

MYCOLOGY- IN CONTEXT WITH NANOTECHNOLOGY, MEDICINE & COSMETOLOGY

Yash Sandeep Shinde*¹

*¹Department Of Botany St. Xavier's College Mumbai, Maharashtra, India.

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ABSTRACT

Fungi are microorganisms and are referred to as eukaryotic in nature. They are also classified as simple plants and belong to the kingdom 'Mycetae'. Now days, people are switching their lifestyles towards a more healthy and organic pattern; hence, fungi-like plants are incorporated into many medicines, which not only make the product more natural but also maintain its quality content. There are many advanced techniques, like nanotechnology, which emphasizes performing engineered nanoparticles that can be subjected to many medical treatments, therapies, medicines, pharmaceuticals, and also in the area of cosmetology. Hence, the skincare industry is also witnessing a massive revolution, as skin science has shifted its focus to the organic basics. The fungi-based commodities are creating a significant change in the glamour business because of their bio-organic properties. There are varieties of fungi that have a tremendous propensity to combat any medical condition. Are discussed in the review paper in the following order:

Keywords: Nano-Technology, Cosmetology, Medicine, Dermatology, Fungi, Healthcare.

I. INTRODUCTION

In today's contemporary world, healthcare has become a very crucial factor in an individual's life. This review paper categorically discusses the upgrades and advancements made in the field of biotechnology. "Nanotechnology" is one of the outputs of the upgraded life sciences area. The paper tries to shed light on how nanotechnology can be blended with organic and biotic components, especially "fungi," and introduced in fields like medicine and cosmetology, respectively, as fungi are rich sources of numerous vitamins, minerals, enzymes, peptides, proteins, etc., so hence it is a worthy candidate that can be used to reconstruct products that are efficient and robust enough to withstand the developing sciences. So that it can benefit the larger society and be utilized for the betterment of mankind. The paper tries to recollect significant data regarding the variety of fungi that contain some potent chemical constituents that can be used comprehensively in multidisciplinary fields of science, particularly medicine, cosmetology, and nanotechnology.

II. MODELLING AND ANALYSIS

FUNGI USED IN THE NANOTECHNOLOGY-

1. Fusarium oxysporium- due to the rapid synthesis capacity towards the silver nanoparticles *F. oxysporium* is used for the optimization of the psycocultural conditions hence these NP's are widely used in the sectors of the agriculture, consumer goods and the biolabs for preparation of the excellent bio-organic products. **(1)**

2. Penicillium aurantiogriseum- as because of the eco-friendly behaviour of the metabolically mediated nano-particles hence these are incorporated in a majority of bio-organic culture preparations. One of the important usage is in green synthesis of metal nanoparticles in the agriculture industry these engineered NP'S are used for the plant disease control and management, the upgraded version of the nanoparticles are been subjected to the formulation of the non-toxic insecticides which aids in the maintaining the high yielding capacity of the plant and restores the balance by ensuring the shielding of the crop body for the certain period of an intervals. **(2)**

3. Aspergillus terreus- due to the great anti-bacterial ability of the fungus it is been utilized in the bio-technology for the determining the controlled synthesis of the gold nanoparticles the fungi shows the resistance to the gram negative bacteria which is a basically pathogenic in a nature on an advance research analysis it is been discovered that engineered gold particles are showing the bactericidal actions against the *Escherichia coli*. The chemical reaction- $Au + H_2O_2 \rightarrow Gold\ NP'S$ **(3)**

4. Aspergillus niger- the pure culture is been used in an experiment where A.niger filtrate is separated by chemical scrutiny protocol as the isolated fungal filtrate is an amalgamation of the numerous enzymes like anthraquinone which is referred as the powerful larvicidal agent this element also helps in the capping procedure and also partially works as a antibacterial body which do not allow the growth of mosquito population vector in a crop field.(4)

5. Coriolus versicolor- which commonly called as “turkey tail” fungi predominantly used in the protein molecules identification in the mycelium membranes it helps in the extracellular nanoparticle synthesis mostly **gold and silver** ions further converting in a reduction and restabilizing the Au, Ag molecules. Also the novel innovations in the nanotechnology sector has successfully identified the KDa protein which is called Musarin hence it more over used in the the vaccine conglomerates as it shows significant reduction in the tumor cell growth. The recent data also supports that these fungal body also aids in combating the COVID-19 virus vectors (5)

6. Botrytis cinerea- an extracellular, spherical fungi with reasonably size of a 1-100mm widely well known for a **gold particle** synthesis in a biomedical industry and an agricultural sector. As per the current upgradation done in the field of biotechnology it suggest that strains of a B. cinerea are use for performing biological synthesis of AuNPs with a help of phytopathogenic fungus the metal nanoparticles procured from the process are used in the applications like semi-conductors, photoluminescence , biomedicine, diagnosis and imaging catalyst its one of profound use is to cure the malignant neoplasms i.e [cancer-cells] (6)

7. Hormoconis resiniae- the fungi is been genetically engineered and hence this upgradation provides the fungi to enables its potential to preform the **microbial synthesis of gold nanoparticles** the fundamentals and the kinetics of chemical reaction was studied using UV-Vis spectroscopy whereas, it further analyze by the help of **X-ray [EDX]** and high resolution transmission electron spectroscopy the fungi capable of maintaining the optimal rate of a biomass present in as soil the cost effective fungi can also consider as the best agent for creation of various gold base nanoparticles. (7)

8. Cladosporium cladosporides – the fungal species is used in the biotech companies for the upgradation and enhancement of the nanoparticles especially gold nanoparticles are synthesis biogenically we procure the endophytic fungi from the seaweed and further subjected for the perfect estimation of a anti-oxidant and anti-microbial compounds which are again used in the bio-organic products to enhance there quality content. The chemical analysis shows that the NADPH reductase + Phenolic compound converts the gold metal salt → **AuNP'S** (8)

9. Rhizopus oryzae- the fungi generally localized at the cell surface and its in nanocrystalline manner is one of the worthy elements used in a preparation of an **organic pesticides** , also the metabolites of the R. oryzae strain mostly use as bio-catalyzing agents to perform the green synthesis of MgONPs the nanoparticles were further analyze by the various techniques like **UV-Vis spectroscopy, TEM, XRD, FT-IR** this above methods are used to gain specifically a crystalline, homogenous and complete well developed particles of **MgONps** . this particles shown **larvicidal** and adult repellence activity against the C .pipens at very low concentration. (9)

10. Verticillium luteoalbum- the fungi body is predominantly used for the surface screening of the gold nanoparticles and besides this it also used for the bio-reduction od silver chloride ions and the fungi nanoparticles are genetically engineered and hence use in the preparation of an enzymes, macromolecules etc the technologically advanced methods like SEM and TEM are generally employed which can provide an accurate and detailed intricate evaluation of the nanoparticles tapping and screening techniques.(10)

FUNGI USED IN MEDICINE AND COSMATOLOGY

11. Penicillium rubens – from this specific fungal body the **β- lactum** is been procured and which can be considered as one of the potent antibiotic agents hence can be a part of several medicinal formulations. The strain derived out of the fungal body is referred as the key factor for the preparation of the various secondary metabolites and this entire procedure was achieved by undergoing genetical engineering method and by altering the biosynthesis pathway. Where on the other side the penicillin is been derived from the fungus which served as an antibiotic agent and arrest the growth of the Staphylococcus aureus bacteria. Numerous mutation reactions are focusing upon the amino acid metabolism and resulted in enhanced **L-cysteine** biosynthesis process. (11, 12)

12. Tolypocladium inflatum- one of those highly medicinal species of fungi which is the substantial source of the different types of secondary metabolites, novel and economically essential pharmaceuticals, mycoinsecticides and an antibiotic it produces one of the quintessential compounds i.e 'Cyclosporine A' it referred as an immunosuppressant drug the compound which is tremendously helpful during the critical medical operations like organ transplantation. CsA aims and attaches to the high affinity 'Cyclophilin A' together CsA + hCypA bonds suppresses vertebrate immune system by inhibiting 'Calcineurin' **(13)**

13. aspergillus terreus- the fungi which is capable of containing numerous anti-cancer bioactive compounds like Butyrolactone-1, Simvastatin, Lovastatin and Terrein (Polyketide), Terpeptin which is a peptide etc. the Polyketide are having significant usage as these compounds are health essential factors and have many therapeutic usage as one of their character to cure the hypercholesterolemia (Lipid disorder) it also treats the cardiovascular disease. This fungi is the source of a norneolignan compounds like an asperjinone. There are few prominent chemotherapeutics like doxorubicin and anthracyclins which exhibits anti-cancerous properties. **(14)**

14. Cordyceps sinensis- it is the one of healthy mushroom body which is having numerous health benefits as it has sufficient natural active biomolecules like β -Glucans, ergosterol, provitamin-D, Linolenic acid the fungi body is largely utilised in the herbal medicinal formulations and also used by pharmaceuticals as to derived the active bio-organic compound i.e Cordycepin along with Cordycepic acid the rich bio-active compounds are strengthens muscle rejuvenation by developing musculoskeletal system and also combats fatigue, tiredness, it also maintains the metabolic- endocrine bodies by performing optimal hormone regulation. Due to the function of sexual enhancing capacity and ability to increase fertility it called as Tibetan Viagra. it also ensures the smooth working of the immune and respiratory systems. **(15)**

15. Ganoderma lucidum- the fungi referred as lingzhi in a Chinese it considered as an enhancer element of spiritual potency and renders the essence of an immortality the herbal medicine formulations encapsulate its capacity of being the worthy organic element to be use to treat several disease and strengthens the immune system, it shows the anti-diabetic characters as aids in maintaining the blood glucose level. Also performs the hepatoprotection, ensure bacteriostasis etc. the recent research data suggests that the fungi also shows antitumor properties besides this it also works as an antioxidant agent which has an ability to reduce the risks of chronic disease and malignant disease like cancer. The hexameric lectin which is been isolated from the fungal body for the production of glycoproteins various enzymes derived from the fungal body which are metalloprotease which aids in delaying clotting. the fungi also serve as antimicrobial agent. **(16)**

16. Fomes fomentarius- fungal body is used in the cosmetic industries for the preparation of various skincare products as the fungi shows an antioxidant property as it helps to increase defence barrier of the skin to protect from the free radicles. As it also exhibits the anti-inflammatory properties as it reduces the redness and inflammation of the sensitive areas of a skin. The fungal body is contains the gallic acid which is capable to treat the dull skin and also brightens the skin tone. The tranexamic acid procured from the fungus fights the uneven skin tone and discoloration it treats the melasma and combats hyperpigmentation **(17, 18, 19)**

17. Antrodia camphorate- the fungi which is mostly found only in a Taiwan, has shown most medicinal uses especially used in the cosmetology and dermatology ethanolic extract derived from the Antrodia camphorata fruiting body the fungus exhibits an antiproliferation action in B16-F0 melanoma cells. The mushroom body also contains the kojic acid which is capable of tackling with the acne marks and dark spots appears on the face hence this sort of biotic elements are incorporated in the various skincare products like micro-essence, serums, creams, face packs etc. these all products are play crucial role in an elevating the daily skincare regime. **(20, 21)**

18. Saccharomyces cerevisiae- in the sector of dermatology and skin sciences this particular fungi is referred as raw ingredient as it helps in the improving the infected skin condition it the extract derive from the fungal body serves as an oxidative stress many dermatological preparations uses SCE and vitamins as to elevate the quality content of the skincare products. The fungi also maintains the skin pH and increases the hydration levels; it also cures the wrinkles and improves the microrelief. **(22)**

19. Tremella fuciformis- fungal body has an ample amount of vitamin. like vit. C which helps in providing Glow and replenishing the skin the compounds like Resveratrol which boosts the antioxidant levels beside this

it has polyphenol major ingredient for fighting against free radical. Fungal extract also exhibits an antiaging property along with the photoprotection, reducing the scars and maintain the even tone. Polyphenol is the major component and promising antioxidant which brightens the skin improves the complexion reduces fine lines and provide smooth texture to the skin. (23, 24)

20. Pleurotus citrinopileatus – Glucosylceramide the chemical compound extracted from the species shows the anti-bacterial properties hence used in the preparation of various lotions and creams which can able to heal the wound and also use in the preparation of the serums with the amalgamation of salicylic acid which together combats against the microbes and bacteria. Pleurotus extract is observed an equivalent to the ascorbic acid and can be use as the alternative ingredient in the many body lotions and face creams which are rich in antioxidants and also serve as an anti-inflammatory agents. DPPH method is widely used to determine the antioxidant content. (25)

III. CONCLUSION

The 'nanotechnology' and the 'cosmetology' are one of the emerging factors of the industrial revolution over the periods and the fungi are most potent bio-organic sources which are highly nutritive and also have a wide range of extracts. Which are having high quality content and many health benefits hence incorporated in the multiple scientific areas. these fungi base products and commodities are hold a very promising capacity. Which has an ability to shape the future of healthcare systems.

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