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Phyto-Assisted Synthesis of Magnesium Oxide Nanoparticles: Characterization and Applications

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Abstract : Magnesium oxide nanoparticles (MgO NPs) are less toxic to humans and the environment as compared to other metal oxide nanoparticles. Various conventional chemical and physical methods are used for synthesis whose toxicity level is high and highly expensive. As the best alternative, phyto-assisted synthesis has emerged, which uses extracts from plant parts for the synthesis of nanoparticles. Here, we report the synthesis of MgO nanoparticles with the assistance of beetroot extract and leaf extract of P. guajava and A. adenophora. The synthesized MgO NPs were characterized by X-ray diffraction (XRD), Fourier transforms infrared spectroscopy (FTIR), and UV-visible spectroscopy. X-ray analysis for the broadening of peaks was used to evaluate the crystallite size and lattice strain using Debye-Scherer and Williamson–Hall method. The results of crystallite size obtained by both methods are in close proximity. The crystallite size obtained by the Williamson-Hall method seems more accurate, with values being 8.1 nm and 13.2 nm for beetroot MgO NPs and P. guajava MgO NPs, respectively. The FT-IR spectroscopy revealed the dominance of chemical bonds as well as functional groups on MgO NPs surfaces. The UV-visible absorption spectra of MgO NPs were found to be 310 nm, 315 nm, and 315 nm for beetroot, P. guajava, and A. adenophora leaf extract, respectively. Among the three samples, beetroot-mediated MgO NPs were effective antibacterial against both gram-positive and Gram-negative bacteria. In addition, synthesized MgO NPs also show significant antioxidant efficacy against 1,1-diphenyl-2-picrylhydrazyl radical. Further, beetroot MgO NPs showed the highest photocatalytic activity of about 91% in comparison with other samples.

Keywords : MgO NPs, XRD, FTIR, antibacterial, antioxidant and photocatalytic activity
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