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GREEN SYNTHESIS OF SILVER NANOPARTICLES FROM POMEGRANATE (*Punica granatum*) LEAF, FLOWER AND FRUIT EXTRACT

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ABSTRACT

Nanoparticles are one of the drug delivery tools. They can be used either as drug carriers or as the treatment itself. Using this delivery technique, nanoparticles will minimize the side effects of painful chemical therapy as in cancer cases. Several methods have been used to form nanoparticles. One of the simplest ways to form nanoparticles is the chemical reduction reaction in aqueous conditions. It is a chemical reaction that occurs between two components. One of them is the nanoparticles precursor, while the other acts as reducing agent. Several researchers change the chemical reagent with natural products that are enriched with reducing agents compounds such as strawberry, cranberry and others. Using this method, which known as green synthesis of nanoparticle, will produce nanoparticles with less toxicity. The reduction of pure Ag++ ion monitored by the absorption maxima was scanned by UV-Spectral photometer at the wave length of 200- 800nm. The sharp bands of silver nanoparticles were observed around 350 and 400 nm in leaf, 450 and 490 nm in flower and fruit. The antibacterial assays against Gram positive (*Staphylococcus aureus*) and Gram negative strains (*Pseudomonas*) and two pathogenic fungi namely *Candida albicans* and *Aspergillus* were also performed by standard disc diffusion method.

KEYWORD: silver nanoparticle, pomegranate leaf, flower and its fruit extract, silver nitrate biosynthesis.

1. INTRODUCTION

In recent years, Nanotechnology has attracted many researchers from various fields like biotechnology, physics, chemistry, material sciences, engineering, and medicine. Nanoparticles are synthesized by physical and chemical Methods; these are suffering from drawbacks like expensive reagent, hazardous reaction condition, longer time, tedious process to isolate nanoparticles. Hence, there is scope to develop new methods for the synthesis of nanoparticles which should be required inexpensive reagent, less drastic reaction condition and eco-friendly. They use these natural products as reducing agents in order to form nanoparticles. This new method, which is known as green synthesis of nanoparticles, reduces the use of toxic chemicals that can harm the environment treatment or reducing agent to produce metal nanoparticles, there is no evidence that proves any attempts to use natural products as substrates to produce nanoparticles.

The word "pomegranate" (*Punica granatum L.*) comes from the Latin for "fruit of many seeds." Pomegranate belongs to the Punicacea family.[1,2,3] Health benefits of pomegranate, the fruit is suggested by nutritionists in the diet for weight reduction and cholesterol controlling programs. Regular inclusion of fruits in the diets boosts immunity, improves circulation, and offers protection from cancers.[4] The fruit and seed are used in modern herbal medicine. And also helps overcome depression, Protect against heart ailments, provides relief from stomach disorder, Reduces risk of developing cancer, provides youthful and glowing skins, helps reduce symptoms of anemia.[5] Pomegranate leaf has a wide range of potential health benefits. It has been shown to aid in digestion and to help treat certain infections and illnesses. More recently, it has been studied as an appetite suppressant and weight loss aid. One potential benefit of using pomegranate leaf is that is helps aid indigestion.[6] This present work aims to design nanoparticles using the completely green synthesis style. It uses pomegranate fruit juice as a source of the particles and the pomegranate peels and flower as a reducing agent. Nanoparticles can be synthesized using various approaches including chemical, physical, and biological. Plants provide a better platform for nanoparticles synthesis as they are free from toxic chemicals as well as provide natural capping agents. Moreover, use of plant extracts also reduces the cost of microorganisms isolation and culture media enhancing the cost competitive feasibility over nanoparticles synthesis by microorganisms.[7]

2. MATERIALS AND METHODS

Description of the Experimental Plant

Kingdom	:	*Plantae*
Phylum	:	*Angiosperms*
Order	:	*Myrtales*
Family	:	*Punicaceae (Lythraceae)*
Genus	:	*Punica*
Species	:	*P.granatum*

Pomegranate is a fruit –bearing deciduous shrub or small tree growing between 5 and 8 m (16 and 26 ft) tall.

2.1 PREPARATION OF POMEGRANATE LEAF, FLOWER AND FRUIT EXTRACTS

All the chemical reagents used in this experiment were of analytical grade purchased from modern scientific chemicals. The pomegranate leaf (FIG 1), flower (FIG 2), Fruit (FIG3) were collected. Thoroughly washed pomegranate leaf, flower, Fruit (25 g each) were cut and grained with 100 ml of de- ionized water for fresh extract. The resulting product was filtered and stored in refrigerator for further experiments.

FIG 1

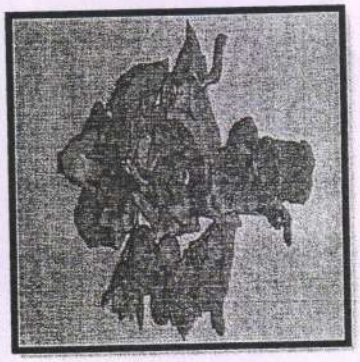


FIG 2

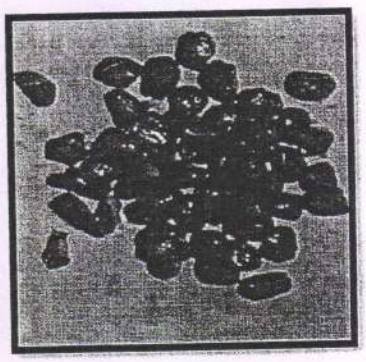


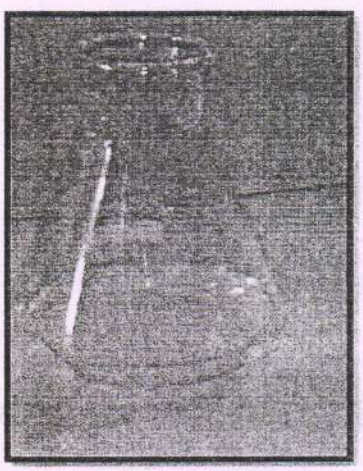
FIG 3

2.2 SYNTHESIS OF SILVER NANOPARTICLES (SNPS)

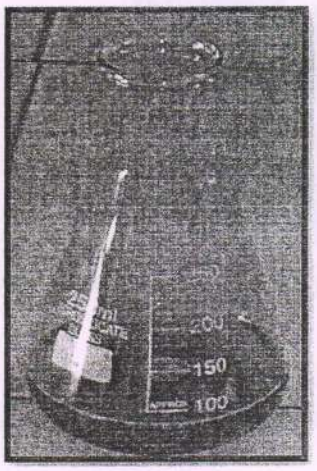
Synthesis of silver Nanoparticles Using pomegranate juice and its leaf, flower extracts For the silver nanoparticles synthesis, 10 ml of pomegranate leaf and its flower extract was added separately to 90 ml of 1mM aqueous $AgNo_3$ solution in a 250 ml Erlenmeyer flask. The flask

was then kept overnight at room temperature for 1day. The silver nanoparticles solution thus obtained.

2.2.1 POMEGRANATE LEAF EXTRACT USING SILVER NANOPARTICLE PREPARATION



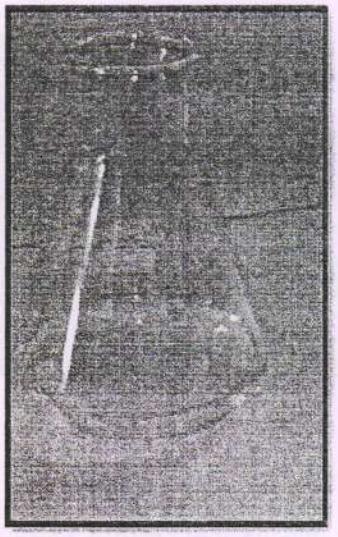
Silver nitrate 1Mm of 90 ml water



Pomegranate leaf extract

$AgNo_3$ 90 ml+10 ml leaf extract

2.2.2 POMEGRANATE FLOWER EXTRACT USING SILVER NANOPARTICLE PREPARATION

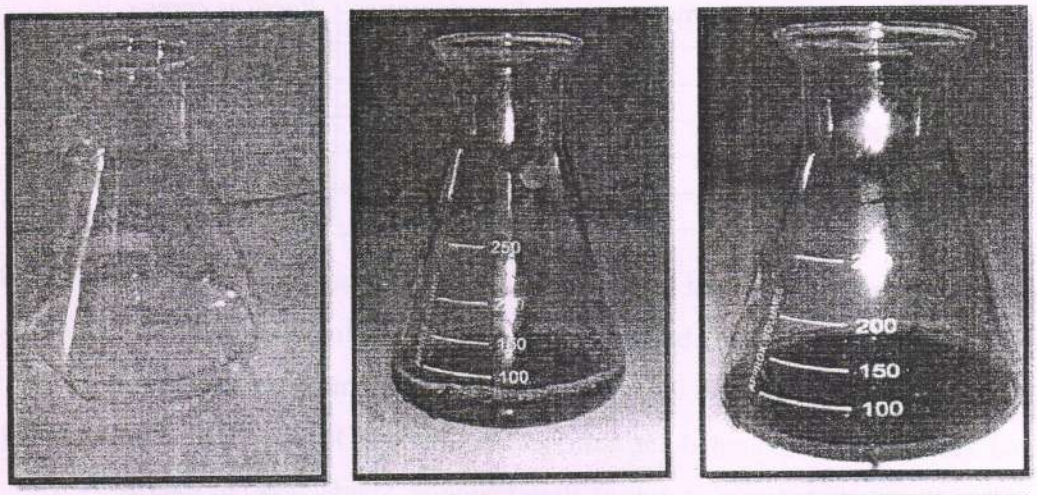


Silver nitrate 1Mm of 90 ml water

Pomegranate Flower extract

$AgNo_3$ 90 ml+10 ml flower extract

2.2.3 POMEGRANATE FRUIT EXTRACT USING SILVER NANOPARTICLE PREPARATION

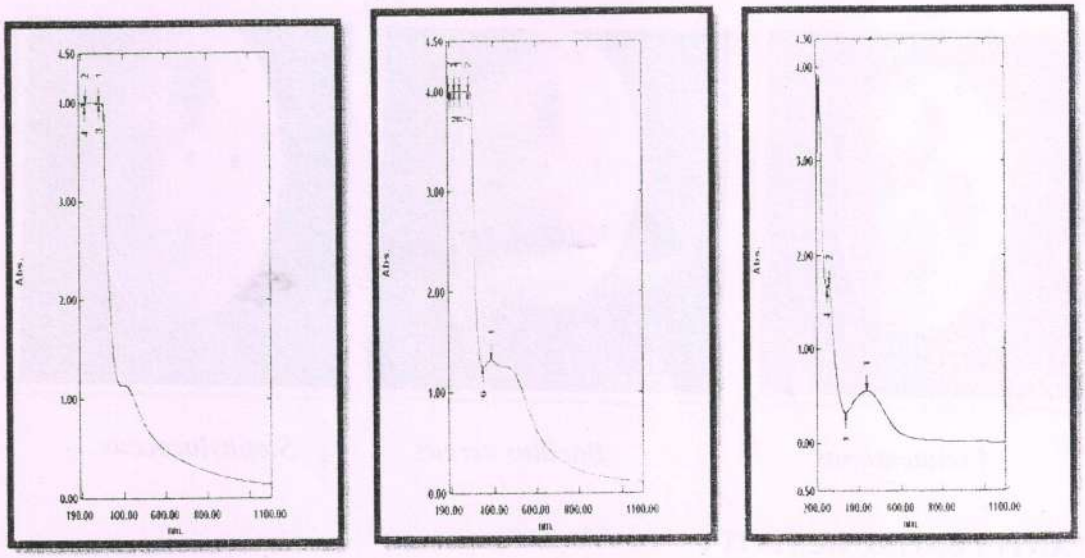


Silver nitrate 1Mm of 90 ml water | Pomegranate Fruit extract | $AgNo_3$ 90 ml+10 ml fruit extract

3. RESULTS AND DISCUSSIONS

3.1 UV–VIS SPECTRA ANALYSIS

It is well known that SNPs exhibit yellowish brown color the UV spectroscopy was the prillimery technique for the characterization of the silver nanoparticle the UV absorption analyzed after centrifuging and re-dispersing the particle in de ionized water the maximum smooth and broad absorption peak was absorbed at 300 to 600 nm.

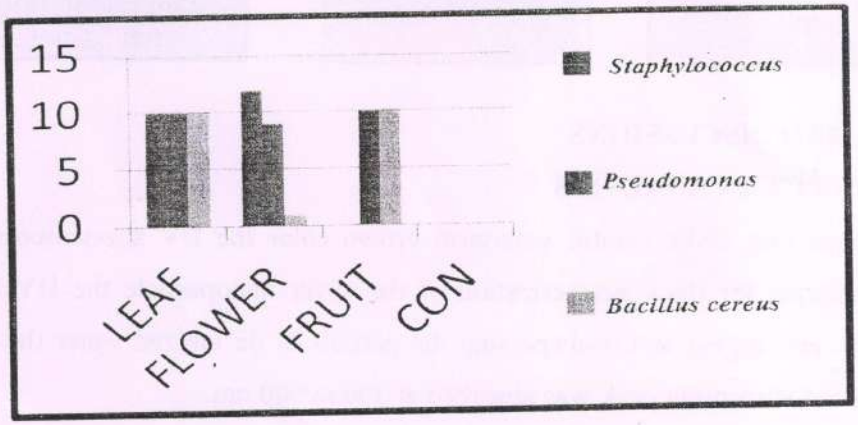


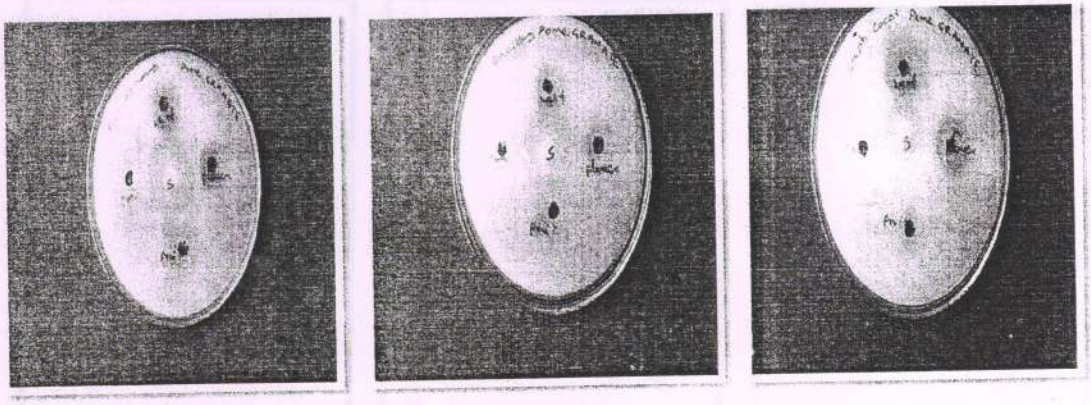
LEAF FLOWER FRUIT

4. ANTI-BACTERIAL ACTIVITY

Sample (pomegranate)	*Staphylococcus*	*Pseudomonas*	*Bacillus cereus*
Leaf	10	10	10
Flower	12	9	1
Fruit	R	10	10
Control	R	R	R
Standard	18	19	18

The disc diffusion method was used to screen the antibacterial activity. Antibacterial activity of biogenic AgNPs was evaluated by using standard Zone of Inhibition (ZOI) microbiology assay. The nanoparticles showed inhibition zone against almost all the studied bacteria. Compound Seed exhibited potential antibacterial Maximum ZOI was found *Bacillus Cereus*. Whereas, the other three bacterial strains of *Pseudomonas*, *Staphylococcus auerus*.





Pseudomonas *Bacillus cereus* *Staphylococcus*

5.0 ANTI-FUNGAL ACTIVITY

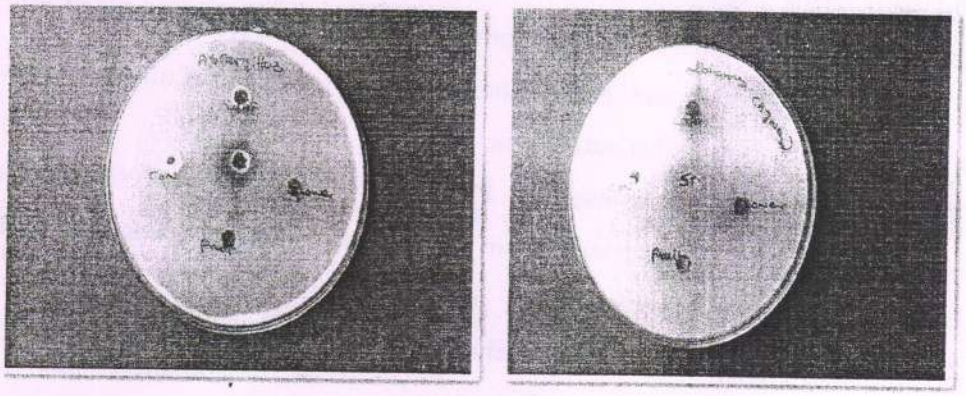
Test Fungal assay the activity of pomegranate leaf, flower and its fruit extract on various fungal strains was assayed by agar plug methods.

Test microorganism the two fungal strains were used in the present study,

1. Candida albicans,

2. Aspergillus

Antifungal activity Agar plates were prepared, sterilized and solidified, after solidification fungal cultures were swabbed on these plates. The sterile discs were dipped in silver nanoparticles solution (10mg/ml) and placed in the agar plate and kept for incubation for 24 hrs. After 24 hrs days zone of inhibition was measured. The Anti-fungal activity of biogenic Silver nanoparticles was evaluated by using standard Zone of Inhibition (ZOI) microbiology assay. The nanoparticles showed inhibition zone against two fungi that is



Aspergillus *Candida albicans*

6.0 CONCLUSION

In the present work we found that pomegranate leaf, flower and its fruit can also a good source for synthesis of silver nanoparticles and also environmental friendly process etc. In this work I got high result in flower this because of presence of xanthophyll and it has the capacity to convert into fruit also. It cures stomach upsets, menopausal hot flashes, osteoarthritis, reduces the risk of heart disease and lowers cholesterol and suggest that it can be used to formulate new ecofriendly formulation of antimicrobial agents for the treatment of microbial infections in human beings for avoiding side effects caused by synthetic and semi synthetic chemical formulations.

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