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Green synthesis of zinc oxide nanoparticles and their antibacterial activity

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 Nanoparticles (NPs) have unique optical, mechanical, catalytic, as well as biological properties, leading to a wide range of applications. Inorganic zinc oxide (ZnO) NPs are widely employed in electrochemistry, medical devices, cosmetics, the textile industry, and other industries due to their high specific surface area, biocompatibility, optical and antibacterial capabilities. The physical and chemical processes used to synthesise the ZnO NPs have drawbacks such as high energy consumption, low purity, uneven particle size distribution, high cost, significant amounts of secondary waste, and irreversible damage to the environment. As the number of uses for ZnO NPs grows, so does concern over their synthesis. Thus, the need for environmentally friendly methods has grown. Green synthesis refers to the utilisation of microbes, enzymes, and plant extracts in the fabrication process. It involves the use of materials that are not harmful, and the process should be energy efficient. It is an appealing alternative to traditional physical and chemical procedures because of its environmental sustainability, eco-friendliness, and low cost. Plant extracts from plants such as Hibiscus sabdariffa, Myristica fragrans, etc., are readily available, and the synthetic pathway simply requires only the use of zinc salt solution as a metal precursor. The antibacterial activity of ZnO NPs generated from plant extracts is 17–19 times more than that of chemically manufactured ZnO NPs, which have no antibiotic resistance. They are non-toxic and skin-friendly, making them ideal for use as additives in materials intended for human contact. Based on these properties, the green synthesis of ZnO NPs from plant extracts could be employed in textiles to offer antibacterial functionality while remaining environmentally friendly. Bacteria are becoming increasingly resistant to antibiotics, posing a major threat to human life. The use of plant extracts in the green synthesis of ZnO NPs would solve the problem of antibiotic resistance caused by bacterial biofilm development due to their good antibacterial properties and biocompatibility, non-toxic, safe, and high stability. Due to these properties, green ZnO NPs are currently a focus point in the realm of antibacterial agents.

Keywords: Nanoparticle, Antibacterial, Plant extracts, Green synthesis, Zinc oxide

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