



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

This Thesis contains five chapters. Chapter 1 is the introduction which describes the contribution of metals in our daily lives and their adverse effects on human beings when exposed to excess amounts along with a brief elaboration of different detection techniques. Some recent developments in devising fluorescent and colorimetric probes are also discussed. In Chapter 2 the 2,4,5-tris(2-pyridyl)imidazole (L1H) molecule has been evaluated as a probe for dual sensing of Hg^{2+} and Cu^{2+} ions in EtOH/HEPES buffer medium (5 mM, pH = 7.34, 1:1, v/v). Probe L1H shows a good sensitive and selective *turn off* response in the presence of both Hg^{2+} and Cu^{2+} ions, which is comprehensible under long UV light. Its sensitivity was evaluated in different pH medium and in presence of other metal ions. Paper strip experiments and in-vitro cell imaging was done to know the sensitivity of the probe towards the metal ions in different environment. Chapter 3 describes the probe 2,6-di(2-pyridyl)-1,5-dihydroimidazo[4,5-f]benzimidazole (L2H₂) and its sensing application towards metal ions. This probe could detect Zn^{2+} and Cd^{2+} ions in three different aqueous systems viz., water, DMSO/HEPES buffer (1:1, pH = 7.34, rt), and DMSO/water (1:1, rt). In water a *“turn-on”* response was observed for both metal ions, whereas in the latter two solvent systems, a ratiometric change in fluorescence maximum was observed. The detection limit of this probe was as low as 0.3 μM and 0.62 μM (in water) for Zn^{2+} and Cd^{2+} ions, respectively. In Chapter 4 synthesis and evaluation of a novel probe N-(pyren-1-ylmethylene)benzo[d]imidazo[2,1-b]thiazole-2-carbohydrazide (L3H) as metal ion sensor was explored. It was found to be able to nanomolar detection of Pd^{2+} and Ni^{2+} ions by colorimetric change. This probe was also able to detect the presence of Pd^{2+} ions in drug samples and APIs without any major interference. LOD values were calculated to be 46.1 to 93.9 nM (4.9 to 6.0 ppb) for PdCl_2 and 10.6 to 19.6 nM (1.1 to 2.1 ppb) for $\text{Pd}(\text{PPh}_3)_2\text{Cl}_2$ and 9.301 nM for NiCl_2 solutions. It also showed extremely good recovery of Pd^{2+} in presence of all the drug molecules. In Chapter 5 another novel ligand L4H based on 2,7-dichlorofluorescein was synthesized and evaluated for sensing applications. It was found to be able to detect Co^{2+} and Cu^{2+} ions differentially by different colouration of the solution in presence of these two metal ions. *In situ* Cu-complex of the ligand was utilised for quantification of amino acids like BSA and HSA proteins. Its differential selectivity paved the way for molecular logic gate application.