Plant Archives Vol. 19, Supplement 2, 2019 pp. 1063-1066 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

BIOSYNTHESIS AND STUDY OF SOME OPTICAL PROPERTIES OF SILVER NANOPARTICLES IN CORPORATE PLASMON RESONANCE FOR ANTIBACTERIAL ACTIVITIES

Alyaa Hussein Ali [1], Tahseen H. Mubarak[2], Nadia Mohammed Jassim[3*] and Izdehar Mohammed Jasim[4]

[1, 2,3*] Department of physics, College of science, Diyala university, Iraq.

[4] Department of biology, College of science, Diyala university, Iraq.

Corresponding Authors: alaahadi18@yahoo.com: nadiajassim@sciences.uodiyala.edu.iq*

Abstract

Silver nanoparticles" Ag NPs" were synthesized by a simple green method from silver nitrate solution of flowers of *Hibiscus rosa-sinensis* extract. UV-Vis spectra photometer, FTIR Fourier Transform Infrared spectrometer, XRD "X-ray diffraction", FESEM field Emission scanning electron microscopy and EDX" Energy dispersive X-Ray spectroscopy" were used to characterized Ag NPs of *Hibiscus rosa-sinensis* extract. UV-Vis spectrum of Ag NPs showed surface Plasmon resonance (SPR) peak at (480 nm) of *Hibiscus rosa-sinensis*. The reduction of silver –ions in silver nanoparticles synthesized was showed in FTIR,X-ray diffraction .Results showed the extract crystalline nature. FESEM result extract was exhibited spherical shaped and single distribution of Ag NPs as well as a create of Ag NPs –Energy dispersive X-ray spectroscopy was used to determine the particle size of *Hibiscus rosa-sinensis* extract. The silver nanoparticles were isolated from plant extract and tested for antimicrobial activity. The results indicated that silver nanoparticles have good antibacterial activity against *Escherichia coli* and *Staphylococcus aurous* bacteria.

Key words : *Hibiscus rosa-sinensis,* silver nanoparticles, antimicrobial activity.

Introduction

Due to the novel properties of noble metal nanoparticles such as (Ag and Au) nanoparticles occupied the important applications in scientific research and other applications (Syrya *et al,*, 2016). Silver nanoparticles (Ag NPs) were used in different potential applications spatially in bio medical (Jassim *et al*., 2017), Antibacterial (Ibrahim, 2015) and biological labeling properties (Gopinath *et al*., 2013). Silver nanoparticles synthesis as executed by different chemical and physical techniques using different toxic and un safety materials (Li *et al*., 2007). The green synthesis technique is considered as the test technique to get a synthesis of silver nanoparticles with more safety and nonhazardous (Islam and Miyazaki, 2009). Many scientific papers have been reports about the production of silver cease (Komar and Mamidyala, 2011). *Tamarinds in dice* (Farhan *et al*., 2018). *Malva parviflora* (Farhan *et al*., 2018). *Hibiscus rosa-sinensis* (Sikarwar and Patil, 2011). In the present study, the green method have been used as a synthesis method and study the character of Ag NPs by the silver nanoparticles and then detection of the antibacterial effects of Ag NPs that capable of Ag NPs on inhabitation effect. In this study *Malva parviflora* plant was used as an ornamental plant which is from *Malvaceue* family and it characterized by the rapid growth of multi-color flowering.

Materials and Methods

Hibiscus rosa-sinensis flowers were collected from diyala city gardens–Iraq, and were identified in the laboratory of plant in the biology department, college of science at diyala university. About (150) gm. of *Hibiscus rosa-sinensis* plant was weighted and mixed with 1000 ml ethanol and allowed to stand for 48 hours at room temperature .The mixtures were filtered then 150 ml of filtrate were mixed with 600 ml of 3mM silver nitrate solution .The color of *Hibiscus rosa-sinensis* plant was changed from pink to dark brown, which indicates the formation of silver nanoparticles. The reduced solution was centrifuged at 7000 rpm for 15 minutes. The supernatant was collected and left to the solute evaporated, then keep in tubes in 4 ℃ yet using. The spectroscopic studies were measured using UV–Vis spectrophotometer. The characterization of functional groups on Ag NPs surface by plant extract was a achieved by FTIR fourier transform infrared spectrophotometer. After cool-drying of the purified silver nanoparticles, the structure and average size of the synthesized silver nanoparticles were measured by field emission - scanning electron microscopy (FESEM), X-ray diffraction spectroscopy (XRD) and energy-dispersive X-ray microanalysis spectroscopy (EDX).

Results and Discussions

Biosynthesis of silver nanoparticles

Hibiscus rosa-sinensis extract to produce the silver nanoparticles. when the plant extract is mixed with $AgNO_3$ solution by 1:4. The silver ions are reduced to Ag nanoparticles and then an immediate change in the color of the plant extract from light to dark brown in the ethanol solution of the plant because of excitation of surface Plasmon vibration in silver nanoparticles. Further more formation of Ag NPs in ethanol extract watched by color change in the reaction vessels of the plant from light to dark indicates the formation of silver nanoparticles. Figure 1 shows : (A) represent the plant extract and (B) represent the silver nitrate with the presence of optimized amounts *Hibiscus rosa-sinensis* extract solutions after completion of the reaction.

Fig. 1 : Shows solutions (A) represent the plant extract and (B) represent the silver nitrate in the presence of optimized amounts *H. Rosa- sinensis* extract solutions after completion of the reaction.

UV-Vis. Spectroscopy

The reduction of silver nanoparticles in *Hibiscus rosa-sinensis* plant was done by leaving 24 hours in the incubation and in dark room. The color has changed from light to dark brown. The reduction of ions was determined by *Hibiscus rosa-sinensis* extract. The surface plasmon resonance (SPR) of silver nanoparticles produced peak at (480) nm for *Hibiscus rosa-sinensis* it was measured by UV-Vis spectrophotometer, Figure 2 shows that:

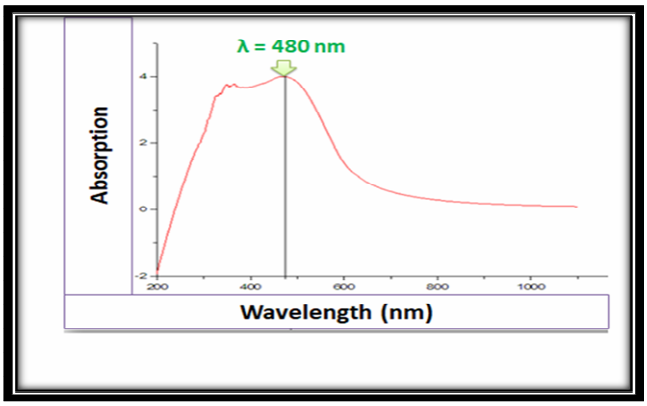

Fig. 2 : shows UV-Vis spectra of the *Hibiscus rosa-sinensis* extract.

FTIR Analysis

The FTIR spectrum obtained for *Hibiscus rosa-sinensis* flowers extract The FTIR analysis information of *Hibiscus rosa-sinensis* extract showed in table (1). The absorption peak at 3.436 cm^{-1} result from stretching of the –OH hydroxyl group. The absorption peaks at 2.925cm^{-1} could be assigned to stretching vibrations of (C-H) functional groups. The peak at 20360 cm^{-1} could be assigned to stretching vibrations of (C-=N).the peaks at 1.641 cm^{-1} and 1.384 cm^{-1} indicate the finger print region of CO, C-O and O-H groups .the peak at 1.041 cm^{-1} could be assigned to the (C-O). Figure 3 shows the FTIR analysis spectrum of *Hibiscus rosa-sinensis*. Inset in this Figure represent to table of FTIR analysis information of *Hibiscus rosa-sinensis* extract.

Table 1 : The FTIR analysis information of *Hibiscus rosa-sinensis* extract

Absorbent peak	Functional groups	Plant name
3.436c	-OH	*Hibiscus rosa-sinensis*
2.925cm^{-1}	C-H	
2.360cm^{-1}	C=-N	
1.641cm^{-1}and1.384cm^{-1}	CO,C-O,O-H	
1.041$cm^{-1}m^{-1}$	C-O	

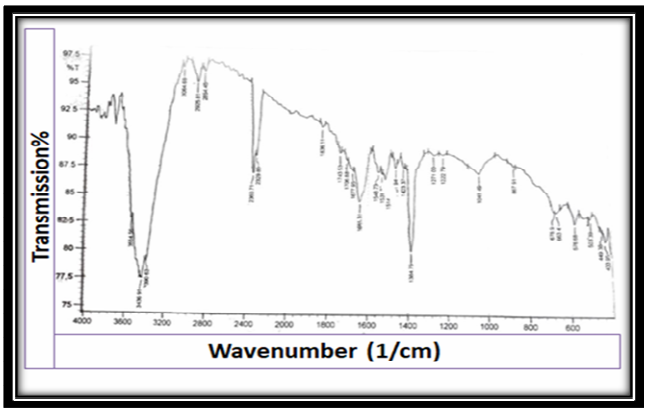

Fig. 3 : FTIR spectrum of *Hibiscus rosa-sinensis* extract.

Morphology, Particle size and chemical composition

FESEM, X-ray diffraction and EDX characterization of silver nanoparticles were performed. FESEM characterization shows silver nanoparticles distributed uniformly on the surface of cells. Figur4 shows the FESEM images of silver nanoparticles, its clear from this figure the single spherical poly dispersed of Ag NPs were irregular disturbed in the shape. The particle size of silver nanoparticles was found to be (38.15 – 70.15) nm with average size (55.22) nm in *Hibiscus rosa-sinensis* plant. The biggest silver nanoparticles may be caused to the aggregation of the smaller ones.

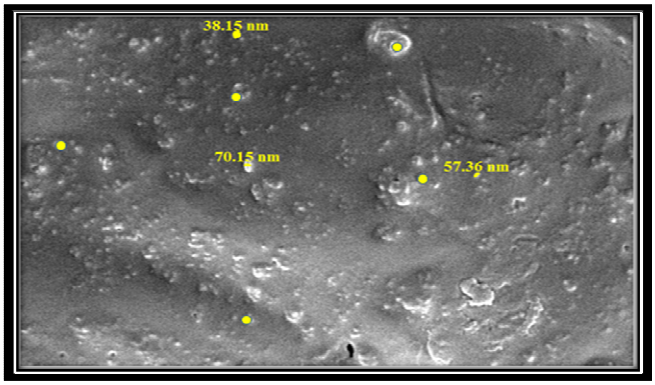

Fig. 4 : Shows FESEM images of silver nanoparticles.

Energy- dispersive of x- ray diffraction "EDX" was used to study the element analysis of silver nano particles and reveals to the formation of silver nanoparticles was showed in Figure5

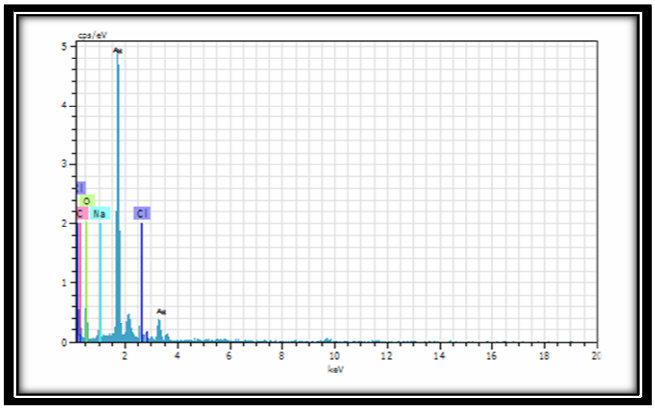

Fig. 5 : shows EDX analysis spectrum of silver nanoparticles

Table 6 : EDX results shows percentage of elements in resulting suspension

Atomic	Weight	Elements
42.75	47.03	OK
52.51	43.37	CK
2.47	6.03	CL
2.26	3.57	Na
100.00	100.00	Total

X-ray diffraction analysis(XRD) was studied to confirm the crystalline state of silver nanoparticles. Hence the silver nano particles powder was taken to test of x-ray diffraction. Figure 6 shows the x-ray diffraction of silver nanoparticles, its clear from this figure many peaks at 2Θ values of 38.185º, 43.519º and 64.581º can be indexed to the (111), (200) and (220) reffraction planes for face centered cubic structure of silver these corresponds to pure silver metal powder and its

indicates that the silver nanoparticles have a spherical structure and purity.

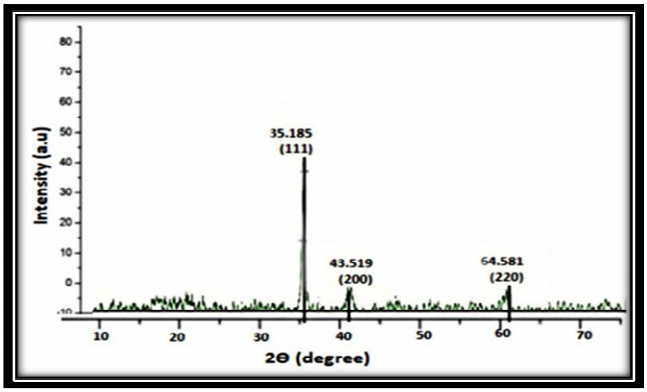

Fig. 6 : Shows the x-ray diffraction of silver nanoparticles

Antibacterial Activity

The antibacterial activities of normal and silver nanoparticles synthesized *Hibiscus rosa-sinensis* were completed by agar well diffusion method. The maximum region of inhibition by flowers extract against E coli is (11) mm. The synthesized silver nanoparticles displayed maximum region of inhibition (14) mm. The maximum region of inhibition by flowers extract against *Staphylococcus aureus* is (9). The synthesized silver nanoparticles displayed maximum region of inhibition is (14)mm green synthesis of nanoparticles has an advantage over physical and chemical method. Synthesized silver nanoparticles from plants extracts are no need to high pressure and higher temperature, low cost of preparation, easy method and no need to toxic chemical (Farah *et al.*, 2018). Antimicrobial chemical agent resistance increases for a wide spectrum of antibiotics. Silver salts and silver ions have been used as antimicrobial agent indifferent fields because of their inhibitory abilities to grow against microorganisms (Sikarwar and Patil, 2011). Silver ions are supposed to stick from the silver nanoparticles to the cell wall of the negatively charged bacteria and rupture, which leads to denaturation of the protein and then death of the cell (Kamyar *et al.*, 2012).

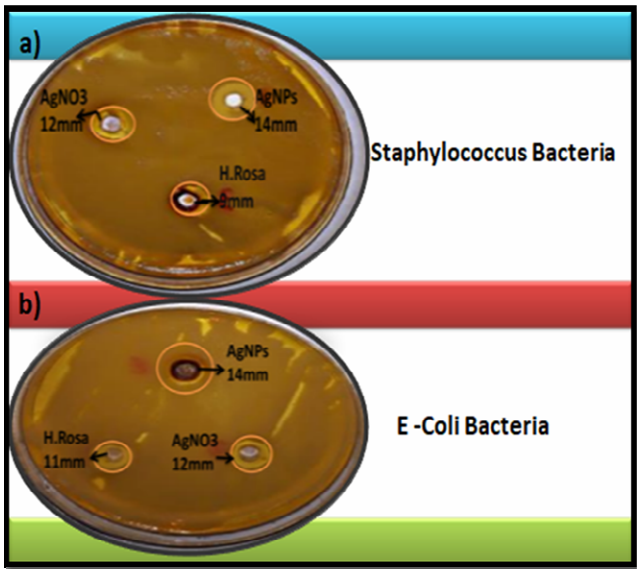

Fig. 5 : Shows(a) antibacterial activity of silver nanoparticles against of staphylococcus bacteria, (b) antibacterial activity of silver nanoparticles against of *E. coli* bacteria.

Antibacterial activities of normal and silver nanoparticles synthesized. The synthesized silver nanoparticles were tested against *E. coli* silver nanoparticles offer. The result indicated that silver nanoparticles have excellent antibacterial activity against *E. coli* similar report was reported that the biological synthesized of silver nanoparticles from plant showed good antimicrobial activity against *Aeromonas hydrophila* and another report from *Dracocephalum moldavica* seed extract showed excellent antimicrobial activities against *E. coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Serratia marcescens* and *Bacillus subtilis* (Awwad *et al.*, 2013).

Conclusion

This work highlights one of the simple, economical, easy and eco-friendly methods of green synthesis for nanoparticles. We used flowers of plant .This study proved the biological effectiveness of silver nanoparticles prepared in green synthesis. Where it has been tested against pathogenic bacterial. The particles were widely examined because they are characterized by optical, electronic and chemical properties depending on their size and shape. Nanoparticles are one of the inorganic nanomaterial's that are considered as good antimicrobial bialagents. Researchers have found that nanoparticles have opened a new era in pharmaceutical industry. The results showed that of silver nitrate with plants extract has an important role in the reduction and stabilization of silver to silver nanoparticles.

References

Awwad, A.M.; Salem, N.M. and Abdeen, A.O. (2013) Green Synthesis of silver Nanoparticles using *Carob* leaf Extract and Its Antibacterial Activity. International Journal of Industrial Chemistry 4: 1-6 .

Farhan, A.M.; Gassim, R.A.; Kadhim, N.G.; Mehdi, W.A. and Mehdi, A.A. (2018) Synthesis of Silver Nanoparticles from *Malva parviflora* Extract and Effect on Ecto-5-Nucleotidase (5-NT), ADA and AMPDA Enzymes in Sera of Patients with Arthoros clerosis. Baghdad Science Journal 14(4): 742-750.

Gopinath, K.; Gowri, S.H. and Arumugam, A. (2013) Phytosynthesis of silver nanoparticles using *Pterocarpus santalinus* leaf extract and their antibacterial properties. Journal of Nanostructure in Chemistry 3(68): 1-7.

Ibrahim, H.M. (2015) Green Synthesis and Characterization of silver Nanoparticles using *banana* peel Extract and their antimicrobial Activity against represent dative microorganisms. Journal of Radiation Research and Applied Sciences, 8: 265-275.

Islam, N. and Miyazaki, K. (2009) "Nanotechnnology innovation system: Understanding hidden dynamics of nanoscience fusion trajectories". Technological Forecasting and Social Change, 76: 128-140.

Jassim, N.M.; Wang, K.; Han, X.; Long, H.; Wang, B. and Lu, P. (2017) Plasmon Assisted Enhanced Second-Harmonic Generation in Single Hybrid Au/ ZnS Nanowires. Optical materials, 64: 257-261.

Kamyar, Sh.; Ahmad, M.B.; Al-Mulla, E. and Ibrahim, N.A. (2012) "Green biosynthesis of silver nanoparticles using *Callicarpa maingayi* stem bark extraction". Molecules 17(7): 8506-8517.

Kumar, C.G. and Mamidyala, S.K. (2011) Extra-cellular synthesis of silver nanoparticles using culture supernatant of *Pseudomonas aeruginosa.* Colloids and Surfaces, Biointerfaces, 80: 462-466.

Li, H.J.; Sun, Q.; Lu, D.; Su, Y.; Yang, Y. and Wang, X. (2007) Biosynthesis of silver and gold nanoparticles by novel sundried *Cinnamomum camphora* leaf. Nanotechnology, 18: 105104-105115.

Roy, K.; Biswas, S. and Banerjee, P.C. (2013) Green Synthesis of Silver Nanoparticles by using Grape (*Vitis vinifera*) Fruit Etract: Characterization of the particles and Study of Antibacterial Activity. Research Journal of Pharmaceutical , Biological and Chemical Sciences, 4: 1271-1278.

Sikarwar, M.S. and Patil, M.B. (2011). Antihyperlipidemic Effect of Ethanolic Extract of *Hibiscus rosa sinensis* Flowers in Hyperlipidemic Rats. RGUHS Journal of Pharmaceutical Science, 1: 117-122.

Syrya, S.; Kumar, G.D. and Kumar, R.R. (2016). Green Synthesis of silver Nanoparticles from Flower Extract of *Hibiscus rosa-sinensis* and Its Antibacterial Activity. International Journal of Innovative Research in science, Engineering and Technology, 5: 5242-5247.