Magnetic Behavior Studies on Co (II) Complexes with N-And O-Donor Sites Ligand

Dr. Rajni Kant

Dept. Of Chemistry, J.A.C.M. Inter College Motihari

DOI: 10.29322/IJSRP.9.03.2019.p87101
http://dx.doi.org/10.29322/IJSRP.9.03.2019.p87101

Abstract- Mention the abstract for the article. An abstract is a brief summary of a research article, thesis, review, conference proceeding or any in-depth analysis of a particular subject or discipline, and is often used to help the reader quickly ascertain the paper's purpose. When used, an abstract always appears at the beginning of a manuscript, acting as the point-of-entry for any given scientific paper or patent application.

Index Terms- About four key words or phrases in alphabetical order, separated by commas. Keywords are used to retrieve documents in an information system such as an online journal or a search engine. (Mention 4-5 keywords)

I. INTRODUCTION

Co (II) Ni(II) and Cu(II) salts are found to form complexes of types

![Diagram]

Fig. 1

1. The present investigation involves complexes of Co(II) With a semicarbazone ligand, 3-hydroxy-2-naphthalidene semicarbazone,
2. It was Gilbert Newton lewis who recognized magnetic moment data as a diagnostic tool for determining structure of complexes.

II. EXPERIMENTAL

The metal complexes have been prepared by allowing metal salts to catalyse the condensation of 3-hydroxy-2-naphthaldehyde with semicarbazide hydrochloride. The ligand 3-hydroxy-2-naphthalidene was prepared by refluxing the solution of equimolar amount of 3-hydroxy 2-naphthaldehyde and semicarbazide in methanol for 2 hours.
The hot solution was filtered when yellow crystals of the ligand were deposited on cooling, which were recrystallised from methanol (M.P. 230-232°C)

III. RESULT AND DISCUSSION

Cobalt(II) forms generally four coordinated tetrahedral and six coordinated octahedral complexes, however, a few four coordinated planar and five coordinated trigonal bipyramidal complexes have also been reported. Cobalt(II) complexes with one unpaired electron can be either low spin octahedral or planar but complexes with three unpaired electron can be either octahedral or tetrahedral. The existence of high spin square planar complexes of cobalt (II) has been described but such reports have been found to be incorrect or unfounded.

Magnetic moment values of cobalt(II) complexes provides important information in distinguishing octahedral, planar and tetrahedral configurations. High-spin octahedral cobalt(II) complexes have magnetic moments ranging from 4.7 to 5.2 B.M.2 i.e. they have very large orbital contribution since the spin only moment for three unpaired electrons is to the three-fold orbital degeneracy of 4T1g ground state. The values of magnetic moment of octahedral complexes vary with temperature. In a high-spin tetrahedral complex the values of magnetic moments range between 4.3-4.7 B.M.3 which are temperature independent. In tetrahedral complexes, cobalt (II) has ground state 4A2. The symmetrical and heavily populated ground state does not contribute large orbital moment to magnetic moment values. The low-spin octahedral cobalt(II) complexes exhibit magnetic moment value of 1.92-2.47 B.M. at room temperature and which varies with temperature. The planar complexes also exhibit magnetic moment value in the same range. A number of complexes with intermediate magnetic moment values between 2.5-4.3 B.M. have also been reported. Such complexes are viewed as anomalous.

Magnetic moments of several carbohydrates of cobalt(II) have been studied by Ranade and Subba Rao4. Magnetic moment values of cobalt(II) mandelate, malonate and tartarate lie between 4.43-4.467 B.M. which suggest tetrahedral symmetry for those complexes. Several complexes of cobalt(II) have been reported by Gill and Nyolm5 and the magnetic moment values are given in Table-1.

<table>
<thead>
<tr>
<th>Solid Complex</th>
<th>Color</th>
<th>B.M.</th>
<th>Color in Nitrobenzene</th>
<th>B.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CoCl$_2$.2Py</td>
<td>Blue</td>
<td>4.42</td>
<td>Blue</td>
<td>4.52</td>
</tr>
<tr>
<td>CoBr$_2$.2Py</td>
<td>Blue</td>
<td>4.50</td>
<td>Blue</td>
<td>4.52</td>
</tr>
</tbody>
</table>

These complexes exhibit a large deviation from normal Curie-Weiss behavior. They interpreted the results supporting a model in which there is a distribution of magnetic ions among two or more low lying electronic levels.

The Complex of cobalt(II) in the present investigation shows the magnetic moment value to be 2.25 B.M. at room temperature (34°C). These values clearly indicate that the complexes have either four coordinated square planar stereochemistry or six coordinated low-spin octahedral structure. On the basis of magnetic moment it is difficult to distinguish between low-spin octahedral and square planar complexes of cobalt(II) as in principle for both cases the moment should be close to the spin-only value for one unpaired electron. Four coordinated planar complexes are easily oxidized to a diamagnetic octahedral cobalt(II) on exposure to air. But in the present case, on exposure to air for several days there is no change in colors and magnetic moment values of these complexes. Since the cobalt(II) are not oxidized readily to its Co(III) complexes. Therefore, it is suggested that the complexes do not have planar stereochemistry rather they possess low-spin octahedral structures. Bis-2- quinideno cobalt(II) salts show magnetic moment in the range 4.15-4.60 B.M.7 where as the complex [(Me2NC6H$_3$)$_2$P$_2$Cl$_2$.Co](ClO$_4$)$_2$ shows magnetic moment value 4.768.

### Table-2

<table>
<thead>
<tr>
<th>Compound</th>
<th>Temperature</th>
<th>$\mu_{\text{eff}}$ (B.M.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Co(ter Py)$_3$.Br$_2$.H$_2$O</td>
<td>295 K</td>
<td>2.63</td>
</tr>
<tr>
<td>[Co(PBl)$_2$.I$_2$</td>
<td>295 K</td>
<td>3.72</td>
</tr>
<tr>
<td>[Co(BMI)$_2$[BF$_4$]</td>
<td>295 K</td>
<td>2.91</td>
</tr>
<tr>
<td>[Co(GdH)$_2$.Br$_2$</td>
<td>295 K</td>
<td>3.16</td>
</tr>
<tr>
<td>[Co(DTHB)][ClO$_4$]</td>
<td>295 K</td>
<td>2.36</td>
</tr>
</tbody>
</table>

### REFERENCES


Authors

First Author – Dr. Rajni Kant (Deptt. Of Chemistry), J.A.C.M. Inter College Motihari