CGC International Journal of Contemporary Technology and Research
ISSN: 2582-0486 (online) Vol.-5, Issue-2; DOI: 10.46860/cgcijctr.2024.01.10.361

Synthesis of Copper oxide Nano particles

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Abstract: **The synthesis of copper oxide nano particles (CuO NPs) using neem leaves extract as a green reducing agent has gained significant interest due to its eco-friendly and cost-effective nature. Neem leaves extract acts as a reducing agent and capping agent simultaneously, making it a promising alternative to traditional methods. The size, shape, and optical properties of the synthesized CuO NPs can be controlled by varying the concentration of neem leaves extract and reaction time. The synthesized CuO NPs exhibit excellent antimicrobial, antioxidant, antiviral, anti-inflammatory and catalytic activities, making them suitable for various applications in bio medicine, wastewater treatment, and energy storage. Overall, the green synthesis of CuO NPs using neem leaves extract holds great potential for sustainable and green nanotechnology.FTIR and UV Studies carried out in which it showed that drug-drug and drug-excipients are compatible.**

***Indexed Terms*- Nanocrystals, Nano suspension, Liquisolid Technology (*Keywords*)**

I. INTRODUCTION

Nanoparticles are significantly smaller than the particles found in everyday materials, and their small size gives them unique physical, chemical, and biological properties that are different from their bulk counterparts.They can be produced using different methods, such as chemical precipitation, sol-gel, and aerosol methods. The synthesis method and the material used can influence the size, shape, surface area, and other properties of the nanoparticles.[1]In electronics, nanoparticles can be used for the fabrication of nanoelectronics and nanosensors.

In energy, nanoparticles can be used for energy conversion, storage, and harvesting. In environmental remediation, nanoparticles can be used for water purification, air pollution control, and soil remediation.[2]Despite the potential benefits of nanoparticles, there are concerns regarding their potential toxicity and environmental impact.Research is being conducted to understand the potential risks and develop safe and sustainable applications for nanoparticles. Overall, nanoparticles hold great promise for the development of innovative and sustainable technologies[3]

CuO NPs have dimensions in the nanometer scale range, typically ranging from 1 to 100 nanometers. The small size and large surface area of CuO NPs result in unique physical, chemical, and biological properties that are distinct from their bulk counterpart synthesis of CuO The properties of CuO NPs can be tuned by controlling their size, shape, and surface chemistry. NPs have been extensively studied for their potential applications in areas such as catalysis, energy storage, biomedicineTheir unique properties such as high catalytic activity, good electrical conductivity, and strong antimicrobial activity make them attractive for these applications.[4]

Despite their potential benefits, the use of CuO NPs raises concerns regarding their potential toxicity and environmental impact. Thus, extensive research is being conducted to understand their potential hazards and risks and to develop safe and sustainable applications for CuO NPs[5].

II. LITERATURE REVIEW

Green synthesis of copper oxide nanoparticles (CuO NPs) using neem leaves extract has gained significant attention in recent years due to its eco-friendly and sustainable approach. The use of neem leaves extract as a reducing agent for the synthesis of CuO NPs offers several advantages such as cost-effectiveness, non-toxicity, and biocompatibility. This literature review aims to summarize the recent studies on CuO NPs synthesized using neem leaves extract and their potential applications.[6]

The synthesized CuO NPs exhibited good antimicrobial activity against various bacterial strains, including Escherichia coli and Staphylococcus aureus. [7,8].Development of antioxidant agents for biochemical applications can be possible by Green synthesized CuO NPs CuO NPs were synthesized using neem leaves extract and tested for their antibiofilm activity against various bacterial strains. [9] The synthesized CuO NPs exhibited good antibiofilm activity and inhibited the formation of biofilms. The authors suggested that the green synthesis of CuO NPs using neem leaves extract can be a promising approach for the development of antibiofilm agents for medical applications.[10]

NPs were synthesized using neem leaves extract and tested for their antioxidant activity. NPs were synthesized using neem leaves extract and tested for their antioxidant activity. Overall, the studies reviewed suggest that the green synthesis of CuO NPs using neem leaves extract is a promising approach for the development of efficient, eco-friendly, and sustainable nanoparticles with potential applications in various fields such as medicine, environmental remediation, and energy. Further studies are needed to understand the toxicity and environmental impact of these nanoparticles and to develop safe and sustainable applications.[11]

CuO NPs were synthesized using neem leaves extract and tested for their photo-catalytic activity. Copper oxide nanoparticles have gained significant attention in recent years due to their unique physical and chemical properties, including high surface area to volume ratio, excellent catalytic activity, and strong antimicrobial properties.

However, the conventional methods for synthesizing copper oxide.To overcome these drawbacks, green synthesis methods have been developed using natural extracts such as neem leaves extract.[12]The green synthesis of copper oxide nanoparticles using neem leaves extract is a simple, cost-effective, and environmentally friendly method that offers several advantages over traditional chemical methods.

Studies have shown that copper oxide nanoparticles synthesize dusing neem leaves extract possess excellent antibacterial, antifungal, antioxidant, and photocatalytic activities. In conclusion, the green synthesis of copper oxide nanoparticles using neem leaves extract is a promising approach for the development of eco-friendly and biocompatible nanoparticles with various potential applications. Further research is needed to explore the full potential of these nanoparticles and optimize their synthesis parameters for specific applications.[13,14]

III. SYNTHESIS

The synthesis of copper oxide nanopaticles using neem leaves extract involves the reduction of copper ions present in a copper precursor solution by the biomolecules present in the neem leaves extract. These biomolecules reduce the copper ions to form CuO NPs and also cap the NPs to prevent agglomeration and ensure stability. The reaction is typically carried out at room temperature, and the size and shape of the CuO NPs can be controlled by varying the concentration of the neem leaves extract and the reaction time.[15,16]

IV. APPLICATIONS

The synthesized CuO NPs using neem leaves extract have shown excellent antimicrobial activity against various pathogens, including bacteria, fungi, and viruses. This makes them promising candidates for biomedical applications such as drug delivery, wound healing, and diagnostic imaging.The CuO NPs also exhibit strong antioxidant activity, making them suitable for use in cosmetics and personal care products.[17]

In addition, the synthesized CuO NPs have shown excellent catalytic activity in various reactions, including the degradation of organic dyes and the reduction of pollutants in wastewater. This makes them a promising candidate for use in environmental remediation.[18]

Table 1: various excipients

S.No	Non Volatile Solvent	Carrier	Coating
1	Polyethylene Glycol	Avicel pH 101	Neusilin (Magnesium aluminometa silicate
2	Propylene glycol (PG),	Fujicalin (Dibasic Calcium Phosphate)	Aerosil
3	Oils : Olive oil, Castor oil, Soyabean oil, Liquid Paraffin, Glycerin	Neusilin (Magnesium aluminometa silicate)	Lactose

Apart from nanoparticle Neem leaves has so many properties can be formulated in the form of Liquisolid Compacts. Nanoparticles enhance solubility as in case of liquisolid technology which converts drug solution into free flowing powder.[19] Excipients play vital role in liquisolid technology. as increase wettability, surface area and aqueous solubility.

V. METHODOLOGY

Extract preparation: The chosen leaves were washed twice, once with distilled water and twice with running tap water. Then, absorbent paper was used to dry the leaves. A sterilized knife was used to chop up these leaves into tiny pieces. 250 ml of distilled water was added to a beaker containing roughly 40g of cut neem leaves. This was heated to 60 °C for an hour. Aqueous component had at this point turned yellow. ordinary filter paper and Whatmann No. 1 filter paper was used. For later usage, it was then kept in the refrigerator.[20,21]

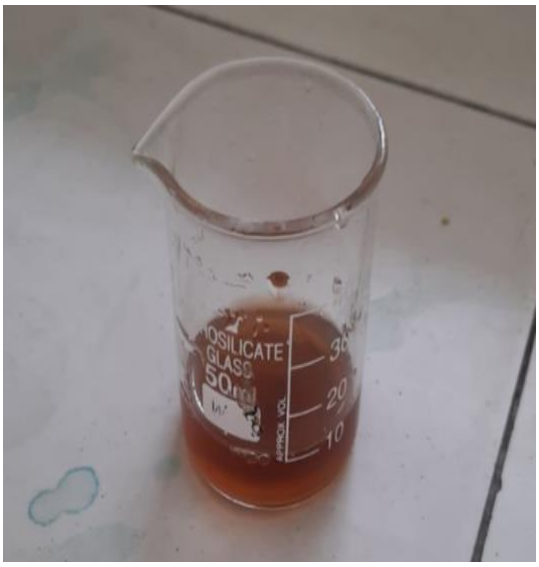

Fig. 1. Extract of Neem Leaves

Preparation of 0.1 M Copper Acetate Solutions
Materials and Methods

For Preparing A 0.1 M Copper Acetate Solution, standard measuring flask was filled to capacity with 4.99 g of copper acetate salt, correctly weighed, and then kept at a volume of 250 ml

Copper oxide nanoparticles synthesis

150 ml of neem leaf extract and 50 ml of copper acetate were combined in a beaker for the creation of copper oxide nanoparticles. When it was blended, it was noticed that the precipitate had a dark green tint and was brown in hue. This precipitate was obtained, centrifuged, cleaned with distilled water and ethanol, and then allowed to dry overnight. CuO nanoparticles were gathered the following day.

i. 40gm of the plant's green leaves were cut off and cleaned twice once in tap water and once in distilled water. boil the freshly cut leaves for 1 hour at a

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temperature of 80°C.

ii. After that 200ml of distilled water is used to boil freshly cut leaves for 1hr.at 80º C

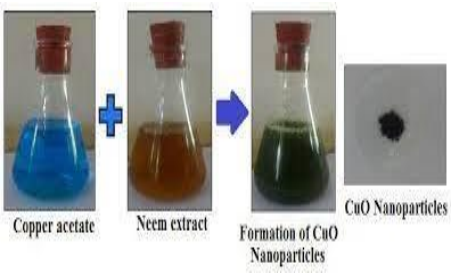

Fig. 2: Synthesis of copper oxide nanoparticles

iii. The boiling extract was filtered using regular filter paper, and the filtrate was then once more filtered using what-man filter paper and employed for more nanoparticlecreation.

iv. A solution of copper acetate was utilised as a precursor.

v. A homogenizer was used to combine the plant extract (150 ml) and the precursor solution (50 ml) while heating the mixture at 80°C.

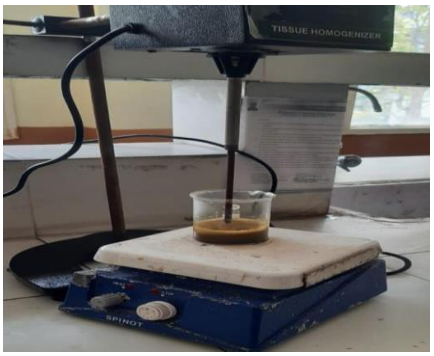

Fig. 3: Mixing of plant extract and precursor solution

vi. A switch from green to dark brown in color indicated the presence of copper oxide.

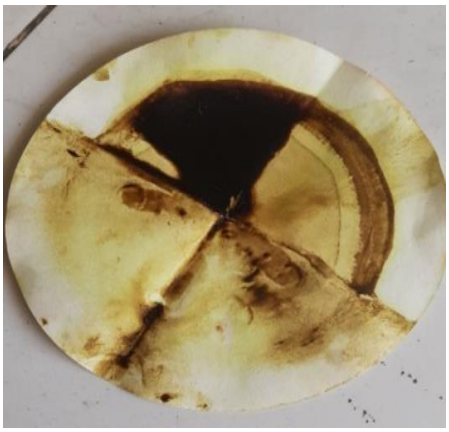

Fig. 4 : Collection of CuNPs

vii. What-man filter paper was used to filter the solution. The product was recovered after the brown solid filtration process and washed numerous times with ethanol and distilled water. At 80 °C, the product was dried overnight.

VI. EVALUATION

UV-Vis Spectra Analysis

UV-Vis spectral analysis of CuO NPs was done in the In wavelength range of 200-800nm analysis of CUO NPs was done as represented in FIgure5.FT-IR

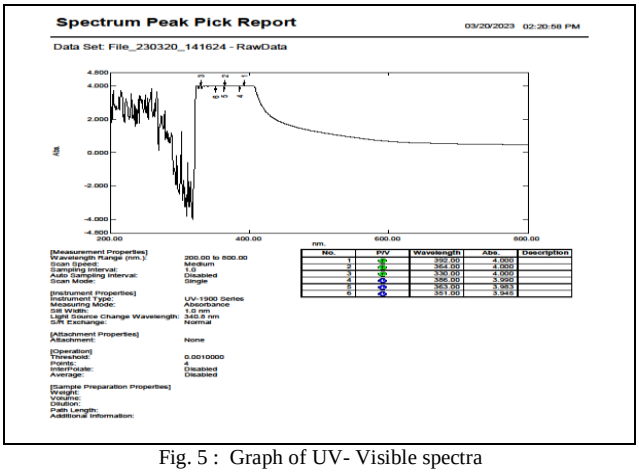

Fig. 5 : Graph of UV- Visible spectra

The UV-Vis spectra analysis shows that the absorption
values for CuO NPs was at 400nm

FTIR Studies

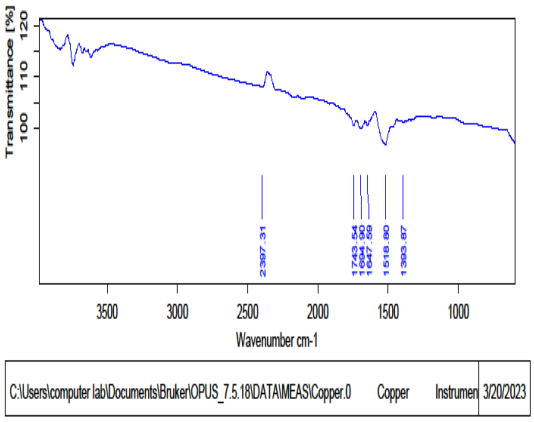

Fig. 6: Graph of FT-IR

The FTIR shows that there is no interaction between drug-drug and drug-excipients

VII. CONCLUSION

Copper oxide Nanoparticles of Neem Leaves was prepared and spectral analysis performed. By UV- Visible spectra its wavelength gets to know. FTIR shows that there is no interaction between drug –drug and drug –excipients. It increase the solubility

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