Synthesis, characterization and biological activities of zinc oxide nanoparticles derived from secondary metabolites of lentinula edodes

ABSTRACT

Zinc oxide nanoparticles (ZnO NPs) are the second most prevalent metal oxide, owing to their characteristics of low cost, safe, and easily prepared. ZnO NPs have been found to exhibit unique properties which show their potential to be used in various therapies. Numerous techniques have been devised for the manufacture of zinc oxide because it is one of the nanomaterials that has received major research interest. Mushroom sources are proven to be efficient, ecologically friendly, inexpensive, and safe for humankind. In the current study, an aqueous fraction of methanolic extract of Lentinula edodes (L. edoes) was used to synthesize ZnO NPs. The biosynthesis of ZnO NPs was achieved by using the reducing and capping capability of an L. edodes aqueous fraction. Bioactive compounds from mushroom, such as flavonoids and polyphenolic compounds, are used in the green synthesis process to biologically reduce metal ions or metal oxides to metal NPs. Biogenically synthesized ZnO NPs were further characterized by using UV–Vis, FTIR, HPLC, XRD, SEM, EDX, zeta sizer and zeta potential analyses. The FTIR showed the functional group at the spectra in the range 3550–3200 cm^{-1} indicated the presence of the hydroxyl (OH) group, while bands in the range 1720–1706 cm^{-1} indicated C=O carboxylic stretches bonds. Furthermore, the XRD pattern of ZnO NPs created in the current study was found to be nanocrystals which are hexagonal. The SEM analysis of ZnO NPs showed spherical shapes and size distributions in the range 90–148 nm. Biologically synthesized ZnO NPs have substantial biological activities including antioxidant, antimicrobial, antipyretic, antidiabetic and anti-inflammatory potential. Biological activities showed significant antioxidant (65.7 ± 1.09), antidiabetic (85.18 ± 0.48), and anti-inflammatory potential (86.45 ± 0.60) at 300 µg inhibition in paw inflammation of (1.1 ± 0.06) and yeast-induced pyrexia (97.4 ± 0.51) at 10 mg in a dose-dependent manner. The outcomes of this research indicated that ZnO NPs significantly reduced inflammation and have the ability to scavenge free radicals and prevent protein denaturation, while also indicating their possible use in food and nutraceutical applications to treat various ailments.