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Green Synthesis of Silver Nanoparticle Isolation using from *Moringa Oleifera* Leaf

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ABSTRACT
Silver nanoparticles (AgNPs) also gained a lot of attention because of their biomedical applications, antimicrobial properties, and applicability for electronics, optics, and magnetism. In the present study, a simple and environmentally friendly green chemistry process is used to synthesize silver nanoparticles from Moringa oleifera (drumstick tree) leaves, and their antimicrobial activity is examined. The Moringa oleifera leaves extract was mixed with a silver nitrate solution to produce AgNPs. The UV- visible spectrophotometer analysis was used to track the generation and stability of the reduced Silver nanoparticles in colloidal solution. The antimicrobial activity was investigated against the bacteria such as Bacillus subtilis, Pseudomonas spp., Staphylococcus spp.,growth of several harmful microorganisms. It was revealed that the silvernanoparticles produced from the Moringa oleifera had the good antimicrobial activity against the bacterium Bacillus subtilis. The method described in the study is an environmentally friendly, cost-effective, convenient, and straightforward for the production of silver nanoparticles.
Keywords: Nanotechnology, Silver, Nanoparticles, *Moringa oleifera (*MO),Uv-vis spectra analysis and antimicrobial activity.

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INTRODUCTION

Nano particles have a greater surface area and a higher atom percentage at the base surface. Scientists are interested in nanoparticle for a variety of reasons, including enzymatic performance, dielectric properties, electrical properties, antimicrobial properties, but also magnetic properties [1,5].The metal nanoparticle production is now a hot issue in current nanomaterial research. Biomolecular detection, diagnostics, antimicrobials, treatments, reactivity, as well as microsystems are just a lot of small uses for crystalline silver nanoparticle [3].

However, a cost-effective, economically feasible, and environmentally benign silver nanoparticle production route is still needed. Metal inhibits a wide range of germs and infections commonly encountered in industrial and medicinal settings[4].

Nanoscience is now gaining a lot of attention from researchers and scientists who are seeking for a more ecologically friendly technique to create nanoparticles utilising biochemistry [4]. Green metal biosynthesis of nanoparticles suggests the presence of carbohydrates, polyphenols, flavonoids, terpenoids, lipids, enzymes, and alkaloids in the plant. That combination of biologically based technologies, green chemistry, and nanotechnology has been a biggest reason of interest in recent years . Nanomedicine is the method of producing particles with diameters ranging from 1 to 100 nanometers [5]. The benefit of a nanoscale size is that it has a significantly higher surface area to volume ratio. The Greater cover area, in conjunction with nanoparticle form and dispersion in liquid results in better physiochemical, which are useful in a variety of applications, including antibacterial research.

A few researchers have described on use of leaves extract to synthesise AgNPs of important antibacterial properties: Acalypha indica leaves extracts[16],*Solidago altissimo* [17],*Xanthium stramonium L* [18],*Murraya koenigii* (curry leaf). The antibacterial characteristics of AgNPS may offer a solution to the

problem of antibiotic resistance[19].Since they are related to the cell wall and affect permeability and cellular respiration, they can be used as an active antimicrobial treatment[20]. Because of this property, AgNPs are now commonly used in the diagnosis of a variety of diseases, the treatment of cardiovascular abnormalities, and biopharmaceuticals.

The production of silver nanoparticles utilizing *Moringa oleifera* is done in the current study (MO-AgNPs). *Moringa oleifera* has been a staple of the Indian diet since ancient times. The plant leaves also have hypotensive, anticancer, cardioprotective, ophthalmic, and wound healing properties. The hydrothermal approach was employed in nanoparticle synthesis. The features of synthesized nanoparticles were UV-visible after the creation of silver nanocomposites (UV-Vis).

In present research the isolation of nano particle from *Moringa oleifera* is carried out. The antimicrobial assay shows that the nps from this plant has a good efficiency to kill the pathogenic microbes such as *Bacillus subtilis, Pseudomonas spp., Staphylococcus spp.* Therefore, the nanoparticles isolated from *Moringa oleifera*plant may be used as an treatment of bacterial diseases in future.

MATERIALS AND METHOD

Selection and Collection of Plant Material

The sample was collected from shreeambika farm and nursary,vadu. The natural plant of, *Moringa oleifera* (Drum stick). The de-ionized water was used to wash the leaves for 2-3 times.

Plant Extract Preparation

The leaves were then dried and scraped into little pieces before being baked for two days at 500°C to remove any leftover moisture. Using roughly 25g of Drum stick leaf powder and 150ml of distilled water in a beaker, the mixture was cooked to around 1 hour at 70°C with continual stirring on a magnetic stirrer. The mixture was heated indefinitely until the color became pale yellow. The*Moringa oleifera* leaf solution is now allowed to cool before being filtered using Whatmann filter paper No. 1. Before being used in a project, the created solution was chilled in the subsequent tests.

Preparation of Silver Nitrate (AgNO3) solution

1mM AgNO3 solution was prepared in a 1L volumetric flask by dissolving 0.17 gram $AgNO_3$ in tripal-distilled water. To prevent silver auto-oxidation, the solution is kept in an amber-colored container.

Moringa Oleifera-mediated Silver Nanoparticle Biosynthesis (MO-AgNPs)

Plant extract combinations were combined with 150 mL of silver nitrate solution in a flask sealed with aluminium foil to make nanoparticles from *Moringa oleifera* plant leaves. At a temperature of 35°C, the flask was held on a magnetic stirrer**.**

Characterization of silver nanoparticles

A UV-visible spectrophotometer was used to examine the sample absorption spectra, which vary from 300 to 600 nm, to determine when the highest number of silver nanoparticles were produced.

Antimicrobial activity

The silver nanoparticles synthesised from *Moringa oleifera* were subjected to test the antimicrobial activity using the disc diffusion technique. The pathogenic microbes against which the antibacterial assay was performed includes *Bacillus subtilis, Pseudomonas spp.,* And *Staphylococcus spp.,*The antibiotic discs such as Gentamicin, Streptomycin, and Chloramphenicol were used to combat these bacteria. The plates having swabbing of microbes, antibiotic discs at one side and AGNP other side were incubated at 36 °C for 18–24 hours.

RESULTS AND DISCUSSION

Biosynthesis of silver nanoparticles:

It was observed that a natural plant extract of *Moringa oleifera* can produce silver nanoparticles. When silver ions in water were mixed with a natural *Moringa oleifera* plant extract, the silver nanoparticles were formed. After the titration, the colour of the solution changed from yellow to brown, then dark brown. The appearance of a brown colour in the flask having leaves extract indicated the formation of silver nanoparticles.

UV- visible spectrophotometer analysis

UV-visible spectroscopy was used to investigate the formation and stability of reduced silver nanoparticles in colloidal solution. It is well known that UV-Vis spectroscopy can be used to investigate the structure or shape-controlled nanoparticles in aqueous solutions. The presence of Ag nanoparticles generated by *Moringa oleifera* leaf extract was discovered in the UV-visible spectrum of the reaction medium which exhibited a peak at 432nm. The impact of electron plasmon resonance in the reaction medium increased the peak, and the broadening of the peak indicated that the molecules were polydisperse. The existence of this peak, which is associated with plasmonic surfaces, has been thoroughly documented. The absorbance was 0.461 when the peak was visible (Figure 2).

Antibacterial Properties of silver nanoparticles isolated from *Moringa oleifera*

The disc diffusion method was used to test the antibacterial efficacy of silver nanoparticles derived from natural plant *Moringa oleifera* leaf extract against a variety of pathogenic bacteria, including *Bacillus subtilis*, *Pseudomonas spp*., and *Staphylococcus spp*. The presence of silver nanoparticle solution and antibiotic disc, the diameter of the inhibition zone (mm) surrounding each well is shown in Table 1. The silver nanoparticles synthesized by *moringa oleifera* extract were found to have highest antibacterial activity against *Pseudomonas spp* which reveals that the silver nanoparticles isolated from *Moringa oleifera l*eaves may be used to treat the diseases caused by *Bacillus subtilis*. The silver nanoparticle zone was 8 mm in diameter, whereas the antibiotic disc zone was 18mm (Figure.3-A) The antimicrobial activity was observed against *Staphylococcus spp*. and *Pseudomonas spp*. which expressed that the silver nanoparticles of *Moringa oleifera* plant can kill these pathogens till some extent (Figure.3-, B). The nanoparticles can enter the bacteria by adhering to the cell membrane. The silver nanoparticles interact with sulfur-containing proteins in the bacterial membrane as well as phosphorus-containing molecules like DNA. When silver nanoparticles enter a bacterial cell, they form a low-molecular-weight zone in the bacteria's centre that protects the DNA from silver ions. The nanoparticles choose to attack the chain, resulting in cell division and death. In bacterial cells, the nanoparticles produce silver ions, which improves their antibacterial activity [17, 18].

CONCLUSION

Silver nanoparticles are synthesized from *Moringa oleifera* extract. This was a low-cost, high-efficiency, and ecologically beneficial strategy. UV-visible spectrophotometer methods have been used to confirm the conversion of silver nitrate to silver nanoparticles. The zone of inhibition established in the antimicrobial screening test demonstrated that the silver nanoparticles synthesized in this method have effective antibacterial action against pathogens such as *Pseudomonas spp., Staphylococcus spp.,* and *Bacillus subtilis*. Because of their potent antibacterial properties, biologically generated silver nanoparticles can be used in medicine.

Table: 1 Silver nanoparticles are synthesized by moringa oleifera leaf extract have antibacterial action (mm).

Zone of Inhibition		
Name of the test organisms	Ag Nanoparticle	Antibiotic
B.subtilis	8mm	chloramphenicol (18mm)
Pseudomonas aeruginosa	6mm	gentamicin(11mm)
Staphylococcus aureus	5mm	streptomycin (12mm)

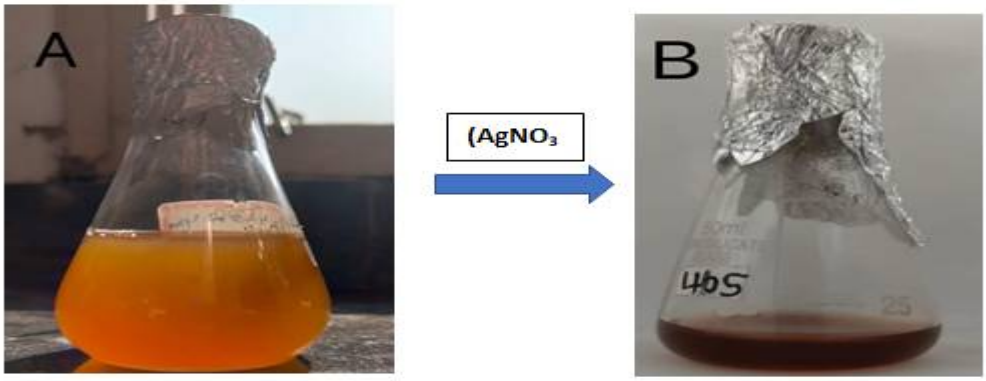

Figure: 1 Colour change of reaction solutions (A) *moringa olerifera* leaves extract (B)Ag nanoparticles solutions

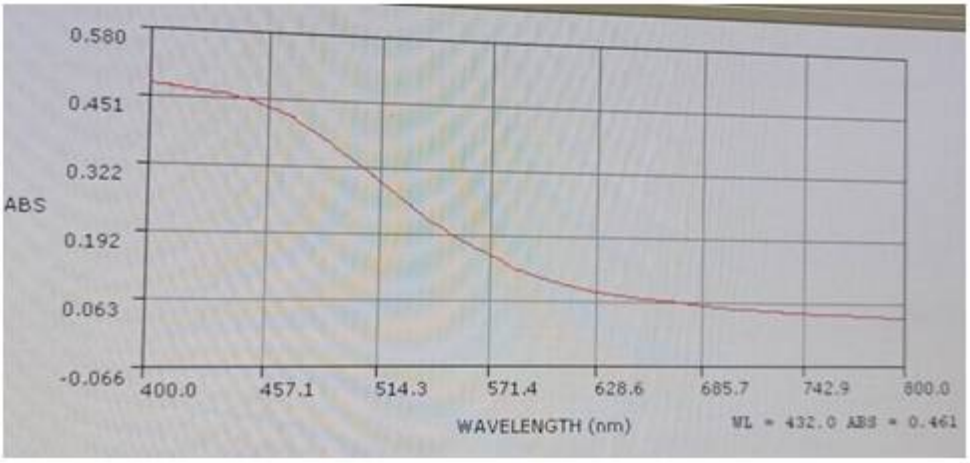

Figure 2 :The graph shows absorbance as with light wavelength in the frequency range of ultraviolet to visible of *moringa olerifera* based reduction of silver nanoparticles

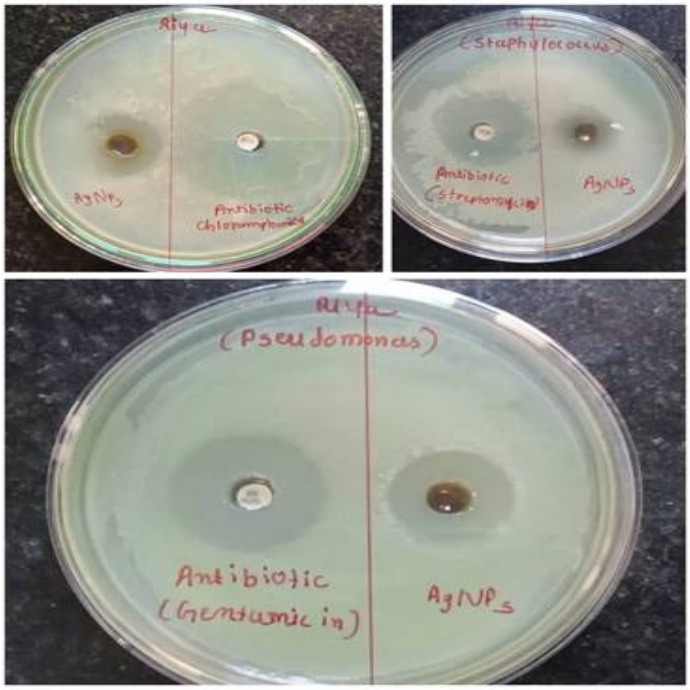

Figure: 3 Antibacterial activities in discs with various concentrations of Silver Nanoparticle antibiotic affecting images(A) *Bacillus subtilis* (B)*Streptococcus pneumonia* (C) *Pseudomonas aeruginosa*

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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