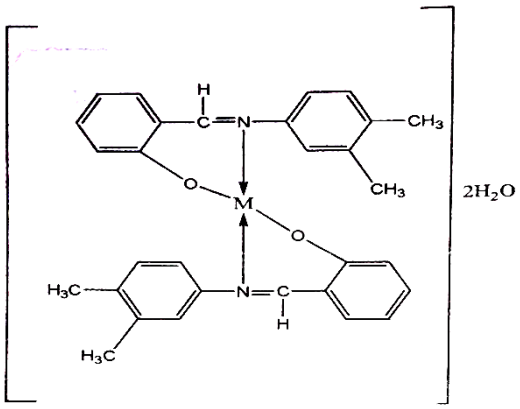

Table -1 Analytical and Physical data of the ligand and its complexes

Compounds	Yield (%)	Analytical Analysis Found (cal) %			ʎm(VL^{-1} cm^2 mol^{-1}
		C	H	N	
SchiFFbase $C_{15}H_{15}NO$	78	79.72 (80.01)	6.23 (6.66)	6.13 (6.22)	
$[CoC_{30}H_{32}N_2O_4]$	70	66.12 (66.26)	5.92 (5.88)	5.01 (5.15)	14
$[NiC_{30}H_{32}N_2O_4]$	65	66.21 (66.33)	5.78 (5.89)	5.21 (5.16)	12
$[CuC_{30}H_{32}N_2O_4]$	69	54.71 (54.79)	5.92 (5.84)	5.03 (5.11)	9.1

Table – 2 Ir spectra of ligand and its complexes

compound	r(C=N)	r(OH)	r(C-O)	H_2O	r(M-O)	r(M-N)
SchiFFbase	1620	3300	1240	-	-	-
$[Co(L)_2(H_2O)_2]$	1600	-	1270	3390, 810	538	490
$[Ni(L)_2]2H_2O]$	1595	-	1275	3430	542	492
$[Cu(L)_2]2H_2O]$	1590	-	1273	3395	548	498

Table – 3 Growth Inhibition Zone of Microbes in mm

Compound	E.coli	S.qureus	A.niger	F.Oxysporum
SchiFF base	5	7	11	13
Co-complex	9	13	12	19
Ni-complex	10	10	13	13
Cu-complex	12	11	16	22

CONCLUSION

The Schiff base derived from 2 – hydroxyl benzaldehyde and 3, 4 – dimethyle aniline and its metal complexes were synthesized and characterizes by analytical and spectroscopic techniques. The Schiff base ligand acts as bidentstl and coordinated with the metal ions through azomethine nitrogen and phenolic oxygen on the basis of spectral data cupper and nickel complex octahedral geometry has been suggested. The antimicrobial data shows that the metal complexes have higher antimicrobial activity than the free ligand.

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