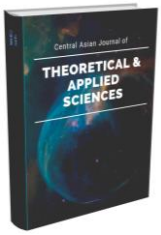

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*Article*

# Study the Characterization of Silver Nanoparticles Synthesized Using Natural Extracts Lantana Camara

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**Abstract:** For synthesizing silver nitrate nanoparticles (AgNPs), preparation is not harmful to the environment( Green synthesis) by using natural materials found in the plant. This study was used to identify the compounds responsible for the reduction of silver ions prepared in the extract of the leaves Lantana camara. The nanoparticles were inferred by color from light brown to dark brown. The results of the UV absorbance confirmed the appearance of a peak at a wavelength of 387 nm. FT-IR spectroscopy provided additional support for the results. In the region of (1400-1700) cm1, FTIR spectra of extract combinations with AgNP were examined (Fig. 5). Second-level architecture Amide-I and Amide-II bands in the (1400-2000) cm-1 range were used for analysis. The size of the green silver nanoparticles ranged between (63.7 and 99.2) nm, which was an acceptable size and evidence of the presence of nanoparticles.

**Keywords:** Green silver nanoparticles, UV-Vis spectroscopy, FTIR, (lantana camara).

## 1. Introduction

Applied sciences involving nanotechnology are on the rise, which is currently improving human life. Nanoparticles are defined as particles of common particles (1-100) Nano-meters in size, and these nanoparticles (MNPs) are used in the spotlight where they can be used (Reagents, catalysts, coating agent for antimicrobial surface) ,[1,2,3] .

Metals (silver, gold, and zinc) are used in the preparation of nanoparticles; other materials can also be used, as well, and some of them. (AgNPs) are becoming increasingly popular because of their antimicrobial properties.

Several chemicals, solvents, and reducing agents are used to prepare nanoparticles (the chemical method), There are various antioxidants, such as ascorbic acid, hydrazine, trisodium and citrate sodium borohydride.. However, the chemical method has limitations, such as low yield, huge energy use, a complex refinement process, and lack of environmental protection. As a result, efforts were directed toward finding an environmentally friendly and clean method, so silver, gold, zinc, and palladium nanoparticles were manufactured by a biological method. Nano synthesis is carried out using biological materials,[2,5,8,12].

For the synthesis of nanoparticles Minerals (MNPs) are composed of plant materials (leaves, bark, and seeds) ,[3-6,13] .

According to some researchers, chemical reduction of AgNPs is not as effective as synthesis using plant materials. ,[8,9,11]

AgNPs used as antimicrobials and antifungal· AgNPs break the wall and membrane of biological cells and the mechanism of antimicrobial activity, ,[1,3,7,13] .

It is somewhat harmful for humans to use chemical or physical methods because they require chemicals to reduce metal into nanomaterials. The synthesis of nanoparticles in nanotechnology uses a variety of metals, such as copper [11], zinc [12], gold [13,14] and silver [15-17]. As a result of its unique properties, silver is used in Nanotechnology and nanomedicine more often than other metals, including good conductivity and chemical stability antimicrobial activity, catalytic activity, and stability The reason for this is that eukaryotic microorganisms and bacteria can live together in harmony.[18,19]

As a nanomaterial, silver was used in the present study. Silver There are many applications for nanoparticles, especially in pharmaceutical sciences which include treatment of cancer, use to identify the compounds responsible for the reduction of silver ions to prepare them in the leaf extract *Lantana camara* for the use of environmentally friendly substances that do not affect the body of the organism,[20]

**The aim of our study:**

Prepare silver nanoparticle by using *Lantana camara* leaf extract, and characterization by Uv-Spectro photometer and confirmed by FTIR and nanoparticle size software.

**Material and Methods:**

**Materials**:

This study used leaf extract *Lantana camara*, analytical grade chemicals, solvents, water and media purchased from Hi Media (Iraq).

**Methods:**

**Plant Extract Preparation and Collection of Leaves:**

Leaves of *L. camara* Linn were collected from Baghdad, Iraq and then carefully cleaned two to three times under running water. A Whitman filter paper was used to filter the extract and storing in a refrigerator. The leaves were first rinsed twice with sterile distilled water, dried, and ground into powder using an electric grinder. 10g of leaf powder dissolved 70 ml of sterile distilled water was prepared.

**Phytochemical Screening**

*L camara* leaf extracts were subjected to analyses in order to determine their phytochemical composition[18]

**Green synthesis of silver nanoparticles (AgNPs):**

Three concentrations from solution of silver salts dissolved in 1M m of distilled water were prepared in conical flasks. The purpose of preparing the solution is to obtain silver nanoparticles resulting from a mixture of silver nitrate salts with *L. camara* leaf extract. Bio- reduction of silver ions and analysis of AgNPs with leaf extract. The mixture included a ratio of 1gm of silver nitrate salt to 9gm of leaf powder in 1mm of distilled water.

The solution preparation for synthesis of green silver nanoparticles was from silver nitrate salts in order to get silver ions; 1Mm solution was used prepare sterile distilled water and *Lantana camara* leaf extract ,The preparation was made by mixing a solution of silver nitrate AgNPs 1Mm in a ratio of 1:9 to the plant, extract , Both were mixed together then we put it in a bath of water at a temperature of 50ºC under ultrasonic frequencies, then yellow colour was changed to brown then to a dark reddish brown colour after 12hours of mixing ,The AgNPs were confirmed by UV and FTIR spectra ,[9.10].

**Characterization of Synthesized Silver Nanoparticles**

**Ultraviolet (UV) spectrophotometer**

In order to analyses UV spectrums, a UV-Vis spectrophotometer was used (UV-1800, Shimadzu, Japan). With a resolution of 1nm, absorption spectrophotometer

**Fourier-transform infrared (FT-IR)**

In order to perform the FTIR analyses, (Agile Technologies, USA), used a Cary 630 FTIR spectrometer. A comparison was made between the spectrum of the extract and AgNPs in order to establish this point. The samples were analysed using FT-IR in the range of (4000–600) $cm^{-1}$ at room temperature.

**Energy diffraction X-ray (EDAX)**

The elemental composition of AgNPs was studied using EDAX.

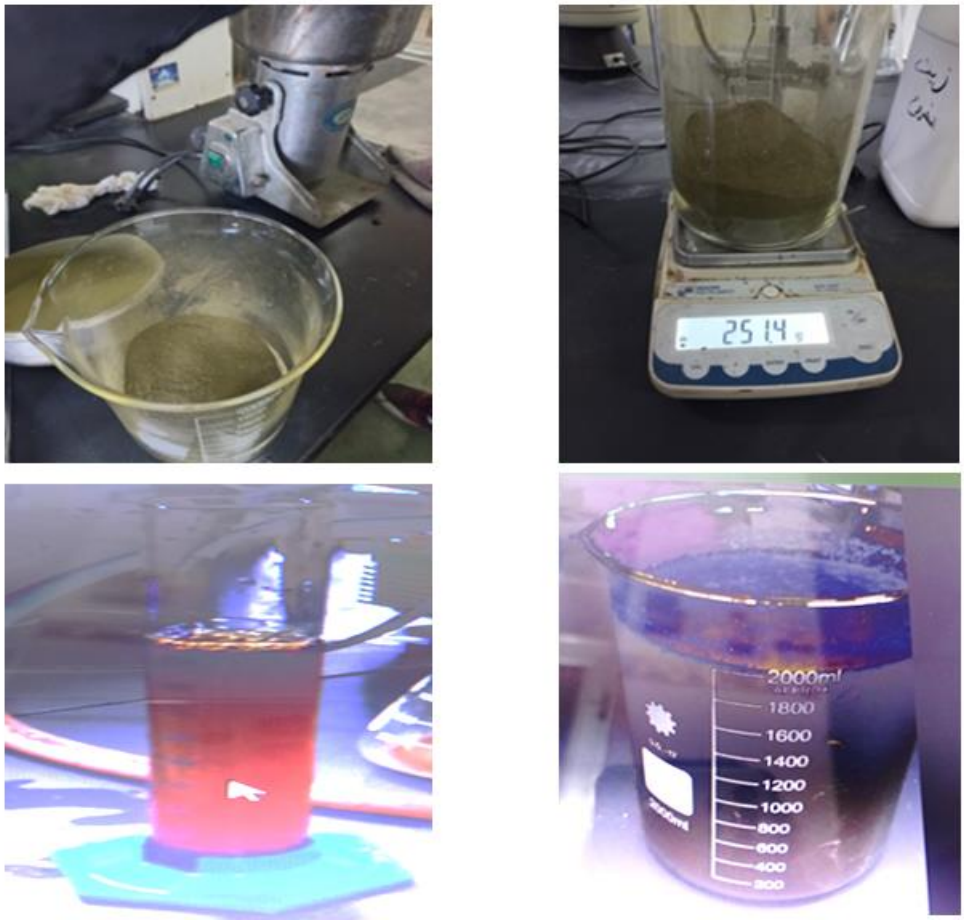



**Figure (1).** Schematic Silver nanoparticles are synthesized from *Lantana camara* leaves using the following steps: (a) Extracting the leaves, (b) Collecting leaves, (c,d) Synthesizing AgNPs from the leaves

## 1. Results and Discussion

In order to produce AgNPs, a leaf extract of *Lantana camara* was heated for 15minutes at 80°C. After mixing for 12hours, the yellow colour of AgNPs turned brown, followed by a dark reddish brown colour. This colour is caused by the reduction force of *Lantana camara* extract, which converts Ag ions into AgNPs. A large surface area of AgNPs, which produces the colour, is excited by surface plasmon resonance. one of the crucial methods for figuring out how metal nanoparticles develop and remain stable in aqueous solutions is UV-Vis spectroscopy is essential techniques to determine the formation and stability of metal nanoparticles in an aqueous solution. Visual perception of the reaction mixture's colour changing from watery to yellowish Once leaf extract has been added to the control, it is a available for use.

the effect of extract volume was studied and it found that 1ml were used each time to prepare AgNPs and Ag ion was constant (1mM). may be increase in extract volume has

been observed to affect AgNP synthesis, where all of the enzymes are capable of synthesizing AgNPs and there is no shift in absorption wavelength at the surface plasmon resonance (SPR) band, where AgNPs grow without agglomerating to larger particles. Based on the relationship between *Lantana camara* extract reduction force and the absorption of AgNPs, the absorption of AgNPs showed a remarkable.

As the amount of extract is increased, the power decrease is more evident. As shown in (Fig. 2), the gradual increase in absorption is related to the addition of 1ml of extract to the constant concentration of Ag ion and all samples exhibit the same broadening and at the same wavelength (416nm). AgNPs form and produce a broad spectrum, leading to this wavelength and the emergence of narrowly multi-dispersed AgNPs.

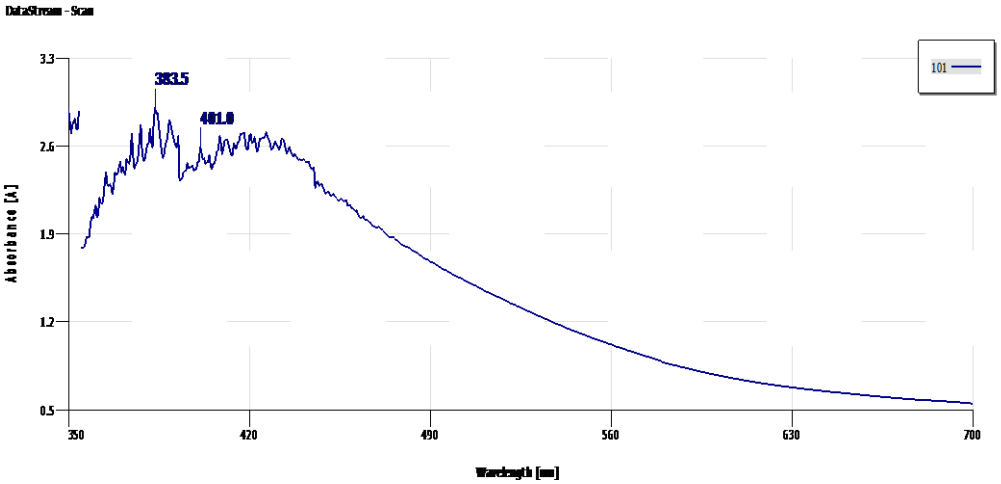



**Figure (2).** UV–vis spectra of an aqueous solution of prepared AgNPs after addition of 1ml of *L camara* leaf extract and conditions are: 0.001M AgNO3, ambient pH, the temperature was 50°C, time of reaction was 15 min and total volume was 100 ml

Uncovering yet another factor, the consequence of which is not depicted here, that is to say, the rise in extract quantity brings about a more intense hue and a shift in wavelength with the precipitation of some AgNPs after cooling at ambient temperature. When the extract quantity increases, this limitation boosts the amount of extract. The ingredients of the extraction are adsorbed onto the large surface area of the AgNPs, leading to their assembly. Given a high concentration of AgNPs, the active components of the extract are unable to form shells around the particles, in contrast to AgNPs that accumulate to yield bigger particles, and many active biomolecules that cause accumulation when they come into contact with AgNPs. This occurrence is comparable to what was mentioned in [21], In cases where the active components of the extract are at such a low level that agglomeration is not prevented.

Indicated by the brown colour, and their production is attributable to the combined oscillation of A qualitative Phytochemical assay of *L. camara* leaf separated and extract was conducted. Table1 shows the presence of alkaloids, phenolic, flavonoids, tannin, sapiens, terponoids, and phlobetanin. Time-dependent UV-Vis spectra were recorded to illuminate the nucleation and growth processes of AgNPs (0.001M) that were reduced under the influence of *L. camara* extract.

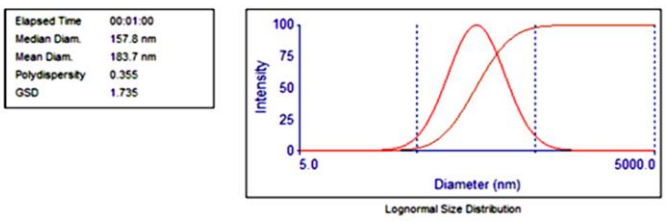
The absorption spectra with respect to the time evolution are shown in (Fig. 2). It has been observed that the appearance of the peak at 421nm corresponds to the absorption intensity and increases steadily as a function of reaction time without any shift in the position of the peak, revealing an increased formation rate of nano-sized AgNPs.

**Table 1**: *Lantana camara* leaf extract phytochemical screening

| *Phytochemicals* | *Aqueous extract* |
|---|---|
| *Tannins* | + |
| *Alkaloids* | + |
| *Carbohydrates* | + |
| *Amino acids* | - |
| *Flavonoids* | - |
| *Steroids* | - |
| *Cardiac glycosides* | + |
| *Saponins* | + |
| *Proteins* | - |

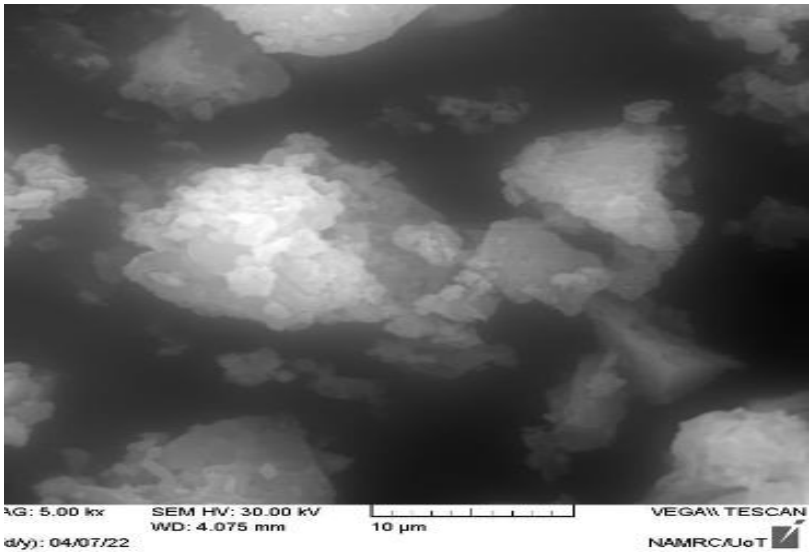
was studied by UV and FTIR spectra, i.e. UV-visible spectroscopy carried on a Shimadzu spectrophotometer, which was captured after 24hours at room temperature. For complete bio- reduction of $Ag^{+}$ ions, Figure (1,a). Silver nanoparticles are synthesized from *Lantana camara* leaves using the following steps: (a) Extracting the leaves, (b) Collecting leaves, (c,d) Synthesizing AgNPs from the leaves shows the stages of preparing AgNPs and the stages of colour change of the nano-extract .

Figure b (2) UV-visible spectrometer, the results of the UV absorbance spectra confirmed the appearance of a peak at wavelength 387 nm AgNPs are known to exhibit a UV–Visible absorption maximum in the range of (300–500) nm because of surface plasmon resonance the figure (4). (a) , showed the size of the green silver nanoparticles by particle sizing software ranged between (63.7-99.2) nm, which is an acceptable size and evidence of the presence of nanoparticles (63.7, 77.9,89.2, 99.2) also The figure (4). (b) show SEM image of synthesized silver nanoparticles particles size distribution assay for green silver nanoparticles.




| d(nm) | G(d) | C(d) | d(nm) | G(d) | C(d) | d(nm) | G(d) | C(d) |
|---|---|---|---|---|---|---|---|---|
| 63.7 | 26 | 5 | 137.3 | 97 | 40 | 228.8 | 80 | 75 |
| 77.9 | 44 | 10 | 147.2 | 99 | 45 | 250.9 | 70 | 80 |
| 89.2 | 58 | 15 | 157.8 | 100 | 50 | 279.3 | 58 | 85 |
| 99.2 | 70 | 20 | 169.1 | 99 | 55 | 319.8 | 44 | 90 |
| 108.8 | 80 | 25 | 181.4 | 97 | 60 | 390.6 | 26 | 95 |
| 118.2 | 87 | 30 | 195.1 | 93 | 65 | | | |
| 127.6 | 93 | 35 | 210.6 | 87 | 70 | | | |

**(a)**




**(b)**

**Figure (3). (a)** Particle size for different concentrations of the green silver nanoparticles by particle sizing software with the curve for this concentrations **(b)** SEM image of synthesized silver nanoparticles particles size distribution assay for green silver nanoparticles**.**

The profile of green synthesized AgNPs (0.001 M) is shown in (Fig. 4). The X-ray diffraction peaks appeared at (38.1o), (44.8o), (64.4o) and (77.3o) indexed as (111), (200), (220) and (311) miller indices, respectively. The AgNPs are crystalline in nature with fcc structure [JCPDS No. 04-0783]. Broadening of the peaks confirms the formation of nanosized particles. Debye Scherer's formula is given as [28], $D= K\lambda/\beta\cos\theta$ (1) where K denotes the Scherrer's constant (K=0.94), λ X-ray wavelength (0.1546 nm), β full-width at half-maximum of diffraction line in radian and θ half diffraction angle.

The above formula is used for average particle size calculation and size was estimated to be 20 nm with respect to high intense peak.

No other impurity peaks were identified, which indicates the purity of AgNPs the mixture was heated in a water bath at 50°C for 60min. Then filtered by a gauze cloth to remove the coarse material , then filtered through the Whitman 1 filter. Its final volume is up to 100 ml leaf extract used to prepare silver nanoparticles from (Ag salt) . It was kept at 40°C and used within one week Experimental Procedure.

Preparation of (*Lantana camara*) fresh leaf extract collected for experimental purposes. First the leaves were washed twice with sterile distilled water, then dried, grounded with an electric grinder into powder and 10g of leaf powder dissolve 70ml of sterile distilled water.

The mixture was heated in a water bath at 50°C for 60 min. Then filtered by a gauze cloth to remove the coarse material, then filtered through the Whitman 1 filter. Its final volume is up to 100ml leaf extract used to prepare silver nanoparticles from (Ag salt) . It was kept at 40°C and used within one week. Bio- production of silver ions and analysis of AgNPs with leaf extract.

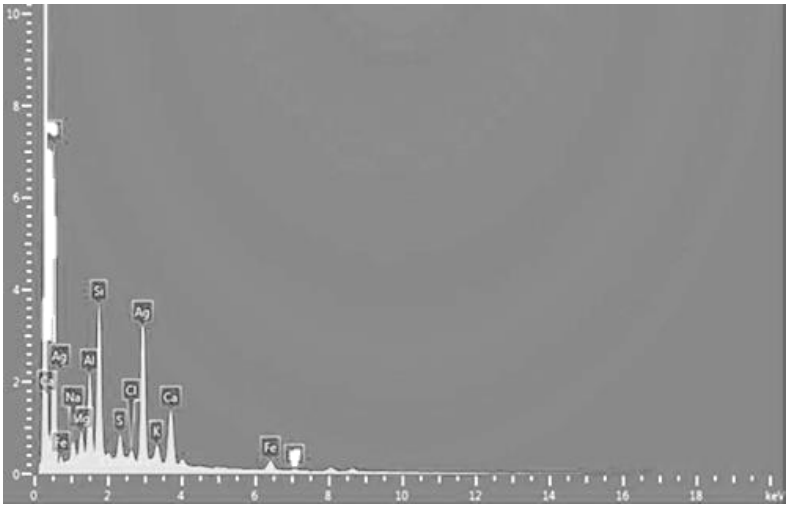



**Figure (4).** Diffraction energy X-ray spectra for green synthesized AgNPs nanoparticles

The FTIR patterns of AgNPs both freshly made and stored for 60 days can be seen in (Fig. 5). The data was recorded over the wavelength range of (1400-1700) $cm^{1}$. The extract has –OH, $–NH_2$, –NH groups, which is confirmed by the main peaks at (890), (749), and (3272) $cm^{-1}$ in the infrared spectrum. Second-level architecture Amide-I and Amide-II bands in the (1525) $cm^{-1}$ range were used for analysis. Area with the removal of the backdrop soaking up. We can see a band at (2361) $cm^{-1}$ due to the >C=O group in secondary amides in proteins. There were two bands, one at (3741) $cm^{-1}$ and the other at (3853) $cm^{-1}$, which were assigned to C–N and O–C–O stretching, respectively. The maximum at (629) $cm^{-1}$ is evidence of the C–S stretch in protein. FTIR analysis showed that AgNPs remain the same in terms of surface and adsorbed components after 2 months of storage, meaning that AgNPs are stable during storage.

In conclusion, our study's findings show that I AgNPs can lower the incidence of Extract by non-enzymatic alteration, and (ii) AgNPs have the ability to alter the secondary structure in a independent of concentration.


**Figure (5).**FTIR analysis of AgNPs before and after storage (2 months) and AgNPs formulation using *L camara* leaf extract was synthesized in green color.

## Conclusion

*Lantana camara* leaf extract was used to synthesize silver nanoparticles at room temperature. An extract of the leaves of *L. camara* was shown to bio-produce aqueous Ag+ ions. *L camara* leaf extract contains carbohydrates, tannins, alkaloids, flavonoids, and sapiens which reduced and stabilized AgNPs. Size and shape of AgNPs were analysed using SEM and FTIR, and particle size was examined as a function of AgNO3 concentration. Additionally, the catalytic activity of nanoparticles was studied and explored that the AgNPs synthesized act as effective green catalyst. Formation of nanoparticles was inferred by colour change, as the colour changed from light brown to dark brown. Results of the UV examination confirmed the appearance of a peak at wavelength at (378) nm. The size of the green silver nanoparticles ranged between (99.2 - 63.7) nm , which is an acceptable size and evidence of the presence of Nano par. The length of time stored is the most important factor; AgNPs activity against bacteria in the study is decreased after 10 months, which implies that AgNPs have an expiration date, maybe to use antibacterial activity against some strains of bacteria or use in vivo

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