

Abstract No: 200

Physical Sciences

SYNTHESIS OF CERIUM OXIDE NANOPARTICLES BY HYDROTHERMAL METHOD AND INVESTIGATION OF THEIR ANTIBACTERIAL ACTIVITIES

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Metal oxide nanoparticles have been suggested as promising candidates for the development of antibacterial agents. Among metal oxides, cerium oxide (CeO₂) nanoparticles have been utilised in different applications due to their physical, chemical and redox properties. Cerium nitrate hexahydrate and sodium hydroxide were used as a precursor and reducing agent for the synthesis of CeO₂ using the hydrothermal method. The synthesised samples were characterised using various techniques to understand their structural, optical and antibacterial properties. From XRD analysis, the average crystallite size ~ 25 nm was determined from the Debye-Scherrer relation. Raman peak was observed (F_{2g}) at 464 cm⁻¹, attributed to the symmetric stretch of the Ce–O vibration. The optical energy band gap of the CeO₂ nanoparticles was estimated to be ~ 3.3 eV by the UV- V reflectance spectrum. The FTIR spectrum of the prepared CeO₂ nanoparticles identified the chemical bonds as well as functional groups in the sample. Also, the signature bands due to the stretching frequency of Ce–O can be seen in between 400 to 500 cm⁻¹, indicating the formation of CeO₂ nanoparticles. The antibacterial activity was studied by disc diffusion assay against common pathogens (*Escherichia coli* and *Staphylococcus aureus*), and a strong antibacterial effect against Gram-positive pathogen *S. aureus* was observed.

Keywords: Antibacterial activity, Cerium Oxide Nanoparticles, Hydrothermal method, Optical properties, Zone of inhibition