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Notice for the PhD Viva-Voce Examination

Ms Jissa Theresa Kurian (Registration Number: 1981603), PhD Scholar at the School of Sciences, CHRIST (Deemed to be University), Bangalore Central Campus will defend her PhD thesis at the public viva-voce examination on Saturday, 12 April 2025 at 9.30 am in Room No. 044, Ground Floor, R & D Block, CHRIST (Deemed to be University), Bengaluru - 560029, Karnataka, India.

Title of the Thesis	:	**Green Synthesis of *Garcinia* Species Mediated Nanoparticles, Characterization and Evaluation of their Photocatalytic Dye Degradation Activity**
Discipline	:	**Biotechnology**
External Examiner - I	:	**Dr Rachayya M Devarumath** Scientist Molecular Biology and Genetic Engineering Lab Vasantdada Sugar Institute, Manjari (Bk), Tal Haveli Dist, Pune - 412307 Maharashtra
External Examiner - II	:	**Dr H R Raveesha** Professor Department of Botany Jnanabharathi Campus Bangalore University Bengaluru, Karnataka - 560056
Supervisor	:	**Dr Joseph K S** Assistant Professor Department of Life Sciences School of Sciences CHRIST (Deemed to be University) Bengaluru, Karnataka-560029

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: 02 April 2025

ABSTRACT

Ecosystems are seriously threatened by the dye pollutants released by the textile industry, which contaminates water supplies and has detrimental health effects. This work emphasizes the synthesis, characterization, dye degradation, and toxicity investigation of Ag-ZnO nanocomposites (Ag-Zn NCs: AgZn-GG, AgZn-GI) and ZnO nanoparticles (Zn NPs: Zn-GG, Zn-GI) made from leaf extracts of *Garcinia gummi-gutta* and *Garcinia indica*. The generation of biogenic Zn NPs and AgZn NCs was confirmed by UV-visible spectrum analysis, which also showed distinct surface plasmon resonance (SPR) peaks for Zn-GG NPs at 377 nm, AgZn-GG NCs at 353 nm and 438 nm, Zn-GI NPs at 357 nm, and AgZn-GI NCs at 355 nm and 408 nm. Using Fourier-transform infrared spectroscopy (FTIR), phytochemicals such as alkaloids, flavonoids, and saponins that are involved in the formation of nanoparticles were found. The average crystalline diameters of Zn-GG NPs, Zn-GI NPs, AgZn-GG NCs, and AgZn-GI NCs were found to be 22.27 nm, 2.94 nm, 7.77 nm, and 7.09 nm, respectively, according to X-ray diffraction (XRD) examination. Energy-dispersive X-ray spectroscopy (EDX) and field emission scanning electron microscopy (FESEM) were employed to examine the morphology and elemental constitution of the produced particles. Zn-GG NPs' SEM micrographs showed hexagonal particles with an average size of 72.78 nm, whereas AgZn-GG NCs showed a mixture of spherical and hexagonal particles with an average size of 33.07 nm. AgZn-GI NCs displayed spherical particles with an average size of 26.33 nm, while Zn-GI NPs displayed hexagonal and spherical particles with a size of 65.29 nm.

Transmission electron microscopy (TEM) validated the NPs' size and morphological characteristics, similar to FESEM. SAED patterns matched the XRD planes under study and validated the synthesis of Zn NPs and Ag-Zn NCs, demonstrating the NPs' polycrystalline nature. Using Zn NPs and AgZn NCs, the photocatalytic degradation of textile dyes has been investigated. With NP concentrations of 1 mg/ml, the produced Zn NPs and AgZn NCs from *Garcinia* extracts showed efficient catalytic degradation at dye concentrations of 1 ppm, 5 ppm, and 10 ppm (Reactive yellow-86, Reactive blue-220, Reactive blue-222, and Reactive red-120). The degrading reaction's pseudo-first-order kinetics were discovered by a chemical kinetics study. Tests of *Vigna radiata* growth inhibition showed notable decreases in seedling growth inhibition and confirmed the NPs' degradation effectiveness. Aquatic life was not at risk from the produced NPs or the byproducts of their degradation, according to the *Artemia salina* lethality assay. The fabrication, characterization, and use of Zn NPs and AgZn NCs derived from plant extracts are clarified by this comprehensive study. These NPs show incredible potential for the synthesis of sustainable nanoparticles and for the mitigation of textile dye-induced water pollution.

Keywords: *Green synthesis, Nanoparticles, Nanocomposites, Garcinia gummi-gutta, Garcinia indica, Characterization, Photocatalytic activity, Chemical kinetics, Toxicity assay.*

Publications:

1. **Jissa Theresa Kurian**, & Joseph K S (2024). Biogenic ZnO Nanoparticles Derived from *Garcinia gummi-gutta* Leaves: Synthesis, Characterization and its Multifaceted Applications. *Asian Journal of Chemistry*, *36*(3), 603–612. https://doi.org/10.14233/ajchem.2024.31059
2. **Jissa Theresa Kurian**, & Joseph K S (2024). *Garcinia indica* Leaf Extract Derived Ag-Zn Nanocomposites: A Sustainable Approach for Textile Dyes Photodegradation. *Asian Journal of Chemistry*, *36*(7), 1483–1488. https://doi.org/10.14233/ajchem.2024.31450
3. **Jissa Theresa Kurian**, & Joseph K S (2024). Synthesis of Nanoflowers using *Garcinia gummi-gutta* Leaf Extract via Green Route for Enhanced Antifungal and Anti-cancerous Activities: Silver Nanoflowers with Biological Applications. *Journal of Tropical Life Science*, *14*(2), 253-262.
4. **Jissa Theresa Kurian**, Joseph K S, Balasubramanian, B., Meyyazhagan, A., Pappuswamy, M., Alanazi, A. M., Rengasamy, K. R., ... & Chen, J. T. (2023). One-Pot Synthesis of Silver Nanoparticles from *Garcinia gummi-gutta*: Characterisation, Antimicrobial, Antioxidant, Anti-Cancerous and Photocatalytic Applications. *Frontiers in Bioscience-Landmark*, *28*(8), 169