

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Internship Report

**Submitted in partial fulfillment of the requirements for the
award of Master of Science in Chemistry.**

Submitter By:

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Done at,
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DEPARTMENT OF CHEMISTRY

This is to certify that this Internship Report is the Bonafide work of **ROSHINI M Reg No: 42910016** who carried out the internship entitled **“Synthesis of Green Synthesis Nano Material for Environment Application”** (Internship Work at Viyen Biotech - LLP, Coimbatore) under our supervision from **SEPTEMBER TO OCTOBER.**

Head of the Department

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Submitted for Viva-voce Examination held on **06/01/2024.**

Internal Examiner

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INTERNATIONAL RESEARCH CENTRE

PREFACE

In this internship report I will describe my experiences during my internship period. The internship report contains an overview of the internship company and the activities, tasks and projects that I have worked on during my internship. Writing this report, I also will describe and reflect on my learning objects and personal goals that I have set during my internship period. In compiling this report, I have intended to provide a synthesis of theoretical approaches and methods of implementing them in the world of business. I have tried to bridge the gap between theoretical assumptions and practical necessities. During the entire course of our academic study, I remain engaged in theoretical learning where the primary objective is academic success. The report first shall give an overview of the tasks completed during the period of internship with technical details.

My university (Sathyabama Institute of Science and Technology, Chennai) has therefore been seized with the need of developing practical guideline which would help in providing experience to students to meet the future needs of the industry. In this regard I have been given an opportunity to experience 15 days internship at **Viyen Biotech - LLP, Coimbatore**. During this time, I have visited different sections of the company and I have been guided properly and I am very glad to compile what I have learnt in this report.

ACKNOWLEDGEMENT

I profusely thank all those who have contributed to the successful completion of my internship.

I express my heartfelt thanks to **Dr. Ranjithkumar Rajamani (Chief Scientific Officer)** for his guidance and providing necessary facilities to carry out my work throughout the intern.

I express my sincere thanks to **Mr. Karthik Kumar Dhanabalan (Chief Operating Officer)** who helped me to gain more knowledge about the topic.

With a deep sense of gratitude, I thank all the staff for the timely help and guidance.

I record my profound thanks to my parents for providing me with valuable support.

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INDEX

Preface

Acknowledgement

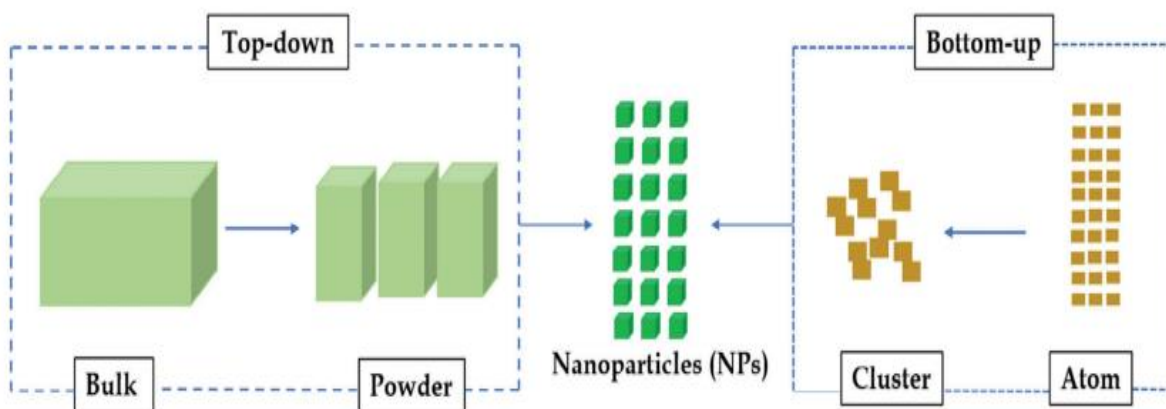
TABLE OF CONTENTS

Introduction	1
Conventional	2
Green Synthesis	3
Impact of Green Synthesis	4
Green Synthesis for Environmental Applications	5
Future Perspective of Green Synthesis Approach	5
Conclusion	6

1. Introduction

The most advanced industry in the 21st century is Nanomaterials. Due to their unique and captivating qualities with a variety of applications, nanoparticles have attracted a lot of attention. Nanotechnology is a multidisciplinary, promising area of research that offers numerous prospects in industries like agriculture, electronics, pharmaceuticals, and medicine. Typically, materials with a size between 1 and 100 nm are referred to as nanomaterials. Nanomaterials have unique optical, physical, and biological features because of their small size and large surface area. The creation of nanoparticles can be accomplished through chemical, physical, or biological means. Due to their unique physical and chemical characteristics, nanoparticles have been in the spotlight of modern nanotechnology for the past few decades. Nanoparticles are useful in a wide range of application areas, including the biomedical and pharmaceutical sectors, wastewater treatment, remediation of environmental pollutants, and food preservation, thanks to several features, including their catalytic, superparamagnetic, antibacterial, and anticancer activities. The recent focus of nanotechnology has been on the detection and control of plant diseases as well as the creation of nano nutrients to promote plant growth. A technique to transport various macro- and micronutrients into the soil gradually and in a controlled way, preventing accumulation and polluting of diverse natural resources, is to replace traditional techniques of fertilizer delivery with nano fertilizers. Nano fertilizer innovation necessitates a multidisciplinary approach because it has the ability to outperform conventional fertilizers. In nano fertilizer, nutrients can be delivered as emulsions or nanoparticles, encapsulated by nanomaterials, or coated with a thin protective layer. Numerous physical and chemical

procedures, including coprecipitation, microemulsion, laser pyrolysis, sol–gel, and laser ablation techniques, can be used to create nanoparticles. Green synthesis of Nanoparticles is a low-cost and environmentally friendly manufacturing process that leverages natural biogenic platforms like plant extracts, microbes, or fermented extracts.



2. Conventional

Nano fertilizers have emerged as a promising solution to address the challenges faced by traditional fertilizers in modern agriculture. These nanoscale materials, typically ranging from 1 to 100 nm in size, offer unique properties that enhance nutrient delivery and uptake efficiency in plants. By encapsulating essential nutrients within nanoparticles, conventional nano fertilizer provides controlled release mechanisms, ensuring a sustained and targeted nutrient supply to crops. However, despite their potential benefits, conventional nano fertilizers also raise concerns regarding their environmental impact and long terms sustainability. The widespread application of these nanoparticles may inadvertently lead to the accumulation of toxic residues in soil and water bodies. Additionally, their production processes often involve resource-intensive techniques that may have adverse ecological consequences.

3. Green Synthesis

Due to its eco-friendliness and ease of manufacturing compared to other methods, the creation of green nanoparticles generated from plants and microorganisms has gained more interest in the field of green synthesis Nanoparticles.

The plant is demonstrated to be protected from infection by bacteria, fungus, and pests by NPs such as silver (AgNPs), gold (AuNPs), copper (CuNPs), palladium (PdNPs), selenium (SeNPs), zinc oxide (ZnONPs), magnesium oxide (MgONPs), titanium dioxide (TiO₂NPs), and iron oxide NPs, among others of the green synthesis approach.

Their findings indicated that an increase in nanoparticle concentration led to increased seedling length (in cm), the average number of seedlings with leaves, and root length (in cm) compared to the control. Furthermore, greater levels of iron oxide nanoparticles (Fe₂O₃NPs 1000 mg L⁻¹) have increased the activity indicated a suppression and promoted plant growth. Besides, the effectiveness of a strategy for producing magnesium hydroxide nanoparticles [Mg(OH)₂NPs] green synthesis on various concentrations for seed germination, in vitro and in vivo plant growth promotion. The findings showed that plants treated with Mg(OH)₂NPs had greater Mg levels in their leaves and roots. The fungus extract, which was employed to create Mg(OH)₂NPs, demonstrated significant promise. The percentage of seed germination was dramatically increased by the biogenic Mg(OH)₂NPs.

4. Impact of Green Synthesis

Green synthesis mediated nanomaterials approaches offer a promising strategy for enhancing stress tolerance in plants through biochemical, molecular, and cellular interventions. They provide insights

into the role of the plant's photosynthetic apparatus in stress tolerance and help in understanding the mechanisms observed at the cellular level. This knowledge opens up new possibilities for designing biomimetic materials with improved performance against environmental stresses, which could have applications in human health. Additionally, these nanomaterials possess unique properties that make them valuable in applications requiring high standards, such as gas storage and separation, catalysis, sensing, and chemical/biochemical separations. They also show potential for use as sacrificial materials in environmental cleanup and wastewater treatment. Silver nanoparticles (AgNPs) have gained increasing popularity in agriculture due to their impact on stress tolerance. They have been explored in various forms for their potential role in protecting against abiotic stress. AgNPs have been shown to improve crop stress tolerance by addressing nutritional deficiencies, enhancing enzymatic activities, and promoting the adherence of plant growth-promoting bacteria to plant roots under abiotic stresses.

Green synthesized nanomaterials can also facilitate the breakdown of contaminants in the soil, facilitating nutrient absorption and growth in plants, while simultaneously reducing overall soil contamination levels. Scientists have engineered bioinspired metal-based nanoparticles such as AgNPs, ZnNPs, AuNPs, FeNPs, CdNPs, PdNPs, TiO₂ NPs, and CuNPs.

5. Green Synthesis for Environmental Applications

The green synthesis nanoparticle approach is being employed for the remediation of contaminated soil in agriculture. These nanoparticles have proven effective in removing contaminants from the soil and restoring its quality. Nanomaterials, particularly those produced through

green synthesis approaches, show great promise in environmental remediation due to their cost effectiveness and eco-friendliness. Soil contamination is a significant issue in agricultural regions, leading to substantial agronomic losses. The contamination often arises from the use of harmful pesticides and industrial effluent dyes. This contamination negatively impacts plant growth and crop yields by disrupting the soil's nutrient balance, hindering plants' access to essential nutrients, and ultimately causing wilting and death. In addition to affecting plant growth, soil contamination poses risks to human health as contaminants are absorbed by plants, and certain industrial heavy metals can leach into groundwater, rendering it unsafe for consumption. The biological synthesis of nanomaterials offers a solution to mitigate the harmful effects of soil contamination by providing a protective barrier against contaminants. This barrier safeguards plants, allowing them to thrive in contaminated soils and promoting plant growth and crop yields.

6. Future Perspective of Green Synthesis Approach

Green synthesis technology holds great promise due to its potential for simplicity, effectiveness, cleanliness, non-toxicity, and environmental acceptability in the synthesis of metallic nanoparticles. Metallic Nano particles can be efficiently biosynthesized using various microbes and plant extracts. However, further extensive research is needed to fully understand and enhance the wide range of applications and transformative potential of biosynthesized Nanoparticles. Significant progress has been made in the past decade regarding the production of chemical nanoparticles.

7. Conclusion

This internship covers a major role in environmental studies and how they impact biologically and chemically.

The primary focus lies in the domain of agricultural nanotechnology. I have gained the valuable knowledge of the outlook of the green synthesis approach in crop production system.

Although by this internship the main criteria I came to learn is green synthesized nanoparticles are still in early stages with significant process have been achieved.

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(DPIIT- Recognized Startup)

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Coimbatore
Dt. 25/10/23

To Whomsoever It May Concern

This is to certify that **Ms. Roshini M**, IInd year, M.Sc., Chemistry, Sathyabama Institute of Science and Technology, Chennai, Tamil Nadu, has undertaken a internship training titled “**Green Nanotechnology and its Applications**” in our organization from 19th October to 25th October 2023.

During the project period, her performance and conduct was good.

We wish her all success in her future assignments

Provided by

Viyen Biotech LLP



Chief Scientific Officer



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