Notice for the PhD Viva Voce Examination

Ms Ashlin M Raj (Registration Number: 1650076), PhD scholar at the School of Sciences, CHRIST (Deemed to be University) will defend her PhD thesis at the public viva-voce examination on Friday, 10 February, 2023 at 3.00 pm in the Syndicate Room (Room No. 802), Ground Floor, Auditorium Block, CHRIST (Deemed to be University), Bengaluru - 560029.

Title of the Thesis	:	**Cost Effective Synthesis of Carbon Nanoparticles and Exploring the Fluorescence and Electrochemical Applications**
Discipline	:	**Physics**
External Examiner (Outside Karnataka)	:	**Dr P Venkatachalam** Associate Professor Department of Physics Annamalai University Annamalai Nagar Chidambaram P O Tamil Nadu
External Examiner (Within Karnataka)	:	**Dr M K Kokila** Professor Department of Physics Jnana Bharathi Campus Bangalore University Bengaluru – 560056 Karnataka
Supervisor	:	**Dr Manoj B** Professor Department of Physics and Electronics School of Sciences CHRIST (Deemed to be University) Bengaluru - 560029 Karnataka

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.

Registrar

Place: Bengaluru
Date: 31 January 2023

ABSTRACT

In the first study, carbon nanostructures are synthesized from lignite using various simple, scalable, and economical techniques, and the as-prepared carbon nanostructures demonstrated excellent fluorescence characteristics. Furthermore, the as-synthesized carbon nanostructures exhibited remarkable copper ion sensing with a dual linear range with limits of detection (LOD) as low as 1.32 pM and 2.35 pM. The captivating results imply that these lignite-derived carbon nanostructures could efficiently and economically detect low concentrations of copper ions in water. The second study synthesized carbon nanoribbons and nanosheets with superior fluorescence from lignite using a facile chemical oxidation process. The as-synthesized nanomaterials can sense glucose in a linear range of 8-3000 µM. All three samples exhibited remarkable glucose sensing with a dual linear range with limits of detection (LOD) as low as 3.3 µM and limits of quantification (LOQ) of 10 µM. This work would contribute to the mass production of glucose sensors with a considerable reduction in the glucometer cost. The third study provides a facile, scalable, and cost-effective method for preparing mesoporous nanocarbon extracted from low-grade coal lignite with excellent electrochemical activity. The synthesized nanostructure-modified electrode is used for individual and simultaneous quantitative detection of heavy metal ions cadmium and lead. The sample exhibits a triple linear detection range over the concentration ranges from 2.08 to 129 nM and 5.56 to 129 nM for cadmium ions and lead ions, respectively. The detection limit calculated from the three linear ranges is 1.83 nM, 1.5 nM, and 1.83 nM for cadmium ions and 0.68 nM, 0.73 nM, and 1.38 nM for lead ions.

Keywords: Low-grade coal, carbon nanostructures, fluorescence, copper ion sensing, carbon nanoribbons, nanosheets, micromolar glucose sensing, mesoporous nanocarbon electrochemical sensing, heavy metal ions.

Publications:

1. **Ashlin M. Raj**, Manoj Balachandran. (2021) Cost-effective route to nanodiamond from low-rank coal and their fluorescent & dielectric characteristics. *Ceramics International*, 79(1) 887-895. https://doi.org/10.1016/j.ceramint.2021.09.171
   (Impact factor – 4.527)
2. **Ashlin M. Raj**, Manoj Balachandran. (2020) Coal-Based Fluorescent Zero-Dimensional Carbon Nanomaterials: A Short Review. *Energy & Fuels* **2020** *34* (11),13291-13306. https://dx.doi.org/10.1021/acs.energyfuels.0c02619
   (Impact factor – 3.605)
3. Manoj Balachandran, **Ashlin M. Raj,** & George Thomas. (2018) Tailoring of low-grade coal to fluorescent nanocarbon structures and their potential as a glucose sensor. *Scientific Reports* 8, 13891. https://doi.org/10.1038/s41598-018-32371-9
   (Impact factor – 4.379)
4. Manoj Balachandran, **Ashlin M. Raj**, & George Thomas. (2018) Facile synthesis of preformed mixed nano-carbon structure from low rank coal. Materials Science-Poland 36(1):14-20. DOI: 10.1515/msp-2018-0026
   (Impact factor – 0.95)
5. Manoj Balachandran, **Ashlin M. Raj**, & George Thomas. (2017) Tunable direct band gap photoluminescent organic semiconducting nanoparticles from lignite. *Scientific Reports* 7, 18012. https://doi.org/10.1038/s41598-017-18338-2
   (Impact factor – 4.379)
6. Manoj Balachandran, **Ashlin M Raj,** (2017) Extraction and Characterization of Preformed Mixed phase Graphene Sheets from Graphitized Sub-Bituminous Coal. *Asian Journal of Chemistry* 29 (11), 2425-2428. https://doi.org/10.14233/ajchem.2017.20722 (SJR – 0.15)