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Notice for the PhD Viva Voce Examination

Ms Shilpa Susan Scaria (Registration Number: 2170252), 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 Friday, 8 November 2024 at 11.30 am in Room No. 044, Ground Floor, R & D Block, CHRIST (Deemed to be University), Bengaluru - 560029.

Title of the Thesis	:	**Photocatalytic Degradation of Textile Dyes Using *Quassia indica* (Gaertn.) Noot. Mediated Nanoparticles**
Discipline	:	**Botany**
External Examiner - I	:	**Dr Dennis Thomas T** Professor Department of Plant Science Central University of Kerala Tejaswini Hills, Periye Post Kasaragod District Kerala - 671316
External Examiner - II	:	**Dr S Anitha** Professor Department of Biotechnology Sri Krishnadevaraya University Anantapur Andhra Pradesh - 515003
Supervisor	:	**Dr Joseph K S** Assistant Professor Department of Life Sciences 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: 30 October 2024

Registrar

ABSTRACT

Prognostic research points at the necessity and relevance of revamping polluted environments. The toxic effect of textile dyes released into waterbodies can be reduced by the degradation process and alternate methods in nanotechnology are used to lessen the gravity of the situation. Compared with chemical and physical nanoparticle synthesis, plant extract-based nanoparticle synthesis is an environmentally friendly alternative method. UV-visible spectrum analysis validated the production of nanoparticles (NPs), revealing unique peaks at 430 nm for *Quassia indica* (QI)- mediated Silver nanoparticles (QI-Ag NPs), 368 nm for QI-mediated Cobalt oxide nanoparticles (QI-Co_3O_4 NPs), 348 nm for QI-mediated Zinc oxide nanoparticles (QI-ZnO NPs, 350 nm and 408 nm for QI-mediated Silver/Zinc oxide nanoparticles (QI-Ag/ZnO NPs), 415 nm and 675 nm for QI-mediated Cobalt oxide/Zinc oxide nanoparticles (QI-Co_3O_4/ZnO NPs). Fourier Transform Infrared Spectroscopy (FTIR) investigation identified phytochemicals involved in nanoparticle synthesis. The X-Ray Diffraction (XRD) examination unveiled the crystalline structures of QI-mediated NPs. Dynamic Light Scattering (DLS) study revealed information on the hydrodynamic diameter and colloidal stability of the NPs, which showed average particle size. Field Emission Scanning Electron Microscopy (FE-SEM) and Energy-Dispersive X-Ray Spectroscopy (EDX) were used to investigate the morphology and elemental composition of NPs.

The morphological shapes of QI-Ag NPs were spherical, QI-ZnO NPs showed hexagonal, QI-Co_3O_4 NPs displayed octahedral, QI-Ag/ZnO NPs exhibited spherical structure, and QI-Co_3O_4/ZnO NPs unveiled a mixture of octahedral and hexagonal shaped NPs. The High-resolution Transmission Electron Microscopy (HR-TEM) validated the NPs size and Selected Area Electron Diffraction (SAED) confirmed the crystalline characteristics. The NPs displayed excellent catalytic degradation at dye (Reactive Blue-220, Reactive Blue-222, Reactive Red-120, Reactive Yellow-86, and Reactive Yellow-145) concentrations of 1 ppm, 5 ppm, and 10 ppm with NP concentration of 1 mg/mL efficiently under UV light exposure. The recovered QI-NPs after degradation processes are stable and reusable. Chemical kinetics research revealed that the degrading processes had pseudo-first-order kinetics. Phytotoxicity tests conveyed that QI-NPs were beneficial in lowering seed germination inhibition and toxicity in *Vigna radiata*. *Artemia salina* exposed to treated dye solutions using NPs showed less toxicity when compared with untreated dye solutions. Limited studies in the area of plant extract-based nanoparticle synthesis marks the novelty of this attempt and this trailblazing and pioneering approach using non-toxic QI-NPs synthesized through green synthesis is futuristic and sustainable helping in effective wastewater treatment.

Keywords: Quassia indica, green synthesis, nanoparticles, textile dyes, photocatalytic degradation

Publications:

1. **Scaria, Shilpa Susan**, and Kadanthottu Sebastian Joseph. "Novel biocompatible zinc oxide nanoparticle synthesis using *Quassia indica* leaf extract and evaluation of its photocatalytic, antimicrobial, and cytotoxic potentials." Biomass Conversion and Biorefinery (2023): 1-20. https://doi.org/10.1007/s13399-023-04989-x
2. **Scaria, Shilpa Susan**, and Kadanthottu Sebastian Joseph. "Exploring the photocatalytic and cytotoxic potential of *Quassia indica*-derived bimetallic silver-zinc oxide nanocomposites". Waste and Biomass Valorization (2024): 1-15. https://doi.org/10.1007/s12649-024-02600-6
3. **Scaria, Shilpa Susan**, and Kadanthottu Sebastian Joseph. "Eco-conscious silver nanoparticles via *Quassia indica*: Characterization and multifaceted applications." Nano LIFE (2024): 2440001. https://doi.org/10.1142/S1793984424400014