



Antibacterial activity of nanoparticle of *Diospyros malabarica* (Desr.) Kostel.

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Abstract

The aim of the present study was a synthesis of silver nanoparticles using air-dried fruits of *Diospyros malabarica* extract and antibacterial activity of selected bacteria. The results of the synthesis of nanoparticles were observed by bioreduction of silver when the mixture (AgNO_3 + extract) changed its color from yellow colour to dark brown. Anti-bacterial activity of silver nanoparticles synthesis from *D. malabarica* fruits have shown active against *Pseudomonas aeruginosa* and *S. aureus* respectively.

Keywords: *Diospyros malabarica*; Fruit extract, Silver nanoparticles, UV- vis spectroscopy, Antibacterial activity

1 INTRODUCTION

The development of reliable green processes for the synthesis of silver nanoparticles is an important aspect of nanotechnology and medical technology. The development of nanoparticles has been the subject of focus due to their unique optical, electronic, mechanical, magnetic and chemical properties. Preparation of silver nanoparticles has attracted particularly considerable attention due to their diverse properties [1]. The applications of the metal nanoparticles, especially silver nanoparticles, in the field of medicine is using these nanoparticles as antimicrobial agents. The lethal activity of nanoparticles against broad spectrum of Gram-positive bacteria, Gram-negative bacteria and fungi has been approved by earlier studies [2].

The genus of *Diospyros* is a large genus of shrubs and trees comprising of more than 500 species distributed in the worldwide. The synonyms of *Diospyros malabarica* (Desr.) Kostel. *Embryopteris peregrina* Gaertn. *Garcinia malabarica* Desr. It is belonging to the family Ebenaceae. *Diospyros peregrina* is distributed all over India especially in the plains of coastal regions and river banks. The tree is indigenous to India and Bangladesh, and is also found in many other countries of Asia and America [3]. The species' name means strange or foreign, probably an exotic in the country from which the species was described. The plant species is found in Thailand and North Malaysia [4] and introduced as an ornamental tree in Pakistan [4].

The plant is reported to possess many medicinal properties. The plant has an astringent action and is particularly used for the treatment of diarrhoea and dysentery. An ether extract of the fruits possesses antibacterial properties, and has also been used for dye making and tanning fishing nets [5]. The methanol extracts of the bark and the seeds of *D. peregrina* have been investigated as an antidiarrheal [6]. Anthelmintic activity of a methanol extract of unripe fruits of *D. peregrina* has been reported [7]. The methanol extract of *D. peregrina* fruits has shown inhibition of the growth of a number of bacteria [8]. In the present study was synthesis of nanoparticle and antibacterial properties of *Diospyros malabarica* fruits extracts.

2. MATERIALS AND METHODS

2.1 Collection of plant materials

The plant materials of *Diospyros malabarica* fruits were collected from Tirunelveli hills, Southern Western Ghats region, Tirunelveli District, South India.

2.2 Synthesis of Nanoparticles

The dried fruits were ground to a fine powder. 1 mM silver nitrate was added to the plant extracts separately to make up a final solution of 200 ml. The extraction for totally 8 hr and filtered. The filter extract was heated at 50 to 95°C. A change in the color of the solution was observed during heating of process within 10-15 minutes. The color changes



indicate the formation of silver nanoparticles (SNPs). The reduction of pure Ag^{2+} ions were monitored by measuring the UV-Vis spectrum of the reduction media at 5 hours after diluting a small aliquot of the sample in distilled water by using systronic UV-Vis Spectrophotometer.

2.3 Antibacterial activity

The synthesis of silver nanoparticles of *Diospyros malabarica* fruits was tested for antibacterial activity selected human pathogen such as *Bacillus subtilis*, *Salmonella typhi*, *Streptococcus pyogenes*, *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Klebsiella pneumonia* by disc diffusion method. Antibacterial activity was evaluated by measuring the diameter of the inhibition zone (IZ) around the discs. Fresh overnight culture of inoculums (20 mL) of each culture was spread on to Muller Hinton Agar (MHA) plates. Sterile paper disc of 6mm diameter containing 1mg/l disc of silver nanoparticles, and standard antibiotic erythromycin discs were placed in each plate as control. The plates were incubated at 28°C for overnight (12h) and the inhibition zones around the discs were measured. Antibacterial activity was expressed as the mean zone of inhibition diameters (mm) produced by the silver nanoparticle leaf extract. The assay was repeated trice.

3. RESULTS AND DISCUSSION

The results of silver nanoparticles synthesized from *Diospyros malabarica* fruits were exhibited in the yellow colour to dark brown in aqueous solution. The observed result that the appearances of yellow-brown colour in the reaction vessels suggest the formation of silver nanoparticles. The antibacterial activity of silver nanoparticle observed that strong antibacterial activity active against *Pseudomonas aeruginosa* and *S. aureus* respectively (Table-1). Earlier studies on the antimicrobial activity of silver nitrate nanoparticle active against *E. coli*, *Salmonella typhi* and *Staphylococcus aureus* respectively [9]. The effect of AgNPs as antimicrobial agent depends on the shape of nanoparticles as encountered from the work monitoring the effect of different shapes of AgNPs (spherical, rod-like and triangular) on *E. coli* and found that triangular-shaped nanoparticles are the most effective shape [10]. Previous studies, Dhand,[11] who reported that anti-bacterial activity of silver nanoparticles on *E. coli* and *S. aureus* demonstrated diminished bacterial growth with the development of well-defined inhibition zones. Similarly, silver nanoparticle of orange showed 5 mm and 6 mm ZoI against *S. aureus* and *S. typhi* respectively [1]. Previous studies have also reported the antibacterial activity of AgNPs against gram-negative and gram-positive strains of bacteria [12]. It is well recognized that the antibacterial effect of AgNPs is size and dose dependent. The results were supported by previously reported studies [13], which have shown that AgNPs have more potential against gram-negative bacteria than gram-positive bacteria. Considering the advantage of the microbicidal activities of the silver compounds and the ability to stay as

drug without microbial resistance, chemical drugs are slowly taken over by bioorganic nanoparticles. Smaller particles with a larger surface area possess higher antibacterial effects compared to the larger particles [14]. The antibacterial activity of the nanoparticles may be centered on permeability of bacterial cell wall layers or its charges [15]. Studies have shown that nanoparticles may infiltrate the cells causing intracellular loss leading to cell death and this inhibition depends on the concentration of AgNPs [16]. The conclusion the present results of silver nanoparticles synthesized from *Diospyros malabarica* fruits extract have shown potential of antimicrobial activity. Future studies are needed to uncover the underlying mechanism of bacteriostatic or bactericidal effects of green synthesized nanoparticles.

Table-1: Antibacterial activity of nanoparticles synthesized from *Diospyros malabarica* fruits

S. No	Pathogenic bacteria	Zone of inhibition (mm)	
		Water Extract	Silver nanoparticles
1	<i>Escherichia coli</i>	12	14
2	<i>Bacillus subtilis</i>	14	16
3	<i>Klebsiella pneumonia</i>	12	16
4	<i>Streptococcus pyogenes</i>	16	17
5	<i>Pseudomonas aeruginosa</i>	21	23
6	<i>Salmonella typhi</i>	15	17
7	<i>Staphylococcus aureus</i>	17	21

4. ACKNOWLEDGEMENTS

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5. REFERENCES

1. Hungund BS, Dhulappanavar GR, Ayachit NH. Comparative evaluation of antibacterial activity of silver nanoparticles biosynthesized using fruit Juices. J Nanomed Nanotechnol, 2015; 6:271.
2. Dhand V, Soumya L, Bharadwaj S, Chakra S, Bhatt D, Sreedhar B. Green synthesis of silver nanoparticles using *Coffea arabica* seed extract and its antibacterial activity. Mater Sci Eng, C, 2016;58:36-43.
3. Kirtikar KR, Basu BD. Indian medicinal plants, Edn 2, Vol-I. Lalit mohan Basu Allahabad, India, 1935; 785-788.



4. Anon. Annual rainfall, relative humidity and temperature of Lahore 2004- 2009. Pakistan Metrological Department Jail Road Lahore, Pakistan, 2009.
5. Anon. Dictionary of Indian Raw materials and Industrial products, CSIR, Vol., 1952; 3: 27-28.
6. Rouf R, Uddin SJ, Shilpi JA, Toufiq-ur-rahman M, Ferdous MM, Sarker SD. Anti-diarrhoeal properties of *Diospyros peregrina* in the castor oil-induced diarrhoea model in mice. *Ars Pharmaceutica*, 2006; 47: 81-89.
7. Dewanjee S, Kundu M, Maiti A, Majumdar R, Majumdar A, Mandal SC. *In vitro* evaluation of antimicrobial activity of crude extract from plants *Diospyros peregrina*, *Coccinia grandis* and *Swietenia macrophylla*. *Tropical Journal of Pharmaceutical Research*, 2007a. 6: 773–778.
8. Dewanjee S, Maiti A, Kundu M, Mandal SC. Evaluation of anthelmintic activity of extracts of *Diospyros peregrina*, *Coccinia grandis* and *Schima wallichii*. Dhaka University, *Journal of Pharmacy and Science*, 2007b;6: 121–123.
9. Jain J, Arora S, Rajwade JM, Omray P, Khandelwal S, Paknikar KM. Silver nanoparticles in therapeutics: development of an antimicrobial gel formulation for topical use. *Mol Pharm*, 2009;6(5):1388-1401.
10. Wang C, Kim YJ, Singh P, Mathiyalagan R, Jin, Yang DC. Green synthesis of silver nanoparticles by *Bacillus methylotrophicus*, and their antimicrobial activity. *Artif Cells Nanomed Biotechnol* 2016;44(4):1127-113.
11. Pal S. Tak YK, Song JM. Does the antibacterial activity of silver nanoparticles depend on the shape of the nanoparticle? A study of the gram-negative bacterium *Escherichia coli* *Appl Environ Microbiol*, 2007; 73(6):1712-1720.
12. Singh M, Singh S, Prasad S, Gambhir IS. 2008. Nanotechnology in medicine and antibacterial effect of silver nanoparticles. *Digest Journal of Nanomaterials and Biostructures* 3(3):115-122.
13. Sana SS, Dogiparthi LK. Green synthesis of silver nanoparticles using *Givotia moluccana* leaf extract and evaluation of their antimicrobial activity. *Materials Letters*, 2018; 226:47-51.
14. Panacek A, Kvítek L, Pucek R, Kolar M, Vecerova R, et al. Silver colloid nanoparticles: synthesis, characterization, and their antibacterial activity. *J PhysChem B*, 2006; 110: 16248-16253.
15. Chamakura K, Perez-Ballesteros R, Luo Z, Bashir S, Liu J. Comparison of bactericidal activities of silver nanoparticles with common chemical disinfectants. *Colloids Surf B Biointerfaces*, 2011; 84: 88-96.
16. Sondi I, Salopek-Sondi B. Silver nanoparticles as antimicrobial agent: a case study on *E. coli* as a model for Gram-negative bacteria. *J Colloid Interface Sci*, 2004; 275: 177-182.