Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 9[10] September 2020 : 103-106

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.876
Universal Impact Factor 0.9804
NAAS Rating 4.95

ORIGINAL ARTICLE **OPEN ACCESS**

Silver Nano Particles (AgNP) Synthesis Using Apple Extract

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ABSTRACT
Silver nanoparticles is famous for its multiple important characteristics like antimicrobial, catalytic properties, uses in optics etc. but due to high demand and scarcity make it very expensive and unavailable. Current study aimed to synthesize the AgNPs at low cost but ecofriendly method for this green method was adopted by using apples from the local market. In this procedure apples were used as reducing agents while silver nitrate in aqueous form as a precursor. Formation of the silver nanoparticles was observed by changing the colors of the mixture that is from colorless to dark brown. Presence of the Ag is confirmed by the diffraction of the X-ray. Size of the AgNPs was estimated as 30.26 ± 5.27 nm with the help of dynamics light scattering. Ethylene groups' presence was confirmed by UV-vis spectroscopy and Fourier Transform Infrared as capping and reducing agent during the formation of the silver Nanoparticles. The green method is very useful procedure for the formation of the nanoparticles as it is ecofriendly, simple and economical procedure and it should be promoted.
Key words: *Nanoparticles, apple extraction, AgNP, Green method*

INTRODUCTION

There are bundles of the nanoparticle synthesized in laboratory, many of them are very important and unique due to their interesting properties but silver nanoparticles attracted the world for most of its reasons like their uses in optical, bio-labeling, its catalytic properties, many antimicrobial properties etc. [1-5].It has high demands due to low toxicity to the humans. But due to limited supply it is one of the expensive NPs. Many procedures have been followed to synthesis the nano-particle at low cost [6-12] because conventional procedure require high expensive chemicals which is also very toxic to man during handling. One of the most important economically, ecofriendly and cleaner method is green synthesis method. The best examples are the extract of black tea leaf, extract of the *Mangiferaindica* which produce NPs of 20nm [13,14]. Besides this several fruits extraction like *Capsicum Annuum var aviculare* (red fruits of the piquin pepper) has been used to synthezise 3-10nm of NPs [15]. Current study aimed to synthesize the silver nanoparticle by using green method.

Received 24.07.2020 Revised 23.08.2020 Accepted 05.09.2020

MATERIAL AND METHODS

Synthesis procedure

First local market was search for red apples. Then extract was prepared by cutting the apples into small pieces and washed properly with the tap water. After that 100g of apple sample put into deionized water (200ml) and heated at 80°C for one hour. The heated sample was then filtered through filter paper of whattman. The filtrate obtain from the extraction was store in clean bottle and were used as reducing

agents. For the synthesis of the AgNPs a mixture was made by mixing 180mL of the apple extract with 0.1 aqueous $AgNO_3$ solution. The mixture was then stirred and heat with different duration for 80°C.

Characterization

Different instruments was used to characterize the synthesized NPs. First at time of the heating, color changes were monitored and observed by using UV-vis spectroscopy at different time interval that is after every 5 minutes (5, 10, 15, …60 minutes). And the wavelength of region 200-700nm were recorded by using UV-2450 Shimadzu UV spectrophotometer. Morphology was observed by using FESEM (HITACHI SU-6600 model). Next the residue was washed several times with the deionized water. After that powdered was hot air dried for 24hour at 100°C. Final crystalline structure was analyzed by using Bruker model D8 advanced powder X-ray diffract meter. The specific functional groups were analyzed and identified by PerkinElmer Fourier Transform Infrared (FTIR) Spectroscope. Furthermore zeta potential measurement and particle size was study by using a Malvern Zetasizer Nanoseries Nano ZS (Malvern Instruments, Herrenberg, Germany) and scattering (DLS) instrument (Zetasizer Nanoseries, Malvern Instruments Ltd., Malvern, Worcestershire, UK) respectively.

RESULTS AND DISCUSSION

Current study was aimed to synthesis the AgNPs by green method which is one of the most important ecofriendly and economical method. For this purpose, red fresh apple from the local grocery market were purchased. And we were successfully able to synthesis the AgNPs. The colorless mixture gradually changes to dark-brownish suspension this gradual changes is exactly accordance to some previous publications [16–19]. The crystalline structure obtained by the XRD spectrum is shown in the figure 1a. The peak values we obtained at 38.16°, 44.36°, 64.58°, 77.48° and 81.61°. Whichcorrelate to 112, 201, 221, 312 & 223 planes of lattice of the Nanoparticles crystals. Figure 1c shows the morphology of the AgNPs produced during green method. Some previous studies, reports an unassigned peak, incomplete peaks, weak peaks or oxides of Ag [19, 17,15,20].

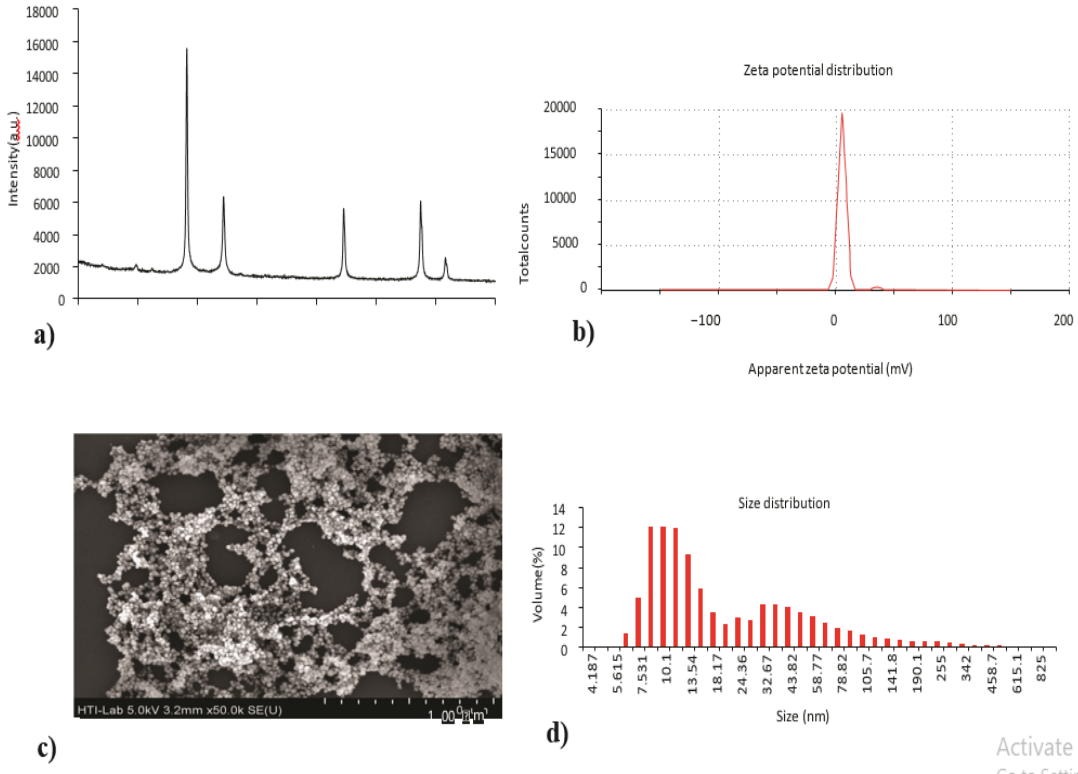

Figure 1: a) Spectrum XRD b) Zeta Potential c) morphology of the AgNPs d) Size of the nanoparticles

Average size of the particle was 30.26±5.27 (figure 1d), shape of the nanoparticle was spherical and exhibit aggregation. Size achieved in current study is similar to some previous studies [21,22]. Silver Nanoparticle synthesized in current studies has strong agglomeration with zeta potential value of 5.69 ± 3.29mV (figure 1b) [23]. Synthesis of the AgNPs was thoroughly monitored by using UV-vis spectra at 5 min interval times Besides this absorption peak in range 420-450 in UV-vis test confirmed the synthesis

of the silver nanoparticles. Figure 2 shows the different time intervals studied under UV-vis test. High intensity during formation of the AgNPs may be due to several reasons like organic elements may encapsulate the AgNPs which originate from the extraction of the apple, very fine nature, homogenisty,[24,25,26]. Further the presence of the organic elements which encapsulate the nanoparticle was analyzed by using FTIR. And spectra were used to observe the functional group associated with the AgNPs, which reduce the AgNPs.

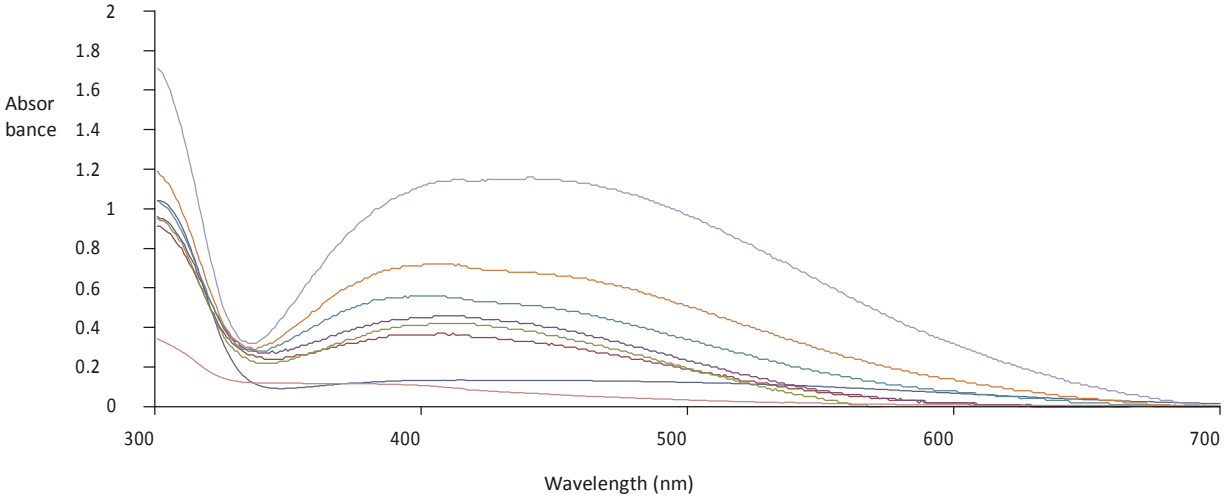

Figure 2: UV-vis spectra shows different interval of time for observation

Besides this bands with low intensity 2364.90 cm^{-1} and 2342.39cm^{-1}revealed the presence of the ethylene group bound to the AgNPs. Other studies also report presence of the organic compounds with the nanoparticles [14,27,22]

CONCLUSION

AgNPs were successfully synthesized with average size of 30.26 ± 5.27nm, strong agglomeration (zeta potential 5.69 ± 3.29) and precipitation by using green method. Sharp peaks in XRD confirmed the crystalline nature of the nanoparticles. Further ethylene group extracted from apple can be a good reducing agent. Green method is one of the best ecofriendly, simple and economical method and can be used to synthesize nanoparticles. This method should be promoted.

REFERENCES

1. A. Sivanesan, H. K. Ly, J. Kozuch et al.,(2011). "Functionalized Ag nanoparticles with tunable optical properties for selective protein analysis," *Chemical Communications*, vol. 47, no. 12, pp. 3553–3555.
2. K. Liu, S. Qu, X. Zhang, F. Tan, and Z. Wang, (2013). "Improved photovoltaic performance of silicon nanowire/organic hybrid solar cells by incorporating silver nanoparticles," *Nanoscale Research Letters*, vol. 8, no. 1, pp. 1–6.
3. H. Zhu, M. Du,M. Zhang et al., (2013). "Facile fabrication of AgNPs/(PVA/PEI) nanofibers: high electrochemical efficiency and durability for biosensors," *Biosensors and Bioelectronics*, vol. 49, pp. 210–215, 2013.
4. P. Zhang, C. Shao, Z. Zhang et al.,(2011). "In situ assembly of well dispersed Ag nanoparticles (AgNPs) on electrospun carbon nanofibers (CNFs) for catalytic reduction of 4-nitrophenol," *Nanoscale*, vol. 3, no. 8, pp. 3357–3363.
5. W. A. Ismail, Z. A. Ali, and R. Puteh, (2013)."Transparent nano crystallite silver for antibacterial coating," *Journal of Nanomaterials*, vol. 2013, Article ID 901452, 6 pages.
6. M. Rai, A. Yadav, and A. Gade, (2009)."Silver nanoparticles as a new generation of antimicrobials," *Biotechnology Advances*, vol. 27, no. 1, pp. 76–83.
7. K. K. Caswell, C. M. Bender, and C. J. Murphy, (2003). "Seedless, surfactantless wet chemical synthesis of silver nanowires," *Nano Letters*, vol. 3, no. 5, pp. 667–669.
8. Y.Yin, Z.-Y. Li, Z. Zhong, B. Gates,Y.Xia, and S.Venkateswaran,(2002). "Synthesis and characterization of stable aqueous dispersions of silver nanoparticles through the Tollens process," *Journal of Materials Chemistry*, vol. 12, no. 3, pp. 522–527.
9. P. K. Khanna, N. Singh, S. Charan, V. V. V. S. Subbarao, R. Gokhale, andU. P.Mulik,(2005). "Synthesis and characterization fAg/ PVA nanocomposite by chemical reduction method," *Materials Chemistry and Physics*, vol. 93, no. 1, pp. 117–121.

10. L. Maretti, P. S. Billone, Y. Liu, and J. C. Scaiano, (2009). "Facile photochemical synthesis and characterization of highly fluorescent silver nanoparticles," *Journal of the American Chemical Society*, vol. 131, no. 39, pp. 13972–13980.
11. B. Wiley, T. Herricks, Y. Sun, and Y. Xia, (2004). "Polyol synthesis of silver nanoparticles: use of chloride and oxygen to promote the formation of single-crystal, truncated cubes and tetrahedrons," *Nano Letters*, vol. 4, no. 9, pp. 1733–1739.
12. M. D. Malinsky, K. L. Kelly, G. C. Schatz, and R. P. Van Duyne,(2001). "Chain length dependence and sensing capabilities of the localized surface plasmon resonance of silver nanoparticles chemically modified with alkanethiol self-assembled monolayers," *Journal of the American Chemical Society*, vol. 123, no. 7, pp. 1471–1482.
13. M. J. Uddin, B. Chaudhuri, K. Pramanik, T. R. Middya, and B. Chaudhuri, (2012). "Black tea leaf extract derived Ag nanoparticle-PVA composite film: structural and dielectric properties," *Materials Science and Engineering B*, vol. 177, no. 20, pp. 1741–1747, 2012.
14. D. Philip,(2011). "*Mangifera Indica* leaf-assisted biosynthesis of well dispersed silver nanoparticles," *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, vol. 78, no. 1, pp. 327– 331.
15. R. Mendoza-Res´endez, N. O. N´u˜nez, E. D. Barriga-Castro, and C. Luna, (2013). "Synthesis of metallic silver nanoparticles and silver organometallic nano disks mediated by extracts of *Capsicum annuumvar. aviculare*(piquin) fruits," *RSC Advances*, vol. 3, no. 43, pp. 20765–20771.
16. K. Paulkumar, G. Gnanajobitha, M. Vanaja et al., "*Piper nigrum*leaf and stem assisted green synthesis of silver nanoparticles and evaluation of its antibacterial activity against agricultural plant pathogens," *The Scientific World Journal*, vol. 2014, Article ID 829894, 9 pages, 2014.
17. O. S. Oluwafemi, Y. Lucwaba, A. Gura et al., "A facile completely 'green' size tunable synthesis of maltose-reduced silver nanoparticles without the use of any accelerator," *Colloids and Surfaces B: Biointerfaces*, vol. 102, pp. 718–723, 2013.
18. V. K. Vidhu, S. A. Aromal, andD. Philip,(2011). "Green synthesis of silver nanoparticles using *Macrotylomauniflorum*," *SpectrochimicaActa Part A: Molecular and BiomolecularSpectroscopy*, vol. 83, no. 1, pp. 392–397.
19. M. Karuppiah and R. Rajmohan, "Green synthesis of silver nanoparticles using *Ixoracoccinea a*leaves extract," *Materials Letters*, vol. 97, pp. 141–143, 2013.
20. A. Saxena, R. M. Tripathi, F. Zafar, and P. Singh, (2012). "Green synthesis of silver nanoparticles using aqueous solution of *Ficusbenghalensis*leaf extract and characterization of their antibacterial activity," *Materials Letters*, vol. 67, no. 1, pp. 91–94.
21. N. Basavegowda, A. Idhayadhulla, and Y. R. Lee, (2014). "Tyrosinase inhibitory activity of silver nanoparticles treated with *Hoveniadulcis* fruit extract: an *in vitro* study," *Materials Letters*, vol. 129, pp. 28–30.
22. P. Velmurugan, S. Lee, M. Iydroose, K. Lee, and B. Oh,(2013). "Pine cone-mediated green synthesis of silver nanoparticles and their antibacterial activity against agricultural pathogens," *Applied Microbiology and Biotechnology*, vol. 97, no. 1, pp. 361–368, 23
23. T. M. Riddick, (1968). "Control of colloid stability through zeta potential," in *Blood*, vol. 10, p. 1.
24. K. Shameli, M. B. Ahmad, E. A. Jaffar Al-Mulla et al., (2012) "Green biosynthesis of silver nanoparticles using *Callicarpamaingayi*stem bark extraction," *Molecules*, vol. 17, no. 7, pp. 8506–8517.
25. K. Shameli, M. B. Ahmad, S. D. Jazayeri et al., "Synthesis and characterization of polyethylene glycol mediated silver nanoparticles by the green method," *International Journal of Molecular Sciences*, vol. 13, no. 6, pp. 6639–6650, 2012.
26. M. Zargar, A. A. Hamid, F. A. Bakar et al., (2011). "Green synthesis and antibacterial effect of silver nanoparticles using *Vitexnegundo*L.," *Molecules*, vol. 16, no. 8, pp. 6667–6676, 2011.
27. D. Philip, (2010). "Green synthesis of gold and silver nanoparticles using *Hibiscus rosasinensis*," *Physica E: Low-Dimensional Systems and Nanostructures*, vol. 42, no. 5, pp. 1417–1424.

CITATION OF THIS ARTICLE

A Rafi, M Asif, T Alam, Z Iqbal, Z Tahir, F Elahi, A A Sumra, W A Qureshi, A Kalsoom, A Malik. Silver Nano Particles (AgNP) Synthesis Using Apple Extract. Bull. Env. Pharmacol. Life Sci., Vol 9[10] September 2020 : 103-106