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CHARACTERIZATION AND ANTIBACTERIAL EFFECT OF GREEN SYNTHESISED SILVER NANOPARTICLES BY THE AQUEOUS EXTRACT OF *Mimusops elengi* FLOWER

Mariselvam, R., *Usha Raja Nanthini, A., Athinarayanan, G. and Ranjit Singh, A. J. A.

Department of Zoology, Sri Paramakalyani College, Alwarkurichi, Tirunelveli, Tamilnadu, India

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ABSTRACT

The present study focus on the green synthesis of AgNPs using *Mimusops elengi* flower aqueous extract. The flower extracts were analyzed phytochemical constitutions and to used to synthesis of nanoparticles by nitrates reduction method (green synthesis). The $AgNO_3$ solution will reduce AgNPs by this flower extract present in the carbohydrates, protein, alkaloids, reducing sugar, aromatic acids and tannins. The green synthesized AgNPs were characterized by using UV-Visible Spectroscopy and Scanning Electron Microscopy. The *Mimusops elengi* flower extracts based silver nanoparticles have good inhibitory activity against $Gram^{-ve}$ bacterial strains viz., *Klebsiella pneumonia, Vibrio parahaemolyticus, Shigella spp* and *Vibrio alginolyticus.*

INTRODUCTION

Nanomaterials have a long list of applicability in recuperating human life and its environment. The first relation between human life and nano scale was developed physically in ayurveda, which is a 5000-year-old Indian system of medicine. Modern science has just started exploring nanoscience in the 21st century (Dubeya *et al*., 2010). A number of approaches are available for the synthesis of nanoparticles for example, reduction in solution, chemicals and photochemical reactions in reverse micelles, thermal decomposition of silver compounds microwave assisted process and recently via green chemistry way. The use of environmentally begin materials like plant extract (Parashar *et al*., 2009; Mariselvam *et al*., 2013), bacteria (Saifuddin *et al*., 2009), fungi and enzymes for the synthesis of silver and copper nanoparticles offers numerous benefits of eco-friendliness and compatibility for pharmaceutical and other biomedical applications as they not use toxic chemicals for the synthesis protocol. Plant extracts are very cost effective and eco –friendly and thus can be an economic and efficient alternative for the large scale synthesis of nanoparticles. *Mimusops elengi* is a medium-sized evergreen tree found in tropical forests in South Asia, Southeast Asia, and Northern Australia. Its timber is valuable, the fruit is edible, and it has traditional medicinal uses. Flowers are cream, hairy and scented. Bark is thick and appears dark brownish black or grayish black in colour, with striations and a few cracks on the surface. In the present study green synthesis of silver nanoparticles by using the seed flowers extract of the plant *Mimusops elengi* was carried out. The nanoparticles were characterized by UV/Vis double beam spectrophotometer, potentiometer and Scanning Electron Microscope (SEM). Antibacterial activity of the raw extracts synthesis silver nanoparticles were evaluated against eight bacterial pathogens.

Corresponding author: Usha Raja Nanthini, A.,
Department of Zoology, Sri Paramakalyani College, Alwarkurichi, Tirunelveli, Tamilnadu, India

MATERIALS AND METHODS

Mimusops elengi flower, silver nitrate ($AgNO_3$), Double distilled water, Whatman No 1 filter paper, Magenetic stir.

Plant source Collection and processing

The flowers of the tree *Mimusops elengi* were collected from Sri Paramakalyani College campus, Alwarkurichi, Tirunelveli (Dist), Tamilnadu, India in the month of June 2013. The collected seeds were washed with Double distilled water. The flowers were dried at room temperature. Five grams of flowers were boiled with 100ml of Double distilled water at 90°C for 30 minutes. The aqueous extracts were then filtered by using Whatman No 1 filter paper. After filtration the extracts was used for further studies.

Preliminary Phytochemical study

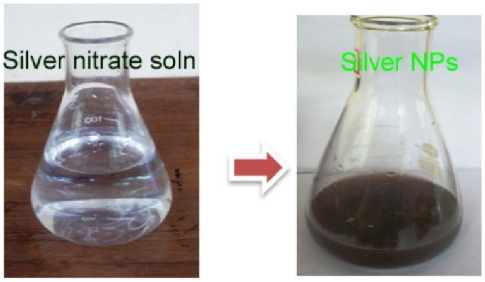
The extracts were tested for phytochemical composition like carbohydrate, protein, amino acid, alkaloid, flavonoid, tannins, saponins, terpenoids, aromatic acids, phenolic compounds, xanthoprotein, reducing sugar and triterpenoids using standard procedure (Kumar *et al.*, 2009; Edeoga *et al*., 2005).

Preparation of $AgNO_3$ Solution

$AgNO_3$ were purchased from Merk Limited, Baroda. To 0.17grams of $AgNO_3$, 1000ml Double distilled water was added and $AgNO_3$ was dissolved in it. This was stored in a clean brown bottle and stored away from light.

Synthesis of AgNPs

Ninety millilitres of $AgNO_3$ solution was added to 10ml of plant extract and stored in room temperature with continuous stirring using magnetic stirrer. The colour of the solution changed into dark reddish brown indicating the AgNPs formation.



Characterization of Synthesized NPs

The synthesized AgNPs were analysed using UV/Vis Spectrophotometer and SEM. The rate of absorption in UV/Vis region was analysed by spectrophotometer in the range of 200 to 800nm. Scanning electron micrographs have a large depth field yielding a characteristic three dimensional appearance useful for understanding the surface structure of a sample.

Antimicrobial Study

The antibacterial activity of the raw extract of Jambolan seed and green synthesized NPs was tested against eight bacterial isolates using agar well diffusion method (Ahmad and Beg, 2001). The zone of inhibition was measured and expressed in millimetres. Antibacterial activity was recorded if the zone of inhibition was greater than 8mm (Mariselvam *et al.,* 2012). The antibacterial activity results were expressed in term of the diameter of zone of inhibition and <9mm zone was considered as inactive; 9-12mm as partially active; while13-18mm as active and >18mm as very active (Junior and Zanil, 2000; Mariselvam[a] *et al*., 2013).

RESULT AND DISCUSSION

The preliminary phytochemical screening of the aqueous extracts of the flower is summerized in the Table 1. The aqueous extracts contained carbohydrates, proteins, alkaloid, tannins, aromatic acids and reducing sugars. The phytochemicals in the seed act as a reducing agent or capping agents in the nanoparticles synthesis process (Mariselvam[b] *et al*., 2013). These phytochemicals oxidized and to reacted with the silver nitrate solution to form silver nanoparticles.

Table 1. Phytochemicals screening of *Mimusops elengi* flower aqueous extract

S. No	Test for	*Mimusops elengi*
1	Carbohydrate	+
2	Protein	+
3	Amino acid	-
4	Alkaloids	+
5	Flavonoids	-
6	Terpenoids	-
7	Tannins	+
8	Saponin	-
9	Aromatic acids	+
10	Phenolic compounds	-
11	Xanthoproteins	-
12	Reducing sugar	+
13	Triterpenoids	-
14	Phlobatinnins	-

The colour of the prepared AgNPs was dark reddish brown. The absorption strongly depends on the size of nanoparticles and chemical surroundings. The plant extracts had acted as a reducing agent and capping agent. It converts $AgNO_3$ solution to form the AgNPs by reduction method. The initial reaction of $AgNO_3$ and plant extract within 10 minutes the absorption peak was obtained in the visible region at 500nm. After 50 minutes the absorption peak was abtained from the visible region at 438nm. The variables of the absorption spectra different in different time duration. As the $AgNO_3$ solution was completely reduced by the plant extract the absorption range got slowly reduced and the absorption peak was obtained in the visible region at 438nm (Fig 2).

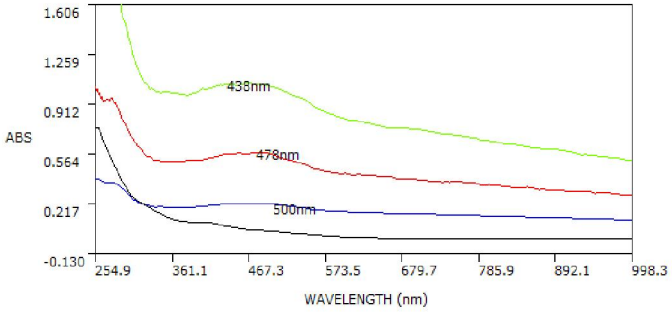
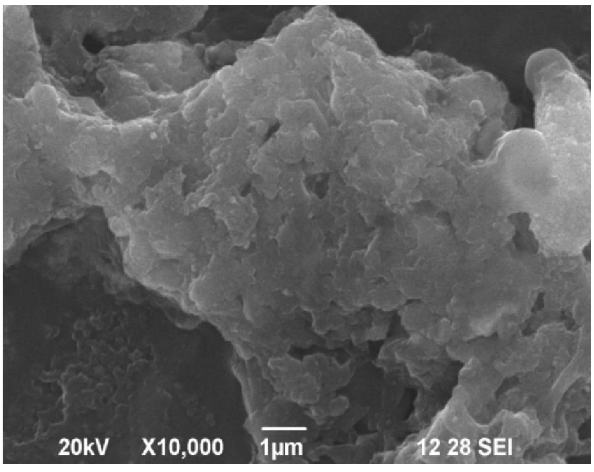


Fig. 2. UV-Spectrum analysis of silver nanoparticles

Scanning Electron Microscope images confirmed the formation and surface analysis of AgNPs. The surface characters were analysed by SEM images. These images confirmed the nanoparticles structure was spherical in shape and the size range 20nm to 50nm (Fig 3).



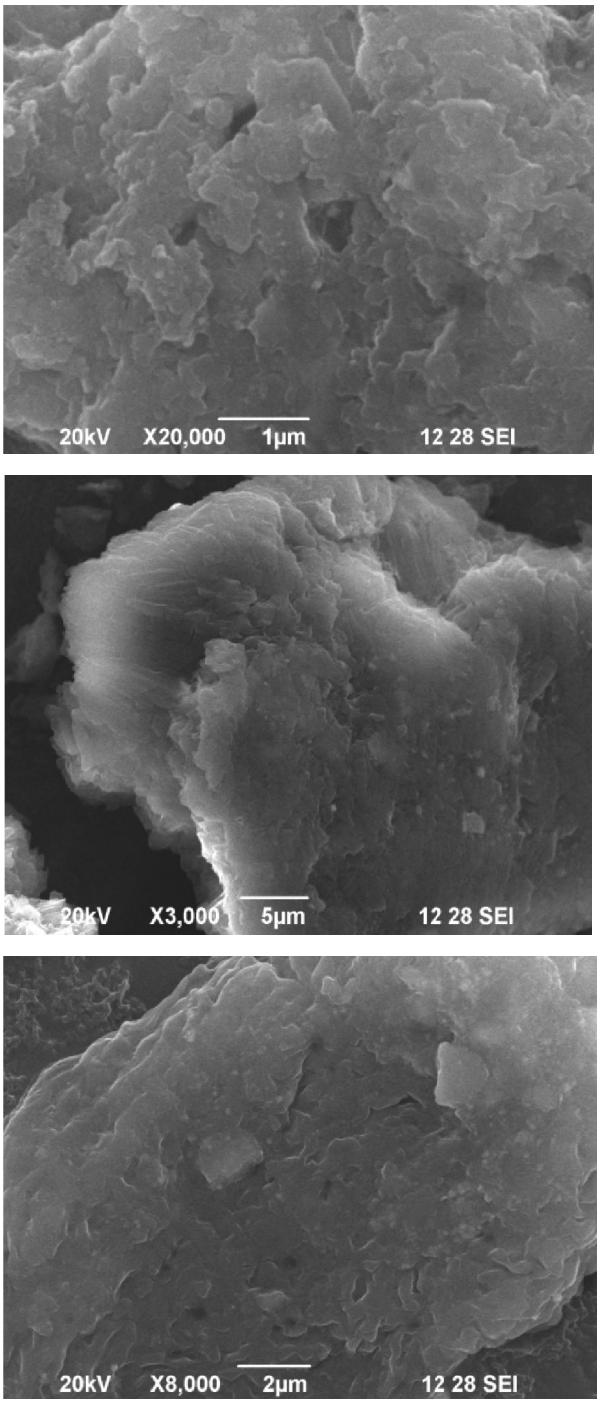
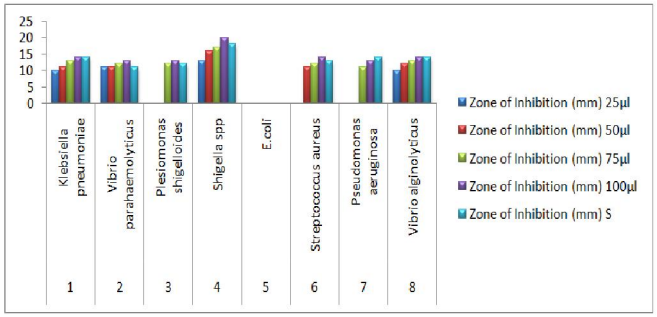


Fig. 3. SEM images of silver nanoparticles

The green synthesized NPs had inhibited the microbial growth (Table 2). These NPs was highly inhibiting growth of *Shigella* sp (20mm). The AgNPs had raptured the cell wall of the microorganisms.

Table 2. Antimicrobial activity of green synthesized Silver NPs using *Mimusops elengi*

S. No	Microorganisms	Zone of Inhibition (mm)				
		25µl	50µl	75µl	100µl	S
1	*Klebsiella pneumoniae*	10	11	13	14	14
2	*Vibrio parahaemolyticus*	11	11	12	13	11
3	*Plesiomonas shigelloides*	0	0	12	13	12
4	*Shigella spp*	13	16	17	20	18
5	*E.coli*	0	0	0	0	0
6	*Streptococcus aureus*	0	11	12	14	13
7	*Pseudomonas aeruginosa*	0	0	11	13	14
8	*Vibrio alginolyticus*	10	12	13	14	14



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