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**Title of Thesis:** Preparation, Characterization and Biological Activity of  
Metal Incorporated Macromolecules

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### **Abstract**

The chemistry of macromolecules has been an interesting and fascinating area of research for chemists all over world. The continued efforts of chemists to proliferate this chemistry is not only due to structural novelties of these compounds but also because of their varied applications in the areas *viz.* medicinal, biochemical, bioinorganic, environmental, industrial, photophysical, photochemical, photoelectronic etc. The intense escalation in the diversity of research in the area of metal-containing macromolecules is due to the extraordinary concentration in the search of new materials that display useful chemical, optical and electronic properties. Thus, an idea was conceived to initiate work for Ph.D. thesis aimed to synthesize and characterize some novel macrocyclic macromolecular complexes derived from and various diketones compounds to investigate the novel structural features and to explore the biological significance of these complexes. The entire work is divided into five chapters:

**First chapter** gives the summary of systematic expansion in the coordination chemistry of the macromolecular metal complexes including the macrocyclic complexes. It covers the basic definition of macromolecules, macrocyclic compounds, gradual historical developments, synthetic approaches, possible bonding sites, stabilization of metals in different oxidation states and its application in catalysis, electrochemical sensors, electroluminescent materials, non-linear optics and medicinal chemistry.

**Second Chapter** deals with the synthesis of macrocyclic ligand and its metal complexes,  $[M(C_{44}H_{32}N_8O_4)X_2]$  resulted by template condensation reaction between 1,2-diphenylethane-1,2-dione and 1,4-dicarbonyl-phenyl-dihydrazide. The macrocyclic ligand behaves as a tetradentate ligand and coordinates to the metal ions via the nitrogen atoms and the complexes have the mononuclear structures. The synthesised compounds were evaluated for their inhibition potential against bacterial and fungal strains and were found to be biologically

active. The activity results show that the metal complexes have a comparable biological activity with the parent ligand against all bacterial and fungal species. In addition, the antioxidant activity of the compounds was also studied through scavenging effect on DPPH radicals with the copper complex showing enhanced than other antioxidants.

**Third Chapter** discusses the development of a macrocyclic ligand derived from the condensation of 1, 4-dicarbonyl-phenyl-dihydrazide and pentane-2, 4-dione in 2:2 ratio. The analytical and spectroscopic results indicated that the complexes are non-electrolytes in nature and may be formulated as  $[M(C_{26}H_{28}N_8O_4)X_2]$  [where, M = Co(II), Cu(II) and Ni(II) and X = Cl<sup>-</sup>]. The antimicrobial activities of the ligand and its complexes, as growth inhibiting agents, have been screened in vitro against different species of bacteria and fungi and the results concluded that the metal complexes are the effective drugs against the tested strains as compared to the macrocyclic ligand

**Fourth Chapter** deals with the preparation of novel macrocyclic Schiff base and its complexes derived from 1,4-dicarbonyl-phenyl-dihydrazide and ethyl 3-oxobutanoate. The synthesised compounds were investigated in vitro for their antimicrobial activities to evaluate their inhibiting potential against bacterial species *Pseudomonas aeruginosa*, *Escherichia coli*, *Salmonella typhimurium*, *Staphylococcus aureus* and fungal species include *Aspergillus flavus*, *Aspergillus fumigatus*, and *Candida albicans*. The complexation led to a remarkable increase in antimicrobial activity. In addition, the antioxidant activity of the compounds was also observed through scavenging effect on DPPH radicals.

**Fifth Chapter** deals with the designing of new macrocyclic Schiff base ligand and its metal complexes derived from 1,4-dicarbonyl-phenyl-dihydrazide and O-phthalaldehyde. The Schiff base and its metal complexes were evaluated for antimicrobial activity against bacteria (*E. coli*, *B. subtilis*, *S. aureus*) and fungi (*A. niger*, *A. flavus*, *C. albicans*). The ligand and some of its complexes were found to be biologically active. In addition, the antioxidant activity of the compounds was also investigated through scavenging effect on DPPH radicals. The obtained IC<sub>50</sub> value of the DPPH activity for the copper complex was higher than other compounds.