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Notice for the PhD Viva Voce Examination

Ms Vinanthi Rajalakshmi K S, Registration Number: 2090240, PhD Scholar at the Department of Life Sciences, School of Sciences, CHRIST (Deemed to be University) will defend her PhD thesis at the public viva-voce examination on Friday, 12 December 2025 at 12.00 pm in Room No. 628, 6th Floor, R&D Block, CHRIST (Deemed to be University), Bengaluru - 560029, Karnataka, India.

Title of the Thesis : **Development and Characterization of Modified Bio-Adsorbents and their Applications in Removal of Toxic Metals from the Aquatic Ecosystems**

Discipline : **Zoology**

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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: 04 December 2025

ABSTRACT

A major global environmental concern is the discharge of toxic pollutants into water bodies, primarily due to the disposal of hazardous wastes from automobile engines, industrial activities, and domestic sources. Consequently, innovative technological interventions such as bioremediation and phytoremediation have gained significant attention for mitigating the harmful effects of these pollutants. The present study aims to develop an effective strategy for treating metal pollutants from industrial and urban wastewater using Azolla pinnata. To enhance metal adsorption, the biomass underwent cell surface modifications through physical treatments—such as heating in a muffle furnace, gamma irradiation, and ultrasonication—as well as chemical treatments including sulphuric acid, sodium hydroxide, sodium chloride, ethanol, and hydrogen peroxide. Batch experiments were conducted to optimize parameters such as biosorbent dosage, contact time, initial metal ion concentration, temperature, and solution pH. The point of zero charge (pHpzc) of the adsorbent was determined to be 5.85. Characterization techniques such as SEM, FTIR, and XRD confirmed changes in surface morphology, elemental composition, and crystallinity, validating the enhanced adsorptive properties of both modified and unmodified biomass. Increased intensity of functional groups corresponding to O–H, C–H, C–N, N–H, and C=O stretching bands was observed in treated samples, indicating successful functionalization. Out the five chemical treatments, ethanol modification achieved the highest cadmium (Cd2+) adsorption efficiency at 94.36%. Physical treatments also demonstrated high adsorption capacities, with ultrasonicated and muffle furnace-treated biomass achieving 83.28±2.62% and 96.92±0.55% removal efficiency at a dosage of 0.25 g. Notably, 100% removal of Cd2+ was achieved using 1.0 g of physically treated sorbent within 15 minutes, attributed to the introduction of new binding sites. These findings confirm that surface modifications enhance cadmium adsorption by improving structural porosity and introducing additional functional groups. The desorption efficiency of Cd2+ ions from various biomass types over three consecutive adsorption-desorption cycles using 0.5N HCl and 0.5N NaOH as eluents was evaluated. HCl treatment was consistently more effective than NaOH, achieving high desorption percentages (>88%) even after three cycles. Among all, raw biomass with HCl showed the highest initial desorption upto 94.69±0.62%. Chemical modified biomass maintained relatively better performance with NaOH across cycles compared to other modified types.

Keywords: *Phytoremediation, Azolla pinnata, cadmium chelation, surface properties, chemical and physical modifications.*

Publications:

1. **Vinanthi Rajalakshmi, K. S.,** & Paari, K. A. (2023). A comprehensive study on the assessment of chemically modified Azolla pinnata as a potential cadmium sequestering agent. Int. J. Exp. Res. Rev, 36, 01-19.
2. **Vinanthi Rajalakshmi, K. S.**, & Paari, K. A. (2024). Synergistic Effect of Chemical and Physical Treatments on Azolla pinnata for Cadmium Ions Removal from Synthetic Wastewater Systems. Current Trends in Biotechnology & Pharmacy, 18(3).