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PLANT EXTRACT MEDIATED SYNTHESIS OF GOLD NANOPARTICLE AND ITS ANTIBACTERIAL ACTIVITY

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Abstract: **Biosynthesis of nanoparticles is under exploration is due to wide biomedical applications and research interest in nanotechnology, the present study was evaluating green synthesis of Gold nanoparticle using *Abutilon indicum*. Leaf extract, the use of plant material not only makes the process eco-friendly but also the abundance makes it more economical. The UV-visible spectral analysis indicated the formation of nanoparticles, which were characterized by Fourier infrared spectroscopy (FTIR), scanning electron microscope (SEM) analysis and antibacterial activity was studied, This approach is not only of a green rapid synthesis kind and considered as a better alternative to chemical synthesis, but also found to be effective for large scale synthesis of gold nanoparticles.**

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I INTRODUCTION

The field of nanotechnology is one of the most active areas of explore in innovative nano sciences. The novel exploitations in Nanoscience have rescued a far-reaching explore along intersect ant with several other branches of science and forming impact on all forms of life. On the progress of engineering science and superscript technological realizing surfaced a path for explore and development in the field of plant biology towards intersection of nanotechnology. One such interference is employing plants or plant parts in the synthesis of nanoparticles [1]

Environmentally- friendly synthesis of nanoparticles is a bottom up method where the primary chemical reaction is reducing/ oxidization. The involve for green synthesis of nanoparticles as the physical and chemical processes was costly [2]. This is not an emerge whenever it derives to green synthesised nanoparticles [3]. So, in the search of research methods since nanoparticles synthesis, researcher expended microbic proteins and herbals. on their inhibitor or reducing agent they are commonly creditworthy for the reducing of alloy chemical compound into their various nanoparticles. Biosynthesis allows progress all over chemic and physical methods because cost-efficient, eco-friendly; well surmounted up for eminent nanoparticle synthesis and in this performing there is no more demand to consumption prominent atmospheric pressure, propellant, degree of heat or cold and harmful armament.

Abutilon indicum (*Malvaceae*) is a hairy under-shrub with golden yellow flowers, found in hotter parts of India. The medicinal plant is very much applied in traditional medicines. In fact, the root, bark, flowers, leaves and seeds are all used for medicinal purposes by Tamils. The herbals are second hand as accessory to drugs used for pile ailments. The blooms are applied to enhance seminal fluid in male [4].

Since stately metal nanoparticles are wide employed to fields of man contact, there is a involve for 'eco-friendly chemistry' with the possibleness of speedy synthesis, economic, cost-effective, ataxic and eco-friendly method for nanoparticle synthesis. In the confront explore is synthesis and characterization *Abutilon indicum* intermediated gold nanoparticle and antimicrobial activity.

II MATERIALS AND METHODS

Preparation of Plants Extract

The herbal *Abutilum indicum* of was gathered from internal flora and the campus of SPK Centre for

Environmental Sciences, Manonmaniam Sundaranar University, Alwarkurichi, Tamilnadu. In this experiment, the above mentioned natural products extract were involved on the synthesis of metallic nanoparticles. About 10 g of natural products were washed with double distilled water and finely chopped and boiled it with 100 ml double distilled water at 60-80^{0}C for 10 min. After that, the solution was filtered through nylon mesh cloth and stored at 4^{0}C for further nanoparticle synthesis process.

Green synthesis of gold nanoparticles

Individually, about 10 ml of pure plant extract solution was added to 100 ml 1 mM HAuCl4 to synthesis gold nanoparticles, after that, the solution was kept in magnetic stirrer for constant stirring. The colour change of the solution indicates the reduction of gold metal ion is reduced into Au NPs, respectively by using the plant extract.

Antibacterial assay by using agar well diffusion method

The present study was obtained from Microlabs, tamil nadu, india. They are *Bacillus sp.* and *Streptococcus* sp. cultures were purchased from Microlabs, Chandigar, India.

Antimicrobial activity of the synthesized CuO nanoparticles was determined by using the Agar well diffusion method [5]. The bacteria used for the antibacterial activity were *Bacillus sp.* and *Streptococcus* sp. Two different concentrations of nanoparticle solutions were prepared; the antibacterial activity was assayed by measuring the diameter of the inhibition zone formed around the well.

Characterization of synthesized metal nanoparticles

The synthesized Nanoparticles were characterized by techniques are UV-vis spectrophotometer, Fourier Transform Infrared spectroscopy (FT-IR) and Scanning Electron Microscope (SEM).

Uv-Vis Spectrophotometer

Information pertaining to the composition and structure of nanomaterials can be acquired using optical spectroscopy. The bio fabrication of Nanoparticles in aqueous solution was monitored for optical absorption by UV-vis spectra of the solution between 200 to 800 nm with different time intervals using double beam UV-vis spectrophotometer Make: PerkinElmer, Singapore. Distilled water was used for the adjustment of baseline.

Scanning Electron Microscope (SEM)

Make: Hitachi, Model: S-3400N. Scanning electron microscopy (SEM) is a method for high resolution surface imaging. The SEM uses an electron beam for surface imaging. SEM facilitates the observation of very fine details (high resolution) of nanoparticles and good focus over a wide range of specimen surface (large depth of field). It also produces clear image of specimen ranging from object visible to the naked eye to a structure spanning few nanometers.

Fourier Transform Infrared Spectrometer (FT-IR)

Fourier transform infrared spectrometer of nanoparticles was centrifuged at 7500 rpm for 10 min and the resulting suspension was redispersed in 20 ml sterile distilled water. The centrifuging and redispersing process was repeated thrice. Thereafter, the purified suspension was completely dried at 600C. The purified nanoparticles were then dried and the powder was subjected to FTIR spectroscopy measurement. Atoms or atomic groups in molecules are in continuous motion with respect to one another. They vibrate about some mean position. IR absorption has numerous applications in qualitative and quantitative analysis.

III RESULT AND DISCUSSION

Biosynthesis of gold nanoparticles

Results showed that the gold nanoparticles were synthesized using the *Abutilum indicum* extract. When the extract was subjected to gold nanoparticle, the biosynthesis reaction started within few minutes and the color reaction was observed in which clear pale yellowish gold nanoparticle solution turned to ruby red colored solution which indicates that formation of corresponding gold nanoparticles (Fig. 1). The UV–Vis spectra of gold nanoparticles synthesized by *Abutilum indicum* are shown in (Fig. 2.) The broad peak observed at 540 nm, that is surface plasmon resonance of the gold nanoparticles

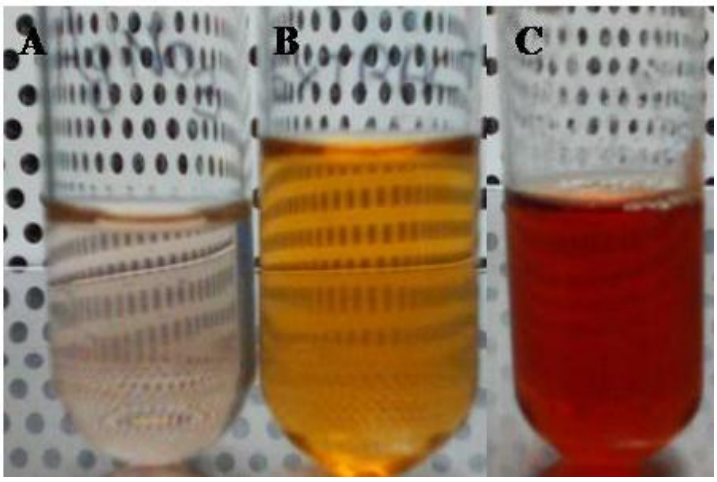

Figure 1 Synthesis of gold nanoparticles (A) gold solution (B) Abutilum indicum plant extract (C) synthesized gold nanoparticle in ruby red colour solution

The maximum absorption band occurs at the wavelength of 460 nm due to the excitations of surface plasmon resonance in the nanoparticles and the broadening peak indicates particles are polydispersed. While adding the *Abutilum indicum* leaf extract into the gold solution the reduction starts in 1 hr min and steadily increases in absorbance as function of reaction time indicates that the continuous formation of silver nanoparticles. After 24 h of reaction time the absorbance was decreased indicates the

completion of reaction. The optimum time required for completion of reaction was recorded as 24 h. The formation of SPR peak is assigned to the oscillation of electrons at the surface of the nanoparticles is well matched for various metal nanoparticles with size ranging from 2 to 100 nm [6].

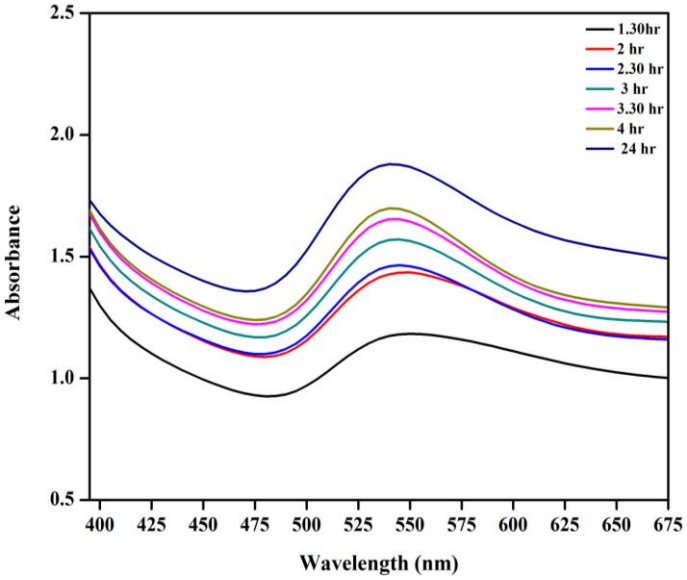

Figure 2 UV-Vis spectrum analysis Plasmon resonance of gold nanoparticles reduced by Abutilum indicum at 540 nmCharacterization of silver and gold nanoparticles Fourier Transform Infrared Spectrometer (FT-IR)

FTIR spectroscopic studies were carried out to investigate to find possible bio reducing agents present in the *Abutilum indicum*. The spectra of *Abutilum indicum* were recorded before and after adding the gold solution (Figure 3). The interferrogram exhibit a broad at 3412 cm−1 is assigned to the N–H group from peptide linkage present in the *Abutilum indicum*. Formation of C-C bonds is energetically favoured over S C bonds, as the latter will impose severe geometrical constraints on the molecule more specific in thiol group and less in acidic as compared to alcohols and that makes elimination of hydrogen attached to sulfur group. The peak found around 1500-1550 cm-1 showed a stretch for C-H bond, peak around 1450-1500 cm-1 showed the bond stretch for N-H. There is a decrease in the concentration of the amide linkage in the aqueous solution after the formation of gold nanoparticle.

Scanning Electron Microscope (SEM)

In this scanning electron microscope study the structure of synthesized gold nanoparticles of *Abutilum indicum* was observed and it is round shaped in which the gold nanoparticle is in condensed form (Figure 4). SEM photograph of gold nanoparticles clearly Indicates that in the room temperature synthesized samples the size the average size of the nanoparticles is ~100cnm.

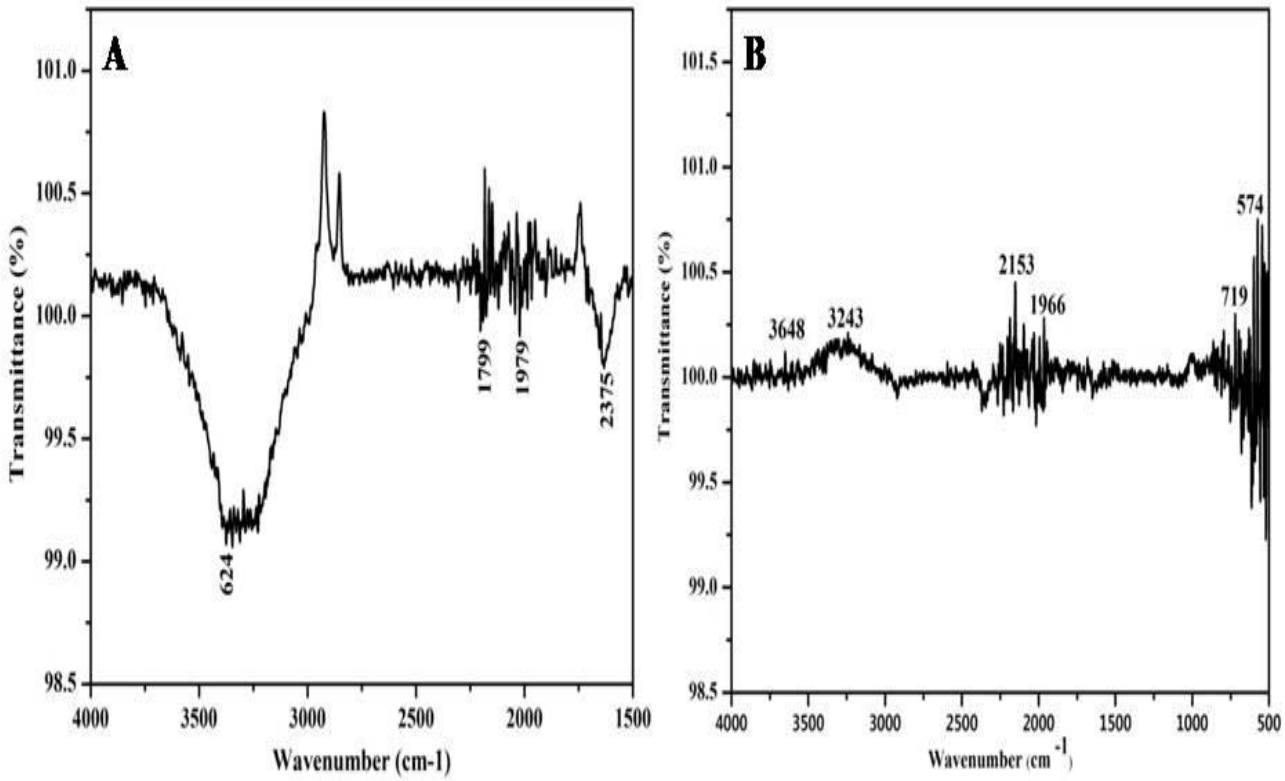

Figure 3 FTIR spectrum of A) Abutilum indicum B) gold nanoparticles synthesized by plant Abutilum indicum

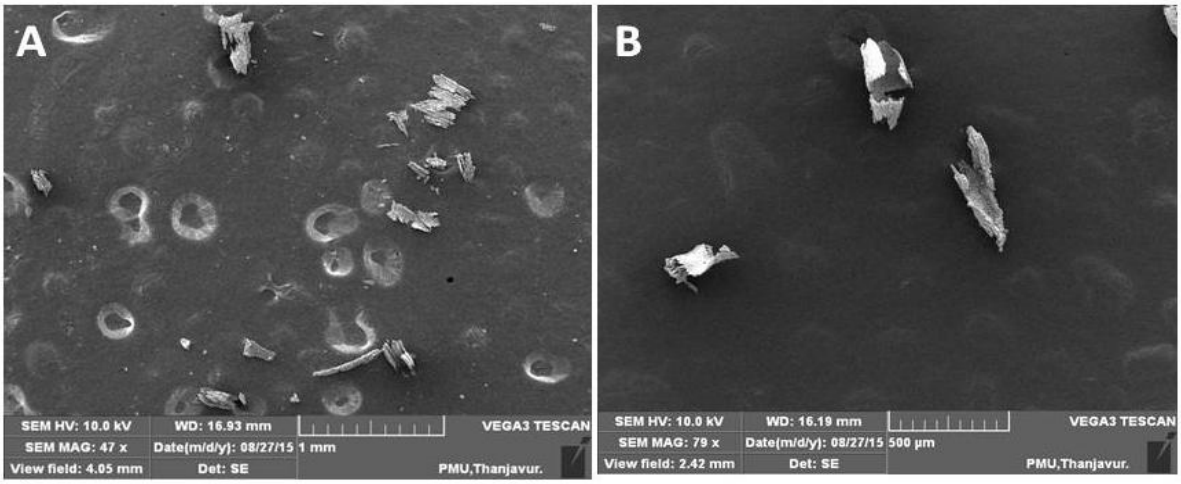

Figure 4 Scanning electron microscope image of gold nanoparticle synthesized by plant Abutilum indicum

Antibacterial activity

Mechanism of antibacterial activity of gold nanoparticles The NPs are capable of attaching to the bacterial membrane by electrostatic interaction and disrupt its integrity [7]. They can change membrane potential and decrease ATP levels within the cell and inhibit the binding of tRNA with ribosomal subunit, affecting translation [8] GNPs can generate holes in the cell wall causing leakage of cell contents, and bind with the DNA, inhibiting transcription [9]. GNPs aggregate within bacterial biofilms and bind to their surfaces causing cell wall distortions which can be utilized to minimize treatment durations and side effects of drugs [10]. The interaction between ultra small GNPs (less than 2nm range) and bacteria likely induce a metabolic imbalance in bacterial cells resulting in an increase of intracellular ROS species production that culminated in death of the bacteria [11].

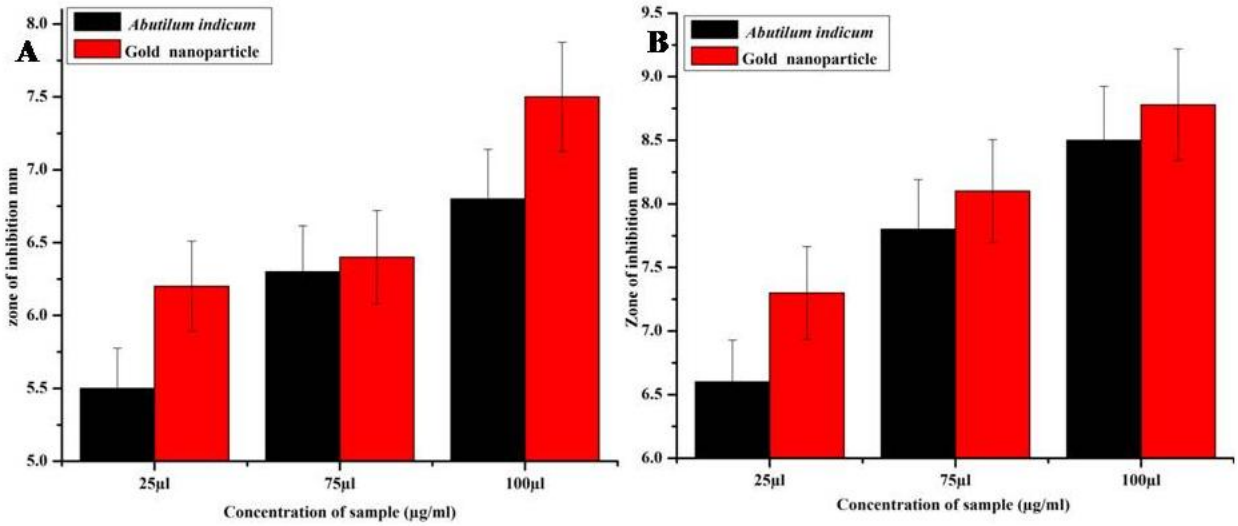

Figure 5 Antimicrobial activity of gold nanoparticle using A) *Bacillus sp.* B) *Streptococcus s.*

In the present study gold nanoparticles showed good antibacterial activity against tested pathogens (Figure 5). These results also showed that gold nanoparticle had higher antibacterial activity [12]. *Bacillus sp.* was the most sensitive to gold nanoparticles (100 µg/ml) followed by *Streptococcus sp.* (50 µg/mL). These results are in agreement with other studies [13]. *Bacillus sp* was resistant to gold nanoparticles. Similar results were observed in a previous study where silver nanoparticles were more active against gram negative bacteria than gram positive bacteria and this was attributed to change in the cell wall composition of bacteria [14]. Gold nanoparticles were effective at 100 µg/ml amongst the varied concentration range against the tested pathogens [15]. Recent reports also suggest similar mechanism where gold nanoparticles functionalized with small molecules have shown good antibacterial activity [16].

IV CONCLUSION

Researchers are expanding their interests towards synthesise of gold nanoparticles as they provide superior

properties for different types of applications. The UV visible spectra measurements were carried out at 540 nm with sharp peak. The surface of the nanoparticle was ascertained from the SEM analysis. In the present research program, cost effective and environment friendly gold nanoparticles were synthesized using the *Abutilon indicum*. On the whole it can be said that GNPs have created immense interest in the field of medicine as an antimicrobial agent

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this paper.

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