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Green Biosynthesis of Silver Nano Particles from *Aegle Marmelos* Aqueous Leaf Extract

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Abstract
Objectives: *Eco friendly methods of green mediated synthesis of nanoparticles are the present research in the limb of nanotechnology. The biosynthesis of silver nanoparticles are done using dried leaves extract of Aegle marmelos L by reacting these samples with 1mM concentration of silver nitrate. Characterization are done using UV Spectroscopy, XRD, SEM, EDAX and FTIR are carried out for synthesized nanoparticles using plant sources. UV, XRD, SEM, EDAX and FTIR confirms the formation, crystal structure, size, elemental silver formation and functional group responsible for the capping and stabilization of nanoparticles.*
Aegle marmelos L plant source have good capabilities for synthesize silver nano particles by biological route.
Keywords: *Green synthesis, Nanoparticles, A.marmelos*

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I. Introduction

Nanotechnology is the latest one and most promising areas of modern research in Biomedical science.A number of approaches are available for the synthesis of silver nanoparticles, such as thermal decomposition [1], electrochemical [2], micro wave assisted process [3] and green Chemistry [4]. Many of the nanoparticle synthesis or production methods of nanoparticles involve the use of hazardous chemicals, low material conversions and high energy requirements. Sliver has long been recognized as having as inhibitory effect toward many bacterial strains and micro organisms commonly present in medical and industrial processes. The most widely used and known applications of silver and silver nanoparticles are in the medical industry. In this present paper, we highlight the unreported work on the green biological route for the synthesis of silver nanoparcticles using an extract derived from *Aegle marmelos* leaves. The nanopracticles are characterized by UV- Visible Spectroscopy, XRD and SEM with EDAX analysis.

II. Material And Methods

Collection of plant materials

Aegle marmelos leaves are collected from Ammapettai of Thanjavur Dt , Tamilnadu, India. The voucher specimens are authenticated by the Rapinat Herbarium, St Joseph's College, Tiruchirappalli. Tamilnadu, India. The leaves of plant are rinsed with water thrice to remove the fine dust materials. The leaves of plant are air dried for 15 days and then they are kept in air hot oven at 60°for 36 hrs. The leaves are ground to a fine powder. 50g of powdered material of each sample is packed in soxhlet thimble individually and it is extracted using water as a solvent. The extract was filtered with the help of filter paper and solvent is evaporated from extract in rotary evaporator to get the syrupy consistency. Then the extract is kept individually in refrigerator at 4 ºC for future experiments.

Synthesis of Silver Nanoparticle

The 5ml of aqueous filtrate extract of *Aegle marmelos* is taken into 250ml Erlenmeyer flask individually. Extract is mixed with silver nitrate(AgNO3) to make final volume concentration of 1mM solution . The reaction mixture is kept in dark room condition until the onset of colour change is observed. The colour changes in the reaction solution is watched carefully for the characterization of silver nanoparticles.

Characterisation of Silver Nanoparticles

Silver nanoparticles are characrterized by UV-Vis schimadzu 1600 spectrophotometer. The bioreduction is monitored in the UV absorption spectrometer from 300 to 700 nm range. Then the solution was centrifuged at 18,000 rpm for 30 min at room temperature to precipitate the nanoparticles . The resulting pellet is dissolved in deionized water and filtered through whatman filter paper No: 42. An aliquot of this filtrate

containing silver nanoparticles are used for Fourier transmission Infrared spectroscopy (FTIR). X-ray powder diffraction data is taken with a Ni filter and CuK_α (λ=1.5406Å) radiation, operated in the θ :2θ mode primarily in the 10º-80º (2θ) range and using FEI Quanta FEG 200-High resolution scanning electron microscope (HRSEM) analysis is done for obtaining the micrographs . Energy dispersive X-ray spectrometric (EDAX) analysis is also carried out with their Thermo EDAX attachments.

III. Results

UV-Vis Spectra analysis

The reduction of silver is confirmed in both the samples by visual observation. The sample exhibited yellow colour. This colour variation may be attributed to excitation of surface plasmon vibration in silver nanoparticles [5]. After24 hrs incubation in dark room condition, the pale coloured reaction mixture turned into dark brown , indicating silver nano particle formation (Fig. 1). The broad surface Plasmon resonance is observed at 436nm is seen in Fig.2.

XRD analysis

Fig3 shows the X-ray diffraction pattern of the silver nanoparticles. From the spectra, it is found that, along with the weak peaks, four prominent peaks are observed at 2$\theta \approx$ 2.62,38.02.46.07 and 64.28 respect to the plane of (110),(111), (200), (220).From the analysis, it is confirmed that the silver nanoparticles are successfully obtained from the $AgNo_3$.

SEM analysis with EDAX of Silver nanoparticles

The SEM images are shown in Fig. 4. It is obvious from Fig. 4, the products exhibit more or less uniform small sized grains. The presence of expected element in the final products Ag is confirmed through the EDAX profiles Fig. 5.

Fourier transform infrared spectroscopy (FTIR)

FTIR is an important tool which enables us to understand the involvement of functional groups in the interactions between metal particles and biomolecules [6]. In the present work, FTIR spectra are used in the identification of biomolecules responsible for capping and stabilizing the silver nano particles. The FTIR spectra of the sample are given in the fig.6 which shows the presence of silver nanoparticles, peak at 3461cm-11 which are assigned as -OH stretching in alcohols and phenolic compounds [7]. From this sample, similar peak is observed at 1637cm^{-1} that could be the stretching vibrations of C=C. At 1021cm^{-1} a peak is observed that could be ascribed to multiplet of C=O group.

Fig. 1 The conversion of silver nitrate to nano silver by *A.marmelos* after 24hrs.

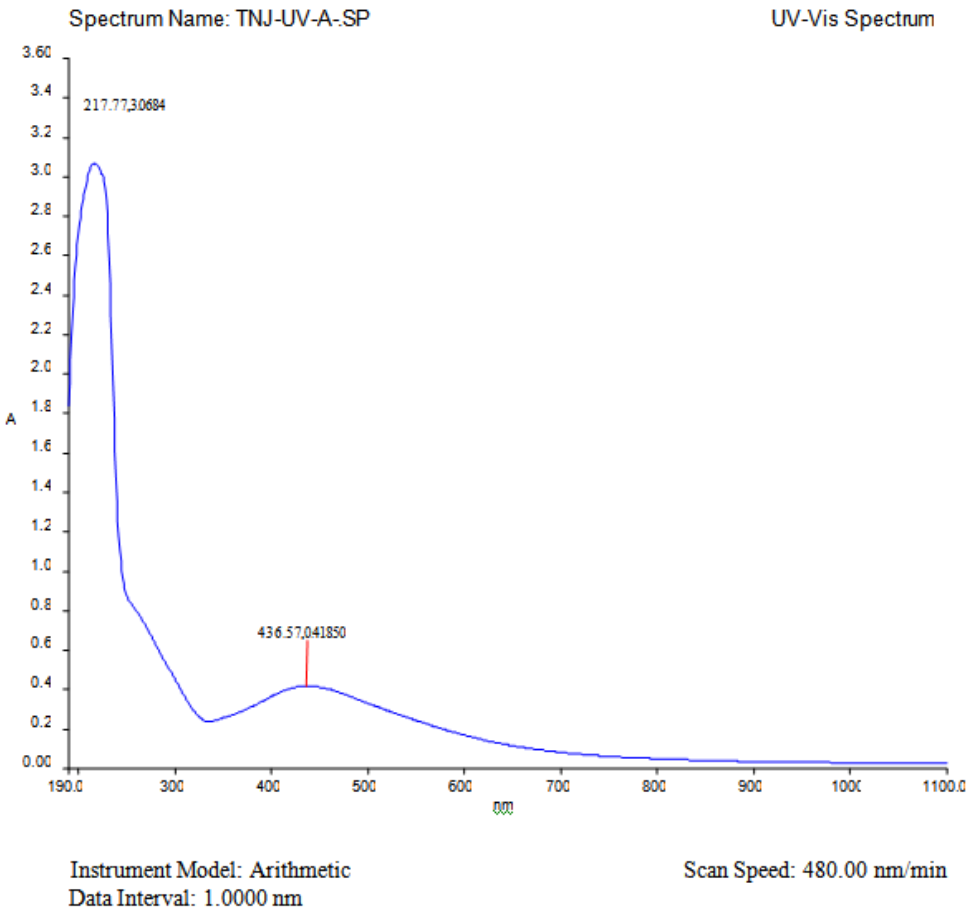

Fig.2 UV spectra of *A.marmelos* containing AgNPs

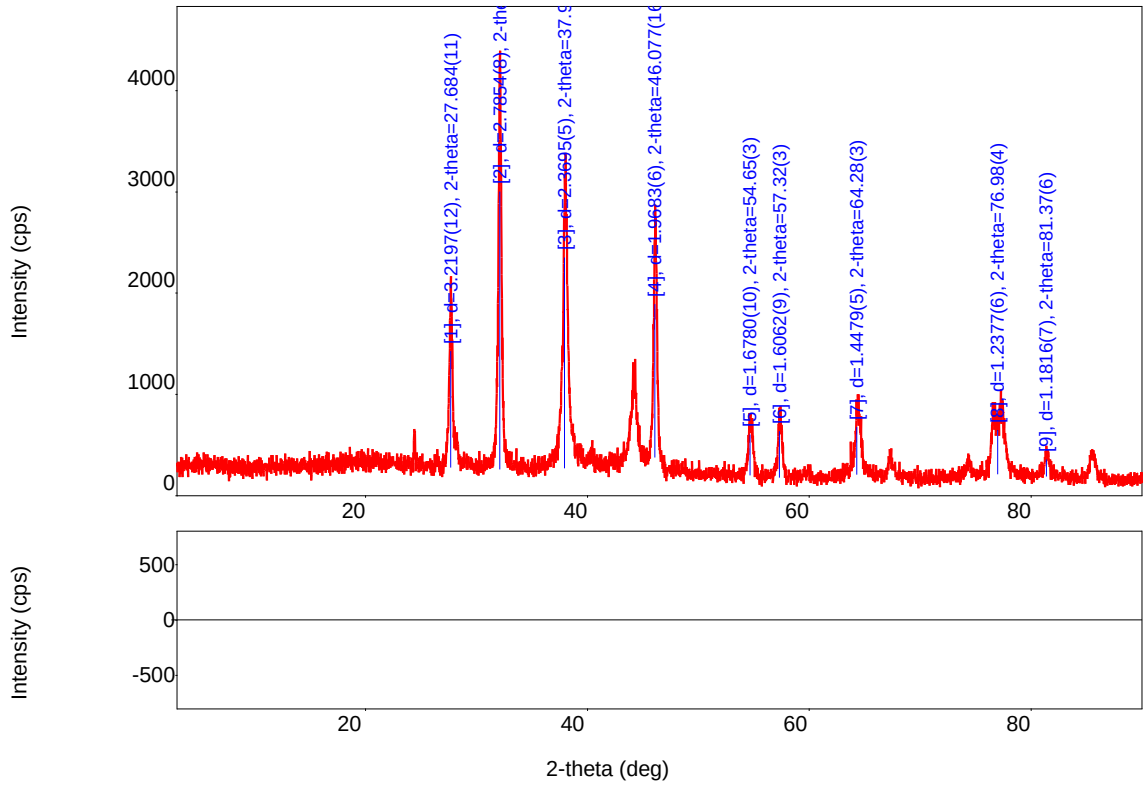

Fig. 3 XRD of silver nanoparticles synthesized using *A.marmelos*

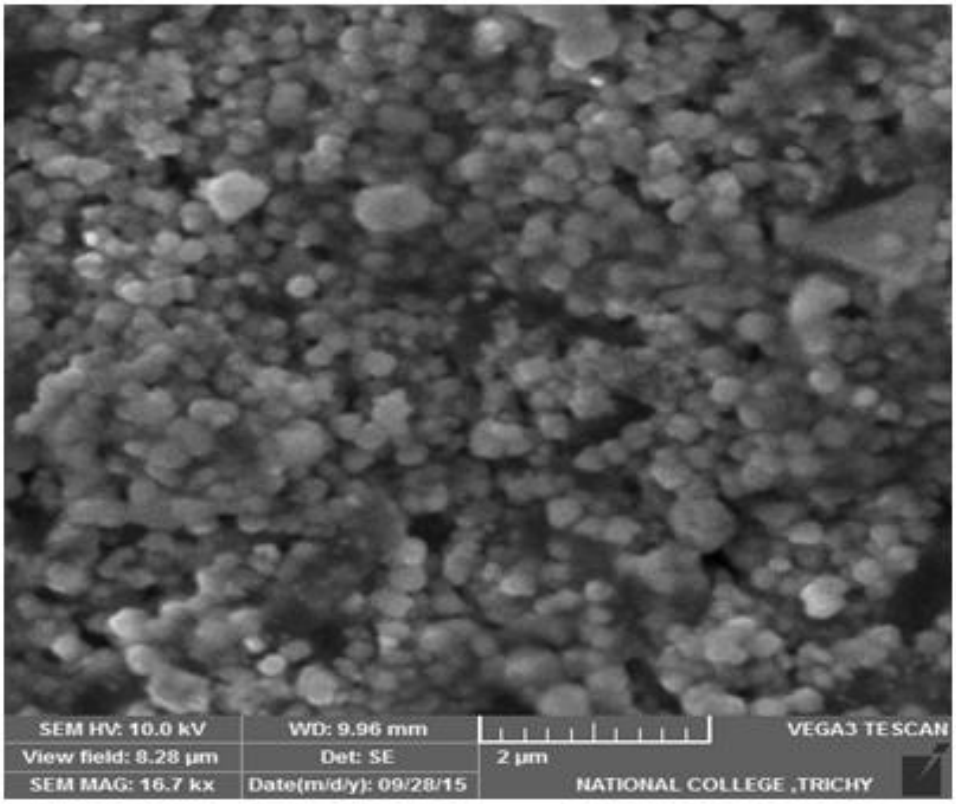

Fig. 4 FESEM image of leaf extract of *A. marmelos*

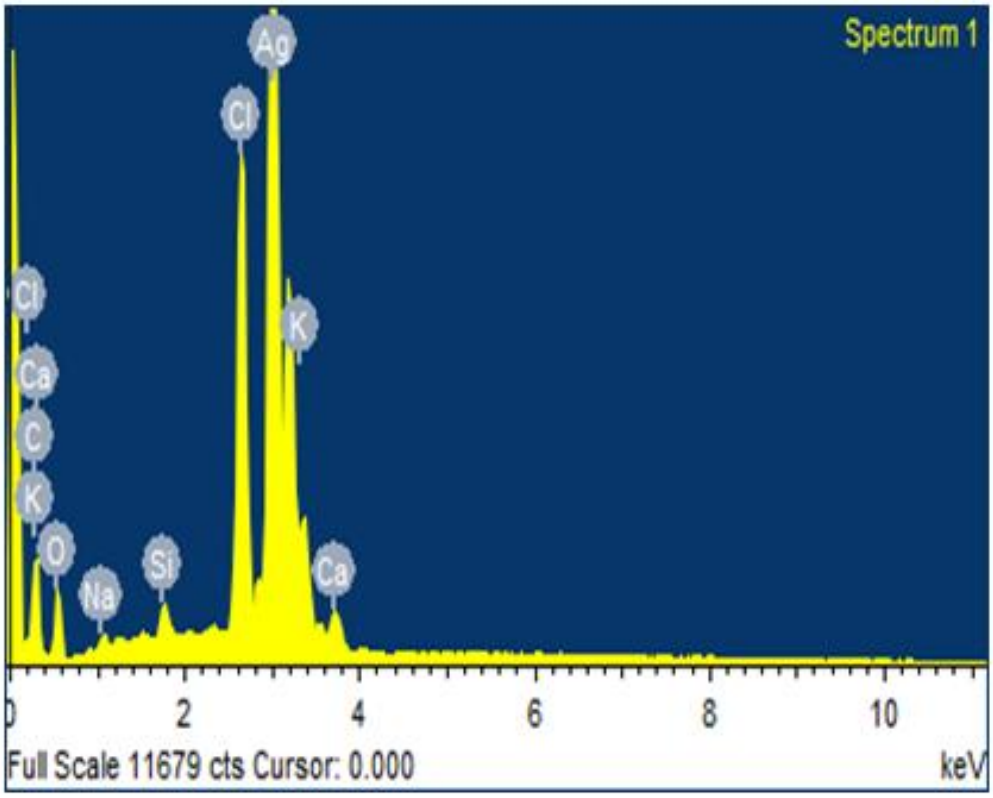

Fig. 5 EDAX profile of silver nanoparticles by *A.marmelos* leaf extract

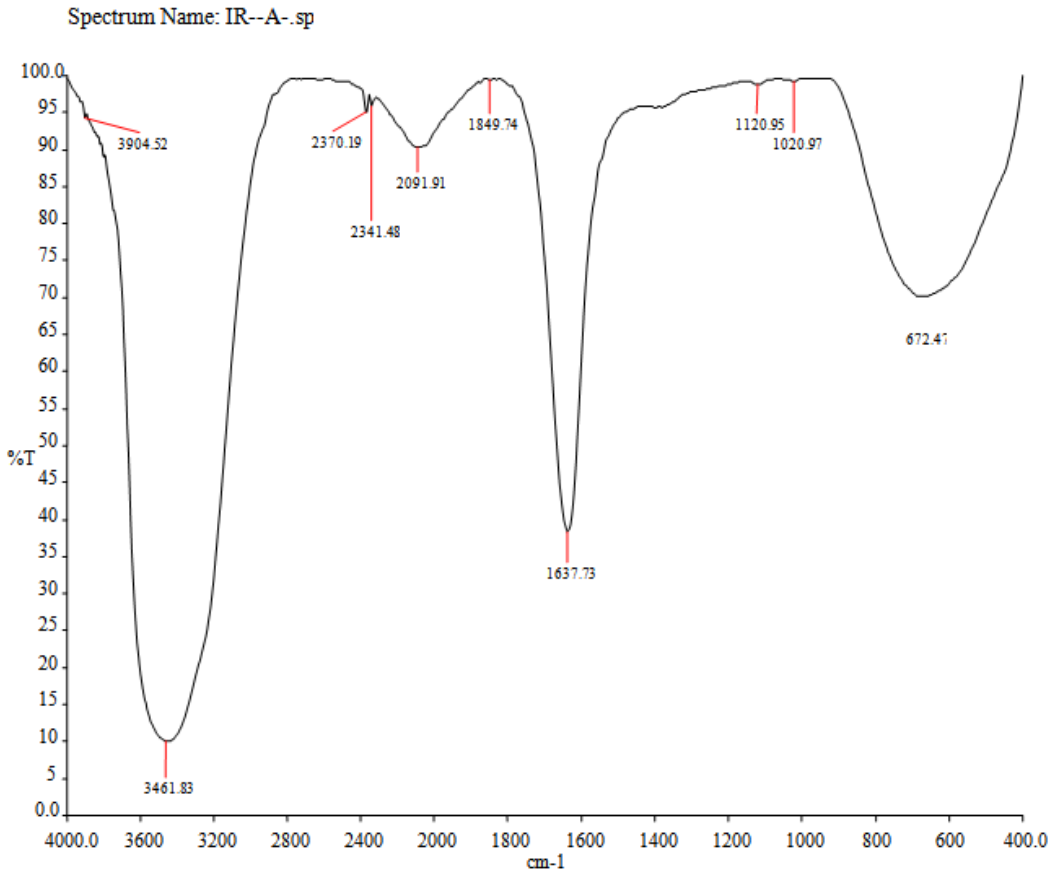

Fig. 6 FTIR spectra of silver nanoparticles AgNPs synthesized using *A.marmelos.*

IV. Discussion

The above results suggest that the surface plasmon resonance bands are strongly influenced by size, shape morphology, composition and dielectric environment of the synthesized nanoparticles [8,9]. Besides these peaks corresponding to the silver nanoparticles the recorded XRD pattern show some other unassigned peaks in the cases Fig. 3.These may be attributed to the formation of crystalline bio-organic compounds. Similar observations are reported [10,11] .SEM results confirm the formation of nanoparticles. EDAX profile confirmed the reduction of silver oxide to silver. The presence of above mentioned bonds which are present in FTIR may be related to the compounds such as flavonoids, alkaloids and terpenoids present in plant leaves. Hence, we can safely presume that these biomolecules are by and large responsible for capping and stabilization [12].

V. Conclusion

The green synthesis of silver nanoparticle using *Aegle marmelos* extract produce nanoparticles of more or less round shape . The characterization from UV-Vis, SEM, EDAX, FTIR render good support to the stability of the biosynthesized nano particles. Nano particles synthesized confirms the biomolecules cubic structure in comparison to JCPDS data. The FTIR confirms the functional groups in the biomolecules which are responsible for capping and stabilization.The nanoparticle research may open up new vistas in pharmaceutical fields due to their application.

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