

Chapter - 11

SUMMARY AND CONCLUSION

The design, synthesis, characterization and structural assignments of transition metal complexes of thiosemicarbazones have been considered as promising research activities of inorganic chemist. This is because thiosemicarbazones and their metal complexes are show interesting structural, analytical and pgarmacological properties.

The lacuna identified in the literature and objectivities of the present work are revealed in the first chapter. In the light of the objectives, a series substituted thiosemicarbazones (I-VIII)

- I** Cuminaldehyde thiosemicarbazone (**CTH**)
- II** Cuminaldehyde-4-methyl-3-thiosemicarbazone (**CMTH**)
- III** Cuminaldehyde-4-ethyl-3-thiosemicarbazone (**CETH**)
- IV** Cuminaldehyde-4-phenyl-3-thiosemicarbazone (**CPTH**)
- V** Cinnamaldehyde thiosemicarbazone (**TCTH**)
- VI** Cinnamaldehyde-4-methyl-3-thiosemicarbazone (**TCMTH**)
- VII** Cinnamaldehyde-4-ethyl-3-thiosemicarbazone (**TCETH**)
- VIII** Cinnamaldehyde-4-phenyl-3-thiosemicarbazone (**TCPTH**)

have been synthesized and characterized. Copper, cobalt and nickel complexes of these thiosemicarbazones have been prepared and characterized by analytical, conductivity measurements, magnetic moment data, IR, electronic and ESR spectral studies. Mixed ligand metal complexes of cuminaldehyde thiosemicarbazones and pyridine have been synthesized and characterized. In addition to above, copper

complexes of thiosemicarbazide and phenothroline / dimethyl sulfoxide have been prepared and characterized. based on the results obtained in analytical, conductivity measurements, magnetic moment data, IR, electronic and ESR spectral data. Structure of complexes are tentatively assigned. Electrochemical behaviour of all the complexes investigated by employing cyclic voltammetry. The structure of $\text{Cu}(\text{CETH})_2\text{Cl}$ has been determined using single crystal diffraction method.

Some salient structural features of the metal complexes are summarized below:

1. In the present study, thiosemicarbazones are act as either mono anionic or neutral bidentate ligands. However in $\text{Cu}(\text{CETH})_2\text{Cl}$ complex the ligand acts as neutral mono dentate ligand.
2. All complexes are non-electrolytes.
3. Monomeric and dimeric nature of complexes is revealed by magnetic moments data.
4. Spectral studies reveals that copper and nickel complexes of CTH, CMTH, CETH and CPTH are square planar complexes while others assume octahedral structure. X-ray data revealed that $\text{Cu}(\text{CETH})_2\text{Cl}$ complex has three coordinate copper and the complex has T-shape structure.
5. The complexes have covalent character as suggested by ESR and electronic spectral data. The distortion of the complexes is calculated using the factor, f.

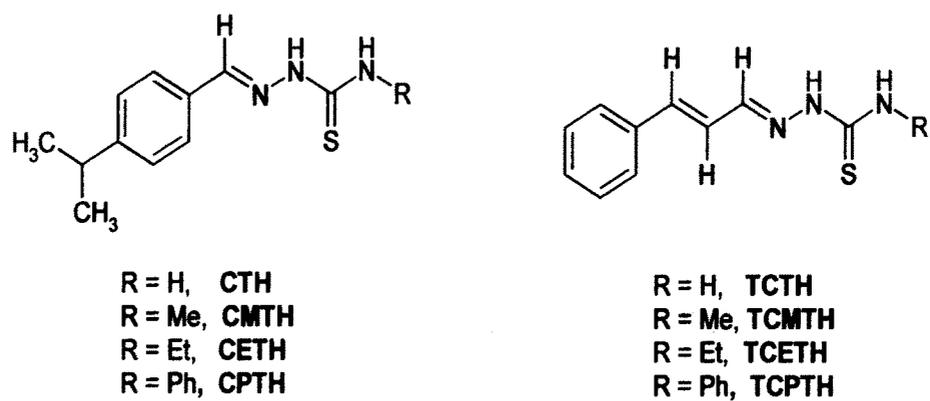


Fig. 11.1. Structures of the ligands.

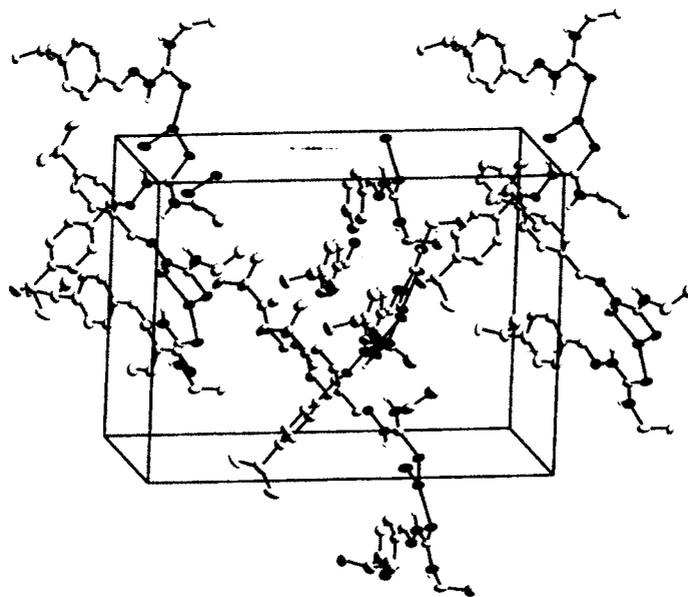


Fig. 11.2. Packing structure of $\text{Cu}(\text{CETH})_2\text{Cl}$

6. The cyclic voltammetric data suggest that all the complexes undergo quasi-reversible one electron reduction. Repeated scans as well as various scan rates showed that dissociation does not take place. The non-equivalent current intensity of cathodic and anodic peaks indicates quasi-reversible behaviour of these complexes.
7. Ligands do not show any binding affinity on calf thymus DNA, but the affinity is greatly enhanced by the incorporation of metal ion (copper, cobalt and nickel) in respective ligands. Metal complexes of phenyl substituted thiosemicarbazones show higher binding affinity towards DNA. The binding constants of these complexes are found to be in the order of 10^3 to 10^8 M^{-1} .
8. Ligands do not show significant nuclease activity, but it is greatly increased by the incorporation of metal ion in the respective ligands. All metal complexes show more nuclease activity in the presence of oxidant (H_2O_2). Even in the absence of oxidant also some complexes show appreciable cleavage activity. The nuclease activity of complexes are also investigated using control reactions in the presence of DMSO (free radical scavenger), EDTA (chelating agent) and DTT (reducing agent).

Thus, in present work transition metal complexes of ligands derived from cuminaldehyde thiosemicarbazones and cinnamaldehyde thiosemicarbznes have been synthesizwd and characterized, structures of the complexes are assigned based on physicochemical and spectral data. The complexes are found to bind DNA very strongly. The complexes of ligands derived from the constituents of Indian spices (cuminaldehyde and cinnamaldehyde) show more nuclease activity. Thus the objectives of the work are fairly achieved.