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# Amplification of Compressive Strength of Bricks made of Different materials by adding molten plastic waste

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**Abstract**

Environmental pollution and environmental accumulation of high percentage of plastic waste can be reduced by utilizing waste plastic in bricks. This benefit construction industry filling the gaps of demands of building materials and disposal of plastic waste through recycling instead of the process of land filling or burning etc. the present experiment setup for manufacturing of plastic sand bricks. An attempt was made to study the characteristics of bricks made of m-sand and plastic waste with varying volume of plastic waste as 15%, 20%, 25%, 30% and 35%. A step by step procedure was adopted to perform various Indian standard code recommended important tests on the above stated plastic bricks. The compressive strength, efflorescence, soundness test, water absorption test of bricks made with stated % of plastic was determined. The study highlighting the fact that the bricks 20% plastic with 80% m-sand having maximum compressive strength and also indicates that as the amount of plastic waste increase the water absorption increases and also having low or nil efflorescence.

**Key words:** M-sand brick, plastic bricks, plastic waste, polyethylene.

## 1. Introduction

Bricks have a remarkable history as the main construction and building material. The demand for bricks is expected to be continuously raised due to the substantial increment in new construction projects. There is two main types of bricks used in construction clay bricks cement bricks, however, these two types of bricks consumed much energy and raw materials in the production stage, which results in a shortage of the raw materials (Rawat et al., 2014). Studies have been attempted to utilize PW to produce bricks as an alternative option towards the circular economy and environmental protection. The primary objective of the

present study is to improve the compressive strength of bricks made of plastic waste material. The study focuses over the performance of bricks, made out of varying % of plastic in combination with m-sand. Essential tests specially, the compressive strength test was later carried out on the manufactured bricks. The strength of plastic waste brick has been doubted by the public since they are made from plastic waste. However, this doubt is solved because plastic waste bricks are stronger and have good load bearing capacity (Ronak, et al., 2017).

## 2. Literature review

**Ahmed et al., (2018):** This study showed that increasing PW as raw material in paving block production reported decreasing the compressive strength. He observed that control paver block with 0% replacement of PET recorded the highest compressive strength 21.4N/mm$^2$, followed by 20.9 N/mm$^2$, 12.2 N/mm$^2$ and 10.9 N/mm$^2$ for 5%, 10% and 15% of PET respectively.

**Gul and Ozbakkaglu (2016):** They showed that plastic waste can be added to replace the conventional material, but it is not widely used in the commercial level application. To date, there has been little agreement on reusing plastic waste in construction material as it might reduce the compressive strength. However, there is evidence that plastic waste enhances the compressive strength of the product.

## 3. Objectives

- To evaluate the possibility of recycling plastic waste.
- To investigate the mechanical (Strength) behaviour of plastic sand bricks.
- To test and compare the compressive strength of plastic sand brick with burnt clay bricks.
- To make green structure to conserve natural resources such as clay for future need.
- Plastic waste management and provide an effective way to minimize it.

## 4. Material used

The different types of materials used for the manufacture of plastic brick are:

### **4. 1.** Plastic

When it comes to promotional give away and even items we use around the house, there is no material more important than plastic. The same can be said for the items we use at present. Most of our supplies contain at least a little bit of this material. In fact, humans have the so for produced 9.1 billion tons of

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plastic. For the sake of the environment, it is important to know the different types of plastic and their uses, as well as the resin identification codes found on each.

Accumulation of such wastes can result into hazardous effects to both human and plant life. Therefore need for proper disposal and if possible, use of these wastes in their recycled forms occurs. This can be done through process of plastic management. Waste management in respect to plastic can be done by recycling if they are not recycled then they well be big pollutant to the environment as they not decompose easily and also not allow the waste to percolate into the soil they are poisonous.

Properties

| S. No. | Chemical formula | $(C_{10}H_8O_4)_n$ |
|---|---|---|
| 1. | Melting point | 180°C to 250°C |
| 2. | Specific gravity | 1.3-1.4 |
| 3. | Water absorption | 0.07-0.10% |
| 4. | Thermal conductivity | 0 |
| 4. | Solubility in water | Perfectively insoluble |

### 4.2. M-SAND

M-sand is a common byproduct of mining and quarrying rather than being discarded it as a wastes material it can be utilized in various construction processes of the pavements. The cost of the m-sand is respectively low as compared to natural sand. M-sand is 50% cheaper as compared to natural sand and provides 9% extra strength in the concrete.

| Shape | Cubical and Angul |
|---|---|
| Impurities | Absent |
| Fines Modules | 2.92 |
| Specific gravity | 2.89 |
| Water absorption | 2-4% |

**4.3. MOULD** Aluminum mould used in the present investigation was collected from the nearby brick kiln with a dimension of 19×9×9 cm.

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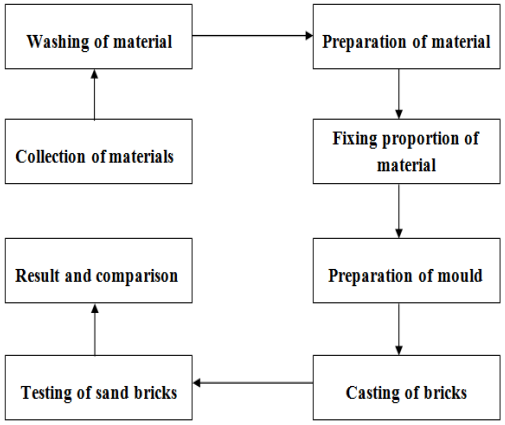
## 5. Methodology




## 6. Testing and results

To know the quality of plastic sand bricks following tests can be performed to find out the properties of plastic sand bricks in tests some are performed in laboratory and the rest are on field

Tests on prepared bricks

- Compressive strength
- Water absorbing test
- Efflorescence test
- Shape and size test
- Soundness test

## 6.1 COMPRESSIVE STRENGTH OF PLASTIC SAND BRICKS

The axial force applied on a body is referred as a load. The intensity resisting force offered by the body per unit area against deformation is termed as stress. Here, we calculated the compressive stress which is the ultimate compressive load to the body divided by cross section area.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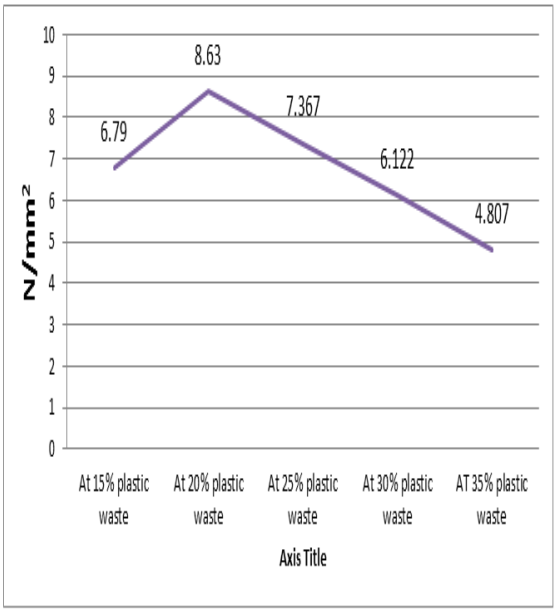
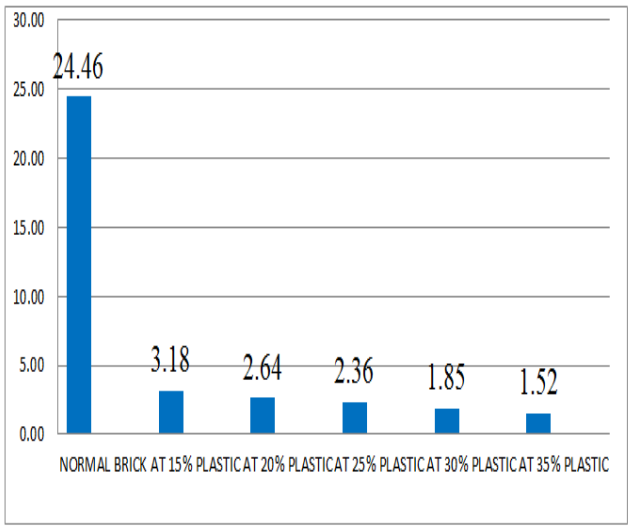
| % of plastic waste | % of M-sand | Compressive strength |
|---|---|---|
| 15% | 85% | 6.79 N/ mm² |
| 20% | 80% | 8.63 N/ mm² |
| 25% | 75% | 7.367 N/ mm² |
| 30% | 70% | 6.122 N/ mm² |
| 35% | 65% | 4.807 N/ mm² |




## 6.2 Water Absorption test

Absorption test is carried on the brick to discover the measure of dampness context consumed by the brick under extreme conditions in this brick are taken weighted then these brick are put in water for 24 hours. After 24 hours brick is cleaned by cloth and measured again. The measure of water assimilation is the difference between the dry and wet brick.

| % of plastic waste | % of M-sand | Water absorption$=\frac{w2-w1}{w1}\times 100$ |
|---|---|---|
| 15% | 85% | 3.18% |
| 20% | 80% | 2.64% |
| 25% | 75% | 2.36% |
| 30% | 70% | 1.85% |
| 35% | 65% | 1.52% |




## 6.4 EFFLORESCENCE TEST

Efflorescence simply means the appearance of white-colored powder material on the surface of the bricks. The alkaline salt present in the brick absorbs moisture from the air which on drying leaves power deposited on the surface. It is also caused if pyrite was present in clay used for brick making and water used for pugging contains gypsum.

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| Efflorescence Test Results | | | |
|---|---|---|---|
| S. No | Mix Percentage | Nil | Slight |
| 1 | Burnt clay Brick | Nil | ✓ |
| 2 | 15% Plastic waste brick | Nil | Nil |
| 3 | 20% Plastic waste brick | Nil | Nil |
| 4 | 25% Plastic waste brick | Nil | Nil |
| 5 | 30% Plastic waste brick | Nil | Nil |
| 6 | 35% Plastic waste brick | Nil | Nil |

From the testing of efflorescence of the bricks, it was observed that the plastic m-sand brick does not show any efflorescence since the plastic contains less amount of soluble salts in it. Hence finally it is proved that the efflorescence of bricks was very less.

## 7. PEFERRED IS-CODE BOOKS.

IS: 1077(1992): (For the tests and dimension of bricks).

IS: 3495-(Part 1)-1992, RA 2011(Fr compressive strength test)

IS: 3495-(part 2)-1992), (for water absorption test)

IS: 3495-(part 3)-1992 (For efflorescence test)

IS: 383 (1970: (coarse and fine aggregates spaceman for concrete).

## 8. Conclusion

In this project, the plastic was used as the binding material so it restricts the absorption of water and also provides the good plasticity to the brick. This plastic bricks has high compressive or crushing strength at the use of 20% plastic waste and also has less water absorption value when compared to normal conventional burnt clay bricks. So hence the plastic sand brick 20% and 80% of plastic waste and m-sand is preferable for the usage to the constructions. By use of plastic sand bricks, the water absorption was highly reduced. So this type of bricks can be used at underwater construction, underground construction, and also used for underground septic tank construction. Hence the main aim of this work was to reduce plastic waste in our environment by utilizing as a material for the building construction.

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