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REVIEW FOR USE OF MYCELIUM IN CONTRUCTION INDUSTRY.

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Abstract - *Mycelium is skinny root like fibers from fungi. The growing of plant structure primarily based material is created by victimization Petri dish, cloth formwork, every kind of moulds. A mycelium brick is a organic brick that is forms from organic waste and the mycelium of fungus. Combining plant structure with another substance provides the foremost sturdy, sustaining material. Plant structure acts as natural self grouping glue and also low priced organic waste as feedstock, will grow to fill advanced geometric & haven't any finish of life disposal price since they're inherently viable various to several artificial materials. The aptitude of various fungi to bind is employed to develop natural bio-composite materials for numerous applications in style and design. Tests on totally different agricultural wastes were done and results are compared. Utilization of polymers with mycelium has the subsequent advantages with construction materials and process like light-weight, workability, low chemical reactivity, wetness resistance.*

Key Words*: *Mycelium, Construction materials, Bio-composite

1. INTRODUCTION

Significant pressure has been applied to the development trade over the past decade because of the provision of ancient constructional materials like cement, bricks, timber, cladding and partitioning materials has struggled to stay up with an ever increasing international population. Production of those standard materials consumes energy, restricted natural resources and fouls out air, land and water. A physical smart economy needs the mining of raw resources and turns giant quantities of these smart into trash at the top of the utilization. A linear material economy is damaging to setting and causes pollution. Mycelium composites are new kind of novel, economical and environmentally property materials that have attracted increasing educational and industrial interest over the past decade. Fungi are organisms able to provide cohesion to incoherent materials because of the assembly of a mass of microscopic filaments that forms the plant structure. The substrate is replaced partly by the plant biomass and ensuing plant structure is in a position to powerfully cement the substrate itself leading to biocomposite material. As a part of industry's move to light-weight elements by victimization composite materials, biocomposites, with the additional advantage of property, are finding applications starting from building, transportation to physical science and sports equipments. The low-embodied energy production method used for mycocomposites makes them price competitive with synthetics, however the fabric is inherently property since it comes from utterly renewable sources and can biodegrade below the correct conditions or may be recycled into feedstock for packaging.

2. Literature review

Noam Attias, et al. (Sept2017) have studied the binding property of mycelium that is the root part of fungus is used as binding material to form various bio-composite materials which will use as construction material in future. Their objective of this experiment was to determine which fungus species is most suitable for this experiment and which substrate is to choose that will give better growth of mycelium. They selected four different species of mycelium and five different types of agricultural waste as substrate. The samples are then kept to grow under observation. Each sample was checked for the growth percentage at various time intervals. The selection of mycelium-substrate was based on the ratio of substrate utilization to the growth of mycelium. They come to know that, P.ostreatus mycelium grown on vine and on apple substrates give the best result among all the samples. They mentioned that there are some more tests are required to conclude the best results. They mentioned that the bio-composite material will be used in future as building material and will have various applications.

Yangang Xing, et al. (Sept 2017) had studied growing and testing mycelium bricks as building insulation materials. In this study they prepared and tested alternative building insulation materials. They selected the species of basidiomycete fungi and used to grow mycelium bricks on straw waste. Use of dual needle probes was done to measure thermal conductivity and specific heat capacity. They concluded that, selection of fungal species, growing substrates and growing environment is important. Improvement of growing process should be done. Also, future research is essential in this area.

Santosh B S et al. (2018) prepared light weight mycelium brick as green building materials. Following process like spawn (mushroom spores) were collected and placed in PDA. Material for initiating the growth of mycelium fibers from spores. The fibers were transferred into the substrate and allowed then to grow for few days. Substrate and mycelium fibers were further condensed into a mould to form a brick. This brick was burnt to get a strong green

building material, mycelium brick. Tests were conducted compressive strength test, water absorption test. They concluded that, this material can be used in constructing may be non load bearing wall until research will get required strength.

Mitchell Jones, et al.(April 2018) have studied about low cost mycelium composite. Preparation of block using rice husk also wheat grains which were passed through incubation process adding it with fungal material also glass fines. Prepared blocks by composite were tested for fire reaction testing and scanning electron microscopy and elemental analysis. The findings of this study show that mycelium composites are very economical alternative to highly flammable petroleum derived and natural gas derived synthetic polymers and engineered woods for applications including insulation, furniture and paneling.

Elvin Karana, et al. (2018) studied designing with mycelium based materials, following cycle, fungi to base plate growth to natural growth with fibers or particles to shaping to drying to mycelium composite. Tensile test results were plotted using displacement versus stress graph by study. The present paper explored the journey of master's product design students who searched for product application idea for mycelium based material. Their goal was to provide partial understanding of material growing process. Furthermore they provided at critique on the final outcome of design effort, in comparison to existing mycelium based product applications.

Ali Ghazvinian, et al (2019) studied on the strength parameters of bio-composite material using mycelium as binding material. They form the structure of mycelium and the substrate and compressive test was taken on each sample. They observed that the compressive strength is very low. The straw based and mix based sample show a quite well elastic behavior. Sawdust specimen has quite well compressive strength. They also observed some advantageous properties of specimen like, all specimens are light in weight, also they are biodegradable, and renewable also. They conclude that the bio-composite materials cannot be replaced masonry due to low compressive strength.

Mitchell Jones, et al. (2018) purpose of this study was to determine which type of fungus species is having higher rate of mycelium growth and suitable for formation of bio-composite material. They collect different types of species based on availability from RMIT culture collections. They prepared two different types of media for growth of the mycelium namely liquid media and solid media. They found that the Growth results are, T. versicolour and P. brumalis were the most suitable species assessed in this study based on growth performance and enzymatic compatibility with typical mycelium composite substrates.

Kishan, et al. (April 2018) checked the usability of mycelium brick as replacement against standard modular bricks were studied. For preparation of mycelium bricks mushroom seeds, agricultural waste and water along with chemicals to stop the growth of microbes as the microbes may interfere with the growth of mycelium were used. After the growth of mycelium when the brick became ready it was tested for tests such as efflorescence test, compressive strength test, and water absorption test and the results were compared with standard tile brick. This showed that mycelium brick has better properties than standard tile brick which concluded that though it has better properties more study is required so as to grow mycelium faster and for utilization of mycelium bricks on larger scale.

Neha Anukia, et al. (2019) focused on the utilization of biological growth for the production of mycelium brick rather than expensive manufacturing processes. It gave the manufacturing process as collecting agricultural waste, sterilizing waste, filling the material in the mould, allow the mycelium to grow and then drying the product for killing the bacteria in oven. The author concludes that though the current application of mycelium brick is limited due to growth restricting factors such as temperature, humidity with more research the mycelium bricks can be involved in construction process of building.

Sonali D. Randive (2012) studied oyster mushroom by growing it on various substrate which were paddy straw, wheat straw, vegetable plant residue etc. and after the process of soaking, pasteurization, spawning, cropping, harvesting, and growing of oyster mushroom biochemical test were carried and the results of cultivation growth, protein content, lipid content, crude fiber contain, ash content, moisture content, total carbohydrate contain, total metabolizable energy of mushroom when grown on different substrate were given.

Mitchell Jones, et al. (2020) had done detailed study of mycelium composites was done. The author focused on the different properties of mycelium composites such as thermal conductivity, acoustic properties, thermal degradation and fire safety properties, water absorption, termite resistance. The result showed that the mycelium composites are well suited for thermal and acoustic insulation application and also the fire reaction and fire safety properties are better than traditional construction material. But due to typical foam like mechanical properties, high moisture uptake the mycelium composites have limited scale of application. Hence more research is required to use the mycelium composites on larger scale.

A. R. Ziegler, et al. (2016) studied to evaluate the potential of bio composite material to use as commercial product and packaging material. The bio composite material was prepared by using fungus mycelium as matrix to bind cellulosic plant fibers. Then the physic-mechanical properties of bio composite was evaluated which include specific gravity, surface hardness, water absorption, coefficient of linear thermal expansion and resistance to tension and compression. The study showed that due to favorable properties of mycelium bio composites they can be

used for packaging, shipping, and marine floatation application. Also the manufacturing process needs to improve so as to increase the scale of application of mycelium reinforced bio composites.

Lai Jiang, et al. (May 2013) have done the investigative study the manufacturing of bio-composite materials, in which mycelium is used as binding material and agricultural waste as substrate. They follows Process as, die cutting station, dip and soak station or curtain coating station, manually stack skin piles, matched tool forming low-power microwave drying, fill formed skins with mycebond regrind, seal part in plastic bag and let grow, colonized part drying etc. as they mentioned. They mentioned that, Future work will involve prototyping the entire manufacturing line and testing it with a realistic part shape to determine best combination for bigger production.

3. CONCLUSION

As the construction industry is growing day by day, more number of problems are faced. So the mycelium is introduced as a bio based green material. This material can be introduced because of its unique qualities, properties, possible applications and sustainable features as reviewed in this paper. Mycelium composites utilize biological growth rather than expensive manufacturing processes which is the work towards more environment friendly aspect**.** The more study is required as this material is not strong enough to replace conventional masonry materials without introducing any reinforcement as well as to increase mycelium replacement in construction field.

REFERENCES

[1] Noam Attias, Ofer Danai, Nirit Ezov, Ezri Tarazi, Yasha J. Grobman[2017] " Developing Novel Applications Of Mycelium Based Biocomposite Materials For Design And Architecture''

[2] Yangang Xing, Matthew Brewer, Hoda EI- Gharabaway, Gareth Griffith And Phil Jones [2017] "Growing And Testing Mycelium Bricks As Building Insulation Materials" Earth And Environment Science

[3] Santosh B S, Bhavana D R, Rakesh M G[2018] " Mycelium Composites: An Emerging Green Building Material'' International Reasearch Journal Of Engineering And Technology Vol-5 Issuejun-2018

[4] Mitchell Jones, Tanmay Bhat, Tien Huynh, Everson Kandre, Richard Yuen, Chun H. Wang, Sabu John[2018] " Waste-Derived Low Cost Mycelium Composite Construction Materials With Improved Fire Safety" Issue Feb-2018

[5] Elvin Karana, Davine Blauwhoff, Erik –Jan Hultink And Serena Camere[2018] "When The Materials Grows: A Case Study On Designing (With) Mycelium Based Materials" International Journal Of Design Vol-12 Issue 2018

[6] Ali Ghazvinian, Paniz Farrokhsiar, Fabrico Vieira, John Pecchia, Benay Gursoy " Mycelium Based Biocomposites For Architecture''matter- Material Studies And Innovation Vol-2

[7] Mitchell Jones, Tien Huynh, Sabu John[2018] " Inherent Species Characteristics Influence And Growth Performance Assessment For Mycelium Composite Applications"

[8] Kishan, Rahul Kashyap,Rohan Tyagi,Anushal Jain [2018] " Production Of Mycelium Bricks ''International Journal Of Innovative And Research Technology Volume 3Issue Apr-2018

[9] Neha Anukia, Veda Shewalkar Shubham Wath, Sunil Sahare, Samiksha Yerpude, Sachin Surjagade, Gaytri Thakare, Akash Ghugal,Nirantar Borkar [2019] " Study Of Mycelium Bricks '' IJSRSET Vol-5 Jun-2019

[10] Sonali Randive [2012] " Cultivation And Study Of Growth Of Oyster Amushrooms On Different Agriculturai Waste Substrate And Its Nutrients Analysis'' Advance In Applied Science

[11] Mitchell Jones, Andreas Mautner, Stefano Luenco, Alexander Bismarck, Sabu John [2019] "Engineered Mycelium Composite Construction Materials From Fungal Biorefineries: A Critical Review" Elsevier Issue 25 Oct-2019.

[12] A.R. Ziegler, S. G. Bajwa, G. A. Holt, G. Mcintyre, D. S. Bajwa [2016] " Evaluation Of Physical-Mechanical Properties Of Mycelium Reinforced Green Biocomposites Made From Cellulose Fibers '' American Society Of Agricultural And Biological Engineers Vol-32

[13] Lai Jiang, Daniel Walczyk, Liam Mooney, Samuel Putney[2013] "Manufacturing Of Mycelium Based Biocomposites''