ABSTRACT

The preparation, general behaviour and structure of "Co-ordination compounds of transition elements with amines and amides" has assumed great importance due to their therapeutical studies and applications in industry. Modern theories and experimental techniques have been applied to the field successfully and as a result it has now been possible for us to get clear picture of the shape and configuration of complex molecules as a whole.

The co-ordination complexes of copper(I), copper(II) and nickel(II) are most thoroughly studied. A survey of the literature shows that a large number of such complexes of these metals have been prepared and studied. But no systematic work has been done to study the complexes of the above metals. In the present investigations, systematic physico-chemical approach has been made to study the above metals in detail with regard to their complex forming capacity, with ammonia, primary aliphatic amines, heterocyclic amines and urea, and their magnetic and absorption behaviour.

Further, the investigations on copper(I), copper(II) and nickel(II) with amines have also been made to study the effect of anion (e.g. thiocyanate, chromate and succinimide) to see whether the anion besides neutralizing
the charge on the cation is also co-ordinated or not.
The nature of the anion has been found to be a contributing factor towards stability, colour and many other properties of the complexes.

The author has undertaken the help of a number of physical methods e.g. molecular weight, molar conductance, magnetic susceptibility, visible and infra-red absorption spectrophotometric measurements to elucidate the structure of these complexes.

The copper(I) complexes have the general molecular formula \([\text{Cu(Am)(SCN)}]\), where Am represents ammonia, primary aliphatic or heterocyclic amine. All the complexes are diamagnetic. The infra-red studies indicate these complexes to be linear.

The copper(II) complexes have general molecular formulae \([\text{Cu(Am)}_4\text{CrO}_4\], \([\text{Cu(Am)}_2\text{(H}_2\text{O})_2\text{CrO}_4\] and \([\text{Cu(Urea)}\text{(Succ)}_2\), where Succ. represents succinimide ion.

In the latter complex (i.e. \([\text{Cu(Urea)}\text{(Succ)}_2\]), urea is probably acting as a bidentate ligand. Thus the central metal ion possesses a co-ordination number of four. The magnetic susceptibility and infra-red studies show these complexes to be square planar with \(sp^2d\) hybridization.

The nickel(II) succinimide and chromate complexes are divided into two groups, one in which the nickel(II) ion possesses a coordination number of six and other in which it has a coordination number of four. The general molecular formulae for these groups are 

\[ [\text{Ni(Am)}_4(\text{ Succ})_2], [\text{Ni(Am)}(\text{H}_2\text{O})_2(\text{ Succ})_2] \text{ and } [\text{Ni(Am)}_2(\text{ Succ})_2] \]

\[ [\text{Ni(Am)}_2(\text{H}_2\text{O})_2]\text{CrO}_4 \], respectively. The magnetic and visible absorption studies show that 6-co-ordinate complexes are octahedral in solid as well as in solution, whereas, 4-co-ordinate complexes of the type 

\[ [\text{Ni(Am)}_2(\text{ Succ})_2] \]

don't change to octahedral structure in solution. The diamminediaquo-nickel(II) chromate complex is supposed to possess tetrahedral structure on the basis of magnetic susceptibility measurements. The infra-red studies indicate that succinimide ion is co-ordinated to the metal through negatively charged nitrogen.