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Notice for the PhD Viva Voce Examination

Ms Varsha Lisa John (Registration Number: 2071410), PhD scholar at the School of Sciences, CHRIST (Deemed to be University), Bangalore will defend her PhD thesis at the public viva-voce examination on Wednesday, 24 January 2024 at 3.00 pm in Room No. 044, Ground Floor, R & D Block, CHRIST (Deemed to be University), Bengaluru - 560029.

Title of the Thesis	:	**Design, Synthesis, and Applications of Carbon Dots with Controlled Physicochemical Properties**
Discipline	:	**Chemistry**
External Examiner (Outside Karnataka)	:	**Dr Biji P** Professor Department of Nanotechnology PSG Institute of Advanced Studies Peelamedu, Coimbatore – 641004 Tamil Nadu
External Examiner (Within Karnataka)	:	**Dr S Anandhan** Professor Department of Metallurgical & Materials Engineering National Institute of Technology Surathkal, Srinivasnagar (P.O.) Mangaluru - 575025 Karnataka
Supervisor	:	**Dr Vinod T P** Associate 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

Place: Bengaluru
Date: 19 January 2024

ABSTRACT

Modification of carbon dots (CDs) is essential to enhance their photophysical properties and applicability. Physical (e.g., composite material blending, core-shell architecture) and chemical (e.g., doping, surface passivation) methods exist to modify CDs. Different precursors can impart varied functionalities and heteroatomic dopants on CDs. Despite several modification strategies, the reproducibility and scalability of CDs still need to be improved. Newer approaches for modifying CDs are thus essential to ensure lab-to-lab and batch-tobatch consistency. Our study focused on developing novel strategies for the physicochemical modifications of CDs. The theoretical simulation we performed for surface-functionalised CDs with the aid of density functional theory and time-dependent density functional theory helped to predict the mechanism of photoluminescence (PL) and to analyse the effect of hydrogen bonding on the properties of CDs. We have developed a novel and general method for preparing amine functionalized CDs from modified paper precursors. This strategy allows us to prepare CDs with customized functionalities, alleviating the post-synthesis modification.

A novel ion-imprinting strategy involving CDs synthesised from modified paper precursors was also developed through our research. In another work, we utilized silk fibers as a matrix for immobilising CDs. CDs prepared from mulberry leaves were fed to silkworms to produce CD-embedded silk fibres, which could be used to detect dopamine. In addition, we prepared CDs from an unreported natural source (frankincense), which were used to detect lead ions. We demonstrated the heavy metal sensing application of these CDs in combination with a UV-light LED chip and a smartphone, which is relevant in resource-limited areas. The research results presented in the thesis are expected to inspire further investigations and applications related to CDs.

Keywords: Carbon dots, Physicochemical properties, Photoluminescence mechanism, Density functional theory, Modification of carbon dots, Ion-imprinting, Sensing, Frankincense, Silk fibers

Publications:

1. **V. L. John**, A. R. Nayana, T. R. Keerthi, A. K. K. A., B. C. P. Sasidharan, and V. T. P., *Macromol. Biosci.*, p. 2300081, Apr. 2023, doi: https://doi.org/10.1002/mabi.202300081.
2. **V. L. John**, F. P. M., C. K P, and V. T. P., *Nanotechnology*, 2022, doi: 10.1088/1361-6528/ac8e76.
3. G. Ayiloor Rajesh, **V. L. John**, A. Pookunnath Santhosh, A. Krishnan Nair Ambika, and V. Thavarool Puthiyedath, *Part. Part. Syst. Charact.*, vol. 39, no. 9, 2022, doi: 10.1002/ppsc.202200017.
4. **V. Lisa John**, F. Joy, A. Jose Kollannoor, K. Joseph, Y. Nair, and T. P. Vinod, *J. Colloid Interface Sci.*, vol. 617, pp. 730–744, 2022, doi: 10.1016/j.jcis.2022.03.070.
5. **V. L. John**, Y.Nair, and T. P.Vinod, *Part. Part. Syst. Charact.*, vol. 2100170, , doi: 10.1002/ppsc.202100170.