







# Antibacterial activity of silver nanoparticles phytosynthesized from *Glochidion candolleianum* leaves

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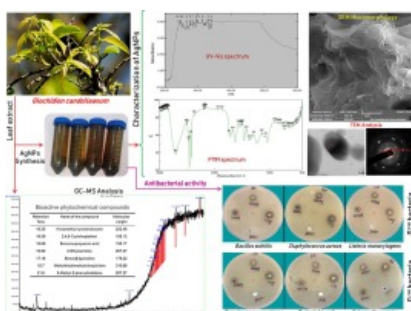
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## Abstract

In the present study, *Glochidion candolleianum* (Wight & Arn.) Chakrab. & M. Gangop. leaf (GCL)-ethyl acetate extract was used for the phytosynthesis of silver nanoparticles (AgNPs) and subjected to antibacterial assay with G<sup>+ve</sup> and G<sup>-ve</sup> bacteria. The GCL-AgNPs synthesized were characterized through various spectroscopic and microscopic analyses, while the phytochemical compounds was analyzed by GC-MS. The discrete GCL-AgNPs formed were micron-scale range. TEM images of AgNPs reveal that nanoparticles were spherical and ellipsoidal in shape, dispersed uniformly and capped with secondary material of  $\approx 10$ nm thickness. A maximum inhibition zone of 12.2mm diameter was observed against *Salmonella enterica* followed by 11.8mm diameter against *Pseudomonas aeruginosa*. GC-MS analysis revealed the occurrence of bioactive phytochemicals in GCL extract, hexamethylcyclotrisiloxane, 2,4,6-cycloheptatrien, benzenepropanoic acid, 2-ethylacridine, benzo[h]quinoline, methyltris(trimethylsiloxy)silane and 5-methyl-2-phenylindolizine. The findings suggest that GCL could be used for developing antibacterial AgNPs against pathogenic bacteria.

## Graphical abstract



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## Introduction

Nanotechnology is one of the well established fast growing field of science due to its multifaceted applications in agriculture, environment, medicine, and various other industries [1], [2]. Significantly, the application of AgNPs in the field of pharmacy is growing very rapidly because of its promising results. Green synthesis of AgNPs from plant resources is one of the emerging fields in phyto-nanotechnology [3]. Green synthesized AgNPs are cost-effective and environmental friendly with wide variety of biological properties, including antiviral, anticancer, antibacterial, and antifungal activities [4]. Even though the biosynthesis and applications of AgNPs as antibacterial agent are given much attention, the search for newer AgNPs from plants is currently being investigated in view of emergence of drug resistant pathogenic bacteria [5].

Phytosynthesis of AgNPs is a modern approach where various parts of several plant species have been utilized [5]. During phytosynthesis of nanomaterials, the role of reduction and stabilization is accomplished by phytochemical constituents present in plant parts [5]. The genus, *Glochidion* consists of >250 species and many of the species are used as traditional medicine in India, demonstrates various pharmacological activities: used to treat oedema, kidney troubles and snakebites, dysentery, fever and cough [6]. However, green synthesis of AgNPs from the species, *Glochidion candolleianum* (Phyllanthaceae) and their antimicrobial activity against G<sup>+ve</sup> and G<sup>-ve</sup> bacteria have not been researched yet. Hence, the current study has been aimed to phytosynthesize AgNPs from ethyl acetate leaf extract of *Glochidion candolleianum* and to test their antibacterial efficacy against G<sup>+ve</sup> and G<sup>-ve</sup> bacteria.

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## Section snippets

### Collection and preparation of leaf extract

Fresh *Glochidion candolleianum* (Fig. 1a) leaves (GCL) were collected from Shervaroyan Hills, Salem (Dt.), southern India, extracted with ethyl acetate and subjected to AgNPs preparation (Fig. 1b and c) as described by Balachandar et al. [3]...

### Physicochemical characterization of phytosynthesized AgNPs

The size, morphology, and physicochemical properties of GCL-AgNPs were characterized by Ultraviolet-visible, FTIR, TEM, and SEM analyses following the routine protocols provided in the supplementary data (SD.1)...

### Phytochemical analysis

GCL extract was studied by Agilent GC-MS 5977E...

## Results and discussion

The GCL-AgNPs formed were confirmed by the change of color from pale to deep brown which is considered as one of the indicators of green NPs formation [8]. Various phytochemical constituents in GCL can reduce the Ag<sup>+</sup> to Ag<sup>0</sup>. In the present research, the GCL extract was used for the preparation of AgNPs and tested for antimicrobial activity against selective G<sup>+ve</sup> and G<sup>-ve</sup> bacteria. The optical property of GCL-AgNPs was affirmed by absorption peak of UV-Vis spectra at 340nm which decreased...

## Conclusions

The AgNPs synthesized from ethyl acetate extract of *Glochidion candolleianum* leaves unique optical property confirmed with UV-Vis, FT-IR and SEM has considerable attraction. TEM analysis revealed that nanoparticles were distributed evenly without any physical contact between particles, indicating that the capping of secondary material was ≈10nm thickness. The antibacterial activity of GCL-AgNPs was found to be concentration dependent. The formation of AgNPs might be due to the presence of...

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper....

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