

Experimental Effect of Addition of waste Plastic in the Fly-Ash Bricks

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Abstract – The main objective of this research work is to develop an efficient way to effectively utilize the waste plastic which is a great threat for the sustainment of ecological balance and to reduce the plastic waste which is increasing day by day. Bad effects of plastic waste are felt throughout the world. At the same time, the thermal power plants in India continue to generate a huge amount of fly ash, disposal of which poses significant challenges for the power plants. So, in order to solve this issue, an attempt is done to reduce the disposal problem of plastic waste and fly ash by using plastic extruder machine to melt the plastic and then mixing it with other ingredients of the fly ash brick. In this paper, efforts have been made to study the behavior of fly ash bricks by taking different proportions of fly ash, cement, quarry dust and plastic. This study also aims at reducing the soil getting wasted during manufacturing of burnt bricks, by producing a brick which is environmentally friendly and also economical. A comparative study of conventional ash brick and plastic dust brick is done to showcase the advantage of plastic dust brick in areas of strength, economy, etc. Compression strength test was performed on the plastic dust brick and its strength was found to be higher than the conventional ash brick and red clay bricks.

Keywords – Pet, Fly Ash, Quarry Dust, Molten Plastic

I. INTRODUCTION

During the India day by day the growth of development is increased that requires the big and strong infrastructure. The review focuses more on bricks which are one of the most important materials in construction industry. Bricks are the major component of any construction, it is a first and basic priority in construction. It should be very sure that the prime objective should be strength of bricks. For making a green building it is important that the material using in such construction process should be eco-friendly.

Research is made to incorporate different waste material in brick production such as plastic waste, fly ash, bottom ash, rich husk ash, ceramic waste and all the solid waste. India produce approximately 46 million tons of solid waste, of which 17.3% are plastic which is discarded mainly in the form of waste plastic bottles. The plastic waste is not biodegradable and harmful to the environment. It is necessary to find a practical solution to the reuse of the waste. Plastic is found out to be very useful in gaining the strength of bricks. The strength and stability are achieved by using the components like plastic mainly PET (poly ethylene Terephthalate) and fly ash, which is generated in mass quantity from the modern thermal power plant.

The focus is towards reuse of industrial waste like PET and fly ash rather than its disposal. PET has characteristics like versatility, hardness, chemical resistance, etc. But recycling of PET is much lower than its usage. But PET can be used in bricks. It can improve tensile strength as the brick is better in compressive strength.

Coal dust has been collected as a waste product from homes and industry. During the process of combustion, carbon is burnt leaving the incombustible clay particles as ash. In the process of combustion, mineral impurities in the coal, fuse in interruption and near the surface of the combustion chamber with the exhaust gases. Fly ash is normally a byproduct from burning pulverized coal in electric power generating plants. The money received from the sale of ash would normally pay for the collection of waste.

The created and found to be highly effective, production of products using PET plastics became more popular. PET plastic has both industry- and consumer-related application. PET plastics are some of the more commonly consider as plastics when searching for solutions for drinking water bottles.

Fly ash bricks are hi-tech will-refine quality bricks used for construction of brick masonry structures. They are used as replacement for conventional bricks and has enhanced properties than it. Fly ash causes serious pollution of air and water, and its disposal bolt up large tracts of land. Fly ash accommodates CO₂ emitted from Thermal power plants, industries using coal as a fuel emits unwanted ash and smoke from which fly ash is generated. In all the power plants and industries, they dispartate the fly ash by using the cyclone converter and electrostatic precipitator. This fly ash is then utilized as a raw material for the manufacture of bricks.

The current movement in brick manufacturing has major significance on the use of post-consumer wastes and industrial by-products on the production process. More researches were held in progress bricks from wholly waste materials without utilizing any sort of natural resources, in order to achieve sustainability.

II. OBJECTIVE

This aims at designing and constructing a machine that is capable to manufacture brick using non bio-degradable material molten PET plastics along with fly ash and mixed with construction materials. The aim of this machine is to make economical

and green bricks to maintain environmental balance, and avoid problem of plastic and ash disposal that can be used in building constructional activities similar to the conventional bricks. To enhance the properties of fly-ash bricks by using non biodegradable materials as compare to conventional bricks .It should be easily operated, easily repairable and it should be economical. Machine design should help in overcoming any dynamic scatter in the machine by the operator itself.

III. METHODOLOGY AND PROBLEM STATEMENT

A. Problem statement

1) Environmental Considerations :As disposal problem and utilizing available of fly ash, non biodegradable plastic materials is a major issue , utilization of fly ash, quarry dust, plastic materials can result not only reducing the magnitude of the environmental problems, but it is also used to exploit fly ash as a raw material for value added products and for extraction of valuable materials.

2) Availability and Quality :Production of such fly ash bricks has technically sound proposition and is of particular advantage in areas where good quality and quantity of clay is not available. Quality proportional composition of mixing contains of bricks decide life of product brick to constructional use.

B. Methodology

In order to accomplish the objectives, the project work has been divided into eight major parts. They are:

- 1) Material collection.
- 2) Prepare the mixture of melt plastic and quarry dust.
- 3) Specimen making.
- 4) Preliminary tests.
- 5) Optimization of mix.
- 6) Comparison with conventional bricks.

IV. DESCRIPTION OF COMPONENTS

The components of brick manufacturing machine as shown in fig.1 and its description is given below:

- a) Screw conveyor: Inclined upward flow operated screw conveyor is used to operate flow of material.
- b) Electric motor: The electric motor used is single phase DC 0.745KW, 1 horse power motor that is designed to rotate at 1440 revolutions per minute.
- c) Heater: The heater used to generate the temperature range of 200 to 250 °C
- d) Hopper: A hopper is a funnel-shaped device used to move material from one receptacle to another.

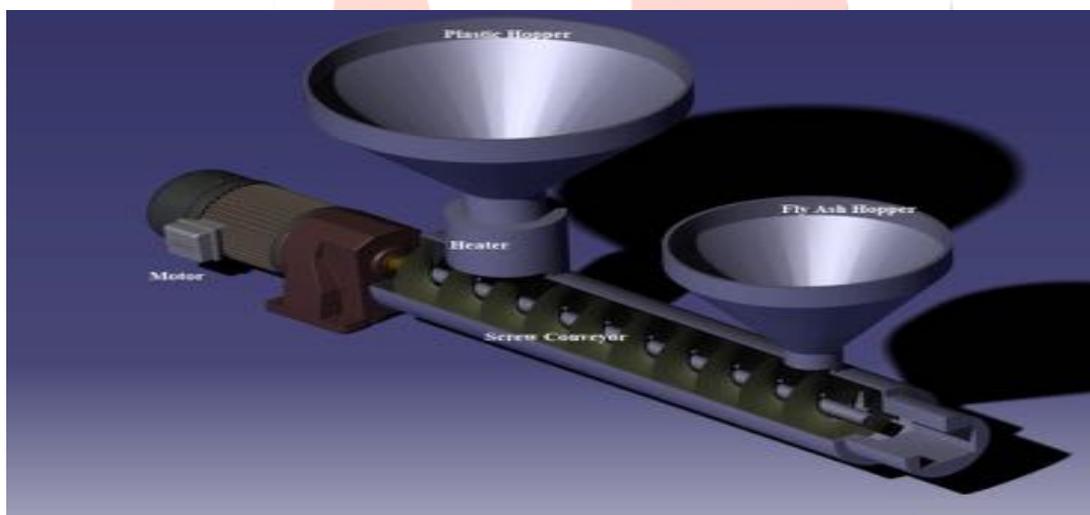


Fig.1 CAD Model of Mixing Machine

V. SPECIMEN MAKING

Proportion of molten PET plastic and Fly-Ash Bricks.

Molten plastics is the major constituent of the bricks while other ingredients are fly-ash, quarry dust and cement.

Table 1 Composition of bricks

Sr .No.	Constituents	Sample A	Sample B	Fly Ash bricks
1	Cement	10%	10%	8%
2	Fly-ash	50%	50%	30%
3	Quarry Dust	35%	33%	62%
4	Molten Plastic	5%	7%	0%

VI. EXPERIMENTAL ANALYSIS

The various test perform on bricks to find out the mechanical properties. This test are given below.

- A. Compression test
- B. Water absorption test

A. Compression test

1. Two bricks of the each mix have been taken of respective curing days.
2. Then bricks is place on Universal Testing Machine.
3. Then load is applied and by using tabular column optimum strength is find out.
4. Compressive strength=load/area (N/mm²).



Fig 2.Compression Test on UTM

B. Water Absorption Test

1. Dry the specimen to obtain constant mass by ventilated in oven at 105 to 115 °C .
2. Then specimen is cooled to be room temperature and its weight(M1) is obtain.
3. Deep the completely dried specimen in clean water for 24 hours.
4. Then removed the bricks from water and weight the bricks(M2).
5. Water absorption after 24 hours .

$$\frac{M1 - M2}{M2} \times 100$$

VII. RESULT AND DISCUSSION

A. Compression Test

Compression strength test reading of bricks are given below.

Table 2 Result of Compression Test

SAMPLES	7 DAYS	14 DAYS
Sample A	3.2 N/mm ²	3.72 N/mm ²
Sample B	3.42 N/mm ²	4.12 N/mm ²
Fly ash Bricks	3.24 N/mm ²	3.45 N/mm ²

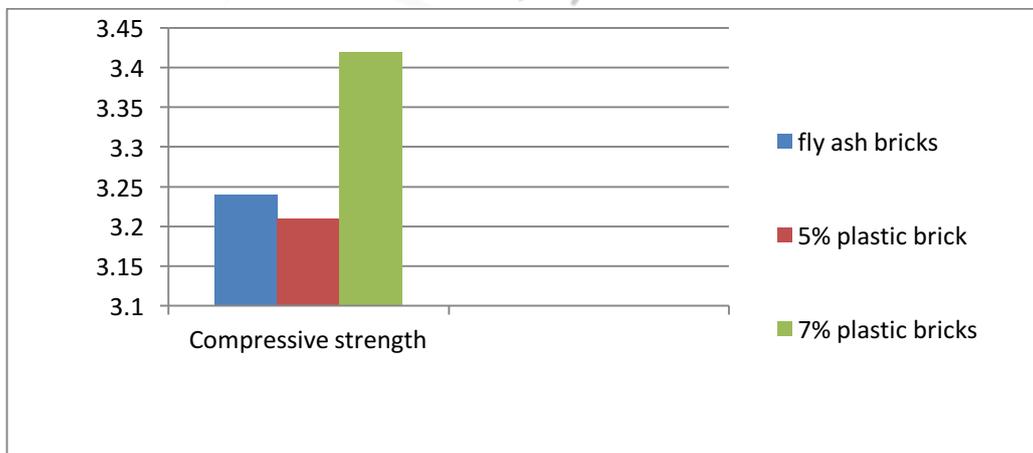


Fig 3. Result of 7 Days curing

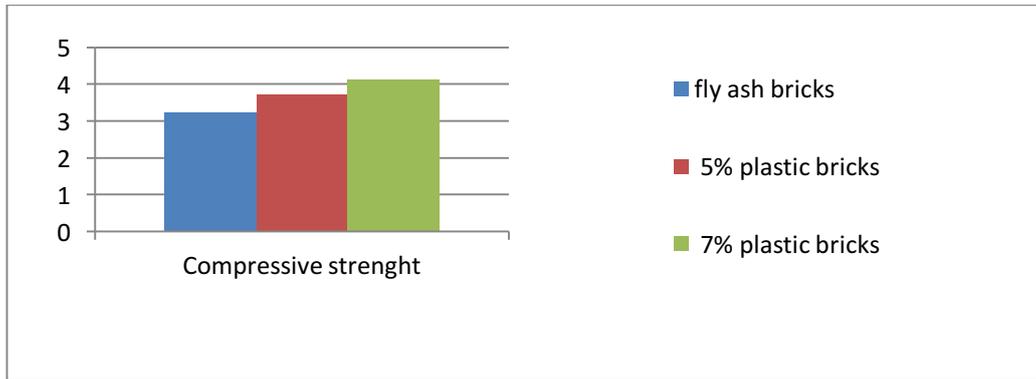


Fig 4.Result of 14 Days curing

B. Water Absorption Test

We conduct the water absorption test on bricks the following results are.

M1=2.89 kg

M2=2.7 kg

For 7 days curing of 5% bricks.

$$= \frac{M1-M2}{M2} \times 100 = \frac{2.89-2.7}{2.7} \times 100$$

$$= 7.03\%$$

Water absorption test reading of bricks are given below.

Table 3 Result of Water Absorption Test

SAMPLES	7 DAYS	14DAYS
Sample A	7.03	6.32
Sample B	6.52	6.12
Fly Ash Bricks	7.32	7.14

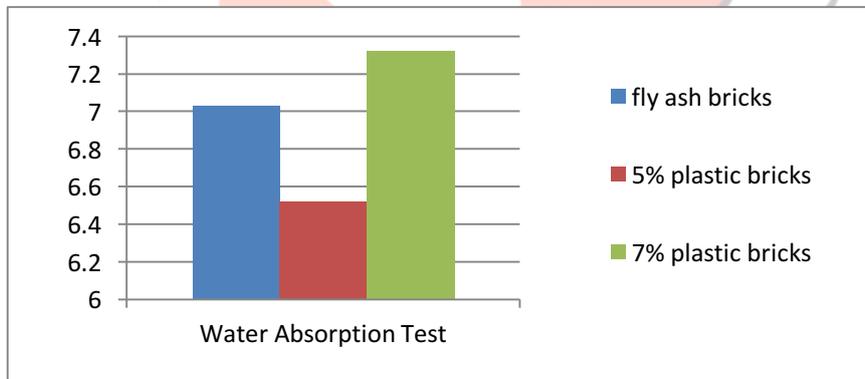


Fig 5.Result of 7 Days curing

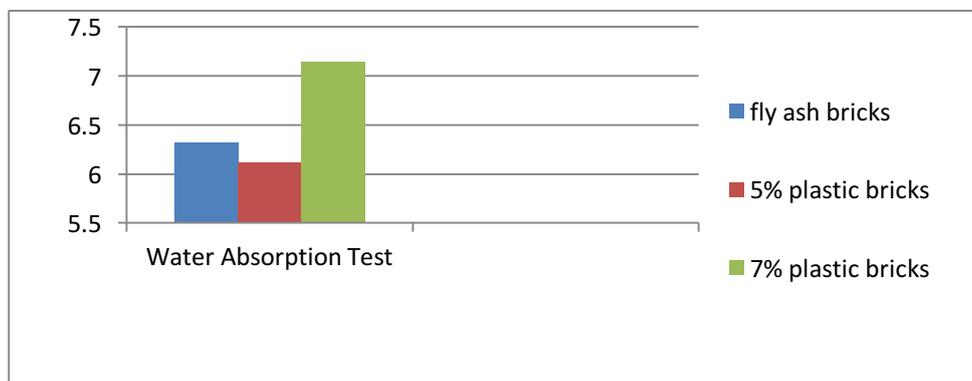


Fig 6.Result of 14 Days curing

VIII. CONCLUSION

From this investigation, the following conclusions can be derived on the basis of the tests performed:

The primary raw material used for bricks is the soil, which is often taken from prime agricultural land, causing land degradation as well as economic loss due to diversion of agricultural land. Use of traditional technologies in firing the bricks results in consequential local air pollution. At the same time, the thermal power plants in India continue to generate a huge amount of fly ash, disposal of which poses significant challenges for the power plants. Plastic waste which is increasing day by day becomes disgrace and in turn pollutes the environment, especially in high mountain villages where no garbage collection system exists. The study presented above helps in reducing the fly ash and plastic waste disposal problem as it utilizes the both even in its finest form and converts that useless material into a useful construction material forming eco-friendly bricks. In Compression test, Sample B of 7% at 14 days curing gave optimum value of 4.12 N/mm² while the fly ash bricks only 3.24 N/mm². Its shows that with the addition of molten PET plastic in fly ash bricks the compressive test is increased by 27.16%. In Compression test, Sample A of 5% at 14 days curing gave the value of 3.72 N/mm² while the fly ash bricks only .24 N/mm². Its shows that with the addition of molten PET plastic in fly ash bricks the compressive strength is increased by 15%. In Water Absorption Test, it was found that Sample B of 7% brick curing at 14 days is 16.67% less than the fly ash bricks. In Water Absorption Test, it was found that Sample A of 5% brick curing at 14 days is 12.97% less than the fly ash bricks. When the bricks are immersed in water and dried, white patches are not formed, so the results for efflorescence of bricks are nil. Since plastics are used as a partial replacement of quarry dust, the bricks are economical and the cost of brick is lesser than normal fly ash bricks. Since plastics are added as a partial replacement for quarry dust, the weight of the brick decreases. From above analysis, this brick can be effectively used in construction field. Its uses are not restricted as only brick; it can even be utilized as a building block by increasing the dimension of the mould.

IX. REFERENCES

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