EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 8
Issue: 7
349-351
Year: 2021

GREEN SYNTHESIS OF SILVER NANOPARTICLES BY USING CEIBA PENTANDRA AQUEOUS LEAF EXTRACT

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Article Received on 30/04/2021 **Article Revised on 19/05/2021** **Article Accepted on 08/06/2021**

ABSTRACT
Secondary metabolites and inherent healing properties of plants have long been recognized. They are used to treat a variety of infectious diseases due to the active compounds found in them. Plant-mediated synthesis of silver nanoparticles has been established in response to the growing demand for nanoparticles and their applications. Silver nanoparticles have been shown to have useful biomedical properties. The Study of silver nanoparticles synthesized from the aqueous leaf extract of *Ceiba pentandra* was carried out in this paper using an environmentally friendly process, and it was characterized using UV-visible spectroscopy and SEM analysis. *Ceiba pentandra* is well-known for its high antimicrobial content. UV light with a wavelength of 260 to 400 nm was observed, and the rate of absorption was measured. The Green synthesis of the nanoparticles proves to be non-hazardous as the leaf extract acts as both reducing and capping agent without the usage of chemicals. The Synthesized nanoparticles can be used for further biomedical applications.

KEYWORD: Silver nanoparticles, Green synthesis, Medicinal plant, Plant extract.

I. INTRODUCTION
Nanotechnology seems to take over day-to-day life in these recent years.[1] and their applications are used in medical and biological applications and for research purposes.[2] Due to the emerging need for environmentally friendly plant-based products, researchers started focusing on Nanotechnology. It provides various advantages in the field of medicine and biological applications. Silver has long been regarded as a disinfectant, and its nanoparticle forms allow it to be used in a variety of applications ranging from medicine to food.[3] Silver nanoparticles can be synthesized by both physical and chemical methods, but they are hazardous and use lots of chemicals during the synthesis which may cause biological risks and may shield the biomedical applications. To develop an environmentally friendly product, Green synthesis has been developed. Plant extracts are easily available, non-toxic, secure with various metabolites which aid in silver ion reduction.[4] The demand for natural plant-based products has been increased due to their curing properties.

Ceiba pentandra exhibits many medicinal properties. It shows inhibitory effects on many bacterial and fungal species. The leaves show high antimicrobial and analgesic properties. The phytochemical constituents present in the plant are alkaloids, flavonoids, glycosides, carbohydrates, tannins, saponins, and steroids.[5]

This study was drafted simply with cost-effective and environmentally friendly methods of synthesis of silver nanoparticles using the aqueous leaf extracts of *Ceiba pentandra* which acts as a reducing and capping agent. The synthesized silver nanoparticles can be further studied for their properties.

II. MATERIALS AND METHODS
A. Preparation of leaf extract
Ceiba pentandra leaves were washed thoroughly with tap water to remove the dust particles. The extract of the leaf was prepared by finely chopping 20 g of thoroughly washed leaves. In a 500ml Erylenmeyer flask, the chopped leaves were combined with 100 ml distilled water and stirred for 1 hour at 60℃. After cooling, the mixture was filtered.

B. Synthesis of silver nanoparticles
Silver nanoparticles was synthesized by following the method.[6] From the prepared leaf extract 5 ml of the extract was taken along with that 45 mM of $AgNo_3$ in a conical flask and then left for the bioreduction process. It was kept at 30℃ in dark condition.

C. Characterization studies

UV visible spectroscopy

Ultraviolet-Visible spectra of prepared sample was viewed in range between 260-400 nm. The sample was deposited on clean glass substrate using screen printing technique. It shows optical absorbance spectrum of as prepared film at 100℃.

SEM Analysis

The Surface morphology and shape of the nanoparticles were examined using Field Emission Scanning Electron Microscopy (FESEM; Hitachi SU6600, Japan).

III. RESULTS AND DISCUSSION

The Leaf extract showed a colour change which indicated the reduction of silver nitrate solution into silver nanoparticles. It was due to the active biological compounds present in the leaf extract which aided in the reduction of silver ions.

The Stability and the absorption rate of silver nanoparticles were studied by using UV-vis spectroscopy. It was observed in the range of 260 to 400 nm. Fig no 1 shows the absorption rate which steadily increases without any deviation in its range. It was due to the formation of stable silver nanoparticles. SEM images shows clear spherical images of the nanoparticles formed. It was observed in two magnifications. More

stable silver nanoparticles were observed as shown in fig 2. Their size ranges between 2 µm and 20 µm. Many particles were predominantly spherical in shape and some were aggregates. It was due to the presence of secondary metabolites in the leaf extract. Similar results were reported by using *Euphorbia hirta*.[7] and *Coleus aromaticus*.[8]

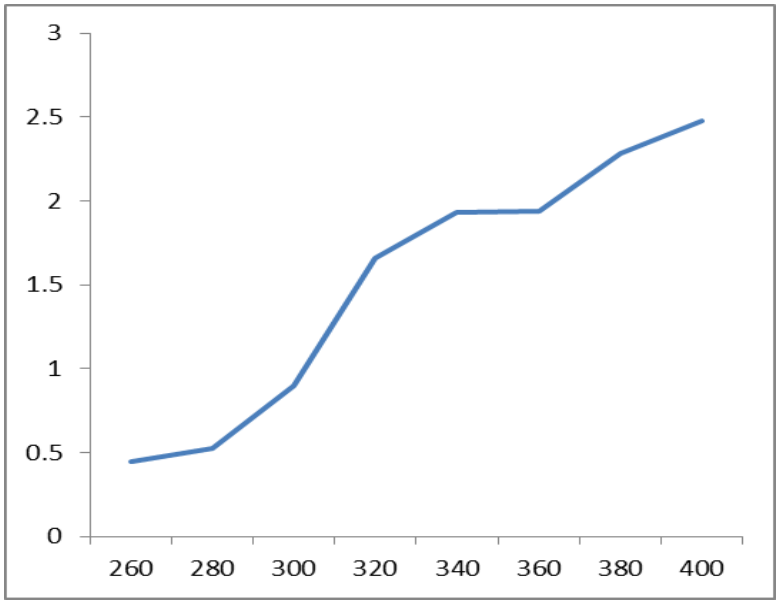

Fig no. 1: UV-vis absorption rate of the nanoparticles.

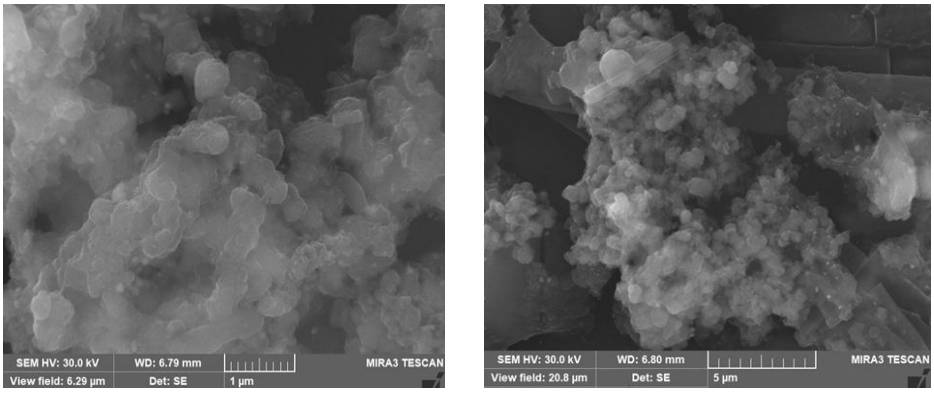

Fig no. 2: SEM images of the nanoparticles in two magnifications.

III. CONCLUSION

The Green synthesis of silver nanoparticles by using the leaf extract of *Ceiba pentandra* was a fast process with less time consumption. It is an environmentally friendly and convenient method as no harmful chemicals were involved. Silver nanoparticles formed were stable and was achieved within 12 hours. It was characterized by UV-vis spectroscopy and SEM analysis. The Leaf extract

played a major role in the reduction of silver ions by acting as both reducing and capping agent. This economically friendly can be applied for nanoparticles synthesis which forms less harmful and large sized nanoparticles. Biomedicine and other medical instruments are an important aspect of silver nanoparticles for which this green chemistry method would be more effective.

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