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Antibacterial activity of aqueous and nanoparticle of *Adiantum capillus* -veneris L.

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Abstract
The antibacterial potential of extract and silver nanoparticle synthesized from the extracts from *Adiantum capillus* -veneris (L) was screened against six bacteria using the disk diffusion method. The maximum activity of zone of inhibition was active against Staphylococcus aureus. The synthesis of nanoparticle was observed that the antibacterial activity against all tested bacteria more than the aqueous extract of *A. capillus* -veneris.

Keywords: Biosynthesis, silver nanoparticles, *Adiantum capillus*-veneris L, antibacterial activity

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1. Introduction

Nano-technology is a rapidly growing field of various industries such as environmental, food, health care, optics, healthcare, chemical industries, etc. Nanoparticles show specific characteristics as compared to large particles such as their morphology, size, and distribution. Chemical and physical methods for synthesis of nanoparticles are costly and releases toxic byproducts in nature. Due to these problems, there is a requirement of an alternative for synthesis of nanoparticles. Silver nanoparticles have been extensively used in health care, food, environment and biomedical sectors. Application of silver nanoparticles includes anti-bacterial, anti-viral, anti-fungal and anti-cancer activities [1]. It has also seen that silver nanoparticles synthesized from chemical methods show less antibacterial activity as compared to the nanoparticles synthesized from biological approach. This is may be due to the presence of protein coating of nanoparticles obtained from plant extract[2-6].

Adiantum capillus- veneris (L.) is belongs to the family Pteridiaceae. It has been used for traditional, Ayurvedic and Unani medicine. The distribution of A. capillus veneris is a common fern found in pak-indian subcontinent, Mexico, western Himalaya, warmer parts of America, and other tropical and subtropical regions of the world [7-8]. It is used as expectorant, emmenagogue, astringent, demulcent, antitussive, febrifuge, diuretic and catarrhal affections [9]. Several extracts obtained from Adiantum species had shown potential of antimicrobial activities [10]. Various phytochemical compounds such as alkaloids, tannins, triterpenoids, steroids and glycosides in the extracts of these plants supports their traditional uses as medicinal plants for the treatment of various ailments. In this paper we designed to synthesis of nanoparticles and antibacterial activities of Adiantum capillus veneris were investigated.

2. Materials and Methods

2.1 Collection of Plant Materials

The leaves of Adiantum capillus-veneris was collected from the fields, at the well surround wall in Sambavarvadakarai village, Tirunelveli District,Tamilnadu.

2.2 Preparation of the Extract

The leaves of Adiantum capillus-veneris were air dried and powdered. The powdered material weighing 100g were extracted with distilled water and filtered through Whatmann No.1 filter paper.

2.3 Synthesis of silver Nanoparticles

1mM aqueous solution of Silver nitrate ($AgNO_3$) was prepared and used for the synthesis of silver

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nanoparticles. 10 ml of plant extract of A. capillus -veneris was added into 90ml of aqueous solution of 1mM silver nitrate for reduction into Ag+ ions and kept at room temperature for 10-12 h. The collection of nanoparticles were further studies.

2.4 Antibacterial activity

The synthesis of silver nanoparticles of A. capillus -veneris was tested for antibacterial activity selected human pathogen such as Bacillus subtilis, Salmonella typhi, Streptococcus pyogenes, Staphylococcus aureus, Escherichia coli 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, extract and standard antibiotic erythromycin discs were placed in each plate as control. The plates were incubated at 28oC 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

3.1 Antibacterial activity

The results of the extract and synthesized silver nanoparticles obtained from Adiantum capillus-veneris leaves showed that maximum good activity against staphylococcus aureus (Table-1).

Table-1: Antibacterial activity of aqueous extract and nanoparticle

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

The zone of inhibition of extract and nanoparticle was represented in the table 1. Previously, A. capillus -veneris has been used as anti-fertility, anti-candidal, anti-viral, contraceptive, cough suppressant, blood cleanser, diaphoretic, diuretic, expectorant, hepatoprotective, menstrual stimulant and wound healer [11-12]. Earlier studies on ethanol, methanol, petroleum ether and aqueous extracts of Melia azedarach possess significant inhibitory effect against tested pathogens[13]. The use of plant extracts is effective against various microorganism including plant pathogens [14]. Oligodynamic silver antimicrobial efficacy extends well beyond its virotoxicity [15]. The utilization of various plants extracts for silver nanoparticles synthesis has to gain importance due to its various advantages such as eco-friendly, rapid, non-pathogenic and economical. Reduction and stabilization of silver ions are due to the combination of biomolecules such as amino acids, proteins, enzymes, alkaloids, saponins, terpenoids, phenolics, tannin and vitamins present in plant extracts. Earlier report, an antibacterial activity of plants is believed to be due to tannins, saponins, phenolic compounds, essential oils and flavonoids [16]. The conclusion of the present results observed that nanoparticles synthesized are good antibacterial activity.

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