

SOLID STATE METHOD FOR SYNTHESIS OF SILVER NANO PARTICLE BY USING FENUGREEK PLANT EXTRACT

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Abstract-We have reported a fast, convenient and a solid state method for synthesis of silver nano particles by reducing silver nitrate with the help of fenugreek plant extract. For synthesis of silver nano particles, containing 1mM AgNO₃ was reacted with 10ml of the aqueous extract of fenugreek. In a solution precursors react to form stable nuclei followed by the growth of particles. The characterization of nano particles was done by using X-ray diffraction Analysis (XRD) studies, Morphological and Elemental studies of silver nano particle were confirmed by Scanning Electron Microscopy (SEM & EDAX). The XRD pattern showed the highest Bragg peaks of (111) plane at a diffracting angle 37.91° in the face center cubic (FCC) of silver nano particle and confirmed that these nano particles are crystalline cubic structure. The optical absorbance was recorded in the UV study of the wavelength region in 200nm to 800nm. The particle size is 52 nm and shaped in spherical without significant agglomeration, as revealed from the SEM analysis. The Silver nano particle was synthesized at room temperature using fenugreek extract. The present method of synthesis does not involve the use of harmful chemical and hence and safely be used for medical application.

Keyword: plant extract, XRD, SEM & EADX and UV studies

I. Introduction:

In general, Nano particles are prepared by a variety of chemical methods which are not gracious nature. Use of plants in the synthesis of nano particles is quite novel leading to truly green chemistry which provided advancement over chemical and physical method as it is cost effective and friendly manner. The recital and property of materials depend on atomic structure, composition, microstructure and defects which are forbidden by thermodynamic and kinetic of the creation and handling out. Fenugreek (*Trigonella Foenum -Graecum*) found in nature and is cultivated in India and Pakistan is a well known medical plant having the properties of reducing blood sugar level antibacterial and anti-inflammatory. It contains lecithin and choline that helps to dissolve cholesterol, fatty substance, minerals, B.Complex, iron, phosphate, Para Amino Benzoic Acid, Vitamins A and Vitamins B. At the familiar the nanoscale in one dimension is less than 100nm, more typically less than 50nm. In many cases, the physics of such nano materials can be different from the property of the material. Learn of clusters preceded this work by researchers such as Uyeda [2]. The main results of this study have been published [3] and formed one of the drivers for the U.S.National Nanotechnology Initiative. In this work attempted to envelop the broad field of nanostructure science and technology and the area of synthesis such as functional nano scale devices, bulk nano structured materials and biologically related aspects of nanoparticles, nano structured materials, and nano devices. In the present work, Synthesis of silver nano particle from the fenugreek plant extract and main studies of the XRD structure and luminescence are enhanced property of the material.

2. Experimental:

2.1 Preparation of Plant Extract

Plants were collected from Jajhindupuram, Madurai district, TamilNadu. The plant was initially washed 100ml of distilled water for 30 minutes and ground without adding water. After that the extract was passed through WhatmannNo.1 filter paper and then filtrates were kept at room temperature for further uses.

2.2 Synthesis and Optimized of Silver Nano particles

For synthesis of silver nano particles, the round bottom flask containing 1mM AgNO₃ was reacted with 10ml of the aqueous extract of fenugreek. In a solution of precursor reacted to form stable nuclei followed by the growth of particles. The parameter are used the optimized pH, time duration, temperature, concentration of silver nitrate, calculation ratio of leaf extract, For co-precipitation of component particles, attention is required to control the conditions to achieve homogeneity of the final result.

3. Results and Discussion

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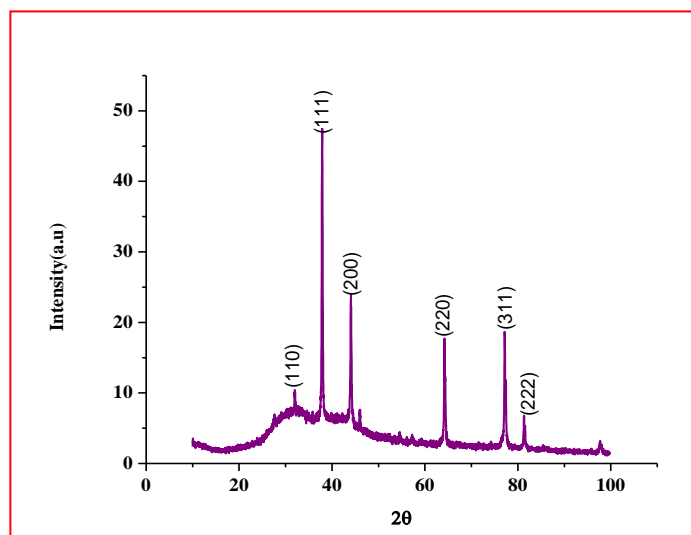
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3.1 Structural studies

The structural properties have been studied using X-ray diffraction technique using Cu K α radiation source ($\lambda = 1.54056$) with powder diffraction. The XRD pattern the peak intensities were observed and matched to the JCPDS standards. The peaks were indexed. The maximum peak of the XRD pattern is corresponding to the theoretical pattern of JCPDS data. The X-ray diffraction pattern of the synthesized silver nano particle was recorded between the range 10° to 90° as shown in the fig 3.1. Grain Size, Crystal structure of the silver nano particle is an analysis by x-ray spectroscopy. XRD studies were carried out to identify the crystalline nature of the synthesized biogenic AgNPs. Diffraction peaks were observed at 2θ values of 37.91° , 44.09° , 31.97° , 64.2° , 77.18° and 81.22° that can be indexed to (111), (200), (110), (220), (311) and (222) reflex plane of the face centre cubic. The grain size of synthesized silver nano particle was determined by Debye Scherer's formula and found to be the range of (52nm). The lattice parameter was calculated according to Bragg's Law and was found to be $a=b=c=4.074$ and $\alpha=\beta=\gamma=90^\circ$.



3.2 SEM and EDAX

The morphological and elemental characteristics of silver nano particle have been studied using Scanning Electron Microscope instruments. These films have microstructure grains spread out as shown in the fig.3.2 (a) and EDAX spectrum as shown in the fig.3.2 (b). The elements are analyzed as shown in the Table 3.2. An image shows smooth and uniform spherical shaped grains spread all over. It appears to be more uniform with decreased porosity. The materials are depending on the several parameters so the distribution of the particle is varied then size of the particle is almost same. Scanning Microscope indicate that the substrate is almost complete covered spherical grains. Agglomerations were observed at pH level immediately of to adding the AgNO $_3$ into the reaction mixture and sheltered the areas ranging from approximately up to 200nm in width can be imaged in a scanning mode using conventional SEM techniques (magnification ranging from 20X to approximately 20,000X).

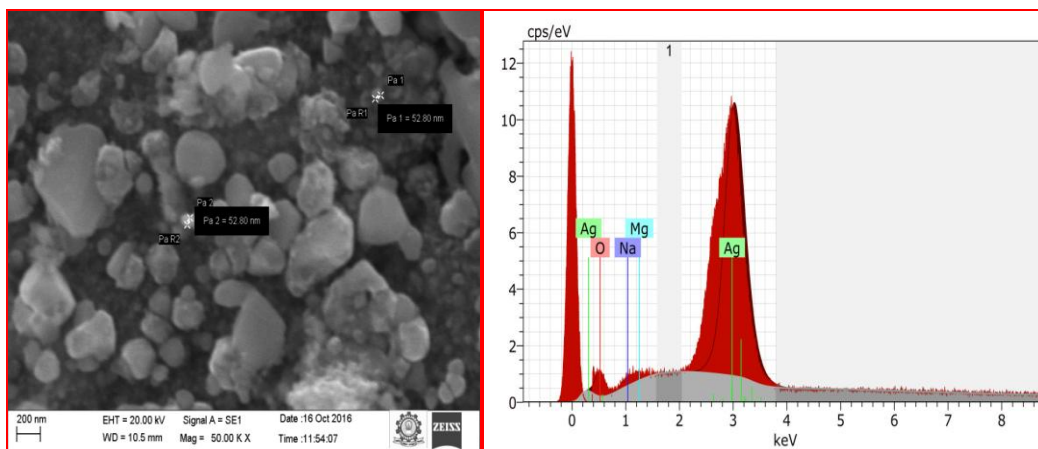


Fig.3.2 (a) SEM picture

Fig.3.2 (b) EDAX spectrum

Table 3.2: Elemental Analysis.

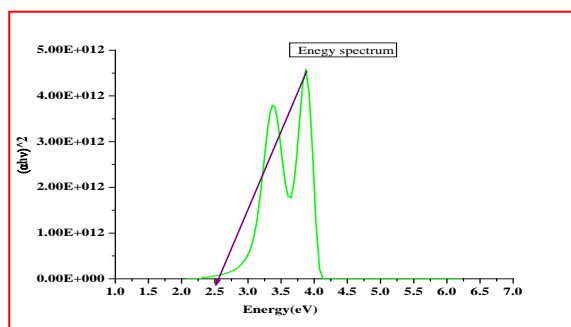
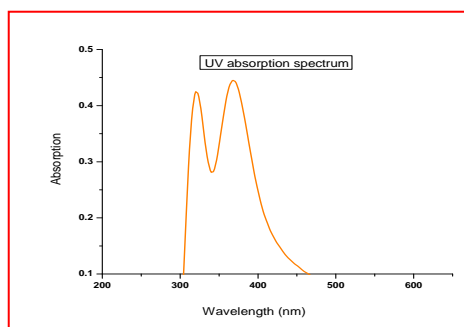
Elements	Normal (Wt %)	Atomic (Wt %)
Oxygen	17.95	55.90
Silver	78.34	36.14
Sodium	2.57	5.57
Magnesium	1.14	1.14
Total	100	100

3.3 UV-Vis. Studies

The UV absorption and transmission spectra of silver nano particle within the range of 200nm -800 nm as shown in Fig.3.3(a) . The optical absorption edge is approximately located on the corresponding wavelength. The optical band gap of the samples can be calculated using the relation

$$(\alpha h\nu) = A (h\nu - E_g)^{1/2}$$

Where A is a constant and E_g is the optical band gap energy. In absorption spectra was found that the $(\alpha h\nu)^2$ is plotted and obtain the optical band gap as shown in Fig.3.3(b)



3.4 PL Studies

Photoluminescence spectroscopy is a contactless, non-destructive method of probing the electronic structure of materials. Photoluminescence is the spontaneous emission of light from a material under the excitation. PL spectra of the silver nano particle were obtained the excitation and emission spectra as seen in the Fig.3.4. The quantum yield (1.04) of silver nano particle have been determined by using PL excitation and emission studies. Excitation is localized at the absorption edge which corresponds to the recombination of the charge carriers between the lower energy levels or shallow traps.

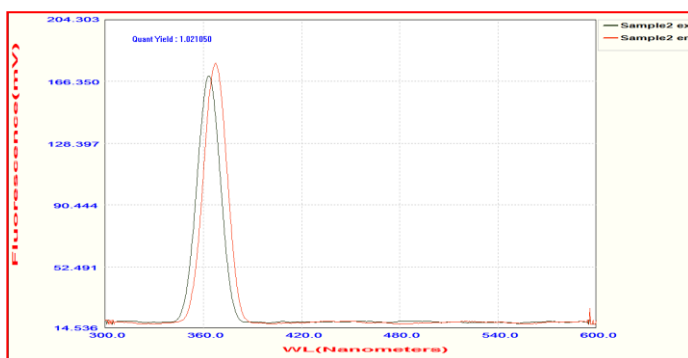


Fig.3.4 PL spectra for silver nano particle

4. Conclusion

In this present study the synthesis of silver nano particle was synthesized by the solid state reaction method using Fenugreek leaf extract which acts as a reducing agent to reduce silver metals to nanosize particles. The synthesized silver nano particle

was subject to analysis, such as XRD, SEM & EDAX, UV and photoluminescence in order to characterize them. The excitation spectra revealed the absorption behavior of the silver nano particle. The emission spectra revealed the near band edge transitions of the highest band edge material dominating the spectra. This is support our earlier discussion that the material with most optical band gap energy dominate the emission and excitation properties and is conformity with the optical and structural results. This opens a way to understand the synthesis mechanism of Ag nanoparticles formed from other plant extracts.

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