INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study	:	Ph.D.

Thesis Title : "Design and synthesis of Fluorogenic and Chromogenic probes for the Detection of Ionic Guests in Solution and Biological medium"

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Thesis Submitted to the Department/ Center	:	Chemistry
Date of completion of Thesis Viva-Voce Exam	:	03/06/2016
Key words for description of Thesis Work	:	Chemosensor, Ions, Fluorescence, Chromogenic, Fluorophore, Sensing, Cell Imaging, Traffic light, NIR Probes, Supramolecular Chemistry

SHORT ABSTRACT

Chapter 1 and 2 describes the background, importance, synthesis, characterization and experimental details. Chapter 3 describes the thorough investigation of the binding properties of a diformylquinoline based receptor (L_1) which exhibits selective colorimetric and fluorometric sensing of Zn^{2+} in aqueous medium at pH 7.4 based on ICT process. The in situ formed phenoxo-bridged complex, $L_1.2Zn$ can selectively and specifically sense PPi among all the other biologically important anions including ATP through reversible binding. The detection limit for Zn^{2+} and PPi were found to be approximately 56 ppb and 2 ppb respectively. The unique selectivity of the PPi by L_1-Zn ensemble could be used as an analytical tool to probe PPi generation in a prototype PCR setup and track DNA amplification with higher sensitivity as compared to conventional agarose gel electrophoresis. Interestingly, the principle of PPi estimation in PCR rendered rapid estimat ion of bacterial cell numbers with a limit of detection of 10 CFU of E.coli MTCC 433 in as early 10 PCR cycles. The proposed method of PPi sensing offers interesting application potential in PCR based rapid diagnostics for pathogenic agents and microbiological quality control. In Chapter 3 a imine-hydrazone based fluorescent chemosensor (L_2) have been designed which was used for efficient and selective sensing of Zn^{2+} over other biologically important metal ions in physiological conditions is reported. Interestingly, the receptor functioned in completely physiological condition (99.7% HEPPES buffer) and has visible light excitability. The receptor could detect as low as 69 ppb Zn^{2+}. The developed receptor was non-toxic and rendered intracellular sensing of Zn^{2+} in HeLa cells through fluorescence imaging studies. Chapter 4 gives detailed information about a novel dialdehyde-based multi-analyte sensor (L_3) which renders distinctive emission spectra for Al^{3+}, Zn^{2+} and F^- ions. The ligand exhibited different types of interactions with these three different ions resulting into the enhancement of fluorescence intensity at three different wavelengths. The ligand is non-toxic and amicable for sensing intracellular Al^{3+} and Zn^{2+} in live Hela cells. The final chapter describes a new tricarbocyanine-based chemosensor (L_4) which exhibited a dramatic Al^{3+}-specific fluorescence turn-on response in the Near-Infrared (NIR) region. The sensor was also capable to sense Al^{3+} in complex medium like environment samples (tap water, lake water and river water). The sensor was non-toxic and could thus be employed as an imaging probe for detecting intracellular Al^{3+} in live cells. Interestingly, upon interaction with DNA in solution, the L_4-Al^{3+} ensemble rendered tracking of DNase activity in solution through a systematic reduction in the fluorescence emission intensity.