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# Biosynthesis of Silver Nanoparticles Using Rosaceae Petal Extract and Analysing Its Antimicrobial Assay

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***Abstract***

*Recent developments in nanoscience and nanotechnology have brought about a fundamental shift in the way we identify, treat, and prevent numerous diseases in all aspects of human life. Silver nanoparticles (AgNPs) are among the most significant and intriguing metallic nanoparticles employed in biomedical applications. AgNPs are very important for the domains of nanomedicine, nanoscience, and nanotechnology. Although numerous noble metals have been used for a wide range of applications, AgNPs have drawn special attention because of their potential for use in cancer treatment and diagnosis. The study showed an efficient method for the successful synthesis of AgNPs using petal extract from Rosaceae plants and characterizes them using a UV spectrometer and SEM. The produced AgNPs showed notable antibacterial activity against a variety of microbes, suggesting that they could find use as an antimicrobial agent in a number of different contexts. The work offers insightful information about how AgNPs might be used as a robust antibacterial agent against a variety of microbes.*

**Keywords:** *Biosynthesis, Sliver Nanoparticles, Rosaceae petal extract, Antimicrobial activity, SEM and UV spectrometer*

## 1. Introduction

A lot of study has been done on silver nanoparticles since their special qualities and possible utilization in numerous industries, including the biological sciences. Silver nanoparticles have better antibacterial and antifungal capabilities than other nanoparticles (Singh et al., 2020; Vijayan et al., 2021). For use in biological applications, where they can be employed to fight bacterial infections and stop the production of biofilms, this makes them extremely appealing (Singh et al., 2020). Additionally, silver nanoparticles have been shown to possess excellent biocompatibility and low toxicity towards mammalian cells, making them suitable candidates for use in drug delivery systems and other biomedical applications (Pandey et al., 2022; Xiong et al., 2016). Furthermore, silver nanoparticles could easily be prepared using green chemistry methods, such as using plant extracts, which are eco-friendly and sustainable (Das et al., 2017; Shankar et al., 2004). In summary, silver nanoparticles hold great promise for a collection of functions in the field of life sciences due to their unique properties and advantages over other nanoparticles Rosaceae petals have been used in a number of experiments to produce AgNPs through biosynthesis. For example, a work by Ezhilarasi and colleagues (2021) described how AgNPs were made from Rosaceae petals. According to the study, the extract from the petals served as a capping and reducing agent during the synthesis process, causing AgNPs to develop by way of a usual size of 21.8 nm. The produced AgNPs also demonstrated notable antioxidant and antibacterial properties. The biosynthesis of AgNPs using plant extracts, such as Rosaceae petals, has a number of benefits over traditional techniques, not the least of which is that it is more economical and environmentally benign. Moreover, the synthesised AgNPs have outstanding biocompatibility, which qualifies them for a range of biomedical uses, such as tissue engineering and drug administration (Patra et al., 2019). A viable method for the sustainable and environmentally friendly synthesis of AgNPs is the biosynthesis of AgNPs using the petals of Rosaceae plants. Excellent antibacterial, antioxidant, and anticancer properties of the synthesised

AgNPs make them appropriate for a range of biological uses. The development of innovative and effective methods for the production of AgNPs with improved characteristics may result from more research in this field. The nanoparticles in this work were characterised using SEM and UV spectroscopy, which showed a size range of 30-110 nm as well as a peak at 453 nm, respectively. AgNPs' antibacterial properties have also been studied in great detail; a common technique for assessing AgNP antimicrobial activity is the disc diffusion experiment on Mueller-Hinton agar. The study's microorganisms, which comprised gram-negative, gram-positive bacteria and fungi, include E. Coli, P. aeruginosa, B. subtilis, S. aureus, and Candida albicans. The experiment's findings may provide insight into the potential applications of AgNPs as antibacterial agents. The disc diffusion method was used to investigate the antibacterial capabilities of silver nanoparticles beside several pathogens, including E. coli, P. aeruginosa, Bacillus subtilis, S. aureus, and Candida albicans, with promising findings.

## 2. Materials And Methods

### Preparation of Different Rosaceae Extract

To get rid of contaminants, fresh petals from the Rosaceae family - yellow, pink, orange, and red - were gathered and cleaned with distilled water. The petals were heated to 70–80ºC after being combined 1:10 (w/v) with distilled water.

**Figure 1:** Different Colour of rose used for extract

### Synthesis of AgNPs using *Rosaceae* Extract

A 1:10 (v/v) ratio was used to combine the rose extracts with the silver nitrate ($AgNO_3$) solution. The mixture was kept at room temperature for the entire night, and the colour change was noted. While the extracts of the red and pink roses stayed largely intact, suggesting little AgNP creation, the mixture's colour changed for the yellow and orange roses, going from yellow to reddish-brown and orange to light brownish.

**Figure 2 :** Rose Petal extract + Silver nitrate solution

**Figure 3 :** Petal extract mixed with Silver nitrate solution

**Figure 4 :** Formation of Silver Nanoparticle (AgNP's)

**Characterization of AgNPs**
The synthesized AgNPs were exemplified using SEM, and UV spectrophotometer.

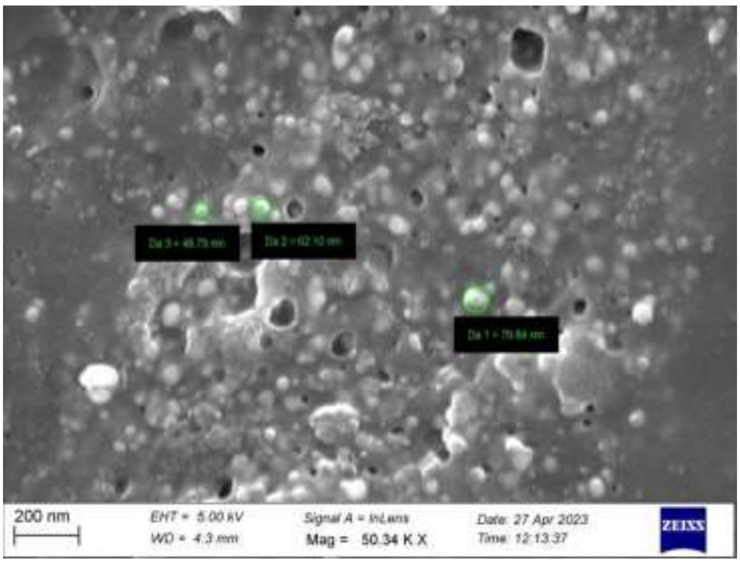
**Scanning Electron Microscopy (SEM)**
The surface morphology of the synthesised AgNPs can be examined using SEM. AgNPs that have dried can be put on a stub and given a thin layer of gold coating. The size, shape, and distribution of the AgNPs can be determined from the SEM pictures.

**UV-Visible Spectrophotometer:** The synthesised AgNPs' absorption spectrum can be examined using a UV spectrophotometer. A UV spectrophotometer can be used to examine the dried AgNPs after they have been diluted in distilled water. The size and morphology of the AgNPs can be inferred from the absorption peak.

**Antimicrobial activity (well diffusion method)**
DMSO was used to dissolve the AgNP powder and create a stock solution. AgNP solutions at various concentrations (50, 100, and 150 µg/well) were then prepared using the stock solution. AgNP solutions were put on the top of Muller-Hinton agar that had already been inoculated with bacteria, and they were loaded onto sterile filter paper wells. Next, the plates were incubated for 24 hours at 37°C. The inhibitory zone's diameter was measured in millimetres and contrasted with the positive (DMSO) and negative (Ampicillin for bacterial cultures and Fluconazole for fungal cultures) controls. Three duplicates of the experiment were run, and the mean values were computed.

## 3. Results and Discussion

**Characterization of Silver Nanoparticles (AgNP's)**
**Scanning Electron Microscopy (SEM) analysis**
Since it can produce high-resolution images of the size distribution and surface morphology of nanoparticles, scanning electron microscopy, or SEM, is frequently employed for the characterisation of nanoparticles. Understanding the agglomeration and clustering behaviour of nanoparticles is crucial for comprehending their characteristics and behaviour in various settings, and SEM offers this information. The AgNPs' spherical form and size range of 30 to 110 nm were revealed by the SEM pictures.



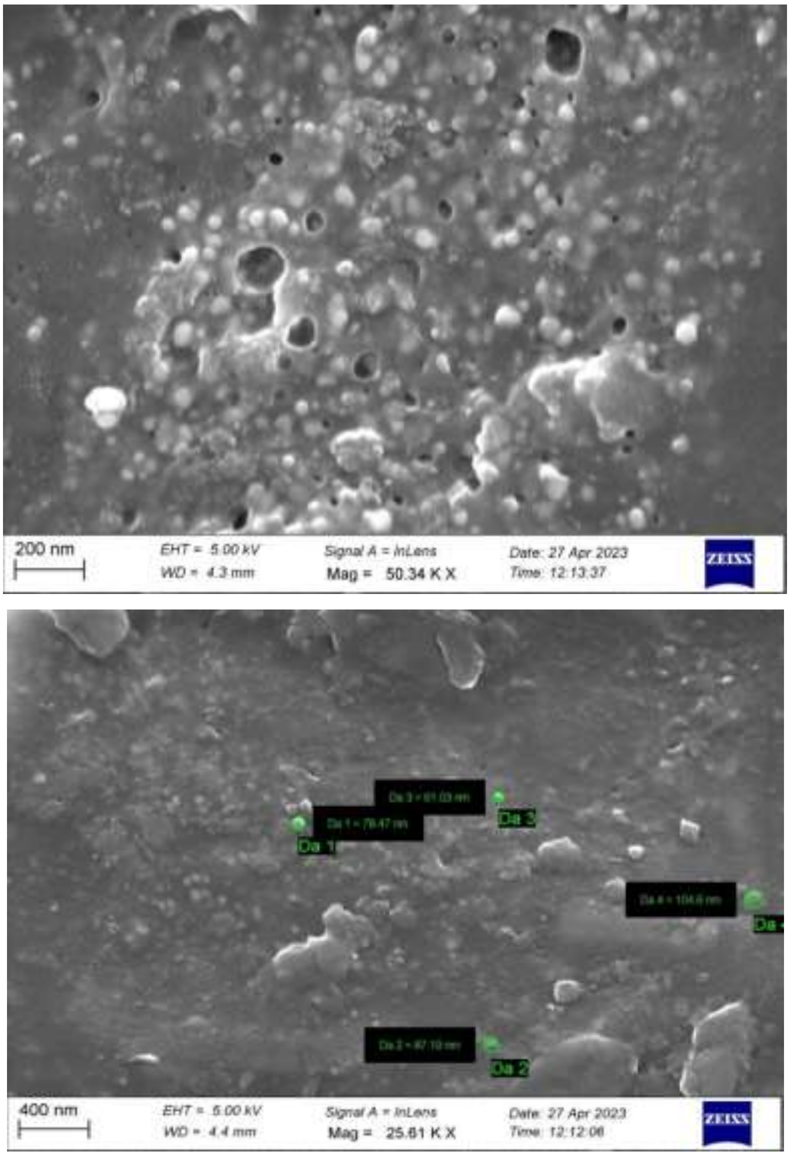



**Figure 5:** SEM images of AgNP's

**UV Spectroscopy analysis**

The UV-Visible spectrum of the AgNPs from Yellow rose extract exhibited a characteristic peak at 453 nm which is considered ideal being lowest, which is indicative of the presence of AgNPs of desired size while Orange rose extract exhibited peak at 463nm which beyond the requirement.

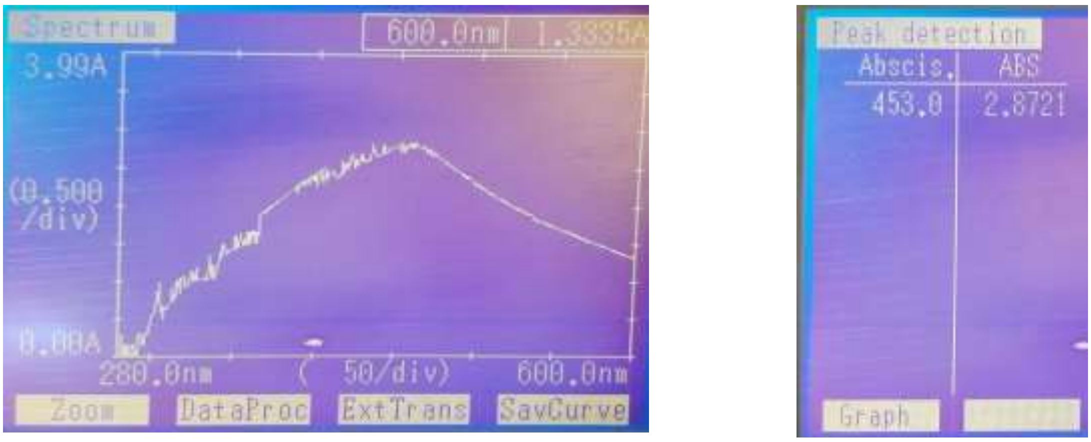



**Figure 6:** Graph and peak detected at the required range of Spectrum from yellow rose extract under UV spectrometer

**Antimicrobial activity (well diffusion method)**

The antimicrobial activity of the synthesized AgNPs was evaluated against *B. subtilis*, *S. aureus*, *E. coli*, *P. aeruginosa*, and *C. albicans* using the well diffusion method. The results showed that the AgNPs exhibited significant antimicrobial activity against all the tested microorganisms. The zone of inhibition at (100 µL concentration) was found to be 2 mm for *Candida albicans,* 13 mm for *Staphylococcus aureus*, 12 mm for *Escherichia coli*, 24 mm for *Bacillus subtilis*., and 12 mm for *Pseudomonas aeruginosa*. The results suggest that the synthesized AgNPs have potential as an antimicrobial agent.

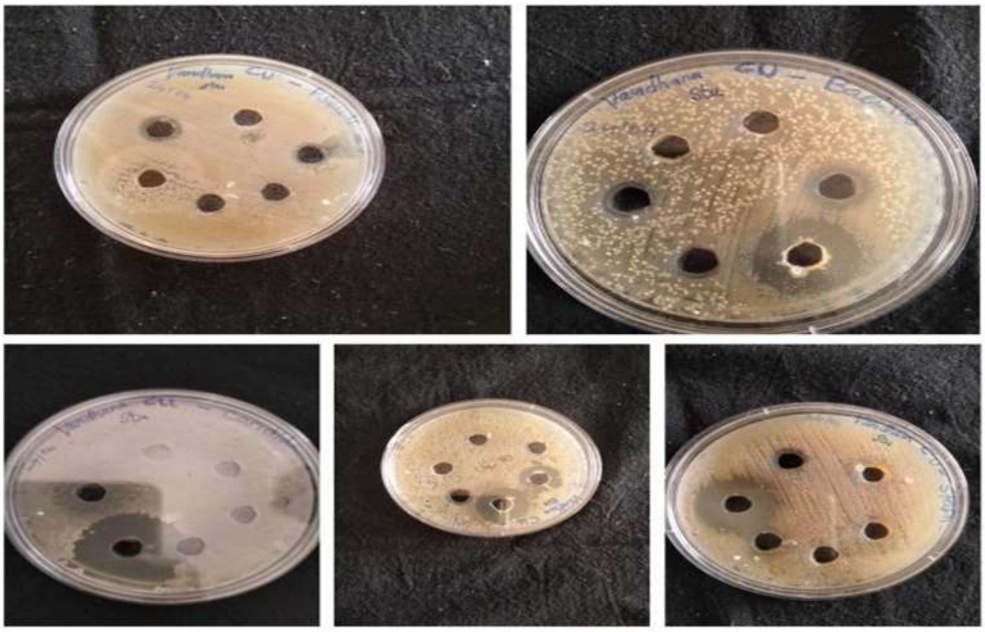


**Figure 7:** Antimicrobial activity - well diffusion method of of AgNP's from Rose petal extracts against (a)*Pseudomonas sp.,* (b) *Bacilus sp*., (c)*Candida sp.,* (d) *E.coli and* (e)*Staphylococcus sp* respectively

**Table 1:** Zone of Inhibition (mm) of AgNP's from Rose petal extracts

| **Concentration of sample** | ***Staphylococcus aureus*** | ***Escherichia coli*** | ***Pseudomonasa eruginosa*** | ***Bacillus subtilis.*** | ***Candida albicans*** |
|---|---|---|---|---|---|
| +ve Control | 29mm | 25mm | 25mm | 20mm | 32mm |
| -ve Control | - | - | - | - | - |
| 25 µL | - | - | - | - | - |
| 50 µL | - | - | - | - | - |
| 75 µL | - | - | - | 12mm | - |
| 100 µL | 13mm | 12mm | 12mm | 24mm | 20mm |

## 4. Conclusion

Recent years have seen a significant increase in interest in the production of silver nanoparticles (AgNPs) from yellow rose petals due to its potential applications in fields such as environmental research and biomedicine. The nanoparticles were characterised by SEM and UV spectroscopy, which showed a peak at 453 nm and a size range of 30-110 nm, respectively. AgNPs' antibacterial properties have also been studied in great detail; a common technique for assessing AgNP antimicrobial activity is the disc diffusion experiment on Mueller-Hinton agar. The study's microorganisms, which comprised gram-positive and gram-negative bacteria as well as fungi, include *E. Coli, P. aeruginosa, B. subtilis, S. aureus*, and *Candida albicans*. The experiment's findings may provide insight into the potential applications of AgNPs as antibacterial agents. With encouraging results, the antibacterial properties of silver nanoparticles against a variety of pathogens, such as *E. Coli, P. aeruginosa, Bacillus subtilis, S. aureus*, and *Candida albicans*, were examined using the disc diffusion method.

**Summary**

It has been noted that using yellow rose petals for AgNP production results in good nanoparticle stability and efficacy. Using UV spectroscopy and SEM, the produced nanoparticles were characterised. The results showed a peak at 453 nm and a size range of 30-110 nm, respectively. Using UV spectroscopy and SEM, the produced nanoparticles were characterised. The results showed a peak at 453 nm and a size range of 30-110 nm, respectively. Using the well diffusion method, the antibacterial capabilities of the silver nanoparticles were evaluated against a range of pathogens, including *E. Coli, P. aeruginosa, Bacillus subtilis, S. aureus*, and *Candida albicans*, with encouraging outcomes. Thus, this research can aid in the creation of environmentally friendly and long-lasting processes for AgNP synthesis.

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