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Biosynthesis of silver nanoparticles using the *Agaricus bisporus* (Button Mushroom) extract

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ABSTRACT

Biosynthesis of silver nanoparticles using ***Agaricus bisporus*** was carried out. The large-scale application of silver nanoparticles (AgNPs) in areas such as chemical sensing, nanomedicine, and electronics has led to their increased demand. The Silver nanoparticles were characterized with the help of X-Ray Diffraction and FTIR (Fourier Transform Infrared Spectroscopy). The XRD confirms the formation of nanoparticles and size of nanoparticles was found to be 27.33 nm. The FTIR gives the prominent bands of absorbance at 1627 cm^{-1}, 2923.45 cm^{-1} , 3442.44 cm^{-1} .The observed peak 3442.44cm^{-1} denote the occurrence of O-H stretching bond of alcohol functional groups. These groups may responsible for efficient capping and stabilization of silver nanoparticles.

Keywords: Silver nanoparticles, *Agaricus bisporus* extract, biosynthesis, XRD, FTIR.

INTRODUCTION

The medicinal plants are easily accessible in every part of India. Such medicinal plants have large applications in nanotechnology. These plants have great significance in Ayurveda [1]. The silver nanoparticles were synthesized using Ocimum sanctum (Tulsi) leaf extract. The prepared nanoparticles were characterized by XRD, UV, TEM, and FTIR [2]. The gold nanoparticles using *Mentha arvensis* leaf extract was prepared. The gold nanoparticles were found in spherical and hexagonal shape from TEM [3].

The silver nanoparticles were prepared from medicinal plants. The silver nanoparticles were synthesized using the leaves of *Svensonia hyderobadensis* and the stem barks of *Boswellia, Shorea* species. These nanoparticles showed the best antimicrobial activity against various microorganisms [4]. The biological synthesis of nanoparticles is ecofriendly and cost effective [5]. The silver nanoparticles was synthesized using mangrove plant extract [6].

METHODOLOGY

The *Agaricus bisporus* was collected for biosynthesis of silver nanoparticles. The *Agaricus bisporus* was cut into small pieces and 10 gm of pieces was added into 100 ml deionised water and extract was prepared for further study. The silver nitrate solution of 1mMole was prepared and 20 ml extract was added in 1mMole $AgNO_3$ solution and the solution was heated up to 80^o C. This solution was stirred up to three hours. The colour of solution was changes from pale yellow to light brown to dark brown. It was indicated that the formation of silver nanoparticles. Kept this flask at room temperature for overnight and silver nanoparticles settled at the bottom of this solution. The silver nanoparticle was obtained by centrifugation method at 15000 RPM for 30 minutes and this process is repeated. Then the silver nanoparticles were dried in oven at 80^{0}C.

RESULT AND DISCUSSION

The Button Mushroom is shown in Fig.1. The 1m Mole $AgNO_3$ solution and extract of the Button Mushroom is shown in Fig. 2. The extract of the Button Mushroom is added in 1mMole $AgNO_3$ solution which showed the color change of the solution and shown in Fig. 3.

Fig.1: Button Mushroom (*Agaricus bisporus*)

Fig. 2: 1mMole $AgNO_3$ solution and Extract

Fig. 3: 1mMole $AgNO_3$ + Extract

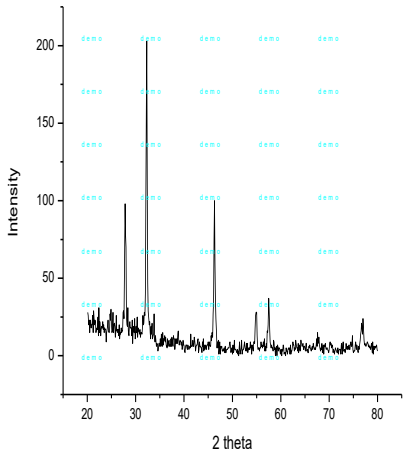

Fig.4: XRD of Silver nanoparticles

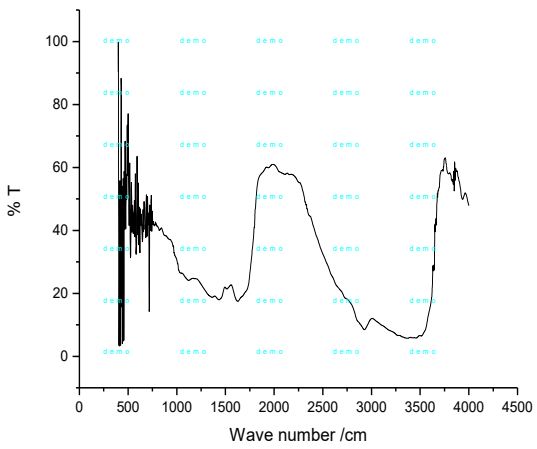

Fig.5: FTIR of Silver nanoparticles

X-Ray Diffraction:

The XRD pattern of synthesized AgNPs using extract is as shown in Fig.4. The sample demonstrated a high crystallinity level with diffraction angles (2θ) of 26.18^0, 32.3^0, 46.3^0, 54.1^0, and 57.5^0. The size of nanoparticles determined using debye-scherrer equation.

$$D = \frac{0.9 * \lambda}{\beta * Cos(\theta)}$$

Where, D= grain size, β= Full Width at Half Maxima (FWHM), θ = Corresponds to angles of diffraction peaks.

The average size of nanoparticles was found to be 27.33 nm.

Study of FTIR Spectrum:

FTIR spectra of biosynthesized AgNPs using *Agaricus bisporus* (Button Mushroom) were shown in Fig.5. The FTIR Spectra were used to identify the capping reagent and stability of the metal nanoparticles present in *Agaricus bisporus*. The FTIR gives the prominent bands of absorbance at $1627cm^{-1}$, $2923.45cm^{-1}$, $3442.44\ cm^{-1}$. The observed peak $3442.44cm^{-1}$ denote the existence of O-H stretching bond of alcohol functional groups.

CONCLUSION

The Silver nanoparticles using Button Mushroom extract was successfully prepared. The biosynthesis method is ecofriendly and easily developed in laboratory. The size of Silver nanoparticles was recorded 27.33 nm from XRD. The peaks were recorded at $1627\ cm^{-1}$, $2923.45\ cm^{-1}$, $3442.44\ cm^{-1}$ from FTIR. The observed peak $3442.44cm^{-1}$ denotes the presence of O-H stretching bond of alcohol functional groups.

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Conflicts of interest: The authors stated that no conflicts of interest.

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