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Notice for the PhD Viva-Voce Examination

Mr Vishnu S, Registration Number: 2270127, PhD Scholar at the Department of Chemistry, School of Sciences, CHRIST (Deemed to be University) will defend his PhD thesis at the public viva-voce examination on Thursday, 06 November 2025 at 10.00 am in Room No. 044, Ground Floor, R & D Block, CHRIST (Deemed to be University), Bengaluru – 560029, Karnataka, India.

Title of the Thesis	:	**Development of Fluorescent Chemosensors for the Selective Detection of Biologically and Environmentally Significant Cations and Anions**
Discipline	:	**Chemistry**
External Examiner - I	:	**Dr Subrata Jana** Professor and Head Indira Gandhi National Tribal University Central University, Lal Pur Amarkantak - 484887 Madhya Pradesh
External Examiner - II	:	**Dr Murugan Veerapandian** Principal Scientist Central Electrochemical Research Institute Karaikudi - 630003 Tamil Nadu
Supervisor	:	**Dr Avijit Kumar Das** Assistant Professor Department of Chemistry School of Sciences CHRIST (Deemed to be University) Bengaluru - 560029 Karnataka

The members of the Research Advisory Committee of the Scholar, the faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva-voce examination.

Registrar (Academics)

Place: Bengaluru
Date: 27 October 2025

ABSTRACT

Designing fluorescent probes for the sensing of biologically and environmentally significant cations and reactive oxygen species is the need of the hour. This work presents the design and development of four novel fluorescence-based sensors capable of selectively identifying crucial cations (Cu^{2+}, Hg^{2+}) and biologically significant anions (OCl^-). A range of unique characteristic compounds have been utilized as the base for synthesis, such as anthracene, rhodamine, and quercetin. Four novel sensors, pyridine-coupled bis-anthracene (PBA), rhodamine-derived probes (BBS and BHS), and quercetin-based QBE, demonstrate high selectivity and sensitivity for Cu^{2+}, Hg^{2+}, and OCl^- via distinct mechanisms. PBA exhibits a dual function as a ratiometric water sensor and a turn-on Cu^{2+} detector, providing a fluorescence enhancement of 10-fold, with a lower limit of detection (0.358 μM). The sensor was successfully implemented for real sample (soil) analysis and studied for interactions with BSA and ct-DNA via fluorescence titrations and docking simulations. Similarly, rhodamine-based BBS and BHS probes detect Cu^{2+} and OCl^- through spirolactam ring-opening mechanisms induced by coordination (Cu^{2+}) or oxidation (OCl^-), showing significant Stokes shifts and fluorescence enhancements. BBS achieved LOD's of 2.61 μM for Cu^{2+} and 1.96 μM for OCl^-. BHS highlighted ESIPT inhibition upon analyte binding, validated by DFT and docking studies. QBE, a quercetin-derived sensor, selectively detects Hg^{2+} via chelation-enhanced fluorescence (CHEF), exhibiting an 18-fold intensity increase and an LOD of 8.47μM. Its efficiency in bioimaging and PET/ESIPT mechanistic studies underscores its biological relevance. All sensors integrated theoretical analyses to elucidate structural and interaction dynamics with biomolecules. These innovations highlight the potential of tailored fluorophores for environmental monitoring, biomedical diagnostics, and real-sample applications.

Keywords: *Chemosensors; Fluorescence; Metal ion detection; Anion sensing; Environmental monitoring; Molecular docking/DFT.*

Publications:

1. **Vishnu S**, Anish Nag, and Avijit Kumar Das. A Versatile Sensor Capable of Ratiometric Fluorescence Detection of Trace Water and Turn-on Detection of Cu 2+ Modulating the Binding Interaction of a Cu(II) Complex with BSA and DNA Complemented by Docking Studies. Anal. Methods 2024, 16 (30), 5263–5271.
2. **Vishnu S**, Avijit Kumar Das, Yatheesharadhya Bylappa, Anish Nag, and Malay Dolai. A Dual-Functional Rhodamine B and Azo-Salicylaldehyde Derivative for the Simultaneous Detection of Copper and Hypochlorite: Synthesis, Biological Applications and Theoretical Insights. Anal. Methods 2024, 16 (47), 8164–8178.
3. **Vishnu S**, Sibaprasad Maity, Annada C. Maity, Malavika S Kumar, Malay Dolai, Anish Nag, Yatheesharadhya bylappa, Gorachand Dutta, Bimalendu Mukherjee, Avijit Kumar Das. Development of a Fluorescent Scaffold by Utilizing Quercetin Template for Selective Detection of Hg2+: Experimental and Theoretical Studies along with Live Cell Imaging. Spectrochim. Acta Part A Mol. Biomol. Spectrosc. 2024, 315, 124249.
4. **Vishnu S**, Avijit Kumar Das, Gouri Karan, Sujata Maiti Choudhury. Fluorescence switching *via* competitive ESIPT and spirolactam ring opening in a multifunctional rhodamine B probe for selective detection of Cu^{2+} and OCl^-: theoretical insights with anticancer and biosensor activity. Mater. Adv. 2025, 6, 4499-4512.