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## Green Synthesis of Copper Oxide Nanoparticles from *Catharanthus Roseus* Plant Leaf Extract and Its Investigation

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In recent years, nanotechnology is a burning field for researchers. Studies on the green synthesis of metal oxide nanoparticles (NPs) have been carried out with various plant extracts. Considering the huge possibility of plants as sources, this work expects to apply green preparation for the copper oxide (CuO) NPs as an option in contrast to regular techniques. Plant separates ready to lessen the metal particles in a more limited time, while microorganism-based techniques require a more extended time. The simple accessibility of plants in nature makes them more favored organic assets than microorganisms. CuO NPs were infused by green synthesis procedure from copper sulphate solution through the aqueous extract of *catharanthus roseus*, a relentless ratio of plant extract to metal ion was prepared, then the color change was observed which proved the formation of NPs. This method is fast, straightforward with no unsafe synthetic substances as lessening or balancing out specialists, and prudent to blended CuO NPs. The NPs obtained were analyzed by X-ray diffraction (XRD), UV-DRS spectroscopy method, Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and zeta potential. The prepared NPs were found in crystalline size range of 43.7 nm. The SEM images confirmed and explained that the NPs shape is a spherical shape with an average diameter of 43 nm. FTIR analysis confirmed that Cu-O peaks are obtained. The CuO demonstrates direct bandgap energy of 2.04 eV from UV-DRS spectroscopy. Zeta potentials analyzed explained the narrow size of NPs stability. CuO NPs, due to their unique physical and chemical properties and low-cost preparation, have been of great interest recently. CuO NPs have been applied as dietary added substances, grease supplements, compound sensors, covering materials notwithstanding countless biotechnological and drugs applications. The article explains the comfortable application of *catharanthus roseus* extract as an efficient preparation of CuO NPs through green synthesis technique to obtain crystalline material.

**Keywords:** *Catharanthus roseus*, CuO, Green synthesis, Nanoparticles, Zeta potential.

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### 1. INTRODUCTION

In the latest method, nanotechnology could be an aglow area for the researchers. Green synthesis techniques have different ways in the field of nanoscience. The nanotechnology, which gets rid of manufacture cost and more energy, is being developed within the usual technique of preparing nanoparticles (NPs) [1, 2]. Green synthesis also includes cancellation of complex set of ways, the choice of solvent water, change of toxic reluctant and stabilizing agent with renewable and sustainable materials. The biological synthesis of nanomaterials also uses algae, fungi, yeasts, and bacteria. The implementation of plant extracts for metal hybrid NPs preparation is currently a replacement research focus that has obtained [3]. Material is in the nanoscale range, which has novel characteristics they possess, application of such material is within the chip technology. Materials are reduced to the size also confined by the flexibility to tune the property of nanomaterials for applications in optoelectronics, biomedicine, and so on. The biomolecule in plants has essential oils (terpenes,

eugenol), carbohydrates are found in its active functional groups like aldehyde, amine and carboxyl entities. *Catharanthus roseus* could be habitually used as a medicinal plant. It widely grows up to one meter height in subtropical area, and it is an herb. It retains well-known antifungal, antioxidant, antibiotic, wound healing and antibacterial activities. Herewith, for the first time, we prepared an extract of copper oxide (CuO) NPs from *catharanthus roseus* using the reduction of oxide ions present within the solution of copper sulphate with water [4]. CuO NPs gain considerable attention because of their excellent optical, electrical, physical, and magnetic properties. The prospect of manipulating the band gap of CuO NPs through quantum (bulk) confinement from 1.2 to more than 2 eV acts as a noteworthy optical property. With altered band gap, CuO NPs become a highly attractive and versatile material for more applications [5]. The structural and optical properties of green-synthesized CuO NPs prepared using *Catharanthus roseus* leaf extract were characterized by XRD, UV-DRS, FTIR, SEM, and zeta potential.

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