Biosynthesis of Silver Nanoparticles Involving Tamarind Leaf Extract (Tamarindus indica)

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Abstract-- **Nanoparticles play a major role in the field of engineering and medicine. The survey of review of literature shows that not much work being done in the preparation silver nanoparticles from leaf extracts. The synthesis of silver nanoparticles largely helps in enhancement of their antimicrobial and antioxidant properties. In the present study an attempt has been made in the synthesis of silver nanoparticles using tamarind leaves extract. The synthesized tamarind silver nanoparticles have been characterized using Fourier transform infrared spectroscopy, scanning electron microscopy. powder X-ray diffraction analysis and Ultraviolet visible spectroscopy.**

Key words : Nanoparticle , SilverNitrate

I. Introduction

A. Tamarind Tree

Tamarinds indicia is a leguminous tree in the family fabaceae indigenous to tropical. Tamarind is a monotypic tax on having only a single species. The tamarind is a long lived, medium growth shrub which attains a maximum crown height of 12 to 18 meters (39 to 59 ft) .The crown has an irregular vase shaped. The tree grows well in full sun and acidic soil types. The ever green leaves are alternately arranged. The leafiest are bright green less than 5 cm (2.0) In length the branches droop from a single. The tamarind is best described as sweet and sour in taste and is high in tartaric acid, sugar B vitamins and calcium.(Fig.1)

Figure 1. Tamarind Tree

1) Tamarind Leaves

The large pods of the fruit contain small seeds and a sour-pulp that when dried, becomes extremely sour. Tamarind leaves are used for herbal medicine as well as for spicing up soups. Tamarind leaves are added to fish soups other soups. Folk medicine uses tamarind leaves for sprains and swelling. (Fig1.1)

Fig 1.2 Tamarind leaves

B. Health Benefits of Tamarind

Tamarind is a very well-known herb having many uses such as culinary, medicinal, uses and as an economic dye. It is used in Ayurveda medicine for gastric problem, digestion problems and cardio protective activity. Tamarind is very useful to treat bilious disorders. Being acidic it excites the bile and other juices in the body. Other uses of tamarind are,

* Natural Anti-Ageing Agent
* Removes Dark Rings around the Neck
* Prevents Hair less
* Cures Malaria
* Treats Piles
* Aids proper Blood Circulation
* Improves Nerve Function

C. Preparation Of Plant Extract

Fresh leaves were collected and washed several times with the distilled water to remove the dust particles at room temperature and dried 5 grams of dried leaves were taken into mortar and pestle ground we with 20 ml of distilled water and boiled for 30 mints at 60^0C and cooled. The extract was filtered with what man filter paper the filtrate was collected and used for synthesis of silver Nano particles.

D. Synthesis Of Silver Nanoparticles

Prepared aqueous solution of 1mM SILVER nitrate (AgNO3).Added 1 ml of leaf extract to 9 ml of aqueous solution of 1mM Silver nitrate. For reduction into Ag+ions the solution was kept for incubation period of 16-hours at room temperature in dark conditions. The reaction was observed by monitoring the pale colour change from yellow color to brown color (Fig1.3).

Fig 1.3 plant extraction solution and Fig 1.4 Silver nitrate solution with plant extract solution.

E. Extraction Of Silver Nanoparticles

After the incubation period the Silver Nano Particle solution was purified by repeated centrifugation at 15ooo rpm for about 20 minutes. The supernatant liquid is completely removed to get pure silver nanoparticles.

F. 1.6 Uv-Vis Spectral Analysis

UV-Visible Of spectrophotometer (shiatzus, Japan) measurement was carried out at room temperature, operated at resolution of 1 nm. The reduction of silver ions was monitored by measuring the absorbance of the reaction mixture in the wave length from 200 to 800 nm .

G. FTIR Anaysis

For Fourier transform infrared (FTIR) spectroscopy measurements the following method was adopted. The silver nanoparticles were synthesized after 24 hours of incubation with the leaf extracts, centrifuged at 10000 rpm for about 20 minutes minutes and their pellets were then dried and the power was analysed by FTIR spectroscopy measurements (Perkin Elmer spectrophotometer)in the reflectance mode at a reduction of 4 cm^{-1} potassium bromide (KBr)pellets.

H. Scanning Electron Microscopy

After 16 hours of incubation, leaf extracts were analyzed under a scanning electron microscope (JEOL) at a voltage of 120kV.

I. X-Ray Diffraction Spectroscopy

The nature of silver nanoparticle and the particle size were determined by X-ray diffraction studies, leaf extracts were analyzed by powder-ray diffraction methods.

II. Results And Discussion

The Silver Nanoparticles obtained is subjected the following instrumental TechniquesUV-Visible spectrophotometer analysis

FTIR Spectrophotometer analysis

SEM Analysis

XRD Analysis

A. UV-Visible Spectrophotometer (Shimadzu)

UV-VIS (shiatzu) spectrum of AgNPs:
It is generally observed that UV-Vis spectroscopy could be used to examine size and shape collected nanoparticles in aqueous suspensions. The reduction of silver nitrate to AgNPs was confirmed by the peak at 443nm.The graph obtained is show in the (Figure 1.5)

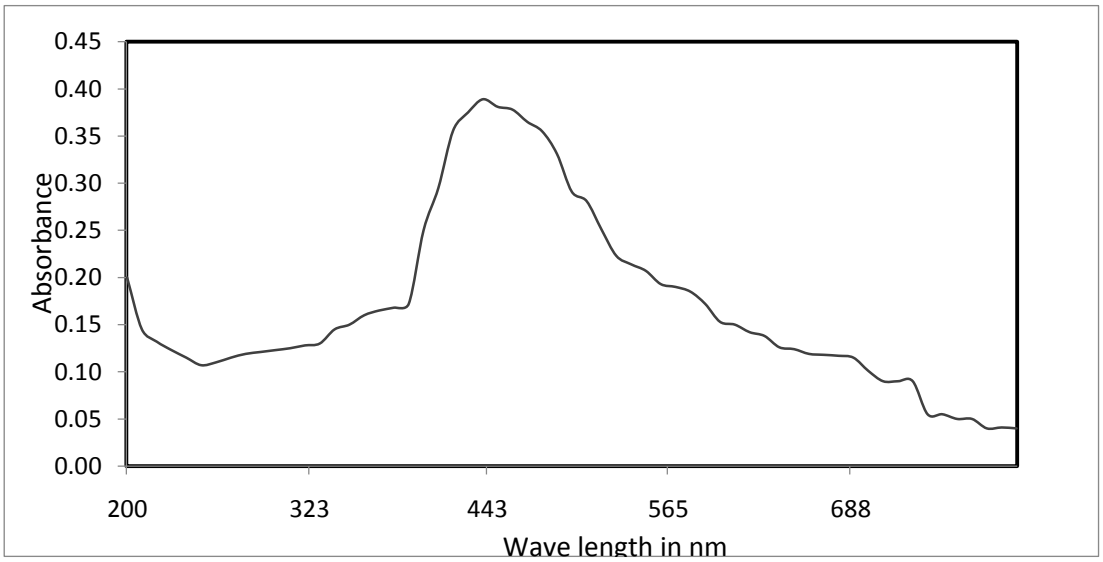


Fig 1.5 UV Spectrum of Ag Nano Particle

B. UV-Visible Spectral Analysis

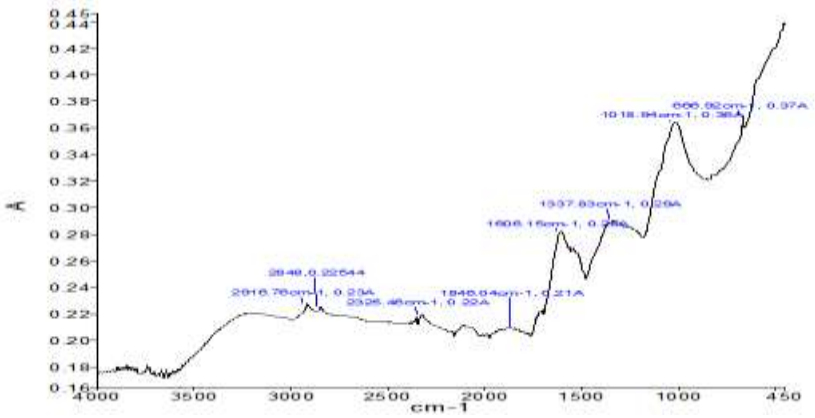
UV-Vis spectroscopic measurements were carried out at room temperature, operated at a resolution of 1 nm. The color of the solutions changed from pale yellow to yellow to yellowish brown indicating the of AgNPs formation It is well known that the AgNPs exhibit yellowish brown color in aqueous solution due to excitation of surface Plasmon vibrations in AgNPs.The broadening of peak indicated that the particles are poly dispersed. The spectra of AgNPs showed maximum absorption at 443nm to the surface Plasmon resonance SPR of the formed AgNPsThe result obtained from bio reduction of AgNPs using spiraling planeness, showed that a SPRSilver band occurred at 400-480nm. [Narayanan and sakthivel (2008)].The color change was due to the excitation of surface SPR in the production of AgNPs[Narayanan and sakthivel (2008)].

C. Instrumental Working

The dry powder of AgNPs is subject to FTIR measurements.Poly chromatic light is passed through a sample and the intensity of transmitted lights is measured at each frequency. The light exits the source and become spilt into the beam, one to the sample and other to the reference. The emission spectra of IR source are first recorded followed by IR source with sample. The frequency range are measured as wave number ranges from 4000-600cm-1. KBr discs allow suspension of powder or contaminants in IR transparent KBr, so they may be analyzed. The obtain the FTIR spectrum of the extract, an appropriate amount of the extract was mixed with KBr

D. FTIR (PERKIN ELMER) Spectrum of AgNPs.

FITR analysis was carried out at a resolution of 4cm-1 to evaluate function groups that might be involved in nanoparticle formation. The FTIR spectrum of AgNPs.is shown in Fig 1.7



ectGraph 1.7 FTIR Sprum of AgNPs Particles

E. FTIR Spectral Analysis

FTIR analysis was used for the characterization of the extract and the resulting nanoparticles.[prati et al. (2010)]
The peak at corresponds to 2916, 2848cm^{-1} C-H stretch
The peak at corresponds to 1846 cm-1 C=O stretch
The peak at 1606 cm^{-1} indicates amide group arising due to C=C stretch conjugated bond.

F. SEM for AgNPs

This figure show the SEM spectrum of the synthesized silver nanoparticle It is observed that most of the silver nanoparticles were spherical in shape Fig 1.8

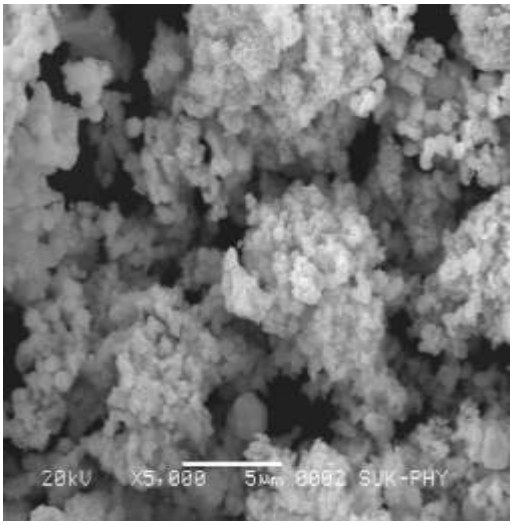


Fig 1.9 SEM images of AgNPs

G. SEM Analysis

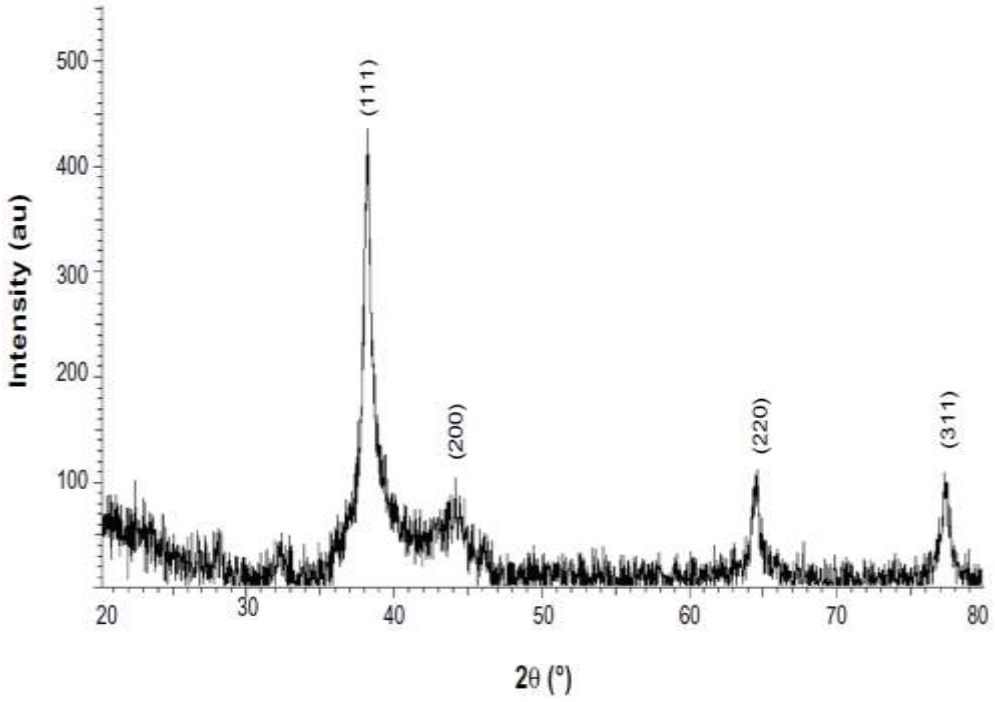
The formation of AgNPs as well as their morphological dimension in the SEM study demonstrated that the size of the nanoparticle ranges The average particles size of the individual silver nanoparticle using SEM analysis is estimated to be 29.15nm.The above figure confirms the presence of AgNPs.The

interaction such as hydrogen bond and electrostatic interactions between the bio-organic copping molecules band are the reason for the synthesis of silver nanoparticles using plant extract **[mano et al. (2011)]**It is observed that most of the silver nanoparticles were spherical and irregular in shape.

H. XRD Analysis

The nature of AgNPs and the particle size were determined by x-ray diffraction spectroscopy-ray powder diffraction is a rapid analytical technique mainly used for phase identification of crystalline material and can provide information of unit cell dimensioning the present works, the X-ray powder diffraction technique is used for the synthesized AgNPs (fig 4.7).XRD is based on constructive interference of monochromatic x-rays and a crystalline sample It satisfies Bragg's law which relates the wavelength to the diffraction angle and the spacing in a crystalline sample.

Fig Power XRD



Graph 1.10 XRD Spectrum of AgNPs

I. POWDER XRD Spectrum Of AgNPS

Results are presented as peak position at 2 teta and x-ray counts [intensity (1)] in the form of table or an X-ray plot (fig 4.8) The relative intensity is recorded as the ratio of the peak intensity to that of the most intense peak. The d-spacing of each peak is obtained by solution of the Bragg`s equation for the appropriate value of lamda. Once, all d-spacing has been determined and compared the d-spacing of the unknown can be obtained because each material has a unique set of d-spacing. Matching these d-spacing provides an identification of the unknown sample.

J. XRD Analysis

The characterization of silver nanoparticles is done by powder x-ray diffraction analysis. The measurement done is 250C and the anode material used is copper. The voltage used in powder x-ray diffraction analysis is 40 kw. The above figure shows the XRD patterns of dried AgNPs synthesized from tamarind leaf extract. The peak was observed at 2θ which equal twenty two. A peak intensity occurs when the material contains lattice planes with d-spacing appropriate to different x-rays at that value of teta. This shows that crystallization of bio-organic phase occurs on the surface of the silver nanoparticles The XRD peaks at 2θ of 38.2, 44.3, 64.5,77.5, could be attributed to the 111,200,220,311, crystallographic planes From the XRD analysis; it is clear that the silver nanoparticle formed using tamarind leaf extract is purely crystalline. The average crystalline size is found to be 28nm.The X-ray diffraction spectrum of silver Npsis show in fig

CONCLUSION

The present study deals with the biosynthesis of silver nanoparticles from tamarind leaf extract and also its characterization. The first chapter deals with the introduction to nanoparticles and nanotechnology. The second chapter deals with the scope and objective of the present study. The third chapter deals with methods and methodology to which the study is carried out. The fourth chapter deals with the results of the present study and its discussion The following conclusion is done based on the study. The present work confirms the excellent capability of synthesizing the silver nanoparticles using tamarind leaf extract. This work proved the ability of using the bio material for the synthesis of silver nanoparticles with the principle of green chemistry. Nanotechnology deals with the eco-friendly process for the synthesis of metallic nanoparticles. Here, the biological reducing agents used are the plant extract.

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