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REPLACEMENT OF MATERIAL AND TESTING OF BRICKS USING DEMOLITION AND AGRICULTURAL WASTE WITH FUNGUS (MYCELIUM FIBRE

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Abstract - The main purpose of the experimentation is to study the use of biological growth for the development of environment friendly brick combined with agricultural waste, demolition waste to reduce the use of conventional brick. For this the Mycelium bricks were made. For making a brick the procedure was collection of agricultural waste that is substrate, filling the moulds, drying to appropriate condition, killing the bacteria in an oven. Also while making a brick the percentage of demolition waste were varied so as to study the binding property of Mycelium to given waste and substrate. The main aim of the study was to produce mycelium brick and depending upon properties of bricks decides its mode of application. For that, the properties evaluated were compressive strength, water absorption, fire resistance. The results showed that the mycelium can hold the demolition waste, but with the increase in its percentage the weight of brick increases and also binding of Mycelium decreases. Hence the brick material is suitable only for targeted application where light weight, low chemical reactivity, wetness resistance, as well as where the partial fire resistant is desirable.

Key words: **Mycelium, demolition waste, substrate, chemical reactivity**

1. INTRODUCTION

The race to find the next sustainable technology or material that will greatly reduce our ecological footprint as well as improve our environment is causing countless new materials to develop which hold the possibility of helping to achieve this generation's sustainability goals. One of the newest and most promising is the mycelium brick. A mycelium brick is an organic brick that is formed from organic waste and the mycelium of fungus. Mycelium are the thin root-like fibers from fungi which run underneath the ground, when dried it can be used as a super strong, water, mold and fire-resistant building material that can be grown into specific forms, thus reducing the processing requirements

1.1 Mycelium

Mycelium is a vegetative part of a fungus consisting of mass of branching, thread like hyphae. Fungal colonies composed f mycelium is found on many substrates. The mycelium hyphae network exerts the important function of growing and seeking new feedstock, of recognizing and transporting nutrients, and of transmitting chemical signaling mechanism which regulates several other functions.

1.2 Agricultural Waste

Agricultural waste is defined as unwanted waste produced as a result of agricultural activities. Agricultural wastes disposal is of primary concern in today's world as they are rich in nutrient and their disposal without pretreatment can cause leaching field, which can cause environment pollution.

1.3 Demolition waste

Demolition waste is the waste originated from destruction of buildings, roads, bridges or other structures. Construction and demolition waste is one type of solid waste. It is a large and varied waste stream that includes concrete, asphalt, wood, gypsum, and asphalt shingles generated from the construction, renovation, and demolition of buildings, roads, bridges, and dams.

2. LITERATURE REVIEW

Stefano Parisi et al (Sep 2016) studied on mycelium based composites, through Material Driven Design method supporting designers in understanding and designing. A mycelium based composites is described focusing on its potential properties and its manufacturing process. Study achieved understanding of the material and developing an experiment that enhances its qualities and characteristics of mycelium based composites.

Freek V. W. Appels et al (2019) studied mycelium based composites from the growth of filamentous fungi on organic materials such as agricultural waste streams. Authors addressed whether non foam type of mycelium composite material can be obtained by varying the type of fungus, substrates, and processing of the material

Mohit agrawal, et al(dec 2017) studied about the production of construction and demolition waste is carried out, the C and D waste is mostly used for land filling. Due to which pollution of land occurs to consume or to find alternate solution for this problem experimental base study was taken

about the consumption of C and D material in bricks production. There are two types of bricks formed C-type (cement as binder) and F-type (cement and fly ash as binder). C and D waste is partially replaced of coarse aggregate conventional bricks and concrete is selected as C and D waste. There are two major ways to approach CD waste management: first, to assess and control the factors leading the generation of waste and second to reuse the generated waste several studies suggest that utilization of solid waste is not only a viable option to waste management but also desirable.

Sutas et al (2011) studied that the bricks are well known and widespread due to durability and local production which by local composition and labour. Properties of bricks easily allow heat transfer and keep the heat inside for long time which means high heat capacity. Then, the brick is appropriate for construction material. This research aims to study effect between rice husk and rice husk ash to properties of bricks. Comparative adding between rice husk and rice husk ash were varied by 0-10% by weight. The results showed that more adding rice husk less compressive strength and density of specimens

3. METHODOLOGY

3.1 Sterilization Process

For sterilization chemicals used were Formalin and Bavistin. 40% of formalin in water was used as disinfectant and 10% of Bavistin was used to kill fungi that are present in substrate.
Substrate was kept in prepared water for 18 hours for sterilization

Figure: Sterilization Process

3.2 Atmospheric Condition

Darkness to be maintained
Humidity
Temperature
These conditions were maintained during Mycelium network Growth

Trial- 1

1. Prepared moulds for brick preparation.
2. Sterilized the substrate i.e. Agricultural waste, Wheat Straw Also Demolition waste i.e. Tile waste, Glass.
3. Prepared mixture of agriculture waste and demolition waste also Mushroom Seeds.
4. In this case we prepared two types of mixtures. In 1st mix. We added red soil, In 2nd mix. We eliminated red soil.
5. We filled moulds with two types of mixtures.
6. Leaved the mould in dark place for 18 days.
7. After 18 days we observed growth of mycelium network.
8. Results were like, In mix. 1 there was no growth of mycelium network because of red soil. On other side In mix. 2 there was grow growth of mycelium network.
9. With Reference of results, we decided to eliminate Red soil from Brick.

Figure: Material in moulds

Trial- 2

1. This work was for selection of Agriculture waste, which will show fast growth of mycelium network.
2. We prepared moulds for brick.
3. For testing we selected agriculture waste like, Rice Husk, Saw Dust, Soyabean Straw, and Wheat Straw.
4. By sterilizing all types of agriculture wastes we kept it in separate moulds adding Mushroom seeds into it.
5. Moulds were kept in dark place for 18 Days.
6. After 18 days we observed growth of mycelium network in agriculture waste.
7. From results we decided to select Soyabean Straw.

Figure: Filling moulds

Figure: Mycelium covering brick

Trial- 3

1. We prepared acrylic moulds of size 19×19×9cm. Also made holes to allow some air to enter in it.
2. We prepared mixture of sterilized agricultural waste i.e. soyabean straw. Demolition waste i.e. tile waste, glass, cement waste (5% 10% 15%) and mushroom seeds
3. Filled moulds with mix. And kept in dark place for 18 days to observe growth of mycelium network also it's workability as a binder.
4. After 18 days we obtained our brick.
5. We dried brick in oven so that bacteria will die.
6. On prepared brick we carried out few civil engineering tests.

Figure: Packing of moulds

Figure: Mycelium brick

4. TESTS

4.1 Compression Test

On applying the load, the brick starts compressing and deflection takes place. Average depth change was 6.1cm

4.2 Water Absorption

Average water absorption was 11.07%

4.3 Density test

Average density of brick is 259.007kg/m3

5. CONCLUSION AND FUTURE SCOPE

As the main purpose of the experimentation was to study the use of biological growth for the development of environment friendly brick which showed that the strength of brick depends upon the Mycelium content of brick. Also the demolition waste used does not contribute to strength rather it affect the bidding of Mycelium that is more the percentage of demolition waste more will be the weight and less will Mycelium binding. Since the Mycelium brick is new concept no Indian standards are available hence detailed study of Mycelium brick is needed. Also the study is required so as to grow Mycelium faster, to make brick cheaper, and to increase the range of application of Mycelium brick.

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