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Notice for the PhD Viva Voce Examination

Ms Jaya Gangwar (Registration Number: 2090178), 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, 14 August 2024 at 11.00 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 Strobilanthes Species Mediated Nanoparticles**
Discipline	:	**Biotechnology**
External Examiner (Outside Karnataka)	:	**Dr Naresh Kumar Sharma** Associate Professor Department of Biotechnology Kalasalingam Academy of Research and Education Krishnankoil Tamil Nadu - 626126
External Examiner (Within Karnataka)	:	**Dr Shivasharana C T** Associate Professor Department of Biotechnology Karnatak University Dharwad Karnataka - 580003
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.

Registrar

Place: Bengaluru
Date: 31 July 2024

ABSTRACT

Discharge of dye pollutants from textile industries jeopardizes ecosystem by leading to grave threats like contamination of water resources and hazardous health effects. The current study points and focuses at the synthesis, characterization, dye degradation and toxicity analysis of zinc oxide nanoparticles (ZnO NPs) and silver nanoparticles (Ag NPs) derived from *Strobilanthes barbatus* and *Strobilanthes hamiltoniana* leaf extracts. UV-visible spectrum analysis validated the biogenesis of ZnO and Ag NPs, revealing unique peaks at 359 for ZnOSB NPs, 360 nm for ZnOSH NPs, 428 nm for AgSB NPs, and 432 nm for AgSH NPs. Fourier transform infrared spectroscopy (FTIR) investigation identified phytochemicals involved in nanoparticle synthesis, manifesting the presence of flavonoids, saponins and alkaloids. The X-ray diffraction (XRD) examination disclosed the crystalline structures of ZnOSB NPs, ZnOSH NPs, AgSB NPs and AgSH NPs displayed an average crystalline size of 22.29 nm, 26.9 nm, 23.5 nm and 20.6 nm. Dynamic Light Scattering (DLS) study revealed information on the hydrodynamic diameter and colloidal stability of the NPs, which showed average particle size for ZnOSB NPs, ZnOSH NPs, AgSB NPs and AgSH NPs as 91.6 nm, 165.4 nm, 142.3 nm and 255.3 nm. Field Emission Scanning Electron Microscopy (FESEM) and Energy-dispersive X-ray spectroscopy (EDS) were used to investigate the morphology and elemental composition of ZnO NPs and Ag NPs, revealing particle shape and size variations. The morphological shapes of ZnOSB NPs were spherically shaped NPs, ZnOSH NPs showed rod-shaped NPs, AgSB NPs and AgSH NPs both showed spherical-shaped NPs. The High-resolution Transmission Electron Microscopy (HRTEM) validated the nanoparticles' size and crystalline characteristics, similar to FESEM.

The photocatalytic degradation of textile dyes using ZnO NPs and Ag NPs were researched, and the results revealed that diverse dyes degraded efficiently under UV light exposure. The ZnO NPs and Ag NPs showed excellent catalytic degradation at dye (Reactive Blue 220, Reactive Blue 222A, Reactive Yellow 145, and Reactive Yellow 86) concentrations of 1 ppm, 5 ppm, and 10 ppm with NP concentrations of 1 mg/ml. Chemical kinetics research unveiled that the degrading processes had pseudo-first-order kinetics. Phytotoxicity tests conveyed that ZnO and Ag NPs were beneficial in lowering seed germination inhibition and toxicity in *Vigna radiata*. The brine shrimp lethality experiment indicated that the synthesized nanoparticles were not hazardous. This comprehensive work gives insight and sheds light on the synthesis, characterization, and use of ZnO and Ag NPs utilizing plant extracts, highlighting their promise for environmental remediation and sustainable nanoparticle synthesis.

Keywords: green synthesis, photocatalytic degradation, phytotoxicity, reactive dyes, UV radiation, silver nanoparticles, zinc oxide nanoparticles

Publications:

1. **Gangwar, Jaya**, and Joseph Kadanthottu Sebastian. "Eco-conscious photocatalytic degradation of organic textile dyes using green synthesized silver nanoparticles: A Safe and Green Approach Toward Sustainability." Biomass Conversion and Biorefinery (2024). DOI: https://doi.org/10.1007/s13399-024-05348-0
2. **Gangwar, Jaya**, and Joseph Kadanthottu Sebastian."Photocatalytic degradation of toxic textile dyes by Bio-inspired Silver Nanocatalysts."Asian Journal of Chemistry (2024). DOI: https://doi.org/10.14233/ajchem.2024.31064
3. **Gangwar, Jaya**, Akshay Pratap Singh, Nidhin Marimuthu, and Joseph Kadanthottu Sebastian. "Environmentally sustainable zinc oxide nanoparticles for improved hazardous textile dye removal from water bodies." AQUA-Water Infrastructure, Ecosystems and Society (2023). DOI: https://doi.org/10.2166/aqua.2023.023
4. **Gangwar, Jaya**, Balamuralikrishnan Balasubramanian, Akshay Pratap Singh, Arun Meyyazhagan, Manikantan Pappuswamy, Amer M. Alanazi, Kannan RR Rengasamy, and Joseph Kadanthottu Sebastian "Biosynthesis of zinc oxide nanoparticles mediated by *Strobilanthes hamiltoniana*: Characterizations, and its biological applications." Kuwait Journal of Science (2023). DOI: https://doi.org/10.1016/j.kjs.2023.07.008