

**SYNTHESIS OF SILVER NANOPARTICLE FROM *PSIDIUM GUAJAVA* LEAF
EXTRACT AND THEIR ANTIBACTERIAL ACTIVITY**

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ABSTRACT

The emergences of new diversity of pathogens and their adverse effects have led to the development of new modified drugs. The advancement in science and the knowledge about the various pharmacological properties of herbal plants have brought up with a new idea of using nano-suspension synthesized from plants for medical purposes. In the present study, silver nanoparticle is synthesized using ethanolic extract of *Psidium guajava* leaves. And the synthesized silver nanoparticle was subjected to antibacterial assay which showed maximum zone of inhibition for gram negative than gram positive species.

KEYWORDS: *Psidium guajava* leaves.

INTRODUCTION

Medicinal plant is any plant which could be used in therapeutic purpose and also used in the development of drugs. There are ample evidence which proves that plants produce alkaloids, cyanogenic glycosides, glucosinolates, flavonoids, saponins, steroids and terpenoids as their secondary metabolite to protect themselves from the attack of pathogens, insect pests and various other stresses (Kumar *et al.*, 2009). Advancement in scientific knowledge and technology has paved ways to use nano-suspension of these medicinal plant against various human pathogens.

Guava is an important food crop with medicinal value because they have immense pharmacological properties. Each parts of this plant exhibit medicinal property including antibacterial action against intestinal pathogens. Even though the medicinal properties of this plant has numerous effect against pathogens, the adverse effect and diversity of new pathogens leads to development of a new modified and biologically improved drug to treat that particular kind of new species. As per the need the present research has aimed to synthesis of silver nanoparticles from *Psidium guajava* and their antimicrobial against both gram positive and gram negative bacteria was also studied.

MATERIALS AND METHODS

Preparation of *Psidium Guajava* Leaf Extract: 10 grams of the powdered guava leaf sample was boiled in 100 ml of ethanol for about 10 minutes. This solution was filtered using Whatmann No. 1 filter paper into a

screw cap bottle and stored for further study (Jain *et al.*, 2009).

Synthesis of Silver Nanoparticles: For the confirmation of nanoparticle synthesis 5 ml of ethanolic *Psidium guajava* leaf extract was taken in conical flask separately and to this 45 ml of prepared 1 millimolar silver nitrate solution was added drop wise with constant swirling and observed for the color change. (Ibrahim, 2015).

Then the nanoparticle was centrifuged out from the solution by centrifugation at 5000 rpm for 10 minutes. The pellet formed is washed with distilled water and again centrifuged at 5000 rpm for 5 minutes. The pellets were dried using the hot air oven at 45°C and further this dried powdered pellet was used for investigating antimicrobial activity.

Antibacterial Activity: The antibacterial activity of the synthesized nanoparticle was investigated using agar well diffusion method against four test organisms namely, *Klebsiella pneumonia* (MTCC Strain no. 109), *Pseudomonas putida* (MTCC Strain no.672) , *Bacillus subtilis* (MTCC Strain no. 1427) , *Staphylococcus aureus* (MTCC Strain no. 96) which were spread throughout the Muller Hinton Agar medium on the petri plates by cotton swab. A corn borer was used to make 5 wells on each plate which was introduced with 100 µl each of Ethanol, guava leaf ethanolic extract, Silver Nitrate, Synthesized silver nanoparticle and Antibiotic amoxicillin in separate wells. Control plates were also maintained. The plates were incubated for 24 hours at 37°C and the zone of

clearance around each well was observed and measured. Both Gram-positive and Gram-negative bacteria were used in this study.

Human pathogen used for antibacterial assay

S. No	Organism	Type
1.	<i>Klebsiella pneumonia</i> (MTCC Strain no. 109)	Gram negative
2.	<i>Pseudomonas putida</i> (MTCC Strain no.672)	Gram negative
3.	<i>Bacillus subtilis</i> (MTCC Strain no. 1427)	Gram positive
4.	<i>Staphylococcus aureus</i> (MTCC Strain no. 96)	Gram positive

RESULTS

Visual Confirmation: The synthesis of silver nanoparticle was monitored by colour change from green to yellowish brown in 5 minutes and further to dark brown after 45 minutes. The colour change was found to be rapid and intensity of colour was indicative of formation of Silver nanoparticle. (Figure: 1.).



(a) 1mM Silver nitrate, (b) Plant extract, (c) Silver nanoparticle.

Figure 1. Visual confirmation of silver nanoparticle synthesis.

Antibacterial Studies: Antibacterial activity of the synthesized silver nanoparticle against two gram positive (*Bacillus subtilis* and *Staphylococcus aureus*) and two gram negative (*Pseudomonas putida* and *Klebsiella pneumonia*) microorganism were performed and the observations are tabulated in the Table: 1.

Table 1. Zone of Inhibition of the silver nanoparticle against the both Gram Positive and Gram Negative organisms.

S. No	Test Organism	Positive control	Negative control	Plant extract	Silver nanoparticle solution	Silver nitrate solution
1.	<i>Bacillus subtilis</i>	23mm	8mm	15mm	6mm	8mm
2.	<i>Staphylococcus aureus</i>	NA	NA	12mm	5mm	7mm
3.	<i>Pseudomonas putida</i>	NA	NA	7mm	8mm	6mm
4.	<i>Klebsiella pneumonia</i>	25mm	NA	10mm	9mm	8mm



Figure: 2. Antibacterial plates for two Gram positive Bacteria (a) *Bacillus subtilis* (b) *Staphylococcus aureus*.

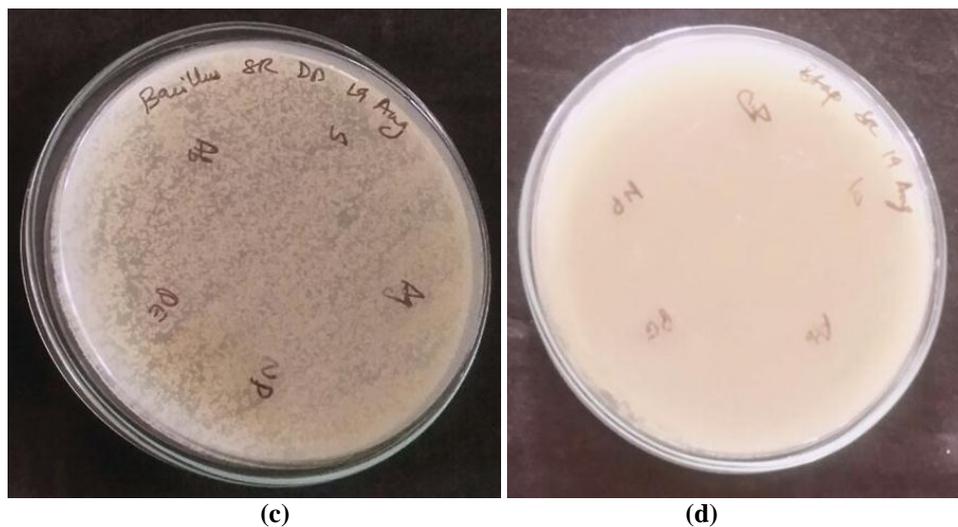


Figure 3. Control plates for (c) *Bacillus subtilis* (d) *Staphylococcus aureus*.

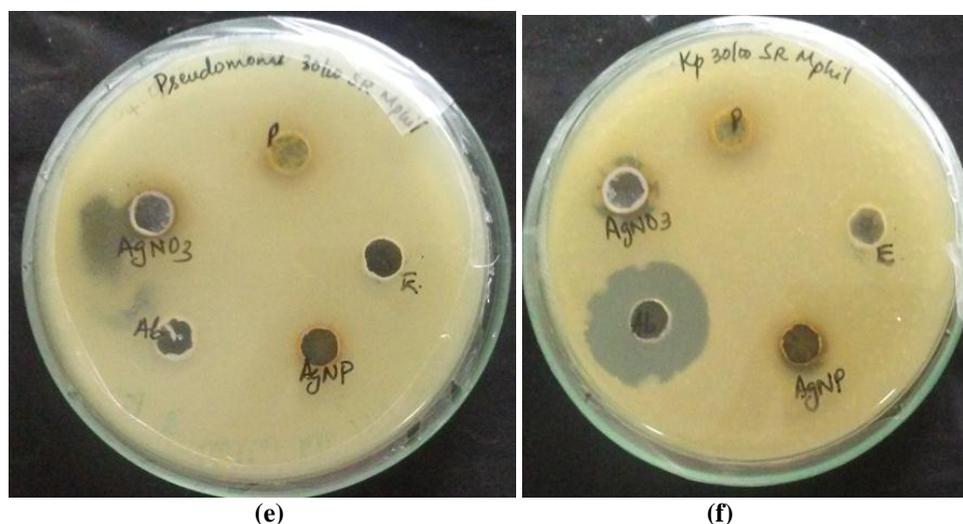


Figure 4. Antibacterial plates for two Gram positive Bacteria (e) *Pseudomonas putida* (f) *Klebsiella pneumoniae*.

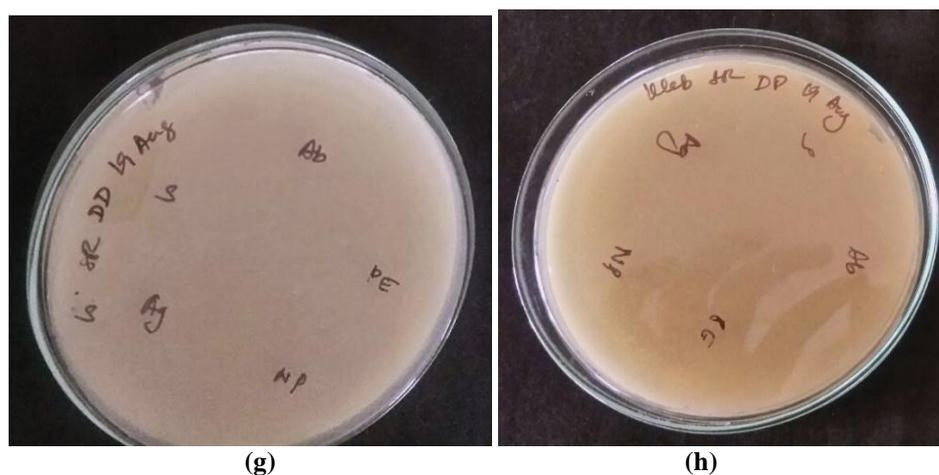


Figure 5. Control plates for (g) *Pseudomonas putida* (h) *Klebsiella pneumoniae*.

DISCUSSION AND CONCLUSION

The formation of silver nanoparticle was confirmed by the change in the colour of the solution from green to yellowish brown to dark brown within 45 minutes. This

colour change is due to the excitation of surface plasmon vibration of silver nanoparticle (Veerasingam *et al.*, 2011).

The synthesized silver nanoparticles showed significant antibacterial activity against both gram positive and gram

negative bacteria. The zone of inhibition of *Psidium guajava* ethanolic extract and silver nanoparticles along with control plates are depicted in the Figure: 2, 3, 4 and 5 and Table: 1, respectively. The maximum antibacterial zone of inhibition was recorded in *Klebsiella pneumonia* followed by *Pseudomonas putida*, *Bacillus subtilis* and *Staphylococcus aureus*. In the present study the synthesized silver nanoparticle from *Psidium guajava* leaf extract showed significant zone of inhibition against gram negative bacteria. This may be due to reason that negatively charged silver nanoparticles has the ability to bind gram negative bacterial cell wall (Sinha *et al.*, 2015).

REFERENCE

1. Ibrahim, H.M.M. Green synthesis and characterization of silver nanoparticles using banana peel extract and then antimicrobial activity against representative microorganisms. *Journal of Radiation Research and applied science*, 2015; 8(2015): 265-275.
2. Kumar, A., Ilavarasan, R., Jayachandran, T., Decaraman, M., Aravindhana, P., Padmanaban, N and Krishna V. Phytochemical investigation on tropical plants. *Pakistan Journal of Nutrition*, 2009; 8: 83-85.
3. Sinha, N.S., Paul, D., Halder, N., Sengupta, D., and Patra, S.K. Green synthesis of silver nanoparticles using fresh water green alga *Pithophora oedogonia* (Mont.) Wittrock and evaluation of their antibacterial activity. *Applied Nanoscience*, 2015; 5(6): 703-709.
4. Veerasamy, R., Xin, T.Z., Gunasegaran, S., Xiang, T.F.W., Yang, E.F.C., and Jeyakumar, N., et al. Biosynthesis of silver nanoparticles using mangosteen leaf extract and evaluation of their antimicrobial activities. *Journal of Saudi Chemical Society*, 2011; 15: 113-120.
5. Jain, D., Kumar Daima, H., and Kachhwaha S., et al. Synthesis of plant-mediated silver nanoparticles using papaya fruit extract and evaluation of their antimicrobial activities. *Digest J Nanopart Biostruc*, 2009; 4: 557-263.