SYNOPSIS OF THE THESIS ENTITLED

STRUCTURAL, THERMAL, CORROSION INHIBITION
AND ELECTRICAL CONDUCTIVITY STUDIES ON
SOME SCHIFF BASES AND THEIR TRANSITION
METAL COMPLEXES

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By

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SYNOPSIS

Transition metal complexes with Schiff bases as ligands have been amongst the widely studied coordination compounds and find remarkable applications in different fields. The chelating characters of Schiff bases towards transition metals are very interesting. Schiff bases coordinate to the metal ion through nitrogen atom of azomethine group. The presence of functional group with replaceable hydrogen atom near enough to $\text{C}=\text{N}$ renders extra stability to metal complexes through chelation. In the present course of studies the complexation of four new Schiff bases furoin-2-aminothiophenol (FATP), furoin-2-aminophenol (FAP), furoin thiosemicarbazone (FTSC) and furoin semicarbazone (FSC) have been studied extensively.

The thesis is divided into five parts. Part I deals with the synthesis and characterisation of various complexes derived from the Schiff base ligands. Part I comprises of six chapters. The first chapter consists of an introduction and a critical review of the published work on metal complexes of Schiff bases. In the second chapter, materials, methods and instruments used for the various studies are described. Synthesis and characterisation of Co(II), Ni(II), Cu(II) and Zn(II) complexes of FATP are described in the Chapter 3. Structural elucidation of these complexes has been made on the basis of microanalytical, spectral and magnetic data. These data suggest that FATP
act as a dianionic tridentate ligand for the metal ions. All these complexes possess 1:1 metal ligand ratio and they are non-electrolyte in nature. All complexes are found to be paramagnetic except Zn(II) complex which is diamagnetic. Based on the above physicochemical studies, an octahedral structure is suggested for all the four complexes. The synthesis and characterisation of Co(II), Ni(II), Cu(II) and Zn(II) complexes of FAP, FTSC and FSC are described in the Chapters 4, 5 and 6. These complexes are characterised and structural elucidation have been made. All the complexes of FAP, FTSC and FSC also possess 1:1 metal ligand ratio and are non electrolytes in nature. The ligands FAP, FTSC and FSC acted as dianionic tridentate and the geometry of their complexes are found to be octahedral.

Thermogravimetric investigations of Co(II), Ni(II), Cu(II) and Zn(II) complexes of FATP along with the Cu(II) and Zn(II) complexes of FAP, FTSC and FSC were carried out using TG techniques and results presented in part II. This part comprises of three chapters. The first Chapter describes introduction and Chapter 2 explains the materials, methods and instruments used for the present study. The thermal decomposition studies of ten complexes are discussed in chapter 3. All the TG curves were subjected to kinetic analysis and the kinetic parameters namely energy of activation, Arrhenius frequency factor and entropy of activation for decomposition have been calculated from the TG data using the Coats-Redfern equation. On the
basis of the temperature of inflection and initial decomposition, the relative thermal stabilities of the chelates were determined.

The Co(II) and Cu(II) complexes of FATP follows a two stage decomposition pattern while the Ni(II) and Zn(II) complexes follow a three stage decomposition pattern. The relative thermal stabilities of FATP complexes follow the order, Ni(II) > Co(II) ≈ Cu(II) ≈ Zn(II). The Cu(II) and Zn(II) complexes of FTSC and FAP follow decomposition in two stages while the complexes of FSC follow a three stage decomposition pattern. The relative thermal stabilities of the Cu(II) complexes were higher than the Zn(II) complexes in the case of FAP, FTSC and FSC.

Part III consist of unit cell determination of eight newly synthesised Schiff base complexes using X-ray powder diffraction technique. Chapter 1 and 2 give the introduction, materials and methods employed respectively. In the Chapter 3, the X-ray diffraction studies of Ni(II) and Cu(II) complexes of FATP, FAP and FSC along with the Cu(II) and Zn(II) complexes of FTSC are presented. It was found that Ni(II) complexes of FATP and FSC as well as Cu(II) and Zn(II) complexes of FTSC belong to orthorhombic crystal system. But in the case of Cu(II) complexes of FATP, FAP and FSC tetragonal system is identified. A cubic crystal system is reported for the Ni(II) complex of FAP. The calculated density of each complex was in good agreement with experimental value found out, which confirm the proposed molecular formula
and existence of 1:1 stoichiometry between the metal ion and the ligands for all the studied complexes.

Studies of corrosion inhibition efficiency of four Schiff bases FTSC, FATP, FAP and FSC towards mild steel in hydrochloric acid are described in Part IV. A critical review of Schiff base based corrosion inhibitors is included in first chapter. A detailed description about the theory and methods used for the corrosion inhibition studies are discussed in Chapter 2. In Chapter 3, the results of the corrosion inhibition efficiency determined using laboratory corrosion immersion technique and electrochemical methods like potentiodynamic polarization method and electrochemical impedance spectroscopy are described. Results reveal that all the four Schiff bases act as good corrosion inhibitors having efficiency of 85% and above towards mild steel in 1M hydrochloric acid solutions. Hence they can be used as corrosion inhibitors for mild steel in hydrochloric acid media. The efficiency of the investigated compounds varied depending upon their chemical structure and constituents present in them. The adsorption isotherm analysis and thermodynamic parameters calculated indicate that the Schiff bases inhibit corrosion through the physical adsorption process and follow Langmuir adsorption isotherm.

The Part V of this thesis deals with electrical characterisation of the prepared Schiff bases and their selected metal complexes using D.C electrical conductivity measurements. The Chapter 1 of this part contains introduction
and review of literature related to the electrical conductivity studies of metal complexes and Chapter 2 explains the material and methods adopted. The results of D.C. electrical conductivity of Co(II), Ni(II), Cu(II) and Zn(II) complexes of FATP, Cu(II) complex of the FAP, FTSC, FSC and four Schiff bases are presented in the Chapter 3. The conductivity obtained for the investigated samples show that these materials can be classified into the category of organic semiconductors. Among the studied materials few of them show typical semiconductor behaviour of increasing conductivity with increasing temperature in the studied temperature region which suggest another potential application of these studied compounds. The probable mechanism of electrical conduction in these materials is also discussed.

The thesis concludes with summary. Detailed lists of references arranged in serial order are given at the end of each part.