

Synthesis of Nanomaterials

Course code: 601102



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Biosynthesis of silver nanoparticles using *Plumbago auriculata*

- **Ag nanoparticles are shown antimicrobial activities.**
- **Leaf and calyx extracts of *Plumbago auriculata* use for the biosynthesis of silver nanoparticles (AgNPs).**
- **The formation of AgNPs was confirmed by the colour change in the plant extracts.**
- **Characterized by UV-Vis spectrophotometric.**
- **The present water-soluble components of the extracts were responsible for the reduction of Ag⁺ ions.**

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Biosynthesis of silver nanoparticles using *Plumbago auriculata*

- **AgNPs were evaluated against both gram-negative and gram-positive bacteria.**
- **The results produce showed good antibacterial activity against *Klebsiella pneumoniae*.**
- **It contributes to the environmentally friendly and cost-effective technique of the biosynthesis of nanoparticles against the drug development.**

Materials and method

- **Aqueous extracts of leaves and calyces were prepared using fresh samples (25 g) .**
- **Then crushed in distilled water (100ml) using a mortar and pestle.**
- **Samples were filtered through Whatman no.1 filter paper and stored at 40 °C for 14 days.**
- **1mM silver nitrate solution was prepared as follows: one molar silver nitrate stock solution was prepared by dissolving AgNO₃ (0.17g) in distilled water (100ml).**
- **A 1 mM solution was prepared by diluting 1 M solution (10ml) in distilled water (90ml).**
- **This solution was stored in a dark bottle for further use at room temperature.**
- **The concentrations of the extracts and AgNO₃ were 17 000 µg × ml⁻¹ and 10 000 µg × ml⁻¹ , respectively.**

Synthesis procedure of AgNPs

- **Aqueous and methanolic extracts of leaf and calyx (5ml each) were added separately to 1mM AgNO₃ solution (45ml) for reduction of Ag⁺ ions.**
- **Synthesis of AgNPs occurred at both room temperature (24 °C) and at 60 °C by heating extracts in a water bath.**
- **The change in colour of the solution indicates the formation of the AgNPs.**

Biosynthesis of AgNPs at two different temperatures of the different extracts

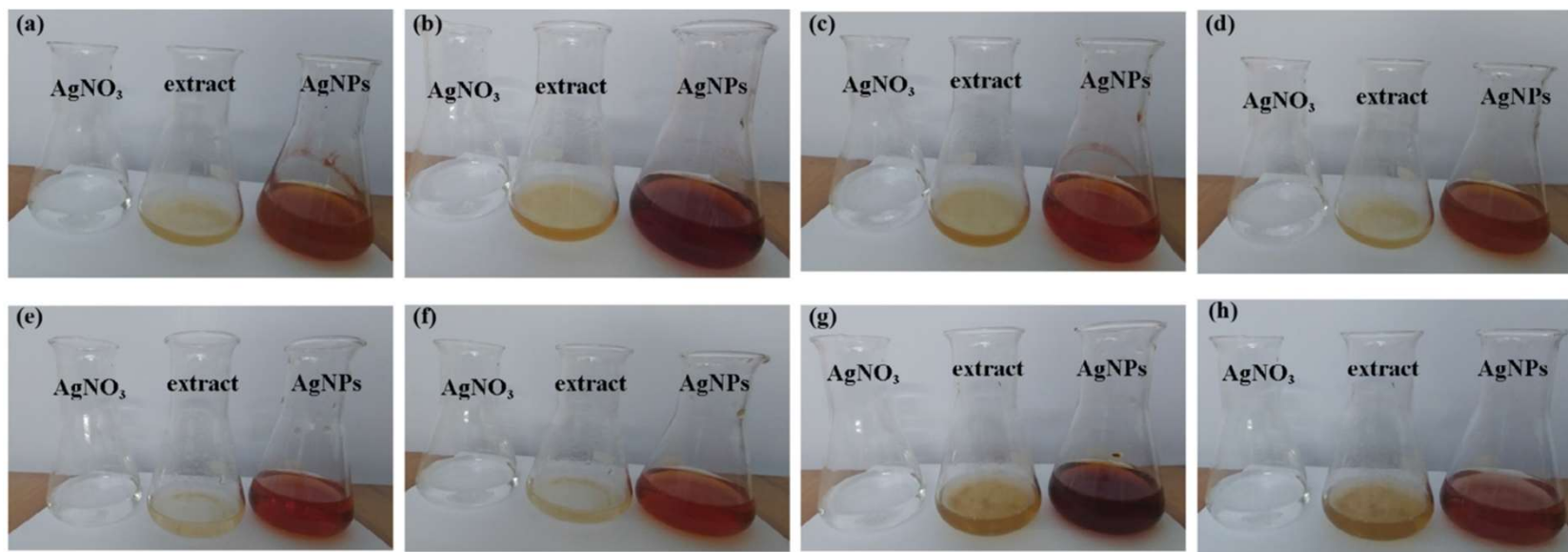
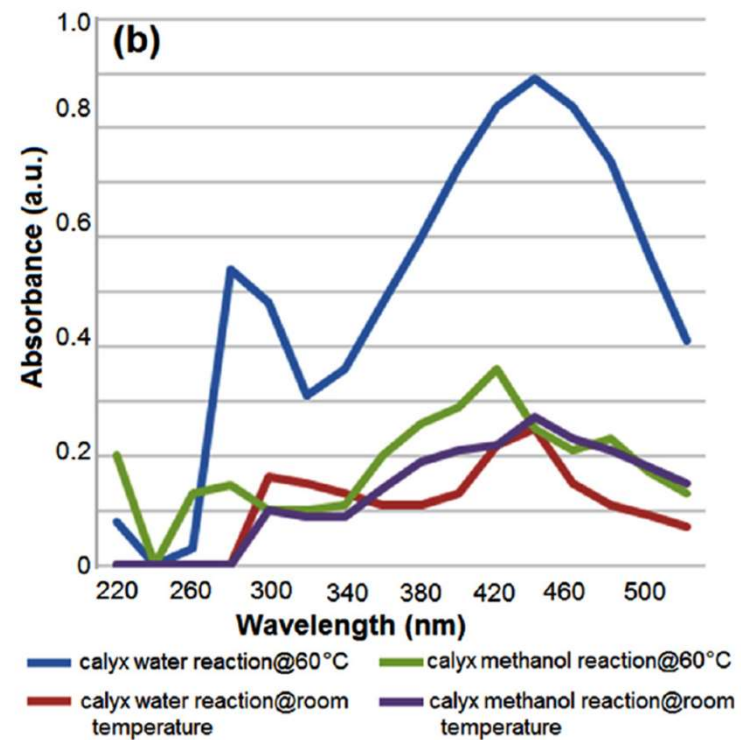
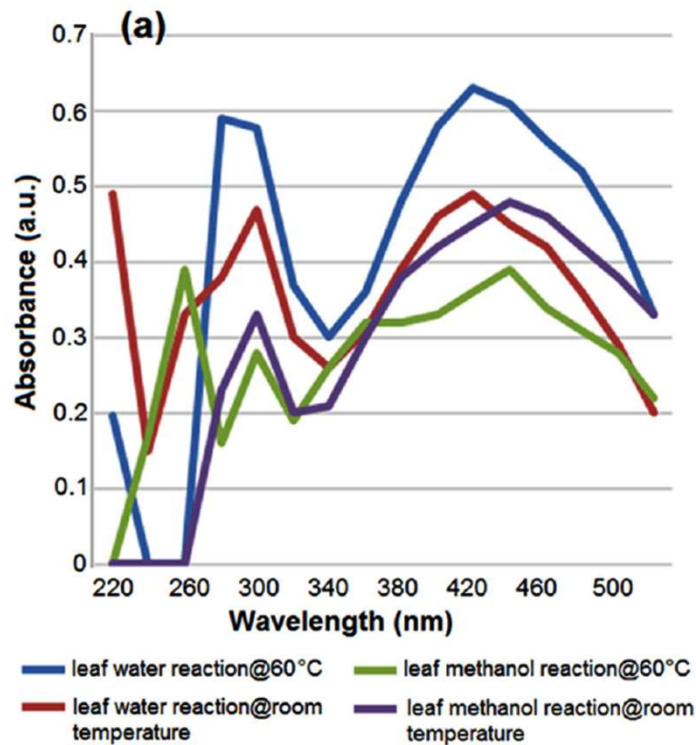


Figure 1. Colour changes are seen in the biosynthesis of AgNPs at two different temperatures of the different extracts: (a) yellowish brown of leaf methanolic extract (24 °C) (b) dark brown of leaf methanolic extract (60 °C) (c) yellowish brown of leaf water extract (60 °C) (d) yellowish brown of leaf water extract (24 °C) (e) yellowish brown of calyx methanolic extract (24 °C) (f) yellowish brown calyx water extract (60 °C) (g) dark brown of calyx methanolic extract (60 °C) and (h) yellowish brown of calyx water extract (24 °C).

Characterization of *P. auriculata* AgNPs

- UV-Vis spectrophotometer used for analysis the formation of NPs.
- The reduction of pure Ag⁺ ions was monitored by using a UV-Vis spectrophotometer.
- Distilled water was used as blank. The reaction medium was analyzed for its maximum absorption at scan wavelength range of 220–600 nm and the corresponding peaks were recorded.
- The absorbance of the reaction medium was measured within 24 h.

Characterization of *P. auriculata* AgNPs



Biosynthesis of gold nanoparticles using *Pseudomonas aeruginosa*

- *Pseudomonas aeruginosa* were used for extra-cellular biosynthesis of gold nanoparticles (Au NPs).
- Consequently, Au NPs were formed due to reduction of gold ion by bacterial cell supernatant of *P. aeruginosa* ATCC 90271, *P. aeruginosa* (2) and *P. aeruginosa*.
- Transmission electron microscopy (TEM) micrograph showed the formation of well-dispersed gold nanoparticles in the range of 15–30 nm.
- The process of reduction is extra-cellular.

Materials and methods

- **Bacterial strain and growth conditions :** Two clinical samples of bacterial isolates used in this study are isolated from burns.
- **The isolates were microbiologically and biochemically characterized as *Pseudomonas aeruginosa*.**
- **Bacteria were routinely cultured in nutrient broth and on nutrient agar plates.**
- **Use *P. aeruginosa* (1) that produce soluble fluorescent pigment pyoverdine and the other *P.aeruginosa* (2) that produce the blue pigment pyocyanin when cultured on cetrimide agar media. *P. aeruginosa* ATCC 90271 was used as standard strain.**

Biosynthesis of gold nanoparticles

- The two isolates and control strains of *P. aeruginosa* were used. The bacteria was grown aerobically in 50 ml nutrient broth media.
- Incubated at 37 °C and agitated at 150 rpm for 24 h.
- After the incubation, the supernatants were obtained by centrifugation of overnight bacterial culture at 5000 rpm for 5 min.
- For synthesis of gold nanoparticles (Au NPs): The hydrogen tetrachloroaurate was mixed with 50 ml of cell free supernatant to obtain a final concentration of gold ions to be 1 mM.
- The solution was incubated at 37 °C for 24 h.
- Control (without the gold ions only supernatant) was also run along with the experimental flask.
- After 24 h of incubation the cell free supernatant containing nanoparticles can be collected.

Au NPs of *P. aeruginosa* ATCC90271, *P. aeruginosa* (2), and *P. aeruginosa* (1)

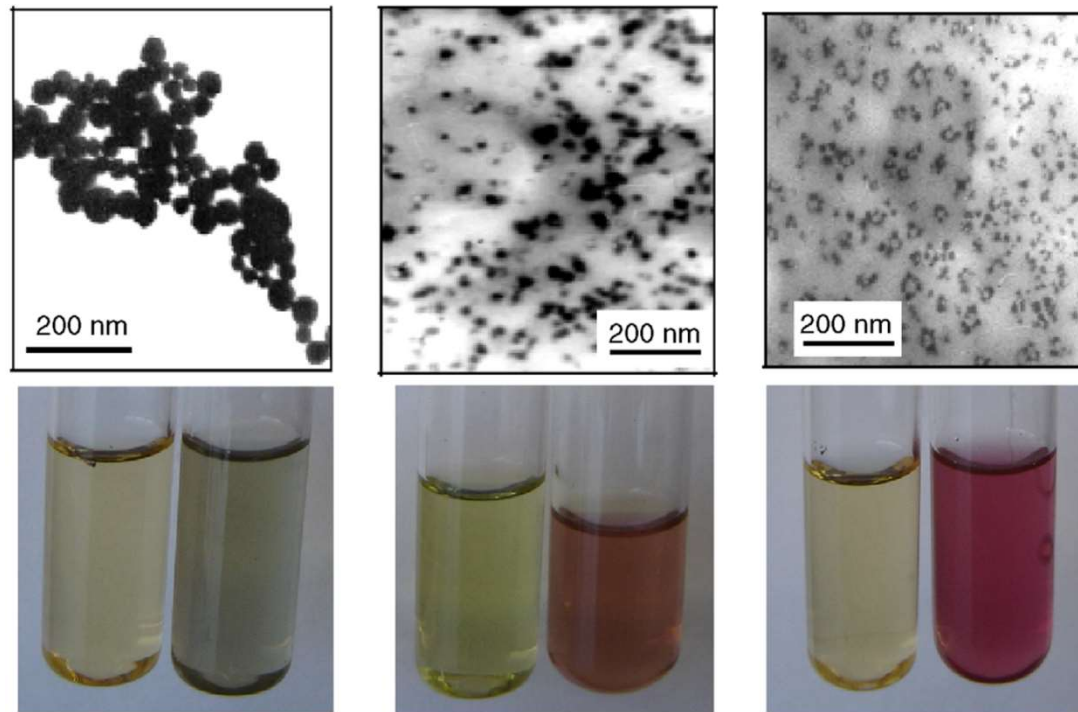
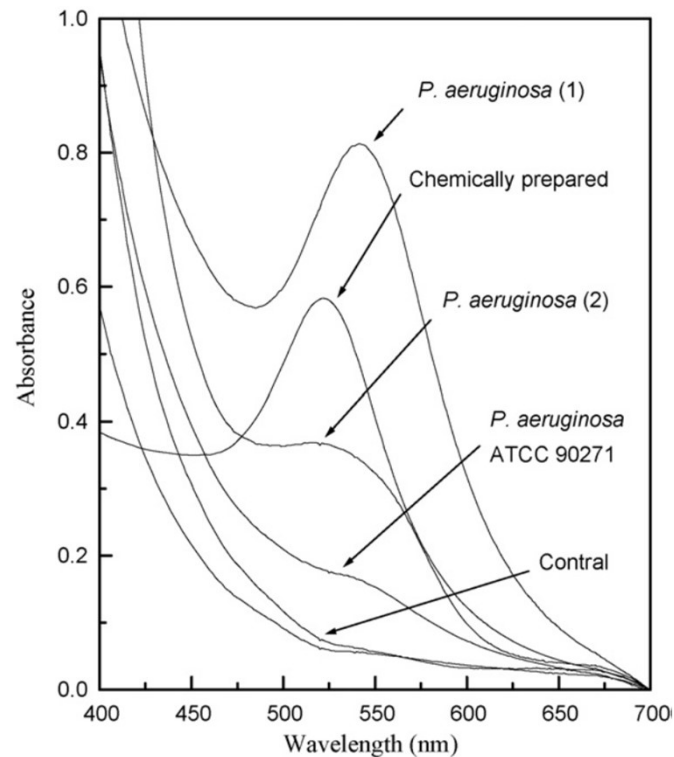


Fig. 1. The transmission electron microscopy and Suspension of Au NPs prepared by supernatant of *P. aeruginosa* ATCC 90271, *P. aeruginosa* (2), and *P. aeruginosa* (1) (from left to right) respectively.

The absorption spectra of Au NPs



The absorption spectra of Au NPs prepared by supernatant of *P. aeruginosa* ATCC 90271, *P. aeruginosa* (2), and *P. aeruginosa* (1).

References

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Thank You