

*Name: Sumaiya Hasnain*

*Supervisor: Dr. Nahid Nishat*

*Co-supervisor: Prof. M. Zulfequar*

*Department: Chemistry*

---

---

SYNTHESIS AND CHARACTERIZATION OF NEW BIOCIDAL  
COORDINATION POLYMERS CONTAINING TRANSITION METAL  
ION

---

---

**ABSTRACT**

This Ph.D. thesis has been divided into eight chapters.

**Chapter 1** involves an introduction of coordination polymer, its classification and types.

Major applications of coordination polymers are explained in detail.

**Chapter 2** introduces the techniques used to identify and characterize all the newly synthesized coordination polymers. Techniques described in this chapter are:

Elemental analysis, IR spectroscopy, NMR spectroscopy ( $^1\text{H}$  NMR &  $^{13}\text{C}$  NMR),  
Electronic spectra & magnetic moment, Scanning electron microscopy (SEM),  
Thermogravimetric analysis, Antimicrobial activity

**Chapter 3** describes the synthesis of polymeric ligands containing barbituric acid / 2-thiobarbituric acid, by the condensation polymerization. Polymer metal complexes were prepared by the reaction of these resins with Mn(II), Co(II), Ni(II), Cu(II) and Zn(II) metal ions.

**In Chapter 4** Schiff base have been synthesized by the reaction of semicarbazide / thiosemicarbazide with salicylaldehyde and formaldehyde. Now transitional metal salts

were incorporated to form the Schiff base metal complex which were then polymerized by toluene 2,4 diisocyanate (TDI), to form metal chelated polyurethanes.

**In Chapter 5** Polymeric ligands were prepared by the addition polymerization of urea / thiourea with toluene 2, 4 diisocyanate in 1:1 molar ratio. The polymer metal complexes were prepared by the reaction of polymeric ligands of urea / thiourea with transition metal ions.

**Chapter 6.** The polymeric ligands were synthesized by the addition polymerization of thiosemicarbazides and ethylenediamine with toluene 2,4-diisocyanate in a 1 : 1 molar ratio. Polymer metal complexes were prepared by the reaction of polymeric ligands with transition metal ions.

**Chapter 7** describes the synthesis, biocidal action and route of thermal degradation of some coordination polymers of first row transition series metal ions. The ligands were synthesized by the addition polymerization of o-phenylenediamine and toluene 2,4 diisocyanate (TDI)/ hexamethylene diisocyanate (HMDI).

All the synthesized compounds in chapter 3 to 7 have been characterized by the techniques as described in chapter 2. The results revealed that metal polychelates are much more thermally stable than their counterparts. Similarly the antimicrobial activity results revealed that coordination of metal enhances the biocidal nature of the compounds.

**Chapter 8** describes the conclusions drawn from the work done and future aspects in the field of coordination polymers.