

RESEARCH AND DEVELOPEMENT OF BRICK USING WASTE MATERIALS

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Abstract - The eco-friendly brick is made from recycled industrial waste materials, an environmentally and economically sustainable alternative to clay fired bricks. The burning of conventional burnt bricks is also responsible for emissions of carbon dioxide, carbon monoxide, sulphur dioxide, nitrogen dioxide and suspended particulate matter which causes considerable health problems, especially related to respiration while also causing damages to properties and crops. This project aims to develop unfired, non-structural, binder brick with 100% waste material using fly ash, Stone Dust, Marble Dust, Construction Adhesive to alleviate resources like coal and diesel, preservation of top soil, prevention of harmful emissions and managing the industrial waste. This study is primarily focused on optimization of the compressive strength of newly developed bricks, while minimizing weight density, and water absorption, through extensive laboratory work. This methodology is to consciously produce bricks out of industrial waste based on the characterization, packing, and other engineering properties.

Keywords: Unfired bricks, Fly ash bricks, Marble dust bricks, Packing density.

1. INTRODUCTION

The brick making is a traditional but important industry in developing nations. Housing is the primary need of every human being. As for the human body, carbons are the building block, bricks are the building blocks of a house. Clay fired bricks form the backbone of the construction industry. It is continually expanding on account of a rapid increase in demand for bricks in infrastructure and housing industry. On one hand, conventional brick-making sector is facing issues of resource depletion in terms of coal and top soil erosion along with other harmful emissions and particulate matter making the brick production process unsustainable. On the other hand, a huge amount of industrial waste like fly ash, marble dust, stone dust, pond ash, coal cinder, paper sludge, rice husk ash, blast furnace slag, etc. are waiting to be utilized as a resource. Development of conventional brick effects as Loss of agricultural top soil, environmental damage, carbon emissions, global warming. It causes higher energy consumption through intensive firing, environmental pollution, increase in industrial waste. While development of unfired eco-friendly brick using industrial waste

materials effects as Low cost to end-user, protection of top soil, as a green building component, improved methodology in recycling of industrial waste materials. It causes low energy consumption in process as unfired bricks, saving natural resources, environmental awareness through recycling. A huge amount of industrial wastes are waiting to be utilized as a resource.

1 METHODOLOGY

From the Literature review we found that different types of material such as Marble powder, Stone Dust, Fly Ash are the best replacement of clay in brick manufacturing. These materials are basically waste materials which we can use in brick manufacturing. Then we decide that we are using these waste materials for making bricks which is strong compared to normal conventional brick in less amount. For the Binding of these materials, we had to use a binding material. For that purpose, we used construction adhesive, i.e. Tile Adhesive.

1.1 TEST ON MATERIALS

Specific gravity test of raw materials

Raw materials	Specific gravity
Stone dust	2.72
Marble dust	2.35

Water absorption test of raw materials

Raw materials	Water absorption (%)
Stone dust	0.97%

1.2 WORKING PROCESS

For making the bricks we sieve those materials with the help of 600-micron sieve. Then we mixed those materials in the ratio of 33%, 30%, 30% marble powder, 33%, 30%, 30% stone dust, 33%, 30% 30% fly ash 33%, 30%, 30% and 3%, 3%, 3% of construction adhesive.

We calculate the weight of one brick by using volume method with the help of mass, volume and density (wet) formula. And we found that the approximate Weight of

One brick is 4kg. Then we prepare one batch of 8 kg. In that we take 33%,30%,30% of marble powder which is 2.64 kg, 2.8 kg and 2.96 kg respectively, 30% of stone dust which is 2.4 kg, 30% of fly ash which is 2.4 kg and 3%,3%,3% of construction adhesive which is 240gm,400gm and 560gm respectively. We mixed those dry materials properly and then added water in the mixture. We took 0.4 water to material ratio for mixing. Then we apply the oil on Mould which is 23x11x9 cm in

size. Then we filled that mould with the mixed material and then the bricks are ready in shape. But that bricks are in the semi-solid form, so we kept that bricks in room temperature for 24 hours. Then we kept that bricks in sunlight for naturally drying.

2. TEST ON BRICKS

Compression strength test, Water absorption test, Impact test, Hardness test, Soundness test.

To check the Strength of that bricks we have done Compression Strength Test by using CTM. That test have done in 7, 14 and 28 days from the date of manufacturing of that bricks.

Calculation: Compressive Strength of Bricks = Maximum Load at Failure (N)/Average area of bed face (mm²)

We have done Water Absorption Test on bricks to check the absorption capacity of brick, for that first take the weight of brick (W₁) then we put that brick in water on 7th day of manufacturing of the bricks for 24 hours then take the weight (W₂), by using the formula of water absorption, calculate the percentage of water absorption. Calculation: $W = (m_2 - m_1 / m_1) \times 100$

To take the Soundness Test on brick for that impact two brick on each other, after that the noisy sound should be produced without breaking the bricks.

In this test few bricks are dropped from 1-meter height. If bricks are broken it indicates low impact value and not acceptable for construction work. Good quality bricks do not break at all.

Compressive Strength Test Results

Name	Fly ash	Marble Powder	Stone dust	Tile adhesive	Compressive strength		
					7 days	14 days	28 days
M1	30%	33%	30%	3%	1.30	2.64	4.3
M2	30%	30%	33%	3%	2.85	4.9	7.6
M3	33%	30%	30%	3%	2.26	3.4	6.4

Water Absorption Results

Name	Water Absorption percentage
M1	16.07 %
M2	14.39%
M3	15.02%

3. CONCLUSION

1. Construction Industry is a huge industry that keeps growing every day and opening the door to creative and innovative ideas able to improve existing building materials and techniques. This, however, comes with many side effects that badly influence our environment and human health in several ways. More than that, construction industry faces the challenge of increasing costs which makes it hard, especially for low-income families, to construct their houses.

2. Now considering our Compression Strength test, we made three kind of bricks by only Changing the Proportion of Stone Dust, Fly ash, Marble Dust and Tile Adhesive and We Checked the Strength on 7th, 14th and 28th Day. Specifically on second type of Brick i.e. M2, where we used 30% Marble Powder and 3% Tile Adhesive with 30% Fly Ash and Stone Dust 33%, Brick achieved Compressive Strength of 7.6 MPa at 28th Day and Compressive Strength of a First-Class Brick in the country is 10.29 MPa. So Even though its strength value is less than conventional brick, it's close to Second class and Could be enhanced and Improved with Further Research and Development. Considering Water Absorption Test, we conducted it with all Three kind of bricks. For M1, we got Water Absorption Percentage of 16.07% For M2 it was 14.39% and For M3 the Percentage was 15.02 %. According to IS 1077 (1992), The Acceptable water absorption for Bricks are between 12% and 20%. As we Observe, Water Absorbing capacity of the brick is perfectly within the Range of Prescribed Value.

3. As per Cost Analysis, the material like Fly Ash, Marble Powder and Stone Dust are Waste Materials, so can be bought for Free. Price of Tile Adhesive is 350Rs per 20kg bag, as of 2020. Amount of Addition of Tile Adhesive determines the Price of per brick. So For adding 3% Tile Adhesive, 1 brick require 0.12 gm of Adhesive. So by Calculating, Cost of one brick is Rs.1.47 INR. Cost of one brick is Rs.4 INR. in our Country, Minimum price of Brick is Rs.4 and Maximum price of Brick is Rs.11. So even at adding 3% Tile Adhesive, we end up at Minimum price of Rs.4 for the brick. As per Indian Market.

REFERENCES

1. Indian Standard: IS 1077:1992. Common burnt clay building bricks specifications. New Delhi.
2. Mayur Tanpure, Mr. Pratik P. Shinde (2017). "Manufacturing of bricks from sewage sludge and waste materials"
3. Miss shrutakirti, a. Mahajan, Dr. M. Husain. (2015). Utilization of waste sludge in brick making
4. Ayesha Rehman, Abida Farooqi, Jahangir Mirza. (2014). "Utilization of Marble Dust and Steel Slag from Industrial Waste to Produce Non-Fired Environment Friendly Construction Bricks", World Applied Sciences Journal, ISSN 1818-4952, Volume 2.
5. Prof. Nidhin, B. Parappattus, S. Sankar, Athira Thankachan. (2013). "Use of waste material as an ingredient in brick."