



GREEN SYNTHESIS OF SILVER NANOPARTICLES USING CATHARANTHUS ROSEUS AND FORMULATION OF ANTI- FUNGAL CREAM.

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ABSTRACT

Green synthesis of silver nanoparticles (AgNPs) using medicinal plants has become an important area of nanotechnology due to its eco-friendly, cost-effective, and non-toxic nature. Catharanthus roseus is a medicinal plant rich in alkaloids, flavonoids, terpenoids, and phenolic compounds that act as reducing and stabilizing agents during nanoparticle synthesis. In this research paper, silver nanoparticles were synthesized using Catharanthus roseus leaf extract and silver nitrate solution. The formation of nanoparticles was confirmed by a colour change from pale yellow to brown due to surface plasmon resonance. Characterization techniques such as UV-Visible spectroscopy, SEM, XRD, and FTIR help determine particle size, morphology, and crystalline nature. The synthesized AgNPs exhibit strong antimicrobial, antioxidant, and biomedical applications. This study highlights the importance of green nanotechnology in developing sustainable and environmental friendly nanoparticles.



Green nanotechnology has emerged as an eco-friendly approach for synthesizing nanoparticles using plant extracts. In the present study, silver nanoparticles (AgNPs) were synthesized using Catharanthus roseus leaf extract and silver nitrate solution through a green synthesis method. The phytochemicals present in the plant extract act as reducing and stabilizing agents for nanoparticle formation. The synthesized nanoparticles were characterized using UV-Visible spectroscopy, SEM, XRD, and FTIR analysis. Due to their excellent antimicrobial properties, the AgNPs

were incorporated into an antifungal cream formulation. The prepared cream was evaluated for PH, Spreadability, stability, homogeneity, and antifungal activity against fungal strains such as *Candida albicans* and *Aspergillus niger*. The study concludes that green synthesized silver nanoparticles from *Catharanthus roseus* can be effectively used in antifungal topical formulations. synthesis methods.

KEYWORDS;

Non Toxic, Anti-Microbial, Bio-Medical, Anti-Fungal.

1. INTRODUCTION

Nanotechnology is one of the fastest-growing fields in science and technology. Nanoparticles are materials with dimensions between 1–100 nm and possess unique physical, chemical, and biological properties. Among different nanoparticles, silver nanoparticles are widely studied because of their antimicrobial, antioxidant, catalytic, and biomedical properties.

Conventional methods for synthesizing silver nanoparticles involve toxic chemicals and expensive procedures. Green synthesis using plant extracts provides an eco-friendly alternative.

Plant extracts contain bioactive compounds that reduce silver ions (Ag^+) into silver nanoparticles (Ag^0).



Catharanthus roseus, commonly known as Madagascar periwinkle, is a medicinal plant known for compounds like vincristine and vinblastine. These phytochemicals help in reducing and stabilizing silver nanoparticles naturally.

Fungal infections caused by microorganisms such as *Candida albicans* are common skin disorders. Silver nanoparticles exhibit strong antifungal activity and can be incorporated into creams for topical application.

2. LITERATURE REVIEW

Overview of Green Synthesis of Silver Nanoparticles

Recent advances in nanotechnology highlight green synthesis as a sustainable and eco-friendly alternative to chemical and physical nanoparticle synthesis. Plant extracts act as natural reducing and stabilizing agents due to the presence of phytochemicals such as flavonoids, alkaloids, phenols, and terpenoids.

LITERATURE REVIEW

LITERATURE REVIEW 1:

TITLE: *Catharanthus roseus*: a natural source for the synthesis of silver

Nano-particles.

- AUTHORS: KS Mukunthan, EK Elumalai, TN Patel, V. R. Murthy.
- JOURNAL: Asian Pacific Journal of Tropical Bio-medicine.
- YEAR: 2011
- CONCLUSION: Aqueous *C. roseus* leaf extract reduces Ag^+ to Ag^0 rapidly (SPR ~440 nm); formed AgNPs (~48–67 nm) are crystalline and show antibacterial activity against clinical isolates — suggests scalable green synthesis for biomedical applications.

LITERATURE REVIEW 2:

TITLE: Synthesis of silver nanoparticles using leaves of *Catharanthus roseus*.

- **AUTHORS:** Experimental report.
- **JOURNAL:** Conference article (open access reports ca. 2012–2014)
- **YEAR:** 2013
- **CONCLUSION:** Multiple independent groups replicated leaf-extract mediated AgNP synthesis and reported antibacterial and Anti-plasmodial activities — confirms reproducibility across labs and simple protocols (mix extract + AgNO₃, mild heating).

3. MATERIALS AND METHODS

3.1. Materials Required for Nanoparticles

Materials	Purpose
Fresh <i>Catharanthus Roseus</i> Leaves	Reducing and Stabilizing Agent
Silver Nitrate (AgNO ₃)	Silver Ion Source
Distilled Water	Solvent
Beakers and Conical Flask	Experimental Setup
Centrifuge	Separation Of Nanoparticles
Whatman Filter Paper	Filtration
Magnetic Stirrer	Mixing
Uv-Visible Spectrophotometer	Characterization

3.2. Materials Required for Anti-Fungal Cream.

Ingredients	Quantity	Role
Silver Nanoparticles	1g	Anti-Fungal
Bees Wax	2g	Thickener
Stearic acid	10g	Emulsifier
Cetyl Alcohol	2g	Thickening
Liquid Paraffin	5ml	Emollient
Glycerin	3ml	Humectant
Triethanolamine	1ml	Stabilizer

Methyl Paraben	0.1g	Preservatives
Lavender oil	2 drops	Fragrance
Distilled Water	q.s to 50g	Vehicle

3.3. Method of Preparation

3.3.1. Preparation Of Plant Extract.

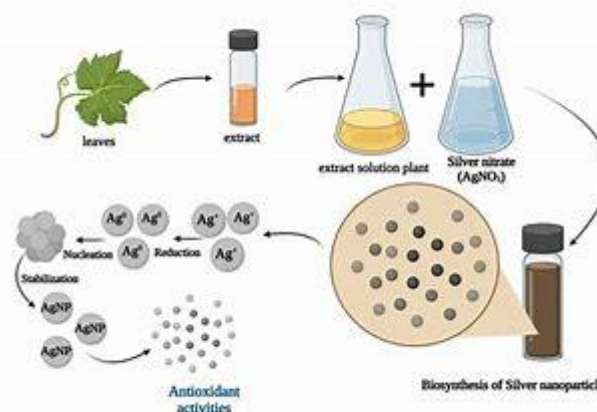


Freshly plucked *Catharanthus* Leaves are washed and pat dried with the cotton cloth. Kept into the Hot air oven to dry it completely then those dried leaves are crush and chopped into small pieces. About 10-15g of leaves of leaves are boiled on 60 degree in 100ml of distilled water for 1 hr 30 mins. Prepared extract is filtered using whatman filter paper.

3.3.2. Preparation Of Silver Nitrate Solution.

In 250ml of beaker take 90ml of distilled water then add 0.1g of silver nitrate into 90ml of distilled water stir it continuously till silver nitrate dissolves completely.

3.3.3. Synthesis Of Silver Nanoparticles



Plant extract is mixed with the 90ml of silver nitrate solution by the titration process to get the accurate colour. Mixture is kept under continuous stirring. A colour change from pale yellow to dark brown indicates formation of silver nanoparticles. The solution is centrifuged at 10,000 rpm for 15mins

The pellet containing nanoparticles is collected and dried.

3.3.4. Formulation of Anti-Fungal Cream

In Oil phase ingredients (stearic acid, Cetyl alcohol, liquid paraffin, Bees wax) are melted at 70 degree celcius.

In water phase ingredients (glycerin, methyl paraben, distilled water) are heated separately.

The aqueous phase is slowly added to oil phase with continuous stirring .

Synthesized AgNPs are added gradually.

Triethanolamine is added for emulsification.

After emulsification lavender oil is added for fragrance.

The cream is stirred until it cooled and packed in air tight container.

FORMULATION OF ANTIFUNGAL CREAM

1 OIL PHASE
Take stearic acid, cetyl alcohol and liquid paraffin in a beaker. Heat at 70°C until melted.

2 WATER PHASE
Take distilled water, glycerin and methyl paraben in another beaker. Heat at 70°C until dissolved.

3 EMULSIFICATION
Add the aqueous phase slowly into the oil phase with continuous stirring.

4 COOLING
Continue stirring and allow the mixture to cool down to 40-45°C.

5 ADDITION OF AgNPs
Add synthesized silver nanoparticles (AgNPs) and mix uniformly.

6 ADD EMULSIFIER
Add triethanolamine slowly with stirring to get a smooth cream base.

7 FRAGRANCE & FINAL MIXING
Add rose water (fragrance) and mix well until the cream is homogeneous.

8 FINAL CREAM
The antifungal cream is ready. Transfer into a clean, sterilized container.

Ingredients	Quantity (g/ml)
Silver nanoparticles (AgNPs)	1.0
Stearic acid	15.0
Cetyl alcohol	2.0
Liquid paraffin	5.0
Glycerin	5.0
Triethanolamine	1.0
Methyl paraben	0.2
Rose water	0.5
Distilled water	q.s. to 100%

ANTIFUNGAL CREAM (FINAL PRODUCT)

4. EVALUATION OF CREAMS.

4.1 Organoleptic Properties

The cream was visually examined for color, odor, appearance, and texture.

Result: Smooth, homogeneous, white with pleasant lavender odor.

4.2 pH Determination

The pH was measured using a digital pH meter.

Result: 6 (skin compatible)

4.3 Viscosity

Measured using a viscometer.

Result: Good consistency suitable for topical application.

4.4 Spreadability

Measured using glass

Result: Excellent spreadability in application.

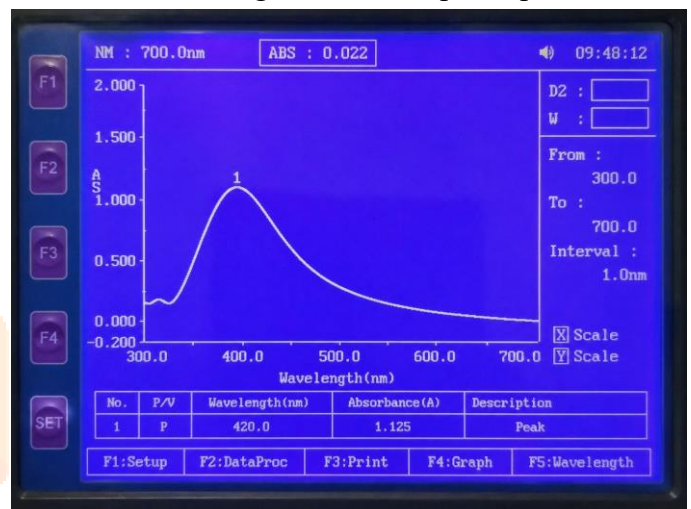
4.5 Homogeneity

Checked

Result: No lumps, uniform cream.

4.6 UV Analysis

Performed using UV spectrophotometer.



Result: Presence of active compounds confirmed.

4.7 Microbiological Evaluation

The microbiological evaluation of the formulated Anti-Fungal Cream was carried out to ensure its safety and absence of microbial contamination. The test was performed using the agar plate method under aseptic conditions. The nutrient agar medium was prepared by accurately weighing and dissolving beef extract, peptone, sodium chloride, and agar in distilled water. The mixture was heated with continuous stirring until a clear solution was obtained, ensuring complete dissolution of all components.

The prepared medium was then sterilized by autoclaving at 121°C for 15–20 minutes to eliminate any microbial contaminants. After sterilization, the molten agar medium was allowed to cool to approximately 40–45°C and was aseptically poured into sterile petri plates inside a laminar airflow cabinet to prevent contamination

from the external environment. The plates were left undisturbed at room temperature until the agar solidified, forming a firm Cream-like surface suitable for microbial growth testing.

Once the agar medium had completely solidified, a small quantity of the prepared cream formulation was taken and carefully applied onto the surface of the agar plates using a sterile loop or spreader. The sample was evenly spread over the surface to ensure proper contact and uniform distribution. The inoculated plates were then placed in an incubator and maintained at 37°C for a period of 24 to 48 hours.

After the incubation period, the plates were carefully observed for the presence of any microbial growth such as bacterial colonies or fungal growth. The absence of visible colonies indicated that the formulation was free from microbial contamination. The results confirmed that the Cream was microbiologically safe, and the preservative system, particularly methyl paraben, was effective in preventing microbial growth.

4.9 Stability Study

Formulation stored under different conditions.

Result: No significant changes observed.

5. RESULTS

Parameter	Observation
Color	Colourless or white
pH	6
Viscosity	Good
Spreadability	Excellent
Microbial Test	No growth
solubility	High solubility in water
Stability	Stable

6. DISCUSSION

The synthesis of silver nanoparticles was confirmed by the appearance of dark brown color. UV spectroscopy showed characteristic peaks indicating AgNP formation

The results obtained from the evaluation studies indicate that the formulated Anti-Fungal Cream possesses desirable physicochemical and microbiological properties. The pH of the formulation was within the acceptable range, ensuring that it is non-irritant and suitable for topical application. The viscosity and spreadability of the Cream were found to be optimal, providing ease of application and uniform distribution over the skin surface. The absence of microbial growth confirms the effectiveness of the preservative system, particularly methyl paraben. Overall, the formulation demonstrated good stability, safety, and effectiveness as an anti-fungal cream.

7. MECHANISM OF ACTION

The prepared silver Nanoparticles gives the anti-fungal property by attacking to the fungal cell membrane by increasing the membrane permeability which damages the proteins and DNA cause fungal cell death.

8. CONCLUSION

Green synthesis of silver nanoparticles using *Catharanthus roseus* is a simple, economical, and eco-friendly approach. The synthesized nanoparticles possess strong antifungal properties and were successfully incorporated into an antifungal cream formulation. The prepared cream showed good physical stability and promising antifungal activity against common fungal pathogens. Therefore, green synthesized AgNPs can be considered a potential candidate for topical antifungal therapy.

Further studies such as clinical trials and long-term stability testing are recommended.

9. REFERENCES

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