

Thesis Title: “**Design and synthesis of fluorescent probes for detection of different metal ions: crystal structure elucidation and biological application**”

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### Abstract

Design and synthesis of fluorescent chemosensors is an extremely interdisciplinary area of research now-a-days because of their importance and application in several different fields, such as chemistry, biology, medicine and environmental studies etc. On the other hand, in a living system, numerous critical biological functions depend on the presence of metal ions, and the absence or insufficiency of these ions may also lead to many diseases.

This thesis consists of six chapters based on the synthesis, characterization and extensive study of sensing properties of the newly constructed probes. **Chapter 1** represents a brief introduction on the basic definition of chemosensor with several possible mechanistic pathways for selective detection of several biologically and environmentally relevant ions. A concise literature survey of various reported chemosensors based on different fluorophoric (Rhodamine, 4-Methyl-2,6-diformylphenol (DFP) and Pyridoxal) platforms are described. **Chapter 2** presents four new rhodamine 6G based chemosensors for selective detection of  $Al^{3+}$  ion in organic-aqueous medium. The chemical structures as well as the photophysical properties of the probes are thoroughly studied by spectroscopic methods. **Chapter 3** includes another two rhodamine and azo based chemosensors, synthesized for colorimetric and fluorometric detection of three trivalent metal ions,  $Al^{3+}$ ,  $Cr^{3+}$  and  $Fe^{3+}$ . Chemosensors can detect intracellular  $Al^{3+}$ ,  $Cr^{3+}$  and  $Fe^{3+}$  ions in cervical cancer cell line HeLa. **Chapter 4** deals with the fabrication of a new chemosensor for dual sensing of  $Zn^{2+}$  and  $Cu^{2+}$  ions distinctly in methanol/water (1:9) medium. Biological studies are performed in MDA-MB-468 cell line. **Chapter 5** represents a rare example of an aza-crown DFP based macrocyclic chemosensor for selective detection of both  $Zn^{2+}$  and  $Cu^{2+}$  in HEPES buffer medium (pH 7.4). The changes in photophysical property of the Schiff-base molecule in the presence of both ions and its cell imaging studies are discussed. **Chapter 6** covers the synthesis of two pyridoxal-based novel Schiff base compounds as chemosensors for detection of  $Zn^{2+}$  ions. Living cell imaging studies using these two compounds have been discussed.

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