wjpls, 2020, Vol. 6, Issue 5, 127-131 **Research Article** **ISSN 2454-2229**

World Journal of Pharmaceutical and Life Sciences
WJPLS
www.wjpls.org
SJIF Impact Factor: 6.129

PLANT MEDIATED SYNTHESIS OF SILVER NANOPARTICLES BY USING DRIED STEM POWDER OF *MUNTINGIA CALABURA* L. MEDICINAL PLANT

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Article Received on 15/03/2020 **Article Revised on 05/04/2020** **Article Accepted on 26/04/2020**

ABSTRACT

Muntingia calabura L. a monotypic genus of family Muntingiaceae is used as medicinal herb, by native people for various medicinal purposes. It is commonly known as Kanakshikha in local language. The synthesis of nanoparticles was confirmed by change in colour from pale green to reddish brown further, a peak between 220-330 nm. was obtained on UV-Vis spectrometer which confirmed the biosynthesis of silver nanoparticles. XRD have been used to investigate the morphology of prepared AgNPs. The peaks in XRD pattern are associated with that of face-centered-cubic (FCC) form of metallic silver. FTIR was performed to identify the functional groups of peaks situated at 2277.20 cm^{-1} (C=N bond), 1629.92-1 (C=N bond), 1426.42cm^{-1} (S=O bond), 1315.51cm^{-1} (S=O), 1249.93cm^{-1} (N-O), 1157.34cm^{-1} (NO_2), 1098.51cm^{-1} (C-O), 1052.21cm^{-1} (C-O), 1018.46cm^{-1} (C-N), 959.63cm^{-1}(C-H). Which form a layer covering AgNPs and stabilize the AgNPs in medium.

KEYWORDS: *Muntingia calabura* L. Nanoparticles, Synthesis.

INTRODUCTION

Nanotechnology is an interdisciplinary field and is formed form the convergence of chemistry, physics and biology. To synthesis stable metal nanoparticles with controlled size and shape, there has been search for inexpensive, safe, and reliable and "green" approach. The novel methods so called green/biosynthesis have been recently developed by a variety of plant extract such as *Coriandrum Sativum* (Sathyavathi *et.al.*2010), *Murraya koenigii* (Christensen *et.al.* 2011), *Ocimum Sanctum* (Singhal, *et.al.* 2011), *Petroselinum crispum* (Roy *et.al.* 2015*)* for the synthesis of metal nanoparticles.

Silver nanoparticles synthesized from plant extract results that silver capped with the functional groups present in the active phytoconstituents of the plant extract, acts as antioxidant agents and enhance the biological activity like anticancer effect (Hussen, and Siddiqi, 2014). Green synthesis and antibacterial activity of silver nanoparticles from leaf extract of *Muntingia calabura* (Thirupathaiah *et. al.*2014).

Among the various metal nanoparticles synthesized (such as silver, gold, iron, zinc and platinum), silver nanoparticles have gained more importance in the nanotechnology field. As silver in the nano size is safe inorganic and non-toxic agents and encompasses a wide range of applications such as antibacterial and antifungal effects (Ashok Kumar *et.al.* 2015). Udhaya C (2018) recently studied that biosynthesis of silver nanoparticles using aqueous leaf extract of *Muntingia calabura* L.

MATERIAL AND METHODS

1. Preparation of *Muntingia calabura* L. stem powder

The whole plant *Muntingia calabura* L. was collected locally from Karjat, Dist- Ahmednagar Maharashtra India. The plants were thoroughly washed in distilled water, cut into fine pieces. 10 gm. of fresh plant material was boiled in to 100 ml sterile distilled water and this cooled mixture was centrifuged at 5000 rpm. for 10 min. and collected yellow supernatant. This supernatant used for further experiments.

2. Synthesis of Silver Nanoparticle

1 mg of silver nitrate (Ag No3) was prepared in 1000 ml of beaker (0.1698 g AgNo3) is added to 1000 ml of distilled water. The 100 ml extract were mixed with 900 ml silver nitrate solution and kept under light condition colour change of the solution from white with pale yellow or brown indicated that the silver nanoparticles get synthesized then the solution was centrifuged at 15000 rpm 150 ^{0}c for 15 min. Then the supernatant is collected from the tube and then it is kept for evaporation until fully evaporated collect the pellate which is kept in oven for 1hr. further the synthesized sample was used for characterization.

3. UV-Visible spectroscopy analysis

Synthesized silver nanoparticles was confirmed by sampling the aqueous component of at different time intervals and the absorption maxima was scanned by UV-Visible spectrophotometer at the wavelength of 300 - 700 nm. on UV-Visible spectrophotometer (Perkin Elmer Lambda 25 spectrophotometer), using deionized water as the reference.

4. Fourier transform infrared spectroscopy (FTIR)

A known weight of sample (mg) was taken in mortar and pestle and ground with 2.5 mg of dry potassium bromide. The powder obtained was filled in 2 mm interval diameter micro cup and loaded on FTIR set at 26 ^{0}C ± 1 ^{0}C. The samples were scanned using infrared in range of 4000-500 cm^{-1} using FTIR. The spectrum obtained was compared with reference chart to identify functional groups present in sample.

5. X-Ray diffraction studies (XRD)

XRD is an analytical technique used to determine phase crystallinity of the material. The XRD pattern was obtained by placing the prepared samples on a glass slide and dried under hot air oven at 50 °C. The samples were dried and analyzed under the XRD instrument (PAN analytical, XPERT- PRO diffractometer) with a Cu source at 1.5406 A^{o} wavelength as X - ray source in thin film mode.

RESULTS AND DISCUSSION

1. Synthesis of Silver Nanoparticle

The presence of AgNPs was checked by the following methods. These methods provided the evidence that the reaction between silver nitrate and plant's stem powder was produced Ag NPs. The color reduction of AgNO3 into Nanoparticles was visibly evident from the color change. Stem powder was added into a silver nitrate solution. After 18-24 hrs color was changed into dark brown. This color change indicates the formation of AgNPs. Earlier this type of color change was observed in plant extracts of *Muntingia calabura* L.

Plate 1: *Muntingia calabura* L.

Plate 2: A. Plant stem extract B. Silver Nitrate.

C. Plant extract + silver nitrate colour change (Dark brown)

2. UV-Visible spectroscopy analysis

The UV-VIS absorption spectra of the Ag NPs of *Muntingia calabura* L. were shown in Fig. 1. A peak specific for the synthesis of silver nanoparticles was obtained at 220-330 nm by UV-Visible spectroscope. This is strong evidence for the formation of Ag NPs.

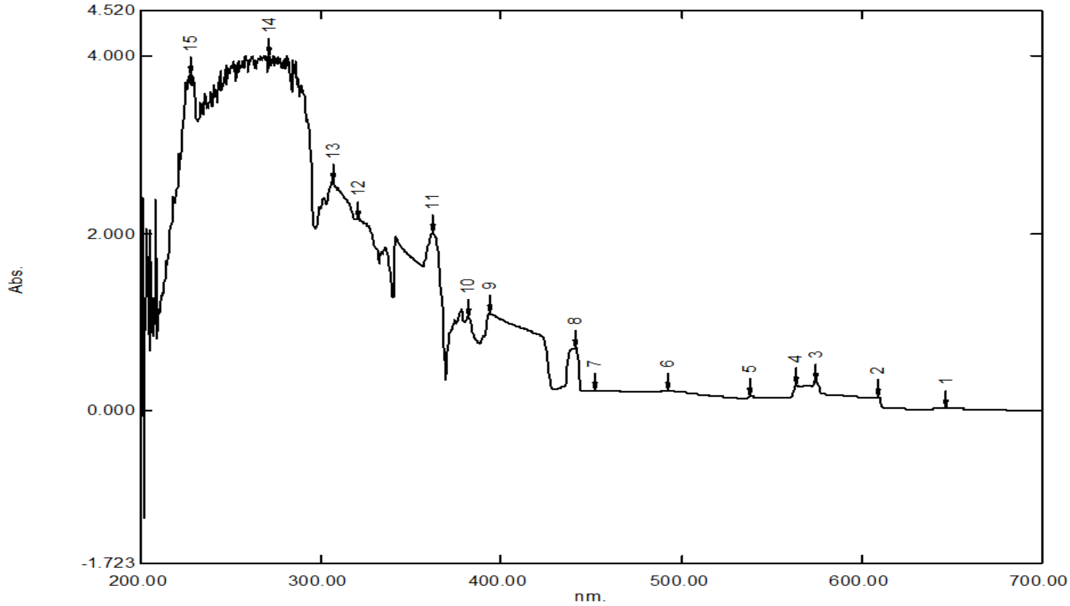

Fig. 1: UV spectra of biosynthesized silver nanoparticles from stem powder of *Muntingia calabura* L.

3. Fourier transform infrared spectroscopy (FTIR)

FTIR spectrum of biosynthesized silver nanoparticles of *Muntingia calabura* L. shown in Fig.2. The observed peaks situated at 2277.20 cm^{-1} (C=N bond), 1629.92-1 (C=N bond), 1426.42cm^{-1} (S=O bond), 1315.51cm^{-1} (S=O), 1249.93cm^{-1} (N-O), 1157.34cm^{-1} (NO_2), 1098.51cm^{-1} (C-O), 1052.21cm^{-1} (C-O), 1018.46cm^{-1} (C-N), 959.63cm^{-1}(C-H).These peaks are known to associated with the -OH, -CH, C=C and C-O.

The peaks, which associated with the specific functional groups which participate in the bio-reduction process of Ag NPs.

The hydroxyl groups of these compounds have a stronger ability to bind silver ions and may be involve in the biosynthesis of Ag NPs and act as reducing agent for the reduction of silver ions (Ag^{+}) to silver Nanoparticles (Ago). The biological molecules such as secondary metabolites may possibly play a major role in the synthesis and stabilization of the metal Nanoparticles. The biological molecules such as secondary metabolites could possibly play a major role in the synthesis and stabilization of the metal Nanoparticles was proved. The functional groups present in the fig.2 are actively participates in the biosynthesis of silver Nanoparticles.

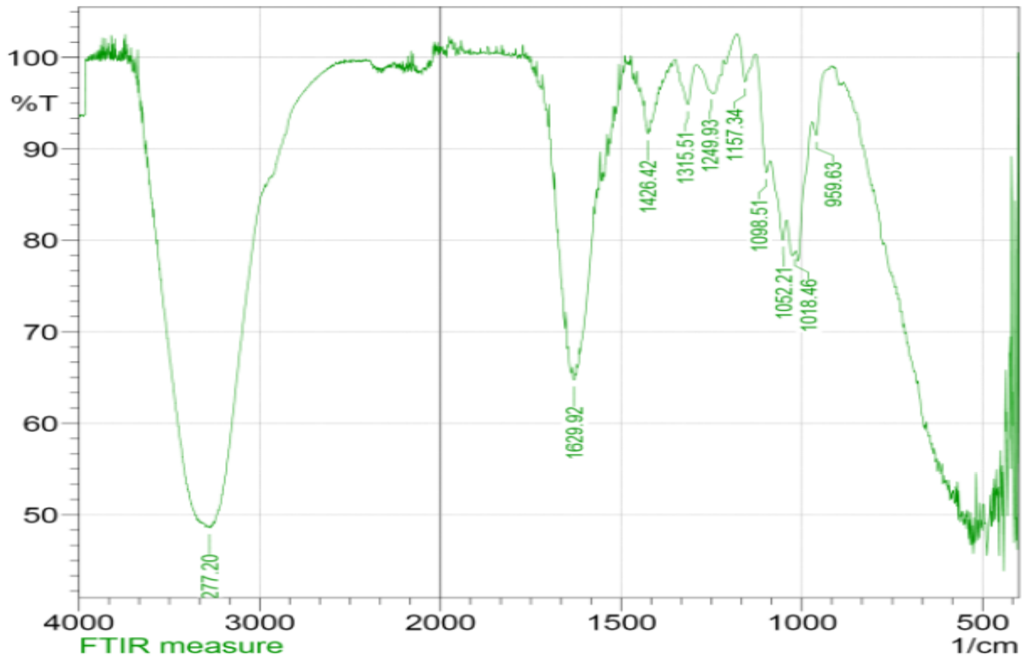

Fig. 2: FTIR spectrum of *Muntingia calabura* L. stem extract.

4. X-RAY Diffraction Analysis (XRD)

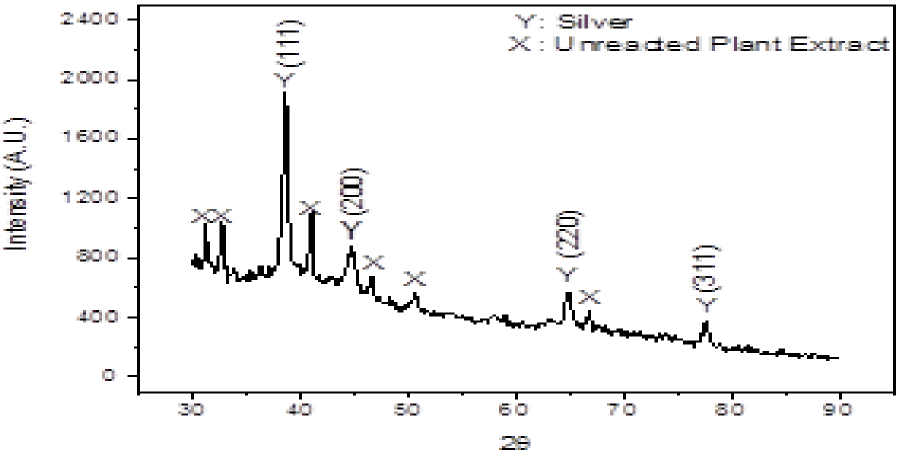

Fig. 3: XRD pattern of AgNPs.

The particle size of the synthesized silver nanoparticles was characterized by XRD analysis. The XRD pattern of synthesized silver nanoparticles of *Muntingia calabura* L. stem is shown in fig. 3. The X ray diffraction shows intense peaks representing 111, 200, 220, 311 face centered cubic structure of silver. Further the XRD pattern was compared with JCPDS software and confirmed the formation of silver nanoparticles. The calculated crystal size of synthesized AgNps is 39.00 nm. which was consistence with earlier reports (Sivkumar *et. al.*, 2018) who has observed in leaf tissues of *Muntingia calabura* L.

SUMMARY AND CONCLUSION

The synthesized Silver nanoparticles using *Muntingia calabura* L. stem extracts were detected by UV-Vis Spectrophotometer. The UV-Vis spectrum of colloidal solution of Silver nanoparticles from *Muntingia calabura* L. has maximum absorbance peak at 220-330 nm, which is proved the synthesis of silver nanoparticles in the colloidal solution. The XRD peaks ascribed with FCC structure of silver. The FT-IR spectrum ascribed the biological molecules which perform dual functions of formation and stabilization of silver nanoparticles in the aqueous medium. So, it can be summarized that, green synthesis is an effective and eco-friendly method of producing metal nanoparticles.

ACKNOWLEDGEMENTS

The authors are grateful to the Principal and Head, Department of Botany, Dada Patil Mahavidyalaya Karjat, Ahmednagar for providing necessary research facilities, encouragement, suggestions and advice throughout the research activities.

REFERENCE

1. Ashok Kumar, S., Ravi, S., Kathiravan, V. and Velmurugan, S. Synthesis of silver nanoparticles using *A. indicum* leaf extract and their antibacterial activity, Spectrochim. Acta A Mol. Biomol. Spectrosc, 2015; 134: 34-39.
2. Christensen, L., Vivekanandhan, S., Misra, M., and Mohanty, A.K. Biosynthesis of silver nanoparticles using *Murraya koenigii* (curry leaf): an investigation on the effect of broth concentration in reduction mechanism and particle size. *Advanced Materials Letters*, 2011; 2(6): 429-434.
3. Hussen, A. and Siddiqi, K.S. Photosynthesize of nanoparticles: Concept, controversy and application, Nanoscale Res. Lett., http://www.nanoscale reslett.com/content/9/1/229, 2014.
4. Iniya Udhaya C Biosynthesis of silver nanoparticles using aqueous leaf extract of *Muntingia calabura* L. *International Journal of Nanobiotechnology*, 2018; 4(1): 1-7.
5. R. Subbaiya, M. Shiyamala, K. Revathi, R. Pushpalatha and M. Masilamani Selvam. Biological Synthesis of Silver Nanoparticles from *Nerium oleander* and its Antibacterial and Antioxidant Property. Int. J. Curr. Microbiol. App. Sci., 2014; 3(1): 83- 87.
6. Roy, K., Sarkar, C.K., and Ghosh, C.K. Plant-mediated synthesis of silver nanoparticles using parsley (*Petroselinum crispum*) leaf extract: spectral analysis of the particles and antibacterial study. *Applied Nanoscience*, 2015; 5(8): 945-951.
7. Sathyavathi, R., Krishna, M.B., Rao, S.V., Saritha, R., and Rao, D.N. Biosynthesis of silver nanoparticles using *Coriandrum sativum* leaf extract and their application in nonlinear optics. *Advanced science letters*, 2010; 3(2): 138-143.
8. Singhal, G., Bhavesh, R., Kasariya, K.., Sharma, A.R., and Singh, R.P. Biosynthesis of silver nanoparticles using *Ocimum sanctum* (Tulsi) leaf extract and screening its antimicrobial activity. *Journal of Nanoparticle Research*, 2011; 13(7): 2981-2988.

9. Srivastava A.A, Kulkarni A.P, Harpale P.M, Zunjarrao R.S, Plant mediated synthesis of silver nanoparticles using a bryophyte *Fissidens minutus* and its anti- microbial activity. *International Journal of Engineering Science and Technology*, 2011; 3(12): 8342-8347.
10. Thirupathaiah A., Peddoju Pranay and Marupati Siddhartha Green synthesis and antibacterial activity of silver nanoparticles from leaf extract of *Muntingia calabura. World Journal of Pharmaceutical Research*, 2014; 3(8): 1265-1273.