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SYNTHESIS OF PUNICA GRANATUM PEEL EXTRACT MEDIATED SILVER NANOPARTICLES BY USING AN UV- VISIBLE SPECTROSCOPY AND ITS ANTIBACTERIAL ACTIVITY

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Abstract:

The field of nanotechnology is one of the most active research projects now a days in modern material science and technology. Eco-friendly methods of green mediated synthesis of nanoparticles are the present research in the limb of nanotechnology. The present work focused on the synthesis of nanoparticles from 1mm AgNO3 solution through aqueous extract of pomegranate peel powder. The study involves the synthesis of silver nanoparticles (AgNPs) using Punica Granatum(pomegranate) peel extract as a reducing agent. The synthesized nanoparticles Were characterized by UV-Visible spectroscopy which showed a peak indicating the formation of AgNPs. The antibacterial activity of the synthesized AgNPs was tested against the bacteria growth.

Keywords: *AgNPs - silver nano particles, $AgNO_3$ - silver nitrate, UV - Ultra Violet, PPE -pomegranate peel extract, S.Aureus - staphylococcus Aureus.*

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NANO TECHNOLOGY:

Nanoscience and nanotechnology' has great approach in research and application in pharmaceutical field. In 1974, the term "nanotechnology" was being used. Any technology which works on nanoscale and has multidisciplinary application will be considered as nanotechnology. It deals with the nano length scale size or molecular level process. Various advantages of nano sizing are rapid therapeutic activity, low dose, increased surface area, solubility and oral availability and decreased patient variance. The structure is known as quantum well, if only one length of 3-dimensionalnanostructure is in nano dimension; and if two lengths are in nano dimension then it will be quantum wire. If all three dimensions are in nano range, then it will be known as quantum dots. New applications of nanoparticles and nanomaterials are increasing rapidly. Nanotechnology is also being utilized in medicine for diagnosis, therapeutic drug delivery and the development of treatments for many diseases and disorders. "Nanotechnology is an enormously powerful technology, which holds a huge promise for the design and development of many types of novel products with its potential medical applications on early disease detection, treatment, and prevention[1].

Nanoparticles:

Building Blocks for Nanotechnology: Nanoparticles are defined as particles with size in the range of1 to 100 nm at least in one of the three dimensions. Nanoparticles exist with great chemical diversity in the form of metals, metal oxides, semiconductors, polymers, carbon materials, organics or biological. They also exhibit great morphological diversity with shapes such as spheres, cylinders, disks, platelets, hollow spheres and tubes, etc. Nanoparticles serve as the fundamental building blocks for various nanotechnology applications. Nanoparticles can be made of materials of diverse chemical nature, the most common being metals, metal oxides, silicates, non-oxide ceramics, polymers, organics, carbon and biomolecules. Nanoparticles exist in several different morphologies such as spheres, cylinders, platelets, tubes[2].

Synthesis of Silver Nanoparticles:

Material Scientists are conducting research to develop novel materials with better properties, more functionality and lower cost than the existing ones. Several physical, chemical and biological synthesis methods have been developed to enhance the performance of nanoparticles displaying improved properties with the aim to have a better control over the particle size, distribution and morphology (Granqvist et al., 1976, Shibata et al., 1998; Shankar, et al., 2003). "Synthesis of nanoparticles to have a better control over particles size, distribution, morphology, purity, quantity and quality, by employing environment friendly economical processes has always been a challenge for the researchers (Hahn, 1997). Chemical reduction is the most frequently applied method for the preparation of silver nanoparticles as stable, colloidal dispersions in water or organic solvents (Tao et al., 2006; Willy et al., 2006). Commonly used reductants are borohydride, citrate, ascorbate, and elemental hydrogen (Lee et al., 2003; Ahmadi, et al., 2003). The reduction of silver ions (Ag+) in aqueous solution generally yields colloidal silver with particle diameters of several Nano meters. When the colloidal particles are much smaller than the wavelength of visible light. The solutions have a yellow-brown colour with an intense band in the 380-400 nm range and other less intense or smaller bands at longer wavelength in the absorption spectrum (Tessier et al., 2000; Cao et al., 2002; Rosi et al., 2005). This band is attributed to collective excitation of the electron gas in the particles, with a periodic change in electron density at the surface (surface plasmon absorption) (Henglein, 1989; Ershov et al., 1993). Previous studies showed that use of a strong reductant such as borohydride, resulted in small particles that were somewhat monodisperse, but the generation of larger particles was difficult to control (Creighton et al., 1994; Schneider et al., 1979). Use of a weaker reductant such as citrate, resulted in a slower reduction rate, but the size distribution was far from narrow (Shirtcliffe et al., 1999; Emory et al., 1997). Controlled synthesis of Ag NPs is based on a twostep reduction process (Schneider et al., 1979). In this technique a strong reducing agent is used to produce small Ag particles, which are enlarged in a secondary step by further reduction with a weaker reducing agent (Lee et al., 1982). Different studies reported the enlargement of particles in the secondary step from about 20-45 nm to 120-170 nm (Schneider et al., 201994; Schirtcliffe et al., 1999; Rivas et al., 2001). Moreover, the initial sol was not reproducible and specialized equipment was needed (Nickel et al., 2000). The synthesis of nanoparticles by chemical reduction methods are therefore often performed in the presence of stabilizers in order to prevent unwanted agglomeration of the colloidal silver Nanoparticle Solution[3].

DRUG PROFILE:

Punica granatum, commonly known as pomegranate, is a fruit-bearing shrub native to the Middle East, but now widely grown throughout the world. The peel of the pomegranate fruit contains a variety of bioactive compounds, including polyphenols, flavonoids, and

tannins, which have been shown to possess antioxidant, anti-inflammatory, and antimicrobial properties. Punica granatum peel powder is a dietary supplement made from the dried and ground peels of the pomegranate fruit. It is rich in polyphenols, particularly ellagitannins such as punicalagin, which have been shown to have numerous health benefits.
Here are some of the potential health benefits associated with the consumption of Punica granatum peel powder:

- Antioxidant activity
- Anti-inflammatory effects
- Cardiovascular health
- Antimicrobial activity
- Anti-cancer properties

SILVER NANO PARTICLES:
Silver nanoparticles are tiny particles of silver that are less than 100 nano meters in size. They have unique physicochemical and biological properties that make them potentially useful for a wide range of biomedical applications, including drug delivery, diagnostics, and therapeutics.

Here is a brief drug profile for silver nanoparticles:
Drug class: Nanoparticle
Mechanism of action: Silver nanoparticles have antimicrobial properties due to their ability to release silver ions, which can damage the cell membrane and inhibit bacterial growth. They also have anti-inflammatory and wound-healing properties.
Indications: Silver nanoparticles have been studied for their potential use in various medical applications, including wound healing, drug delivery, cancer therapy, and diagnostics.

Dosage and administration: The dosage and administration of silver nanoparticles can vary depending on the specific application. In some cases, they may be administered topically, while in others, they may be administered systemically.

Contraindications and precautions: Silver nanoparticles have been shown to have low toxicity invitro and in vivo studies. However, caution should be exercised when using silver nanoparticles, as there is still limited information available on their long-term effects.

Adverse effects: Adverse effects of silver nanoparticles may include cytotoxicity, genotoxicity, and immunotoxicity. Additionally, there have been concerns about the potential for silver nanoparticles to accumulate in the environment and cause ecological harm.

Drug interactions: There is limited information available on drug interactions with silver nanoparticles.

Monitoring parameters: Patients receiving silver nanoparticles should be monitored for any signs of adverse effects or toxicity.

ETHANOL:
Ethanol, also known as ethyl alcohol or drinking alcohol, is a psychoactive substance that is widely consumed for its intoxicating effects. It is classified as a depressant drug.

Mechanism of Action:
Ethanol affects the central nervous system by enhancing the activity of the neurotransmitter gamma-aminobutyric acid (GABA), which inhibits neural activity and produces a calming effect. It also inhibits the activity of the excitatory neurotransmitter glutamate, which contributes to its depressant effects.

Routes of Administration:
Ethanol is most commonly consumed orally as an alcoholic beverage, but it can also be administered intravenously, intramuscularly, or topically.

Pharmacokinetics:
It is metabolized primarily by the liver, The remaining 10% of ethanol is excreted unchanged through the lungs, sweat, and urine.

Effects:
Common short-term effects of ethanol include:
Euphoria and relaxation
Reduced inhibitions and increased sociability
Impaired judgment, coordination, and balance
Slurred speech and blurred vision
Nausea and vomiting (especially at higher doses
Respiratory depression (at very high doses)

Long-term effects of chronic ethanol use can include:
Liver damage (including cirrhosis and fatty liver)Increased risk of certain cancers (such as liver, breast, and colon cancer)Increased risk of heart disease and stroke
Worsening of mental health conditions (such as depression and anxiety)

Withdrawal:
Common symptoms of ethanol withdrawal include:
Tremors, shaking, and sweating
Anxiety and agitation

Insomnia and sleep disturbances
Nausea and vomiting
Seizures (in severe cases)
Delirium tremens

Treatment:
Treatment for ethanol dependence may involve a combination of pharmacological and behavioural interventions, such as detoxification, counselling, and support groups. Medications such as benzodiazepines may be used to manage withdrawal symptoms, other drugs such as naltrexone and acamprosate may be used to reduce cravings and prevent relapse. In severe cases, hospitalization and medical supervision may be necessary to manage complications such as seizures or delirium tremens.

Importance of Silver nanoparticles:
1) It is used for purification and quality management of air, biosensing, imaging, drug delivery system.
2) Biologically synthesized silver nanoparticles have many applications like coatings for solar energy absorption and intercalation material for electrical batteries, as optical receptors, as catalysts in chemical reactions, for bio labelling, and as antimicrobials.
3)Though silver nanoparticles are cytotoxic but they have tremendous applications in the field of high sensitivity bimolecular detection and diagnostics, antimicrobials and therapeutics, catalysis and micro-electronics.
4) It has some potential application like diagnostic biomedical optical imaging, biological implants (like heart valves) and medical application like wound dressings, contraceptive devices, surgical instruments and bone prostheses.

5) Many major consumer goods manufacturers already are producing household items that utilize the antibacterial properties of silver nanoparticles. These products include nano silver lined refrigerators, air conditioners and washing machines.

Properties of AgNP:
shape and Size
Optical Properties
Electrical properties

Applications of Silver Nanoparticals:
Silver nanoparticles have more applications.

Human Health:
Nanoparticles have many different effects on human health relative bulk material from which they are produced. study on toxic effects of silver nanoparticles was done on zebrafish as a model due to its fast development and transparent body structure. The results show a deposition of particles on organs and severe developmental effects. The biocompatibility and toxicity of silver nanoparticles were exhibited by observing single silver nanoparticle inside embryos at each development stage. The types of abnormalities in zebra fish were strongly dependent on the dose of silver nanoparticles.

Environmental:
The environmental risk of silver nanoparticles was recently investigated by determining released silver from commercial clothing. The sock material and wash water contained silver nanoparticles of 10-500 nm diameter.

Catalytic Action:
Growing small particles of silver have been observed to be more effective catalysts than stable colloidal particles. The reduction rate catalysed by growing particles is distinctly faster compared to that of stable and larger silver particles, which are the final products of growing particles. Catalysis is due to efficient particle-mediated electron transfer from the BH4 - ion to the dye. The catalytic activity of the particles depends on their size, E1/2 of the dye, and the dye-particle interaction (Jana et al., 1999). Catalytic activity of silver nanoparticles can be controlled by its size, as redox potential depends on the nanoparticle size.

Antimicrobial:
Silver is a non-toxic, safe inorganic antibacterial agent being used for centuries and is capable of killing about 650 microorganisms that cause diseases. Bactericidal behaviour of nanoparticles is attributed to the presence of electronic effects that are brought about as a result of change in local electronic structure of the surface due to smaller sizes. These effects are considered to be contributing towards enhancement of reactivity of silver nanoparticles surface. Silver in ionic form strongly interacts with thiol groups of vital enzymes and inactivates them. It has been suggested that DNA loses its replication ability once the bacteria are treated with silver ions x. silver nanoparticles destabilize plasma membrane potential and depletion of levels of intracellular adenosine triphosphate (ATP) by targeting bacterial membrane resulting in bacterial cell death[4].

EXPERIMENTAL PROCEDURE:
STUDY AREA:
This research work is carried out at pharmaceutical organic chemistry and microbiology laboratories in Bapatla college of pharmacy

GLASS WARE:
UV-visible spectroscopy, Volumetric flask, Beaker, Conical flask, Magnetic stirrer, Glass rod, Measuring cylinder, Tripod stand, Whatman filter paper.

CHEMICALS:
Pomegranate peel powder, silver nitrate, Ethanol, Distilled water.

MATERIALS AND METHODS:

Pomegranate fruits were collected from the local market. The plant was authenticated as Punica granatum by Dr. D. RAJA KUMARI, Professor and Head, Department of Botany, Bapatla college of arts and sciences, All glass wares and the pomegranate fruits were washed properly with distilled water. The glass wares were dried in hot air oven and from the washed pomegranate fruit the peel was removed and washed again with distilled water and air dried.

Preparation of pomegranate peel extract:
Pomegranate fruits were collected from the local market. All glass wares and the pomegranate fruits were washed properly with distilled water. The glassware's were dried in hot air oven and from the washed pomegranate fruit the peel was removed and washed again with distilled water and air dried for 3 weeks and the peels were triturated by using mortar and pestle and the peel size were reduced to powder by using laboratory mixer grinder for 15 minutes at high speed and then stored in air tight container. The amount of Pomegranate peel powder was taken like 5gms,10gms, 15gms and 20gms was weighed accurately and then 50ml,100ml, 150ml &200ml of distilled water were added to the 250 ml volume containing Erlenmeyer flask and this mixture stirred continuously for 30 mins by using magnetic stirrer and then boiled for 10 minutes. Filter the precipitate with the help of Whatman filter paper (NO.1), and this ppt was used as synthesis of metal nanoparticles.

Preparation of silver nanoparticles by using PP extract:
0.169gms of silver nitrate was taken in to a 250 ml volumetric flask and 100ml of distilled water was added and this mixture was kept in a side for 24 hours. After wards1mM aqueous solution of silver nitrate was prepared for 100 ml. To this 5 ml, 10ml,15ml &20ml of PPE filtrate was added and kept for 24 hours incubation with intermittent shaking. After 24 hours the brown colour development indicated the formation of silver nanoparticles. The bio reduction of Ag+ ion in aqueous solution was monitored with the help of UV-visible spectroscopic analysis. UV Visible spectroscopic analysis of silver nanoparticles was carried out as a function of time needed for bio reduction at room temperature on UV-1800 series Shimadzu spectrophotometer at a resolution of 1nm[5].

Preparation of culture media:
Nutrient Agar media agar is nutrient broth solidified by the addition of 1 to 2 percent agar Composition of nutrient agar
Beef extract -10g
Peptone -10g
Sodium chloride -5.0g
Distilled water to make - Nutrient 1000ml
Agar -20g

Agar:
Agar is a complex polysaccharide(carbohydrate) consisting of 3,6-anhydro-L-galactose and D-galacto pyranose, produced from various red algae belonging to Gelidium, Gracilaria, Gigartina and Pterocladia. It melts at 95 to 100°C and solidifies at 40 to 45°C. It does not provide any nutrition to the microorganisms and it acts only as solidifying agent.? It is not metabolised by any pathogenic bacteria. Agar can be replaced with gelatin (10%w/v) which is replaced by hydrolysis of collagen with boiling water. It is in liquid form at 37°C. It forms transparent gel below25°C or with proteolytic microbes.

Procedure:
Each ingredient except agar is dissolved in appropriate volume of distilled water. The pH of the fluid medium is determined with a pH meter and adjusted by using IN HCI. Add agar powder (1.5%) and medium is heated to dissolve the agar to form a clear liquid. The medium is dispensed into tube (slants, stabs, deep) or flasks. Plug the flasks and lest tubes containing medium by using non-absorbent cotton. Sterilise the media at 121°C,15 bs pressure for 15 minutes in an autoclave. 24 Allow the tubes to cool in a slanting position by resting the plugged end over the glass rod on the table (for agar slants). The tubes are kept in same position until the medium has cooled to room temperature and solidified to look opaque. Allow the flasks to cool up to 50°C and pour the medium quickly into sterile petri plates under aseptic conditions. Allow the medium to cool and to produce solid agar plates

NOTE:
1) Cotton plugs of flasks and test tubes should keep close while autoclaving.
2) Do not prepare medium in excess of2/3 of the capacity of the container or flasks used for autoclaving.

3) Do not pour the media to the petri plates which are hot since it produces much condensed water on the lid and that may lead to contamination.
4) Pour the media quickly to avoid contamination and close the lid as soon as possible when the medium is solidified.
5) Sterilised medium can be stored at room temperature in dust free environment if it is used within 2 to 3 days or in a refrigerator if it is stored for a long time.

subculturing of microorganisms (E. coli, Staphylococcus aureus):
E. coli- Escherichia coli is a rod shape gram negative bacterium normally a resident in humans and other mammalian colons. It can grow rapidly on minimal medium that contains a carbon compound such as glucose (which serves both as carbon source and an energy source) and salts that supply nitrogen, Phosphorous and trace metals.

Staphylococcus aureus - Staphylococcus aureus is a gram-positive bacterium that is commonly found on the skin and in the nasal passages of humans. S. aureus is known for its ability to develop antibiotic resistance, which can make it difficult to treat infections caused by this bacterium. Microbial growth is defined as increase in number and/or biomass. All microorganisms require food, oxygen, moisture and space for growth. Like any other living organisms, they age and their growth is inhibited in the absence of food, space, oxygen etc. In order to sustain any microbial culture in laboratory conditions, subculturing is required.

Subculturing:
It is a procedure of transferring of microorganism into fresh nutritive medium from its stock culture. It includes transfer of culture from slant to slant, slant to plate, plate to plate, plate to slant, solid medium to broth and broth to solid media.

Reference culture:
A reference culture is a microorganism preparation that is acquired from a culture type collection.

Reference stock culture:
A reference stock culture is a microorganism preparation that is derived from a reference culture. Guidelines and standards outline how reference stock cultures must be processed and stored.

Working stock culture:
A working stock culture is growth derived from a reference stock culture. Guidelines and standards outline how working stock cultures must be processed and how often they can be sub cultured**.**

Value of subculture:
subculturing allows an analyst to move microbes from one set of test parameters, such as temperature and media type, to another. This information is useful in microbial identification, as some species will grow and some will not, depending on the parameters chosen. He can also keep cultures alive by subculturing them onto a new growth medium before the microbes use up all the nutrients in their growth medium and die.

Procedure:
1) Sterilise the inoculating loop in the Bunsen burner by putting the loop into the flame until it is red hot. Allow it to cool.
2) Pick an isolated colony from the agar plate culture and spread it over the first quadrant using close parallel streaks or insert your loop into the tube/culture bottle and remove some inoculum.
3)Immediately streak the inoculating loop very gently over a quarter of the plate using a back and froth motion. 4) Flame the loop again and allow it to cool. Going back to the edge of the area I that you just streaked, extend the streaks into the second quarter of the plate.
5) Flame the loop again and allow it to cool. Going back to the edge of the area 2 that you just streaked, extend the streaks into the third quarter of the plate.
6) Flame the loop again and allow it to cool. Going back to the edge of the area 3 that you just streaked, extend the streaks into the centre fourth quarter of the plate.
7) Flame your loop once more.
Tips for the better results:
1) Use only a small amount of inoculum.
2) Streak lightly so that you do not gouge the agar.
3)Flame the loop after you streak each quadrant.
4)Make sure the surface of the plate is free of droplets of condensed moisture.
Procedure:
1) Take 6 petri plates which are washed thoroughly and sterilized by placing them in hot air oven for about 15 minutes.
2) Mark those 6 petri plates with their respective labels as 3)
a) Test (The agar media petri plates which are filled with silver nano particles solution of neem and amla).
b) Standard (The agar media petri plates which is placed with an Ampicillin disc).
C) Control The agar media petri plates which are filled with aqueous plant extract solution of neem and amla).
4) The petri dishes are filled with prepared agar media and allow it to solidify. Agar well diffusion method.

This method is widely used to evaluate the antimicrobial activity of plants or microbial extracts.
5)The agar plate surface (for 6 petri dishes) is inoculated by spreading a volume of the microbial inoculum over the entire agar surface.
6) The Ampicillin disc (about 6mm in diameter) is placed on agar surface of petri dish which is labelled as standard.
7) Then, a hole with a diameter of 6 to 8 mm is punched aseptically with a sterile cork borer or a tip and a volume (20-100 L) of the aqueous plant extract solution and silver nano particle solution into the respective petri dish.
8) All the above process is done under the UV laminar air flow cabinet to avoid.
9) Now place all the petri dishes in incubator for 24 hours.
10)
After 24 hours the petri dishes are analysed for antimicrobial and antioxidant activity[14-18].

ANTI-BACTERIAL ACTIVITY:
Determination of zone of inhibition against Test micro organisms(E.coli, Stapyhlococcus aureus)

Zone of inhibition:
This is an area of media where bacteria are unable to grow, due to presence of a drug that impedes their growth.

Procedure for the measurement of zone of inhibition:
To measure the zone of inhibition, first place the plate on a non- reflective surface. Take a ruler or Calliper that measures in Milli meters and place the (0) in the centre. Measure from the centre to the edge of area with zero growth. Take your measurement in milli meters. The silver nanoparticles synthesized using Pomegranate Peel extract was tested for antimicrobial activity by disc diffusion method against Staphylococcus aureus and Escherichia coli media (Mullar-Hinton agar) was poured into sterilized Petri dishes. The plates were left overnight at room temperature to check for any contamination to appear. The bacterial test organisms were grown in nutrient broth. 0.1ml from 10-8 dilution of different pathogenic bacteria suspension was spread on Muller-Hinton agar plates. Filter discs (5mm in diameter) were impregnated with synthesized silver particles and placed on the plates. Streptomycin served as the standard for measuring the antibacterial activity. The plates were then incubated at 37◦C for 24 hrs and the zone of inhibition was measured in nm[6-13].

RESULTS AND DISCUSSION:
Various methods have been employed for the synthesis of silver nanoparticles such as chemical and biological methods. Currently, syntheses of silver nanoparticles using plant materials are getting more popular. In this study, when we are adding the pomegranate fruit peel extract to the aqueous solution of the silver nitrate the colour of the reaction medium changed rapidly from colourless to brown. Similar results were shown by early workers. The brown colour indicated the formation of silver nanoparticles with the reduction of silver ion, whereas the control AgNO3 solution did not show any colour change. The UV-Visible spectrum of silver nanoparticles synthesized with the help of pomegranate fruit peel extracts as a concentrations range like 5,10,15 &20μg act reducing agent. While no absorbance peak was observed in control, a characteristics surface plasmon absorption were observed at 250nm - 300 nm after 24hrs incubation. In the study the AgNPs synthesized using pomegranate fruit peel extract as a reducing agent has exhibited a fairly significant antibacterial activity against S.aureus and E. coli. Streptomycin was used as the positive control. Maximum zone of inhibition 26mm was observed against S.aureus by 10 μg /ml concentration of silver nanoparticles found that the major mechanism through which silver nanoparticles manifest antibacterial properties was either by anchoring or penetrating the bacterial cell wall and modulating cellular signaling by dephosphorylating peptide substrate on tyrosine residues.

Figure 1: PPE Silver nanoparticles UV-Visible absorbance at 5µg/ml concentration

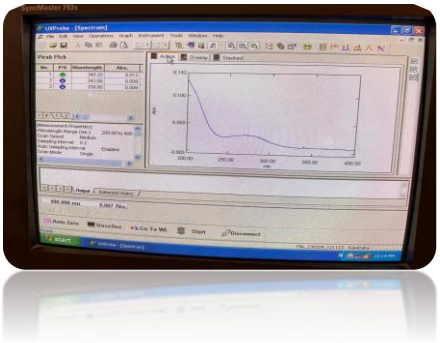

Figure 2: PPE Silver nanoparticles UV-Visible absorbance at 10 µg/ml concentration

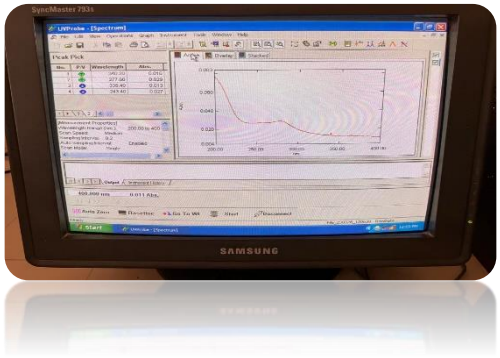

Figure 3: PPE Silver nanoparticles UV-Visible absorbance at 15 µg/ml concentration

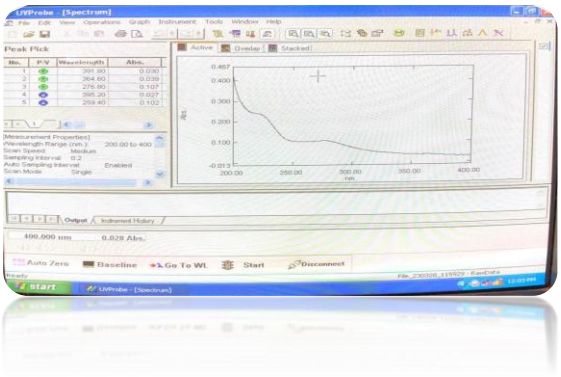

Figure 4: PPE Silver nanoparticles UV-Visible absorbance at 20 µg/ml concentration

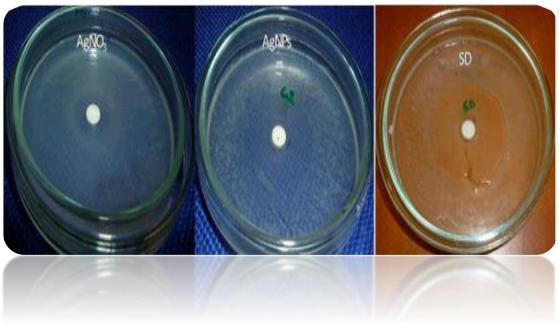

Figure 5: PPE Silver nanoparticle Anti-microbial activity at 5 µg/ml

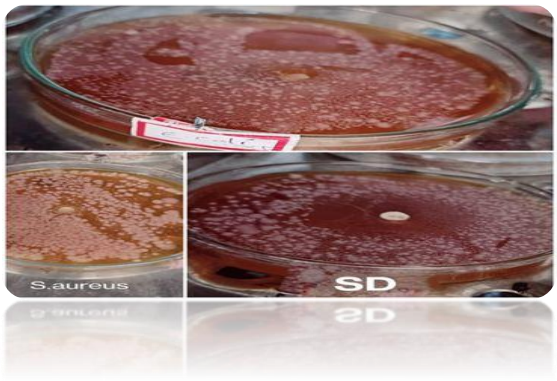

Figure 6: PPE Silver nanoparticle Antimicrobial activity at 10 µg/ml

TABLE -1: Antibacterial activity of synthesized silver nano particles

Name of the organism	1MmAgN03 100 µL	5mg/ml SNPs 100µL	10mg/ml SNPs 100µL	Streptomycin 5mg/ml 100µL
Staphylococcus aureus	20	26	06	25
Escherichia coli	09	08	11	28

SUMMARY AND CONCLUSION:

♣ In this experiment, pomegranate peel extract was used as reducing and capping agent.

♣ This method of AgNPs synthesis has many advantages like, low cost, economic viability, ecofriendly etc. Analytical techniques such as UV-visible spectroscopy.

♣ The silver nanoparticles synthesized using pomegranate fruit peel extract showed maximum antibacterial activity against Staphylococcus aureus. In conclusion the silver nitrate extraction method was successfully used to synthesize Ag NPs from PPP.
♣ Therefore, PPP can be considered a promising natural source of Ag- NPs and a potential candidate for use in the pharmaceutical and cosmetic industries.
♣ The PPP has significant antibacterial activity against pathogenic bacteria and could be used as a natural alternative to synthetic antibiotics in the treatment of bacterial infection.
♣ Further studies are needed to determine the mechanism of action of PPP and to assess its potential for use in clinical settings.

REFERENCES:

1. Albrecht MA, Evan, CW, Raston CL,2006. Green chemistry and the health implications of nanoparticles. Green Chem 2008; 8: 417-432.
2. Taniguchi N, On the Basic Concept of Nano-Technology. Proc. Intl. Conf. Prod. Eng. Tokyo, Part II. Japan society of Precision Engineering, 1974.
3. Sivakumar J, Premkumar C, Santhanam P, Saraswathi N, 2011. Preparation of Silver Nanoparticles Using Calotropis gigantean Leaf. African Journal of Basic & Applied Sciences 2011; 3(6): 265-27.
4. Bae E, Park HJ, Lee J, Kim Y, Yoon J, Park K. Bacterial Cytotoxicity of the Silver nanoparticles related to physicochemical metrics and agglomeration properties. Envion Toxicol Chem 2010; 29(10): 2154-2160.
5. Gurunathan S, Kalishwaralal K, Vaidyanathan R, Venkataraman D, Pandian S R, Muniyandi J. Biosynthesis, purification and Characterization of silver nanoparticles using Escherichia coli. Colloids Surf B Bio interfaces 2009; 74(1): 328-335.
6. Pal S, Tak YK, Song J M. Doses the Antibacterial activity of silver nanoparticles depend on the shape of the nanoparticles? A study of the gram-negative bacterium Escherichia coli. Appl Environ Microbial 2007; 73: 1712-1720.
7. Gong P, Li H, He X, Wang K, Hu J and Tan W. Preparation and antibacterial activity of Fe3O4 & Ag nanoparticles. Nanotechnol 2007; 18: 604-11.
8. Nidhi N, Santosh K, Ghosh T, Dutta PK. Preparation of Chitosan based silver nano composites by a facile method, International Conference on Optics and Photonics. Chandigarh: CSIO; 2009.
9. Navaladian S, Viswanathan B,Viswanath RP, Varadarajan TK. Thermal decomposition as route for silver nanoparticles. Nanoscale Res Lett 2007; 2: 44-48.
10. Starowicz M, Stypula B, Banas J. Electrochemical synthesis of silver nanoparticles. Electrochem Commun 2006; 8(2): 227-230.
11. Easu SR, Roberto SB, Ocotlan-Flores J, Saniger JM. Synthesis of AgNPs by sono chemical induced reduction application in SERS. J Nanopart Res 2010; 9:77.
12. Sreeram KJ, Nidin M, Nair BU. Microwave assisted template synthesis of silver nanoparticles. Bull Mater Sci 2008; 31 (7), 937-942.
13. Begum NA, Mondal S, Basu S, Laskar RA, Mandal D. Biogenic synthesis of Au and Ag nanoparticles using aqueous solution of black tea leaf extracts Colloids Surf B Bio interfaces. 7(1):113-118
14. Li, S. Shen, Y, Xie, A, Yu.X, Qiu, L,Zhang, L, Zhang, Q. Green synthesis of silver nanoparticles using Capsicum annuum L. extract, Green Chem. 2007;9: 852-858.
15. Song, Y.M. and Kim B.S. Rapid biological synthesis of silver nanoparticles using plant leaf extracts, Bioprocess. Biosyst. Eng 2009; 32: 79-84.
16. Krishnaraj C, Jagan EG, Rajasekar S,Selvakumar P, Kalaichelvan PT and Mihan N. Synthesis of silver nanoparticles using Acalyphaindicaleaf extracts and its antibacterial activity against water borne pathogens. Colloids and Surfaces B: Biointerfaces 2010; 76:50-56.
17. Karunakar RaoKudle, Manisha R Donda, Jahnavi Alwala, Rama Koyyati, Veerababu Nagati, Ramchander Merugu, Prashanthi Y, Pratap Rudra MP. Biofabrication of silver nanoparticles using Cuminumcyminum through microwave irradiation. International Journal of Nanomaterials and Biostructures 2012; 2(4): 65-69.
18. Ponaruselvam S, Panneerselvam C,Murugan K, Aarthi N, Kalimuthu K,Thangamani S. Synthesis of silvernanoparticles using leaves of Catharanthusroseus Linn. G Don and their antiplasmodial activities. Asian Pacific Journal of Tropical Biomedicine 2012; 574-580.
19. Panneerselvam C, Ponaruselvam S,Murugan K. Potential anti plasmodial activity of synthesized silver nanoparticles using Andrographis paniculata Nees (Acanthaceae). Archieve of Application Science Research 2011;3(6): 208-217.