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RESEARCH ARTICLE .....!!!

GREEN SYNTHESIS AND CHARACTERIZATION OF SILVER (AG) NANOPARTICLE USING OLIVE LEAF EXTRACT

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ABSTRACT

Metal nanoparticles have a high specific surface area and a high fraction of surface atoms. Because of the unique physicochemical characteristics of nanoparticles, including catalytic activity, optical properties, electronic properties, antibacterial properties, and magnetic properties they are gaining the interest of scientist for their novel methods of synthesis. Ag nanoparticle was synthesized using olive leaf extract in a greener way. The resultant nanoparticles were characterized using UV-vis, IR, SEM and XRD respectively.

INTRODUCTION:

Biosynthesis of nanoparticles as an emerging highlight of the intersection of nanotechnology and biotechnology has received increased attention due to growing need to develop environmentally benign technologies in material synthesis . A great deal of effort has been [1] put into the biosynthesis of inorganic material, especially metalnanoparticle using microorganisms and plants Nanosilver has many important applications. It is used as an antimicrobial agent; it is applied in textiles, home water purification systems, medical devices, cosmetics, electronics, and household appliances [2].Besides their antimicrobial features, silver nanoparticles exhibit strong optical features making the nanoparticles suitable for biological sensing and imaging [3]. Due to their high conductivity, silver nanoparticles are applied in conductive inks, adhesives and pastes for a range of electronic devices. Silver nanoparticles are also used as catalysts in several chemical reactions such as the oxidation of styrene [4]. Vijayaraghavan *et al.,* (2012) synthesized the present investigation deals with the synthesis of silver nanoparticles (AgNPs) by green synthesis that has advantages over conventional methods involving chemical agents associated with environmental toxicity [5].

MATERIALS AND METHODS

Materials:

Silver nitrate ($AgNO_3$), Olive leaves, Nitric acid (HNO_3), De-ionized water are used to synthesis Ag nanoparticle.

Preparation of Olive Leaves Extract:

Olive leaves were collected from Kodaikanal and washed thoroughly with distilled water in order to remove the dust particles. All glass wares were washed with dilute nitric acid HNO_3 and distilled water, then dried in hot air oven.2.0 g of olive leaves was boiled for 15 min, filtrated and completed to 100 ml to get the extract. The filtrate used as reducing agent was kept in the dark to be used within one week. A stock solution of $AgNO_3$ 0.1 N was prepared by dissolving 1.69 g/100 ml de-ionized water [6].

Synthesis of silver nanoparticles:

For the synthesis of the silver nanoparticles, 4 ml of the olive leaf extract was added to the 2ml 0f $AgNO_3$ solution and the volume was adjusted to 10 ml with de-ionized water. The solution was stirred for 2 min. The reduction process Ag^+ to Ag^0 nanoparticles was followed by the color change of the solution from yellow to brownish-yellow to deep brown [7].

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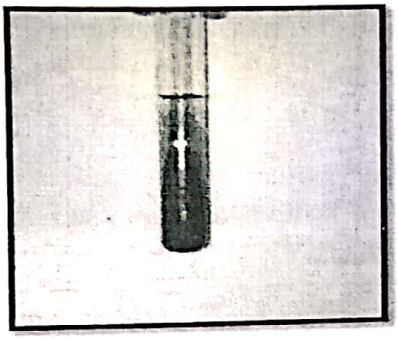

Fig.1 Ag Nanoparticle

RESULT AND DISCUSSION

Characterization

Scanning Electron Microscopy (SEM), X-Ray Diffraction (XRD), Ultraviolet (UV), Infrared (IR) was used to characterize the crystal structure, morphologies, impurities and optical properties of Ag nanostructure.

UV-Visible Spectrum

The UV –Vis spectrum is recorded in acetone solvent by Shimadzu 1800 UV Double beam spectrophotometer .

UV-Visible spectrum has been widely used to characterize the semiconductor nanoparticles. As the particles size decreases absorption wave length will be shifted to shorter wave length and the band gap increases for the nano sized particles. This is the quantum confinement effect of semiconductor nanoparticles. The UV-Visible spectrum of Ag given in fig.2.

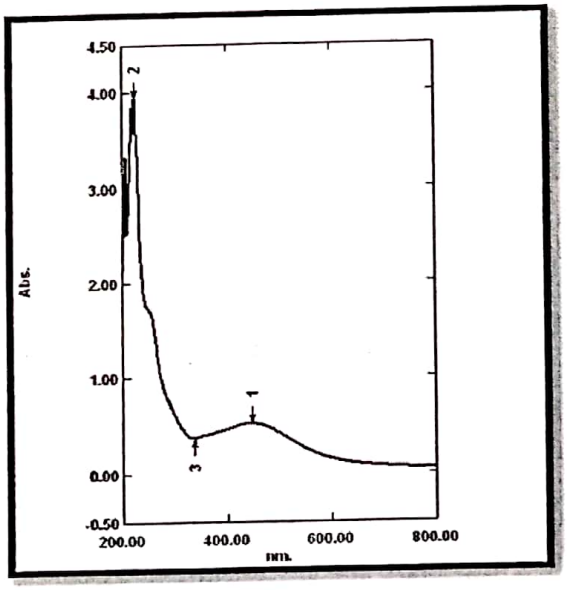

Fig.2 UV-Visible spectrum of Ag

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In these spectra λ_{max} for Ag is observed at 447 nm. This indicates the absorption shift towards the shorter wavelength, because of the particle size reduction. From these spectra, it is evident that resultant nanoparticles were embedded in silica matrix and exhibited the significant blue shift. This is an indication of strong quantum confinement. The bulk value for Ag is at 440–458 nm.

FT-IR Analysis

The FT-IR spectrum is recorded in acetone solvent by Shimadzu 1800 UV Double beam spectrophotometer.

Infrared spectroscopy (IR) is the spectroscopy that deals with the infrared region of the electromagnetic spectrum that is light with a longer wavelength and lower frequency than visible light. It covers a range of techniques, mostly based on the absorption spectroscopy. As with all spectroscopic techniques, it can be used to identify and study chemicals. A common laboratory instrument that uses this technique is a Fourier Transform Infrared (FT-IR) spectrometer [8]. FT-IR spectra for Ag shown in the figure 3.

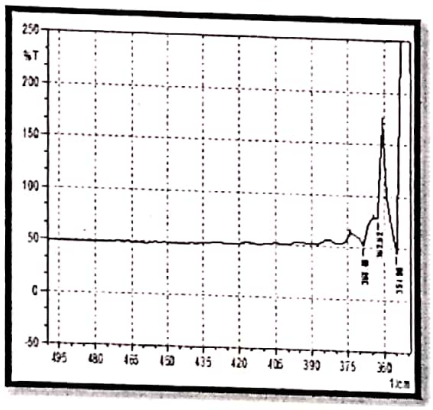

Fig.3 FT-IR spectrum of Ag

The FT-IR spectra of metal sample show specific stretching vibrations for the different structural forms of metal. The specific metal and their IR vibrational frequencies are given below.

The spectrum in the range 362.62 cm^{-1} was showing IR absorption due to the various vibrations involved. The stretching frequencies are observed 400-4000 at cm^{-1}. It is confirmed that the obtained nano metal was Ag.

XRD Pattern

The XRD spectrum is recorded by X-Ray diffract meter with Cu kα radiation at 25^0C. The average particle size is determined using **Debye - Scherrer's equation** applied to major, Peaks corresponding to maximum intensity in the XRD patterns of the sample (Fig.3).

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The size of the synthesized Ag nanoparticle were calculated from powder XRD pattern using Scherrer's formula [9].

$$D=k\lambda/\beta \cos\theta$$

Where

The constant k is the shape factor ≈ 0.94

λ is the wavelength of incident X-Ray (1.5406Å)

β is the full width for half maximum

θ is the Bragg's angle for the peak.

β can be calculated using the equation.

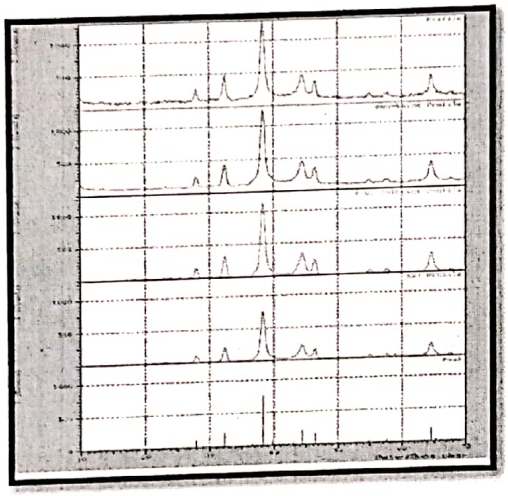

Fig.4 XRD spectrum of Ag Nano

From the XRD data,

The crystalline size (D) = 1.93 nm

Fig. 4 shows the XRD pattern of Ag. The observed "2θ" values come in good agreement with standard "2θ" values. This confirms that powder prepared was Ag. The size of the Ag nanoparticles thus estimated was found to be 1.93nm.

Scanning Electron Microscopy (SEM)

The SEM is recorded by JEOL Model 6390 computer-controlled microscope. The image obtained by SEM of the samples for Ag (Fig.5) show quasi spherical [10] like nanoparticles. The Ag nano particles have been distributed well within the range of~ 100nm which is the

favorable for some other purpose. We can conclude that the samples of Ag synthesized are having particle size in the nano scale.

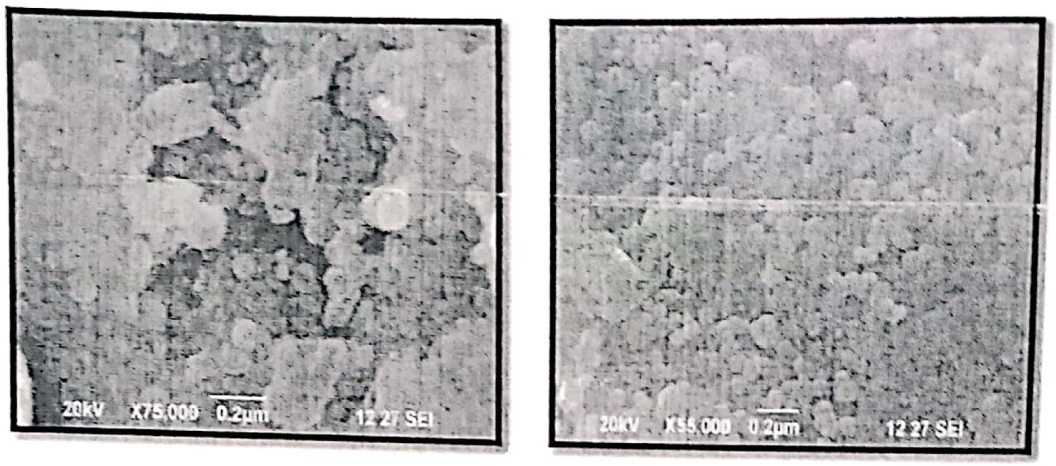

Fig.5 SEM image of Ag Nano

CONCLUSION:

The Ag nanoparticle were synthesized by green synthesis using olive leaf extract. The sample obtained by the green synthesis were characterized by UV, FT-IR, XRD, and SEM instrumental methods. The IR analysis of the spectra shows broad band between 400-4000 cm^{-1} with shoulder shape, characteristic of Ag band. The images obtained by SEM of sample Ag shows quasi spherical like nanoparticles. From the XRD results the size of Ag nanoparticles were calculated to be 1.93 nm. The Ag nanoparticles have been distributed well within the range of ≈100 nm, so it can be used to some other purpose.

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