Short Communication

Biological synthesis of silver nanoparticles by *Lantana camara* leaf extracts

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**Abstract**

In the present investigation, we report the extracellular biological synthesis of silver nanoparticles (AgNP’s) using plant leaf extracts (*Lantana camara*) for the reduction of aqueous Ag⁺ ions. Stable silver nanoparticles were formed by treating aqueous solution of AgNO₃ with the plant leaf extracts as reducing agent of Ag⁺ to Ag⁰. The formation of yellowish brown colour, confirmed the synthesized silver nanoparticles and UV-visible spectroscopy was used to monitor the quantitative formation of silver nanoparticles. The size and shape of the nanoparticles was characterized by SEM (Scanning Electron Microscopy). This environmental friendly method provides simple, easy and cost effective faster synthesis of nanoparticles than chemical methods and can be used in several areas such as food, medical applications etc.

**Key words:** Biosynthesis, AgNP’s, Plant extracts, UV-visible spectroscopy, SEM (Scanning Electron Microscopy)

**Introduction**

Nanoparticles are being viewed as fundamental building blocks of nanotechnology. The development of biologically inspired experimental process for synthesis of nanoparticles is evolving into an important branch of nanotechnology [1,2]. Biologically synthesized silver nanoparticles could have many applications: they might be used as spectrally-selective coatings for solar energy absorption and intercalation material for electrical batteries; they also find use as optical receptors and as catalysts in chemical reactions [3].

Nanoparticles of Free metals have been extensively researched because of their unique physical properties, chemical reactivity and potential applications in catalysis, biological labelling, bio sensing, drug delivery, antibacterial activity, antiviral activity, detection of genetic disorders, gene therapy and DNA sequencing [4]. The antibacterial activities of silver nanoparticles are related to their size, with the smaller particles having higher activities on the basis of equivalent silver mass content. Concerning the biological application of nanoparticles it has been emphasized that methods of synthesis through biological systems viz, microorganisms including bacteria, yeasts, fungi and diatoms synthesizing inorganic materials either intra or extracellularly would make the nanoparticles more biocompatible. There are different Plant extracts have been used and reported for synthesis of gold, silver and bimetallic nanoparticles [5].

In the present study, *lantana camera* leaf extract was used as reducing agent of silver nitrate into silver nanoparticles. Since, this plant is easily available in all the regions in India as an ornamental plant, it was selected for this study and also no study has been conducted using this plant extract for the synthesis of silver nanoparticles. The synthesized nanoparticles were confirmed, appearance of yellowish brown colour and characterized by UV-Visible spectroscopy. The size of nanoparticles observed by SEM (Scanning Electron Microscope).
Methods and Material

Jae Yong Song & Beom Soo Kim (2008) method was used with some modification for the synthesis of nanoparticles [6].

Collection of plant leaves and preparation of extracts

*Lantana camara* plant leaves were collected from university campus itself and dried for 2 days at room temperature. The plant leaf broth solution was prepared by taking 5 g of thoroughly washed and finely cut leaves in a 250 mL Erlenmeyer flask with 100 mL of sterile distilled water and then boiling the mixture for 5 min before finally decanting it. They were stored at 4°C and used within a week.

Biosynthesis of silver nanoparticles

Two test tubes were taken, in the first test tube 1mL of leaf broth was added with 9 mL of 1mM aqueous AgNO₃ solution for reduction of Ag⁺ ions and no leaf broth was added to the second test tubes and it considered as control. Both tubes were kept at room temperature on shaker for 24 hrs. After the incubation period the silver nanoparticle solution thus obtained was purified by repeated centrifugation at 15,000 rpm for 20 min followed by redispersion of the pellet in deionized water.

Characterization

UV-vis spectra were recorded as a function of reaction time on a Perkin Elmer- Lamda 25. After freeze drying of the purified silver particles, the size and shape were analyzed by scanning electron microscopy (JOEL- Model 6390).

Result and Discussion

In the present study, *Lantana camara* leaf extract were used as reducing agent for the synthesis of silver nanoparticles. It is well known that silver nanoparticles exhibit yellowish brown color in aqueous solution due to excitation of surface plasmon vibrations in silver nanoparticles [7]. Fig.1 shows reduction of the silver ion to silver nanoparticles during exposure to the plant leaf extracts could be followed by color change and thus UV-visible spectroscopy.

![Fig.1 1mM AgNO₃ solution before adding extract (Lantana camara) (control), after adding extract to the solution (Test).](image1)

![Fig.2 UV- Vis spectra recorded after adding Plant Leaf Extract (Lantana camara) to Silver Nitrate aqueous solution](image2)

![Fig.3 Shows SEM Micrographs of silver nanoparticles synthesized by lantana camara leaf extracts](image3)
Further characterization was done by SEM. The SEM micrograph of the dry mass shown in figure. 3 showed silver nanoparticles of size approximately about 39.60nm.

Conclusion

In this study, Lantana camara extracts have been used as a reducing agent for the synthesis of silver nitrate into silver nanoparticles. Since, this plant is easily growing and available in all over regions in India as an ornamental plant; it is selected for the present study. Here, synthesized silver nanoparticles are confirmed from the yellowish brown color formation and monitored quantitatively by UV-Vis spectroscopy. The SEM result showed the approximately size of nanoparticles about 39.60 nm. This is the first report of synthesizing silver nanoparticles using Lantana camera leaf extract.

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References


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