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Notice for the PhD Viva Voce Examination

Ms Jelby George, Registration Number: 2170205, PhD Scholar at the Department of Physics and Electronics, School of Sciences, CHRIST (Deemed to be University) will defend her PhD thesis at the public viva-voce examination on Friday, 06 February 2026 at 02.30 pm in Room No. 044, Ground Floor, R&D Block, CHRIST (Deemed to be University), Bengaluru - 560029, Karnataka, India.

Title of the Thesis	:	**Synthesis of Bio-Derived Low-Dimensional Materials for Energy Storage and Optical Applications**
Discipline	:	**Physics**
External Examiner - I	:	**Dr Arvind H Jadhav** Associate Professor Centre for Nano and Material Sciences Jain University, Jain Global Campus Bangalore - 562112 Karnataka, India
External Examiner - II	:	**Dr N Vijayan** Sr Principal Scientist and Professor Indian Reference Materials (BND) Division CSIR-National Physical Laboratory New Delhi - 110012
Supervisor	:	**Dr Manoj B** Professor Department of Physics and Electronics 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.

Place: Bengaluru
Date: 27 January 2026

Registrar (Academics)

Registrar (Academics)
CHRIST (Deemed to be University)
Bengaluru - 560029, INDIA

ABSTRACT

At present, focus on sustainability has become as inevitable as strategies for development, both of which go hand in hand towards a world of nature-human coexistence. Over the past few decades, which can be called as an era of transformations, waste management strategies have shifted from tedious disposal methods to facile routes of reuse and recycling. Following the path of this vital evolution, researches are focusing on valorizing waste materials to useful products such as carbon nanomaterials, which can be employed in a diverse range of applications. Low dimensional carbon materials, which are simply termed as carbon nanomaterials are capable of being game changers in modern day and future technologies.

Carbon nano-materials, with sizes ranging from a few nanometers to several micrometres, are capable of revolutionising the realm of materials, design and technology. These multi-dimensional materials comprising a varying structures and morphologies, decorated with diverse functional groups have already marked their presence in diverse application fields like optics, electronics, electrochemistry, biomedicine and various energy technologies dealing with production, harvesting, conversion, and storage. Carbon nano-materials, when synthesised from biomass precursors, offer possibilities of inherent doping and functionalization in addition to the advantage of external tunability. Also, using biomass precursors promotes environmentally compatible products and often involves the strategy to convert waste to wealth. Several recently reported works substantiate the prospects of developing potentially valuable materials with outstanding physical and chemical properties from biomass precursors. Cassava is a widely cultivated and consumed tuber crop in South America, Africa, and Asia. Cassava peel is an agricultural waste usually disposed of or rarely processed to make livestock feed. Using cassava peel to extract carbon nanomaterials would be a beneficial technology for adding value to this agricultural waste.

Carbon dots, the tiny nanoscale zero-dimensional materials not exceeding 10 nm in size, with unique and highly tunable optical and electrical properties can be considered green, sustainable, and cost-effective alternatives to toxic and expensive fluorescent materials. The environmental compatibility of carbon dots, with the added advantages of facile synthesis and tuning methodologies, makes them favourites among researchers. Due to their tunable optical and electrochemical properties, carbon dots open a vast arena for utilisation in light absorption, downconversion and electrochemical applications. Two-dimensional carbon nanomaterials form yet another species, offering great tunability, in terms of morphology, surface area, porosity, and functionalization. These materials can be effectively utilised in energy storage applications, including supercapacitors, to enhance device performance and stability.

In the present work, carbon dots are synthesized using facile microwave-assisted solvothermal treatment, and surface modifications were attained through solvent engineering using three different solvents: Ethylene Glycol, Water, and Ethylenediamine. As a consequence of surface modifications, carbon dots with tuned optical and electrochemical properties are obtained. The modulated optical properties of the carbon dots made them suitable for application in white LEDs and UV-resistant dispersions, due to broad visible light emission fluorescence and strong UV absorption, respectively. Further, waste cassava peel was valorised into porous carbon nanosheets for supercapacitor electrode applications, attaining promising energy storage performance.

Keywords: *Energy Storage, Energy Conversion, Light Emitting Diode, UV Shielding, Supercapacitors, Carbon Dots, Carbon nanosheets*

Publications

1. **George, Jelby**, and Manoj Balachandran. "Extrinsic pseudocapacitance: Tapering the borderline between pseudocapacitive and battery type electrode materials for energy storage applications." *Journal of Energy Storage* 74 (2023): 109292.
2. **George, Jelby**, and Manoj Balachandran. "Nitrogen-Oxygen Co-Functionalized Waste Cassava Peel-Derived Carbon Dots for White Led." *Advanced Sustainable Systems* 9, no. 3 (2025): 2400938.
3. **George, Jelby**, and Manoj Balachandran. "Modulating Electrochemical Energy Storage Properties of Cassava Peel-Derived Carbon Dots Via Solvent Engineering." *Advanced Sustainable Systems* (2025): e00325.
4. **George, Jelby**, Alex P. Joseph, and Manoj Balachandran. "Perovskites: Emergence of highly efficient third-generation solar cells." *International Journal of Energy Research* 46, no. 15 (2022): 21856-21883.