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EXPERIMENTAL STUDY ON FLY ASH BRICKS BY USING GRANITE AND MARBLE POWDER

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***Abstract**: Construction industries are the backbone for infrastructure development in India. The various By-products produced from industries causes pollution in India. It has a major impact in the healthier environment of the Nation. The combinations of fly ash bricks have different percentage of the fly ash, granite and marble powder. In India thermal power plants and granite industries are generating fly ash and granite dust in large quantities. Industrial waste are hazardous in nature, their disposal of major concern. Recycling such wastes by utilizing them into building materials is a moderate solution for the pollution issues. The scope of this project is to determine and compare the strength of the bricks by using different percentage of fly ash and granite sawing powder waste. The investigation was carried out by various mix ratios using the laboratory test likes compression test, water absorption test. For strength characteristics, the results showed that a gradually increase in compression strength, water absorption values in blocks was good while comparing the characteristics compressive strength of bricks. An effort for an alternate approach in the manufacturing of bricks was accomplished by using industrial by-products like class F fly ash, granite dust and marble dust powder as ingredients. This paper presents the experimental investigation of Fly Ash Bricks using marble and granite. The granite and marble each 10% is used. The ceramic product is mixed as bricks 5%, 10% and 15% of each mix proportions.*

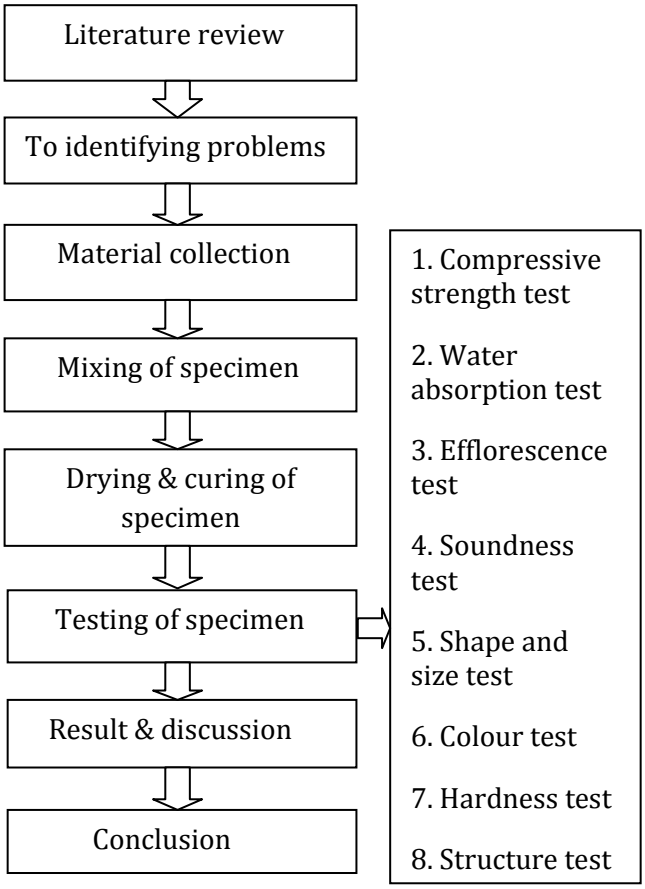
***Keywords:** Fly Ash, Granite Powder, Marble Powder, Water absorption, Compressive strength, Density, Efflorescence, Soundness, Shape and Size, Hardness, Colour, Structure*

1. INTRODUCTION

Energy requirements for the developing countries in particular area get energy from coal. The disposal of the increasing amounts of thermal waste from coal-fired thermal power plants, this disposal of the thermal waste is called fly ash. Fly ash is composed of the non-combustible mineral portion of coal consumed in a coal fuelled power plant. Fly ash is a powdery substance obtained from the dust collectors in the electrical power plants that use coal as fuel. It is a non-biodegradable waste that can be easily inhaled by humans and animals and is also harmful to the environment. The usage of fly ash and granite dust for making bricks is ecologically advantageous as it helps in saving top agricultural soil as well as meets the objective of disposing these wastes which otherwise are pollutants.

2. METHODOLOGY

Shows the methodology adopted this study



3. MATERIAL PROPERTIES

3.1. FLY ASH

Fly Ash is a by-product of the combustion of pulverized coal in electric power generation plants. This ash has pozzolanic properties. In the presence of water and free lime, the ash will react into cementations compounds.

Fig.1. Fly ash

3.2. CEMENT

A cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Cement is seldom used on its own, but rather to bind sand and gravel (aggregate) together. Cement mixed with fine aggregate produces mortar for masonry, or with sand and gravel, produces concrete.

Fig.2. Cement

3.3. LIME

Lime is calcium containing inorganic material in which carbonate, oxide and hydroxide predominate. In the strict Sense of the term lime is calcium hydroxide. Lime is used in building materials is broadly classified as pure, hydraulic and poor lime can be natural or artificial and may be further identified by its magnesium content such as magnesium lime.

Fig.3. Lime

3.4. GRANITE POWDER

Granite is a material used indoor flooring. The industry's disposal of the granite powder material, consisting of very fine powder, today constitutes one of the environmental problems around the world. Major waste generating industries is the granite quarry and production industry by world. Major waste generating industries is the granite quarry and production industry by which around 70% of this precious mineral resource is wasted in the mining, processing, and polishing procedures.

Fig.4. Granite powder

3.5 MARBLE POWDER

Marble is a metamorphic rock that forms when limestone is subjected to the heat and pressure of metamorphism. It is composed primarily of the mineral calcite ($CaCO_3$) and usually contains other minerals, such as clay minerals, micas, quartz, pyrite, iron oxide, and graphite.

Fig.5. Marble powder

4. DESIGN MIX

Table-1: (mix proportion) Conventional Brick

Samples	Flyash %	Lime %	Gypsum %
1	50	30	20

Table-2: (mix proportion) Flyash+ Granite Powder

Samples	Flyash %	Lime %	Gypsum %	Granite powder %
1	45	30	20	5
2	40	30	20	10
3	35	30	20	15

Table-3: (mix proportion) Flyash+ Marble Powder

Samples	Flyash %	Lime %	Gypsum %	Marble powder %
1	45	30	20	5
2	40	30	20	10
3	35	30	20	15

5. EXPERIMENTAL PROCEDURE AND TEST RESULT

COMPRESSIVE STRENGTH TEST

Crushing strength of bricks is determined by placing brick in compression testing machine. After placing the brick, apply load on it until brick breaks. Note down the value of failure load and find out the crushing strength value of brick. Minimum crushing strength of brick is 3.50 N/mm^2. If it is less than 3.50 N/mm^2, then it is not useful for construction purpose.

The crushing strength of brick is expressed in N/mm^2 and it is calculated by dividing the maximum load and the area of the brick.

Fig.6. Compressive strength test

Table-4: Compressive strength test

Bricks sample	Compressive strength		
Trial	7 days N/mm^2	14days N/mm^2	21days N/mm^2
1	3.68	5.71	8.31
2	3.93	5.84	8.35
3	3.60	5.09	7.96

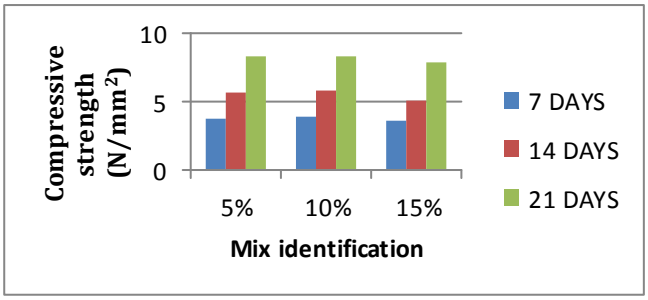


Chart.1. Compressive strength test of fly ash brick

WATER ABSORPTION TEST

Water Absorption test is conducted on brick to find out the amount of moisture content absorbed by brick under extreme condition. In this test, sample dry bricks are taken and weighed. For a good quality brick the amount of water absorption should not exceed 20% of weight of dry brick.

Fig.7. Water absorption test

Table-5: Water absorption test

Brick samples	Water Absorption test in percentage			
Trial	S1	S2	S3	Mean
1	16.89	16.40	15.63	16.41
2	16.74	16.64	16.13	16.50
3	17.37	17.06	16.32	16.91

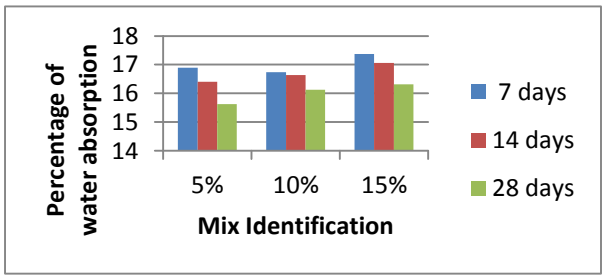


Chart.2.water absorption test of fly ash brick

DENSITY TEST

Density is how dense an object; it is calculated by dividing the mass by volume of an object. Density can be changed by Changing the size or shape of the object. The standard international unit to measure density is kilogram per cubic Meter (kg/m^3).

Table-6: Density of Bricks

Synod	Mix	Sample No.	Weight (Kg)	Density (Kg/m^3)	Average Density (Kg/m^3)
1	M1	1	3.105	2017.5	2128.2
		2	3.308	2149.4	
		3	3.413	2217.6	
2	M2	1	3.310	2150.7	2132.3
		2	3.345	2173.5	
		3	3.190	2072.7	
3	M3	1	2.979	1935.6	2015.1
		2	3.116	2024.6	
		3	3.209	2085.1	

EFFLORESCENCE TEST

A good quality flyash brick should not contain any soluble salts in it. If soluble salts are there, then it will cause efflorescence on brick surface. To know the presence of soluble salts in a brick, placed it in a water bath for 24 hours and dry it in shade. After drying, observe the brick surface thoroughly. If there is any white or grey colour deposits, then it contains soluble salts and not useful for construction.

Fig.8. Efflorescence test

Percentage of white spot in the brick = Nil.

SOUNDNESS TEST

Sound and brick should not break. Then it is said to be good flyash brick. Soundness test of bricks shows the nature against sudden impact. In this test, 2 flyash bricks are chosen randomly and struck with one another. Then sound produced should be clear bell ringing sound and brick should not break. Then it is said to be good flyash brick.

Fig.9. Soundness test

Ringing sound in the all proportions of Bricks = clear ringing sound produced.

SHAPE AND SIZE TEST

Shape and size of bricks are very important consideration. All bricks used for construction should be of same size. The shape of bricks should be purely rectangular with sharp edges. Standard size consists length x breadth x height as 19cm x 9cm x 9cm. To perform this test, select 20 flyash bricks randomly from group and stack them along its length, breadth and height and compare. So, if all bricks similar size then they are qualified.

Fig.10. Shape and size test

COLOUR TEST

Good brick should possess bright and uniform colour throughout its body.

HARDNESS TEST

Good brick should resist scratches against sharp things. So, for this test a sharp tool or finger nail

is used to make scratch on brick. If there scratch impression on brick then it is said to be hard brick.

Fig.11. Hardness test

STRUCTURE TEST

To know the structure of brick, pick one brick randomly from the group and break it. Observe the inner portion of brick clearly. It should be free from lumps and homogeneous.

Fig.12. Structure test

6. CONCLUSION

On comparing with clay brick, its shows better results in strength and heating load. Cost wise it is best in all cases. But it does not come under light weight blocks and thermal efficient. Thus, it is the most economic choice among the building blocks we considered. Hence, it very suitable to far both framed and load bearing buildings.

1. After collecting and analysing all the results, we can conclude that, at 10% replacement of fly ash with granite and marble powder gives maximum compressive strength. After 15%, the compressive strength starts decreasing in both granite and marble powder.
2. So we can analyzed that 10% replacement of granite and marble powder is optimum.

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