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Biogenic Synthesis and Characterization of Silver nanoparticles using the aqueous extract of Lavandula angustifolia

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Abstract

Nanobiotechnology has transformed the scientific world due to its tremendous applications in medicine, energy, food, environmental science, and biomedical engineering. Nanoparticles manufactured through physical and chemical methods are toxic, time-consuming, and takes a lot of time. The novel and easy methods for nanoparticle production are the green syntheses using plant extracts. Due to the presence of different secondary metabolites like alkaloids, phenols and terpenes which act as capping as well as reducing agents. The green synthesis is cost-effective, non-hazardous and environmentally safer and more over one-step approach. In the present study, we have used easy, facile, non-hazardous and green synthesis for the bio-synthesis of AgNPs by using aqueous extract of L.angustifolia. Different techniques were carried out in order to characterize the AgNPs like UV-Visible spectroscopy analysis and Environmental scanning electron microscopy (ESEM).From the results of UV-Vis spectra it was found that AgNPs showed the characteristic peak at 417nm.Further,from the ESEM analysis the AgNPs were found to be cuboidal and spherical in shape with an average size ranges from 30 to 85nm.Overall the results showed the easy, cost-effective, and eco-friendly method for silver nanoparticles from Lavandula angustifolia leaf extract which could be used as an alternative method against physical and chemical synthesis

.Key words: Nanobiotechnology, plant extracts, Silver nanoparticles, phytochemicals, SEM

INTRODUCTION

Over the last years, the field of nanotechnology has been increasingly rising in the different branches in science like agriculture, industry, medicine and information technology [1].Nanotechnology involves the creation of materials at nano-scale with size ranges from 1 to 100 nm [2]. The physical and chemical synthesis of nanoparticles has many drawbacks as they are hazardous, generate a lot of chemicals in the environment, and costly. To avoid toxicity biogenic synthesis of nanoparticles using plant extract is safer alternative over the

physical and chemical methods. AgNPs have gained much attention due to their multiple applications like antibacterial, antifungal, and wound healing [3]. The advantage by using plant extracts for AgNPs production is that they are free of toxic chemicals, easy to handle and contain many secondary metabolites which acts as novel reservoir for bioreduction of silver nanoparticles. Thus the biosynthesis of silver nanoparticles provides an alternative to reduce excess toxic and hazardous effects of the physical and chemicals synthesis of silver nanoparticles [4]. There are several studies reported on the plant-mediated synthesis of AgNPs such as *Plukenetia Volubilis* [5], *Salvadora persica* stem [6], *Aerva lanta* [7], *Rubus glaucus* [8], *Olea chrysophylla*, and *Lavandula denta* [9].

Lavender (*Lavanduala angustifolia*) belonging to the family of *Lamiaceae*, and native to the Mediterranean region. It is also known by several other names as true lavender or common lavender. It has antibacterial, antioxidant, and anxiolytic properties and is used to manufacture perfumes [10].Here in this study; we have synthesis the novel and biogenic AgNPs by exploiting the aqueous extract of *L.angustifolia*, followed by characterization via different techniques like UV-Visible spectroscopy and ESEM.

MATERIALS AND METHODS

Preparation of aqueous extract

The *Lavandula angustifolia* plant material was obtained from the department of botany Kashmir University. The plant was properly identified and authenticated in the Taxonomy department of Botany, University of Kashmir. The leaves were surface washed first with tap water followed by double distilled water. The leaves were kept in shade for about 10 days and grounded in a fine powder using a mortar pestle and taken to the Biomedical Department Sathyabama University, Chennai for further analysis.

Biosynthesis of AgNPs

10 grams of *L.angustifolia* dried powder were added to 100ml of double distilled water and kept for boiling for some time at 50ºC.The extract were filtered by using whatmans no.1 filter paper. About 30 ml of lavender aqueous extract were taken in flask and added with 3.0Mm AgNO3.The solution were heated at 40ºC and continuously stirred for some time. The production of dark brown color from pale yellow aqueous extract confirmed the biosynthesis of AgNPs.

Characterization of AgNPs

The AgNPs were initially analyzed by using UV-Vis spectroscopy (Shimadzu UV-1800) between the UV ranges of 300 to 800nm The Environmental Scanning Electron microscopy (ESEM) model (FEI Quanta 200) was used to determine the morphology and size of AgNPs.

RESULTS AND DISCUSSION

The formation of AgNPs using aqueous extract of *L.angustifolia* was monitored in the gradual color change of the extract from pale yellow to complete dark brown as shown in Fig. 1.The bioreduction of AgNO3 into AgNPs was due to the presence of phytochemicals present in the leaf extract of *L.angustifoia* The similar change in color was also observed in previously published work [11].

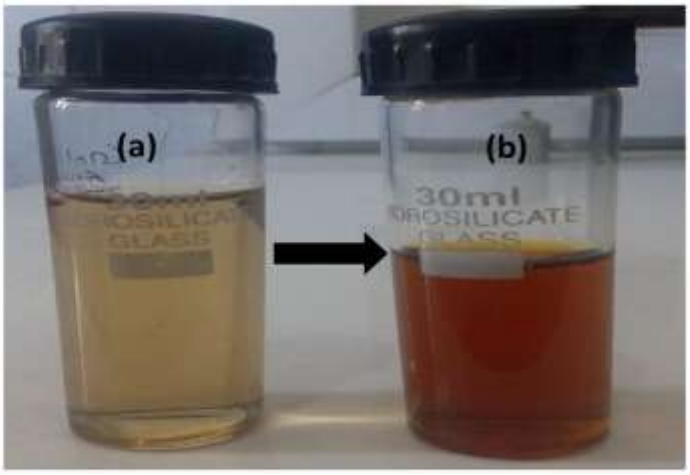

Figure.1 showing the absorption spectrum of AgNPs synthesized from aqueous extract of *L.angustifolia* (a) aqueous extract (b) AgNPs

Followed by change in color, the UV-Visible spectroscopy analysis of AgNPs was done and the absorbance was measured in the UV range from 300 to 800nm.The presence of peak at 417 from UV-Vis spectroscopy as shown in Fig.2.The peak was observed due to Surface Plasmon Resonance (SPR) of AgNPs. The similar results were well accordance with previously reported work in which AgNPs showed SPR peak at 420nm which confirms the biosynthesis of AgNPs [12].

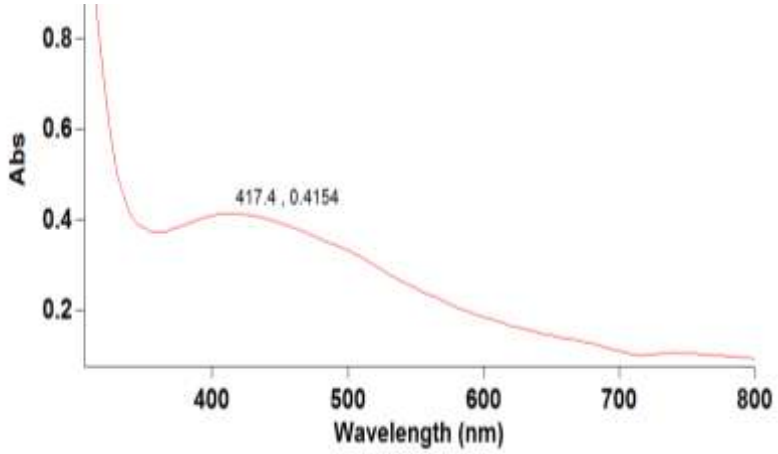

Fig.2 shows the UV-Visible spectroscopic analysis of AgNPs synthesized from aqueous extract of *L.angustifolia*

From the ESEM analysis it was observed that the AgNPs were spherical and cuboidal in shape and the average particle size were in the range of 20 to 85nm shown in Fig.3.

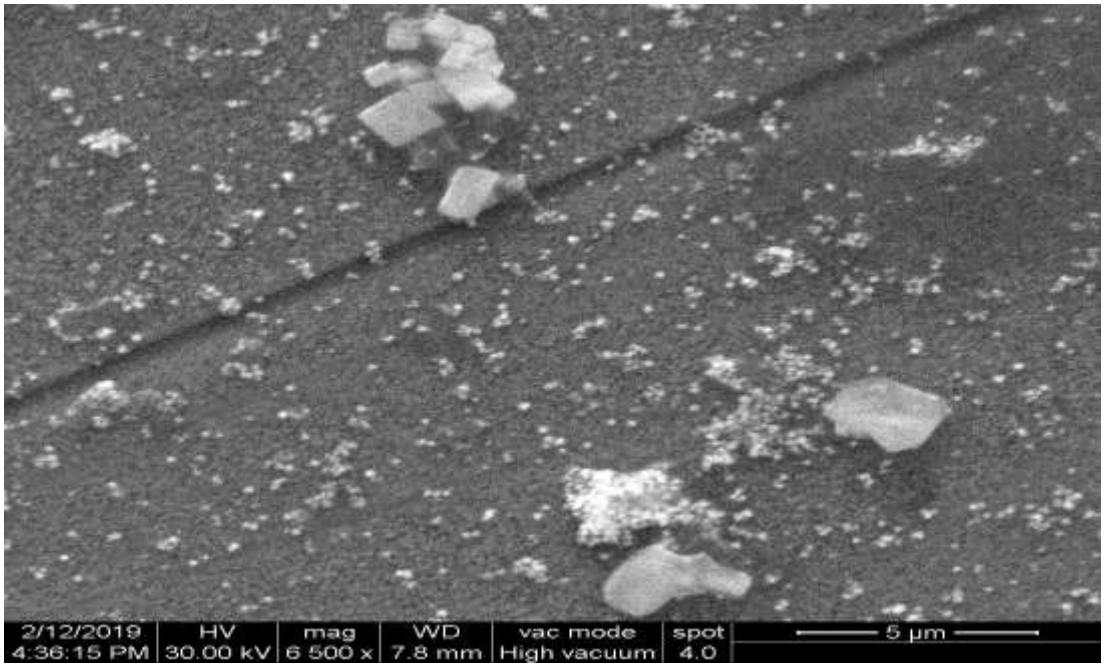

Fig.3 SEM images of AgNPs

CONCLUSION

AgNPs was successfully produced by used the *L.angustifolia* aqueous extract, by the reduction of 3.0mM silver nitrate. It was observed that the AgNPs produced from the green synthesized were dark brown in color. From the UV-Visible spectroscopy it was observed the nanoparticles showed maximum absorption peak at 417nm.Further from the ESEM analysis the AgNPs were cuboidal and spherical in shape with an average size ranging from 30 to 85nm .It is evident that the green synthesis of nanoparticles using plant extracts is an eco-friendly, cost effective and one step approach in comparison to non-greener synthesis.

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