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RESEARCH ARTICLE

SYNTHESIS OF SILVER NANOPARTICLE AND ITS ANTIBACTERIAL ACTIVITY OF *Schizophyllum commune*

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ABSTRACT

Schizophyllum commune is an edible and medicinal mushroom. It is a very good nutritional source of proteins, vitamins, lipids and minerals. This mushroom has been considered as the popular food and an effective medicine to treat several diseases. In the present investigation the strain *Schizophyllum commune* was collected from Microbial Type Culture Collection at Chandigarh. The sample was maintained in Malt Yeast Extract Broth. The cell free filtrate used for biosynthesis of silver nanoparticles. The UV-visible studies indicated the surface Plasmon resonance at 343 nm which depicts the formation of silver nanoparticles. The synthesized nanoparticles showed an effective antibacterial activity against pathogens of gram positive and gram negative bacteria. The above study will concluded that the nanoparticles had potent effect on inhibiting methicillin resisitant bacteria.

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INTRODUCTION

Mushrooms have long been appreciated for their flavor and texture. Now they are recognized as a nutritious food as well as an important source of biologically active compounds of medicinal value (Breene, 1990). Mau *et al.* (2002) reported that medicinal mushrooms are commonly used for pharmaceutical purposes and as health foods. Hence, searching for new biological activities and other medicinal substances from mushrooms and to study the medicinal values of these mushrooms has become a matter of great significance. *Schizophyllum commune* is probably the most widespread fungus in existence, being found on every continent where there is wood to be used as a substrate. It is an edible mushroom which belongs to the family Schizophyllaceae (Alexopoulos *et al.,* 1996). The family Schizophyllaceae contains only one genus; *Schizophyllum* and there is a single common worldwide species, although there are a few less common species of *Schizophyllum*. The genus name means "split gill," and thus it is called the split gill fungus. Nanotechnology is a fast growing area of modern science due to its promising applications in the field of medicine due to variable size, shape, chemical composition and controlled disparity and their potential use for human benefits. The most predominately studied nanoparticles are those from the noble metals Ag, Au, Pt, and Pd among them silver nanoparticles play a significant role in biology and medicine (Philip, 2009). The present study includes biological synthesis of silver nanoparticles and characterized UV-vis spectrophotometer. An antibacterial activity test was conducted to methicillin resistant bacteria *Staphylococccus aureus* observe differences in antibacterial activity among the silver nanoparticles obtained.

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MATERIALS AND METHODS

Culture Maintenance

The strain *Schizophyllum commune* was collected from Microbial Type Culture Collection Centre at Chandigarh. The sample was maintained at 25˚C on malt yeast extract broth. The fungal filtrate used for biosynthetic experiments.

Formation of silver nanoparticle (Nithya *et al*., 2009)

The cell free filtrate was obtained by filtration of the *Schizophyllum commune* using Whatmann. No.1 filter paper.

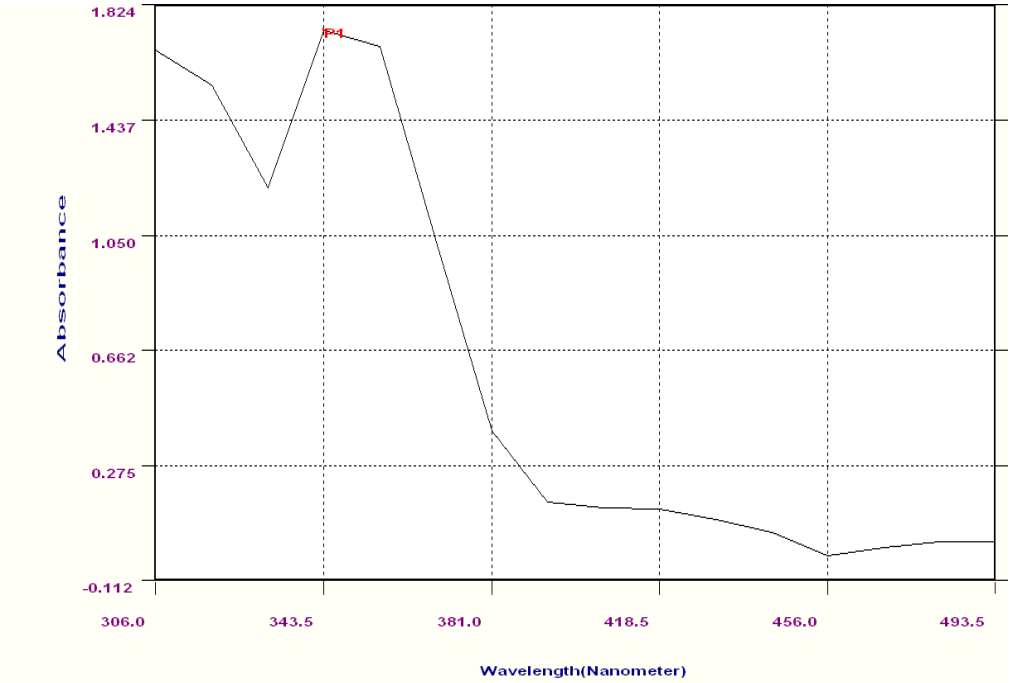

Fig. 1. UV-VIS Spectrum analysis of schizophyllum commune

Table 1. Antibacterial activity of nano particle synthesized and non synthesized strains of *Schizophyllum commune*

Strains	Nano particle synthesized strain (mm)	Non synthesized strain (mm)	1 mM $AgNO_3$ (mm)	Methicillin (mm)
Bacillus subtilis	6	2	3	-
Escherichia coli	6	3	3	-
Klebsiella pneumoniae	10	2	4	-
Staphylococcus aureus	10	1	5	-

For the synthesis of silver nanoparticles 20ml of the cell free filtrate was brought in contact with 1mM final concentration in 150 ml Erlen Meyer flask and agitated at 25˚C in dark conditions under normal pH. Simultaneously control without silver ions was also run along with the experimental flasks.

UV-VIS spectrum analysis ((Nithya *et al.*, 2009)

The reduction of silver ions was monitored by measuring the UV-VIS spectrum of the reaction medium at 24 hr time interval by drawing $1cm^3$ of the sample and the absorbance was recorded at a resolution of 1 nm, between 300 and 500 nm, using 10 -mm -optical- path- length quartz cuvettes (ELICO SL 159 UV - VIS nanodrop spectrophotometer).

Antibacterial activity (Hae Kim *et al.*, 2007)

The antibacterial activity of the synthesis of silver nanoparticles, cell free filtrate, Methicillin and $AgNO_3$ tested against the selected bacterial strains. The 20ml of sterilized agar medium was poured into each sterile petriplates and allowed to solidify. The test bacterial cultures were evenly spread over the appropriate media by using a sterile cotton swab. Then a well of 0.5cm was made in the medium by using a sterile cork borer, synthesis of silver nanoparticle, cell free filtrate $AgNO_3$ and Methicillin were transferred into separate wells. These plates were incubated at 37^0C for 24 hours. After incubation period, the results were observed and measured the diameter of inhibition zone around the each well.

RESULTS AND DISCUSSION

Mulvaney, 1996 investigated the change in colour of the reaction mixture from colourless to reddish brown is observed within minutes of photoirradiation. AgNp shows light brown colour in water which is a clear indication for the formation of AgNPS. Shankar *et al*., 2004 studied the nanoparticles exibit brown colour in aqueous solution due to exicitation of surface Plasmon vibration in silver nanoparticles. Ahmad *et al*., 2002, reported that the appearance of a yellowish brown colour in the reaction vessels suggested the formation of silver nanoparticles. In the present study the change in colour of the solution was recorded by visual observation. The cell free extract when challenged with 1 Mm $AgNo_3$ changed colour from pale yellow to brown colour in 48 hours and attained maximum intensity after 72 hours with intensity increasing during the period of incubation indicates of the formation of silver nanoparticles. The colour arises due to excitation of surface Plasmon resonance (SPR) in the metal nanoparticles. Mulvaney *et al.*, 1996, investigated the UV-visible spectra recorded as absorbance versus reaction time during the synthesis of AgNPs from aq. 10^{-3} $AgNo_3$ and extracellular filtrate of the mushroom *Pleurotus florida* biomass mixture. It is observed that the band corresponding to surface Plasmon resonance occurs at 435 nm which clearly indicates the formation of AgNPs in the reaction mixture. Noginov *et al*., (2008) reported that the formation of silver nanoparticles from 1mM solution of silver nitrate and auric acid was confirmed by using UV- vis spectral analysis. Metal nanoparticles such as

silver have free electrons, which gives rise to a surface Plasmon resonance (SPR) absorption band. Rai *et al*. (2006) reported that the presence of AgNPs exhibiting yellowish brown colour in solution due to excitation of surface of Plasmon vibrations. In the present study UV-VIS Spectrum obtained from biologically synthesized silver nanosolution. Formation of metal nanoparticles provided surface Plasmon resonance exists for the metal Plasmon vibration and the peak at 343 nm corresponded (Fig.1). Feng *et al.* (2000) investigated that the inhibitory action of silver ions on microorganisms show that upon silver ion treatment DNA loses in its replication ability. Yamanaka *et al*., (2005) investigated that the expression of ribosomal subunit proteins as well as some other cellular proteins and enzymes essential to ATP production becomes inactivated. Nithya and Ragunathan (2009) reported function of the silver nanoparticles against gram negative and positive organisms. The present study clearly indicates that *Pleurotus sajor caju* has good antibacterial action against gram negative organism *Pseudomonas aureuginosa and Escherchia coli* when compared to gram positive organism *Staphylococcus aureus*. In the present study the synthesized silver nanoprticle and standard antibiotic was tested on bacterial strain *Staphylococccus aureus, E.coli, Klebsiella pneumoniae and Pseudomonas aureuginosa*. The formation of clear zone (restricted bacterial growth) around the cavity is an indication of antibacterial activity. The result indicated that synthesized silver nanoparticles from *Schizophyllum commune* has stronger activity than silver nitrate and standard antibiotic (Table 1).

Conclusion

The biological process involved in the formation of silver nanoparticles using *Schizophyllum commune.* The nanosilver was found to have wider antibacterial activity to Gram positive and Gram negative bacteria. Silver nanoparticles can be used effectively against multidrug resistant bacteria due to their small size and relatively large surface area in comparison to their volume makes easy to interact with substances and increases their antibacterial efficacy. The biosynthetic method developed in this study for producing silver nanoparticles showed distinct advantages over chemical methods such as high biosafety and being ecofriendly and non toxic to the environment.

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