Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 5 [8] July 2016: 91-94

Online ISSN 2277-1808
E-ISJN: A4372-2590
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.533
Universal Impact Factor 0.9804

ORIGINAL ARTICLE **OPEN ACCESS**

Synthesis and Antibacterial activity of Silver nanoparticles from *Prunus armeniaca* (Apricot) fruit peel extract

[1]*Noushin Ajmal, [1]Keerti Saraswat, [2]Vandana Sharma, [3]Mohammad Ezaz Zafar
[1]Department of Basic Sciences and Humanities, Pratap University, Jaipur, Rajasthan
[2]Department of Pharmaceutical Chemistry, College of Pharmacy, Rajasthan University of Health Sciences, Jaipur, India.
[3]Biochemistry Department, Kathihar Medical College, Kathihar, Bihar, India
Department of Basic Sciences and Humanities
Email: noush.biochem04@gmail.com

ABSTRACT
Present study deals with synthesis of silver nanoparticles by using fruit peel extract of Prunus armeniaca (Apricot). *Silver nanoparticles synthesized by simple, fast and ecofriendly method was characterized by scanning electron microscopy (SEM) and X-ray diffraction (XRD). Average size of silver nanoparticle was derived by Debye-Scherer's equation and found out to be 50nm. The synthesized silver nanoparticles were also evaluated for antibacterial activity against some microorganisms as zone of inhibition. Maximum zone of inhibition by silver nanoparticles was found against S. aureus which was close to reference drug.*
Keywords: *Fruit peel, silver nanoparticles, Prunus armeniaca, Antibacterial activity*

Received 09.03.2016 Revised 23.06.2016 Accepted 01.07. 2016

INTRODUCTION

Exploring the waste materials in different area of human applications has given much attention in recent years. Use of plant waste materials (e.g. fruit peel) for value added discoveries for identification of major biological potentials is one such area where scientists are focusing with zeal [1-4]. Synthesis of metal nanoparticles also one such area where plant materials such as peels, leafs, seeds and roots were extensively utilized in these days [5,6].Utilization of these waste materials in the synthesis of nanoparticles is studies under the light of green chemistry. Nanoparticles are regarded fundamental of nanotechnology. In recent past, noble metal nanoparticles have been main subject of research owing to their excellent electronic, optical, mechanical, magnetic and chemical properties [7]. Metal nanoparticles have immense applications in the area of diagnosis, biological and catalysis [6] Ag, Pt, Au and Zn are among major metal used in the formation of nanoparticles [8,9]. To the preparation of different metal nanoparticles for pharmaceutical applications, researchers adopting environmental friendly approach in these days [10]. Conventional techniques for the synthesis of nanoparticles such as chemical precipitation, sol-gel process, micelle, hydrothermal method, chemical vapor disposition etc. generate toxic chemicals that may causes adverse effects [11, 12]. Biological methods using plants parts extracts, microorganisms(bacteria, fungi, yeast) have been a valuable choice and regarded as best alternatives to chemical methods for the synthesis of metal nanoparticles [12-14]. Current bio-inspired methods are economical and less chances of use of toxic chemicals as well as high pressure and temperatures to the preparation of metal nanostructures [15,16].

In present research, we are going to report synthesis of silver nanoparticles by methanolic extract of *Prunus armeniaca* peel extract. Morphological characterization of present silver nanoparticles is characterized by X-ray diffraction (XRD) and scanning electron microscopy (SEM). Furthermore, silver nanoparticles were evaluated for antibacterial activity against selected bacterial pathogens.

MATERIALS AND METHODS

In present research chemicals were purchased from sigma Aldrich (USA) and no further purification was carried out. I R spectra were recorded by KBr discs using FT/IR - 4100 JASKO model in the ratio of 1:100. X-ray diffraction (XRD) patterns were recorded on a Rigaku Ultima IV X-ray Diffractometer at angles between 2^0 and 80^0, with a scan rate of 2^0/min.

Scanning electron microscopy was done using Carl Zeiss EVO LS10 (Oberkochen, Germany).

Coating was carried out using quorum Q150 R S (Quorem Technologies Ltd, 2 Acorn House, The Broyle, Ringmer, East, Sussex, United Kingdom) sputter coater by the deposition of gold on the samples.

Preparation of apricot extract: For the synthesis of silver nanoparticles rosacea fruit, apricot peel extract were used as reducing and capping agent.

About 1 kg of apricot fruit were purchased from local market. Peels of the fruit were dried and powdered. In an about 500mL beaker containing methanol powdered peel were dipped and kept overnight. After 24 hr, the methanolic extract was evaporated till syrupy consistency. Extract was kept in a refrigerator at 4^0c for the synthesis of silver nanoparticles.

Synthesis of silver nanoparticle: An aqueous solution of silver nitrate ($AgNO_3$) at concentration of 0.02 mmol/L was prepared and used for the synthesis of silver nanoparticles. About 10 mL of apricot (*Prunus armeniaca*) peel extract was added into 80 mL of aqueous solution of 0.02 mmol/L silver nitrate ($AgNO_3$) for the reduction into Ag+ ions and exposed to sunlight and a color change takes place from yellowish to reddish brown after repeated experiments two or three times.

Evaluation of antibacterial activity: The silver nanoparticles synthesized from apricot (*Prunus armeniaca*) peel extract was evaluated for antibacterial activity by disc diffusion method against different pathogenic bacterial strains such as *E.coli*, *S.aureus*, *P.aeruginosa* and *Bacillus substilis*. A standard inoculum (1-2x10^7 c.f.u/mL) 0.5 McFarland standards was inserted on the surface of sterile agar plates. A glass spreader was used for even distribution of the inoculum. The disc of 6.25mm were made from whatman no 1 filter paper and subsequently sterilized by dry heat at 140^0C.

RESULTS AND DISCUSSION

X-Ray Diffraction Analysis

The x-ray diffraction pattern of the synthesized silver nanoparticles from extract of apricot peel was demonstrated by major peaks corresponding to 2Θ values ranging from 20-50 as shown in fig 1. These peaks are supported by Joint Committee on Powder Diffraction Standards (JCPDS) file No.04-0783. Average size of silver nanoparticles was calculated by Debye-Scherer's formula and found out to be 50nm.

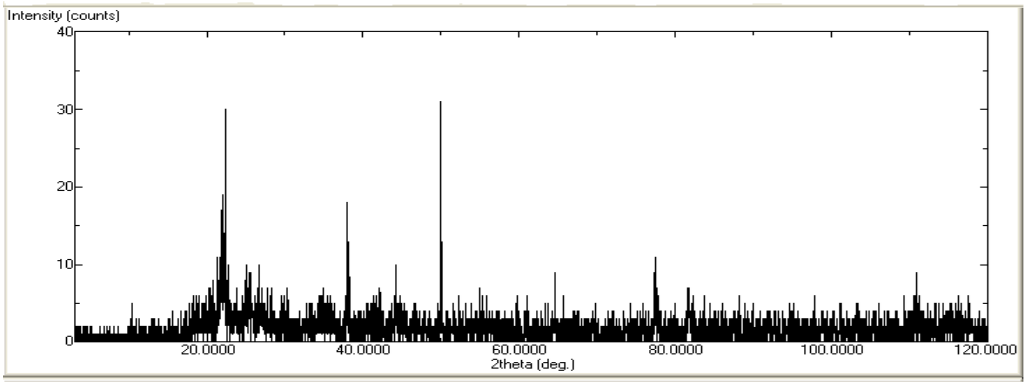

Fig 1. XRD pattern of silver nanoparticles

Scanning Electron Microscopy (SEM)

SEM analysis was done to identify the size and shape of silver nanoparticles obtained as a result of apricot peel extract with silver nitrate. Silver nanoparticles have somewhat rod shaped including some particles aggregates. Aggregates molecules appeared 20µm range as shown in fig 2.

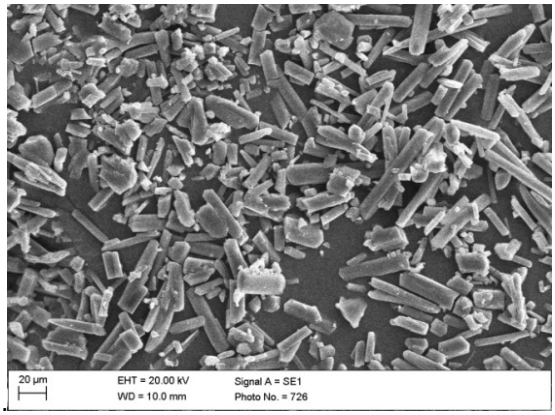

Fig 2. SEM images of silver nanoparticles

Antibacterial activity

Antibacterial activity assay of apricot peel extract mediated silver nanoparticles was performed against some selected bacterial pathogens by disc diffusion method. Antibacterial activity was compared among different bacterial strains along with standard ciprofloxacin as zone of inhibition (mm). Maximum and minimum zone of inhibition of synthesized silver nanoparticles was found against *S.aureus* (24mm) and *P.aeruginosa* (16mm). Standard drug (28mm) produce zone of inhibition 28mm. Silver nanoparticles shows good results against *S.aureus* (24mm) very close to standard drug. Zone of inhibition against two other strains (*E.coli, Bacillus substilis*) are 19&21 mm respectively (Table 1).

Table1:- Inhibition zone for silver nanoparticles synthesized by apricot (*Prunus armeniaca*) peel extract against selected bacterial strains.

Pathogens	Zone of inhibition(mm)
E.coli	19
S.aureus	24
P.aeruginosa	16
Bacillus substilis	21
Ciprofloxacin(Std.)	28

Antibacterial activities of silver nitrate solution and nanoparticles have been reported in plenty of literatures [17]. Mechanism of antibacterial propensity of silver nanoparticles ($AgNO_3Np$) is still a matter of discussion. Reports reveals that, due to electrostatic interaction between negatively charged cell membrane of microorganism and positively charged of Ag+ ions of nanoparticles is primarily responsible for antibacterial activity. Some researchers reported that generation of free radicals by silver nanoparticles are responsible for damaging the membrane of pathogens [18].

CONCLUSION

In conclusion, in present research we have prepared silver nanoparticles from apricot fruit peel extract and characterized by x-ray diffraction and scanning electron microscopy. Fully characterized nanoparticles were evaluated against some bacterial pathogens. Antibacterial activity of synthesized nanoparticles finds good results as compared to standard drug. Thus, production of such nanoparticles is worthy in terms of economy and also environmentally viable approach. We will try few more metal nanoparticles by selecting other fruit peels for different biological activities. Toxicity studies of *Prunus armeniaca* peel mediated silver nanoparticles are progress in our laboratory.

ACKNOWLEDGMENTS

Authors are thankful to the Hamdard University, New Delhi for antibacterial activity.

REFERENCES

1. Chandrasekaran. M & Bahkali. A. H (2013), Valorization of date palm (Phoenix dactylifera) fruit processing by-products and wastes using bioprocess technology – Review, Saudi. J. Bio. Sci, 20, 105-120.
2. Azmira. J, Zaidula. I. S. M, Rahmana. M.M, Sharif. K. M. A, Mohamed. A, Sahenab. F, Jahurulb. M. H. A, Ghafoor. K, Norulaini. N. A. N & Omar. A. K. M (2013), Techniques for extraction of bioactive compounds from plant materials: A review, J. Food. Eng, 117, 426–436.

3. Pérez. C, CastGillo.M.L.R, Gil. C, Blanch &, Flores. G.P (2015), Supercritical fluid extraction of grape seeds: extract chemical composition, antioxidant activity and inhibition of nitrite production in LPS-stimulated raw 264.7 cells, 6, 2607-2613.
4. Singh. P. P & Marleny. D. A (2011), Saldaña subcritical water extraction of phenolic compounds from potato peel, Food. Res. Int, 44, 2452–2458.
5. Mubayi. A, Chatterji, Rai. P.M & Watal.G(2012), Evidence based green synthesis of nanoparticles, Adv. Mat. lett, 3, 519-525.
6. Sulaiman. G.M, Mohammed. W.H, Marzoog.T.R, Al- Amiery.A.A.A, Kadhum.A.A.H & Mohamad. A.B (2013), Green synthesis, antimicrobial and cytotoxic effects of silver nanoparticles using Eucalyptus chapmaniana leaves extract, Asian. Pac. J. Trop. Biomed, 3, 58-63.
7. Guzmán. M.G, Dille.J & Godet.S (2008), synthesis of silver nanoparticles by chemical reduction method and their antibacterial activity, World. Acad. Sci. Engin. Techn, 2, 7-27.
8. Gurunathan.S, Kalishwaralal. K, Vaidyanathan. R, Deepak. V, Pandian. S.R.K & Muniyandi. J(2009), Biosynthesis, purification and characterization of silver nanoparticles using Escherichia coli, Colloids. Surf B, 74, 328-335.
9. Parashar. V, Parashar. R, Sharma. B & Pandey. A.C(2009), Parthenium leaf extract mediated synthesis of silver nanoparticles: a novel approach towards weed utilization, Dig. J. Nanomater. Biostruct, 4, 45-50.
10. Awwad. A.M, Salem. N.M & Abdeen. A.O (2012), Biosynthesis of Silver Nanoparticles using Olea europaea Leaves Extract and its Antibacterial Activity, Nanosci. Nanotech, 2, 164-170.
11. Hudlikar.M, Joglekar.S, Dhaygude. M & Kodam.K (2012), Latex-mediated synthesis of ZnS nanoparticles, J. Nanoparticle Research,14, 865-866.
12. Singhal. G, Bhavesh.B, Kasariya.K, Sharma.A.R& Singh. R.P (2011), Biosynthesis of silver nanoparticles using Ocimum sanctum (Tulsi) leaf extract and screening its antimicrobial activity, J. Nano. Res,13, 2981–2988.
13. ManiKanth.S.B, Kalishwaralal.K, Sriram.M, Babu.S, Pandian.R.K & Youn.H.S (2010), Anti-oxidant effect of gold nanoparticles restrains hyperglycemic conditions in diabetic mice, J. Nanobiotechnology, 8-16.
14. Almeida. C.L.F, De. S, Falcao. H, De. M, Lima. G.R & De. A (2011), Bioactivities from marine algae of the Genus *Gracilaria*, Int. J. Mol. Sci,12, 4550- 4573.
15. Alagumuthu.G & Kirubha.R (2012), Green synthesis of silver nanoparticles using Cissus quadrangularis plant extract and their antibacterial activity, Int. J. Nanomat. Biostruc, 2, 30-33.
16. Li. W. R, Xie. X. B, Shi. Q. S, Zeng. H. Y. O, Yang. Y. S & Chen. Y. B(2010), Antibacterial activity and mechanism of silver nanoparticles on *Escherichia colii,* Appl. Microbiol. Biotechnol, 85, 1115- 1122.
17. Kim. J. S, Kuk. E, Yu. K. N, Kim. J. H, Park. S. J, Lee. H. J, Kim. S. H, Park. Y. K, Park. Y. H, wang.H, C. Y, Kim. Y. K, Lee. Y. S, Jeong. D. H & Cho. M. H (2007), Antimicrobial effects of nanoparticles, Nanomed. Nanotechnol. Biol. Med, 3, 95-101.
18. Lee. H.J, Yeo. S.Y & Jeong, S.H (2003), Antibacterial effect of nanosized silver colloidal solution on textile fabrics, J. Mat. Sci, 38, 2199-2204.

CITATION OF THIS ARTICLE

N Ajmal, K Saraswat, V Sharma, M Ezaz Zafar. Synthesis and Antibacterial activity of Silver nanoparticles from *Prunus armeniaca* (Apricot) fruit peel extract. Bull. Env. Pharmacol. Life Sci., Vol 5 [8] July 2016: 91-94