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MANUFACTURING OF PLASTIC-SAND BRICKS

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Abstract*— an innovative way to encounter the grave problem of plastic present in our environment has been studied during this project. Plastic on mixing with soil leads to serious environmental problems which includes depletion of fertility of soils, severe drainage consequences. Various measures have been taken by governing bodies to minimize the production and consumption of plastic. Plastic has been barred from use in numerous states of India including Maharashtra. But there is a monumental amount of plastic present, which needs to be eliminated. Also the quantity of clay required for manufacturing normal bricks have reached soaring heights. This ingenious idea of utilizing plastic as material for manufacturing bricks will aid in management of plastic waste and will lead to a greener environment. It will also reduce the stress on local bodies in managing and disposal of plastics waste. In this project, the properties of conventional and plastic bricks have been carefully studied to conclude that plastic bricks are better in terms of strength, water absorption and hardness.

***Keywords*— Bricks, Plastic, Sand, Compressive Strength, Water Absorption**

1. INTRODUCTION

Plastic is one in every of the daily increasing helpful yet as a risky material. At the time of need, plastic is found to be very useful but after its use, it is simply thrown away, creating all kinds of hazards. Plastic is non-biodegradable that remains as a hazardous material for more than centuries. The quantity of plastic waste in Municipal Solid Waste (MSW) is expanding vastly. It is estimated that the rate of expansion is double for every 10 years. This is due to rapid growth of population, urbanization, developmental activities and changes in life style which leading widespread littering on the landscape. They are non-biodegradable and conjointly researchers have found that the plastic materials will stay on earth for 4500 years while not degradation In Asian country or so forty million loads of the municipal solid waste is generated annually, with evaluated increasing at a rate of one.5 to twenty once a year. Hence, the plastic which is wasted must be effectively utilized. Today, it is impossible for any vital sector to work efficiently without usage of plastic starting from agriculture to industries. Thus we cannot ban the use of plastic but the reuse of plastic waste in building constructions, industries are considered to be the most practicable applications.
Plastic is used in multiple situations such as construction of pavements, walls, etc. Traditionally, the term brick brought up a unit composed of clay, however it's currently accustomed denote any rectangular units arranged in mortar. A brick is composed of clay-bearing soil, sand and lime, or concrete materials. Bricks are made in varied categories, types, materials and sizes that vary with region and period, and are made in bulk quantities. Basically bricks can be manufactured in three types namely unfired, fired and chemically set bricks. Each type is manufactured differently. The standard size of the brick is 19 cm x 9cm x 9 cm.

1.1 Objectives

- To develop an efficient way to effectively utilize the waste plastics and that plastic wastes acts as a great threat for the sustainment of ecological balance
- To reduce the consumption of earth based material as clay for the manufacturing of brick that resulted in resource depletion, environmental degradation
- To reduce the waste plastic quantities on the land and water to avoid land and water pollution.
- To reduce the dumping area of waste plastics

2. MATERIAL SPECIFICATIONS

2.1 Plastic

Plastics are commonly used substances which play an important role in almost every aspect of our lives. Plastic is generated on large scale and in various fields and it needs proper waste management. The highest amount of plastics is found in containers and packaging's (i.e. bottles, packaging, cups etc.), as well as, various building materials and disposable items. Plastic can be classified on various grounds such as chemical properties, density, manufacturing techniques, mechanical properties and thermal properties. Post-production and post-consumer plastics are utilized in a wide range of applications

Table 1: Availability of Waste Plastic

Sr. No.	Waste Plastic	Available as
1	Poly-ethylene terephthalate (PET)	Water bottles etc.
2	High Density Polyethylene (HDPE)	Polyethene bags, bottle caps, etc.
3	Low Density Polyethylene (LDPE)	Milk bags, carry bags, bin linings, detergent bottles and cosmetics etc.
4	Poly propylene (PP)	Bottle caps and closures, wrappers of detergents, biscuit etc.
5	Urea formaldehyde	Electrical knobs, handles and fittings etc.
6	Polyester resin	Casting, bonding fibers (glass, Kevlar, carbon fiber) etc.

2.2 Sand

Sand is a finely divided granular material which occurs due to deterioration of rocks and minerals. Size, fineness, texture, colour are the properties which define sand. Geographical and hydrological conditions also affect the formation and properties of sand. Silica is the most common constituent found in sand. The second commonest sort of sand is carbonate, as an example, aragonite, that has largely been created, over the past billion years, by varied types of life, like coral and shellfish. As an example, it's the first sort of sand appeared in areas wherever reefs have dominated the system for various years just like the Caribbean. Sand is a non-renewable resource over human timescales, and sand suitable for making concrete is in high demand. Natural river sand was used as a fine aggregate.

Natural river sand was used as a fine aggregate. The properties of sand were determined by using density bottle and sieve. 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 11 of IS: 383-1970. The tests performed on the sand are as follows:

Table 2: Results of Soil Testing

Sr. No.	Property	Result
1	Specific gravity	2.71
2	Bulk density	1.45 g/cm^3
3	Fineness modulus	2.3

3. PROCEDURE

3.1 BATCHING

The collected waste bottles are cleaned with water and dried to remove the water present inside the plastic and then weighted. The sand were sieved by using 1.18 mm sieve. The sand and the plastic bottles were weighed in various proportions among which the plastic were taken for burning process.

3.2 BURNING

After batching the plastic bottles were taken for burning in which the plastic bottles are thrown one by one into the drum and allowed to melt. The first step of burning process includes the arrangement of stones, drum and the required firewood. The stones are arranged to hold the drum and the firewood is placed in the gap between stones and it is ignited. The drum is placed over the setup and it is heated to remove the moisture present in it.

3.3 MIXING

The plastic bottles are added one by one into the drum, until the entire plastic content required for making bricks of one mix proportion is added into it. When these plastic thoroughly by using trowel before it hardens. The mixture has very short setting bottles 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.

3.4 MOULDING

The mixture is then poured into the brick mould and is compacted by using tamping rod or steel rod. The surface is finished by using trowel. Before placing the mixture into the mould, the sides of the mould are oiled to easy removal of bricks. Mould removed after 24 hours.

4. TESTS ON BRICKS

4.1 COMPRESSION STRENGTH TEST

The brick specimens was placed in compression testing machine and the load is to be applied without shock and increased continuously at a rate of approximately 140 kg/cm^2 min till the ascending load breaks the sample down and it cannot bear further strength. The maximum load applied to the specimens is to be recorded and the appearance of the brick and any unusual features in the type of failure is noted.

Compressive strength = Maximum load / Area of the specimen

= P/A

Where,

P -Maximum load (N)

A - Area of the specimen (mm^2)

Table 3: Compressive Strength of various Plastic-Sand Ratios

Sr. No.	Plastic-Sand Ratio	Compressive Strength (N/mm^2)
1	1:2	8.63
2	1:3	9.09
3	1:4	9.54

Fig-1: Compression Test of Platic-Sand Brick

4.2 WATER ABSORPTION TEST

After drying the bricks, they are they are dried and immersed in water for 24 hours. After 24 hours of immersion, those are taken out from water and wipe out with cloth. Then, brick is weighed in wet condition. The difference between weights is the water absorbed by brick. Absorbed water is calculated in percentage. If the brick absorbs less water, brick is of better quality. The maximum water absorption is limited to 20%.

Water absorption = {[W2 – W1] / W1} x 100

Where,

W1 = Weight of dry brick (kg)

W2 = Weight of wet brick (kg)

Table 4: Water Absorption of various Plastic-Sand Ratios (%)

Sr. No.	Plastic-Sand Ratio	Water Absorption (%)
1	1:2	3.69
2	1:3	3.19
3	1:4	2.66

4.3 EFFLORESCENCE TEST

The presence of alkalis in bricks is harmful where it forms a grey or white layer on brick surface by absorbing moisture. This test is done to verify the presence of alkalis in bricks. The brick is immersed in fresh water for 24 hours and allowed to dry in shade. The absence of whitish layer prove the absence of alkalis. If the whitish layer appears about 10% of brick surface, then the presence of alkalis is acceptable. If it is till 50% of surface, then it is moderate. If the alkalis appear above 50%, then the brick is heavily affected by alkalis.

Table 4: Efflorescence Test of various Plastic-Sand Ratios

Sr. No.	Plastic-Sand Ratio	Acceptable	Non-Acceptable
1	1:2	✓	-
2	1:3	✓	-
3	1:4	✓	-

4.4 HARDNESS TEST

In this test a scratch is made on brick surface with steel rod (any hard material can be used) which was difficult to imply the bricks or blocks were hard. This shows the brick possess high quality.

Table 4: Hardness Test of various Plastic-Sand Ratios

Sr. No.	Plastic-Sand Ratio	Result
1	1:2	OK
2	1:3	OK
3	1:4	OK

4.5 SOUNDNESS TEST

The soundness test is also done in the field. After the manufacturing of the brick are allowed to dry in air for 2days.Then the bricks are made to hit each other the ring sound produced during the process, which denotes the quality of the brick that it is good. Good quality bricks produce the clear ringing sound. In our project both fly ash bricks and plastic sand bricks clear ringing sound produced.

Table 4: Soundness test of various Plastic-Sand Ratios

Sr. No.	Plastic-Sand Ratio	Result
1	1:2	OK
2	1:3	OK
3	1:4	OK

5. CONCLUSION

After completion of project, it can be concluded that the strength of bricks increases substantially. The water absorption also decreases which improves the quality of bricks. As its strength is good it can be successfully implemented for construction of shear walls and load bearing walls. It will also help in management of plastic waste and will prove as great relief to municipal bodies.

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