International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2019): 7.583

Rapid Synthesis of Metallic Nanoparticles by Using Peel of *Punica granatum* Extract

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Abstract: ***"Nature's power fruit" has been dubbed for Pomegranate from the family Punica granatum L .Nanocapillary, nanopores, nanoshells and nanoparticles are the most positive application from various cancer treatments. Using Pomegranate Peel extract [PPE], a gradual eco-friendly approach for synthesizing metal nanoparticles.Average size of silver nanoparticles is 20nm and gold nanoparticles size is 50nm.Through utilizing metal, nanoparticles become incredibly quick, environmentally safe and stable without the use of surfactant extract.The morphs and crystalline nanoparticles used UV-Visible spectroscopy, Transmission electron microscopy (TEM) and X-ray diffraction (XRD) spectroscopy.There has also been an attempt to understand the possibility involving biosynthesis process for the nanoparticles.***

Keywords: Nanoparticles, Pomegranate peel extract, silver, gold, synthesis.

1. Introduction

Pomegranate [*Punica granatum L.]* is a wide fruit that cultivated throughout the Mediterranean region. Pomegranate is having good anti-microbial properties.It also shows some antioxidant activity due to presence of some species of flavanoids and anthocynidins in Pomegranate. Copper, silver, gold, zinc, titanium, gelatin and magnesium are different metal which can also be used for production of nanoparticles.Synthetic or natural, process can be used for nanoparticles synthesis, however due to the nature of certain hazardous toxins absorbed on the surface, harmful impacts can develop due to chemical influence the capacity. For the synthesis of various nanomaterials, the emerging field which is available in science that can be used is Nanotechnology. By using either silver or gold nanoparticles,eco-friendly synthesized method is evolving into the nanotechnology.The usage of plant extract for the production of nanoparticles may be beneficial over the difficult reduction process for the restoration of cell culture.Constituents like polysaccharides,antioxidant,metabolites,flavonoids which are present in plant extract can be used for biosynthesis of nanoparticles.Phenolic compound like gallic acid and other fatty acids, flavones, flavanones and anthocyanidins arethe most essential constituents which are present in pomegranate peel.Polysaccharide was isolated from Pomegranate rind. Question raised was Is pomegranate a perfect fruit for metal nanoparticles to research and develop?But the usage of pomegranate peel extract for metal nanoparticles biosynthesis has not yet been recorded.In specific silver nanoparticles, which have many applications have developed to grow these green-friendly methods for synthing nanoparticles into an important field of nanotechnology.[1-3]

Plant Description [part of plant and available from]:-
Pomegranates grow best in temp or semi-arid climate with a cool winter and warm summer.They are less hardy than many other deciduous fruit tree but more hardy than citrus. Pomegranate [*Punicagranatum L.*] is evergreen fruit which is very healthy and edible fruit which is used in medicine for various formulations.The fruit has thick, leathery rinds which protect the pulp and seed inside.The inside fruit is separated into compartment by white spongy tissue.The important source of bioactive properties of Pomegranate is to show its anticancer activities which contain high source of ellagitannins,antocyanins and hydrolysable tannins.[4]In western herbal medicine fruits and seeds are used. Pomegranate juice is also distributed in liquid form, but in different formats, and pomegranate extract in tablets, capsules or powder texture.

Figure 1: Pomegranate Fruit Structure

Figure 2: Pomegranate Peel Extract and its Molecular

Nanoparticles: Types

1) Silver:- Silver nanoparticles have verified to be most effective because of their intense antimicrobial activity against pathogens, bacteria, and other unicellular micro-organisms. [5-6]They are without a doubt the most commonly used Nanomaterials of all, used in the textile industry, for the treatment of skin, sunscreen lotions and so on.[7]Studies of plants such as the *Azadirachta indicica*[8], *Cabsicum annus*[9] *and Carica papaya*[10] have previously demonstrated the effectiveness of silver nanoparticles' biosynthesis.
2) Gold:-For immunochemical experiments to classify protein associations, the use of gold nanoparticles (AuNPs) is utilized. They are used as a laboratory tracer in a DNA fingerprint to identify the identity of DNA in a sample. They are also used to track antibiotics such as Tetracycline and Clarithromycin on the amino glycoside. Usage of gold nanorods to identify stem cells from cancer is useful. For cancer detection and for recognition of multiple types of bacteria.[11-12]
3) Alloy:- Nanoparticles in alloys show different structural properties from their collections in large quantities.[13]Since Ag has the highest conductivity between the metal fillers and comparatively better their oxide,[14] Ag flags are used in the majority of cases as opposed to many other metals. Nanoparticles with bimetallic alloy the properties of both metals are affected and have more benefits than typical metallic nanoparticles.[15-16]

2. Material and Method

Method I:-

Preparation of Pomegranate Peel Extract:-

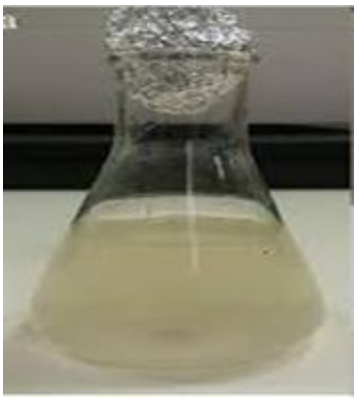
- Take half or one kg of pomegranate from super market. Wash it with tap water and then again wash with duplicated purified water[DDH_2O].Peel off the pomegranate properly.Take the peels again wash it with Double Distilled water to avoid toxicity and soak at room temperature.After drying peels,peels are grind into a fine powder and stored in 4^oC for further use.
- Take 10 gram of powder in 100 ml DDH_2O and keep it for 24 hr at room temperature. After soaking, filtered it using Whatman filter paper no.1 to acquire aq.extract.Performed process under sterilized condition.

Synthesis of Silver nanoparticles {AgNPs}:-

- Silver caustic has been diluted to 250 ml of DDH_2O and shake properly.
- Take 10 milliliters of aq.pome peel powderadded and shake in incubator for 5 min.
- After 24 hr,the result was found that the colour of mixture changes from colorless to brownsolution, which indicatesthat, the degradation of silver ions into silvernanoparticles.
- Above silver nanoparticles solution was centrifuged at 15,000 rpm for 15 min and process repeated for further four times.
- Finally purified silver nanoparticles {AgNPs} were assembled and implemented to determine the characterization and other biological activities for synthesis of nanoparticles.
- Remaining sample of pomegranate powder was stored at 4^oC for further use.

Categorizing the silver nanoparticles {AgNPs} and gold nanoparticles {AuNPs}:-

- A Lambda 950 UV / Vis / NIR spectrophotometer 24, 48 and 72 hours following the initiation of the reaction from 200 to 800 nm and at a resolution of 1 nm, a pomegranate peel was tracked to control the decrease in silver ions.
- PANalytical X-ray diffractometer was obtained to evaluate the crystalline structure of silver nanoparticles for XRD patterns varying from 20 to 50 with 2θ.
- AgNPs were performed with the TEM analyzes carried out with 3.0 nm resolution on JEOL JEM-1230 and JSM 6380 LA SEM.
- An energy-disseminated X-Ray Spectrum (EDX) with pattern JED 2200 (Jeol) was performed for fundamental analysis of the AgNPs.[17-19]



(a) 0.1Mm silver nitrate

(b) Colour changed after addition of Peel Extract

Figure 3

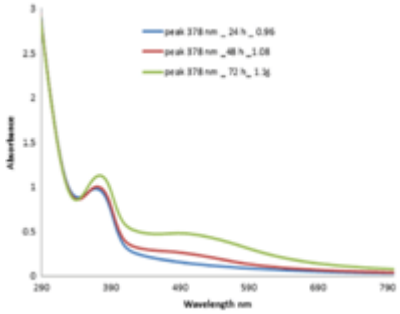


Figure 4: UV-Vis absorbance spectra in time AgNPs from Pome extract

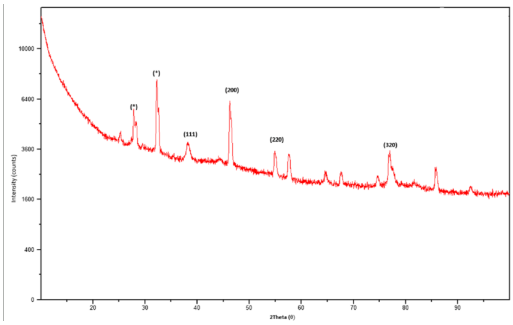


Figure 5: XRD pattern of synthesized intervals synthesized AgNPs at 48-72 hr

Method II:-

- Pome fruit are purched from local market.All the apparatus and fruits were properly washed with deionized water and dry in oven.
- For advancement of silver and gold nanoparticles peel powder of Pome were used as reducing agent.
- After washing, take 50 g peel powder of fruit were added in 250ml pure water in 500ml Erlenmeyer flask and bolied for 10-15 min.
- After boiling, the sample was filtered by using [Whatman filter paper No.40]for use of metal nanoparticles synthesis.
- Aqueous solution [1Mm] of silver nitrate and chloroauric acid solution was prepared and 50 ml of either gold or silverion solution was reduced using 1.8 ml of FPE [Fokker Planck Equation] at room temperature for 5 min.The solution gets 10 min more to get a large Surface Plasmon Resonance [SPR] for both metal nanoparticles, owing to the presenceless quantity of FPE below than this.
- Caramel colored-yellow solution indicates the existence of silver ions wherever pink solution indicates after FPE has been applied gold nanoparticles have been generated.

Characterization of both [AuNPs] and [AgNPs] nanoparticles:-

- UV-Visible spectrum using a spectrophotometer Perkin-Elmer Lamda-45 has spotted spectral tests for the manufacture of nanoparticles with various different responses.
- Transmission Electron Microscope (TEM) JEM-1200EX, JEOL was used for the analysis of different structure of developed nanoparticles. For TEM tests, the copper grid was fitted to 3µL of the sample solution making a thin sample film for 15 minutes and then the sample was taken with the cone of an additional 15 min for drying at room temperatures and extra sample were removed by using paper blotting and reserved in gridbox.
- An energy dispersive X-ray analysis (EDX) of Zeiss Evo 50 instrument was used to determine if elemental silver is present. 1N HCl and 1N NaOH kept the pH of the solution.
- For the calculation of X-ray powder diffraction, the solutions produced from silver and gold nanoparticles were dried at 80^{O}C. X-ray dissipations of powder have been obtained using phase scanning and Johansson's monochromator for pure CuKα radiation (1,5406 A; 45kV; 30mA) using PAN analytical PRO geometry diffractometer in Bragg – Brentano.
- The diffraction database integrated in High Score Plus used portions of the ICDD PDF2 for testing match-phase recognition analyzes.
- With the pseudo-Voigt function, most isolated peak diffractions were constructed to estimate the crystallite sizes of the produced nanoparticles in order to determine the full width at half-maximum (FWHM), which is extremely important for the Scherrer method to determine crystallite sizes. [20-24]

Method III

- Some pomegranate leaves collected and dried in shade for 5 days and grind into fine powder.
- Fine powder for potential use was developed and deposited in the tube. 2 grams of grind leaf powder is washed in 100 ml of beaker with 30 ml of purified water, then boiled for 10 Minutes at 60µC.
- Subsequently, the leaf extract was refreshed and screened into Whatman filter paper and deposited at 4 ° C.
- The concentration of silver nitrate has been kept at 1mM.
- 5 ml of leaves extract has been added to 95 ml of silver nitrate to form 100 ml and kept in darkroom at room temperature for incubation at various intervals of time.

Biosynthesis of Metallic Nanoparticles:

- In sterile tubing containing double water, the biosynthesis reactions (in a volume of 10 ml) were carried out. In addition, the reaction tubes also obtained specific volumes from the pomegranate extract previously prepared (30, 50,100, 150, 200&500µL).
- The pH effect was measured using HCl and NaOH 1 M solutions by adjusting the pH of the reaction tubes to specific values 4, 7 and 10pH.
- In the reaction tubes 1ml of (10mM) stock solutions were then added, to the finalizing concentrations of 1mM, of both tetrachloroauric acid and silver nitrate separately.

Characterization of both Nanoparticles [AgNPs and AuNPs]:-

- The configuration and scale of the nanoparticles is calculated by Transmission microscopy (TEM). To conduct tests with a JEOL 2010F a field emission device operating at 120 kV has been used.

- A drop of strongly diluted sample fluid was mounted on an amorphous carbon copper grid to evaporate at room temperature.
- Aliquots of (200µl) nanoparticles resulting were transmitted in 96-well plate for absorption measures and UV visible Power Wave Reader Spectroscopy (Biotech, USA) recorded absorption within 350:750 nm scanning range.
- At least 3 independent experiments represent mean values in data points. [25-27]

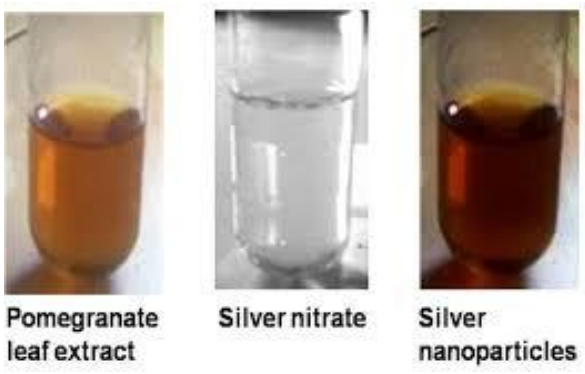


Figure 6: Synthesis of silver AgNPs from synthesized

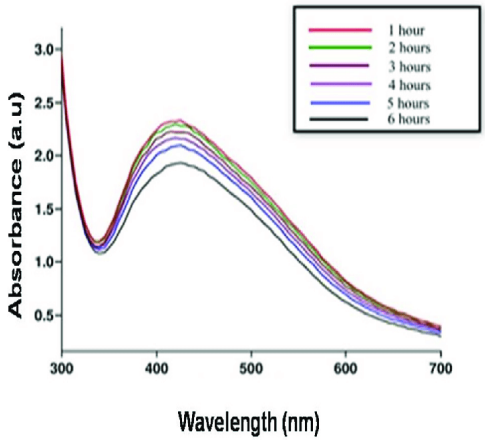


Figure 7: UV-Visible spectral analysis AgNPsleaf extract of Pomegranate from extract of Pome leaves

Application

- The opportunities for diagnosis and treatment of human diseases in nanomedicine are enormous.
- The use of bacteria is an socially appropriate method in the biosynthesis of nanoparticles.
- Nanotechnology can turn a wide spectrum of biotechnology tools more customized, portable, cheaper, safer, and easier to manage.

3. Conclusion

Nanoparticles have been relevant in many ways in recent years because of their thermodynamic properties, such as energy, health care, environment, agriculture and so many more.Nanoparticle techniques have tremendous promise and are able to make the biologically active material that is not easily soluble, poorly absorbed, and labile promising.The development of pomegranate nanoparticles is a simple, easy and clean way to supply nanobiotechnology with the most creative process. For several weeks nanoparticles synthesized via this process remained stable. Then the use of pomegranate extract to biosynthesize metal nanoparticles is a safer alternative to conventional, physical, chemical and even microbial synthesis.This enthusiastic new and easy approach for silver and gold nanoparticles biosynthesis provides a significant contribution in the field of green synthesis and nanotechnology, without introducing numerous physical and chemical steps. Fruit peel extract of Pomegranate was prepared and used effectively for the production of spherical types of silver and gold nanoparticles.The XRD analysis revealed the AgNPs and AuNPs face oriented cubic lattice. The typical AgNP and AuNP crystal size was estimated to be 5 nm and 10 nm , respectively. The drastic reduction in reaction time with fruit peel extract is an important result and will prompt methods of biosynthesis of nanoparticles to compete with other methods for the synthesis of metal nanoparticles that are much quicker at the moment and can be copyright.

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