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Synthesis and Characterization of Silver Nano Particles from Aloe Vera Plant Extract: A Green Approach

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Abstract: *Present study concern with synthesis of silver nanoparticles from aloe vera plant extract. It is an eco-friendly and sustainable approach, often referred to as "green synthesis." This method depends on the utilization of phytochemicals present in plant such as flavonoids, alkaloids, terpenoids, and polyphenols, which act as both reducing and stabilizing agents and avoid the use of harmful chemicals. The present study focus on the green synthesis of silver nanoparticles and characterize the synthesized nanoparticles for their potential applications in various fields. Silver nanoparticles are characterised by UV-Vis and SEM analysis.The result shows the formation of AgNps particle with good yield with diameter of ranging from 52-92 nm.*

Keywords: silver, nanoparticles, aloe vera etc.

I. INTRODUCTION

Aloe Vera (Aloe barbadensis Miller) is a common plant known for its valuable medicinal and cosmetic uses. It's an evergreen perennial native to the Arabian Peninsula but now thrives in various tropical and subtropical climates. Aloe vera's leaves contain a gel rich in acemannan, a polysaccharide that can be used for topical treatments of skin issues like minor burns, abrasions, and insect bites. Originally from the Arabian Peninsula, it's now cultivated and found in many parts of the world, including tropical and semi-tropical regions. Recognized for centuries across different cultures and civilizations, Aloe vera has been widely cultivated and utilized for its therapeutic qualities[1]

Nanoparticles have gained tremendous attention due to their vast applications in fields such as medicine, agriculture, and environmental remediation. Among the various methods of nanoparticle synthesis, green synthesis using plant extracts as an eco-friendly and sustainable approach. This method since has the stabilizing capabilities of bioactive compounds present in plants, such as flavonoids, phenolics, and alkaloids, reducing the need of toxic chemicals. Nanoparticles can be synthesized by physical, chemical or biological method. Biological method is most demanding since it is environment friendly and economical. Biological method included the use of micro-organisms or medicinal plants for the production of nanoparticles. Using medicinal plants is advantageous as their medicinal properties are added to the nanoparticles during synthesis. Phytocompounds of aloe vera plants provide antioxidant property and the plants which have antibacterial activity provide additional antioxidant property to the nanoparticles [2]. From ancient times, silver has been used as an anti-microbial agent. Aloe vera plant extract can work as a good bio-reductant to produce AgNPs, and has a good antibacterial property[3].

The reducing agent concentration in the reaction mixture affects on the yield and size of the silver nanoparticles was studied using transmission electron microscopy [4]. The synthesis of Nanoparticles by plants are more stable and the rate of synthesis is faster than in the case of microorganisms[5]. Some researchers also involved the nanoparticles for better plant growth.[6] The reducing agents involved include the various water soluble plant metabolites (e.g. alkaloids, phenolic compounds, terpenoids Synthesis of metal nanoparticles can also be done by using microbial enzymes Green synthesis protocol as simple, rapid, eco-friendly, non-toxic, and analternative conventional physical and chemical

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methods and also used nanoparticles as an antibacterial agent.[7],[8]. Silver nanoparticles also have a tremendous effect on of biological material, precursor concentration and extract concentration on the morphology of biological nanoparticles. The reducing agents involved the various water soluble plant metabolites e.g. alkaloids, phenolic compounds, terpenoids, this bioactive compounds which facilitate the reduction and capping of silver nitrates. Green synthesis method was proposed because it is cost effective and environmentally friendly. Synthesis of metal nanoparticles can also be done by using microbial enzymes. These silver nanoparticles can characterised by using SEM, EDX, FTIR, and XRD. [9], [10].

II. MATERIALS AND METHODS

PREPARATION OF ALOE VERA EXTRACT

Preparation of Plant Extract:

Fresh plant leaves were collected and thoroughly wash the plant material with distilled water to remove dirt and other impurities. The inner gel was collected and and boiled with 100 mL distilled water at 80 0C. the filtrate was stored at 40C.

SYNTHESIS OF SILVER NANOPARTICLES

10 ml extract was added to the 100 ml silver nitrate solution (1 mM) and stirred two times for 1 hour using a magnetic stirrer at room temperature. The reaction begins with the reduction of metal ions by the bioactive compounds in the plant extract. The solution will change color (e.g., yellow to brown for silver nanoparticles}, The color change is a sign of nanoparticle formation AgNPs. Was washed three times using the 5 ml deionized water and centrifuged at 5000 rpm for 30 min. and dried.

CHARACTERIZATION OF SILVER NANOPARTICLE

After the nanoparticles were purified, they were characterized to confirm their formation and further study the size, shape, and properties by following analysis such as by UV and SEM.

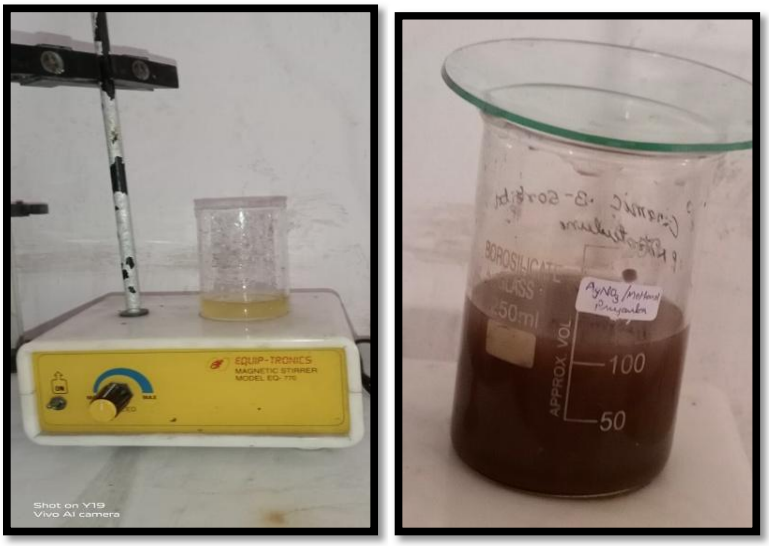

Figure 1. Change of colour for AgNPS from slightly yellow to brown confirms the formation of silver nanoparticles

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Characterization of synthesize silver nanoparticles

UV-Vis Analysis:

Synthesis of AgNPs was further confirmed with the UV-Vis characteristic absorption band of silver nanoparticles at a wavelength of 190–800 nm (Figure 2). The UV -Vis spectra showed maximum absorbance peaks of AgNPs at 420 nm .

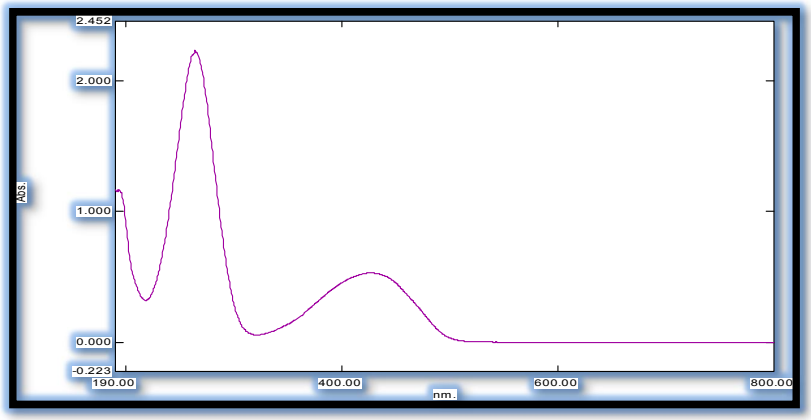
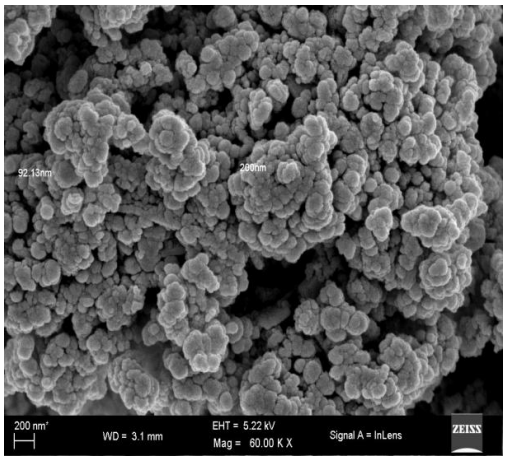


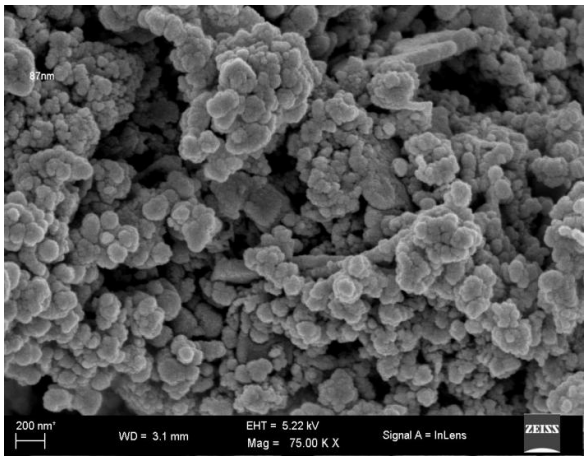
Figure 2. UV-Vis Spectra of AgNpS

Scanning Electron Microscopy (SEM):

SEM provides detailed surface morphology of the nanoparticles and can help in understanding their aggregation and distribution. The SEM analysis showed spherical and uniforms AgNpS with diameter ranging from 92, 87, 62, 52, nm. Morphology: Surface texture is rough and porous. SEM image with more isolated particles (less aggregation)

SEM IMAGES FOR SILVER NANOPARTICLES





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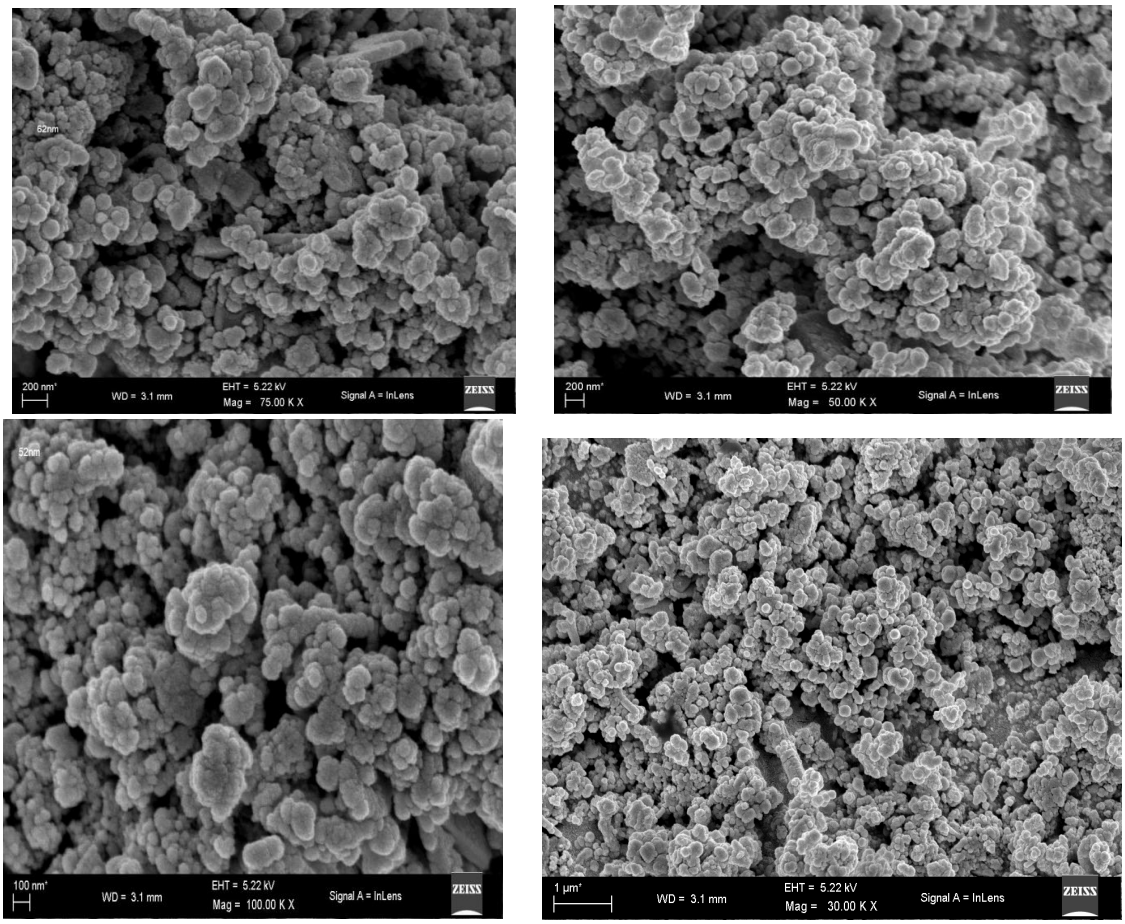

Figure 3. Scanning Electron micrograph of aloe vera mediated AgNPs sphericals nanoparticles with diameter of 52-92 nm.

III. RESULT AND DISCUSSION

The present study deals with the synthesis of AgNPs nanoparticles from aloe vera plant.. The green synthesis of nanoparticles using plant extracts offers an eco-friendly and cost-effective alternative to conventional chemical methods. The procedure involves preparing a plant extract, reducing metal ions using the plant's phytochemicals, and purifying the synthesized nanoparticles. Characterization was done by like UV-Vis spectroscopy, SEM, for confirming the size, and surface morphology of nanoparticles. This green synthesis method is the efficient alternative for nanoparticle production. It opens new routes for utilizing plant resources in nanotechnology, particularly for applications requiring biocompatible nanoparticles. In this study, AgNPs were synthesized by reacting 0.1 M AgNO3 with aqueous extract of aloe vera plant. Plants can rapidly reduce metal ions to nanoparticles due to presence of phytochemicals. We synthesized silver nanoparticle from aloe vera extract there is a colour change from light yellow to brown confirms the formation of silver nanoparticles.(Figure.1) The uv vis. band showed maximum absorbance peaks of AgNPs at 420 nm.(Figure. 2) .The SEM analysis showed spherical and uniforms AgNPS with diameter ranging from 92, 87, 62, 52, nm.(Figure. 3) Morphology of silver nanoparticles is rough and porous surface texture. SEM image with more isolated particles (less aggregation).(Figure. 3)

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IV. CONCLUSION

The nanoparticles formed was characterized by physical data such as change in colour, UV–vis spectroscopy, and SEM. There is change in colour from light yellow to reddish brown indicates the formation of AgNPs. The absorption peaks as shown by UV-Vis. Spectrum was 420 nm. The SEM analysis showed spherical and uniforms AgNPs with diameter ranging from 92, 87, 62, 52 nm. Morphology: Surface texture is rough and porous. We obtained a very good results and SEM images shows more isolated particles (less aggregation).

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