

Review on *Morchella esculenta* use in the environmentally friendly synthesis of silver nanoparticles in Thannamandi District (J and K), India

ABSTRACT

In the present study, a review on biological methods used for the synthesis of stable and well-characterized AgNPs were discussed. Size and shape are controlled by changing conditions such as substrate concentration, temperature, mixing speed and exposure time. Specimen of dried mushrooms were used for AgNPs production. AgNPs are synthesized using a green line of nanoparticles synthesis. Silver nitrate has been used as a source of Silver and *Morchella esculenta* mold has been used as a fuel for bio-reduction and synthetic nanoparticles. During the synthesis of AgNPs, the first confirmation of the synthesis of nanoparticles was the change in color reaction from yellow to dark red. The formation of Ecofriendly nano particles has been bringing a green revolution in treating wastewater and to reduce soil contamination.

Keywords: *Morchella esculenta*, Edible Mushrooms, Nanoparticles synthesis, AgNPs, Green technology, Bioremediation

1. INTRODUCTION

Morchella Esculenta

COMMON NAME:

Commonly called 'guchhi' in India. Commonly known as common morel, morel, yellow morel, real morel and morel mushrooms.

HABITAT:

It grows on rich human soil in wild places. *Morchella* thrives in the highlands with a cool climate. It is seen in India from the northwest of the Himalayan region, especially from Jammu and Kashmir, Himachal Pradesh and Uttar Pradesh. It contains a variety of natural habitats such as forest waste, tropical and subtropical climates.

STRUCTURE:

Head: oval to slightly cylindrical or slightly tapered upwards, but rarely very similar.

Ribs: initially resembling the color of holes and close together, gradually spreading as the head grows larger and whiter than holes; usually white to creamy white, with rust yellow or brown rust; waxier than velvety; falling or squirming in old age.

Holes: usually rounder than ripe; pale gray to red when young, brown, or golden brown as the seeds ripen.

Stem: ivory white or pale cream; appearing to be covered with delicious food in his youth; top layer extended according to age; a foundation that is often enlarged, appears broad or collected.

Spore size: 21–25 (-28) x 12–16 µm.

NUTRITIONAL CONTENT:

Morchella esculenta a famous mushroom all through the globe due its nutritional and nutraceutical assessment. It contains various crucial nutrients such as proteins (32.7%), vitamins (Vit B, C and D) , carbohydrates (38%), dietary fibers(17.6%), minerals, trace rudiments (Copper 21 mg/kg, Manganese 22 mg/kg, Cobalt 0.12 mg/kg, Zinc 153 mg/kg, Iron 304 mg/kg, Calcium 2340 mg/kg and Magnesium 1272 mg/kg, dry weight basis) (Genccelep et al., 2009).s

BIOACTIVE COMPOUNDS:

Morchella esculenta fruiting body consists of an assortment of forms of bioactive compounds which include tocopherols, carotenoids, organic acids and phenolic compounds. Tocopherols consist of α -tocopherol γ -tocopherol and δ - tocopherol. Carotenoids contain β -carotene and Lycopene. Organic acids enclose oxalic acid, quinic acid, fumaric acid, citric acid and malic acid. PCoumaric acid, p-Hydroxybenzoic acid and Protocatechuic acid are phenolic compounds frequently contained by morel mushrooms (Heleno *et al.*, 2013).

Rarely it is used for curative of various diseases i.e. intestinal, gastric problem, general body tonic, arthritis, general weakness, stomach problems, also heal the wound, skin beautification, purgative and worn as an emollient (Wagay and Vyas, 2011). Chemotherapy and radiotherapy are the up to date techniques used for the treatment of cancer but it has destructive effect on human health. In China, Japan, Korea, Russia and America customarily extracts of Yellow morel are used for treatment of cancer, brain tumors and cardiovascular disease. An assortment of phenolic, tocopherols, organic acids, carotenoids and bioactive compounds reported in *Morchella esculenta*.

2. MATERIAL AND METHODS

PROCESSING OF PLANT MATERIAL:

The study area of the present work was Thannamndi, District Rajouri which is the Northern part of Jammu and Kashmir with sub Mediterranean type of climate. Extensive field survey was carried out different areas and a good number of edible and non-edible mushrooms species were collected. *Morchellas* were collected and washed thoroughly under running tap water to remove all adhering soil. The washed *Morchellas* were then shade dry for more than for 15 days. The dried leaves materials were then cut into small pieces and used as working material for AgNPs synthesis.

PREPARATION OF PLANT EXTRACT:

The Mushroom fragments suspended into distilled water and boiled it for few minutes. Allow it to stand at room temperature for few hours, than heat the solution having mushroom pieces at 40 to 45⁰c for few minutes; allow it to stand again for 30 minutes, and then finally heat the mixture at 50⁰c for 5 minutes. The *Morchella esculenta* extract was filtered through Whitman's filter paper. Then take pure sample of extract and allow it to stand at room temperature for 36 hours.

PREPARATION OF SILVER NITRATE:

Fresh sliver nitrate solution was prepared for the synthesis of the AgNPs, by dissolving 1 mM solution in 100 ml of distilled water. The solution then prepared was filter with the help of Whatman paper No1.

BIOSYNTHESIS OF NANOPARTICLE:

Fresh *Morchella* extract and sliver nitrate extract was mixed in different ratios to select the best for the synthesis of AgNPs. Finial 1:9 ratio was selected after the initial exercise. The selected ratio was used for the further work.

The extracts of both Fungi and Sliver were mixed in above said ratio, the reaction mixture kept at room temperature for 36 hours. The solution color changes from lighter yellow to dark brown. The supernatant was discarded and the pellet obtain was redispersed in deionized water. The centrifugation process was repeated two to three times to wash off

any absorbed substances on the surface of silver nanoparticle. After that solution color change from lighter yellow to dark brown color. These changes in the colour of the solution indicate the presence of nanoparticle. After that nanoparticle are under the control condition. Nanoparticles are ready for the further process.

CHARACTERIZATION OF NANOPARTICLE

The Preliminary indication of silver particles production by using mushroom extracts is confirmed by the colors change from light yellow colors to dark brown colour.

FOURIER TRANSMISSION INFRARED SPECTROSCOPY:

FTIR stands for Fourier transform infrared, the preferred method of infrared spectroscopy. When IR radiation is passed through a sample, some radiation is absorbed by the sample and some passes through (is transmitted). The resulting signal at the detector is a spectrum representing a molecular 'fingerprint' of the sample. The usefulness of infrared spectroscopy arises because different chemical structures (molecules) produce different spectral fingerprints.

XRD ANALYSIS:

XRD stands for X-Ray diffraction. It is a process often used in these fields. It is actually a technique of examining the chemical make-up of unidentified solids. Let us say for instance, they found something that cannot be classified right away; the XRD process will then be used to check the make-up of the said item. For XRD to work there must be a sample of the materials first. The powdered sample will then be placed in a holder. It will be illuminated with x-rays of a given wave-length. The intensity of the reflected radiation will then be recorded with the use of a goniometer. From there, the data collected will be analyzed using different computing methods. The intensity will be measured using various D spacing. The result will also be analyzed to find immediately the matches of the item that was given the XRD for analysis. You also have to realize that the greater the tolerance, the more results will be recorded.

X ray diffraction techniques are used for the identification of crystalline phases of various materials and the quantitative phase analysis subsequent to the identification. X-ray diffraction techniques are superior in elucidating the three-dimensional atomic structure of crystalline solids. The properties and functions of materials largely depend on the crystal structures. X-ray diffraction techniques have, therefore, been widely used as an indispensable means in materials research, development and production.

The Bragg equation, $n\lambda = 2d\sin\theta$ is one of the keystones in understanding X-ray diffraction. In this equation, n is an integer, λ is the characteristic wavelength of the X-rays impinging on the crystalline sample, d is the interplanar spacing between rows of atoms, and θ is the angle of the X-ray beam with respect to these planes. When this equation is satisfied, X-rays scattered by the atoms in the plane of a periodic structure are in phase and diffraction occurs in the direction defined by the angle θ . In the simplest instance, an X-ray diffraction experiment consists of a set of diffracted intensities and the angles at which they are observed. This diffraction pattern can be thought of as a chemical fingerprint, and chemical identification can be performed by comparing this diffraction pattern to a database of known patterns.

Here is a typical powder X-ray diffraction or XRD pattern, in this case, of a cement sample.

SYNTHESIS AND CHARACTERIZATION OF AGNPS

In present work AgNPs were synthesized using green route of nanoparticles synthesis. Silver nitrate was used as silver source and *Morchella esculenta* a fungi was used as fuel for the bio-reduction and capping of nanoparticles.

Results obtained from a series of laboratory studies attempted to synthesis and characterize green synthesized silver nanoparticles, showed successfully synthesis of nanoparticles

During work, the extract of whole fungi was reacted with extract of silver nitrate to and allowed to remain at room temperature for 36 hrs. The precipitates formed in the reaction were then collected by centrifuging the reaction mixture. The collected pellets were washed with the help of distilled water thrice followed by drying the pellets in oven for 10 hours at 60⁰ C. Finally synthesized nanoparticles were homogenized using mortar and pestle and then collected in air tight bottles for further use.

PRELIMINARY OBSERVATION

During the synthesis of AgNPs the preliminary confirmation for the synthesis of nanoparticles was the colour change of reaction mixture from yellow to dark red brown. Further, confirmation of ZnO synthesis was carried out by using UV-Vis technique and obtained results showed peaks in the region at 405 to 430 nm, which could be attributed to the AgNPs nanoparticles

The synthesized nanoparticle were then subjected to conformational details about the shape, size, morphology and functional group attached if any which may responsible for reduction and capping of synthesized nano particles by , XRD and FTIR.

3. CONCLUSION:

Habitually *Morchella esculenta* used as medicines in poles apart countries like Japan, China and Malaysia for healing of several diseases. It has a variety of pharmacological properties like anti-inflammatory, antioxidant, immunostimulant, antitumor, anticancer and antimicrobial properties due to the attendance of poles apart bioactive compounds.

Therefore, in present study metal based nano synthesis was attempted.

The main objectives of the present study were as follows:

1. To synthesis Silver nanoparticles using Fungi as a fuel for its bio reduction and capping.
2. To characterize synthesized nanoparticles using modern analytical technique i.e., XRD and FTIR.

The collected *Morchella esculenta* were screened for the potent silver Nanoparticle. Dried fruit of *Morchella esculenta* were taken and are being washed with double distilled water to remove dust and mud adhering the surface of these mushrooms. The mushroom samples are then kept in shadow conditions for drying.

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3. Finally synthesized nanoparticles were homogenized using mortar and pestle and then collected in air tight bottles for further characterization.

After Preliminary characterization of synthesized nanoparticles by visual markers. Secondary characterizations of synthesized ZnO NP were carried out using different tools i.e., UV-Vis, XRD (X-Ray Diffraction) and FTIR (Fourier Transform Infrared Spectroscopy).

XRD spectrogram was performed between 0 to 65 2 θ . The XRD spectra of fungi extract mediated AgNPs showed crystalline nature of nanoparticles and the average calculated size using Debye-Scherrer's equation was less than 12 nm. Further, XRD analysis of the synthesized AgNPs powder showed distinctive peaks at 2 θ = 28.79⁰, 32.88⁰, 38.72⁰, 44.89⁰ and 64.15⁰ which are indexed to (2 1 0), (1 1 3) (1 1 1), (2 0 0) and (2 2 0) of face centred cubic (fcc) nano-Ag crystals, respectively.

FTIR spectra is used to analyse the presence of functional groups on the surface as well as on the surface of the material. FTIR spectra of zincoxide (ZnO) nanoparticles, spectrum consist of various absorption bands around 4000-5000cm. FTIR spectrogram of fungi based synthesized AgNPs showed the peak at 3357.8 cm⁻¹, 2361.5 and 1642.33. Broad band at 3357.80 cm⁻¹ corresponds to the stretching vibrations -OH group (hydroxyl group). The medium and broad stretching of H-C=O: C-H aldehydes and -OH alcohols and

phenols indicated that biomolecules present in the extracts acted as reducing, capping and stabilizing agents for the development of AgNPs.

The objective set for the present study was successfully achieved. So, it may recommend here to use the leaf extract mediated nanoparticles for antimicrobial activity, moreover nanoparticles may be also used for some drug targeting studies.

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