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Green Synthesis of Silver Nanoparticles from Murraya Koenigii Leaves Extract

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Abstract: The green synthesis approach was used for synthesis of silver nanoparticles. The Murraya koenigii leaves were used as reducing agent for (1mM) silver nitrate. The UV-Visible spectrum of synthesized silver nanoparticles shows peak at 428nm .Transmission electron microscope analysis shows polymorphic nature of silver nanoparticles with mean size of 18nm.The Selected area diffraction pattern shows its polycrystalline nature The functional groups present were known by FTIR studies. The antioxidant activity was checked and IC50 was found to be 90.80µg/ml.
Key words: Murraya koenigii, Silver nanoparticles, TEM, SAED antioxidant activity

I. INTRODUCTION

Nanotechnology refers to research and technology development at atomic, molecular and macromolecular scales that leads to study of structure ranging 1-100 nm. The idea of nanotechnology was first highlighted by Nobel laureate Richard Feynman in his famous lecture at California Institute. Richard Feynman published article in 1960 'There is a plenty of room at the bottom' in which he discussed the idea of nanomaterial.

properties. Due to reduction in dimensions of material to atomic level their properties also changes. Nanoparticles have unique physico-chemical, optical & biological properties that can be changed as per need of function.Synthesis methods can be classified according to strategy applied (bottom-up or top-down approach), the nature of the process (physical, Chemical, Biological e.g. bio-mineralization), the energy source (laser, plasma, ion sputtering, electron beam, microwave, hydrothermal, freeze drying, high energy ball milling, combustion or the media (synthesis in gas in liquid or in solid) .Silver is generally used in silver nitrate form ($AgNO_3$) as antimicrobial agent. But when silver is used in nanoparticle form it increased surface area available for the microbe to be exposed. Silver ions are used in formulation of dental resin composites, in coatings of medical devices, as a bactericidal coating in water filters, sprays, pillows, detergent and as bone cement. Many techniques of synthesizing silver nanoparticles (AgNPs) have been investigated. Some of them are chemical reduction, electrochemical, photochemical reduction, microemulsion, ɣ-ray irradiation, UV-irradiation, microwave and ultrasonic. Nowadays special focus on ''green chemistry'' by researchers is strongly created because of increasing awareness about the environment. Metallic nanoparticles like silver nanoparticles can be synthesized from plant extract or also produced from variety of microorganisms.

II. MATERIALS AND METHODS

The silver nitrate solution is purchased from Sigma Aldrich. The 2, 2-diphenyl-1- picrylhydrazyl (DPPH) were brought from Himedia, Mumbai. The plant leaves were collected from local area. All solution was prepared in double distilled water and the DPPH solution was prepared in methanol.

A. Preparation of Plant Material

The leaves of plant *M.koenigii* were collected from the local area of Nanded. The leafs of these plants were separated, washed thoroughly with distilled water; Shade dried and powdered using blender and stored. Some of the primary alkaloids found in the M. koenigii leaves, stems and seeds are -Mahanimbine, girinimbin, koenimbine, isomahanimbin, koenine(3).

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Figure1- Murraya koenigii leaves (a) shed dried and (b) Powdered

B. Green synthesis of Silver Nanoparticles (AgNPs)

By using green synthesis approach silver nanoparticles were synthesized by using aqueous extract of *Morriya koenigii*. Biogenically AgNPs were synthesized from aqueous extract of *Morraya koenigii* leaf by reduction of silver ions. Collected Morriya koenigii leafs were shed dried and finely powdered, then used for biosynthesis of AgNPs.1 gm. fine powder of leaf was added in 100 ml of distilled water and then boiled for 10-15 minutes, after boiling it was cooled and then filtered through whatman's filter paper no.1. 1mM of aqueous silver nitrate solution was kept for stirring at 40^oC on magnetic stirrer. Filtered plant extract was added to 1mM silver nitrate solution drop wise. The brown to yellowish red colour formation is indication of silver nanoparticle synthesis. UV-Visible spectrum was determined on Shimadzu1800 Spectrophotometer in the range 200-800nm. Peak between this ranges (380nm-440nm) shows presence of the silver nanoparticles in mixture. These nanoparticles are then recovered or extracted in powder form by allowing it to air dry at room temperature. After synthesis these silver nanoparticles were characterized by FTIR and TEM analysis.

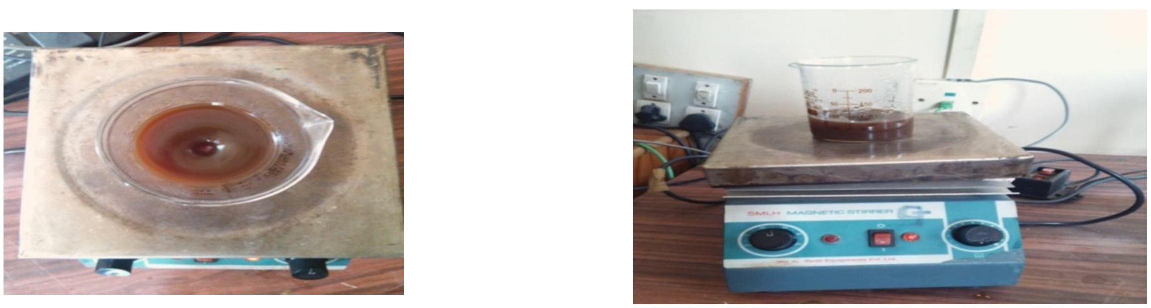


Fig 2: Synthesis of silver nanoparticles by reduction of $AgNO_3$ on magnetic stirrer.

C. UV-Visible Spectroscopy Analysis

UV-visible spectroscopy is one of the most widely used techniques for structural characterization of silver nanoparticles and one of the popular characterization techniques to determine particle formation and its properties.. Noble metal particles are ideal candidates for study with UV- Vis spectroscopy, since they exhibit strong surface Plasmon resonance absorption. The reduction of metal ions was monitored by measuring the UV-Vis spectroscopy. The silver nanoparticles were measured in a wavelength ranging from 200-800 nm. The UV-Vis spectroscopy measurements of silver nanoparticle were recorded on Shimadzu 1800 dual beam spectrophotometer operated at a resolution of 1nm.The UV-Visible analysis of synthesized solution shows peak at 428nm which denotes synthesis of silver nanoparticles in the reaction mixture. The synthesis can also be confirmed with the colour change observation from pale yellow to brown colour. This phenomenon is due to surface plasmon resonance of synthesized nanoparticles.

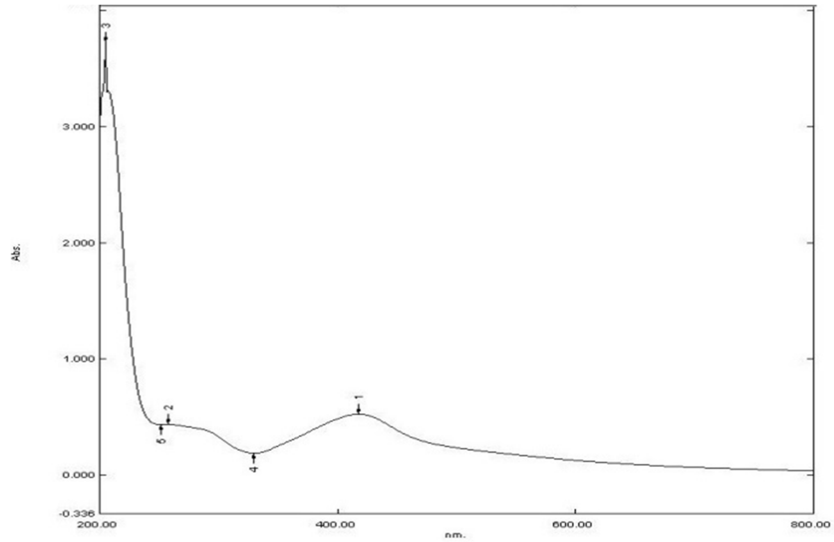


Fig 3: UV-visible spectrum graph of silver nanoparticle showing peak at 428 nm.

D. FTIR Spectra

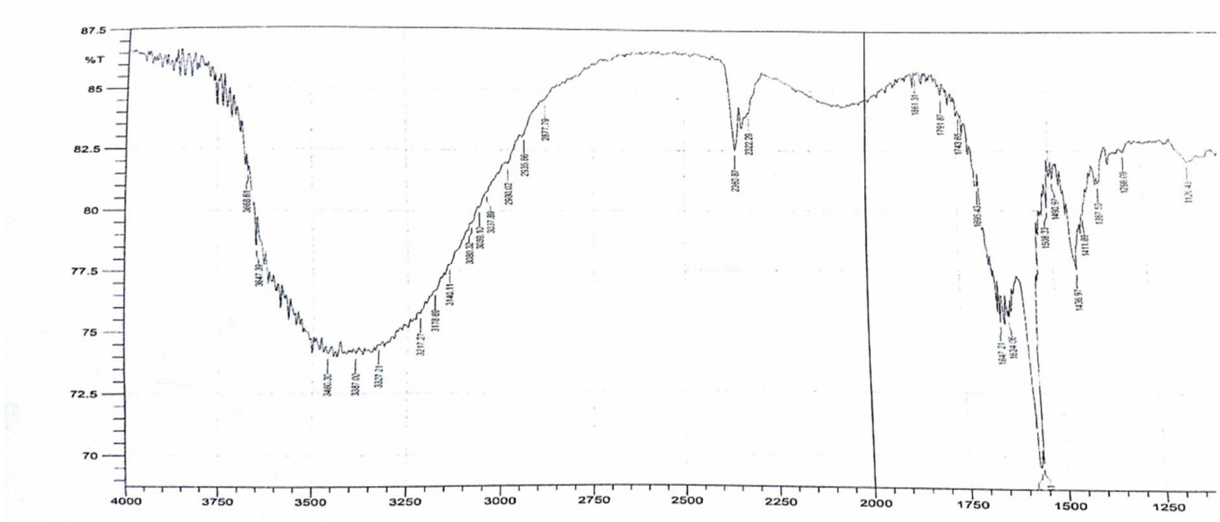
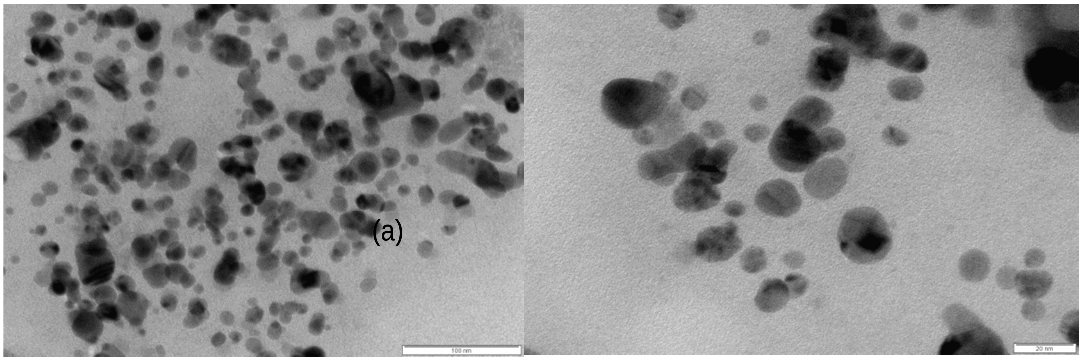


Figure 4: FTIR spectra of Silver nanoparticles synthesized from Murraya koenigii

Fourier transform infrared spectra of synthesized silver nanoparticles shows different functional groups present which are 3460.00cm-1, 3387.45cm-1, 3217.79cm-1, 2980cm-1 belonging to alkane group with H-C-H asymmetric stretch.2877cm-1 and 2360.87cm-1 shows presence of carboxylic acids with O-H bonding stretch .The1624cm-1 indicates C=O stretch ,1411.10cm-1 belongs to nitro group with N-O bend. These are some characteristic functional groups that are responsible for silver nanoparticles synthesis (1,2).

E. Transmission Electron microscope analysis

Transmitted electron images were collected using a JEOL 7500FA scanning electron microscope. A single drop with a volume of 5µL of the various nanoparticle suspensions were dried upon TEM grid with a carbon support film. The TEM analysis reveals the size of nanoparticles in the range of 14nm -25nm.The mean size of synthesized silver nanoparticle was 18nm.The Selected area diffraction pattern shows polycrystalline nature of synthesized silver nanoparticles.



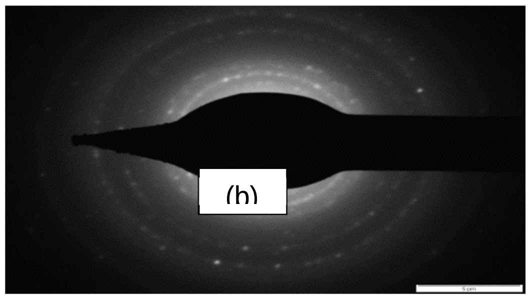
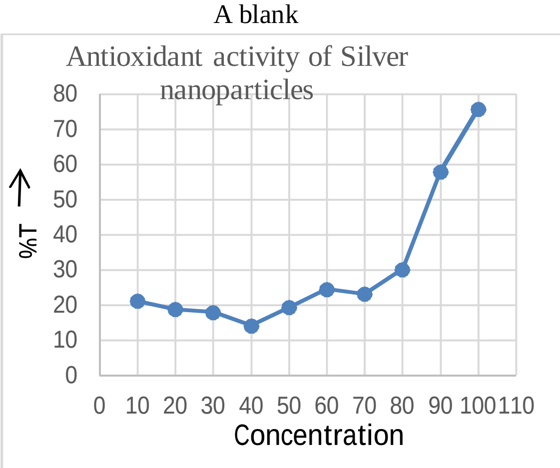


Figure-(a) Transmission analysis of Silver nanoparticles synthesized (b) Selected area diffraction pattern of AgNPs

F. Antioxidant Activity of Sliver Nanoparticles:

Antioxidant assay is to determine the scavenging ability of molecule to the reactive oxygen species which are harmful for health. Antioxidant assay is used to measure the total antioxidant capacity of plasma, serum, urine, and saliva & cell lysate. Oxidative stress is results into number of diseases such as atherosclerosis, chronic renal failure, and cancer. It is a condition where imbalance exists between production of reactive oxidizing species and body's ability to neutralize these intermediates, resulting in cellular damage. Stock of DPPH were prepared(0.2mM) in methanol(7). The nanoparticles were taken in the range of 10µg/ml to 100µg/ml.3 ml of DPPH solution was added in each tube of silver nanoparticles and kept in dark conditions for 30 minutes. Absorption maxima of this reaction mixture were checked at 517nm on spectrophotometer. Inhibition is calculated by using following formula,

$$\% \text{ of inhibition} = \frac{\text{A blank} - \text{B sample}}{\text{A blank}} \times 100$$



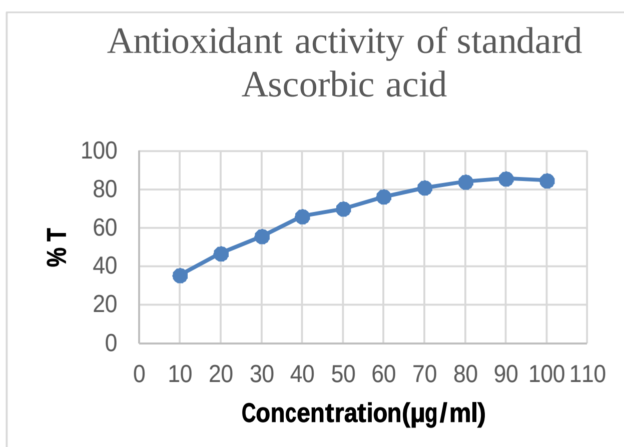


Figure5: Antioxidant activity of silver nanoparticles

Antioxidant activity assay shows IC $_{50}$ value for ascorbic acid 11.63 µg and 92.80 µg for synthesized silver nanoparticle, hence the synthesized nanoparticles possesses the antioxidant activity.

III. RESULT

The silver nanoparticles were successfully synthesized from Murraya koenigii leaves. The synthesis was preliminarily observed by colour change in reaction mixture from green to red colour. This phenomenon is due to surface plasmon resonance of silver nanoparticles. The UV-visible spectra shows peak at 428nm .The narrow peak indicates the small size of synthesized nanoparticles. The FTIR spectrum shows N-O, C=O, O-H, alkenes functional groups. Transmission analysis report shows the monomorphic nature of silver nanoparticles with mean particle size of 18nm.The SEAD pattern shows spots as well as rings confirming its polycrystalline nature.The IC50 for silver nanoparticle was found to be 90.80µg/ml.

IV. CONCLUSION

In this study the silver nanoparticles were synthesized by using green chemistry approach. The silver nanoparticles are polymorphic and polycrystalline in nature. These silver nanoparticles show good antioxidant activity.

A. Conflict of interest

Authors report no conflict of interest .

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