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Green synthesis and characterization of silver Nano particles of *Murdannia sahyadrica* (Commelinaceae)

Kowsalya Devi V, Rajendran Arumugam*
Phytodiversity Research Laboratory, Department of Botany, Bharathiar University, Coimbatore, Tamil Nadu, India

Abstract
Objective: The Biological synthesis of silver nanoparticles has become one of the new ways in nanotechnology, especially from medicinal plants and also commercial applications.
Methods: In the present study, syntheses of silver nanoparticles were carried out on *Murdannia sahyadrica* (Commelinaceae) plant parts such as leaf, stem and flowers. The occurrence of silver nanoparticles are synthesized and characterized by UV visible spectrum and FESEM study.
Results: These silver nanoparticles showed various absorptions peaks from 220-420 nm. The morphology of silver nanoparticles were scanned by under FESEM and suggested that it showed spherical and agglomerated shapes with various diameters.
Conclusion: This method is rapid, simple and could be commercial significant.

Keywords: silver nanoparticles, murdannia sahyadrica, FESEM study

Introduction
Nanoparticles are very small ultra-five smaller particles with structure less than one hundred nanometers or it could be compared with smaller than the cell organelles (or) macromolecules with specific physicochemical properties. Apart from several nanoparticles available, silver nanoparticles are synthesized from several chemical and physical methods [1]. Besides, green chemistry principles have been used as alterative non-toxic materials/sources for the synthesis of nanoparticles from hazardous solvents, reducing agents and stabilizers [2]. In recent times, microorganisms, marine organisms, protein and phytoconstituents were employed for the synthesis of silver nanoparticles because of their biological compatibility [3, 4]. In the plant extracts water soluble flavonoids, alkaloids and polyphenol have strong reducing properties and could be very easily adsorbed on the suitable of nanoparticles. These phenolic compounds from plants have antioxidant properties and they can enable to act as reductant and singlet oxygen gathers. These are found in vegetables, fruits, oil seeds, herbs and even roots of several plant sources [5]. AgNps are now-a-days are used in field of electronic and sensing devise, coating materials, data pacing and molecular switches [6-8]. Besides, nanoparticles used in diagnosis and to overcome various diseases, especially as antimicrobial activates against infectious diseases [9]. Also these are used in medical field as coating product for catheters [10] contact lenses [11] and other medical devices used in bone cement surgical mask, textile fabrics, nanogels, nanolotions etc., [12, 13].
In the present scenario, several new potential sources of phytomolecules are employed for the synthesis of silver nanoparticles which includes *Jatropha curcas* of Euphorbiaceae, *Aloe vera* (Agavaceae), *Acalypha india* of Euphorbiaceae, *Garcinia mangostana* leaf extracts as reducing agents. The silver nanoparticles are also synthesized from *Musa sp*., *Azadiracta indica* (Neem) and *Osimum teuniflorum* (Tulasi) through microwave irradiation method [14-16].

Materials and Methods
For this study, all the chemicals and reagents were procured from sigma Aldrich chemical company, Bangaluru, India and kept under refrigeration at 4ºC till use. The medicinal plant, *Murdannia sahyadrica* of Commelinaceae family was collected from Walayar, Palakkad district, Kerala state, India. It was identified by Dr. A. Rajendran, Professor and Head, Department of Botany, Bharathiar University, Coimbatore, India. A Voucher specimen (BU Bot/ H/ 1512) was deposited at the herbarium maintained by Department of Botany, Bharathiar University, Coimbatore, India.

Preparation of the extracts
Leaf, stem and flower of *M. sahyadrica* plant was separately collected freshly in its habitats and rinsed first with tap water followed by double distilled water (Freshly collected) and removed all dust particles. The plant parts leaf, stem and flowers were separately cut into small pieces and kept for drying at room. 10 g of each part ware weighted separately and put into 100 ml standard flask with 50 ml double distilled water and then boiled for 10-

15 mints gently. Now, all the three leaf, stem and flower extracts of *M. sahyadrica* was filtered in whatman number 1 filter paper and removed all the debris and got a clear filtrate. These filtrates were separately collected in a small 50 ml standard flask. All these filtrates were separately kept at 4º C till further use.

Synthesis of silver nanoparticles

Aqueous extracts of leaf, stem and flower of *M. sahyadrica* was prepared in a flask in a required quantity each and kept separately. In another standard 50 ml flask, 1 mg of silver nitrate was dissolved in double distilled water as above. After this, 10 ml of each part of extract was mixed with 90 ml of 0.2 mm silver nitrate aqueous solution and all the solution in a dark room for 24 hours to synthesize AgNps. Here, a prominent colour transformation was found to appear from green to brown that assumed the occurrence of silver nanoparticles in the all three extracts of *M. sahyadrica* plant. From this experiment, silver nanoparticles were characterized in all three samples of *M. sahyadrica* by UV- visible spectrums. Here, 1 ml of extract containing silver nanoparticles were taken in a curette for UV- visible spectroscopy and scanned at the regions of UV 200 nm to 700 nm with double distilled water as standard. [17]. Further, there three samples were employed for the determination of shape and size of the nanoparticles by SEM at 200 KV voltage and all there nanoparticles were kept on copper grids and coated with carbon (or) gold palladium.

Results

The synthesis of silver nanoparticles were carried out in various parts of *M. sahyadrica* leaf, stem and flower extracts. After the incubation period of eight hours, the plant extracts were mixed with silver nitrate as aqueous solution. Later it was confirmed that silver nanoparticles were formed by the reduction of silver ions because of leaf, stem and flower of *M. sahyadrica* plant extract. After incubation period all there samples were characterized under UV- visible spectroscopy ranges from 200-600 nm. The nanoparticles of leaf sample (A) has found to show at 320 nm absorption and decreased with increased nanometer. In this spectra, the silver nanoparticles has exhibited an absorption up to 1.2 (220 nm) and maximum at 320 nm level. The stem sample the nanoparticles has absorbed at 1.5 (420 nm) and the flower nanoparticle sample has shown at 1.2 (420 nm) respectively. All these bands were directly related to the presence of more reactant (or) electron-rich phytomolecules in the reduction mixture which a few additional peaks also have exhibited at 220,280 and 320 in the these nanoparticle samples of *M. sahyadrica* plant. These peaks are exhibited due to the phytomolecules found on the surface of silver nanoparticles as stabilizing spectra of plant extract colours (Plate I). These leaf, stem and flower extracts after the reduction process were centrifuged at 12,000 rpm for 15 minutes and dried pellets were employed for scanning under FESEM (Field Emission Scanning Electron Microscope at 10 KV).

The silver nanoparticles are formed by the reduction of silver ions due to biomolecules of *M. sahyadrica* leaf, stem and flower extracts. These nanoparticles were detected UV- visible spectroscopy at various nanometers from 200 to 600 nm. These particles were increasingly sharp absorbance maximum peak at 320 nm leaf and it was found to be decreased with nanometers increased. The same trend was found in stem at 420 nm and flower at 420 nm respectively.

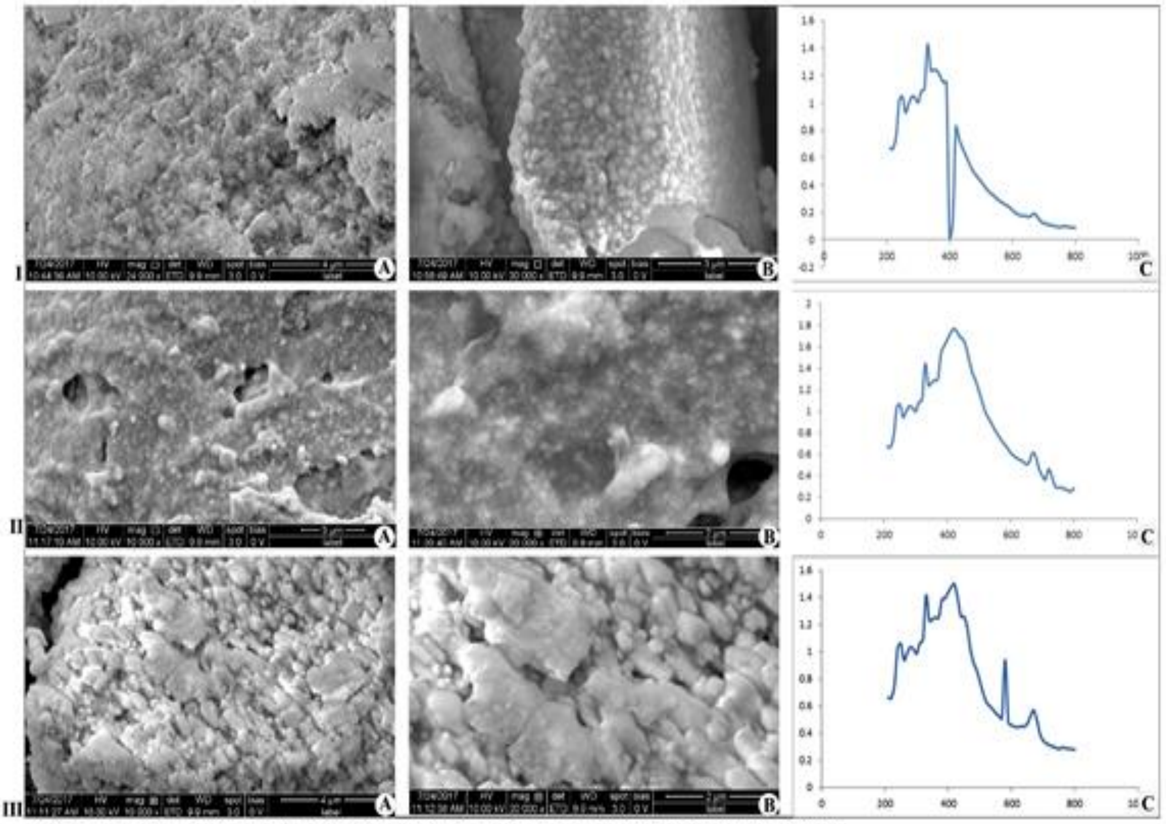
FESEM study

FESEM analyzed the silver nanoparticles were coated on gold palladium grids. The Field Emission Scanning Electron Microscope Photographs were revealed the occurrence of spherical shaped and agglomerated morphology of silver nanoparticles in the leaf extract synthesized particles. In AgNps synthesized from stem extract has shown mostly smaller spherical nanoparticles and nanoparticles synthesized from flower extracts were exhibited irregular shaped, combination of sphere, cube-like and rod-shaped shutter (Plate-1). The magnifications of AgNps were represented in the respective micrographs itself.

Discussion

The Eco-friendly synthesis of silver nanoparticles were confirmed in different parts of *M. sahyadrica* leaf, stem and flower extracts. The reduction of Ag^+ was also revealed from the UV-visible spectroscopic analysis. It was learnt that all biological molecules absorb ultraviolet (or) visible radiation of light based on the frequency of light passed through the samples as per Beer's law. In this study, appearance of silver nanoparticles are defected easily by spectroscopy due to the colored nanoparticles in all there parts of *M. sahyadrica* plant extract. The silver ions were reduced to silver and it was confirmed by transformation in the colour of the reaction mixture from brown to dark brown and no transformation of colour was found to be occurrence in the absence of plant extracts of *M. sahyadrica* leaf, stem and flower parts (or) it could be noted in control sample. The appearance of silver nanoparticles in the plant extracts were confirmed by UV-viable spectroscopyical study and measured after 24-48 hours. The present study also in accordance with the synthesis of nanoparticles from organism unglues extracts as a bio reducing agent by Shaik *et al.*, [18]. They also reported the occurrence of crystalline cubic nature of AgNps and stabilized the surface of the AgNps by acting as a capping agent. The synthesis of nanoparticles from green chemistry (or) green methods were effective for biological uses rather than chemical methods and green synthesis could be exploited for commercial nanoparticles [19]. The formation of spherical silver nanoparticles were also synthesized from fruit extract of *Syzygium cumini* [20]. *Erythrina indica* root extract formed the spherical silver nanoparticles with 20 to 118 nm size [21]. The temperature and concentration of the plant extracts were played an important role in the formation of silver nanoparticles. It was evidenced that the formation of silver nanoparticles. It was evidenced that the size of the nanoparticles and the rats of reaction mixture were found to be higher at the room temperature [22, 23]. It was suggested that a broad of UV absorption at higher walls length was shown an increased in nanoparticles size and a narrow line at lower wave length show to be smaller the nanoparticle size. A literature survey has shown that when the concentration of plant extract increased the size and distribution of nanoparticles could be affected [24]. The size and morphology of nanoparticles were studied by FESEM analysis. In this study the spherical shaped, agglomerated, irregular, combination of sphere, cube-like and rod-shaped nanoparticles were formed in the plant extracts of *M. sahyadrica*. The appearance of their various size and shapes were previously reported during the synthesis of nanoparticles [18, 25].

The AgNps were more inhibited the fungal strains with report to zone of inhibitions. Shaik *et al.*, [18] have reported that the AgNps prepared from *Origanum vulare* has exhibited antimicrobial activity depending on the concentration of the plant extract which was used for the synthesis of AgNps. In another study, the AgNps prepared from *Policaria glutinasa* was found to exhibited antibacterial activity and acted as a green bio-reductant [22] and root extract of *Erythrina indica* [21]. It is evident that the occurrence of phytochemicals (or) phytomolecules was responsible for the antimicrobial activity. These molecules could have acted as reducing and as well as stabilizing agents. It could be also due to the solubility of the extracts that enhanced the entry of nanoparticles into the bacterial cell wall and caused the cell mitosis cell cycle and cell necrosis (or) death [18]. In this study, silver nanoparticles prepared from carious parts *M. sahyadrica* extracts is underway to find out its antimicrobial activity.



Group I - Leaf : A - Low mangnification (24000 X), B - High mangnification (30000 X), C - 320nm.
Group II - Stem : A - Low mangnification (24000 X), B - High mangnification (30000 X), C - 420nm.
Group III - Flower : A - Low mangnification (24000 X), B - High mangnification (30000 X), C - 420nm.

Plate 1: UV and FESEM image of the AgNPs synthesized using *M. sahyadrica* leaf, stem and flower extract.

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