Review Article

Comment [PB1]: Is it original article or review article.

Extraction of Nano Metal from Natural Compound

ABSTRACT

In this study, we used green synthesis method in prepared Nano particles. (AgNps) were prepared by the use of plant extract under standard laboratory conditions in clean room in Nano technology and advance materials research centre (NAMRC) /university of technology /Iraq as initial precursors silver nitrate with Orange and banana fruit waste (peel). the experimental laboratory used for characterization of Ag Nano particles were XRD, UV-visible and FTIR. silver Nano particles were tested against several types of bacteria and gave best results versus gram-positive and gram-negative bacterial.

Comment [PB2]: State brief comments on your findings and conclusions

Keywords: Ag Nanoparticles; silver nitrate; orange peel; banana peel; green synthesis method

1. INTRODUCTION

Nanotechnology rises as a ~~quickly~~ fast developing fields and its application within different sciences and innovation [1]. Nano biotechnology is the field of interrelates both natural scientific fields and nanotechnologies. It gives a stage to the improvement of eco-accommodating and green combination of Nano particles with the assistance of natural provenance as kinds of plant as well as microorganisms [2]. Nano particles ~~shows~~show a very new or reinforced properties depending on a specific quality, like size, dispersion and morphology [3].

The Nano science and innovation is developing quicker stage, or, in other words colossal terms of productions and audits in it from the previous decades. All are concentrating upon this, as the gigantic applications of it. Green blend of Nano particles is eco-accommodating combination by dodging unsafe fills thus numerous individuals have accomplishment in this amalgamation of Nano particles utilizing removes acquired from smaller scale living beings like microscopic organism's growths and in addition separates from various plant parts (leaves, stem, blooms, natural products, seeds and roots) [4].

Biosynthesis of nanomaterials by plant extricates is presently utilized as number of scholars did on it [5] and testing it for the antimicrobial applications [6]. During the previous two decades, broad investigations have carried out to upgrade novel medications out of the natural materials due to the obstruction of the microorganisms for the current medications. Natural material can be considered an imperative wellspring which are currently used for treatments in medicine [7].

Silver Nano particles can be so important for the current environment due to the distinguishing features that involve the shape, size, electric, magnetically and optic features. Therefore, Ag-NPs can broadly ~~employed~~employ in numerous applications such as; composite ~~fibers~~fibres, biosensor material, electronic components, cosmetic production as well as antimicrobial application [8].

The chemically reduced process is broadly defined as procedure utilized to incorporate Ag-NPs in view of its willing to create Ag-NPs below elemental condition with its capacity to great scale synthesis. Nevertheless, such technique of chemic syntheses include the utilizing of chemical

materials which have toxic nature and possess adversative influence upon the environmental conditions and delay the biosynthesized usage for Ag-NPs within fields of medicine. Consequently, synthesizing of Ag-NPs via green synthesized method has been shown to have advantages against the physical and chemical approaches due to its environmental benign, economic and most significantly such method has no need for adversative environment with great temperatures, energy, pressures or using the toxic chemical materials [9].
Henceforth, such biological approach can be utilized in the silver Nano particles. Organic synthetic strategies explain that the synthesized silver Nano particles from the plant source have stability which is better than the stability of the synthesized Ag-NPs from microbial source. Consequently, capping and stabilizing agents which extracted from biodegradable peel wastes of fruits can be utilized to synthesize silver Nano particles out of silver ions [10].
In this current study, biosynthesis of silver Nano particles has been explored utilizing concentrations of banana and orange peels as a perfect innovation for retrieve a noble metal out of dilute sol. Such strategy introduces the astounding preferred standpoint of utilizing manufactured wastes as a decreasing agent and acquire an additional incentive for these items. The targets of this examination ~~was~~were to explore the development of various metal Nano particles with this biomass and to decide the ideal states for the combination and control of molecule shape.

2. MATERIAL AND METHODS

2.1 Preparation of fruit extracts

(50 g) of each orange and banana peel were chopped into a small pieces and collected each one in a different vessel contains (50 ml) of distilled waters then boiling at (80° C) during (10 min) and set for cooling at room temperature thence filtered by the use of ~~whatmans~~Whatman's no.1 filter paper and refrigerate at (-4° C) to use later.

2.2 Preparation Ag NPs

(1 mM) aqueous sol of Silver Nitrate ($AgNO_3$) had been made and utilized to synthesize the Nano particles~~.~~ (10 ml) from each banana and orange extract was added drop by drop to (90 ml) of aqueous sol of (1 mM) Silver Nitrate then heated at (80 °C) by the use of a hot plate for (15 min) then (100 ml) of solution settled for (15 min) within room temperatures. There was changing in the sol colour from ~~colorless~~colourless to dark brown, indicating to the forming of silver Nano particles.

2.3 Ag NPs characteristics

Comment [PB3]: Outline materials used and standard experiemental methods used

The two samples were tested by X-Ray diffract meter (XRD, 6000-Shimadzu), FTIR spectrum and UV (A dual – beam UV-IR 210A Spectrophotometer) to the characterization of the Nano particles .

2.4 Preparation of bacterial culture

Four types of bacteria (*E. coli, Pseudomonas Aerogenosa , Staphylococcus aureus and Streptococcus*) had been cultured on nutrient agar plates at 37° C for 24h.

2.5 Ag NPs' antimicrobial activities

An activity of antimicrobial nature for Ag NPs against bacteria had been performed via Agar Well-diffusing along with disc diffusing techniques. Using the micropipette, (100 µl) of overnight culture for all organisms was spread by using sterilized swabs on Muller Hinton agar plates and wells of (5 mm) was punctured by the use of cork-borer, (50 µm) of Ag NPs had been provided to each well and The petri plates had been allowed to stand for (1 h) for proper

diffusion and then aerobic incubation was made at (37 ± 0.2°C) during (24 hours), for the disc diffusion method, (100 µl) of overnight culture of the two type of organisms was spread on a different plates of Muller-Hinton agar and filter paper of (5 mm) cut off and soaked in Ag NPs solution and placed on agar plate by the use of a sterile forceps after then the petri plates were permit to stand for (1 h) for proper diffusion and then incubated aerobically at (37 ± 0.2°C) for (24 h), The evaluation for antibacterial activity had been measured the inhibiting zone (mm) around the testing bacteria. The test was performed in triplicates with control.

3. RESULTS AND DISCUSSION

The biogenic blend of Ag NPs by banana and orange peel Extracts were done. The arrangement of Ag NPs was observed to be effective as proposed by the beginning of the changes in colour. It is notable that Ag NPs show grey colour in watery solution because of exciting for surface plasmon vibrating within Ag NPs.

3.1 XRD analysis

biogenic synthesis technique was fruitful to deliver high virtue of silver particles with high crystallinity [11]. Figure 1 demonstrates the X-beam diffracting profile of the silver oxide films the deposition of which was done at room temperature substrate (303 K) demonstrated a solid X-beam diffracting top at 2θ = 35.5and two powerless tops at 54.70 and 75.18 (appeared in inset of figure 1). ~~These diffraction (111)~~These diffractions (111), (200), (311) reflection peaks are recognized in single crystal which identified with the cubic structure of Ag, it was shown that the developed movies have polycrystalline nature, the characteristic reflections are indexed by comparing with the literatures report [12,13]. Phase investigation analysis was finished by (Philips PW 1050) XRD, diffract meter has been used. Where utilized the equation (1) for a cubic framework for most power crest (111) to gathered the grid parameter (a) which it was equivalent to (a = 0.407 nm);

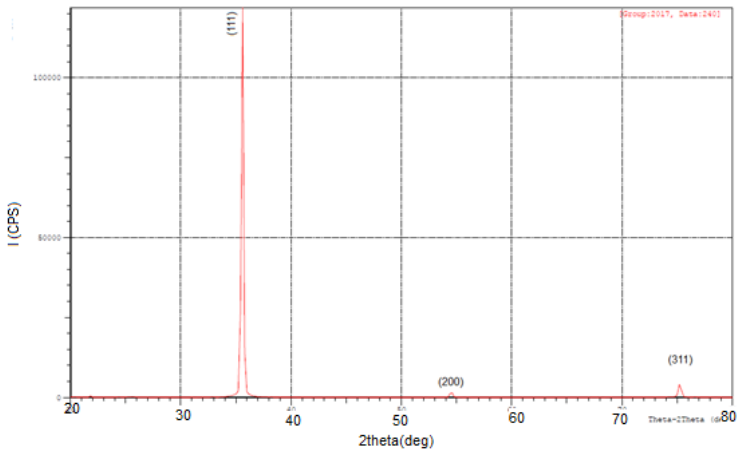
$a^2 = (h^2+k^2+l^2).\ d^2$…… (1)

h,k,l is miler index, d is the inter planer spacing.

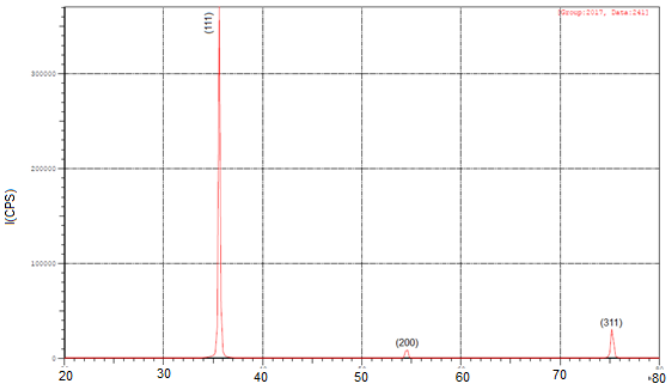
Using Scherer equation to find Average particle size of Ag nanoparticles which prepared by banana extract is found to be (19.11 nm) and for orange extract (20.27nm).

$D_x = 0.9\ \lambda / (\beta \cos \theta)$…….. (2)

λ= represents the length of wave for XRD, β =broadening of the diffracting peak, θ = diffraction angle, the calculate crystallite size from broadening of the (111) XRD peak. Absent of Diffraction pattern corresponding to impurities that is prove pure Ag nanoparticles which as synthesized.



[A]



(B)

Figure 1. presents XRD diffraction of Ag NPs prepared by (A) banana extraction (B) Orange extraction.

3.2 Fourier Transform Infrared Spectroscopy (FT-IR)

Ag nanoparticles measurements spectra by FT-IR to describe the efficient stabilization and possible figuration of bio reduction of biosynthesized AgNPs by using banana and orange peel extricate. In general, metallic absorbing bands in fingerprint area i.e. below 1000 cm-1 arise from inter-atomic vibrating. FT-IR groups of the orange and banana peel extract were deduced at 3651.82 cm-1 that peak watched are might be because of O-H extending and twisting, separately appointed to adsorption of H_2O on the metal shallow. Tops in 1626.82 and 669.05 cm-1 relate to Ag–O extending as well as distortion vibrating, individually. The metal-oxygen frequencies watched in nm range to separate the metal oxides were as per writing regards. Comparable FTIR investigations of Ag NPs are accounted for by N. D. Singho and his associates [14] support the outcomes.

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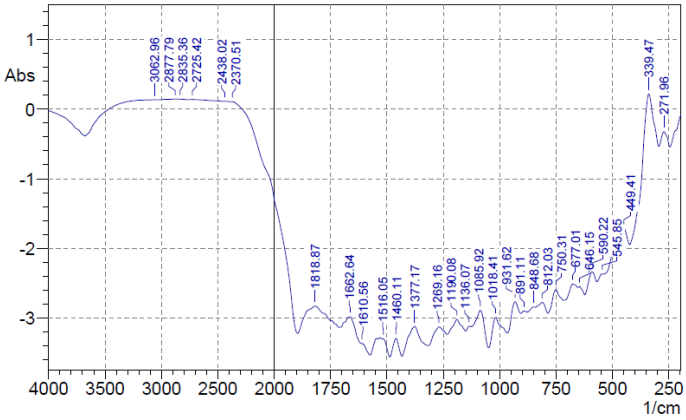
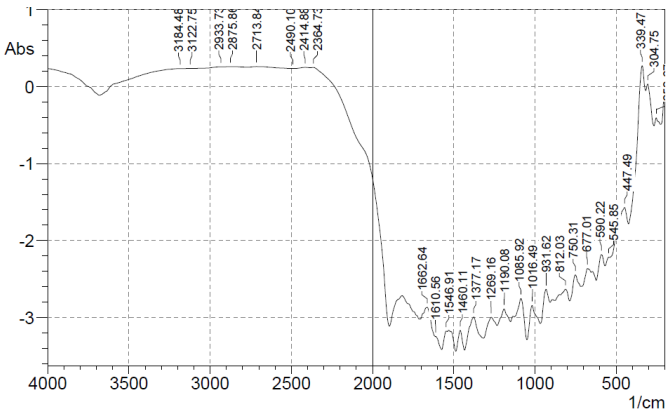


(A)



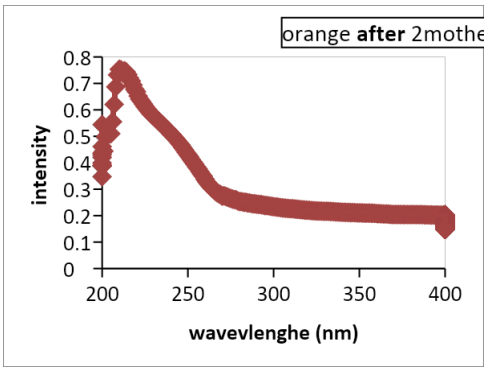
(B)

Figure 2. The FT-IR measurements spectra of Ag nanoparticles prepared by different peel extract by (A) banana extraction (B) Orange extraction.

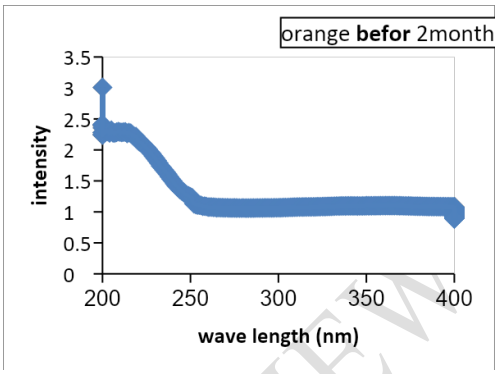
3.3 UV–Visible Spectral Analysing

The optical characterization for the biosynthesized Ag NPs had been proved by UV-V absorption spectrophotometer Fig 3 (a) demonstrates the UV-Visible retention spectra of Ag NPs due to the wavelength function. It is realized that the shade of metal particles was occurred through the entirety of the scatter impacts for visible lighting[15]. As per Mie's hypothesis, small spherical Nano crystals must display a sole surface plasmon band, depending on their shape exhibit two or three bands,

The UV-Vis range of colloidal arrangement of Ag nanoparticles arranged by banana and apple extricate which have absorbance top at 289 nm in UV-Vis ingestion spectra of Ag nanoparticles; and the extending of pinnacle demonstrated that the particles are mono-scattered and No noteworthy change in the force was seen as appeared in Figure 1. Ag nanoparticles arranged by orange concentrate has a tight pinnacle, because of contaminating proteins in the specimen. For confirming the stabilized feature for silver nanoparticle sols, new particles not aggregated point to stable position of absorbance peak. Measured of the absorption spectra one of the colloid systems with dissimilar time intervals where no obvious changing in peak position when the samples leave 2 months, excepting for decreases of absorbance. That decrease of absorption shows that quantity of Ag NPs may be changed [16].



(A)



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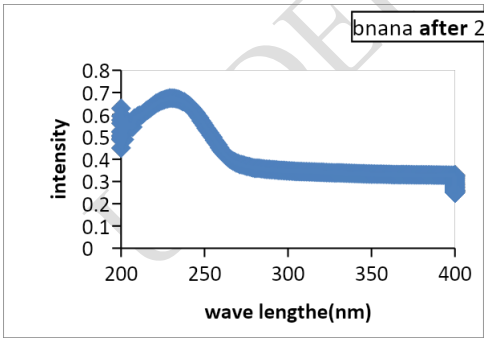

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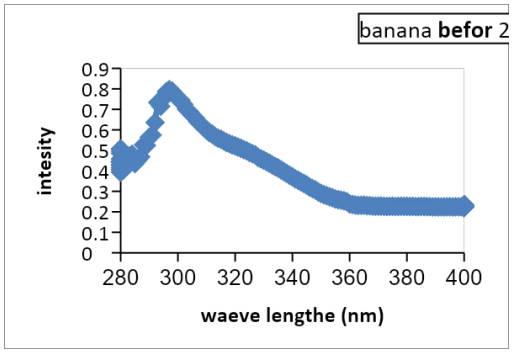

(D)

Figure 3. present UV-Vis absorbing spectra for Ag oxide nanoparticle

3.4 SEM Studies of silver

SEM seen in Figure 4a utilized to dissect the morphology and structure of the nanoparticles to provide encourage knowledge into the highlights of the silver Nano particles acquired from the offered biogenic combination strategy, the film shows small particles on the surface of the film and the picture indicated generally round state of the framed nanoparticles, silver Nano particles are very much scattered and uniform estimated circular shape.

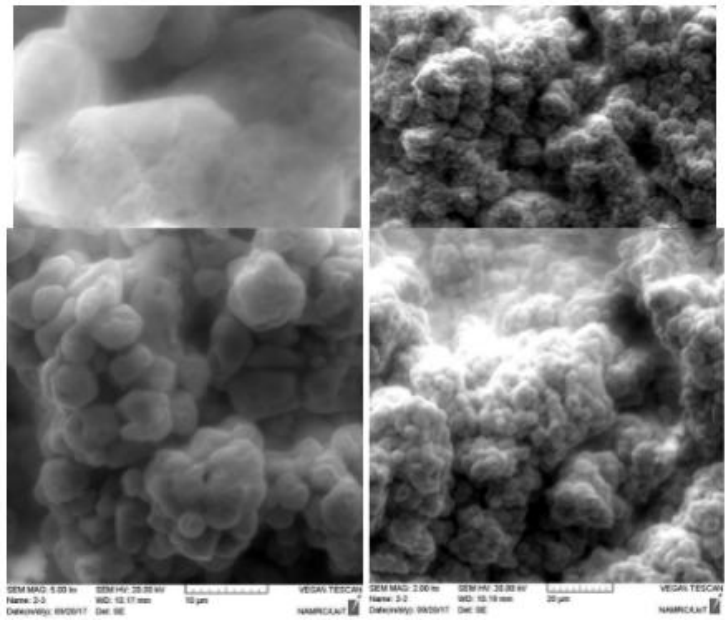

Figure 4. The image shows relatively spherical shape SEM pictures of Ag NPs for different magnification.

3.5 Results and Discussion of antibacterial test

The investigation results showed the impression that Nano particles displayed low? poisonous quality against *S.aureus* which the zone of restraint around Ag NP (soaked discs) in plate of the bacteria culture, and the numeric estimation for distance across to the inhibition area had been exhibited in Table (10) and (2), additionally the outcomes demonstrated most extreme affect ability against *E. coli* and *Pseudomonas aerogenosa.*

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Table (1) :- Inhibition zone of Ag NPs by used filter paper versus gram negative and gram positive bacteria

Types of bacteria	Type of Ag NPs prepared by fruit extraction	
	Ag NPs prepared by Orange Extraction (mm)	Ag NPs prepared by Banana Extraction (mm)

Staph .aureus	14	15
	13	10
	14	13
E.coli	16	15
	18	15
	17	16
Pseudomonas aerogenosa	17	13
	15	12
	16	14

Table (2) :- inhibition zone of Ag NPs by used wells versus gram negative and gram positive bacteria

Types of bacteria	**Type of Ag NPs prepared by fruit extraction**	
	Ag NPs prepared by Orange Extraction	**Ag NPs prepared by Banana Extraction**
	14	15
Staph .aureus	15	10
	14	13
	15	17
E.coli	15	15
	17	16
	23	24
Pseudomonas aerogenosa	22	24
	20	22

The results explain the successfully biogenic synthesized Ag NPs prepared by some fruit peel extraction to show antibacterial activity on different type of gram-negative and gram-positive bacteria by used filter paper method (fig 5) and well diffusion method (fig 6) .

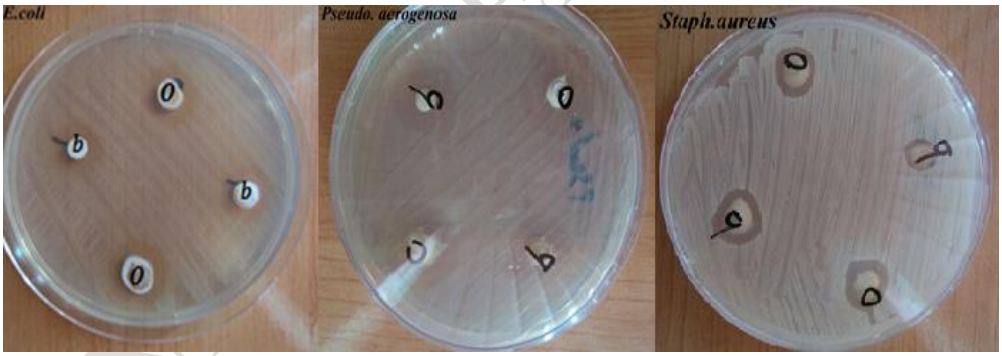

Figure 5. inhibition zone of Ag NPs prepared by orange and banana peel extraction on ~~*E.coli*~~*E. coli* ,*Pseudomonas aerogenosa and Staph.aureus* bacteria by using disc diffusing approaches (filter paper).

Figure 6. inhibition zone of Ag NPs prepared by orange and banana peel extraction on *E.coli ,Pseudomonas aerogenosa and Staph.aureus* bacteria via using good diffusing approaches.

Thusly, Ag NPs arranged via such system must be prospect advance for antimicrobial application to models in treating wastewaters, sustenance as well as waters storing and creation of therapeutic supply, for instance, beds or wound dressings, wraps. The characteristic procedure used in this work is seen by sparing a monstrous measure of vitality, eco-friendly, money related, clean, and has no any deadly engineered substances for the synthesis [17].

The blend of Nano particles utilizing biomass recommended the activity of sugars as lessening factor and the job of proteins as a settling as well as a capping factor. The ~~concent~~consent between amino gatherings and metallic particles are in charge of the adjustment of the Nano particles [18]. Those protein conjugated Nano particles have a potential uses as marks for tissues and living cells because they're not topped by lethal items and could be utilized in the pharmaceutical business and drug [19].

The Vitamin C substance of orange peel possesses antioxidant agent feature, that goes about as decreasing factor and encourages the decrease of Ag+ of AgNO3 to Ag^0.[20]

Likewise, might be caused of the cell wall of Gram-positive microscopic organisms that formed a thick peptidoglycan layer that comprises the direct polysaccharide chains cross-connected via a short peptide, hence making extra unbending structure stimulation troublesome entrance of the silver Nano particle conflict with the Gram-negative microorganisms where the cell divider has thinner peptidoglycan layer [21].

The high bactericidal movement is positive because of the silver cation discharged out of Ag NP which go about as repositories to the Ag bactericidal factor. Huge differences within the film structures of microscopic organisms because of the collaboration with silver cations prompt the expanded layer penetrability of the microbes [22].

This research exhibits the high proficiency of banana and orange peel extraction to lessen and prepare Nano particles of a change nature. Besides, the work gives a basic technique with the perspective of the up-scaling that is permits acquiring the coveted size and shape of the Nano particles via the control of the underlying pH of the arrangement.

4. CONCLUSION

No extraordinary consideration has been given to plants which are extracted out of mechanical waste in biosynthesizing the Nano particles. A decrease of metal salts utilizing plant extricate is a simple dealing with proficient and clean strategy to prepare noble Nano structures from dilute hydro-metallurgic sols. The plant extraction is rich wellsprings of lessening as well as balancing out factors, for example peptides, lipids and polysaccharides. In the present setting of the undeniably perceived utilization of Nano particles within various areas, the current investigation gives a strategy to get Nano particles of a few metals controlling the size and shape of the Nano structures via changing the beginning pH.

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