STUDY OF STRUCTURE,
CHARACTERAZATION OF CO(II) NI(II),
CU(II) COMPLEXES WITH SCHIFF BASE
LIGAND, (E)-7-METHOXY- N1-(2,4,5-
TRIMETHOXY BENZYLDINE)
BENZOFURAN-2- CARBOHYDRAZIDE.

SANDEEP SUDHANSHU
LECTURER IN CHEMISTRY, SENIOR SECONDARY RAJ SCHOOL , DARBHANGA.

ABSTRACT:

This paper presents the schiff base ligands and their complexes of divalent transition metals such as cobalt, nickel and copper. The ligands and the metal complexes were synthesized carefully the ligands were L1 and L2, which coordinated to metal ion through the "O" of carbonyl group and the "N" of hydrazine group. On the basis of characterization of the ligands and the complexes which were substituted benzofuran derivatives, by elemental analysis, magnetic moment, measurement of electrical conductance, electronic transition and the infrared spectroscopy. Electronic data of the complexes suggested the octahedral geometry of the complexes. The complexes of transition metal (II) usually Co(II), Ni(II) and Cu(II) were highly active against all microbes.

L1 → (E)-7-methoxy N1-(2,4,5-trimethoxy benzylidine) benzofuran-2- carbohydrazide.

L2 → (E) – N1- (2,6-dichloro benzylide) 7-methoxy benzofuran -2-carbohydrazide.

Keywords :
Schiff base, Hydrazine group, Carbonyl group, Benzofuran derivatives, Infrared Spectroscopy, Octahedral geometry, Microbes.

Introduction:

The schiff base was named after Hugo schiff. The T.M.(II) complexes with well defined structures play an important role in various biological processes involving the reaction of electron transfer. Schiff base ligand were chelating ligand and useful in catalysis in organic synthesis as well as in medicines. Recently, benzofuran based fused heterocycles have been of great intrest as they were abundant in nature and have wide pharmacological activities 2-3. In the present investigation the amin interest of antimicrobial activities were observed due to presence of benzofuran were proposed as follows5 :
Structures of the benzofuran derivatives in (i) Egonoki plant and (ii) baker's yeast.

MATERIAL AND METHODS:

Material:

All the chemicals used were from AR grade or E. Merck Extra Pure quality. The reagents were purchased from sigma Aldrich. Chemicals/reagents used were: 7-methoxy-1-benzofuran-2-carbohydrazide, 2,4,5-tri-methoxy benzaldehyde, 2,6-dichloro benzaldehyde.

EXPERIMENTAL:

Synthesis of ligands (L1):

To a solution (25ml) of 7-methoxy-1-benzofuran-2-carbohydrazide (2NG, 0.0 mole), dry ethanol (25ml), a solution of 2,4,5-tri-methoxy benzaldehyde (2.37g, 0.01 mole) in dry ethanol (10ml) was added. The reaction mixture was refluxed on a water bath which resulted in light yellow crystals in 7-8 hours. The crystals were cooled, collected, and filtered. The solid was washed with hot water several times and then dried in diethyl ether. Finally, on drying the crystals of C20H20N2O6 obtained with M.W. 383.4 and M.P. 252 C. Similarly, ligand, L2 were also synthesized having mol. Formula C17H12N2O3, M.W. 363.2 and M.P. 130 C.
Synthesis of complex:

The ligand L1 was taken in calculated amount in ethanol and metal chloride (aqucom) were mixed in 2:1 molar ratio and refluxed on water bath for 3-4 hrs. Completion of reaction was monitored by Then Layer Chromotography (TLC). About 56% of the solution was cooled at room temperature, which was then filtered, washed with hot water, ethanol and dried in deductor over anhydrown cacl2. The general reaction of complexion shown under:

\[ \text{MCL}_2 + L \rightarrow [\text{MLCL}_2] \]

Where, L=L1 and L2(ligands)

M= Metal ion (Co,Ni & Cu).

Physical measurement:

Elemental analysis were carried out using Vario El. CHNS analyzer. Magnetic susceptibility were carried out on a magnetic susceptibility balance ( SWSCE) Molar conductance were mode on an Elico CM-82 conductivity bridge in DMF. The ESR spectrophotometer were recorded on a varian E-122 X-band spectrophotometer in DMSO

<table>
<thead>
<tr>
<th>Ligands /complex</th>
<th>Molecular weight</th>
<th>Yield (%)</th>
<th>Colour</th>
<th>MP °C</th>
<th>C</th>
<th>H</th>
<th>N</th>
<th>(\mu_{\text{eff}}) (BM)</th>
<th>AM (ohm\text{ cm}^2\text{ mol}^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1([\text{C}<em>{20}\text{H}</em>{20}\text{O}_6\text{N}_2])</td>
<td>383.378</td>
<td>75</td>
<td>Yellow</td>
<td>252</td>
<td>62.52 (62.55)</td>
<td>5.0 (5.1)</td>
<td>7.35 (7.30)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>[Cu(\text{C}<em>{20}\text{H}</em>{20}\text{O}_6\text{N}_2)\text{Cl}_2]</td>
<td>517.858</td>
<td>80</td>
<td>Green</td>
<td>244</td>
<td>46.44 (46.33)</td>
<td>3.85 (3.76)</td>
<td>5.85 (5.40)</td>
<td>1.74</td>
<td>18.44</td>
</tr>
<tr>
<td>[Co(\text{C}<em>{20}\text{H}</em>{20}\text{O}_6\text{N}_2)\text{Cl}_2]</td>
<td>513.211</td>
<td>78</td>
<td>Dark brown</td>
<td>238</td>
<td>46.95 (46.81)</td>
<td>3.84 (3.93)</td>
<td>5.81 (5.46)</td>
<td>4.68</td>
<td>15.951</td>
</tr>
<tr>
<td>[Ni(\text{C}<em>{20}\text{H}</em>{20}\text{O}_6\text{N}_2)\text{Cl}_2]</td>
<td>512.968</td>
<td>72</td>
<td>Light brown</td>
<td>262</td>
<td>46.54 (46.83)</td>
<td>3.68 (3.93)</td>
<td>5.63 (5.46)</td>
<td>2.85</td>
<td>14.274</td>
</tr>
</tbody>
</table>

RESULT AND DISCUSSION:

a. Characteristics of ligand –

Both ligands were air stable crystalline solids. The analytical produced in table-1.

b. Characteristics of metal complexes:

The analytical data of the complexes indicated that all the complexes were of stoichiometry, [M(L) Cln] where, M=Co(II), Ni (II) and Cu(II).

c. Magnetic Moment:

The magnetic Moment Measurements indicated paramagnetic natur for Co(II), Ni(II) and Cu(II) complexes and octahedral geometry.

\[ \mu \text{ for Co (II)} \rightarrow 4.68 \text{ to } 4.87 \text{ BM} \]

\[ \mu \text{ for Ni (II)} \rightarrow 2.85 \text{ to } 2.92 \text{ BM} \]

\[ \mu \text{ for Cu(II)} \rightarrow 1.74 \text{ to } 1.79 \text{ BM}. \]
d. I.R. spectra:

The IR spectra bonds observed reflects non participation of O- furan ring in bonding with metal ion.

<table>
<thead>
<tr>
<th>Compounds</th>
<th>(\nu(NH))</th>
<th>(\nu(C=O))</th>
<th>(\nu(N-N))</th>
<th>(\nu(M-O))</th>
<th>(\nu(M-N))</th>
<th>(\nu(M-Cl))</th>
<th>(\nu(M-Cl))</th>
<th>(\nu(M-Cl))</th>
</tr>
</thead>
<tbody>
<tr>
<td>([\text{L}<em>1\text{C}</em>{20}\text{H}_{20}\text{O}_6\text{N}_2])</td>
<td>3250</td>
<td>1650</td>
<td>1656</td>
<td>952</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>([\text{Cu(C}_2\text{H}_2\text{O}_6\text{N}_2])\text{Cl}_2]</td>
<td>3255</td>
<td>1556</td>
<td>1650</td>
<td>951</td>
<td>556</td>
<td>455</td>
<td>350</td>
<td>352</td>
</tr>
<tr>
<td>([\text{Co(C}_2\text{H}_2\text{O}_6\text{N}_2])\text{Cl}_2]</td>
<td>3257</td>
<td>1554</td>
<td>1650</td>
<td>958</td>
<td>552</td>
<td>452</td>
<td>350</td>
<td>358</td>
</tr>
<tr>
<td>([\text{Ni(C}_2\text{H}_2\text{O}_6\text{N}_2])\text{Cl}_2]</td>
<td>3259</td>
<td>1558</td>
<td>1656</td>
<td>959</td>
<td>557</td>
<td>455</td>
<td>351</td>
<td>352</td>
</tr>
</tbody>
</table>

e. Electronic spectra:

The electronic spectra of each of the three complexes of Co(II), Ni(II) and Cu(II). In the case of Co(II) and Ni (II). The high band energy range were found to be between 29,000 - 30,000 cm\(^{-1}\). For Co(II) the two electronic bands due \(L_1\) were 16,600, 21,140 cm\(^{-1}\) while for Ni(II) they were 15,340, 25,750 cm\(^{-1}\). Band transition going to held as

\[
\text{GT}_{1g}(F) \rightarrow 4A_{2g}(F) (U_2)
\]

&

\[
4T_{1g}(F) \rightarrow 4T_{2g}(F) (U_1)
\]

Similarly for Ni(II) complexes:

\[
3^3A_{2g} \rightarrow 3T_{1g}(F) (U_2)
\]

<table>
<thead>
<tr>
<th>Ligand</th>
<th>Complexes</th>
<th>Transition in cm(^{-1})</th>
<th>(D_q) (cm(^{-1}))</th>
<th>(B) (cm(^{-1}))</th>
<th>(\beta)</th>
<th>(\beta)%</th>
<th>(\nu_2/\nu_1)</th>
<th>LFSE (k.cal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>([\text{L}<em>1\text{C}</em>{20}\text{H}_{20}\text{O}_6\text{N}_2])</td>
<td>([\text{Co(C}_2\text{H}_2\text{O}_6\text{N}_2])\text{Cl}_2]</td>
<td>7545</td>
<td>16600</td>
<td>21140</td>
<td>800</td>
<td>950</td>
<td>0.950</td>
<td>1.32</td>
</tr>
<tr>
<td></td>
<td>([\text{Ni(C}_2\text{H}_2\text{O}_6\text{N}_2])\text{Cl}_2]</td>
<td>9362</td>
<td>15340</td>
<td>25750</td>
<td>12355</td>
<td>860</td>
<td>0.680</td>
<td>12.12</td>
</tr>
<tr>
<td></td>
<td>([\text{Cu(C}_2\text{H}_2\text{O}_6\text{N}_2])\text{Cl}_2]</td>
<td>16150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For Cu (II) complexes, single broad asymmetric bond were absorbed in the range of 16,150, 12345cm\(^{-1}\). Which indicated three transition:

On the basis of analytical data and spectra characterization the complexes were octahedral geometry and paramagnetic behaviour.

ANTIBICTERIAL ACTIVITY:

Antibacterial activity of substituted benzofuran derivatives and their metal complexes were tested in vitro against representative gram positives bacteria species like " Staphylococcus aereus," Staphylococcus citreus, Bacillus pihymix.
CONCLUSION:

This paper concludes stoichiometric and analytical data of the ligand as well as the complexes and observed that ligands were natural and bidentate in nature. These ligands were coordinated through the "O" of the annicle and "N" of the azomethine group respectively. Each of the complexes were bridge polymeric and octahedral in geometry. The complexes of Co(II),Ni(II) and Cu(II) showed very good activity against bacteria.

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REFERENCES: