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Hemigraphiscolorata Leaf Extract Mediated Green Synthesis and Characterization of Silver Nanoparticles

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ABSTRACT

One of the major developments in nanotechnology is the creation of environmentally acceptable methods for the production of nanoparticles. In the field of study known as nanotechnology, materials are designed at the atomic level to produce specific properties that can be modified for specific applications. Silver nanoparticles differ from other metal nanoparticles because of their unique physical, chemical and biological properties. Green chemistry is an alternative to the methods of synthesizing nanoparticles to overcome their limitations. The use of plants in the synthesis of nanoparticles is the most appropriate green method due to the abundance of biological species found in plants that act not only as degradants but also as healers. In the process of making silver nanoparticles, plant components such as alkaloids, carbohydrates, lipids, enzymes, flavonoids, terpenoids and polyphenols are used to reduce agents. In this study, Hemigrphiscolorata leaf extract was used for the first time to reduce 1 mM silver nitrate solution to silver nanoparticles. This method is very simple, economical and practical. Aggregation of nanoparticles was confirmed by visual observation where the colorless solution turned into a brown solution. Further characterization was done using UV-visible spectroscopy, XRD, FTIR analysis, SEM.

1. Introduction

Because of their potential, metal nanoparticles have found wide application in a variety of industrial and medical applications, including drug delivery, cancer treatment, wastewater treatment, and DNA analysis. It has also been used in the production of solar energy, catalysis, and as a biological agent and antimicrobial agent. Nanoparticles are the focus of research in many fields because of their unique size, shape and properties. Significant changes in the quality of a product are achieved by manipulating its size and shape. Copper and gold are two nanoparticles that are of particular interest in their properties and applications. Silver nanoparticles (AgNO3) have come to the attention of many researchers due to their use in industry and medicine. Other nanoparticles include nickel, iron oxide, silicon oxide, platinum and gold. However, antibacterial activity has not been demonstrated in experiments with Escherichia coli. The existence of many biological substances in plants has led to the use of some plant parts, even all plants in the green production of AgNO3. Plant extracts have been used successfully for this purpose. In our research, the wound healing property of Hemigraphiscolorata plays an important role in the treatment and healing of wounds. According to our research, the ability of Hemigraphiscolorata to heal and heal wounds is important. Indians use different types of herbs medicinally to treat diseases. These types of drugs are known as phytomedicines or plant medicines. In this article we will get to know the characteristics of Hemigraphiscolorata, one of the many types of herbaceous plants. The Hemigraphiscolorata plant is often planted for ornamental purposes. It is native to Southeast Asia and the Upper Cascades of North Queensland, originating from the tropical regions of the Malay Archipelago. Hemigraphiscolorata has the following characteristics. This plant grows between 15 and 30 cm. A plant with purple leaves and seeds, it is a plant used to treat prostate problems. The flowers are small and the leaves are gray-green in color. The flowers are white and the five ribs are beautiful. It looks like an arrow. Hemigraphiscolorata has the following herbal medicinal benefits: It is often used to treat bleeding wounds, cuts and inflammations. It is used orally to treat ulcers, hemorrhoids, diuretics, stones, anemia and diabetes.

2. Materials and Methods

From Trichy, we purchased silver nitrate (AgNO3) and Whatman no. 1 filter paper. Fresh Hemigraphiscolorata leaves were gathered from the garden in Perambalur, Tamil Nadu, India. A Trichy laboratory provided the double-distilled water. The other substances that were utilized in this experiment were all of analytical variety.

Figure 1: Hemigraphisc olorata

2.1 Preparation of plant extract

Hemigraphiscolorata leaves are clean and in good shape when picked and washed in lukewarm water to remove any dirt or contamination. It takes four weeks to dry at room temperature in the shade with the leaves. The dried leaves are finely ground. After boiling for 20 minutes, 10 g of the powder was mixed with 100 ml of double-distilled water. Whatman No. filter paper was used. Then, for use in subsequent experiments, these plant extracts were stored in a refrigerator at 40°C.

2.2 Synthesis of Silver Nanoparticles

It was mixed with 100 ml double distilled water and 1 mM silver nitrate (AgNO3). Fresh plant extracts were mixed with aqueous AgNO3 in 100 ml volume and rapidly stirred at 600 °C for one hour. Due to the formation of silver nanoparticles, the water change color and takes on a brown color. AgNO3 is reduced to Ag + ions in this case. To get more information about the characteristics of dark brown sediment, was analyzed and investigated.

2.3 Characterization of synthesized Ag Nanoparticles

Several experimental methods are available to characterize nanoparticles. Using SEM, the shape, structure and chemistry of silver nanoparticles were investigated. FTIR and UV-Vis spectral analysis were used to investigate the optical properties of silver nanoparticles.

3. Measurements

3.1UV-Visible spectrum Analysis

The absorption spectrum in the visible-UV range is known as visible-ultraviolet spectroscopy (Perkin-Elmer lambda) or visible-ultraviolet spectroscopy (UV-Vis).

3.2 Fourier Transform Infrared Spectroscopy Analysis

FTIR spectra of Hemigraphiscolorata extract, silver nanoparticles and silver nanoparticles used with amine were recorded using FTIR spectrophotometer.

3.3 Scanning Electron Microscopy Analysis

A SEM machine CAREL ZEISS-EVO 18 was used for scanning electron microscopy (SEM). A thin layer of the sample was made by simply dropping a very small amount of the sample onto a carbon coated copper grid. The excess solution was removed and the film was dried on a SEM copper grid under a mercury lamp for five minutes.

3.4 XRD Analysis

The solution containing silver nanoparticles was centrifuged at 2000 g for 15 minutes. The pellet was washed three or four times with 25 ml of distilled water. Using an X-ray diffractometer, after studying the composition of the resulting silver nanoparticles, the XRD patterns of the silver nitrate powder were recorded.

4. Results and Discussion

4.1. UV-Vis Analysis

The aqueous extract of Hemigraphiscolorata leaves was used to study the green synthesis of silver particles made from silver nanoparticles (Ag NO3). UV-vis spectrophotometer results showed the formation of silver nitrate nanoparticles. The silver nanoparticles were subjected to UV-Vis spectral analysis in the 250-450 nm range. The peak at 423 nm was observed because the electrons in the core of the silver nanoparticles are transferred between the bands. The wavelength values for absorption are in good agreement with the reported calculations.

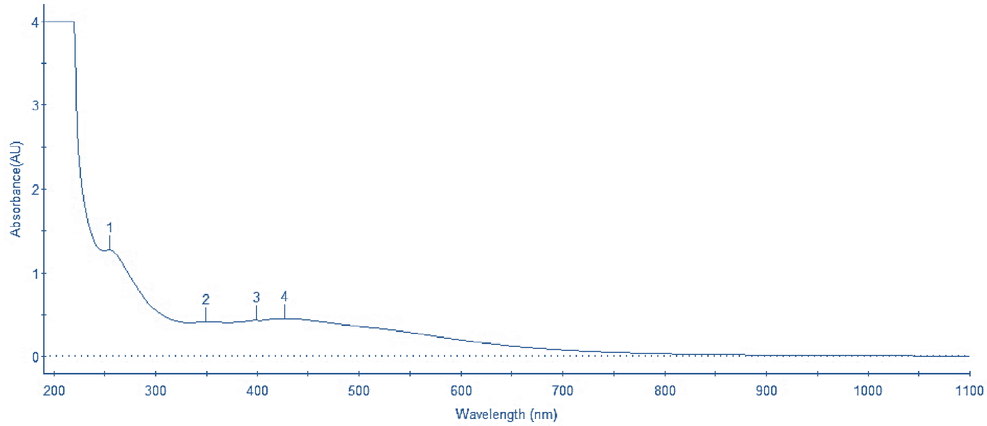

Figure 2.UV-vis spectrum of AgNP$_S$ using *Hemigraphiscolorata* leaf extract

4.2. FTIR Analysis

The FT-IR pattern was taken from 800 to 4000. The bands in the FTIR analysis were found at 3405.38 cm-1, 2923.78 cm-1, 2853.08 cm-1, 1740.65 cm-1, 1628.13 cm -1, 1.4-1 cm-1, 1.4-1 cm cm-1, 6.249. 1384.12 cm-1, 1160.88 cm-1, 1113.26 cm-1, 1052.88 cm-1 and 825.31 cm-1. The O-H stretching of the alcohol group is seen by the peaks at 3405.38 cm-1 (intermolecular H). The stretching of CH alkane group is shown by 2923.78 cm-1. The CH stretching of the alkane group is 2853.08 cm-1. The C-O stretch of the aldehyde group is at 1740.65 cm-1.The alkene group has a length of 1628.13 cm-1 and the aromatic group has a length of 1496.42 cm-1. The bending of the alkane-CH group is measured at 1384.12 cm-1. The C-O stretching alcohol group was found to be 1160.88. The stretching of the C-O alcohol group is indicated by 1113.26 cm-1. The CH stretch of the alkene group was measured at 1052.88 cm-1. 825.31 cm-1 corresponding to the C-O stretching alcohol group.

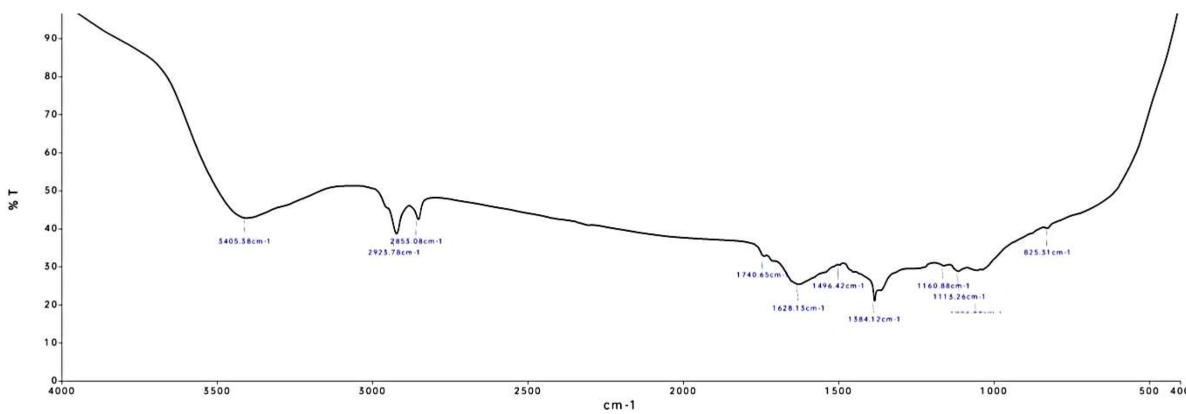

Figure 3.FT-IR spectrum of AgNP$_S$ using *Hemigraphiscolorata* leaf extract

4.3. Scanning Electron Microscopy (SEM)

Scanning electron microscopy was used to examine the morphology of the resulting silver nanoparticles. The presence of small and uniform spherical nanoparticles has been confirmed by SEM imaging. The size of the nanoparticles is usually between 70 and 90 nm. The type of plant extract determines the concentration of silver nanoparticles. The size of the nanoparticles decreased with increasing concentration of the plant extract. The average particlesize of the produced AgNps, determined by SEM imaging, was 63.25 nm.

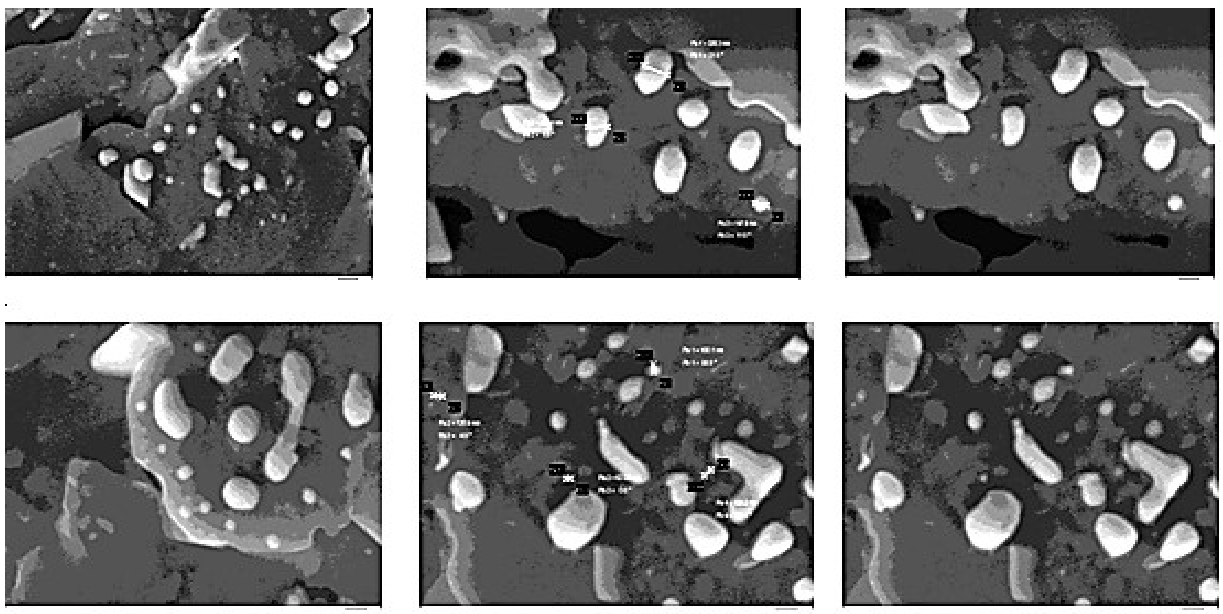

Figure 4. The typical SEM images of $AgNP_S$ of *Hemigraphiscolorata* leaf

4.4 XRD Analysis

XRD analysis confirmed that the samples were metallic silver nanoparticles with cubic crystal structure (FCC) (FCC) (FCC) (FCC) (FCC) (JCPDS NO.04-0783). , (311) in series. The upper peaks of the analysis show a strong silver compound with a signal. As a result, XRD shows that the silver nanoparticles are crystalline, and it is clear from the angle that the complex is stable.

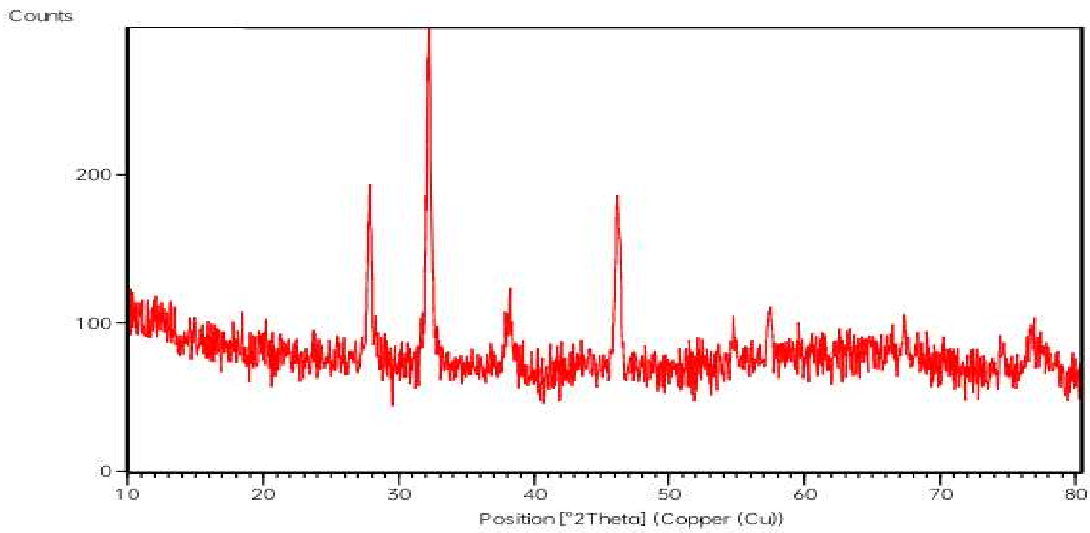

Figure 5. XRD pattern of $AgNP_S$ synthesized using supernatant of *Hemigraphiscolorata* leaf

5. Conclusion

The ecologically inviting, naturally secure, and straightforward green union of silver nanoparticles and commonsense green approach for making AgNPS nanoparticles from silver Nanoparticles in an watery extricate of Hemigraphiscolorata takes off at room temperature. In arrange to form silver nanoparticles; Hemigraphiscolorata is explored as a economical green chemical. In substance, the antioxidant and silver particle lessening capacities of its phenolic components depend on them. The generation of Ag NPs was affirmed by the UV-visible absorbance and reflectance spectra, which appeared max of 427 nm. The nearness of capping operators on the surface of Ag NPs was affirmed by FTIR spectra. The XRD design are range bolstered the crystalline nature and composition of Ag NPs. The SEM of the Ag NPs with all possible shapes, such as round, triangular, hexagonal, and round and hollow shapes, with an normal molecule estimate of 63.25nm, gave adequate confirmation of their nanomorphology. In outline, plant extricate may deliver Hemigraphiscolorata ecologically friendly and green Ag nanoparticles employing a direct, cheap, and fruitful prepare.

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