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Original Article

GREEN SYNTHESIS OF SILVER NANOPARTICLE FROM LEAF EXTRACT OF AEGLE MARMELOS AND EVALUATION OF ITS ANTIBACTERIAL ACTIVITY

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ABSTRACT

Objective: The synthesis of metal nanoparticle is a growing area of research in modern material science and technology. Utilization of the silver nanoparticles in the field of biomedical nanotechnology and nanomedicines is rapidly growing because of their antimicrobial, anticancer, antioxidant property and less toxicity. Nanoparticles are synthesized by chemical methods, but are not eco-friendly. The objective of the study is to develop a fast, eco-friendly and convenient method for silver nanoparticle synthesis.

Methods: In this method utilization of the reducingproperty of *Aegle marmelos* leaf extract was done for synthesis of stable silver nanoparticles. Characterization of the metal nanoparticles was carried out by UV- Vis spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), X-ray Diffraction microscopy (XRD), Energy Dispersive X-ray spectroscopy (EDX) and zeta potential analysis.

Results: This result showed the average particle size of 15 -30 nm and spherical structure of stable silver nanoparticles. Green synthesized nanoparticles tested for its antibacterial activity by the well diffusion method. Silver nanoparticles had shown a more inhibitory effect against *Streptococcus pyogenes, Escherichia coli,* and *Pseudomonas aeruginosa* than *Staphylococcus aureus* and *Aeromonas hydrophila at* 25, 50 and 100 µg/ml concentrations.

Conclusion: This study is recommends the use of *Aegle marmelos* leaves for the synthesis of silver nanoparticles and can be applied as an antimicrobial agent.

Keywords: Nanoparticles, Aegle marmelos, Characterization, Antibacterial activity.

INTRODUCTION

Nanotechnology is one of the fastest developing science during the last few years. It is an interdisciplinary science that connects knowledge of biology, chemistry, physics, engineering and material science [1]. Remarkable advances are made in the field of biotechnology and nanotechnology to harness the benefit of life sciences, health care and industrial biotechnology [2]. It also have extensively been achieved for the treatments of cancer [3], diabetes [4], allergy [5], infection [6], inflammation [7] and cancer [8]. Novel properties of nanoparticles have been exploited in a wide energies, environmental remediation and biomedical devices [9]. It is a well-known fact that silver ions and silver-based compounds are highly toxic to microorganisms which include 16 major species of bacteria [10].

There are many ways to synthesize nanoparticles such as solid reaction, chemical reaction, co-precipitation and sol gel method, etc. The problem with most of the chemical and physical methods of nanosilver production is that they are very expensive and also involve the use of toxic, hazardous chemicals, which may pose potential environmental and biological risks [11]. In recent years, green synthesis of nanoparticles has several advantages over chemical synthesis, as green synthesis technique eliminates the use of energy, high pressure, temperature, and toxic chemicals. Moreover, green synthesized nanoparticles are compatible for biomedical and food applications [12]. The use of plant extracts to synthesize nanoparticles is receiving attention in recent times because of its simplicity. Also, the processes are readily scalable and may be less expensive. Plant extracts may act both as reducing agents and stabilizing agents in the synthesis of nanoparticles [13].

Aegle marmelos (Linn) Correa commonly known as Bael, belongs to family Rutaceae [14]. It is cosmopolitan, distributed the deciduous forests of India. It found almost in all the states of India [15]. The therapeutic value of the plant has been referred by almost all the ancient Ayurvedic treatises like Siddha, Unani, Sushruta Samhita and

Charaka Samhita etc. Bael tree is a medium sized deciduous tree with unusual branches surrounded by aromatic trifoliate leaves [16]. The products obtained from the bale being highly nutritive and therapeutic getting popularized in Indian and international market. In the last five decades, these plants have been extensively studied by advanced scientific techniques and reported the various medicinal properties, which are anticancer, antibacterial, antifungal, antidiabetic, antioxidant, hepatoprotective, hemolytic, larvicidal and anti-inflammatory activity [17]. It has chemicals like caumarins, steroids, alkaloids, tannins etc. [11].

The present work describes the easy and simple method of green synthesis of silver nanoparticles by reducing silver nitrate solution using an aqueous leaf extract of *Aegle marmelos*. Also assessment of the antibacterial activity of synthesized silver nanoparticles against *Streptococcus pyogenes, Staphylococcus aureus, Aeromonas hydrophila, Escherichia coli,* and *Pseudomonas aeruginosa*.

MATERIALS AND METHODS

Materials

For the synthesis of silver nanoparticles, *Aegle marmelos* leave was collected from the area of Madukkarai, Coimbatore, South India. The sample was authenticated by a botanical survey of India, the southern regional center, Coimbatore. Chemicals, media and solvents were purchased from Merck Limited, India.

Methods

Preparation of the extract

The extract was prepared by using 10 g fresh leaves of *Aegle marmelos*. Washed thoroughly thrice with distilled water, cut into fine pieces and transferred into a 500 ml Erlenmeyer flask, then 100 ml of distilled water was added in it and boiled for 10 minutes. Then the extract was cooled to room temperature and filtered with Whatman no. 1 filter paper.