EurAsian Journal of BioSciences
Eurasia J Biosci 14, 2829-2833 (2020)

Eco-friendly synthesis of silver nanoparticles from crust of Cucurbita Maxima L. (red pumpkin)

Ban Mohammed Hussein Ali [1*]

[1] Horticulture and Garden Engineering Department, College of Agriculture, Al- Qassim Green University, IRAQ
*Corresponding author: ban_altaei7931@yahoo.com

Abstract

Lately, the green biosynthesis method has been more concerned with the use of waste vegetable and fruit shells, being less toxic, environmentally friendly, easy to synthesize and important in the manufacture of nanomedicines. The aim was to synthesize silver nanoparticles (AgNPs) from red Pumpkin peel hot aqueous extract and the ethanol extract in an environmentally friendly manner, replacing existing methods for synthesizing AgNPs using hazardous chemicals and toxic solvents. This research describes a green process whereby AgNPs were manufactured using silver nitrate and peel of red Pumpkin extract (hot aqueous extract and ethanol extract) as a reducing agent and coating. The nanoparticles were symbolized using UV-Vis, showed absorbance at 430 nm for both extracts consistent with AgNPs spherical particles within (350-550) nm wavelength spectrum and Scanning Electron Microscope (SEM) showed an average AgNPs diameter 67 nm and 56 nm respectively for the hot aqueous and ethanol extract.The current study effort investigates the findings Silver Nitrate concentration 1Mm for hot aqueous extract and ethanol extract. Silver nanoparticles were distinguished by Energy Dispersive X-Ray Spectroscopy (EDX) and Dynamic Light Scattering (DLS).

Keywords: green biosynthetic, phytochemical, nanoparticles, silver nitrate, red pumpkin

Ali BMH (2020) Eco-friendly synthesis of silver nanoparticles from crust of Cucurbita Maxima L. (red pumpkin). Eurasia J Biosci 14: 2829-2833.

INTRODUCTION

Nanotechnology is the ultimate active research space in current applied science, Green Nanotechnology is a way to assemble nanoparticles that must be low-cost, use no toxic chemicals (environmentally friendly) and have less reaction status (Pharma D et al., 2017).

Biological nano-particles derived from biological sources, such as plant extracts and microorganisms (Singh P et al., 2016). Synthesis of metal nano-particles which can for the synthesis of nanoparticles using plant extracts, act both as reducing and capping agents (Ndikau N et al., 2017).

Cucurbita maxima L. or red pumpkin is usually pulp and seeds can be used in the food industry (Eduarda J et al., 2018). It contains natural active components with polysaccharides, fixed oils, paraaminobenzoic acid, peptides, sterol, and proteins (Carolina A et al., 2016).

Kingdom:	**Plante**
***Division*:**	Tracheophytes
***Sub-Division*:**	Angiosperms
***Class*:**	Eudicots
***Sub-Class*:**	Rosids
Order:	Cucurbitales
Family:	Cucurbitaceae
Genus:	Cucurbita
Species:	C.maximus (Siddha P M and Siddha T K 2017)

Pumpkin is rich in many health-friendly substances such as sugars, mineral salts, vitamins and other substances, and therefore it is involved in the development of many processed food products.

There is also pectin in the pumpkin, which is considered low price, which is extracted and is usually used as jam poisoning agents, it can also be used as a stabilizing em ulsifier, thickener, cationic binding agent, nailing agent and others (Aldow A et al., 2018; Mukadasi, 2018).

The biological (green synthesis) method is classified as a new branch of nanotechnology is a bottom-up approach. The biosynthesis of AgNPs include reductions / oxidation reactions (Rajoriya P 2017).

Silver is effective against germs and is highly toxic to bacteria and non-toxic to animal cells (Article R and Journal O A 2017).

The aim of this study was synthesized AgNPs from the extract of Cucurbita moschata crust by an eco-friendly method.

Received: May 2019
Accepted: March 2020
Printed: September 2020

Fig. 1. Color Change (a) red pumpkin, hot aqueous extracts, (b) red pumpkin, ethanolic extracts. The color aqueous extract indicates the formation of silver nanoparticles after adding Silver nitrate

MATERIAL AND METHODS

Clean and Fresh red pumpkin was collected and obtained from a local market in Iraq, Babylon. The plants were washed with tap water and the crusts were taken away and chopped by mixed in a commercial blender used to make the aqueous extracts with 100 ml of deionized water. Furthermore, utilized day by day for extraction.

Preparation extract of ethanolic and hot extracts

The hot extraction was performed by weight 25 g of red pumpkin in 100 ml of (deionized water) for hot aqueous extract and 100 ml of (ethanolic) to prepare ethanolic extract by electric blender (TJ LASSCO INDIA), which was heated at 60°C using the magnetic stirrer heater for two hours, then by filter paper was filtered and the filtrate was kept (in the refrigerator at 4 ℃) to use later (Altemimi A et al., 2017).

Synthesis of silver nanoparticles

Synthesis of nanoparticles from hot aqueous extracts and ethanol extract:

Five ml of red pumpkin extracts (aqueous or ethanolic) are added to 95 ml of $AgNO_3$ aqueous solution of 1 mmol at 70°C, with stirring. The appearance of brown indicates the formation of silver nanoparticles.

Optimal conditions for the assembly of silver nanoparticles:

The ideal conditions for Silver Nanoparticles, by Silver nitrate, aqueous solution 1 mM was prepared and utilized for the synthesis of silver nanoparticles from red pumpkin (hot and ethanolic) extracts. Preparing of Silver nitrate with slight modification as said by Al-Kawaz and Al-Mashhedy (Al-Kawaz H S and Al-Mashhedy L A M 2016).

Examining the optimal concentration for biosynthesis of nanoparticles. The experiments were performed in different Silver Nitrate.

RESULTS AND DISCUSSION

Silver nanoparticles characterization:-

Color change

The successive color change indicates the formation of AgNPs by red pumpkin extracts, (from hot aqueous or ethanolic) extracts was added into (1mM) Silver nitrate solution within 30 minutes and looking of the color was changed from pale yellow to dark brown **Fig. 1**. This is the primary check for the testing of synthesis of AgNPs. The synthesis of AgNPs was monitored by the colour change of the plant extract after the bioreduction of silver nitrate.

The time duration of the color change differs from from extracts to juiced due to free excite electrons that give a resonance absorption band to surface plasmon due to the combined vibration of AgNP electrons in resonance with light wave (Al-Kawaz H S and Al-Mashhedy L A M ,2016). The significant reduction was due to the increased surface intensity of the Plasmon maximum absorption observed between 400 nm and 500 nm (Pharma D et al., 2017).

UV- Visible spectrophotometer analysis

This study illustrated the maximum absorbance in **Fig. 2** at about high absorbance peak for hot and ethanol extracts at 430, 440 nm respectively suggested silver nanoparticles are generated for colloidal nano-silver, because the brown color of the Ag colloids implied that silver nanoparticals form.

Effect of Silver Ion Concentration

Fig. 3 illustrated, the best concentration of Silver nitrate was 1mM compared with other concentrations (3 mM , 5 mM) and the result shows a broad peak in 1 mM concentration and size of nano-particles. For colloidal silver nanoparticles, a surface plasma absorption strip that was synthesis of 1 mM silver nitrate is observed in brown. Absorption decreased as the silver nitrate concentration increased from 1 mM to 5 mM, and this could be attributed to the creation of more AgNPs as an advanced reaction, because the peak strength of the surface plasmon is directly proportional to the density of AgNPs in the solution.

X- Ray Diffraction Studies (XRD)

Fig. 4 showing a broad reflection peak suggests that the nature of the sample is amorphous/nano-crystalline matches very well with the standard silver powder confirming the formation of silver nanoparticles. The average crystallite size of the synthesized silver nanoparticles is calculated by using Debye Scherrer's equation. Via Scherrer 's formula, full width at half maximum (FWHM) information has been used to evaluate particle size and it was found to be 65 nm for hot extract and 76 nm for ethanol extract. The peak noise observed could be back to the effect of particle

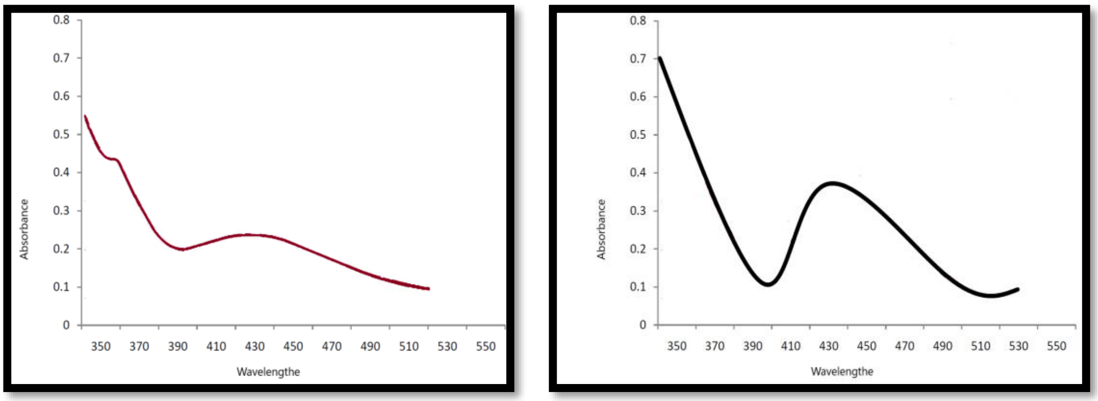

Fig. 2. UV Spectrum of Synthesis of silver Nanoparticles from Hot and Ethanolic Extract

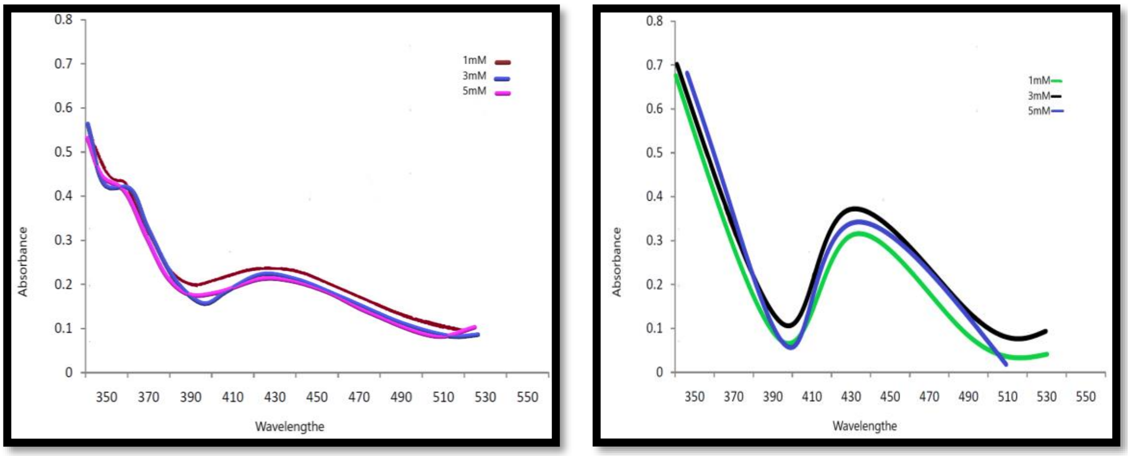

Fig. 3. UV Spectrum of Synthesis of silver Nanoparticles at different concentration of silver nitrate

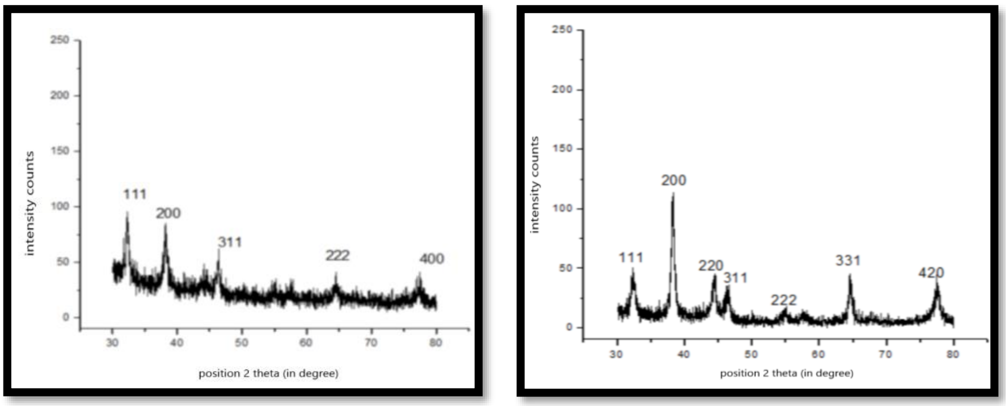

Fig. 4. XRD pattern of silver nanoparticles Which Synthesis From Hot and Ethanolic Extract

non-use and the presence in ethanoic extract of various crystalline biological macromolecules. X-ray diffraction (XRD) additionally assisted the green synthesis of AgNPs. XRD is most widely used to determine a material's chemical composition and crystal structure

The XRD peaks were observed at 111°, 200°, 311°, 222° and 400° were corresponds to the planes 111, 200, 220, 311, 222, 331and 420 for ethanolic extract, which are indexed to the face centered cubic structures of silver nanoparticles. And some of the unassigned peaks have been identified because fewer bio-molecules of stabilizing agents are plant extract enzymes or proteins13.

Scanning Electron Microscopic (SEM)

Fig. 5 shows, the SEM image of AgNPs was amorphase in shape with smooth surface and easily administered. In another study, synthesize silver nanoparticles using red pumpkin crust extract as a reducing agent. The synthesized nanoparticles have average size ranges from 50-90 nm. This result may be

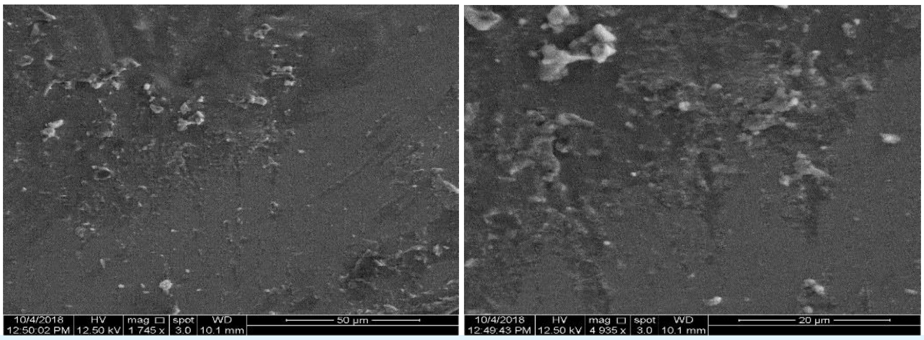

Fig. 5. SEM image For AgNPs Which Synthesis From Hot and Ethanolic Extract

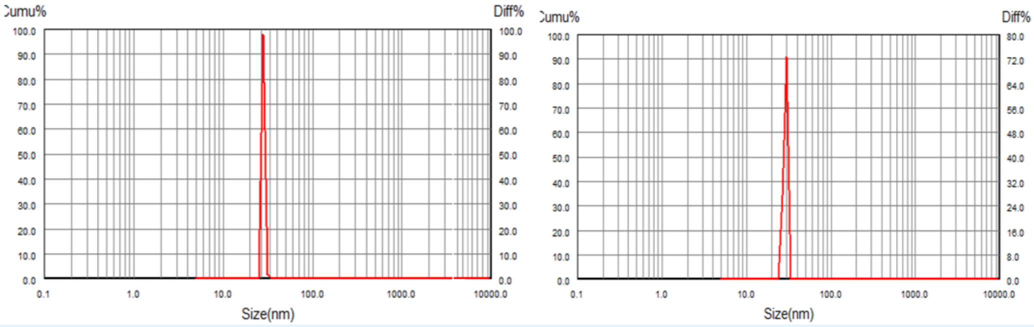

Fig. 6. The DLS For AgNPs Which Synthesis From Hot and Ethanolic Extract

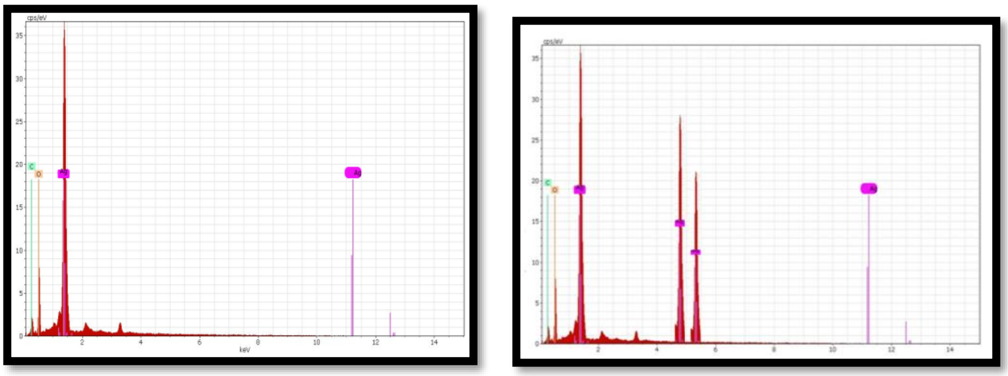

Fig. 7. EDAX spectrum of AgNPs Which Synthesis From Hot and Ethanolic Extract

due to the presence of many types of bioreducing functional groups in red pumpkin crust (Vennila K et al.,2018).

Dynamic Light Scattering (DLS)

The DLS method uses light in a solution to determine the particle size. Illustration **Fig. 6** shows, the hot and ethanolic extract synthesis DLS for AgNPs. As the light interactions with moving particles in a solution and is scattered, the light frequency shift as well. This increase in the frequency of light is forward correlated to the particle size in the solution14. The synthesis silver nanoparticles have an average size ranges <100 nm.

Energy dispersive x-ray spectroscopy (EDX)

Fig. 7 shows, energy dispersive x-ray spectroscopy for AgNPs for hot and ethanolic extract discovered the highest proportion of Silver nanoparticles. The appearance of carbon and oxygen spots in the samples suggests that stabilizers consisting of alkyl chains are present (Rajendran R R et al., 2015, Kirupagaran R et al., 2016, Scimeca M et al., 2018).

CONCLUSION

Green synthesis of nanoparticles is an economic method for the future of synthesis without any adverse side effects. Although there are different ways of green synthesis, the biological method that uses plant extracts is a widely used method. The synthesis of nanomaterials is related to the various factors affecting on size and shape of nanoparticles and can increase yield by improving some parameters.

ACKNOWLEDGEMENTS

To those who helped me even with a smile, my thanks and appreciation.

REFERENCES

Ahmed, S., Saifullah, Ahmad, M., Swami, B. L., & Ikram, S. (2016). Green synthesis of silver nanoparticles using Azadirachta indica aqueous leaf extract. *Journal of radiation research and applied sciences*, *9*(1), 1-7.

Altemimi, A., Lakhssassi, N., Baharlouei, A., Watson, D. G., & Lightfoot, D. A. (2017). Phytochemicals: Extraction, isolation, and identification of bioactive compounds from plant extracts. *Plants*, *6*(4), 42.

Batista, J. E. R., Braga, L. P., Oliveira, R. C. D., Silva, E. P., & Damiani, C. (2018). Partial replacement of wheat flour by pumpkin seed flour in the production of cupcakes filled with carob. *Food Science and Technology*, *38*(2), 250-254.

Hamed, A. A. R., & Mustafa, S. E. (2018). Extraction and assessment of pectin from pumpkin peels. *Biofarmasi Journal of Natural Product Biochemistry*, *16*(1), 1-7.

Isman, M. (2017). P. Li, W. Gu, C. Long, BM Schmidt, SS Ningthoujam, DS Ningombam, AD Talukdar, MD Choudhury, KS Potsangbam, H. Singh, S. Khatoon, and. *Ethnobotany: A Phytochemical Perspective*, 227.

Jerome, S .S.(2015). Biogenic Production And Characterization Of Selenium Nanoparticles Using Lactobacilli Master Of Technology In Dairy Microbiology, Deemed University.

Kirupagaran, R., Saritha, A., & Bhuvaneswari, S. (2016). Green synthesis of selenium nanoparticles from leaf and stem extract of leucas lavandulifolia sm. and their application. *Journal of Nanoscience and Technology*, 224-226.

Mukadasi, B. (2018). Mixed Cropping Systems for Sustainable Domestic Food Supply of the Smallholder Farming Communities in Nakasongola District, Central Uganda. *Canadian Journal of Agriculture and Crops*, *3*(1), 42-54.

Ndikau, M., Noah, N. M., Andala, D. M., & Masika, E. (2017). Green synthesis and characterization of silver nanoparticles using Citrullus lanatus fruit rind extract. *International Journal of Analytical Chemistry*, *2017*.

Pawar, S. H., Rohiwal, S. S., & Yakhmi, J. (2017). Biomaterials and Tissue Engineering Bulletin. *Biomaterials*, *4*(1-4), 66-80.

Pharma D, Al Kinani B. H, & Almashhedy L. A .(2017.) ISSN 0975-413X CODEN (USA): PCHHAX Biosynthesis of Cupper Nanoparticles Using Coriandrum sativum L. Ethanolic Extract.

Rajendran R R, Dhandapani H, Rajaram A (2015) Apigenin mediated gold nanoparticle synthesis and their anti-cancer effect on human epidermoid carcinoma (A431) cells," RSC Adv., vol. 5, no. 6, pp. 51055–5106.

Rajoriya, P. (2017). *Green synthesis of silver nanoparticles, their characterization and antimicrobial potential* (Doctoral dissertation, Department of Molecular & Cellular Engineering, Jacob Institute of Biotechnology & Bioengineering, Sam Higginbottom University of Agriculture, Technology & Sciences Allahabad-211007, UP (India) 2017).

Scimeca, M., Bischetti, S., Lamsira, H. K., Bonfiglio, R., & Bonanno, E. (2018). Energy Dispersive X-ray (EDX) microanalysis: A powerful tool in biomedical research and diagnosis. *European journal of histochemistry: EJH*, *62*(1).

Singh, P., Kim, Y. J., Zhang, D., & Yang, D. C. (2016). Biological synthesis of nanoparticles from plants and microorganisms. *Trends in biotechnology*, *34*(7), 588-599.

Staichok, A. C. B., Mendonça, K. R. B., dos Santos, P. G. A., Garcia, L. G. C., & Damiani, C. (2016). Pumpkin peel flour (Cucurbita máxima L.)—Characterization and techological applicability. *J. Food Nutr. Res*, *4*, 327-333.

Vennila, K., Chitra, L., Balagurunathan, R., & Palvannan, T. (2018). Comparison of biological activities of selenium and silver nanoparticles attached with bioactive phytoconstituents: green synthesized using Spermacoce hispida extract. *Advances in Natural Sciences: Nanoscience and Nanotechnology*, *9*(1), 015005.