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Green Synthesis Of Ag Nanoparticles Using Leaf Extract Of Sansevieria Laurentii

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ABSTRACT: In the present work, we have used a readily available plant Sansevieria Laurentii (SL) leaf extract for the biosynthesis of Ag nanoparticles. By ensuring their specific absorptions in FT-IR spectral analysis silver nanoparticles, the functional behavior of flavones, triterpenoids, and polyphenols found in Sansevieria Laurentii has been discovered. A color shift and UV-Vis spectroscopy with an absorption spectrum at 440 nm were used to analyze the biosynthesized SL-AgNPs. SL-AgNPs are capped and bioreduced by the biomolecules found in Sansevieria Laurentii leaf extract. This composite product offers a novel, affordable formulation. Under visible light irradiation, the photocatalytic degradation efficiency of Ag NPs on methylene blue (MB) dye was assessed, yielding indications of the synthesized material for photo catalytic applications.

Keywords: Ag nanoparticles, Sansevieria Laurentii, Nanocatalyst, Photocatalyst.

I. INTRODUCTION

Nanotechnology can be defined in a number of ways. It is regarded as the ability to measure, manufacture, and make predictions at the scale of 1–100 nm. (Albrecht *et al*., 2006; Donaldson *et al*., 2004; Masciangioli *et al.,* 2003). Nanotechnology is an essential field that is used in agriculture, medicine, and environmental work. Silver nanoparticles (AgNPs) are highly valuable because of their strong antibacterial and antifungal properties. The morphology of the AgNPs is the key element of their chemical and physical properties.(Alzubaidi *et al.*,2023; Bondarenko *et al*., 2013).Nanotechnology is important in developing sustainable technologies for the environment, and for future.(Oberdo *et al*., 2005; Anastas 2003).Traditional methods for producing AgNPs often use toxic chemicals and lot of energy, which can pollute the environment. AgNPs are most widely used for water purification, sensors, electronics, engineering, and magnetic field applications. (Akter *et al*., 2018; Duraisamy *et al*., 2014; Sharma *et al*., 2022). AgNPs are also applied to wounds caused by bacteria to treat it. (Akhtar *et al*., 2025; kaliammal *et al*., 2021; velsankar *et al*., 2020). Green synthesis is a safer and better option. It uses plants and is emerging as an eco-friendly alternative, as plant extract facilitate biosynthesis of nanoparticles and is cost-effective(Anbuvannan *et al*., 2015).Plant extracts contain natural compounds that can reduce silver ions and help form stable nanoparticles without toxic chemicals. *Sansevieria laurentii* (snake plant) is a common plant, it contains useful compounds such as polyphenols, flavonoids and saponins. These natural chemicals can act as stabilizing and reducing agents, which makes the plant ideal for green synthesis of silver nanoparticles. The plant is widely available, and easy to grow and has been used traditionally for its medicinal properties, which makes it helpful for nanoparticle production.

This study aims to produce silver nanoparticles using *Sansevieria laurentii* leaf extract and to analyze their characteristics. The goal is to develop a safe, simple, low-cost, and eco-friendly method for synthesizing silver nanoparticles. The results may help support the use of plant-based methods in future nanotechnology applications.

II. EXPERIMENTAL WORK

All chemicals used in our experiments were reagent grade and used without further purification.

Materials & Method:

Fresh leaves of Snake plant were plucked from the KLE college campus, Panvel. Leaves were washed properly with deionized water 3 times, wiped and were chopped in small pieces. Then they were allowed to dry in the oven overnight at 80 ℃ and were finally ground for a fine powder using mortar and pestle.

Figure 1. Preparation of powder of Sansevieria Laurentii (SL) leaf powder

Biosynthesis of Ag nanoparticles: 5 grams of snake plant powder were combined with 50 millilitres of deionized water. The solution mentioned above was then heated to 100°C for 20 minutes. At room temperature, the resulting infusion was chilled. In an aqueous media, a 50 mM $AgNO_3$ solution was also made. The leaf extract and 50 mM $AgNO_3$ solutions were combined and allowed to come to room temperature. A colour shift from dark brown to grey was seen after the response had been going on for ten minutes. The UV-visible spectrophotometer is used to measure mixture absorption both prior to and following a reaction.

Figure 2. Step by step synthesis of Ag nanoparticle from SL plant extract

III. RESULT AND DISCUSSION

Phytochemical analysis for Sansevieria Laurentii water extracts:

1	Test for Proteins	+
2	Test for Carbohydrates	+
3	Test for Saponins	+
4	Test for Tannins	+
5	Test for Phenols	+
6	Test for Flavonoids	+
7	Test for Anthraquinone glycoside	-

Table 1: Phytochemical analysis for Sansevieria Laurentii plant extracts

Phytochemical analysis demonstrated the presence of phytochemicals in the Dracaena samples, as indicated in the above table. With the exception of anthraquinone glycoside, every sample exhibited positive results for proteins, carbohydrates, saponins, tannins, phenols, flavonoids, and steroids, as indicated in the above table.

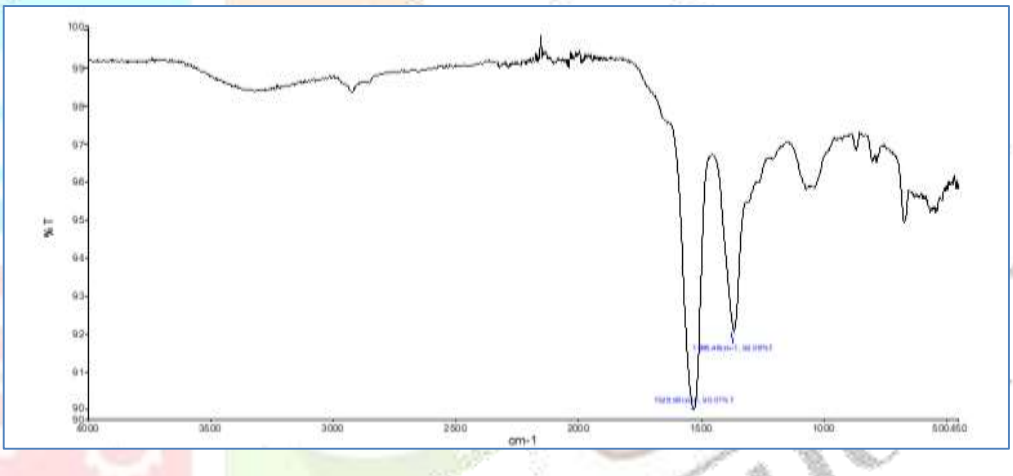

Figure 3. IR spectroscopy interpretation for the Ag-SL nanoparticle

The plant extract's dual function as a reducing and stabilizing or capping agent for Sansevieria Laurentii leaf extract and the biosynthesized SL-AgNPs was revealed by the Fourier-transform infrared (FT-IR) spectrum. The FT-IR spectrum analysis showed that the ketone and hydroxyl groups were represented by strong peaks at 431, 650, 1048, 1327, 1661, 2360, 2885, 2971, and 3448cm−1. The existence of silver nanoparticles was shown by the FT-IR spectrum, which showed absorption between 400 and 600 cm−1.

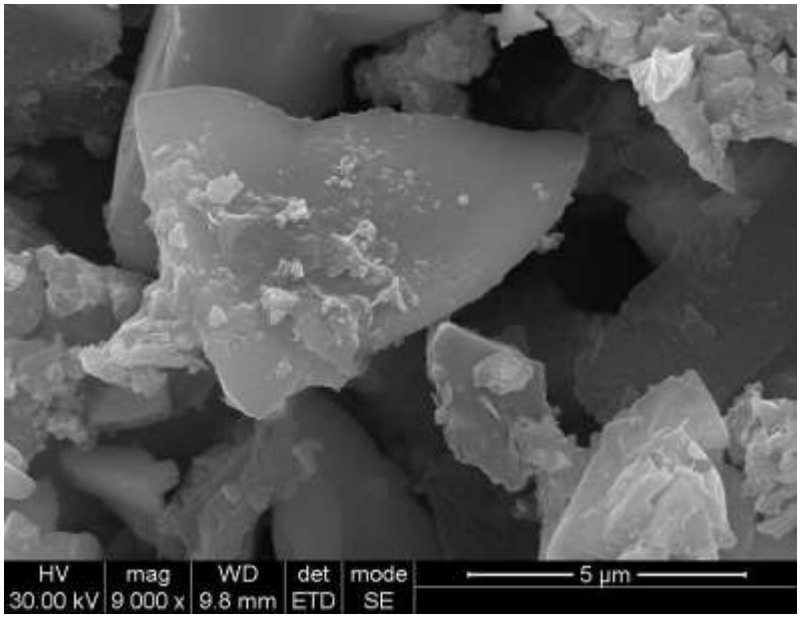

Figure 4: SEM analysis which provides high-resolution imaging revealed the morphology of AgNPs as grain has aggregated to form nanoclusters and is 5nm in size.

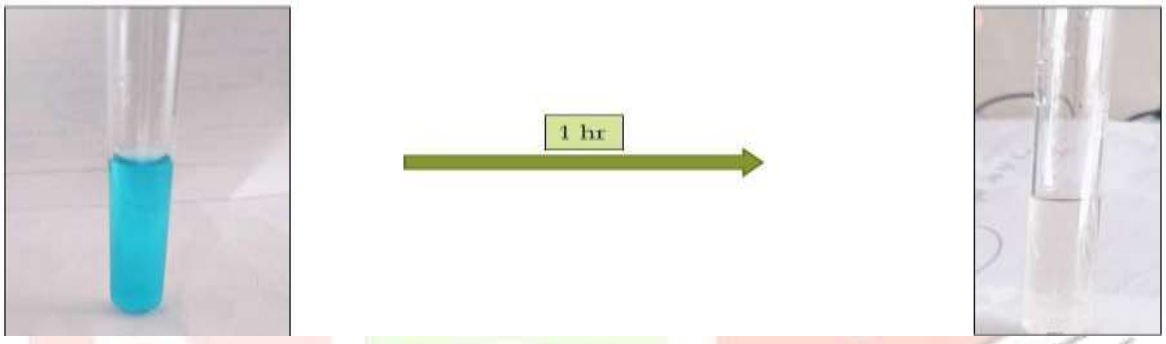

Figure 5. Methylene blue degradation using SL-AgNPs

SEM analysis (figure no. 4) which provides high-resolution imaging reveals the morphology of SL-AgNPs as grain has aggregated to form nanoclusters and is 5nm in size. This property provides good photocatalytic activity. Silver nanoparticles are widely known for their capacity to remove dangerous dyes, pesticides, antibiotics, and other impurities from wastewater. In this study, dye from simulated wastewater was cleaned up using SL-AgNPs. The catalytic activity of SL-AgNPs was measured by neutralizing dyes from synthetic wastewater at an initial concentration of 1 g $L^{-1.}$ The absorbance values at λmax for methylene blue at 500 nm drop when SL-AgNPs on a surface cause decolorization. After being exposed to UV light, the dye did not change noticeably. However, when SL-AgNPs were mixed with UV light, the dye-containing synthetic wastewater showed up to 60–75% decolorization of methylene blue. The biologically produced silver nanoparticles were verified by their colour shifting from colourless to yellow and then brown. A blue shift of the surface plasmon absorption peak with rising temperature was revealed by UV-visible spectroscopy. This experiment demonstrated that time was a positive action to intensify the purple hue. This rise shows that an increase in heating causes an increase in activation energy.

IV. CONCLUSION

This research presents the novel and affordable green synthesis of SF-Ag Nanoparticals from leaf extract of Sansevieria Laurentii. The reduction in metallic silver ions is probably due to an excess of antioxidants. AgNPs are specifically reduced and stabilized by organic molecules, such as metabolites and phenols.SF-Ag Nanopartical from leaf extract of Sansevieria Laurentii is shown up to 60–75% decolorization of methylene blue which is best for waste water treatment.

V. ACKNOWLEDGEMENT

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