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Management of graduate education  
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biotechnology

**Green synthesis of zinc oxide nanoparticles using  
Cymbopogon olivieri extract and its antimicrobial  
effects on some pathogenic bacteria**

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**Abstract:**

Nanoparticles are atomic or molecular assemblies with minimum dimensions between 1-100 nm, which have different physicochemical properties compared to their bulk material. Nowadays, the production of nanoparticles is done by various chemical methods, which have disadvantages such as the lack of stability of the solution, the uneven size of the particles, the impurity of the nanoparticles, low efficiency and the need for advanced equipment for production. For the same reason, researchers have turned to biological systems for the production of nanoparticles, which have minimal environmental risks and simple and biocompatible production methods. In recent years, a large number of living organisms such as bacteria, fungi, algae, plants, plant extracts and their metabolites have been used as mediators for the synthesis of nanoparticles. But the identification of plant systems as potential natural nanofactories has created great interest in the biosynthesis of nanoparticles. In the green synthesis of nanoparticles, natural compounds and biological agents present in plant extracts such as enzymes, carbohydrates and terpenoids replace harmful chemical compounds and solvents that are used in chemical methods, so The synthesis of nanoparticles by using natural resources leads to reduction of synthesis steps and reduction of the use of energy and chemical solvent that destroys the environment, so in this research, the leaf extract of Akhor plant was used. This plant is one of the most important medicinal plants used in Iran and Sistan and Baluchistan to treat many diseases. Therefore, the purpose of this study was the possibility of synthesizing zinc oxide nanoparticles by using azhar leaf extract and investigating the antibacterial properties of the produced zinc oxide nanoparticles. For this purpose, an extract was prepared from the leaves of this plant and nanoparticles were synthesized. Then the produced nanoparticles were characterized (UV-Vis, XRD, TEM and FT-IR) and the sensitivity of bacterial and fungal strains to the synthesized zinc oxide nanoparticles was determined. The biosynthesis of zinc oxide nanoparticles was determined and confirmed by the aqueous extract of Azhar plant by UV-Vis spectroscopy and scanning electron microscopy. The obtained nanoparticles had an average size of 28 nm and an almost spherical shape. In general, our results showed that the aqueous extract of Azhar plant has a good potential for the production of zinc oxide nanoparticles. Both the extract and synthesized nanoparticles have significant biological potential.

**Keywords:** green synthesis, leaf extract, antimicrobial, herbal