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Photocatalytic Performance of Lemon-Capped ZnO Nanoparticles Synthesized via the Ceramic Method

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Abstract: *Zinc oxide (ZnO) nanoparticles are extensively explored as photocatalysts due to their high chemical stability, non-toxicity, and strong oxidative potential. Nevertheless, their practical application is often limited by rapid electron–hole recombination and particle agglomeration. In this work, lemon extract was employed as a natural capping and surface-modifying agent to enhance the photocatalytic performance of ZnO nanoparticles synthesized through a conventional ceramic method. The use of lemon extract introduces bioactive phytochemicals such as citric acid, flavonoids, and ascorbic acid, which regulate crystal growth and improve surface functionality. Structural, morphological, optical, and photocatalytic properties of lemon-capped ZnO nanoparticles were systematically investigated and compared with uncapped ZnO. X-ray diffraction confirmed the formation of phase-pure hexagonal wurtzite ZnO with a notable reduction in crystallite size due to lemon capping. The findings establish lemon capping as an effective, eco-friendly strategy for improving the photocatalytic efficiency of ZnO nanoparticles synthesized via a scalable ceramic route*

Keywords: Zinc oxide