



# Phytogenic synthesis of nanoparticles from *Rhizophora mangle* and their bactericidal potential with DNA damage activity

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## HIGHLIGHTS

- Phytogenic synthesis of silver nanoparticles by *Rhizophora mangle*.
- Bactericidal activity of silver nanoparticles against significant human pathogens.
- Possible mode of action of silver nanoparticles on DNA.

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## ABSTRACT

The present study reports phytogenic synthesis of nanoparticles using aqueous extract of *Rhizophora mangle*. The synthesized nanoparticles were characterized using UV–Visible spectroscopy with maximum absorption at 400 nm. Fourier Transform Infrared spectroscopy (FT-IR) studies revealed the presence of functional groups mediating the synthesis of nanoparticles. X-ray diffraction (XRD) displayed Bragg's intensities at  $2\theta$  angle which confirmed the crystalline nature of the nanoparticles. Transmission Electron Microscopy (TEM) revealed size and shape of the nanoparticles with polydispersity of nanoparticles and size of 10–60 nm. The synthesized nanoparticles expressed antibacterial activity by well diffusion assay, broth micro dilution assay, minimal inhibitory concentration and CFU assay against selective human pathogens. Nanoparticles were more effective against *S. aureus* (MTCC 7443) followed by *B. subtilis* (MTCC 121), *E. coli* (MTCC 7410) and *S. typhi* (MTCC 7407). The possible mode of action of nanoparticles was studied by treating silver nanoparticles with pathogenic DNA which showed defamed and damage DNA in comparison with control DNA.

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## 1. Introduction

Nanoparticles are ultrafine entities with their size less than 100 nm [1]. In recent years, nanoparticles have gained immense interest due to their remarkable properties compared to their bulk counterpart [2–5]. These unique properties of nanoparticles have resulted in their innumerable applications in diverse fields like semiconductors, fluorescent probes, fuel cells, drug delivery

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systems, biocatalysts, biosensing and as antimicrobial agents [4]. Rapid expansion in the number of drug resistant microorganisms has resulted in tapping alternative antimicrobial agents and need for viable substitutes to existing antibiotics is one of the top priority research among the scientific communities [5]. The exuberant properties of nanoparticles can be one such alternative to combat drug resistant microorganisms. Synthesizing nanoparticles bearing antimicrobial properties is an exciting area but one of the major constraint includes conventional approaches to synthesize nanoparticles and most of these methods are bound with various limitations [2,6,7]. Some of the major limitations include production of environmental pollutants, employment of toxic substances and generation of high energy, thus restricting their application in biomedical sector [8–10]. In order to cope with these