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Green Approach to Spinel Ferrite Nanocrystals: Synthesis, Characterization and Photocatalysis

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Abstract: The development of spinel ferrite nanocrystals using eco-friendly methods has gained significant attention due to their sustainability and potential applications in photocatalysis. This study presents a green synthesis approach for spinel ferrite (MFe_2O_4 , where M = Zn, Ni, or Co) nanocrystals using plant extracts as reducing and stabilizing agents. The synthesized nanocrystals were characterized using X-ray diffraction (XRD), Fourier- transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), transmission electron microscopy (TEM), UV-Vis spectroscopy, and photoluminescence (PL) analysis. The results confirmed the formation of highly crystalline spinel structureswith controlled morphology and enhanced optical properties. The photocatalytic activity was evaluated by the degradation of organic pollutants under visible light irradiation, demonstrating superior efficiency due to the optimized band gap and improved charge separation. This green synthesis approach offers an environmentally benign and cost- effective method for fabricating functional nanomaterials for sustainable photocatalytic applications.

Keywords: Spinel Ferrite, Green Synthesis, Photocatalysis, XRD, SEM, Optical Band Gap, Nanocrystals



