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UTILISATION OF PLASTIC WASTE IN MANUFACTURING OF PLASTIC SAND BRICKS

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ABSTRACT

The production of plastic waste is now increasing day by day as more cities become industrialised, the problem of plastic waste management comes along with it. The disposal of plastic waste is the biggest problem and the recycling of the plastic waste repeatedly can result in potential danger. Brick is one among the foremost common masonry units used as artefact. There has been a considerable degradation in availability of conventional building materials and their demand is increasing in the recent past. Plastic waste generated can be easily utilized in manufacturing of plastic sand bricks without creating any bad impacts on the environment. This paper deals with manufacturing process, materials used also the testing of the plastic sand bricks.

Key words - Plastic waste, plastic sand bricks, Bricks

1 INTRODUCTION

Generation of plastic waste is inevitable in each habitation since the dawn of civilization humanity has step by step deviated from nature and nowadays there has been a forceful modification within the lifestyle of human society. This waste generates toxic gases which are inflammable and leads to increase in greenhouse gases. If the plastic waste is thrown away it can create all kinds of hazards as the plastic is non-biodegradable that remains as the hazardous material for the number of centuries.

The generation of plastic waste is expanding rapidly. It is calculable that the speed of growth is double for each ten years. This is thanks to rising of population, urbanization, developmental activities and changes in life style. They are non-biodegradable and additionally researchers have found that the plastic materials will stay on earth for 4500 years while not degradation In India or so forty million tons of the municipal solid waste is generated annually, with evaluated increasing at a rate of 1.5 to 20 per annum.

Therefore, proper plastics waste management should be there. These plastic wastes can be utilized effectively. Now a days it is not possible to work efficiently without plastic from agricultural sectors to industrial sectors due to this we cannot stop the use of plastic. But plastic waste can be used in building constructions, by using the plastic wastes in manufacturing of the Eco-friendly bricks. And this is the best solution to deal with the plastic wastes.

2 OBJECTIVES

- An efficient management of plastic waste which is hazardous to living organisms and environment.
- To reduce the dumping sites of the plastic wastes.
- To avoid land pollution and water pollution due to the dumping of plastic wastes.
- 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 consumption of earth based material as clay for the manufacturing of brick that resulted in resource depletion.

3 SPECIFICATIONS

3.1 Materials required:

1. Natural river sand to increase the compressive strength of the bricks
2. Plastic wastes
3. Mould of size (19x19x9)cm

4 PROCEDURE OF CASTING PLASTIC SAND BRICKS:

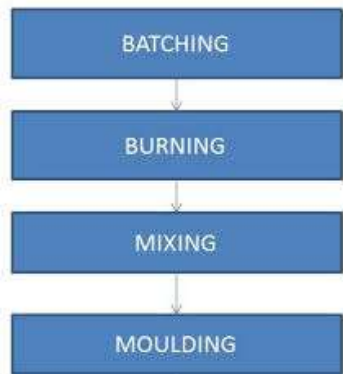


Fig-1: Flowchart of manufacturing of plastic bricks.

4.1 Batching

The collected plastics wastes were cleaned and dried to remove the water or oil present in the plastic wastes and then the plastic waste is weighed. The sand was sieved and the sample retained on the sieve of size 1.18 mm, 600 microns, 300microns is taken for the plastic sand bricks preparation.

4.2 Batching of plastic sand brick

Mix ratio	1:2	1:3	1:4
proportion	600:1200	500:1500	600:1200

Table-1: Proportion of bricks.

4.3 Burning

After batching, the sand was burned in the head pan at the considerable temperature of 28 to 45 degree Celsius. Plastic wastes were thrown into the head pan step by step in desired quantity and was allowed to melt in it. The first step of burning process includes the arrangement of stones, head pan and the required firewood. The stones are arranged to hold the head pan and the firewood is placed in the gap between stones and it is ignited. The head pan is placed over the setup and it is heated to remove the moisture present in it



Fig-2: Burning procedure for brick making

4.4 Mixing

The plastic wastes were added step by step into the head pan, until the entire plastic content required for making bricks of one mix proportion are get added in head pan. After this these plastic wastes is thoroughly mixed with sand using trowel before it gets harden. Hence mixing process should not consume more time

4.5 Moulding

The mixture is then poured into the brick mould of size (19x9x9) cm 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. Moulds are removed after 24 hours.



Fig-3 Manufactured plastic sand brick

5 TESTS ON BRICKS

5.1 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/cm² min until the resistance of the brick specimen to the increasing load breaks down and no greater load can be restrained. The maximum load applied to the brick specimens is to be recorded and the appearance of the brick and any unusual features in the type of failure is noted.

$$\text{Compressive strength} = \text{Maximum load} / \text{Area of the specimen} = P/A$$

Where, P -Maximum load (KN)

A - Area of the specimen (mm²)

Table-6: Water absorption test Results**5.7 Efflorescence test**

The presence of alkalis in bricks is harmful where it forms a gray 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. Then, it is taken out from water and allowed to dry in shade. If the whitish layer is not visible on surface, it proves that absence of alkalis in brick. 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.

5.8 Efflorescence Test Results

SR NO	Mix ratios	Nil	Slight
1	Conventional brick		✓
2	1:2	✓	
3	1:3	✓	
4	1:4	✓	

5.2 Comparison of compressive strength of plastic sand bricks possessing various ratios:

Mix ratios	Plastic sand ratios	Compressive strength (N/mm ²)
1	1:2	5.08
2	1:3	5.48
3	1:4	6.80

Table-2: compressive strength of plastic sand bricks**5.3 Comparison of compressive strength of plastic sand brick with conventional brick:**

SR NO	Types of bricks	Compressive strength (N/mm ²)
1	Conventional brick	4.33
2	Plastic sand brick	5.55

Table-3: compressive strength of bricks**5.4 Water absorption test**

In water absorption test, bricks are weighed in dry condition and let them immersed in fresh water for 24 hours. After 24 hours of immersion, bricks 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. The percentage of water absorption is then calculated. The less water absorbed by brick the greater its quality. Good quality brick doesn't absorb more than 20% water of its own weight

$$\text{Water absorption} = \frac{[W_2 - W_1]}{W_1} \times 100$$

$$W_1 = \text{Weight of dry brick (kg)}$$

$$W_2 = \text{Weight of wet brick (kg)}$$

5.5 Water absorption test of plastic sand bricks

Mix ratios	Plastic sand ratios	Water absorption (%)
1	1:3	2.42%
2	1:4	3.41%
3	1:5	0.35%

Table-5: Water absorption test Results**5.6 Comparison of water absorption of plastic sand brick with conventional type of brick:**

SR NO	Types of bricks	Water absorption (%)
1	Conventional brick	5%
2	Plastic sand brick	2.5%

Table-4: Efflorescence Test Results**5.9 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.

5.10 Fire resistance test

The Plastic is highly susceptible to fire but in case of Plastic sand bricks/Paver blocks the presence of sand imparts insulation. There is no change in the structural properties of block of bricks up to 180°C above which visible cracks are seen and the bricks deteriorate with increase in temperature.

5.11 Soundness test

The soundness test is also done in the field. After the manufacturing of the brick these are allowed to dry in air for 2 days. 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.

6 CONCLUSION

Plastic sand brick possess more advantages than the conventional bricks which includes cost efficiency, resource efficiency, reduction in emission of greenhouse gases, etc. Plastic sand brick is also known as "Eco-Bricks".

Plastic waste is harmful to all living organisms and environment. It can be used for construction purposes. It increases the compressive strength when compared to conventional bricks. By use of plastic sand bricks, the water absorption presence of alkalies was highly reduced. Due to number of advantages of plastic bricks further research would improve quality and durability of plastic sand bricks.

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