

# Experimental Investigation on Usage of Plastic Waste in Manufacturing of Bricks

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**Abstract-** In building construction brick is one of the major ingredients in the material used for construction. In the process of brick making, it has to be burn in kiln which introduced to evolve the CO<sub>2</sub> gas in major quantity. This CO<sub>2</sub> gas pollutes the environment. So the solution on this disadvantage of the burnt clay bricks is replacing the bricks with another material i.e. bricks made from waste plastic bottles. Today we need cost effective and environment friendly material which not pollute the environment. Therefore we can use the waste plastic bottles for making an affordable house.

**Keywords-** eco-friendly bricks, compressive strength test, efflorescence test, plastic waste

## I. INTRODUCTION

Plastic is a non-bio-degradable substance which takes thousands of years to decompose that creates land as well as water pollution to the environment. The quantity of plastic waste in Municipal Solid Waste (MSW) is expanding rapidly. It is estimated that the rate of usage is double for every 10 years. The Plastic usage is large in consumption and one of the largest plastic wastes is polyethylene (PE). The utilization of earth based clay material resulted in resource depletion and environmental degradation. As amount of clay required for brick is huge, in this project these waste plastics are effectively utilized in order to reduce the land space required to dump these wastes. This creates the prevention from various harmful diseases. Polyethylene (PE) bags are cleaned and added with fine aggregate at various ratios to obtain high strength bricks that possess thermal and sound insulation properties. This is one of the best ways to avoid the accumulation of plastic waste. It also helps to conserve energy, reduce the overall cost of construction and hence in this project, an attempts made to manufacture the plastic sand bricks by utilizing the waste plastics.

## II. MATERIALS

### 1. Sand

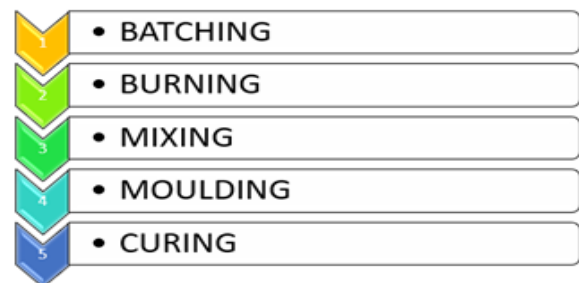
Natural river sand was used as fine aggregate. The properties of sand were determined by conducting tests as per IS: 2386 (Part-1). The results are shown in test data of materials. The results obtained from sieve analysis are furnished.

The results indicate that the sand conforms to zone II of IS: 383-1970.

### 2. Waste Plastic

Plastics are commonly used substances which play an important role in almost every aspect of our lives. The widespread generation of plastics waste needs proper end-of-life management. The highest amount of plastics is found in containers and packaging's (i.e. bottles, packaging, cups etc.), but they also are found in durables (e.g. tires, building materials, furniture, etc.) and disposable goods (e.g. medical devices). Diversity of plastics applications is related with their specific properties, low density, easy processing, good mechanical properties, low density, easy processing, good mechanical properties, good chemical resistance, excellent thermal and electrical insulating properties and low cost ( in comparison to other materials).

## III. METHODOLOGY



### A. Batching of materials:

Mix Ratio	Plastic:Sand Ratio (wt in gms)		
	1:3	1:4	1:5
For 1 brick	1000:3000	800:3200	667:3333

**B. Burning:**

After batching the plastic bottles were taken for burning in which the waste plastic bottles are kept in a drum and allowed to melt. The first step of this process involves arrangement of stones, firewood, fuel and drum.

The drum is placed on the stones and firewood is placed in gap between stones and by using fuel the firewood is ignited. The burning process is continued till the waste plastic gets completely melted and required quantity of plastic is obtained.

**C. Mixing of materials:**

Mixing of materials is very essential step in production of high strength bricks. The mixing should be done until the mass becomes homogeneous and uniform in colour. In this project we adopted hand mixing. For different proportions plastic and sand, bricks are prepared.

**D. Moulding of Bricks:**

For easy removal of bricks the sides of the mould is greased or oiled before filling the mould. The mixture of plastic and sand is then poured into the brick mould and is compacted by using tamping rod. After the mould gets completely filled the surface of the mould is made levelled. Mould is removed after 24 hours.

**E. Curing:**

The test specimens after demoulded were allowed to dry for a period of 24 hours. The specimens were kept in an ordinary curing tank and allowed to cure for a period of 3 days, 7 days and 28 days.

**IV. TESTING OF BRICKS****A. Size and Shape Test:**

In this bricks are stacked along lengthwise, widthwise and heightwise and then those are measured to know the variation of sizes as per standard.

**B. Hardness Test:**

In this test a scratch is made on brick surface with a hard thing. If that doesn't leave any impression on the brick then that is a good quality brick.

**C. Water Absorption Test:**

In this test bricks are weighed in dry condition and let them immersed in fresh water for 24 hours. After 24 hours of immersion the bricks are taken out from water and then wiped out with cloth. Then the brick is weighed in wet condition. The difference between weights is the water absorbed by brick. The percentage of water absorbed is then calculated. Good quality brick should not absorb more than 20% of water by its own weight.

**D. Compressive Strength Test:**

The specimens of bricks were taken to laboratory for testing and tested one by one. In this test, a brick specimen is put on crushing machine and pressure is applied till it breaks. The ultimate pressure at which brick is crushed is taken into account.

**E. Efflorescence Test:**

The presence of alkalis in bricks is harmful where it forms a grey or white layer on brick surface by absorbing moisture. To find out the presence of alkalis in bricks, this test is performed. In this test, a brick is immersed in fresh water for 24 hours. If the whitish layer visible about 10% of brick surface, then the presence of alkalis is in acceptable range. If that is about 50% of surface, then it is moderate. If the alkali's presence is over 50%, then the brick is severely affected by alkalis.

**V. RESULTS & DISCUSSIONS****A. Results of size and shape test:**

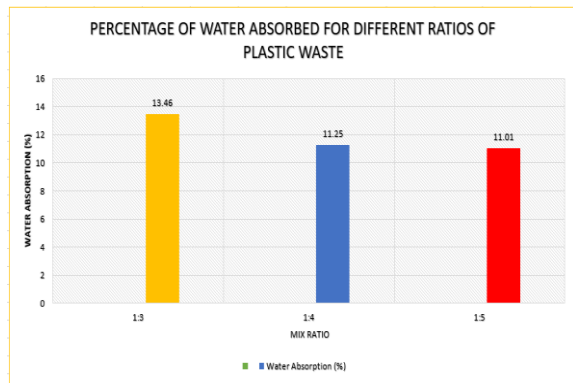
The size of bricks are near to the standard values for any proportion of plastic.

**B. Results of Hardness test:**

Upto 1:4 ratio, bricks are hard. When scratch is made it doesn't leave any mark. But beyond the 1:4 ratio, there was scratch left on the brick surface.

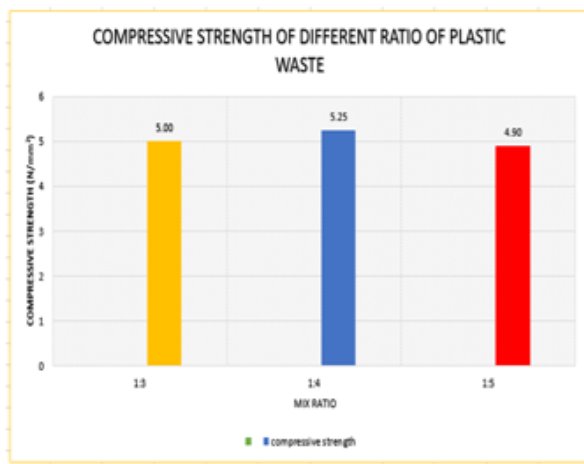
**C. Results of Water Absorption Test:**

S.NO.	MIX RATIO	WATER ABSORPTION (%)
1.	1:3	13.46
2.	1:4	11.25
3.	1:5	11.01



*D. Results of Compressive strength test:*

S.NO.	MIX RATIO	COMPRESSIVE STRENGTH (N/mm <sup>2</sup> )
1.	1:3	4.50
2.	1:4	5.25
3.	1:5	4.90



*E. Results of Efflorescence Test:*

S.NO.	MIX RATIO	SALT DEPOSIT OBSERVED		
		NIL	MODERATE	HEAVY
1.	1:3	√		
2.	1:4	√		
3.	1:5		√	

The efflorescence test also showed the excellent performance of plastic sand bricks for upto 1:4 ratio. There is no absence of grey or white deposit shown on the bricks.

**VI. CONCLUSIONS**

From the analysis of results given above following conclusions can be made:

1. Use of plastic waste in production of bricks can solve the disposal problem.
2. Usage of waste plastic in bricks reduces the water absorption.
3. Plastic sand brick possess more advantages which includes cost efficiency, resource efficiency, reduction in emission of green house gases.
4. By use of plastic sand bricks the presence of alkalis was highly reduced.
5. Plastic sand bricks reduce the usage of clay in making of bricks.
6. Plastic sand bricks gives an alternative option for customers to get bricks on low cost.

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