

**CHRIST**(DEEMED TO BE UNIVERSITY)
BANGALORE | DELHI NCR | PUNE

Notice for the PhD Viva Voce Examination

Ms Avani A V, Registration Number: 2170200, PhD Scholar at the Department of Physics and Electronics, School of Sciences, CHRIST (Deemed to be University) will defend her PhD thesis at the public viva-voce examination on Friday, 27 March 2026 at 2.00 pm in Room No. 044, Ground Floor, R&D Block, CHRIST (Deemed to be University), Bengaluru - 560029, Karnataka, India.

Title of the Thesis	:	Synthesis and Characterization of MoO₃ Based Materials for Catalytic and Luminescence Applications
Discipline	:	Physics
External Examiner - I	:	Dr P P Pradyumnan Senior Professor Department of Physics University of Calicut Thenhipalam - 673635 Kerala
External Examiner - II	:	Dr Paulraj R Professor School of Environmental Sciences Jawaharlal Nehru University New Delhi -110067
Supervisor	:	Dr Anila E I Professor Department of Physics and Electronics 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: 17 March 2026

Registrar (Academics)

ABSTRACT

Synthetic dyes, widely used in industries, pose serious environmental hazards due to their toxic, non-biodegradable nature, leading to water pollution and harmful effects on human and aquatic life. Metal oxides are preferred over other catalysts for dye degradation due to their strong oxidation ability, chemical stability, tunable bandgap, and cost-effectiveness. Among metal oxides, MoO₃ is an ideal catalyst for the enhanced degradation of environmental organic pollutants due to its nontoxicity, layered structure, abundance in source, eco-friendliness, low cost, chemically stable nature, and recyclability. A detailed analysis of the structural, morphological, and optical properties of MoO₃ nanorods synthesized via the hydrothermal method with varying synthesis temperatures displays the formation of blue and purple-blue light-emitting phosphors. The present work mainly deals with treating methyl red and methylene blue dye for sustainable environmental remediation. We present a direct, efficient method for methyl red degradation using MoO₃ nanocatalysts, requiring no external agents. Rapid degradation occurs across diverse temperatures as low as 4 °C, making it adaptable to various climates, with no prior reports on such a simple mechanism. The catalyst's easy and cost-effective synthesis, along with its simple and efficient degradation mechanism, suggests its potential for commercialization. The adsorptive removal of methylene blue dye was carried out using MoO₃ and rGO-MoO₃ nanocomposites, with the rGO (0.5 wt.%)–MoO₃ nanocomposite showing the best performance. The synthesized rGO-MoO₃ nanocomposites demonstrate significant potential for dye adsorption, making them promising candidates as next-generation adsorbent materials for sustainable water purification. Being a wide band gap oxide semiconductor, lanthanide ions doped MoO₃ can act as an excellent phosphor for luminescence applications. The luminescence properties of MoO₃-based phosphors were investigated using three different lanthanide dopants - Ce, Tb, and Eu, and the luminescence quenching mechanism was also studied. MoO₃:Ce³⁺ phosphors exhibited an overall purple-blue emission, while MoO₃:Tb³⁺ samples showed a blue-green emission in the unannealed state, which transformed into a greenish- white emission upon annealing. Similarly, MoO₃:Eu³⁺ nanophosphors displayed a red emission, with the annealed samples exhibiting a pinkish-red color.

Keywords: *Molybdenum trioxide; Methylene blue; Methyl red; Adsorption; Light-free approach; Phosphor; Quenching*

Publications:

1. Avani, A. V., Chrisma, R. B., & Anila, E. I. (2023). Low temperature synthesis of MoO₃ nanoparticles by hydrothermal method: Investigation on their structural and optical properties. *Materials Today: Proceedings*.
2. Avani, A. V., Chrisma, R. B., & Anila, E. I. (2023). Influence of synthesis temperature on the structural, morphological and optical properties of MoO₃ nanorods. *Journal of Fluorescence*.
3. Avani, A. V., Babu, C. R., Shaji, S., & Anila, E. I. (2023). Purple blue emission in MoO₃: Ce³⁺ nanorods: Investigation on the structural and photoluminescence properties. *Solid State Sciences*.
4. Avani, A. V., Babu, C. R., & Anila, E. I. (2024). rGO–MoO₃ nanocomposite for superior methylene blue removal by adsorption and photocatalysis. *Materials Research Bulletin*.
5. Avani, A. V., Babu, C. R., & Anila, E. I. (2025). Red emission in MoO₃: Eu³⁺ nanobelts: Investigation on the photoluminescence quenching mechanism. *Chemical Physics Impact*.
6. Avani, A. V., Babu, C. R., & Anila, E. I. (2025). Effect of doping concentration on the luminescence properties of MoO₃: Tb³⁺ nanobelts. *Luminescence*.
7. Avani, A. V., & Anila, E. I. (2022). Recent advances of MoO₃ based materials in energy catalysis: Applications in hydrogen evolution and oxygen evolution reactions. *International Journal of Hydrogen Energy*.
8. Avani, A. V., Li, Z., Babu, C. R., Soldatov, A. V., Hossain, A., & Anila, E. I. (2025). Lattice distortion suppressed in MoO₃ by incorporating minor impurities of rGO: Strategy for enhanced electrocatalytic hydrogen evolution.
9. Avani, A. V., & Anila, E. I. (2024). MoO₃ nanorods – AMoREDCAT: A nanocatalyst facilitating the unprecedented degradation of methyl red dye with outstanding efficacy (Indian Patent Application No. 202341082817 A, published February 16, 2024).