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RESEARCH ARTICLE

SILVER NANOPARTICLES SYNTHESIS USING EXTRACTS OF *Clitorea ternatea* FLOWERS

[1]Gayathramma, K., [2]Pavani, K. V., [1]Aparajitha Banerjee and [1]Shah Suresh

[1]Department of Biotechnology, Presidency College, Kempepura, Hebbal, Bangalore- 500 024, Karnataka, India
[2]Department of Biotechnology, Gokaraju Rangaraju Institute of Engineering and Technology, Bachupally, Hyderabad-500 090, Andhra Pradesh, India

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ABSTRACT

There is an increasing demand for nanoparticles due to their wide applicability in various areas such as electronics, catalysis, energy, and medicine. In this study synthesis and characterization of silver nanoparticles using *Clitorea ternatea* flowers is reported. The reduction of silver (Ag+) was monitored using UV- visible spectrophotometry and showed formation of silver nanoparticles in 60mins. The reaction mixture exhibits an absorbance peak around 450 nm characteristic of Ag nanoparticle. Scanning electron microscopy (SEM) analysis showed silver nanoparticles was pure and polydispersed and the size were ranging from 10-50 nm. The approach of green synthesis seems to be cost efficient, eco-friendly and easy alternative to conventional methods of silver nanoparticles synthesis.

INTRODUCTION

Bio-nanotechnology is as amalgamation between biotechnology and nanotechnology for developing biological synthesis and environmental-benign technology for synthesis of nanomaterials. New applications of nanoparticles and nanomaterials are emerging rapidly. Silver nanoparticles are used as antimicrobial agents in surgically implanted catheters in order to reduce the infections caused during surgery as they possess anti-fungal, anti-inflammatory, anti-angiogenic and antipermeability activities (Kalishwaralal *et al.,* 2009; Gurunathan *et al.* (2009); Sheikpranbabu *et al.* (2009). Nanocrystalline silver particles have found tremendous applications in the field of high sensitivity biomolecular detection and diagnostics, antimicrobials and therapeutics, Catalysis and micro-electronics (Sahayaraj and Rajesh, 2011). However, there is still need for economic, commercially viable as well environmentally clean synthesis route to synthesize silver nanoparticles.

In the past few years, the potential of various plants for the synthesis of silver nanoparticles (SNPs) was explored. Several plants like *Cinnamon zeylanicum* (Sathishkumar *et al.,* 2009), Cuury leaves, (Laura *et al*., 2011) Neem (Tripathy *et al*., 2010), Sunflower, Spinach, Sugarcane (Arangasamy Leela and Munusamy Vivekanandan 2008), Eucalyptus (Manish Dubey *et al*., 2009), Coriander (Sathyavathi *et a*l. 2010), Capsicum (Shikuo *et al.,* 2007), Cassia auriculata flower (Velan *et al*., 2012), Papaya fruit (Jain *et al.,* 2009), Phyllathin extract (Kasturi *et al*., 2009) *Clitorea ternatea* is known as Butterfly pea and belongs to the family Fabaceae. It widely grows in tropical areas including Southeast Asia. Its flowers can be white, blue, or purple. The butterfly pea flowers are blue scabbards and flat, 6-12 cm long (Kalamani and Michael Gomez, 2003). It is used as a companion crop, an ornamental plant, or animal feed (Morris, 2009). Butterfly pea commonly known as Shankupushpam, is widely used in traditional Indian systems of medicine as a brain tonic and is useful for throat and eye infections, skin diseases, urinary troubles even in cattle, ulcer and antidotalproperties. (Malabodi and Nataraja, 2001).

***Corresponding author:** jaharisangu01@gmail.com

MATERIALS AND METHODS

Fresh flowers of widely growing *Clitorea ternatea* were picked randomly from the plants at the roadside areas near Presidency College, Hebbal, Bangalore, Karnataka, India. The flowers were washed thoroughly in running tap water for 5 minutes then the petals were separated from the flower (for the study) and kept for drying in a tray at room temperature.

Preparation of Crude Extracts

10 gm of dried flowers was used, which were cut into fine pieces and were crushed in motor and pestle using 100 ml methanol and then filtered using Whatman No.1 filter paper (pore size 25 µm). The filtrate obtained is dried in a vacuum drier and the powder was stored at 4^{o}Cor for further use. 100ml distilled water was added to the powder and the aquous extract was used for the studies.

UV-VIS Spectral analysis

The dried powder was added in 100ml distilled water and used for further studies. 1ml of aqeous flower extract was added into the 10ml of 5 mM Silver Nitrate The reduction of Ag+ to Ag0 was monitored by measuring the UV-Vis spectrum at different time intervals (range from 5- 120 min) within the range of 400 – 480 nm wave lenght in the UV-Vis spectrophotometer (ELICO-SL159).

Sample preparation for SEM

The samples were characterized using Cambridge Scanning Electron Microscope with EDAX attachment (CF) for the analysis of size and the presence of silver nanoparticles. The samples were sonicated before drop-casting on Silicon wafer, a very small amount of the sample were dropped on the grid, and excess solution removed using a blotting paper and then the film on the SEM grid were allowed to dry under a mercury lamp for 5 minutes. The SEM study was carried out in the Department of Chemical Engineering, Indian Institute of Science, Bangalore.

RESULTS AND DISCUSSION

The change in the colour of the solution was noticed when the silver nitrate solution was added to the flower extract. The change in the colour after 60 mins indicates the formation of silver nanoparticles. The silver nanoparticles displayed an optical absorption band peak at about 440 nm, typical of absorption for metallic silver nanoclusters, due to the Surface Plasmon Resonance (SPR), which increased with time till about 1 hour of reaction period and then gradually decreased [25]. The decrease in absorbance probably corresponded to the precipitation observed as the nanoparticles aggregated over time (Fig.1).

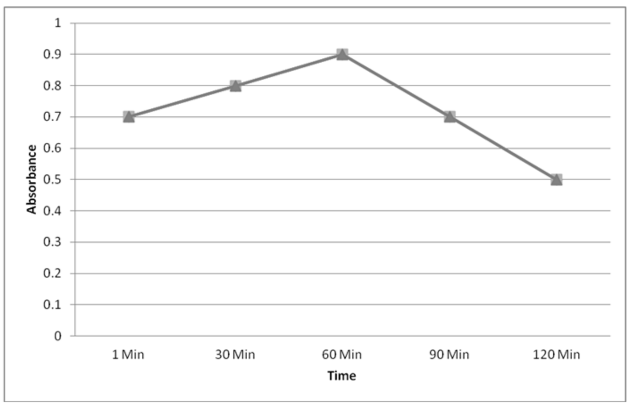

Fig.1. UV-Vis absorption spectrum of silver nanoparticles synthesized by treating 5mM aqueous AgNO3 solution with *Clitorea ternatea* flower extract at different time intervals

For silver nanoparticles, kmax values were reported in the visible range of 400–500 nm (Sastry *et al*. (1997). The optical absorption spectrum of metal nanoparticles is dominated by the SPR, which exhibits a shift towards the red end or blue end depending upon the particle size, shape, state of aggregation and the surrounding dielectric medium (Mock *et al*. (2002). The SEM image showed relatively spherical shape nanoparticle formed with diameter range 10-50 nm (Fig.2.). Similar phenomenon was reported by Chandran et al (2006).

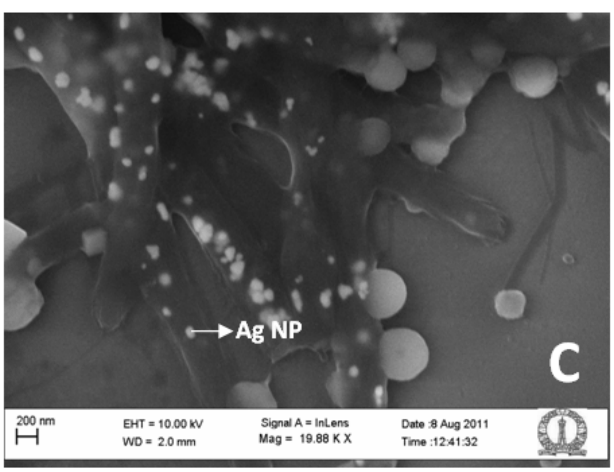

Fig. 2. scanning electron microscopic (SEM) image of silver nanoparticles (AgNPs). Polydispersed AgNPs ranged between 5–50nm.

Conclusion

Plants have emerged as an efficient candidate for the synthesis of nanoparticles. These biogenic nanoparticles are cost efficient, simpler to synthesize, and focus toward a greener approach. The methanolic extract of *Clitorea ternatea* flowers showed a very promising reducing effect on the reduction of Ag^{+} silver nanoparticles at room temperature. The characterization by UV Vis Spectroscopy, and SEM confirmed the formation of silver nanoparticles. The particles synthesized were in a range of 5-50 nm size with a uniform shape (cubic or spherical). The particles also tended to aggregate which suggests they may be useful in applications requiring the coating of materials. Nanoparticles of various sizes and properties may be obtained by further tapping the different plants in wild environment.

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