IOCN 2025 Conference
The 5th International Online Conference on Nanomaterials
22–24 September 2025 | Online
MDPI

Green synthesis, characterization, and biological activity of silver nanoparticles

Mustapha Mouzaki[1], Youssef Mir[1]
1 Faculty of Medicine and Pharmacy, BIOMCI, University Ibn Zohr, Agadir 80060, Morocco

INTRODUCTION & AIM

Statistically, millions of people die each year from cancer and other gene-alteration–associated diseases. Their etiology is often linked to oxidative damage, where reactive oxygen species (ROS) induce diverse forms of cellular injury. Silver nanoparticles (AgNPs) have emerged as a promising nanomaterial due to their strong antioxidant potential, cancer-fighting properties, and a wide range of other bioactive effects (Maria et al, 2024).

In this context, we undertook the present study to synthesize AgNPs using a green plant extract approach, with rosemary serving as the reducing agent. The synthesized nanoparticles were then characterized and validated using visual color change, UV-Vis spectrophotometry and dynamic light scattering (DLS). Finally, their in vitro antioxidant activity was evaluated.

Aims of the Study

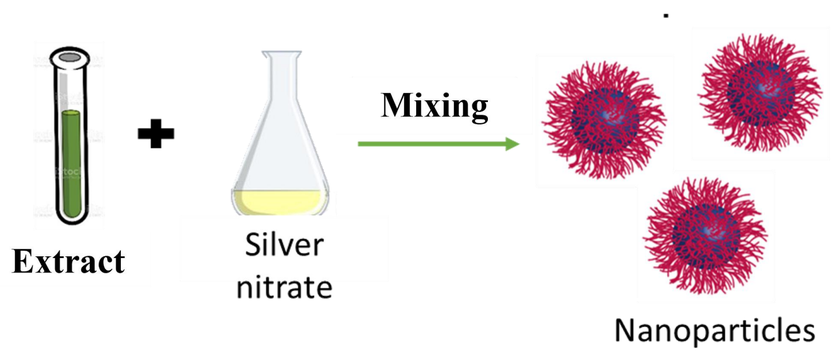
- To synthesize silver nanoparticles (AgNPs) using rosemary extract as a natural reducing agent.
- To characterize the synthesized AgNPs using UV-Vis and DLS techniques.
- To assess the antioxidant activity of the green-synthesized AgNPs in vitro.
- To explore the potential of rosemary-mediated AgNPs for biomedical applications.

METHOD

Synthesis of silver nanoparticles: The reaction was composed of a mixture of rosemary extract and silver nitrate ($AgNO_3$). The blend was then mixed thoroughly for 60 minutes using a magnetic stirrer in dark environment.

Characterization: by the change in the color of the mixture, UV-vis spectroscopy of sample and DLS.

Antioxidant activity: testing potential antioxidant activity using DPPH (2,2-diphenyl-1-picrylhydrazyl) assay and vitamin c as control.



RESULTS & DISCUSSION

AgNPs synthetise was first confirmed by change in color of solution to a light brownish color (figure 1), however UV-Vis spectrophotometry was necessary to acknowledge that nanoparticles were the source of color change (figure 2). The band peaks were a demonstration of AgNPs formation which through their properties reflect and absorb a specific wavelength from 300 to 400 nm. DLS The DLS analysis provided an extensive characterization, revealing significant insights into their synthesis and stability. It was found that AgNPs mean size was 46 nm, 0.38 polydispersity index and -20.02 zeta potential. These results reveal significant quality synthetise of AgNPs through rosemary extract containing polyphenols as a mean reductor and stabilizer of AgNPs among other phytochemicals (Alowaiesh et al., 2023).

Figure 1 : color change

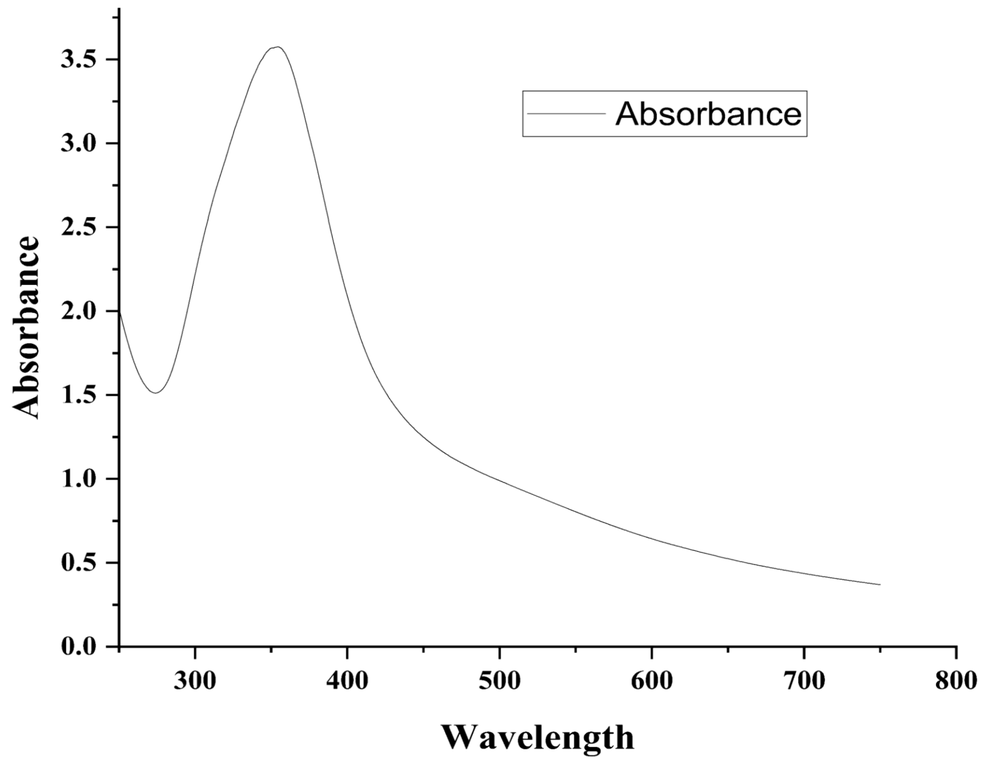


Figure 2 : UV-vis spectrophotometry absorbance spectre

Figure 3 demonstrate strong antioxidant activity of AgNPs compared to ascorbic acid. AgNPs show competitive inhibition compared to ascorbic acid further confirming characterization results. Their efficiency can be explained by their small size-as confirmed by DLS analysis-because with a greater surface area, one should obtain higher efficiency in the interaction with free radicals.

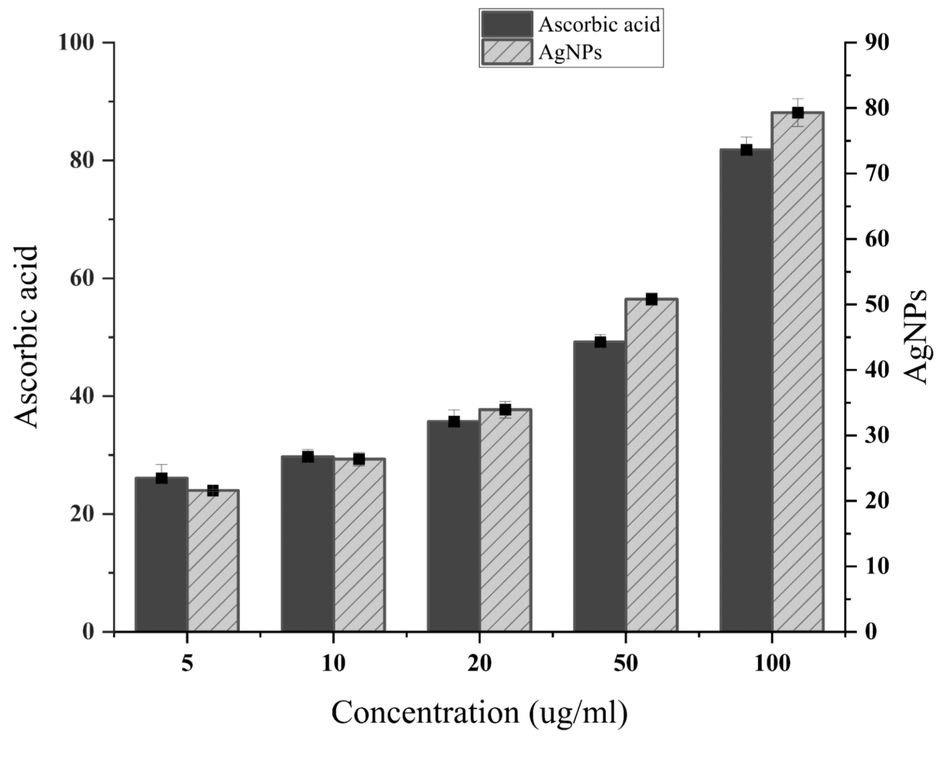


Figure 3 : Antioxidant activity

CONCLUSION

The success of this green synthesis opens the way to new techniques for an inexpensive, ecological, less toxic synthesis without the use of chemical reducers. However, more studies should be initiated to further characterize and study more biological activities of AgNPs and to evaluate their toxicity in vivo in animal models before any medical use.

FUTURE WORK / REFERENCES

1. Further extensive characterization AgNPs (SEM, TEM, XRD)
2. Explore antimicrobial activity against pathogenic bacteria.

ACS Omega 2024, 9, 10, 12146–12157

Alowaiesh BF et al. Green Biogenic of Silver Nanoparticles Using Polyphenolic Extract of Olive Leaf Wastes with Focus on Their Anticancer and Antimicrobial Activities. Plants (Basel).doi: 10.3390/plants12061410. PMID: 36987100