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ECOFRINDLY SYNTHESIS OF SILVER NANOPARTICLES

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Abstract:

During the research the synthesis of eco-friendly silver nanoparticles by the reduction of medicinal plant tulsi, This plant was used as reducing and stabilizing agents, formed nanoparticles was analysed by UV-Vis absorption spectroscopy .Whereas the size was confirm for the formation of silver nanoparticles with the help of X-ray diffraction analysis (XRD),),and scanning electron microscopy (SEM). The spectrum of the solution containing silver nanoparticles confirmed the presence of an elemental silver signal without any peaks of impurities. The average diameter of the prepared nanoparticles in solution was about 50 nm.

Key Words: Eco-friendly, Nanoparticle, tulsi, silver,

1.0 Introduction:Nanotechnology is the study of nanoparticles and during the last several years and play a vital role in the daily life (Baker S *et a*l), the most research is focussed on metal nanoparticles due to their unique electrical, optical, electronic, mechanical, magnetic, and chemical properties that are mostly different from those of bulk materials (L. González et al). The specific properties of nanomaterial is due to high surface to volume ratio,(M Cross *et* al, J.V Kim *et* al, W.J.Parak *et* al, D.ASchultz *et* al,M smith *et* al ,Karni TC *e*t al ,Singh S *et* al.) and these are as catalytic, photonics, and electronics. Silver nanoparticles is subject of highly attracting considerable attention due to their diverse properties and uses, like magnetic and optical polarizability, electrical conductivity (Shen Y *e*t al.Zalevsky *et* al,Taylor A *et* al,Kalidindi SB *et* al ,serp *et* al , Das S *et* al, H Y wang *et* al), catalysis (Shiraishi), antimicrobial and antibacterial activities (Baker et al., 2005; Shahverdi et al., 2007), DNA sequencing, and surface-enhanced Raman scattering (SERS) (Kung *et* al., Somura *et* al,Jotterend F *et* al ,Lee H *et* al, Ethridge M L *et* al, Mata A *et* al, Moephy CJ *et* al). There are many methods for the fabrication of silver nanoparticles, such as sol -gel of silver ions in aqueous solutions with or without stabilizing agents (Zhang H et al,Niraimathi *et* al,Sharma VK *et* al, Narayana KB *et* al,), thermal decomposition in organic solvents (Ashanrani PV *e*t al., 1990), chemical reduction and photo reduction in reverse micelles,. The methods which is used are extremely expensive and are not eco-friendly because these involve the use of toxic, hazardous chemicals, which are highly risky and pollute to the environment. Since metal nanoparticles are extensively applied to areas of human contact (Landwith DM *et* al), therefore to develop environmentally friendly processes for nanoparticle synthesis is highly needful because hazardous chemical is not involve during fabrication of these nanoparticles. During this researchwork, we synthesised silver nanoparticles with the bio reduction method using tulsi plants this is acting stabilised as well as reducing agents.

2.0 Experimental.

2.1. Materials and methods

2.1.1. EXTRACTION OF PLANTS: Silver nitrate was procured from E.Merck and

Used as such which obtained. Dilution and dissolution of the chemicals were done in the During experiment 25 gm tulsi plant was taken and it gently washed with 50 mL ofdouble distilled water, and then boiling the mixture for 15 min on a water bath. The mixture is allow to keep cool and then filtered andcentrifuged at 5000 rpm for 15 min.

Figure 1: Tulsi plant

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2.1.2. SYNTHESIS OF SILVER NANOPARTICLES: Nanoparticles was studied by carrying out the reaction in a water bath at and heat up to boiling After 20 minutes the colour was changed from green to yellowish red. Different diluted samples of silver nitrate was prepared, and these were mixed with variable quantity of the mixture of the concentrations of silver nitrate solutionand plant extract were also varied, at 1-5 mM and 10-50% (V/V), respectively. It has been observed the sample consists 25 % (v/v) was the highest reducible character in comparison of others. The silver nanoparticle solution thus obtained was purified by repeated centrifugation at 12,000 rpm for 20 min.

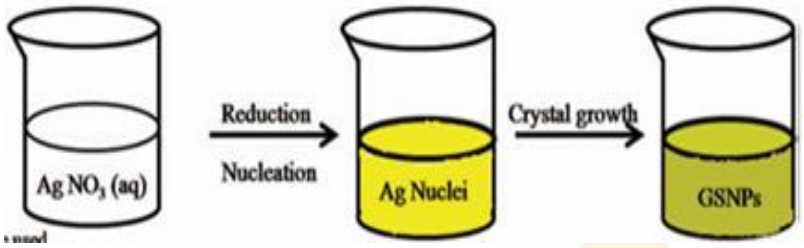

Figure 2. Process of green silver nanoparticles synthesis using plant extracts.

2.2. CHARACTERISATION OF SYNTHESISED NANOPARTICLES:

2.2.1 U.V-VIS SPECTROSCOPY: The ultraviolet and visible spectrum was taken with the help of spectrophotometer (Perkin Elmer Lambda 20 spectrophotometer, PerkinElmer, Waltham, MA, USA) and the analysis was done with the help of Spectronic -20 spectronic made instruments by using quartz made cubate. The entire analysis of UV-VIS spectrum was taken in between 400 nm to 900 nm. It is obvious that the formation of nanoparticle was observed at 580 which shows that by the maxima of maximum absorbance given in uv-vis spectra. Series 1 to 7 represent wavelength 480 to 700 nanometres viz 480 nm,520nm, 560nm, 600nm, 640nm, 680nm, 700nm,

Figure 3.:UV-VIS spectra for the formation of nanoparticles

2.2.2**. TEM ANALYSIS**: After 24Hrs, the SEM (SEM using a Jeol 2010 F apparatus ,JEOL Ltd.,Akishima-shi, Japan) operating at 200 kV analysis was done by preparing slide after the addition of extracted solution of silver nitrate with the variable concentration of silver nitrate as concentration is increasing then some bulky nanoparticle is observed of silver nitrate (Figure 3) , and then slide was allowed to stake the SEM image.it may be happened due to stabilising effect of silver nitrate.

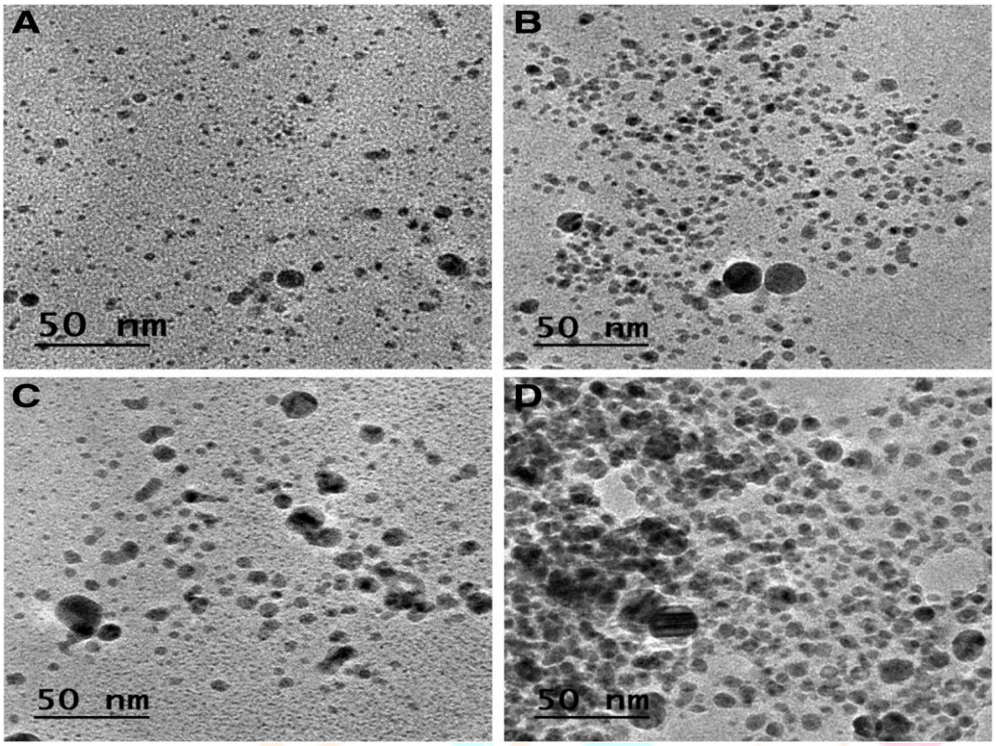

Figure 4 SEM micrographs of the silver nanoparticles obtained for different AgNO3 concentrations. (A) 1 mM, (B) 2 mM, (C) 3 mM, and (D) 4 mM, after a reaction time of 24 h

2.2.3. **XRD ANALYSIS**:To confirm the particle size the XRD analysis was done (PANalytical BV, The Netherlands) operated at a voltage of 30 kV and a current of 30 mA with CuKα radiation in a θ- 2θ configuration and nanoparticles were examined by X-ray diffractometer. The solution of nanoparticles was filled into the cubes of XRD and then the result was taken by X-ray diffractometer the values of 2θ is 38. 28°, 44.04°, 64.34°, and 77.28° along with the plane of (111),(200), (220), and (311) reflections respectively, This may be identified as face-cantered cubic structure of silver. From the above diffraction results it is clearly identified that the silver nanoparticles formed by the reduction of Ag+ ions by the tulsi leaves are crystalline in nature. The non-mentioned peaks at 2θ = 27.96°, 32.28°, and 46.18° denoted by (*) in Figure 5 are may be identified as amorphous organic phases. From the XRD data and Debye-Scherrer equation the size of obtained nanoparticles is 42 nm. By the structural peaks in XRD patterns and the average crystalline size around 27 nm clearly prove that the AgNPs synthesized by our green method were Nano crystalline in nature. The size of silver nanoparticles synthesized by the bio green method can be calculated using the Debye-Scherrer equation D = Kλ/β cosθ;where D is the size of AgNPs, λ is the wavelength of the X-ray source (0.1541 nm) used in XRD, β is the full width at half maximum of the diffraction peak, K is the Scherrer constant with a value from 0.9 to1, and θ is the Bragg angle.

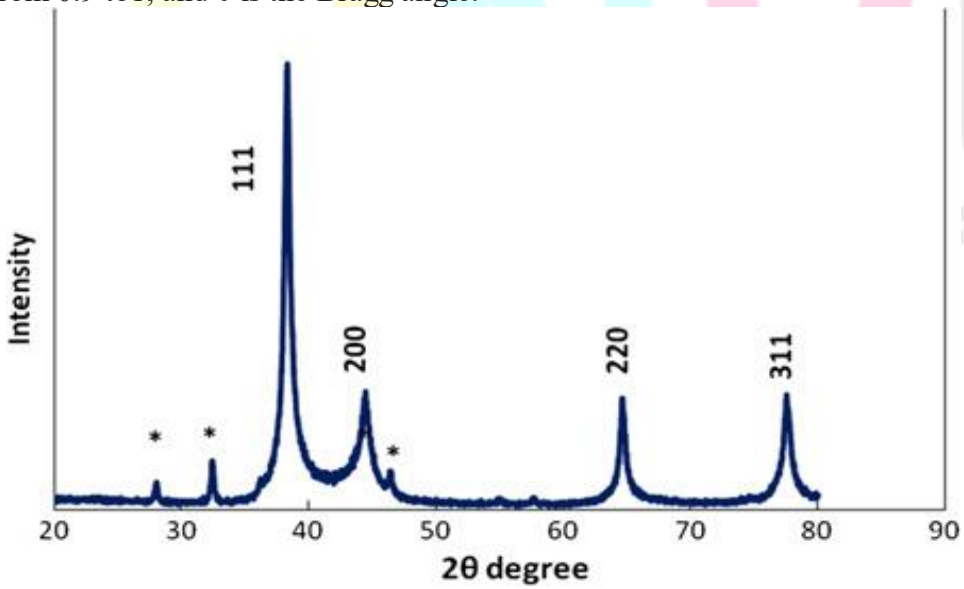

Figure 4 XRD pattern of silver nanoparticles biosynthesized by treating silver nitrate with tulsi leaves

2.2.4. pH ANALYSIS : The pH was determined by using Systronics made digital pH meter .It has been observed The formation of naaopartcles occur in acidic medium as pH is decresing the formation of nanoparticles occur. And at pH 3 the above synthesys was done .

3.0 CONCLUSIONS

During the research We have developed a fast, eco-friendly, and convenient green method for the synthesis of silver nanoparticles from silver nitrate using tulsi leaf extract without affecting the temperature. Tulsi leaves extract is found a very good reducer for the green synthesis of silver nanoparticles within 10 min at all atmospheric conditions .The AgNPs of particle sizes ranging from 5 to 50 nm with an average size of 50 nm are obtained. The Color changes occur due to surface reaction with the ingredients present in the Tulsi leaf extract resulting in the formation of silver nanoparticles, which is confirmed by XRD,UV–vis spectroscopy, and TEM., It is suggesting the a layer which is covering silver nanoparticles and acting as a capping agent to prevent agglomeration and provide stability to the medium, yet further research is needed in this area to explore the possible biomolecule responsible for the bio reduction process..

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