Research article No. (3) (Published in international journal).

Article title	Green Approach for the Synthesis of ZnO Nanoparticles using *Cymbopogon citratus* aqueous leaf extract: Characterization and Evaluation of their Biological Activities.
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Journal name	Chemical and Biological Technologies in Agriculture, (2023), 10(63).
Impact Factor	6.6

Abstract

Background: The green synthesis of metal and metal oxide nanoparticles (NPs), notably from plants, has attracted increasing attention in recent years. Although the increased popularity use of *Cymbopogon citratus* as a therapeutic substance, to date, there hasn't been any research on the chemistry of *C. citratus* aqueous leaf extract (ALE) or synthesis of ZnO NPs utilizing an extract from it. The ecologically safe ALE of *C. citratus* was employed in this study as a bio-reducing and capping agent to synthesize ZnO NPs.

Results: The novelty of the current study is the investigation of the antioxidant, anti-inflammatory, anti-microbial, and cytotoxic potencies of biosynthesized ZnO NPs utilizing *C. citratus* ALE. Zinc acetate dihydrate was used as the precursor and the leaf extract serves as the

reducing agent. ZnO NPs from ALE of *C. citratus* were characterized by the spherical in form by using high-resolution transmission electron microscopy (HR-TEM) and the Scherrer formula was used to calculated the size of the crystalline structure. The presence of numerous functional groups in both the ALE and the NPs is confirmed by FTIR analysis. The highest absorption peak is observed at 370 nm. The stability and particle size of the biosynthesised ZnO NPs are demonstrated by Dynamic Light Scattering (DLS) analysis. The biosynthesised ZnO NPs exhibited excellent antioxidant activity with an IC_{50} value of 45.67±0.1 µg/mL and exerted interesting anti-inflammatory activity (98.1%±0.04) when compared to the standard indomethacin (92.1%±0.07) at 1mg/mL. They also showed anti-microbial activity for both bacterial and fungal which growth rates for both significantly decreased with the increase in ZnO NPs concentration compared to the control. The anticancer activity of biosynthesized ZnO NPs and *C. citratus* ALE was *in vitro* tested against seven human cancer cell lines (HCCL) (i.e., H1299, MDA-MB-468, HNO97, HEK, HCT116, HuH7, and HEPG2) compared to normal cells (HSF) using the sulphorhodamine-B (SRB) assay. More interestingly, the biosynthesized ZnO NPs displayed remarkable selective cytotoxicity against all tested cancer cell lines without any effect on normal cells. In contrast, the cancer cell lines were not affected by the ALE of *C. citratus* at any concentrations tested.

Conclusions: All the findings confirm that the ZnO NPs biosynthesized in the current work are promising candidates for a variety of biological activities, and as a result, they can be helpful to the medical sector, environmental and agricultural applications.

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