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Study Properties of Plant Medicated Green Synthesis of Silver Nanoparticles

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Abstract:- Low Cost silver nanoparticles were prepared by using the leaf extract of Azadirachta indica, Ocimum sanctum, which served as reducing agents. The quantitative formation of nanoparticles was observed by using a UV-Visible spectrophotometer. This study also compares the formation of Ag nanoparticles prepared by fresh and dry leaves of Neem and Tulsi. The confirmation of formation of Ag NPs done using UV spectrum. This spectrum lies in a range between 350 nm to 450 nm for both fresh and dry leaves of Neem. The antimicrobial activity of AgNPs prepared from fresh and dry leaves of Tulsi was found to be higher compared to that of Neem leaves. They demonstrated effectiveness against organisms such as Bacillus subtilis, Escherichia coli, etc.

Keyword:- *Silver Nanoparticles, Azadirachta Indica, Ocimum Santum, Absorption, Antimicrobia Property.*

I. INTRODUCTION

Nowadays, research field of material science and biomedical focuses on nanotechnology [1-2]. Nanoparticles of silver are having size in between 1 to 100 nm [3]. These are important due to their large surface to volume ratio. Different shapes of nanoparticles have different applications. Generally, synthesized silver nanoparticles (AgNPs) were spherical in shape but sometimes diamond, octagonal, and thin sheets are also formed which enhances the tumor-killing effects of anti-cancer drugs. Recently, AgNPs found applicable in various fields which are food, health care, consumer, and other industries since they have unique physical and chemical properties [1-5]. Researchers studied the use of AgNPs from plant leaf extract, root, stem, bark, leaf, fruit etc [6-9].

The properties of AgNPs like antimicrobial and anticancer were found to be applicable in medical application for wound repair, bone healing, dental material filling, vaccine adjuvants, bioimaging etc [10]. The preparation and formation of AgNPs from aqueous Neem (Azadirachta indica) leaves extract have many advantages. Thus present work focuses on to study the effects of various physico-chemical parameters on properties of AgNps. We attempted to investigate antimicrobial property of synthesized nanoparticles. Neem (Azadir-achta indica) is a common plant found abundantly in India and in near by Indian subcontinents. It belongs to Meliaceae family and their medicinal properties were studied by [4,5]. The Neem contains phytochemicals (terpenoids and flavanones) in leaf act as a reducing and capping agent. For the preparation of AgNPs, silver salt is treated with Neem leaf extract.

In various studies different medical plants like Azadirachta indica, Ocimum santum, Vitex negundo are already used to synthesized AgNPs [1-5]. Tulsi leaves are used in the present study to fast & facile synthesis of AgNPs. The chemical composition of tulsi is complex but they have used for anti-stress, antioxidant, antibacterial, antiviral, antifungal, anti-inflammatory, antipyretic, antimalarial properties with a safety [11].

In this communication, we report properties of AgNPs prepared by green synthesis method and their application as antimicrobial agents, and the mechanisms of their antimicrobial mode of action.

II. MATERIAL AND METHODS

- *Plant Collection*

Fresh leaves were collected from the Gadhinglaj and Chandgad tehsils of Kolhapur district in Maharashtra, India.

- *Preparation of Plant Extract*

In order to remove all dust and unwanted visible particles, collected fresh and healthy leaves were thoroughly rinsed with distilled water and conductivity water. After being divided into small pieces, the leaves were dried at room temperature. These delicately cut plant leaves weighted about 10 g each before being added to a 250 mL beaker with 100 mL of distilled water. The solution was then heated to a boil for around 15 minutes using a magnetic stirrer. After cooling, the extracts were filtered using Whatman No. 1 filter paper to get clean solutions by removing any impurities. Once more passing through Whatman No. 1 filter paper, the solutions were then chilled to 4°C for storage. The same procedures were carried out for the dry leaves, which were dried at room temperature in a dark chamber.

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➢ *Synthesis of Silver Nanoparticles*

In the synthesis of silver nanoparticles, 1 and 3 mL of the aqueous fresh leaf extract of Azadirachta indica were added to 10 mL of a 1 mM aqueous $AgNO_3$ solution in a test tube. The solution was scanned on a UV-Vis spectrophotometer at various time intervals. The test tubes were then incubated at room temperature in a dark place for 24 hours. The formation of AgNPs was indicated by a change in color from yellow to dark brown. The extract was stored at 4°C for further use. The dried leaf extracts of Tulsi and Neem were processed using the same method. Using a UV-Vis spectrophotometer, the synthesis of AgNPs was further validated.

➢ *Characterization of Silver Nanoparticles*

- *UV-Visible Spectrophotometer*

A Systronics UV-Vis spectrophotometer was used to analyze the production and completion of silver nanoparticles. The samples were scanned within a range of 300–700 nm. 1 mM silver nitrate solution used as blank reference. A 1 mM silver nitrate solution was used as a blank reference.

- *Antimicrobial Activity*

✓ *Agar Well Diffusion Method*

Mueller-Hinton agar was prepared according to the manufacturer's suggestions and autoclaved at 121.5 °C for 15 minutes. After autoclaving, 20 mL of the media was distributed into sterile jumbo tubes. The media was cooled to a temperature of 40 to 45°C, and then, 1 mL of a 24-hour fresh inoculum of the test organism was added to each MH agar tube using a micropipette. The tubes were shaken to ensure complete mixing of the test organism and sterile media. The mixture of media and test organism was poured into petri plates. After the agar plates solidified, using a sterile 6 mm cork borer, equally spaced holes were bored in the MH agar plates. In each of the three wells, 100 microliters of the extract was inoculated, and in one well, standard silver nanoparticles were inoculated as a control. The plates were then incubated for 24 hours at 37°C in an upright position. After the incubation period, the zone of inhibition was measured, indicating the degree of susceptibility or resistance of the test organism to the extract.

III. RESULTS AND DISCUSSION

➢ *UV- VIS Spectrophotometer*

Figure 1. shows the plot of Absorption verses wavelength of UV-Vis spectra recorded for a time intervals of 30 min, 2 hr and 24 hr. Absorption spectra of AgNPs formed in the reaction media has absorption maxima in the range of 324 to 400 nm due to surface plasmon resonance of AgNPs. From this graph we observed that as time period increases the formation of silver nanoparticle also increases. After 24 hr at 350 nm near about 3 absorbance is observed which more as compared to 0 min is.

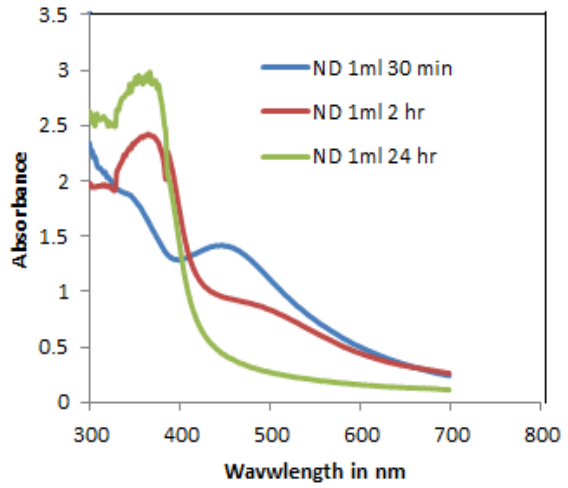

Fig 1Wavelength Scanning - UV Spectrophotometer (Neem Dry 1 ml)

From this graph it is observed that as time period increases the formation of silver nanoparticle also increases. After 24 hr at 448 nm near about 2 absorbance is observed which is more as compared to 0 min as shown in fig.2. As the wavelength is small it implies the size of silver nanoparticle is also small.

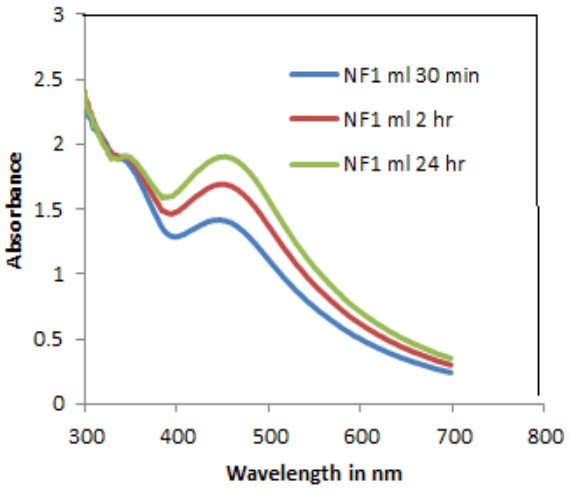

Fig 2 Wavelength Scanning – UV Spectrophotometer (Neem Fresh 1 ml)

In fig.3 there is two different leaf extract Neem dry & Tulsi dry 1 ml concentration. From this graph we observed that the formation of silver nanoparticles of tulsi dry leaf is good as compared to neem dry leaf. The leaf extract of tulsi dry is recorded at 360 nm 2.38 absorbance and the leaf extract neem dry is recorded at 352 nm 2.34 which means that tulsi dry extract AgNPs more effective as compared to neem dry extract.

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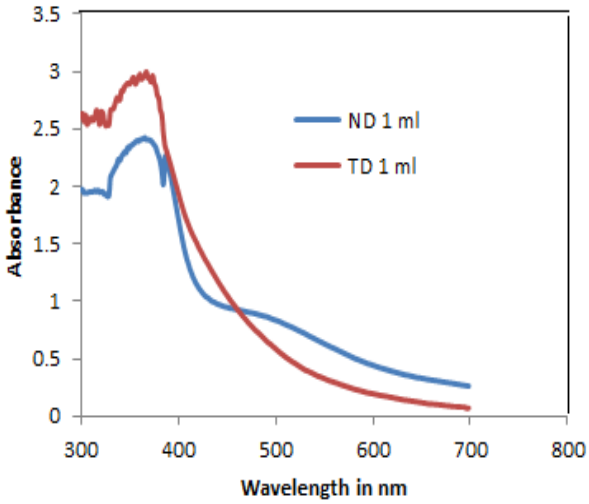

Fig 3 Wavelength Scanning – UV Spectrophotometer (Neem Dry & Tulsi Dry 1 ml)

In fig.4 there is two different leaf extract Neem fresh & Tulsi fresh 1 ml concentration. From this graph we observed that the formation of silver nanoparticles of tulsi fresh leaf is good as compared to neem fresh leaf. The leaf extract of tulsi fresh is recorded at 350 nm 2.3 absorbance and the leaf extract neem fresh is recorded at 330 nm 2.0 which means that tulsi fresh extract AgNPs more effective as compared to neem fresh extract.

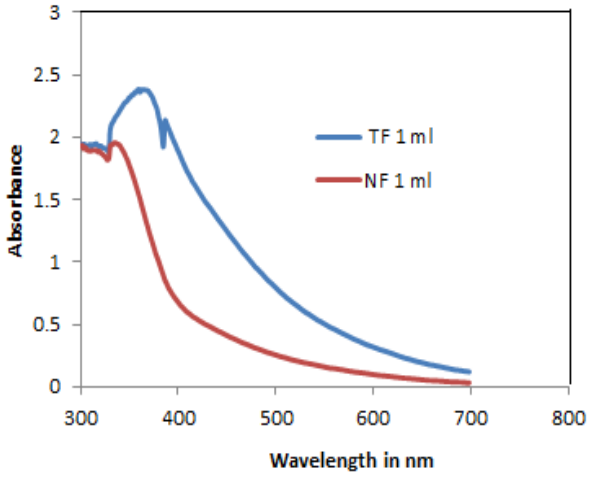

Fig 4 Wavelength Scanning – UV Spectrophotometer (Neem Fresh & Tulsi Fresh 1 ml)

➢ *Antimicrobial Activity*

The present investigation evaluated the antimicrobial efficacy. The product showed varying level of inhibition against the test organisms. Escherchia Coli, was the most susceptible to the product of tulsi fresh and Escharichia pneumonia to the product of tulsi dry. The control standard silver nitrate was found to have greater antimicrobial activity as compared to other plant extract.

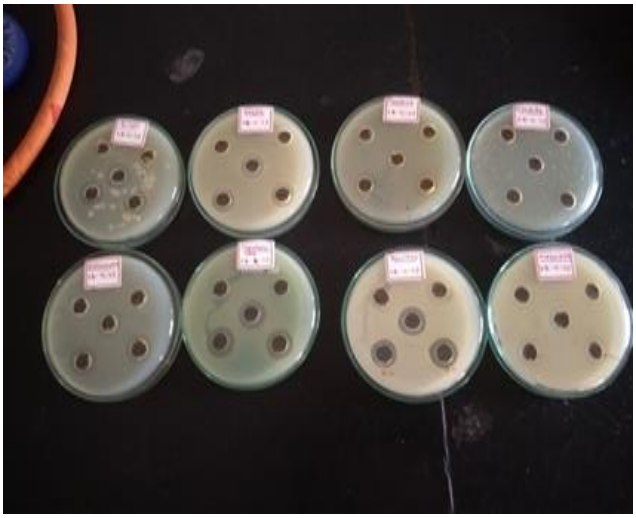

Fig 5 Agar Well Diffusion Method Showing Zone Of Inhibition

IV. CONCLUSIONS

A shift in color from yellow to dark brown, which signifies the creation of silver nanoparticles, was found to be a reliable indicator of the synthesis of silver nanoparticles from the leaves of Azadirachta indica and Ocimum sanctum. A UV-VIS approach was used to examine the resulting silver nanoparticles' properties.The outcomes demonstrated that silver nitrate was converted into highly stable, impurity-free silver nanoparticles. All of the plant extracts put to the test had antibacterial activity and were successful in killing bacteria. In the medical field, as well as in the food and cosmetics industries, they can therefore be employed successfully.

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