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Research Article

Green synthesis and evaluation of the antibacterial activity of Silver nanoparticles from *Bambusa affinis* leaves

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ABSTRACT

Silver nanoparticles (ZnNPs) were synthesized by employing *Bambusa affinis* leaves extract having a particle size of 24.18 nm from TEM. SEM represents the globular shapes of nanoparticles. The color of the AgO / *Bambusa affinis* extract solution changed from colorless to dark yellowish. Four IR bands are observed at 3235 cm^{-1}, 1874 cm^{-1}, 1334 cm^{-1}, and 456 cm^{-1}, signifying the presence of portentous molecules as a capping agent for Silver nanoparticles. The antimicrobial potency of green synthesized AgNPs was studied against *Escherichia coli*. As compared to the control which showed a 48% zone of inhibition, the green synthesized nanoparticles significantly increased the zone of inhibition to 61%.

Keywords: *Bambusa affinis*, *Escherichia coli*, Nanoparticles, Silver

INTRODUCTION

Nanotechnology manipulates substances on an atomic, molecular, and macromolecular at nanoscale level [1]. The principle of nanotechnology is to raise the surface area which manipulates particles in designing, characterizing, manufacturing, and practical application of structures at the atomic level around 0.20 nm up to around 100 nm. Silver nanoparticles (AgNPs) have a potent activity due to their unique physical, biological, and chemical properties [2]. AgNPs are renowned to exhibit a high antimicrobial action against a variety of microorganisms such as bacteria, viruses, and fungi due to their smaller size and higher surface area [3]. AgNPs are also widely used for their anti-fungal, anti-inflammatory, and anti-viral properties.

The presence of multidrug-resistant pathogens has increased the number of infectious diseases and became the main cause of death in the world as per WHO. Broadly misuse and high abuse of antibiotics are the prime reason for antibiotic resistance in the bacteria[4]. Thus, the development of a new and natural antimicrobial agent is needed as there is a growing concern about multidrug-resistant food-borne pathogens [5].

Bambusa affinis has the capability to serve as antibacterial activity [6]. In the present study, *Bambusa affinis* was used to synthesize AgNPs. The aim of the current research work study was to determine the antimicrobial action of green synthesized AgNPs against *E. coli* by employing the agar plate method.

MATERIALS AND METHODS

Preparation of Silver Nanoparticles

The *Bambusa affinis* leaf extract was synthesized by the following procedure. 25 g of *Bambusa affinis* leaves were added to a 500mL beaker along with 100 mL of distilled H_2O and maintained at 60°C for 20 min previous to decanting it. The solution was filtered by a 0.45 µm Millipore filter membrane. For the synthesis of Silver nanoparticles, 50 mL of AgO (0.5 mM) was

reacted with 25 mL of the *Acalypha indica* extract in an Erlenmeyer flask at nearly room temperature. The synthesized green AgNPs were characterized by UV-visible spectroscopy, (FTIR), and TEM.

Characterization

The functional and composition of Ag nanoparticles were characterized by FTIR, spectroscopy [7]. Additionally, the optical property of prepared Ag nanoparticles was analyzed via UV-visible spectrophotometer [8]. The size of the nanoparticles is in the range of 104nm (Fig 1) and zeta potential signifies stability (Fig 2).

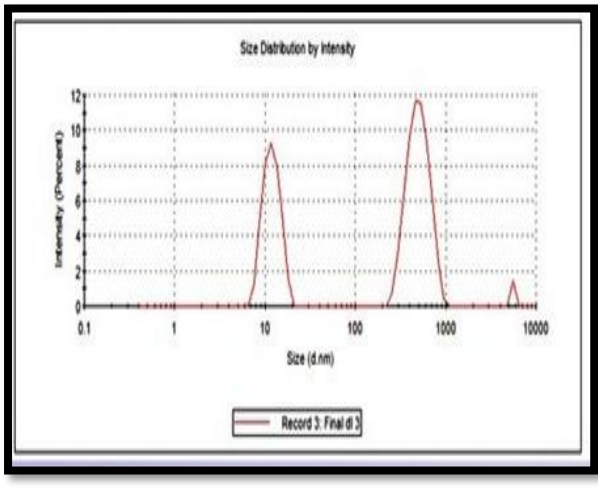

Fig 1. PSA of nanoparticles

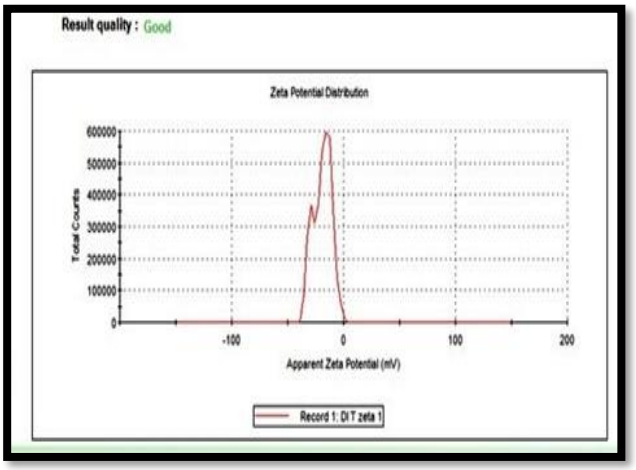

Figure 2: Zeta potential of nanoparticles

The morphology features of the prepared Ag nanoparticles were analyzed by instruments named as TEM (Fig 3) and SEM (Fig 4).

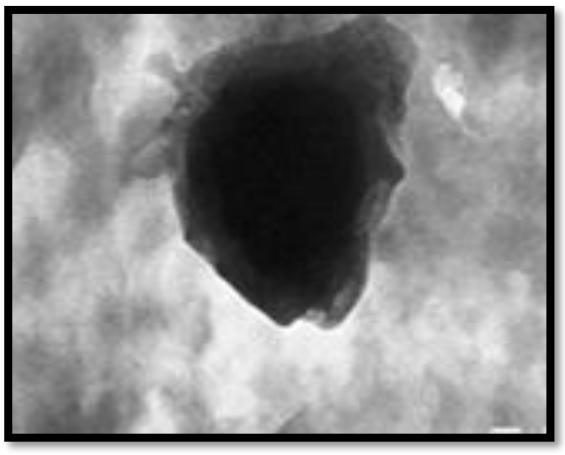

Fig 3 TEM image

Ag nanoparticles were sonicated for 30 min by a sonicator. The particle size distributions were determined using PSA.

The antimicrobial activity was assessed by the agar method.

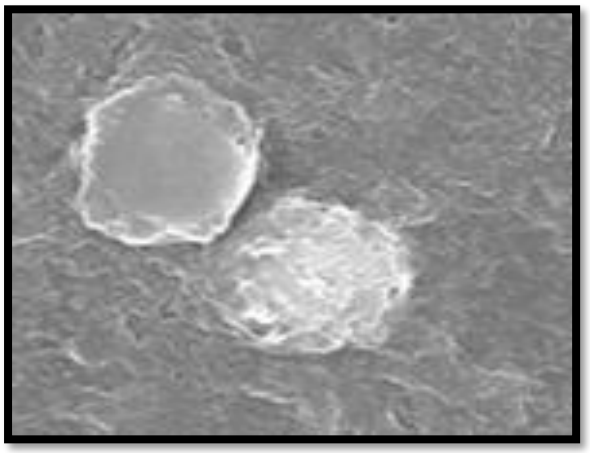

Fig 4 SEM image

RESULTS AND DISCUSSION

Characterization of AgNPs

The color of the AgO / *Bambusa affinis* extract solution changed from colorless to light yellowish green after 10 min and eventually to dark yellowish [9]. This color change indicates the synthesis of Ag nanoparticles in the solution. *Bambusa affinis* extract without AgO did not show any color changes.

The synthesis of Ag nanoparticles was further confirmed by using UV-visible spectroscopy, FTIR, and TEM. A broad absorption peak was observed at 412 nm [10],

Four IR bands are observed at 3235 cm^{-1}, 1874 cm^{-1}, 1334 cm^{-1}, and 456 cm^{-1}. The intense broadband at 3235 cm^{-1} is due to N−H and O−H stretching modes in the linkage of the proteins [11]. From the image, it is evident that the morphology of Silver nanoparticles is spherical which is in agreement with the shape of the SPR band in the UV-vis spectrum. The average particle size measured from the TEM image[12] was 24.18 nm.

Antibacterial activity by agar plate method

The zone o inhibition was measured by a scale and the measurements were tabulated. As compared to the control which showed a 48% zone of inhibition, the green synthesized nanoparticles significantly increased the zone of inhibition to 61%. Thus, current findings suggested remarkable anti-microbial activity of green synthesized AgNPs against *Escherichia coli*.

CONCLUSION

During experiments, we reported a green approach for the synthesis of Ag nanoparticles using *Bambusa affinis* leaves extract. Furthermore, an increased zone of inhibition was also reported against *E.coli* by newly synthesized green AgNPs. Hence, the applications of AgNPs might offer valuable services in diverse medical and nonmedical fields.

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