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Controllable fabrication and characterization of green synthesized ZnO nanoparticles

Fayezeh Samari *[,1,2], **Saeedeh Majnoonpour** [1]

1. Department of Chemistry, Faculty of Sciences, University of Hormozgan, Bandar Abbas, Iran, fsamari@hormozgan.ac.ir
2. Nanoscience, Nanotechnology and Advanced Materials Research Center, University of Hormozgan, Bandar Abbas, Iran

Abstract

Zinc oxide nanoparticles (ZnO NPs) are regarded as highly attractive multifunctional nano-semiconductors owing to their exceptional photostability, wide bandgap, non-toxic nature, thermal stability, cost-effectiveness, corrosion resistance, biocompatibility, wide absorption spectrum, and notable antioxidant, antimicrobial, antibacterial, and anticancer properties [1]. Also, the Food and Drug Administration has recognized it as a safe substance for human use [2]. With these regards, the green synthesis of ZnO NPs using plant extracts has driven tremendous interest in recent years [3]. This research aimed to facilitate the phyto-fabrication of ZnO NPs using the aqueous leaf extract of *Manilkara zapota* (*M. zapota*, commonly known as Chikoo) as a renewable and non-toxic reducing agent and effective capping agent in the synthesis process. The study investigated the effects of varying leaf extract quantities and calcination temperatures to determine the optimal conditions for synthesis. The physicochemical characteristics of the synthesized ZnO NPs were evaluated using ultraviolet-visible spectroscopy (UV-Vis), X-ray diffraction (XRD), field emission scanning electron microscopy (FE-SEM), and energy-dispersive X-ray spectroscopy (EDS). The ZnO NPs derived from the leaf extract of *M. zapota* displayed a broad absorption band in the range of 356–369 nm, indicative of the intrinsic band-gap absorption of ZnO, thereby confirming the formation of ZnO NPs. FE-SEM imaging revealed that the majority of the nanoparticles are spherical, with diameters ranging from 35 to 75 nm. EDX analysis validated the presence of zinc and oxygen, confirming the successful production of ZnO NPs. Finally, the XRD pattern corroborated their crystalline nature with a hexagonal wurtzite structure.

Key words: Green synthesis, ZnO nanoparticles, *Manilkara zapota* leaf extract, Characterization.

References

[1] Zeghoud S, Hemmami H, Seghir BB, Amor IB, Kouadri I, Rebiai A, Messaoudi M, Ahmed S, Pohl P, Simal-Gandara J. A review on biogenic green synthesis of ZnO nanoparticles by plant biomass and their applications. Materials Today Communications; 33: 104747, 2022.

[2] Fujihara J, Nishimoto N. Review of zinc oxide nanoparticles: Toxicokinetics, tissue distribution for various exposure routes, toxicological effects, toxicity mechanism in mammals, and an approach for toxicity reduction. Biological Trace Element Research; 202: 9– 23, 2024.

[3] Hay-Allah MAA, Alshamsi HA. Green synthesis of ZnO NPs using Pontederia crassipes leaf extract: characterization, their adsorption behavior and anti-cancer property. Biomass Conversion and Biorefinery; 14: 10487–10500, 2024.