



Development of ECO – Bricks for Construction Industry

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ABSTRACT

Plastic waste which is increasing day by day becomes eyesore and in turn pollutes the environment, especially in high mountain villages where no garbage collection system exists. A large amount of plastic is being brought into the tourist trekking regions are discarded or burned which leads to the contamination of environment and air. Hence, these waste plastics are to be effectively utilized. Low-density polyethylene bags are cleaned and added with sand at particular percentages to obtain high strength bricks that possess thermal and sound insulation properties to control pollution and to reduce the overall cost of construction; this is one of the best ways to avoid the accumulation of plastic waste which is a non-degradable pollutant. This alternatively saves the quantity of sand/clay that has to be taken away from the precious river beds/mines. The plastic waste is naturally available in surplus quantity and hence the cost factor comes down. Also colouring agents can be added to the mixture to attain desired shades. The present work deals with the manufacturing and analysis of bricks made with waste plastic (LDPE) and fine aggregates. The bricks produced are light weight, have smooth surface and fine edges, do not have cracks and have high crushing strength and very low water absorption.

Keywords: Plastic Waste, Environment, Compressive strength, Water Absorption, Brick.

I. INTRODUCTION

In recent years, the world has witnessed a surge in environmental awareness, with a growing emphasis on sustainability and waste management. One innovative solution that has gained traction is the concept of eco bricks. Eco bricks, also known as plastic bricks or bottle bricks, are plastic bottles stuffed with non-biodegradable waste. These bricks serve as a sustainable alternative to traditional building materials and offer various environmental and social benefits. This essay delves into the concept of eco bricks, their applications, and objectives in promoting sustainability and environmental conservation.

These bricks are sealed to prevent the waste from decomposing or leaching toxins into the environment. The idea behind eco bricks is to repurpose plastic waste that would otherwise end up in landfills or pollute natural ecosystems. In an era marked by escalating environmental concerns and the urgent need for sustainable solutions, innovative approaches to waste management have become increasingly paramount. In an era marked

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The objective of this research was to develop a solution for the use of plastic waste in composite brick manufacturing. This is achieved by experimenting samples of bricks made of different grain sizes of Polyethylene Terephthalate (PET) plastic waste that replace the weight of natural soil in order to achieve the strength of bricks. The optimum mixing proportion is then determined for the maximum compressive strength of the brick. The typical tests that are done for bricks either in the lab or in the field are commonly compressive strength test, water absorption test, efflorescence test, above one metre impact drop test, ringing sound test and hardness test. These tests were performed according to the BIS (Body of Indian Standards) for the proposed composite bricks and their properties were studied.



Figure 1: Eco Bricks

II. LITERATURE REVIEW

Siti Aishah Wahid et al. (2014) has worked on "Utilization of plastic bottle waste in sand bricks" used rejected bottles from factory were collected then put into crusher and get small pieces and sieved to get small uniform size and make plastic sand brick. in which he gets the result after various test on sand plastic brick like compressive strength, water absorption test and efflorescence test. [2] Ganesh Tapkire, Satish Parihar, Pramod Patil (2014) Recycled plastic used in concrete paver block It can be used in traffic and non-traffic roads .and it's also good heat resistance, and the cost of eco bricks is reduced when compare to concrete paver blocks.[3] Mr. N. Thirugnanasambantham et al. (2017) has worked on "Manufacturing and testing of plastic sand bricks" used cement, sand, water fly ash and waste plastic for his study. they used a proportion of 1:2 to 1:6 of plastic and sand to get different results. they use a proper sequence for manufacturing of bricks as batching, mixing, moulding, curing and then testing. test was conducted as compressive strength test, water absorption test efflorescence test, hardness test, fire resistance test, soundness test etc and gave a special name to plastic sand brick as "Eco-Brick. [4] Rajarapu Bhushaiah et al (2019). has studied on "Study of plastic Bricks Made from Waste Plastic". They concluded in their research paper that they made a brick from plastic waste using mix design of plastic. they made the mix design using variable plastic as 5 temperatures of 90-110 degree and then mix with other ingredients. after then they conducted test on plastic bricks as compressive strength test, water absorption, efflorescence test, soundness test. As per their results, they made the 3rd class bricks. [5] Bhushan V. Ghuge et al. (2019) has worked on "manufacturing of plastic sand bricks" his objective was to develop an efficient way to

effectively utilize the waste plastics. he uses poly ethylene terephthalate, high density polythene, low density polythene, poly propylene, urea formaldehyde, polyester resin as a plastic waste. in his research paper firstly he batches all ingredients, burning, mixing, moulding and then testing is done. in various tests compressive strength test, water absorption test, efflorescence test, hardness test, soundness test is included. They concluded that the strength of brick is increased when plastic ratio keeps constant and increase the value of sand ratio.

There are the various researches are going on to find out safe and eco-friendly disposals of plastics. Annually, India release 56 lakh tons plastic waste, whereas Delhi accounting for generating 689.5 tons per day. That means the conclusion is that we can also use plastic waste as an ingredient of concrete which is a better way to dispose it.

III.METHODOLOGY

A. Process of Casting Plastic Sand Brick

- First, we need to collect the plastic waste and separate it from other wastes.
- Second, we should dry the plastic waste if it is wet and it has some moisture content in it. We have to use dry plastic waste in melting of plastic.
- Then, we crush the plastic waste in small particles by crushing machine.
- Then, the small particles crush into fine size particles.
- The ratio of plastic and stone dust which we use in the brick is 1:3.
- The stone dust which we use in manufacturing of bricks is sieved for a size less than 4.75mm using sieve analysis.
- Then, we heated the stone dust on a furnace (kadai).
- The fine particles of plastic waste also heated on a furnace (kadai) till it is in a liquid form.
- Then, we add the stone dust into melted plastic.
- Then, mix it properly and make a mix. Apply the grease to the moulds.
- Then, pour the mix into the moulds. Compact it properly using tamping rod for settling of mix to avoid air gaps.
- Then keep the mould to the atmosphere, let it cool down and demould it next day.

B. Collection of Plastic Materials

The plastic material should be collected from the factories waste and hospital waste and industries waste and also food packages and plastic bottles this will come under the LDPE plastic type.



Figure 2: Collection of Plastic waste

C. Batching of plastic

Measurement of materials for making brick is called batching. After collection of materials, we separate the types of plastic and remove any other waste presented in the collected material and check that any water content in in sample collected ten proceed for burning.

D. Burning of waste plastic

After completion batching the plastic waste was taken for burning in which the plastic bags are drop one by one into the container and allowed to melt. These would be done in closed vessel because to prevent the toxic gases released into atmosphere. These will be at the temperature of 120-150 degrees centigrade.

E. Mixing

Mixing of materials is essential for the production of uniform and strength for brick. The mixing has to be ensuring that the mass becomes homogeneous, uniform in colour and consistency. Generally, there are two types of mixing, Hand mixing and mechanical mixing. In this project, we adopted hand mixing. Until the entire plastic content required for making plastic brick of one mix proportion is added into it. Then these plastic liquids thoroughly mixed by using trowel before it hardens. The mixture has very short setting bags are turned to molten state; the river sand is added to it. The sand added is mixed time. Hence mixing process should not consume more time.



Figure 3: Melting of Plastic waste

F. Moulding

After completion of proper mixing, we place mix into required mould. In these projects we use the normal brick sizes (19x9x9 cm). After 2 days remove the brick from the mould and then done curing.

IV. RESULTS AND DISCUSSION

A. Compressive Strength Test

This test is done to know the compressive strength of brick. It is also called the crushing strength of brick. Generally, 3 specimens of bricks are taken to laboratory for the testing and tested one by one. In this test, a brick specimen is put on compressive strength is put on Compressive Strength testing machine and applied pressure at a constant rate till it breaks. The ultimate pressure at which brick is crushed is taken into account. All three brick specimens are tested one by one and average result is taken as bricks compressive/crushing

strength. The Compressive Strength of the brick is calculated by the formula = (max load taken before failure/ Area of the Brick surface) N/mm².

TABLE I COMPRESSIVE STRENGTH FOR 1:2 PLASTIC TO ROBO SAND RATIO, ECO BRICKS

Plastic Sand Brick (1:2Ratio)	Maximum Load (KN)	Compressive Strength (kg/cm ²)
Specimen 1	525	203.56

B. Water Absorption Test

In this the bricks first weighted in dry condition and they are immersed in water for 24 hours. After that they are taken out from water and they are wiping out with cloth. Then the difference between the dry and wet bricks percentage are calculated. They weight of the three plastic bricks has been taken and then the average weight of the bricks is calculated.

Water absorption = $\{[\text{Weight of wet brick} - \text{Weight of dry brick}] / \text{Weight of dry brick}\} * 100$

Plastic Sand Brick (1:2Ratio)	Maximum Load (KN)	Compressive Strength (kg/cm ²)
Specimen 1	525	203.56

V. CONCLUSION

The proposed project presented above intends to resolve in reducing the plastic waste disposal problem as it utilizes the waste even in its finest form and converts that useless material into a useful construction material. Extruder machine plays a prominent role in the conversion of waste plastic into its melted form. Also, extruder does not possess any threats to the environment and hence can be used without any restriction. It also helps in reducing the usage of natural resources which are utilized during the manufacturing of burnt bricks, also it reduces the pollution which is generated from kiln during brick manufacturing. The final end product can be used as brick, which is having a higher strength than conventional brick. Also, the water absorption capacity is higher in comparison to conventional brick with a lower weight. Its uses are not restricted as only brick; it can even be utilized as a building block by increasing the dimension of the mould. Also, it reduces the use of wire used for fencing. Floor tiles, sleepers, etc. can also be produced from it. This brick also turns out to be economical than conventional brick, by reducing the cost of incinerators for burning purpose and landfills.

VI. REFERENCES

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