B. L. D. E. Association's
S. B Arts and K. C. P Science College, Vijayapur
Department of PG Studies in PHYSICS

Project Batches 2023-2024

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3	Anasuya Rajashekar Math	P15KM22S103002	Dr. Girija M. Nimbal	CdSe Thin Films: The study of optical properties and structural characterization
4	Mahammadajakariya Gadyal	P15KM22S103006		
5	Netravati B Goundi	P15KM22S103004	Dr. Girija M. Nimbal	Green synthesis and characteristics of Zinc Oxide nanoparticles using Betel leaf Extract
6	Niharika V Goudar	P15KM22S103005		
7	Swati Mathapati	P15KM22S103007	Dr. Girija M. Nimbal	Green synthesis of Copper nanoparticles using Neem (Azadirachta Indica) leaf Extract
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9	Misba Patil	P15KM22S103009	Smt. Soumya Sajjan	Green synthesis of Silver Oxide nanoparticles from Colocasia leaf extract
10	Pallavi .S Santi	P15KM22S103012		
11	Soundarya Kotabagi	P15KM22S103014		
12	Rohit Khot	P15KM22S103010	Smt. Soumya Sajjan	A study of Silver doped Cobalt Ferrites
13	Surajkumar Patil	P15KM22S103011		
14	Sheshadri R Hiremath	P15KM22S103018		
15	Siddu Aldi	P15KM22S103013	Miss. Umerabanu Shaikh	Green synthesis and characterization of Zinc Oxide nanoparticles synthesized with Psidium Guajava (Guava) leaf extract and Antimicrobial Activity
16	Vinodkumar Hadapad	P15KM22S103016		
17	Basavaraj Revadihal	P15KM22S103015	Miss. Umerabanu Shaikh	Synthesis and Characterization of Magnesium Oxide (MgO) nanoparticles by Electrodeposition method
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DEPARTMENT OF PG STUDIES IN PHYSICS

2023-2024

PROJECT ON

"GREEN SYNTHESIS OF COPPER NANOPARTICLES USING NEEM (*Azadirachta indica*) LEAF EXTRACT"

SUBMITTED BY:

AKSHATA MALAJI **P15KM22S103019**

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UNDER THE GUIDANCE OF

Dr. GIRIJA. M. NIMBAL

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DEPARTMENT OF PG STUDIES IN PHYSICS

CERTIFICATE

This is to certify that the project entitled ***"Green Synthesis of Copper Nanoparticles Using Neem (Azadirachta indica) Leaf Extract"*** *is being submitted by* ***Ms. Akshata Malaji*** *and* ***Ms. Swati Mathapati*** *for partial fulfilment of the award of degree in Master of Science in Physicsby Rani Channamma University, Belagavi for the academic year 2023-24.*

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DECLARATION

We at this moment declare that the project entitled "Green Synthesis of Copper Nanoparticles Using Neem (*Azadirachta indica*) Leaf Extract" submitted to the Rani Channamma University Belagavi, for partial fulfilment of a degree of MASTER OF SCIENCE in PHYSICS and is a record of work done by us under the guidance of Smt. Dr. Girija. M. Nimbal, Department, PG studies in Physics, B. L. D. E. A's S. B. Arts and K. C. P. Science College, Vijayapura, and this Project Work has not performed on the basis for the award of any other degree or Diploma/Associate ship/ Fellowship.

Akshata Malaji _____

Swati Mathapati _____

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We extend our deep appreciation to our respected Principal, **Dr. R. M. Mirdhe**, for fostering a positive academic atmosphere, which made this project possible.

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ABSTRACT

Nanotechnology has emerged as a transformative field, particularly through the innovative use of nanoparticles, which are defined as particles with dimensions less than 100 nanometers. The unique properties of nanoparticles, including enhanced mechanical strength, increased surface area-to-volume ratio, and varied chemical reactivity, differentiate them significantly from bulk materials. This study investigates the green synthesis of copper oxide nanoparticles (CuO) using neem extract as a reducing agent and copper sulfate as the precursor. This eco-friendly approach not only minimizes environmental impact but also enhances the safety and cost-effectiveness of the synthesis process.

Characterization of the synthesized CuO nanoparticles was conducted using various analytical techniques. X-ray diffraction (XRD) confirmed the formation of monoclinic (C2/c) and tetragonal (I41/amd) structures, with crystallite sizes ranging from 0.48 to 1.25 nm. The UV-visible spectrum exhibited a prominent absorption peak at 320 nm, and the optical band gap was calculated to be 2.6222 eV, indicating potential applications in optoelectronics. Fourier-transform infrared (FT-IR) spectroscopy identified key absorption bands at 2927 cm^{-1} (O-H stretching) and 530 cm^{-1} (Cu-O stretching), further supporting the presence of copper oxide and organic functional groups.

Scanning Electron Microscopy (SEM) analysis revealed elemental compositions of 21.9% copper and 46.7% oxygen in Sample 1, and 24.1% copper and 51.7% oxygen in Sample 2, highlighting effective copper oxide formation. The consistent elemental presence across samples underscores the successful synthesis of copper oxide nanoparticles, paving the way for diverse applications in various fields.

Key words: Nanoparticles, Green synthesis, Copper oxide (CuO), Neem extract, Characterization

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CHAPTER I: INTRODUCTION

Nanotechnology has emerged as a transformative field in recent years, driven by the innovative use of nanoparticles—particles with dimensions less than 100 nanometers. This burgeoning interest is due to the unique properties and diverse applications of nanoparticles, which differ significantly from their bulk material counterparts. These properties, such as enhanced mechanical strength, a significantly increased surface area-to-volume ratio, and varied chemical reactivity, stem from their minuscule size and the distinct physical, chemical, and biological behaviors they exhibit [1]. Nanoparticles can be composed of metals, metal oxides, organic compounds, or carbon, and their specific attributes—such as size, shape, and composition—greatly influence their potential applications across numerous fields.

Nanoparticles can be categorized based on their dimensionality: zero-dimensional (0D), one-dimensional (1D), and two-dimensional (2D). Their extremely small scale enables novel applications that leverage their unique properties at this size level. These materials offer a broad spectrum of sizes, shapes, and compositions, which impacts their functionalities and potential uses [2–4]. The synthesis of nanoparticles has evolved with advancements in various methods, including chemical, physical, and green synthesis techniques. Chemical methods often involve expensive and hazardous reagents and complex procedures [2]. For instance, the use of sodium borohydride and additional stabilizers is common, yet these methods can be costly and environmentally harmful. Physical methods, such as aerosol generation, ultraviolet radiation, and thermal decomposition, typically require high temperatures and pressures, which makes them less environmentally friendly and resource-intensive [5,6].

In contrast, green synthesis methods are gaining prominence as a more sustainable alternative. This approach leverages natural, eco-friendly resources, such as plant extracts and biological agents, to reduce metal ions and form nanoparticles [7,8]. Green synthesis is often highlighted for its cost-effectiveness, non-toxic nature, and environmental benefits compared to traditional methods. The use of green materials, such as plant extracts containing proteins and polyphenols, can not only reduce the need for hazardous chemicals but also serve as dispersants and stabilizers [9]. Despite its advantages, green synthesis faces challenges, including longer reaction times, the need for specific raw materials, and achieving uniform particle sizes [10,11].

The classification of nanoparticles includes organic, inorganic, and carbon-based types. Organic nanoparticles (ONPs), such as liposomes and micelles, are composed of organic molecules and are known for their biodegradability and non-toxicity. These features make them particularly useful in drug delivery systems. Inorganic nanoparticles, which lack carbon in their structure, include metal-based and metal oxide-based particles. Metal-based nanoparticles, like those made from gold, silver, and iron, exhibit remarkable properties such as enhanced UV-visible absorption and electrical conductivity. Metal oxide nanoparticles, such as iron oxide (Fe_2O_3), are known for their stability and reactivity due to their ionic bonds [12,13].

The present investigation aims at green synthesis of copper oxide nanoparticles using neem extract as a reducing agent with copper sulphate as the precursor molecule. Further the antimicrobial activity of the synthesised nanoparticles is also tested invtro.

CHAPTER VI: CONCLUSION

The present study highlights the characterization of biosynthesized CuO nanoparticles using XRD, UV-visible spectroscopy, FTIR, and SEM analyses. The XRD pattern revealed distinct diffraction peaks that correspond to both monoclinic and tetragonal structures, confirming the crystalline nature of the nanoparticles. The crystallite size was calculated using the Debye-Scherrer equation, indicating nanoscale dimensions.

UV-visible spectroscopy showed an absorption peak at 320 nm, and the calculated optical band gap was 2.6222 eV, typical of CuO nanoparticles. FTIR analysis identified various functional groups surrounding the nanoparticles, including hydroxyl, carbonyl, and ether groups, providing insight into the surface chemistry and organic interactions. SEM analysis confirmed the elemental composition, with significant amounts of oxygen, copper, iron, and carbon detected.

Overall, these results demonstrate that the biosynthesized CuO nanoparticles possess structural and optical properties suitable for potential applications in fields such as catalysis, biomedical uses, and environmental sensing.

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2.	Title of the Project/Dissertation	Green Synthesis of copper Nanoparticles using Neem leaf Extract
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DEPARTMENT OF PG STUDIES IN PHYSICS

2022-2023

PROJECT ON

"SYNTHESIS AND CHARACTERIZATION OF NICKEL ZINC FERRITE NANOPARTICLES BY SOL-GEL METHOD"

SUBMITTED BY:

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DEPARTMENT OF PG STUDIES IN PHYSICS

CERTIFICATE

This is to certify that the project entitled, **"Synthesis and Characterization of Nickel and Zinc ferrite Nanoparticles by Using sol-gel Method"** is being submitted by **Ms Daneshwari Hawaldaramath, Mr Praveen Adagal, Mr Sagar Panalakar, Ms Sevanti B Patil.** for the partial fulfilment of the award of degree in Master of Science in Physics by Rani Channamma University, Belagavi for the academic year 2022-23.

Guide

Coordinator

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VIJAYAPURA

DECLARATION

We hereby declare that the project entitled "Synthesis and Characterisation of Nickel and Zinc Ferrite Nanoparticles By Using Sol-Gel Method " submitted to the Rani Channamma University Belagavi, for the partial fulfilment of the degree of MASTER OF SCIENCE IN PHYSICS and is a record of work done by us under the guidance of Smt. Soumya Sajjan, Department of PG Studies in Physics, B. L. D. E. A's S. B. Arts and K. C. P. Science College, Vijayapura and this Project Work has not performed on the basis for the award of any other degree or Diploma/Associate Ship/Fellowship.

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