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Research Article

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Antimicrobial activity of silver nanoparticles synthesized from *Aspergillus species* against common oral pathogens

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ABSTRACT

In the present investigation the antimicrobial activity of silver nano-particle synthesis from Aspergillus sp. was investigated against common oral pathogen. **,** *yeast like Candida glabrata, Candida albicans, and bacteria like Pseudomonas aeruginosa, Streptococcus mutans . In these tests, Muller Hinton agar plates were used and silver nanoparticles of various concentrations were supplemented . It was observed that yeast were inhibited at the low concentration of silver nano-particles, where as the growth-inhibitory effects of bacteria were inhibited at mild. The results indicate that the silver nanoparticles might be exploited as medical devices for the treatment of several infectious diseases caused by these organisms.*

Keywords: Antimicrobial activity, Silver nano-particles, Inhibitory effects.

INTRODUCTION

Due to the outbreak of the infectious diseases caused by different pathogenic bacteria and the development of antibiotic resistance the pharmaceutical companies and the researchers are searching for new antibacterial agents [1] In the present scenario nano-scale materials have emerged up as novel antimicrobial agents owing to their high surface area to volume ratio and its unique chemical and physical properties [2,3].

The antimicrobial activity of silver has been recognized by clinicians for over 100 years [4]. In addition, reports suggest that hygienic benefits have been associated with the use of silver for considerably longer. However, it is only in the last few decades that the mode of action of silver as an antimicrobial agent has been studied with any rigor [5]. The first recorded medicinal use of silver was reported 448 during 8th century [6].Silver nano-particles have also been demonstrated to exhibit antimicrobial properties both against bacteria [7] and viruses [8].

Despite this, the principle activity of silver is as a result of the production of silver ions within an aqueous matrix[9]. Silver ions interact with a number of components of both bacterial, protozoan and fungal cells. They interact with a wide range of molecular processes within microorganisms resulting in a range of effects from inhibition of growth. The mechanism depends on both the concentration of silver ions present and the sensitivity of the microbial species to silver.

However, the spectrum of activity is very wide and the development of resistance relatively low, especially in clinical situations. Colloidal silver solutions (CSSs) have an increased interest due to their antimicrobial properties, with large applications including pharmacology, human and veterinary medicine, food industry, water purification [10]. Thus in the present investigation, the silver nano particles synthesized from strain *Aspergillus sp.* were evaluated for antimicrobial activity against common oral pathogens.

EXPERIMENTAL SECTION

2.1 MATERIALS:

All chemical agents including AgNO3 were obtained From Hi media laboratories.

2.2 Synthesis of silver nanoparticles:

The *Aspergillus sp.* strain isolated from soil was studied. Fungal biomass used for the biosynthetic experiments was grown aerobically in a liquid medium containing (g/l): KH_2PO_4 4.0; K_2HPO_4 2.5; $MgSO_4.7H_2O$ 0.125 $(NH_4)_2SO_4$ 1.0; yeast extract 0.4; glucose 10.0. After the incubation, the biomass was filtered (Whatman filter paper No. 1), and later extensively washed with distilled water to remove any medium components. The resulting fresh and clean biomass was taken into the Erlenmeyer flasks , containing 250 ml OF de-ionized water.. Then the biomass was filtered again (Whatman filter paper No. 1) and the cell-free filtrate was used in the following experiments. $AgNO_3$ at the final concentration of 1 mM was added to the cell-free filtrate and at 25 ±C in da. Control (without the silver ions) was also run along with the experimental flasks. The concurrent studies include time dependent formation of silver nano-particles employing UV-Vis spectrophotometer in the range of 200–800 nm.

2.3 Procurement and maintenance of test pathogens:

The various human pathogenic microorganisms were procured from Microbial Type Culture Collection (MTCC), Institute of Microbial Technology (IMTECH), Chandigarh, which included Gram positive bacteria, *Streptococcus mutans* (MTCC 497), *Pseudomonas aeruginosa* (MTCC 2295), and a yeast *Candida albicans* (MTCC 3017). The slants of brain heart infusion agar were made to preserve the cultures. All the slants were kept at 40ºC in the refrigerator for further studies.

2.4 Agar well diffusion method:

Antimicrobial activity of Ag nano-particle of strain *Aspergillus sp.*were tested using agar well diffusion method [11]. 200µl of bacteria were aseptically introduced and spread using cotton Swabs on surface of gelled sterile Muller Hilton agar plates. A well of about 6.0mm diameter With sterile cock borer was aseptically punched on each agar plate. 50µl of the silver nano-particle from were introduced into the wells in the plates. Plates were kept in laminar flow for 30 minutes for pre-diffusion of extract to occur and then incubated at 37ºC for 24 hours. Resulting zone of inhibition was measured using a Hi-media zone scale.

RESULTS AND DISCUSSION

In the present investigation, the antimicrobial activity of silver nano particle of strain *Aspergillus sp.* was evaluated against gram positive and yeast using well diffusion technique. Results of the experiment are being concluded in the Table 1 and Fig. 1 which clearly shows the anti-microbial activity of Ag nano particle of strain *Aspergillus sp.* The summarized findings of the Table.1 states that the of Ag nano particle of strain shows maximum antimicrobial activity against the test pathogen *Streptococcus mutans* with zone of inhibition range of 23mm also showed significant antimicrobial activity with the zone of inhibition against *Pseudomonas aeruginosa* of 22mm. whereas *C. albicans* was found to show a zone of inhibition of 21mm The encouraging results indicate that the silver nanoparticles of strain *Aspergillus sp.* might be exploited as a drug for the treatment of several infectious diseases caused by these organisms .

Silver has been used for its well known antimicrobial properties since roman time however the advances in generating AgNPs have made possible a revival of the use of silver as a powerful bactericide [27]. Many researchers [28] used *Escherichia coli* as a model for gram negative bacteria and proved that AgNPs may be used as an antimicrobial agent. Other workers [29] also opined that the AgNPs have an antimicrobial effect on *S. aureus and E. coli*. In the present study 0.002 mg of the nanoparticles was taken as final product for antimicrobial assay.

Table 1. Zone of inhibition (mm) of nanoparticles against bacterial strains tested.

Organism	Zone of inhibition (mm)
Pseudomonas aeruginosa	22mm
Candida albicans	21mm
Streptococcus mutans	23mm
Candida glabrata	16mm

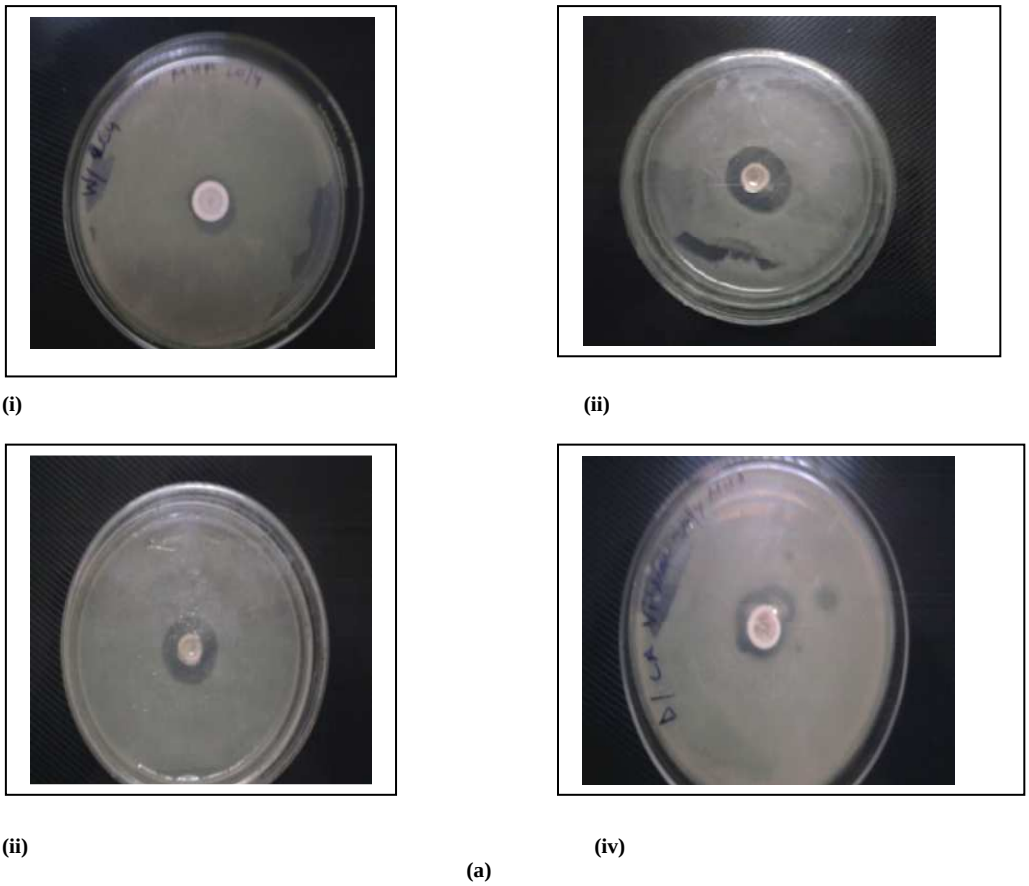

Fig 1. (a) Antimicrobial activity of silver nanoparticles against (i) Candida glabrata (i) Streptococcus mutans (iii) Pseudomonas aeruginosa and (iv) Candida albicans. (b) Absorption spectra of Ag nanoparticle solutions (A). The solid line is for Ag nanoparticle solution as prepared, and the dotted one is for the solution left after the Ag nanoparticles are removed by sedimentation.

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