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PRODUCTION OF BIOGENIC SILVER NANOPARTICLES USING *BOSWELLIA OVALIFOLIOLATA* STEM BARK

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The synthesis, characterization and application of biologically synthesized nanomaterials have become an important branch of nanotechnology. In this paper, we report the synthesis of highly dispersed silver nanoparticles using a dried stem bark of *Boswellia ovalifoliolata* (An endemic plant) extract as the reducing agent. After exposing the silver ions to bark extract, rapid reduction of silver ions is observed leading to the formation of silver nanoparticles in solution. UV–VIS spectrum of the aqueous medium containing silver nanoparticles showed absorption peak at around 430 nm. Scanning electron microscopy (SEM) micrograph analysis of the silver nanoparticles indicated that they were well-dispersed and ranged in size 30-40nm. The most needed outcome of this work will be the development of value-added products from Boswellia *ovalifoliolata* for biomedical and nanotechnology based industries.

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1. Introduction

Nanoparticles, generally considered as particles with a size of up to 100 nm, exhibit completely new or improved properties as compared to the larger particles of the bulk material that they are composed of based on specific characteristics such as size, distribution, and morphology [1]. Nanoparticles of noble metals, such as gold, silver, and platinum, are widely applied in products that directly come in contact with the human body, such as shampoos, soaps, detergent, shoes, cosmetic products, and toothpaste, besides medical and pharmaceutical applications. Therefore, there is a growing need to develop environmentally friendly processes for nanoparticle synthesis without using toxic chemicals. Biological methods for nanoparticle synthesis using microorganisms, enzymes, and plants or plant extracts have been suggested as possible ecofriendly alternatives to chemical and physical methods [2]. There have been recent reports on phytosynthesis of silver and gold nanoparticles by employing coriander leaves [3], sundried *Cinnamomum camphora* leaves [4], phyllanthin extract [5], and purified apiin compound extracted from henna leaves [6].

Boswellia ovalifoliolata Bal & Henry is a narrow endemic, endangered and threatened medicinal tree species. It is deciduous medium sized tree belongs to the family *Burseraceae*. This tree harbours on Tirumala hills of Seshachalam hill range of Eastern Ghats of India. The plant is used by tribals like Nakkala, Sugali and Chenchu and indigenous community to treat number of aliments. The plant is over exploited for its medicinal uses; Specially the stem bark is used to

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reduce rheumatic pains [7,8]. Stem bark decoction is given orally to reduce the pains. Equal mixture of Gum & Stem bark one tea spoon full given daily with sour milk an empty stomach for a month to cure stomach ulcers [8]. Although this plant is considered as undesirable plant, but to the best of our knowledge we are the first to report its use in synthesizing silver nanoparticles, which can provide a new platform to this plant making it a value added tree for nanotechnology based medicine in future.

2. Materials and methods

Plant material and Synthesis of silver nanoparticles

Boswellia ovalifoliolata stem barks were collected from Tirumala hills, Andrapradesh state, India. The stem bark were air dried for 10 days then bark were kept in the hot air oven at 60^0c for 24-48 hrs. The barks were ground to a fine powder. 1 mM silver nitrate was added to plant extract to make up a final solution 200 ml and centrifuged at 18.000 rpm for 25 min.The collected pellet stored at -4^0c.The supernatant was heated at 50^0c to 95^0c.A change in the color of solution was observed during the heating process.

UV-VIS Spectra analysis

The reduction of pure Ag+ ions was monitored by measuring the UV-Vis spectrum of the reaction medium at 5 hours after diluting a small aliquot of the sample into distilled water. UV-Vis spectral analysis was done by using UV-VIS spectrophotometer UV-2450 (Shimadzu).

SEM analysis of silver nanoparticles

Scanning Electron Microscopic (SEM) analysis was done using Hitachi S-4500 SEM machine. Thin films of the sample were prepared on a carbon coated copper grid by just dropping a very small amount of the sample on the grid, extra solution was removed using a blotting paper and then the film on the SEM grid were allowed to dry by putting it under a mercury lamp for 5 min.

EDAX measurements

In order to carry out EDAX analysis, the bark extracts reduced silver nanoparticles were dried and drop coated on to carbon film and performed on Hitachi S-3400 N SEM instrument equipped with a Thermo EDAX attachments.

3. Results and discussion

Reduction of silver ion into silver particles during exposure to the plant extracts could be followed by color change. Silver nanoparticle exhibit dark yellowish – brown color in aqueous solution due to the surface Plasmon resonance phenomenon (Fig.1). The result obtained in this investigation is very interesting in terms of identification of potential forest plant for synthesizing the silver nanoparticles. UV-Vis spectrograph of the colloidal solution of silver nanoparticles has been recorded as a function of time. Absorption spectra of silver nanoparticles formed in the reaction media at 10 min. has absorbance peak at 430 nm, broadening of peak indicated that the particles are polydispersed (Fig.2). From EDAX spectrum, it is clear that *Boswellia ovalifoliolata* has recorded weight percent (39.88 %) of nanoparticle followed. The SEM image showed relatively spherical shape nanoparticle formed with diameter range 30-40 (Fig.3). Similar phenomenon was reported by Chandran et al.[9]

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(a) (b) (c)

Fig.1a: Boswellia ovalifoliolata, b: Colour change of bark extract containing silver before and after synthesis of silver nanoparticles.c: Stem bark.

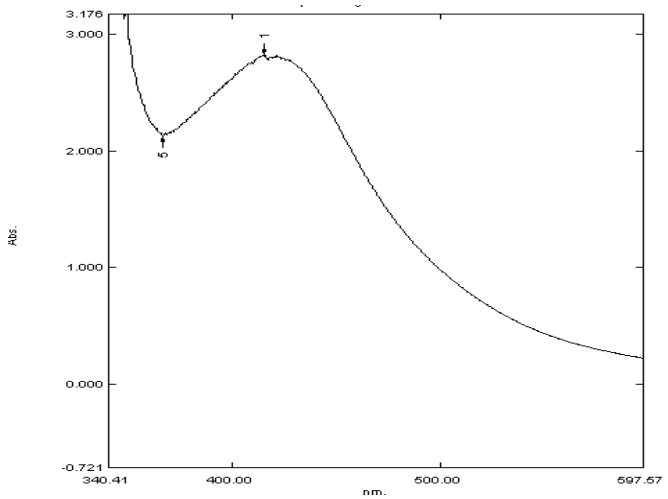

Fig. 2.UV-VIS absorbtion spectra of silver nanoparticle synthesized from Boswellia ovalifoliolata stem bark at 1mM silver nitrate.

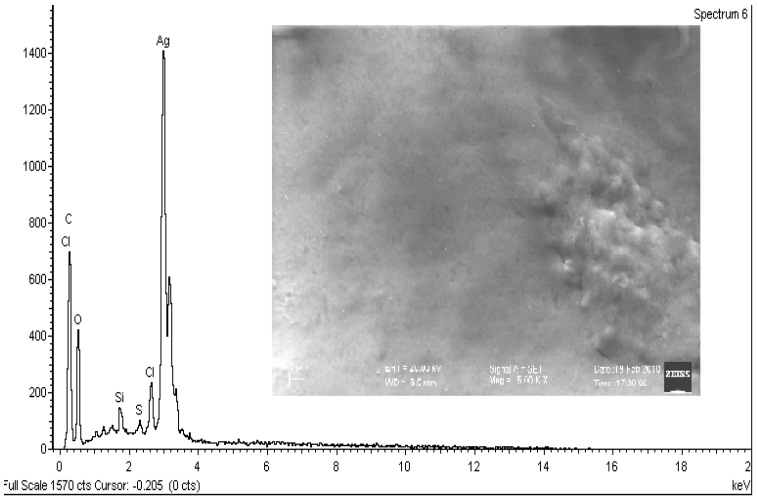

Fig.3.EDAX and SEM image of silver nanoparticles formed by Boswellia ovalifoliolata bark

4. Conclusions

The bio-reduction of aqueous Ag+ ions by the stem bark extract of the plant *Boswellia ovalifoliolata* has been demonstrated. The reduction of the metal ions through bark extracts leading to the formation of silver nanoparticles of fairly well-defined dimensions. This green chemistry approach toward the synthesis of silver nanoparticles has many advantages such as, ease with which the process can be scaled up, economic viability, etc. Applications of such eco-friendly nanoparticles in bactericidal, wound healing and other medical and electronic applications, makes this method potentially exciting for the large-scale synthesis of other inorganic materials (nanomaterials). The antimicrobial studies of *Boswellia ovalifoliolata* mediated synthesized silver nanoparticles are under investigation.

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