



Synthesis of silver nanoparticles using *Azadirachta indica* leaf extract

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Abstract

In the recent years, these green syntheses of nanoparticles have emerged as important role in medicinal and industries etc. With green synthesis we can prevent environment pollution and formation of toxins. The antimicrobial agents like silver nanoparticle synthesis were applied in the study of dried leaves extract of *Azadirachta indica*. The plant leaf serves as a reducing and capping agent at the same time. The various techniques like SEM and TEM are used to characterize synthesised silver nanoparticles. To identify the functional group present in the dried leaves extract through the FTIR spectrometer by the reduction of silver ions. The surface morphology of dispersed nanoparticles studied by using SEM. The TEM displaying the mono dispersion and size range of the silver nanoparticles. The procedure for silver nanoparticles at room temperature is quick and effective, but finding the exact dose in water purification is difficult.

Keywords: green synthesis, *Azadirachta indica*, silver nanoparticles, silver nitrate, characterization

Introduction

Nanotechnology is in greater and development today than before ever. It has a huge impact on industry and medicine and it find out the structure and molecules on the scales of nanoparticles ranging between 1 to 100nm^[1]. In a world full of technology metal nanoparticles are being made more and more as they give new noble applications. The nanoparticles shows different size, morphology and shapes. Silver, gold, platinum, copper and palladium are the some of the metal nanoparticles, which are applied in polymers, electronics, nano ceramics, environment and biotechnology. One of the specialized metal nanoparticles is silver nanoparticles^[2-4]. The silver ions are the highly toxic to the bacteria and microorganisms. The silver nanoparticles used in a medical and pharmaceutical products. It act as antibacterial agent to control the bacterial growth, and it serve as antifungal agents for industrial purpose^[5-7]. AgNps having a antibacterial property, including silver-coated wound dressings, and surgical instruments^[8-9]. The wide range application of silver nanoparticles is the biosensors^[10], therapeutics and catalysis^[11]. By the chemical and physical method the silver nanoparticles are produced at low concentration of silver extract^[12]. The cost-effective, eco-friendly, scaled-up for large-scale synthesis, non-hazardous, and easy-to-handle methods of green synthesis of silver nano particles are described^[13]. It is prepared by the methods are chemical, physical and biological^[14]. Many of the plants parts like leaf, bark, seed, root, fruit are may used in a natural medicinal field^[15]. *Azadirachta Indica*, also known as Neem, is a plant that belongs to the meliaceae family and is employed in the green synthesis of silver nanoparticles. The medicinal plant of *Azadirachta Indica* is well known by Indians, in ancient time, it can be used to treat bacterial, viral, and fungal infections, as well as a variety of other diseases. The dried leaves extract is in the synthesis of various nanoparticles like silver, copper, gold, platinum, palladium etc. The phytochemicals were flavonoids and terpenoids are playing prominent role in the stabilization of nanoparticles and it works as a reducing and capping agent^[16-17]. The conversion of silver salts into silver nanoparticles is aided by phytochemicals^[18]. We can investigate the antibacterial and antifungal activities of produced silver nanoparticles, as well as their involvement in water purification, in the current study. Even the growth of gram-positive and gram-negative bacteria is influenced by silver nanoparticles.

Materials and procedure

Sample collection and identification

On the basis of cost effectiveness and medical properties, *Azadirachta Indica* leaf extract was used to make silver nanoparticles. The leaves were gathered in the town of Molasur. To eliminate the dust and other polluted organic substances, the leaves were thoroughly washed in running tap water and then twice distilled water. These leaves should be left to dry for 7-8 days.

Preparation of leaf (*Azadirachta Indica*)

With the use of a mortar and pestle, the leaves were cut into fine bits and crushed. In a beaker containing 100 ml of double distilled water, about 5gm of finely powdered leaves were retained. It takes 10 to 30 minutes to boil.

The extract was filtered and chilled. The extract will be saved for future use. This solution was employed in the green production of silver nanoparticles as a stabilizing and reducing agent.

Green synthesis of silver nano particles

The 100 cc Silver Nitrate (Merck, India) GR was used, 1mM resolution of silver nano particles was prepared in an Erlenmeyer flask. The plant extract was mixed with 20 mL of silver nitrate solution at a concentration of 1 mM. This solution kept in a dark chamber at overnight for precipitation. The solution's hue changed from yellowish green to brown, suggesting that silver nanoparticles had formed.

Results and Discussion

Scanning electron microscope (SEM) and Transmission electron microscope (TEM).

SEM analysis

A couple of drips of the solution containing silver nanoparticles prepared were placed on a glass plate and dried. Then SEM was recorded. SEM image of silver nanoparticles shown in Figure 1.

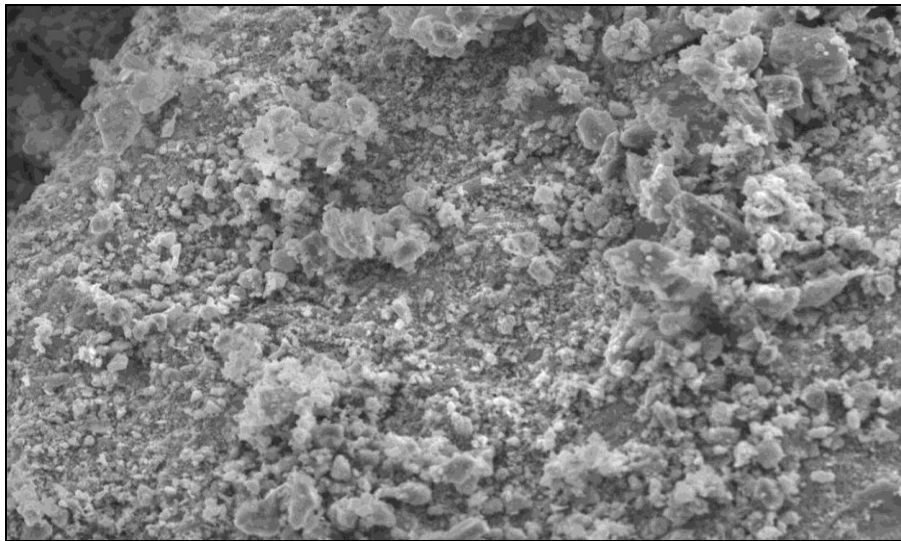


Fig 1: SEM image of silver nanoparticles.

TEM analysis

The size, shape, and morphology of nanoparticles have been determined using transmission electron microscopy (TEM). The organic layer appeared to separate the TEM pictures, which were not physically in contact with each other. As a result, TEM pictures clearly show that Ag nanoparticles are coated with an organic layer. Several polyphenolic components, such as flavonoids and terpenoids, aided in the reduction of Ag ions while also stabilising the surface of the resulting Ag nanoparticles. It demonstrates that the silver nanoparticles are well disseminated and generally spherical in shape, while some of the NPs have irregular shapes as shown in Figure 2. The particle average size around 36 nm.

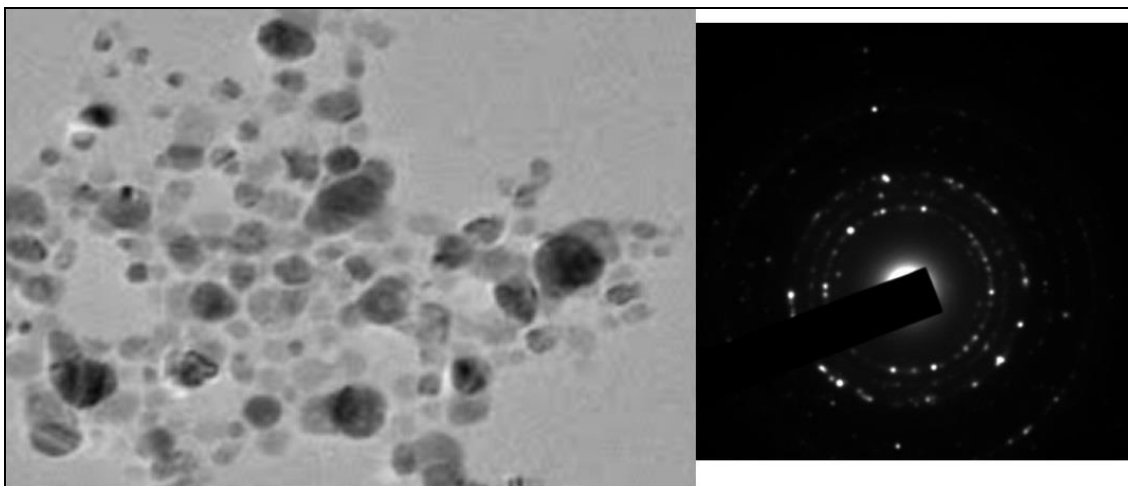


Fig 2: TEM image of silver nanoparticles.

Data on the average size of Ag nanoparticles generated using *Azadirachta Indica* backed up this claim. Previous research has shown that the small size of Ag nanoparticles makes it easier for them to penetrate bacteria's outer walls, enter the body, damage the respiratory chain, and therefore limit cell respiration, resulting in bacterial death.

Conclusion

To make Ag nanoparticles, medicinal plants, namely aqueous extracts of dried leaves of *Azadirachta Indica*, can be employed as bioreduction agents. The colour shift of *Azadirachta Indica* extract from yellowish green to brown indicated the development of Ag nanoparticles in the extract. The appearance of colour shifts indicates the formation of Ag particles. Because of the higher concentration of AgNO₃ solution, the size of the Ag particles produced increased, but the average size is remained 36 nanometer.

The presence of nanoparticles was indicated by characterization data acquired from SEM and TEM examinations, demonstrating that the plant extract was not only effective in reducing the silver salt to silver nanoparticles, but also played a critical role in stabilising the nanoparticles created.

Reference

1. Gleiter H. Nano crystalline materials, *Prog. Material sci*,1989;33:223-315.
2. Hussain I, Brust M, Papworth AJ, Cooper AI, *Langmuir*,2003;19:4831.
3. Sharma VK, Yngard RA, Lin Y. *Adv. colloid interface sci*,2009;145:83.
4. Okuda M, Kobayashi Y, Suzuki K, Sonoda K, Konodoh T et al. *Nano lett*,2005;5:991.
5. Jiang H, Manolache S, ACL Wong, FS Denes. J, *Appl. Polym. Sci*,2004;93:1411.
6. Bhumkar DR, Joshi HM, Sastry M, Pokharkar VB. *Pharm Res*,2007;24:1415.
7. R. Bhattacharya and P. Murkherjee, *Adv. Drug deliv. Rev*,2008;60:1289.
8. Lohse SE, Murphy CJ. *J. Am. Chem. Soc*,2012;134:15607-15620.
9. You C, Han C, Wang X, Zheng Y, Li Q, X. Hu et al. *Mol. Biol. Rep*,2012;39 9193-9201.
10. Chen H, Hao F, He R, DX. Cui, *colloids interface sci*,2007;315:158-163.
11. RM Crooks, Lemon BI, Sun L, Yeungv, M. Zhao. *Curr. Chem*,212:82-135.
12. Shaheed Ahamed, Sai Fullah, Mudasir Ahmed, Babu Lal Swami, Saiga Ikram, *Research and Applied science*,2001-2016;9:1:1-7.
13. Ahmed S, Ahmad M, Swami BI, et al. *J. Adv Res*,2016;7(1):17-28.
14. Saha. J, Begum A, mukherjee. A, Kumar, S Sustain. *Environ. Res*, 2017.
15. Mariselvam R, Ranjitsingh AJ, Nanthini AV, Kalirajan K, Padmalatha C, Selvakumar PM. *Spectrochem Acta*,2014;129:537-541.
16. Banerjee P, Satapathy M, Mukhopahayay A, Das P. *Bio processing*,2014;1(3):1-10.
17. Chandran SP, Chaudhary M, Pasricha, A. Ahmad and M. Sastry, *Biotechnol. Prog*,2006;22:577.
18. Ahmad S, Saifullah Ahmad M, et al. *J Radiate Res Appl sci*,2016;9:1-7.