Study On Organic and Self-Healing Bricks (Mycelium and Fly Ash)

VIJAY S. TUREKAR[1], YOGITA A. MEHER[2], POOJA B. TAKALKAR[3], PROF. D. V. WADKAR[4]
[1, 2, 3, 4] *All India Shri Shivaji Memorial Society's College of Engineering, Pune*

Abstract— The creation of a mixture of mycelium and fly ash brick with specific features was discussed in this study. The mycelium brick heals and fixes itself as it develops, whereas fly ash is a recyclable and biological byproduct of coal combustion. This brick incorporates the usage of natural materials while also maintaining environmental harmony. The goal is to create a natural material for construction that is comparable to existing options. According to the testing results, this combination produces a decent performance outcome. Furthermore, the usage of such a unique building material in the construction area will aid in the creation of a sustainable and environmentally friendly infrastructure.

Indexed Terms-- Brick trends, environmentally friendly construction materials, mycelium brick, and self-sustaining construction materials.

I. INTRODUCTION

In today's world, there is a great demand for low-cost, environmentally friendly construction materials. It's difficult to estimate how many people die prematurely as a result of numerous poisons on a global scale. According to the WHO, around 3 million people die each year as a result of air pollution. Lung, cardiovascular, and respiratory diseases, among others, claim the lives of 8lack people. Brick kilns are a major source of air pollution. Inhaling such pollutants causes irritation of the skin and eyes, as well as respiratory failure illnesses such as pneumoniosis and silicosis. Contamination has an impact on rural output and organic goods as well. To address all of these concerns, a mix of fly ash and mycelium bricks may be used as a wonderful alternative for ordinary modular bricks.

1.1 Mycelium with fly ash bricks concept:

Once mycelium is allowed to dry, it produces a root-like structure called hyphae that holds the mix together, making it a great raw material for building. A mycelium brick is a type of organic brick made from organic waste and mycelium fungus.

The addition of fly ash to concrete increases its workability and decreases the need for portland cement. It hardens and strengthens the brick. Fly ash is made from coal dust, which is a waste product from households and industries. The combination of these two bricks, as well as the qualities of their constituents, creates a cost-effective alternative to typical construction materials.

Constituents of the brick are as follows:

1. Organic waste:
Wheat straws, saw dust, mushroom seeds (Oyster Spawn), agricultural waste are used.

2. Bonding and growth agents:
Sugar, flours, and other similar substances aid in the growth and binding of the combination.

3. Fly ash:
Fly ash is a grey-colored charcoal byproduct that is perfectly natural and does not affect the environment. It also contributes to the brick's strength.

4. Cement:
This brick is made using OPC, which is a mixture of lime sludge, cement, aluminum powder, and gypsum.

5. Sand:
The bricks can be made from locally available sand, stone dust, or river sand. The percentage of harmful components such as silt, clay lumps, and coal particles should not exceed 5%.

1.2 Contribution of constituents:

The proportions of mycelium and fly ash brick components are set at 40% and 60%, respectively. As a result, the contribution of organic waste is 30%, and the contribution of growth and binding agents is 10%. About 36% of the entire brick mass is made up of fly ash, 18% of which is sand, and 6% of which is Ordinary Portland Cement (OPC).

Dimensions of bricks: 230mm X 110mm X 70mm

Dimensions of Frog: 100mm X 40mm X 10mm

Weight of Brick: 1.4 Kg

II. BRICK EVALUATION

2.1 The mycelium + fly ash brick is lighter than traditional fly ash brick and so decreases the dead load on the building, which is a significant benefit. The components for the bricks are readily available. It has a high level of fire resistance. This is environmentally friendly, inexpensive, and fully biodegradable. It leads to the development of new brick trends.

2.2 This brick needs meticulous craftsmanship and expert supervision. Most significantly, it necessitates correct ingredient proportioning and mixing. Curing for ten days is required for increased strength. It takes a long time to do this task.

2.3 The brick's behavior and the results of several tests are represented in the brick's analysis. For 2 days, the block was maintained in clean water in a vertical posture of around 25% of its overall height. The test revealed minor efflorescence due to the absence of constructive soluble salt depositions.

Table I: Test for Efflorescence

Serial Number	Type of Brick	Results
1.	Mycelium	Slight
2.	Mycelium+Fly Ash	Slight

2.4 Hardness is the resistance to scratching. With the assistance of a finger nail, a scratch was formed on the brick surface, but no impression was left, indicating that the brick is firm.

Table II: Test for Hardness

Serial Number	Type of Brick	Result
1.	Mycelium	Good
2.	Mycelium+Fly Ash	Good

2.5 Bricks are commonly employed in the building of masonry walls that are subjected to compressive stresses. Compressive strength testing is used to measure the load bearing capability of bricks under compression force using a universal testing machine (UTM). The brick's average compressive strength is 8.59 N/mm2.

Table III: Test for Compressive Strength

Serial Number	Brick Type	Result (N/mm^2)
1.	Mycelium	15.60
2.	Mycelium+Fly Ash	i. 8.920
		i. 8.260
		Average =8.59

III. CONCLUSION

The use of mycelium and fly ash in a brick is a completely new concept, requiring fresh technology and invention. The goal is to assist society by empowering sustainable construction materials. Because this brick does not require a brick kiln, carbon emissions will be minimized to a larger level.

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