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Research Article

ANTIBACTERIAL POTENTIAL OF GREEN SILVER NANOPARTICLES SYNTHESIZED FROM LEAVES AND BARK EXTRACT OF *SIMAROUBA GLAUCA*

Shital B. Koparde * and D.K. Gaikwad
Department of Botany, Shivaji University, Kolhapur, India
*Corresponding Author Email: shitalkoparde@gmail.com

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ABSTRACT

Green synthesis of silver nanoparticles using the leaves and bark extract of *Simarouba glauca* DC is reported in the present investigation. Synthesized nanoparticles are characterized under UV-Vis spectrophotometer at the range 200-800 nm. The peak showed at 444 to 450 nm for leaves and 462 nm for the bark sample. FESEM studies revealed the nanoparticles synthesized from leaves and bark extract are spherical in shape and size ranging between 30-50 nm and 50-60 nm respectively. These silver nanoparticles showed inhibitory activity against micro-organisms such as *Staphylococcus aureus* and *Pseudomonas aeruginosa*, and exhibits antibacterial potential. Thus these silver nanoparticles might be used in the drug delivery system in pharma and agricultural industries.

Keywords: Antibacterial potential, silver nanoparticles, *Simarouba glauca*, FESEM

INTRODUCTION

Biological synthesis of nanoparticles offers easy and hazardous component free protocol. Among the noble metals, silver is the metal of choice because of its various applications in the different fields like photonics, biological sensing, solar cell surface coatings, electronics, medicine[11]. Silver nanoparticles recognized as antimicrobial agent and having significant inhibitory effect on microbes present in industrial and medical fields[5]. The several researchers reported the biological synthesis of nanoparticles using plant extract such as *Cassia auriculata*[1], *Plectranthus amboinicus*[4], Shorea tumbuggaia[8], *Cissus quadrangularis*[13], *Terminalia chebula*[14]. *Simarouba glauca* is important medicinal as well as oil yielding plant, commonly known as 'Laxmitaru' belongs to family Simaroubaceae. This plant have been various pharmaceutical and ethnobotanical uses. According to Joshi and Joshi (2002)[6] the leaf, fruit, seeds, pulps and bark of *S. glauca* showed the medicinal properties such as antimicrobial, astringent, analgesic, antiviral, tonic and vermifuge. Thus attempt have been made to green synthesis of silver nanoparticles from *S. glauca* and evaluate its antibacterial potential.

MATERIAL AND METHODS

Preparation of leaves and bark extract

Leaves and bark of the *S. glauca* were collected from Department of Botany, Shivaji University Kolhapur. The material were washed with distilled water and dried to make powder. 10 g of leaves and bark powder mixed in 100 ml double distilled water separately and kept in boiling water bath for 15 minutes. The extracts were cooled and filtered using whatman no. 1 filter paper.

Synthesis of Silver nanoparaticles

For the synthesis of silver nanoparticles *S. glauca* leaves and bark extract were reacted with silver nitrate. 10 ml of leaves and bark extract added to the 90 ml of silver nitrate solution, and kept in dark condition at room temperature[9].

UV-vis Spectrophotometer analysis

The colour change in reaction mixture (Silver nitrate solution + leaves extract/ bark extract) was recorded. The bioreduction of silver ions was scrutinized by measuring the Uv-vis spectra of the reaction medium after 24h.

The complete bioreduced sample was centrifuged at 10000 rpm for 15 minutes. Then redispersed the pellet in double distilled water and again centrifuged. For obtaining the silver nanoparticles free from any unwanted residue of biomass, repeated this process of centrifugation for 2-3 times[12].

FESEM analysis

Morphology and size of the synthesized silver nanoparticles were examined by using FESEM images. Used 20 kv voltage for imaging nanoparticles in Field Emission Scanning Electron Microscope. [Model- MIRA 3 LMH].

Antibacterial activity

Antibacterial potential of silver nanoparticles synthesized from leaves and bark extract of *S. glauca* were studied by using agar well diffusion method[2]. Antibacterial activity of silver nanoparticles were tested against *Staphylococcus aureus* and *Pseudomonas aeruginosa*. The agar plates were inoculated by spreading these bacteria over the entire agar surface. Then 8 mm well was punched and the different concentrations (30µl, 60 µl, 100 µl) of the nanoparticles were loaded in each plate. After 24h of incubation zone of inhibition was recorded. Streptomycin was used as control.

RESULTS AND DISCUSSION

The colour change in 1mM $AgNO_3$ solution from colourless to blakish brown (fig-1) and reddish brown (fig-2) was noticed after reaction with leaves extract and bark extract respectively. The characteristic surface plasmone absorption peak were observed at 444 to 450 nm for leaves (fig-3) and 462 nm for the bark sample (fig-4).

The Field Emission Scanning Electron Microscope image has shown the synthesized nanoparticles spherical in shape and size ranging between 30-50 nm (fig-5), for nanoparticles synthesized from leaf sample and 50-60 nm (fig-6) for nanoparticles synthesized from bark sample.

Nanoparticles synthesized from leaves and bark of *S. glauca* have potential to inhibit the growth of some bacterial strains such as *Staphylococcus aureus* and *Pseudomonas aeruginosa* (Table-1). Highest activity of the nanoparticles against both the bacteria were seen due to nanoparticles synthesized from the leaves. Antibacterial activity of silver nanoparticles is due to the interaction with the thiol groups in proteins of bacteria and nanoparticles interfere with DNA replication[3,7.] also nanoparticles disrupt cell membrane and penetrate the bacterial cytoplasm[10]. Synthesized nanoparticles from plant *S.glauca* leaves and bark extract showed toxicity to multidrug resistant microorganisms.(Fig- 7and 8).

Table. 1: Antibacterial activity of AgNPs

Test Bacteria		Zone of inhibition in millimeter			
		Control	Concentration of AgNPs (µl)		
		Streptomycin	30(µl)	60(µl)	100(µl)
Leaves SNPs	*S.aureus*	24	11	17	18
	P.aeruginosa	31	14.5	17.6	18.5
Bark SNPs	*S.aureus*	24	9	12	16
	P.aeruginosa	25	14	17.5	18

Figure 1 (1) AgNO3 solution (2) Leaves extract (3) Synthesized AgNPs

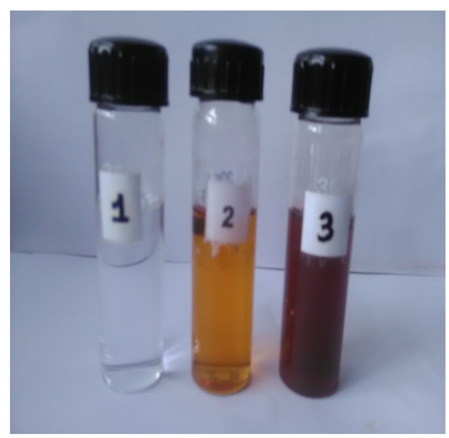


Figure 2 (1) AgNO3 solution (2) Bark extract (3) Synthesized AgNPs

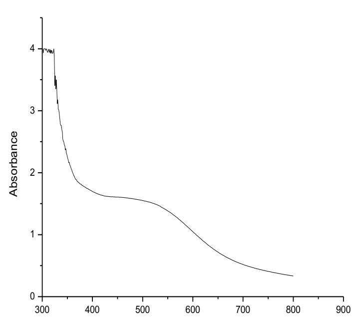


Figure 3 UV- Vis absorption spectra leaf sample

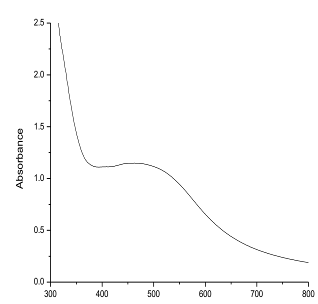


Figure 4 UV- Vis absorption spectra bark sample

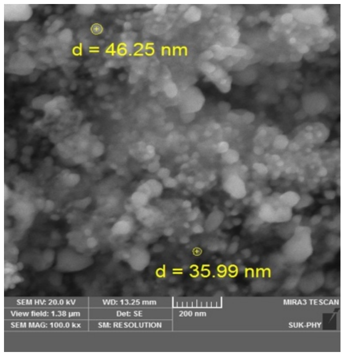


Figure 5 FESEM micrograph of leaf silver nanoparticles.

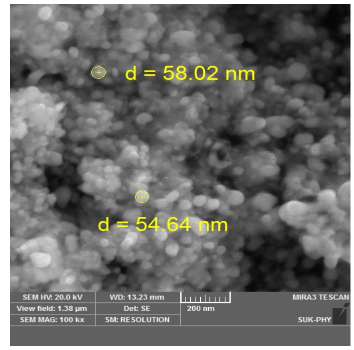
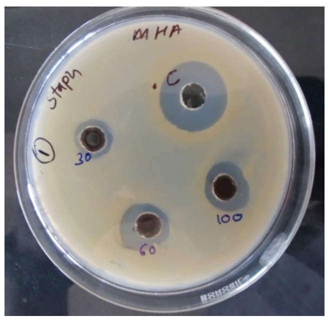
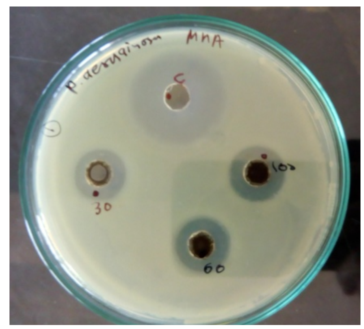


Figure 6 FESEM micrograph of bark silver nanoparticles.

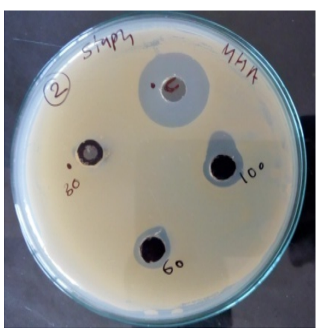


Staphylococcus aureus

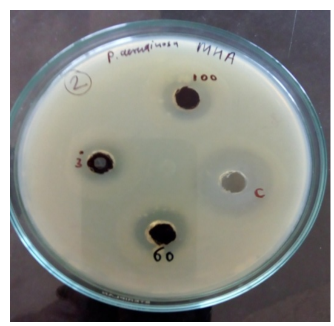


Pseudomonas aeruginosa

Figure 7- Antibacterial activity of leaves AgNPs



Staphylococcus aureus



Pseudomonas aeruginosa

Figure 8- Antibacterial activity of Bark AgNPs

CONCLUSION

In the present study, an ecofriendly process of silver nanoparticles synthesis was evaluated by using plant *Simarouba glauca* and these nanoparticles showed significant antimicrobial activity, indicating its applications in the field of pharmaceutical and pesticide industries.

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