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Research Article

Synthesis of Silver nanoparticles from some selective plant seeds

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ABSTRACT

In the present investigation, we report the extracellular biological synthesis of silver nanoparticles (AgNP`s) using plant seed extracts (*Annona squamosa, Lantana camara* and *Spaghetti squash*) for the reduction of aqueous Ag^+ ions. Silver nanoparticles were successfully synthesized by chemical reduction of silver nitrate in an ionic liquid at room temperature. The formation of reddish brown colour, confirmed the synthesized silver nanoparticles. Synthesized all nanoparticles were examined the antimicrobial activity against some pathogenic bacteria such as *Pseudomonas aeruginosa, Proteius vulgaries, Staphylococcus aureus* and *Escherichia coli.* The synthesized all silver nanoparticles were found most effective against antimicrobial activity against all tested strains to be found in all concentration.

Key words : *Silver nanoparticles (AgNP`s), Antimicrobial Activity, Strains,* apoptosis.

INTRODUCTION

Nanoparticle is a core particle which performs as a whole unit in terms of transport and property [5]. As the name indicates nano means a billionth or 10-9unit. Its size range usually from 1- 100nm [5] due to small size it occupies a position in various fields of nano science and nanotechnology. Nano size particles are quite unique in nature because nano size increase surface to volume ratio and also its physical, chemical and biological properties are different from bulk material. The main mechanism considered for the synthesis of nanoparticles mediated by the plants is due to the presence of phytochemicals. The major phyto chemicals responsible for the spontaneous reduction of ions are flavonoids, terpenoids, carboxylic acids, quinones, aldehydes, ketones and amides [7]. Nanoparticles had a wide variety of application in the major fields of medicine, electronics, therapeutics, and diagnostic agents. Silver nanoparticles have wide application in biomedical science like treatment of burned patients, antimicrobial activity and used the targeted drug delivery, and so forth [12]. Now a days the nanoparticles are coated on the medical appliances, food covering sheets, and cans for storing the beverages and food [8]. However, there are many problems and toxicity of using metal oxide nanoparticles on the human health. Use of plants for the synthesis of nanoparticles does not require high energy, temperatures, and it is easily scaled up for large scale synthesis, and it is cost effective too[1]. A wide range of nano silver applications has emerged in consumer products ranging from disinfecting medical devices and home appliances to water treatments. This paper aims to synthesis of antimicrobial effects of AgNPs from some selective seeds.

MATERIALS AND METHODS

Collection of seeds

Plant seeds *Annona squamosa, Lantana camara* and *Spaghetti squash* were collected from different area. The collected seeds were washed several times with tap and rinsed with distilled water. The cleaned seeds were dried in shade at room temperature and powdered mechanically using electrical stainless steel blender. The fine powder

Table.1. Antibacterial activity of synthesized seed nanoparticles from *Annona squamosa*, *Lantana camara* and *Spaghetti squash*

Name of the synthesized silver nanoparticles	Name of the bacterial strain	Extract concentration		
		75 µg/ml	150 µg/ml	250µg/ml
Lantana camara	*Staphylococcs aureus*	10.76 ± 0.25	12.00 ± 0.00	12.83 ± 0.28
	Pseudomonas aeruginosa	22.00 ± 0.00	23.66 ± 0.57	25.00 ± 0.00
	Proteius vulgaries	11.80 ± 0.26	14.00 ± 0.00	15.93 ± 0.11
	Escherichia coli	13.00 ± 0.00	14.00 ± 0.00	14.63 ± 0.55
Annona squamosa	*Staphylococcs aureus*	11.73 ± 0.30	12.50 ± 0.50	14.00 ± 0.00
	Pseudomonas aeruginosa	14.86 ± 0.15	16.00 ± 0.00	17.16 ± 0.28
	Proteius vulgaries	12.73 ± 0.46	12.00 ± 0.00	12.96 ± 0.05
	Escherichia coli	9.83 ± 0.28	10.66 ± 0.57	12.00 ± 0.00
Spaghetti squash	*Staphylococcs aureus*	12.33 ± 0.57	14.00 ± 0.00	16.00 ± 0.00
	Pseudomonas aeruginosa	18.00 ± 0.00	18.50 ± 0.50	19.00 ± 0.00
	Proteius vulgaries	12.66 ± 0.57	12.86 ± 0.23	13.66 ± 0.57
	Escherichia coli	11.66 ± 0.57	13.00 ± 0.00	13.50 ± 0.50

was stored in a dry air tight container to avoid any other contaminations.

Preparation of plant extract

25 g of each seed powder were separately extract with 250 ml of acetone using Soxhlet apparatus for 8 hrs. The seed extracts were transferred in airtight container and kept in a dark and dry place until further studies.

Synthesis and purification (AgNps)

For the synthesis of silver nanoparticles, 10 ml of the extract was added to 90 ml of 1 mM aqueous silver nitrate solution at room temperature for 24 hrs and the color change was observed periodically. The synthesized AgNP's was purified by centrifugation at 13,000 rpm for 15 mins and washed thrice with double distilled water, then dried in an oven at 37^{o}C for 48 hrs. The stabilized powder forms of the nanoparticles were stored for further study.

Antimicrobial Activity

Antibacterial activity was determined by using the agar-well diffusion method [4]. The MHA plates were prepared by pouring 20ml of molten media into sterile petri plates. The plates were allowed to solidify for 5 mins and 0.1 % inoculums suspension was swabbed uniformly and the inoculums were allowed to dry for 5 mins. Wells were bored into the medium using a sterile 6 mm diameter cork borer. Then different concentrations of extracts (75,150 and 250 µg/ml) were loaded on well separately. The solvent was allowed to evaporate on the surface of medium and the compound was allowed to diffuse for 5 mins and the plates were kept for incubation at 37°C for 24 hrs. At the end of incubation, inhibition zones formed around the disc were measured with transparent ruler in millimeter. These studies were performed in triplicate.

RESULT 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 [13]. In the present study, *Annona squamosa, Lantana camara* and *Spaghetti squash* seeds extract were used as reducing agent for the synthesis of silver nanoparticles. It is well known that silver nanoparticles exhibit reddish brown color in aqueous solution due to excitation of surface plasmon vibrations in silver nanoparticles [10]. The change in colour of the reaction mixture after 24 hrs is presented. Silver is said to be a universal antimicrobial substance for centuries. Though, silver ions or salts have limited usefulness as an antimicrobial agent. Such as, the interfering effects of salts and antimicrobial mechanism of continuous release of enough concentration of Ag ions from the metal form. This kind of limitation can be overcome by using silver nanoparticles. However, to use silver against microorganisms, it is essential to prepare it with environmentally friendly and cost-effective methods. Besides, it is also important to enhance the antimicrobial effects of silver ions [2]. Antibacterial potential of silver is known since many years [9]. The use of plant extracts is effective against various microorganism [3]. In this study, the antibacterial effects of the bioreduced silver nanoparticles from *A. squamosa*, *L. camara* and *S. squash* seeds were investigated against the pathogenic organism *Pseudomonas aeruginosa, Proteius vulgaries, Staphylococcus aureus* and *Escherichia coli* using the agar well diffusion method. Each synthesized seed nanoparticles were used for the study of antibacterial activity at different concentrations (75µl, 150µl and 250µl). In the present study synthesized all seed nanoparticles *A. squamosa, L. camara* and *S. squash* were significantly antimicrobial activity against all bacterial strains (Table.1). *P. aeruginosa* was maximum antimicrobial activity in all tested silver nanoparticles at

250 µl concentration. *L. camara* and *S. squash* were minimum zone of inhibition was observed in *E. coli* at 250 µl concentration but *A. squamosa was* minimum zone of inhibition was observed in *S. aureu* at same concentration. [11] 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 [6].

CONCLUSION

Silver nanoparticles were successfully synthesized using *Annona squamosa*, *Lantana camara* and *Spaghetti squash* used at room temperature and significant antimicrobial activity was observed. Further studies on other biological activities are required to exploit their full potential.

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