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Green Synthesis of Silver Nano size particles with Pine Leaf

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Abstract:

A green, low-cost, and replicate Pine leaf–negotiated synthesis of silver Nanosized particles is reported. X-ray and transmission electron microscopy (TEM) analyses are performed to ascertain the formation of Ag nano size particles. Nanosize particles almost cylindrical in shape having the size of 1-2 nm are found. Reveal analysis of the X-ray data (XRD) indicated that Ag Nano-size particles have an FCC unit cell structure. Ultraviolet (UV)-visible study revealed the surface Plasmon resonance at 449 nm. With the purpose of understanding the possible involved mechanism for the biosynthesis of Ag Nano size particles. The present procedure offers the benefit of eco-friendliness and agreeability for large-scale production through scaling up. Synthesis of metallic and/or oxide Nano sized particle staking support of plant extracts has attained an upsurge in the immediate past. Although s a lot of works have been done in biologically assisted synthesis of metal and oxide.

Keywords: Transmission electron microscopy (TEM), biosynthesis, green synthesis, nanobiotechnology, nanosize particle, silver, Pine leaf.

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Introduction:

Phytodiversity have not only been silent participants of the exponential process of evolution, rather have indeed survived the extremities of environmental rigours themselves by the prodigally reassuring different valued metabolites. Pine which belongs to the family Cycadaceae.Along with fatty acids like palmitic, stearic, oleic. They are rich in flavonoids broadly belonging to the class of phenolic compounds. in fines, 10 classes of flavonoids are recognized but they are mainly hydrophilic compound and are present in all vascular plants and have been found to contain Amentiflavone($C_{30}H_{18}O_{10}$) and Hinokiflavone($C_{30}H_{18}O_{10}$) as characteristic bi flavonols.[1-3] Synthesis of metallic and oxide Nano sized particles taking assistance of plant extracts has attained an increase in the immediate past.[2-4] The present investigation is an effort in this direction. In this work, pine discusses the synthesis of silver nano sized particles (silver and oxide NSPs). An effort has been also been made to understand the possible involved mechanism for the biosynthesis of silver nano sized particles.

Materials and method:

Synthesis of Silver Nano size particles Using pine leaf Broth Known weight (10 g) of freshly collected, taxonomically authenticated healthy leaves of pine were taken and washed thoroughly in the flush of tap water in the laboratory for 10 min to remove the dust particles, cut into small pieces, and rinsed briefly in sterile distilled water.

Then the sample was placed in a 250 mL beaker containing 200 mL 50% ethanol (EtOH) and was positioned on boiling steam bath for 15 to 20 min until the colour of the solvent changes to light brown. This solution was not treated with activated charcoal to avoid adsorption of the probable candidate flavonoid pigments along with chlorophylls and their congeners. The extract was cooled to room temperature, pressed, and filtered

firstly through the sterile serene cloth. This solution was treated as source extract and was utilized in consequent processes.

Next, 40 mL of the source extract was doubled in volume by adding 40 mL of sterile distilled water. The extract solution was treated with 20 mL of 0.25 M AgNO3 solution and warmed again on the steam bath for 10min until the colour of the solution changes to reddish-brown and was allowed to cool and incubate in the laboratory ambience. Concurrently, ultraviolet-visible (UV-VIS) spectrophotometric study was pursued in which 50% EtOH extract of pine was taken as blank. The deposition gets distinctly visible in the flask within 10 min, which was left for 4 hours and subsequently filtered.

Characterization:

The formation of single-phase compound was checked by X-ray diffraction (XRD) technique Transmission electron microscopy (TEM) analysis of AgNPs was performed with Hitachi H-7500, operated at 80 kV. The specimen was suspended in distilled water, disseminated ultrasonically to separate individual particles, and two drops of the suspension. Was dropped onto holey-carbon–coated copper grids and dried under an infrared lamp. The absorption spectra of the sample were measured by UV-visible spectrophotometer. An effort has been also been made to understand the possible involved mechanism for the biosynthesis of AgNPs.

Results: Figure (1) shows the TEM image recorded from the drop-coated film of AgNPs synthesized by treating the $AgNO_3$ solution with pine leaf broth for 4 hours. The micrograph evidently shows distinct Nano sized particles, almost cylindrical in shape with diameters in the range of 1-2 nm. The measurement was performed along the largest diameter of the particles. Endorsing Nanocrystalline nature of AgNPs as detected in the TEM image (Figure 1). The particle size histogram of Ag NPs (Figure 1a) shows the

distribution of particle sizes.

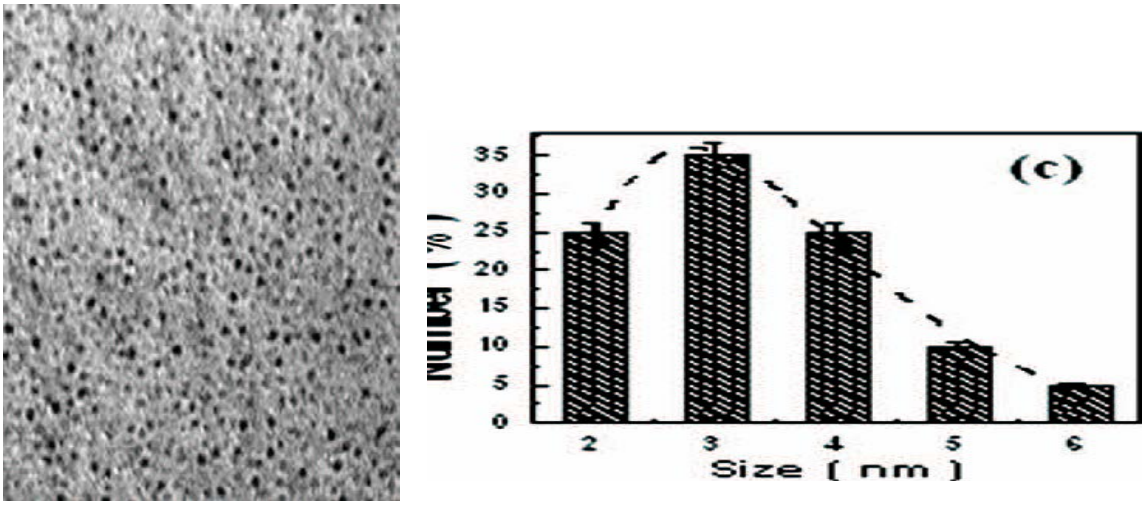


Figure (1a)

Figure (1) TEM photographparticle size distribution of Ag NPs

TABLE1. The crystal data and refinement factors of Ag NPs obtained from X-ray powder Diffraction data

Parameters	Results	Description of parameters
Crystal system	fcc	Rp (profile factor) = 100[_|y
Space group	Fm 3m	the calculated intensity at the ith step.
a (° A)	4.0913	Rwp (weighted profile factor) = 100[_ωi|y
V (°A3)	68.4808	Rexp (expected weighted profile factor) =
100[(n −p)/_ωi(y		100[(n −p)/_ωi(yi)2]1/2, where n and p are
i)2]1/2, where n and p are		the number of profile points and refined
parameters, respectively		parameters, respectively

To ascertain the crystal structure of AgNPs, XRD study was carried out. Riveted refinements on the XRD data of Ag NPs were done, selecting the space group Fm 3m., calculated, and difference XRD profiles for Ag NPs after the final cycle of refinement.

It can be seen that the profiles for observed and calculated ones are perfectly matching, which is well supported by the value of x^2 (= 2.18). The profile fitting procedure adopted

was minimizing the x^2 functions.[5] The XRD analyses indicated that Ag NPS has a face-centred cubic (fcc) unit cell having the sets of lattice planes (111), (200),(220), (311), and (222). The crystal data and refinement factors of Ag NPs obtained from XRD data are summarized in Table 1. The lattice parameter as obtained for AgNPs is in good agreement with the literature report.

FIGURE 2: Riveted refined pattern of Ag NPs in the space group Fm 3m. Symbols represent the observed data points and the solid lines their Riveted fit. Williamson-Hall plot for AgNPs.

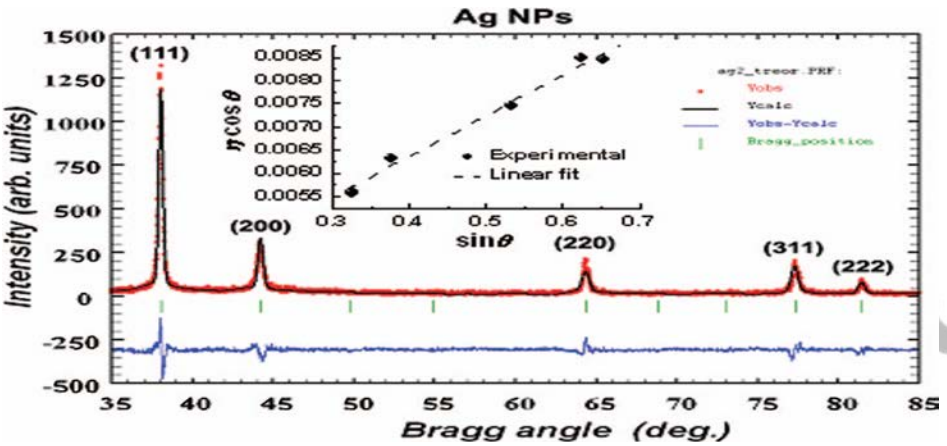


FIGURE 3: UV-vis spectra for Ag NPs recorded as a function of time of reaction of 0.25 M aqueous solution of AgNO3 with pine leaf. In earlier studies on the synthesis of silver Nano sized particles employing bacteria, fungi, or plant extract] the time required for completion (i.e., complete reduction of Ag ions) ranged from 12 to 120, and are rather slow.

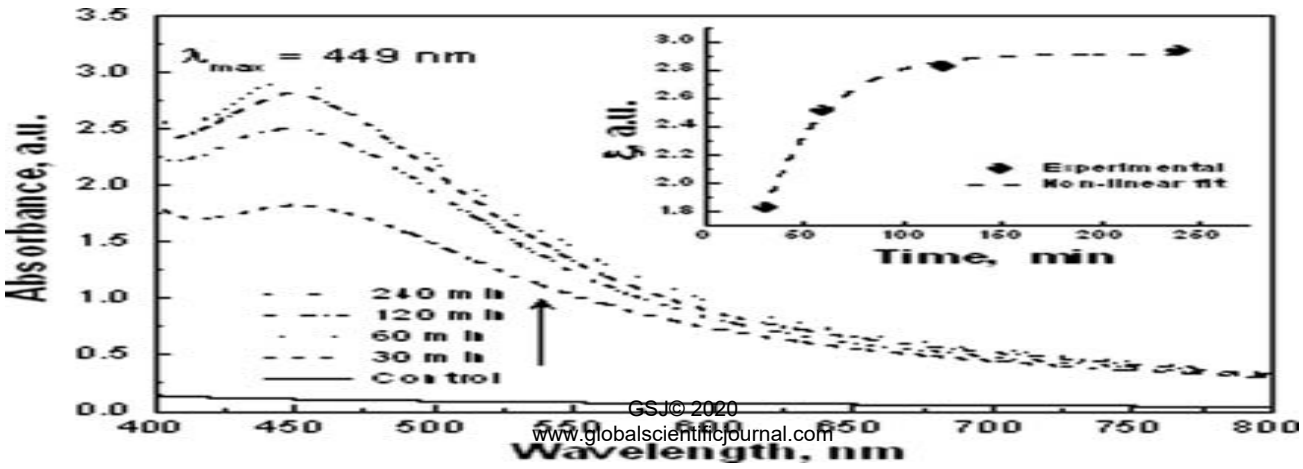
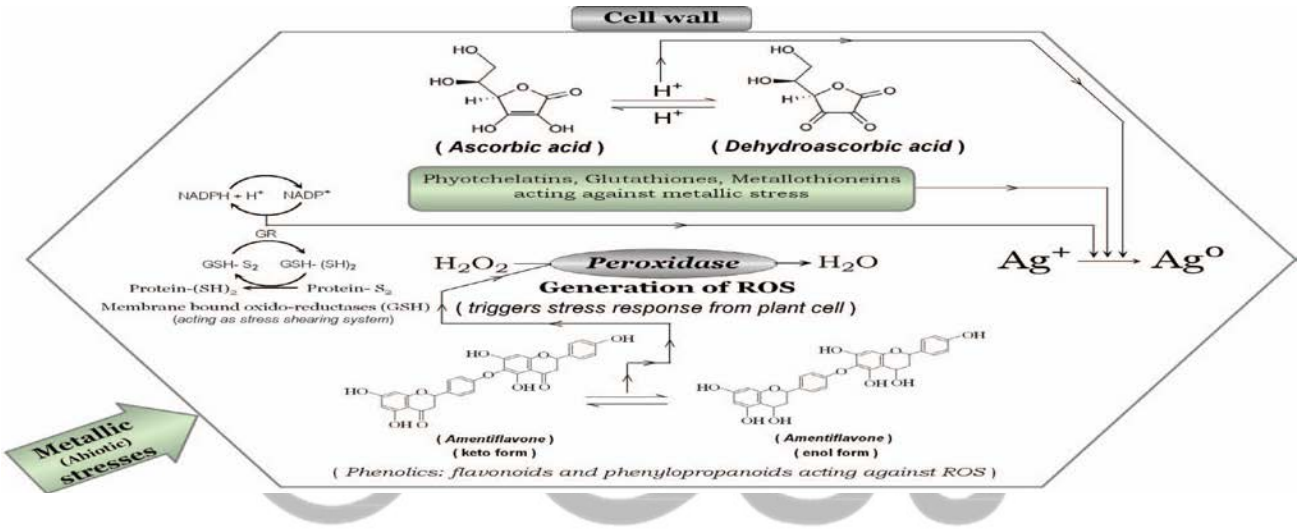


FIGURE 4: Mechanism for the biosynthesis of Ag NPs using pine leaf broth.



DISCUSSION:

Salt/metal ion, as well as drought, chilling and extreme temperatures, increase the levels of reactive oxygen species (ROS).Mechanisms of metal purification by biomolecules proceeds as a cascade of events, such as stimulation of proteins such as metallothionein, phytochelatins, and ferritin, transferring; or by generating antioxidant enzymes such as superoxide dismutase, catalyses glutathione, and peroxides. Glutathione functions as a precursor of phytochelatin synthesis. Metal-induced phytochelatin production decreases cellular levels of glutathione. Glutathione and its homologues, viz. homoglutathione and hydroxyl methyl glutathione, are the abundant low-molecular-weight thiols in plants. Glutathione was implicated to play a major role in plants exposed to metal stress. The

antioxidant action of phenolic compounds is due to their high tendency to chelate metals. Phenolic possess hydroxyl and carboxyl groups, able to bind particularly iron and copper. The reduction is accomplished due to photochemical such as flavonoids or other any other polyphenols or phytochelatins/glutathione/n metallothioneins present in pine leaves. The process of nano-transformation might have resulted due to redox activities of ascorbic/ dehydroascorbic acid and amenti/hinoki flavones and involvement of ascorbates/ glutathiones/metallothioneins, leading to the reduction of silver ions present in the solution, Therefore, compared to bacteria or fungi, plant cells are many suitable candidates for the synthesis of metallic nano-sized particles. The significant reduction in reaction time with pine leaf is an important result and will enable nano-size particle biosynthesis methods to compete with other plant-assisted biosynthesis routes for the formation of silver nanoparticles that are currently much more rapid and reproducible.

CONCLUSION:

Summing up, the present biotechnological method is capable of producing Ag nanoparticles. Also, it is a green, high-yield, fast, and low-cost approach. The reduction is accomplished probably due to photochemical such as polyphones, glutathiones, metallothioneins, and ascorbates, which may help in the production of AgNSPs as a result of the detoxification procedure.

REFERENCES:

1. Goodwin, T.W., Ed. Chemistry and Biochemistry of Plant Pigments: Functions of Flavonoids in Plants; Academic Press: New York, 1976, p. 736.

2. Jae, Y. S.; Beom, S. K. Bioprocess Biosyst. Eng. 2009, 32, 79–84.

3. Jha, A. K.; Prasad, K.; Kumar, V.; Prasad, K. Biotechnology. Prog 2009, 25, 1476.

4. Chopra, R. N.; Nayar, S. L.; Chopra, I. C. Glossary of Indian Medicinal Plants; CSIR Publication: New Delhi, 1956,

5. Harborne J. B.; Mabry, T. J.; Mabry, H., Eds. The Flavonoids: Biflavonoids; Chapman and Hall: London, 1975, p. 693.

6. McCusker, L. B.; Von Dreele, R.B.; Cox, D.E.; Lou¨er D.; Scardi, P. J. Appl. Cyst. 1999, 32, 36

7. Klaus, T.; Joerger, R.; Olsson, E.; Granqvist, C. G.Proc. Natl. Acad. Sci. U.S.A. 1999, 96, 13611.

8. B. Nair, T. Pradeep. Crest. Growth Des.2002, 2,293.

9. Mukherjee, P.; Ahmad, A.; Mandal, D.; Senapati, S.; Sankar, S. R.; Khan, M. I.; Parischa, R.; Ajaykumar,

10. Amako, K.; Ishimaru, T. Nutr. Nat. Resour.2009, 4, 13.

11. Basra, A. S.; Basra, R. K., Eds. Mechanisms of Environmental Studies Resistance in Plants: Mechanisms of Plant Resistance to Aluminium and Heavy Metals; Harwood Academic Publishers: Amsterdam, 1997, 241.