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Green Synthesis of Silver Nano Particles Using *Mimusops Elengi* Leafs Extract and Its Characterization

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ABSTRACT :The Green synthesis of silver nanoparticles using *MimusopsElengileaf* extract. For the synthesis of silver nanoparticles (SNPs) using the 10ml of leaf extract of *MimusopsElengias* a dropping agent from 1 mm silver nitrate (AgNO₃) has been investigated. The resulting SNPs are characterized using UV–Vis, TEM. Silver nanoparticles were synthesized within 24 hours of incubation period and synthesized SNPs showed an absorption peak at more or less 200–600 nm in the UV-visible spectrum. The FTIR spectrum analysis has confirmed the presence of functional groups of stabilizer *MimusopsElengileafs* extractin capping the silver nanoparticles the morphological study of Silver nanoparticles using (SEM, TEM) suggests that the nanoparticles are globular in shape with a diameter more then 50–100nm. This simple without any hazardous chemicals as dropping agent and economical to synthesized SNPs.

KEY WORDS: Green synthesis, *MimusopsElengi* leafs, silver nitrate (AgNO₃).

I. INTRODUCTION

The exponentially growing demand of nanoparticles (NPs) in numerous applications is due to their incredible, exceptional, and astonishing properties that make them different to bulk materials [1]. The quantum confinement effects and large available active surface area of NPs are believed to be the key parameters that provide them with such outstanding physicochemical characteristics [2]. Nanotechnology has revolutionized the world by enhancing the efficiency and durability of nanostructure-based products. Presently, NPs are used widely in different industries, including agriculture, mechanical, food, energy, and electronics. Moreover, in modern chemistry and biomedical science, NPs are being successfully used in several applications [3]. Metallic NPs comprise a versatile class of materials including pure metal NPs—for example silver, gold, iron, cobalt, and nickel—and their compounds—such as oxides, hydroxides, sulfides, phosphates, fluorides, and chlorides [4].

The exciting surface Plasmon properties, attractive physicochemical features, and distinct shape and size of metallic NPs make them potential candidates for memory storage devices, manufacturing of magnetic ferrofluids, photography, catalysis, photonics, and optoelectronics applications [5]. Diagnostic and therapeutic applications, e.g., biomagnetic separation and detection systems, magnetic gene transfect ion, stem cell engineering, immunoassay, and for immune /apt sensors as platforms to Immobilize biocompounds [6–8]. Moreover, antibacterial properties and the ability to be conjugated with different drugs, ligands, and antibodies proved metallic NPs to be successful antimicrobial agents against multi-drug-resistant organisms and as efficient nanocontainers for precise drug and gene transport [9–11]. The availability of more than 600 NP-based consumer products in the market reflects a drastic increase in the production of daily-use items with omnipresence of NPs. These products can be divided in to eight categories: 1) household appliance; 2) health and fitness goods, such as sporting stuffs, sunscreen, and makeup's; 3) food and beverage; 4) home and garden stuff including construction materials, home furnishings, and antibacterial paints; 5) automotive parts such as carbon nano tube Spiked tires; 6) electronics and computers; 7) cross-cutting coatings; and 8)

goods for children, such as silver NP-coated children's toys etc. [12,13]. The growing and widespread applications of NPs have also led to concerns regarding their negative impact on human as well as environment health. Thus, nanotechnology can be considered to be a double-edged sword [14]. The released NPs from NP-based items will end up in the atmosphere, water, or soil, when disposed by any means. The exposure of released NPs to biological organisms can be by direct and indirect means. The possible indirect ways include inhalation or digestion for Land-dwelling organisms, and through plants.

The direct passage for aquatic organisms is likely through external surface epithelia or gills. When NPs are exposed to the environment, interaction of NPs with the surrounding materials and complex organic fluids could result the creation of corona. The produced corona can affect different functions of biological systems [15–17]. Furthermore, the reactivity, mobility, and biological fate of NPs are found to be size-, shape-, and charge-dependent. For the formation of NPs of different size, shape, and composition, various chemical, physical, and biological approaches can be used, such as micro emulsion, electrochemical synthetic approach, microwave-assisted synthesis photo induced reduction, wet-chemical reduction, laser ablation, physical vapor condensation, and green synthesis-based approaches [2,18]. However, wet-chemical reduction method, owing to its easy handling, thermal stability, cost-effectiveness, high purity factor, and a variety of easily available chemicals, can be considered to be one of the best approaches. Different factors, including solvent, precursor, stabilizer, reducing agent, pH adjuster, and temperature, strongly influence the nucleation and growth processes occurring during reduction method. The appropriate use of these factors allows the synthesis of a wide range of NPs with controlled size, shape, and composition [19]. Nanotoxicity is the most prominent adverse effect caused by NPs when they interact with the environment and living systems. The exposure of NPs to living organisms induces various types of toxic attributes such as cytotoxicity (causing apoptosis, autophagy, and mitoptosis), genotoxicity (resulting mutagenicity, clastogenicity, and aneugenicity), and epigeneticity [20, 21]. Changes in hematological, biochemical, oxidative enzyme, and histopathological parameters are considered to be the potential biomarkers for evaluating the toxicological impacts of NPs in living organisms. Moreover, owing to the evolutionary resemblances in the immune system of fish and humans, the fish model can mimic the biological responses happening in human well. Previous literature has also reported fish as an appropriate biological model to examine the toxicity caused by NPs. Verma et al. [22]

II. MATERIALS AND METHODS

2.1 MATERIALS:

- **Silver nitrate** used for the synthesis of silver nanoparticles was procured from ILE Company Limited Madurai, tamilnadu.
- *MimusopsElengi* plant leaves used in this work were collected from the garden at Seelappadi, Dindigul.



Figure.2.1 *MimusopsElengi*Leafs.

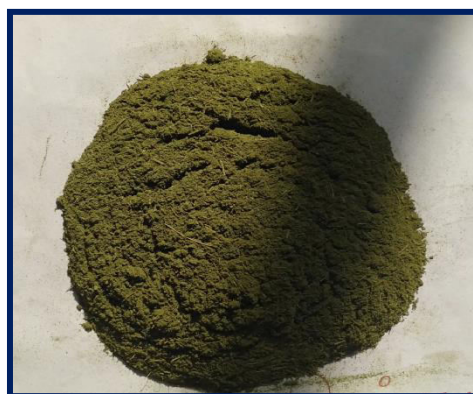


Figure.2.2 *MimusopsElengi*Powder

2.2 Preparation of the Leafs Extract:

Indian medicinal plant *MimusopsElengi* was selected, on the basis of low cost effectiveness, ease of availability and medicinal property. Fresh and healthy leaves were collected locally and rinsed thoroughly first with tap water followed by distilled water to remove all the dust and unwanted visible particles, cut into small pieces and dried at room temperature. About 5 g of leaves were weighed separately and transferred into 250 ml beakers containing 50 ml distilled water and boiled for about 10 min Fig [3]. The extracts were then filtered thrice through Whitman No. 1

filter paper to remove particulate matter and to get clear solutions which were then cooled (4°C) in 100 ml Erlenmeyer flasks for further experiments.

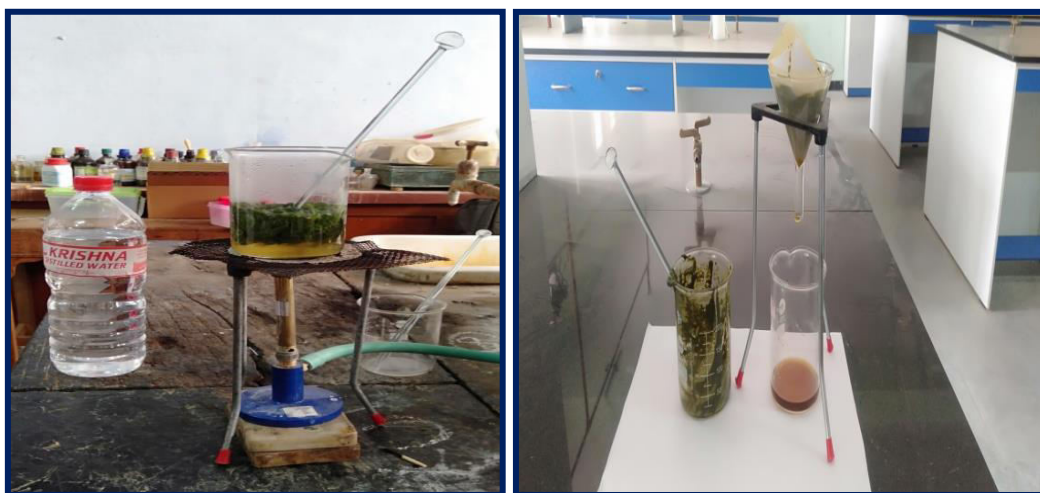


Figure.2.3 Preparation of the Leaf Extract

2.3 Preparation of the Silver Nitrate solution:

1mM and 3mM of silver nitrate solutions were prepared by dissolving 0.017g and 0.051g of the salt respectively in a two 100ml standard flasks and made up to the mark with distilled water according to the formula given below.

$$\text{Molarity} = \frac{\text{Molecular weight} \times \text{required Morality} \times \text{Required Volume}}{1000}$$



Figure.2.4 Silver Nitrate

2.4 EXPERIMENTAL

For the synthesis of silver nanoparticles, 1mm silver nitrate and leaf extract were taken. For the reduction of Ag⁺ ions, 10 ml of *Mimusops Elengi* leaf extract was added drop wise to 5 ml of 1 mm silver nitrate solution. A different color change was observed after 24 hrs as the solution turned into brown from yellow solution at room temperature suggesting formation of silver nanoparticles. The color became brown and turned into dark brown after 48 hrs Figure [5]. The reduction of Ag⁺ was confirmed from the UV–Vis spectrum of the solution. SEM, TEM shows the shape and crystal structure as well as size of the particles



Figure.2.5. 10 ml of Bullet Woodleaf extract was added Drop wise to 5 ml of 1 mm silver nitrate solution.

III. RESULTS AND DISCUSSION

The green synthesis of silver nanoparticles was monitored by UV-Vis spectroscopy .The FTIR spectra were recorded using FTIR spectrometer. A known amount of sample was ground with KBr and the pellet form of the samples was analyzed with FTIR instrument. All spectra were corrected against the background spectrum of water as reference. Morphology and size of silver nanoparticles were investigated using scanning electron microscopes and transmission electron microscopes (SEM and TEM).

After reduction for 24 hours, way of color changed from yellow to brown. Magnification of brown is due to the surface Plasmon resonance property of silver nanoparticles. Aqueous silver nitrate ions were reduced during exposure to the Bullet Woodleaf extract. The color of the reaction mixture changed from yellow to brown indicates the formation of silver nanoparticles.

3.1 Uv-Vis Spectroscopy:

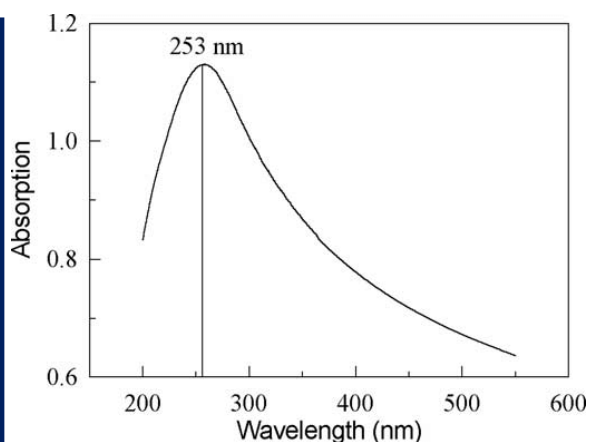


Figure.3.1 Spectra obtained from silver nanoparticles UV-visible absorbance.

To study the stability of silver Nano particles was measured by UV-visible spectroscopy. The absorption band of silver Nano particles has been reported in the range of 200-600nm. UV- visible absorption spectra of AgNPs by green method is shown in the following figures 6 respectively. This spectrum is recorded immediately after the synthesis of silver nanoparticles. The figure 6 shows the broad absorption peaks at nm for green synthesized silver

nanoparticles and 253 nm for green synthesized silver nanoparticles which proves the greater stability green synthesized silver nanoparticles in the solution. The initial pale yellow color of the solution turned brown precipitate; the shifting in color is due to the surface Plasmon resonance (SPR).

3.2 Fourier Transform Infrared (FTIR):

The FTIR spectrum analysis has confirmed the presence of functional groups of stabilizer Bullet Wood leaves extract capping the silver nanoparticles. FTIR measurement was carried out to identify the possible molecules responsible for capping and reducing agent for the silver nanoparticles synthesized using plant Bullet Wood leaves extract stabilizer. The FTIR analysis of silver nanoparticles shows two sharp absorption peaks at 1640 cm^{-1} and 3359 cm^{-1} indicating the possible interaction between proteins and silver nanoparticles. The absorption peak at 1640 cm^{-1} could be due to the amide bond coming from the carbonyl group of a protein (Macdonald and smith, 1996) and the peak at 3359 cm^{-1} may be because of OH groups present in alcohols and phenolics. FTIR spectra of synthesized using silver nitrate salts stabilized by *Mimusops Elengile* leaves extract are shown in Fig. 7.

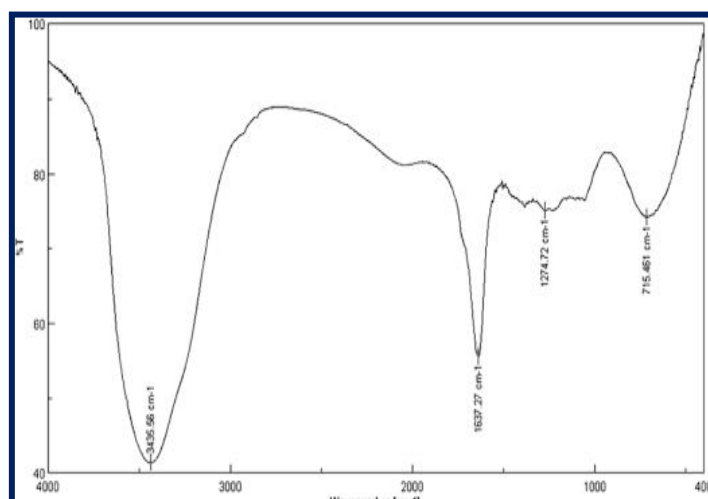


Figure.3.2 Fourier Transform Infrared (FTIR)

3.3 Scanning Electron Microscopy (SEM):

The morphology of the synthesized silver nanoparticle was determined using Scanning Electron Microscope. Figure 8 depicts the SEM images of the green synthesized copper nanoparticles and figure 8 shows the SEM images of green synthesized silver nanoparticles. SEM images of silver nanoparticles stabilized by Indian medicinal plant Bullet Wood leaf extract prepared using Silver nitrate are shown in Fig. [8]. Silver nanoparticles by this method show nearly mono dispersed distribution of particle sizes. The average particle size of the AgNPs nanoparticles is around 80-100 nm.

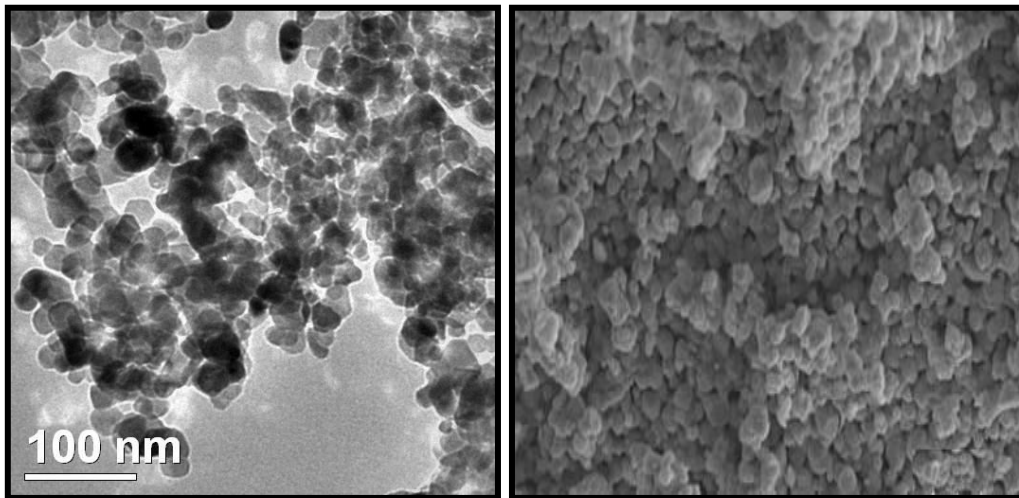


Figure.3.3 Scanning Electron Microscopy (SEM)

3.4 Transmission Electron Microscopy (TEM):

Transmission electron microscopy (TEM) has been employed to characterize the size, shape and morphology of synthesized silver nanoparticles. Silver nitrate is found to be the best precursor that gives better result among other salts used for the synthesis of AgNPs, i.e., good particles size control along with Indian medicinal plant *Mimusops Elengileaf* as capping agent. The TEM image of silver nanoparticles synthesized using silver nitrate stabilized by Indian medicinal plant Bullet Bullet Woodleaf is shown in Fig. [9]. the average size of silver nanoparticles is around 20-50 nm. The sample studied reveal monodispersity of the metal particles.

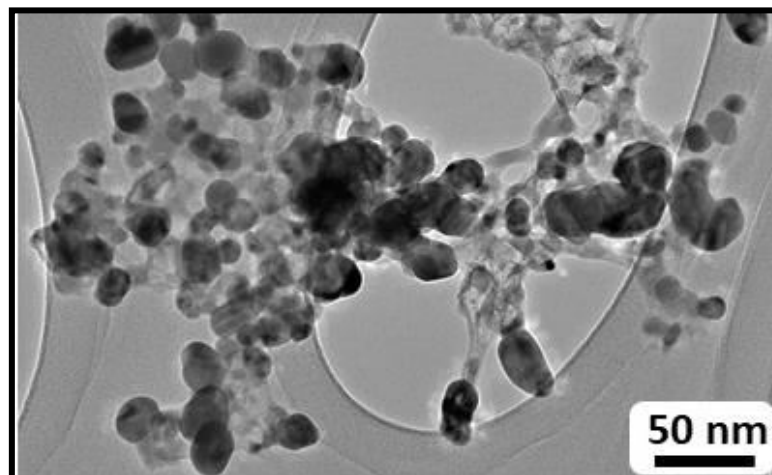


Figure.3.4 TEM image of Silver Nanoparticles.

V. CONCLUSION

Silver nanoparticles (AgNPs) were fruitfully obtained from bio diminution of silver nitrate solutions using Bullet Woodleaf extracts. Green chemistry approach towards the synthesis of nanoparticles has much compensation such as, ease with which the process can be scaled up and economic viability. We have residential a fast, eco-friendly and expedient method for the amalgamation of silver nanoparticles using Bullet Woodleaf extracts with a diameter range of 20nm. These particles are mono dispersed and spherical. No chemical reagent or surfactant template was necessary in this method, which consequently enables the bioprocess with the advantage of being environmental friendly. flush revolutionize occurs due to surface Plasmon resonance during the reaction with the ingredients present in



the *Mimusops Elengi* plant leaves extract results in the construction of silver nanoparticles which is inveterate by UV-Vis, FTIR, SEM TEM, having average mean size of 20-50 nm had Fcc configuration.

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