

PROPERTIES OF PLASTIC AS A BINDING MATERIAL IN BUILDING BLOCKS

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ABSTRACT

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. This study aims to evaluate plastic to use as building blocks. Selection of plastic from different sources and then melted it to give a form of a brick for charactering its suitability for building material. The study showed that the brick made from plastic waste has the Potential to be used as a brick having average compressive strength 4 N/mm², water absorption less than 1%, nil efflorescence effect. Also hardness, fire resistance & soundness respectively are observe as high quality, good & gives ringing sound which indicates that it could be used as a compressive block. In comparison to normal clay brick the plastic made brick can be used as civilian brick replacement.

Keywords: Non-bio-degradable, Blocks, Efficiency, Comparison, Brick.

INTRODUCTION

Plastic is a very common material that is now extensively used by everyone in this world. At the time of need, it is seen that the plastic is very useful, but is discarded only after its use, all the risks made of plastic are not biodegradable and it is a dangerous element for more than a century. Nowadays, it is impossible to work effectively in a key sector without using plastic from agricultural and industrial. Therefore, we cannot ban the use of plastic, but the recycling of plastic waste is used in building construction, industries are considered to be the most effective applications. In a remote area like Saint Martin which is a tourist area, there are many plastic bottles are wasted and they cannot be recycled. It's harmful to the marine environment. So if we can collect them and recycled in manufacturing bricks, it will be more effective for the people of the area. This project will aware the people about the recycle way of plastic as well as it will be cost effective for construction. To fulfil the above need, this study is based on two objectives, namely: to characterize plastic waste's potential for reuse in civil construction and to compare its properties with conventional brick used in civil construction.

METHODOLOGY

2 sacks of plastics had been collected from the different CUET canteen. Natural river sand was used as a fine aggregate. This had been collected from a construction site in CUET. Plastic PET categories such as bottles as water, soft drinks, juice, etc. were collected from CUET canteens. Mould had been made according to Bangladesh standard specification for brick, tiles, and compression test. Collected plastics were clean with water and dried in sunlight. Collected sand was sieved through #50 sieve. After batching the plastics were taken for melting in which the plastic bottles were thrown one by one into the

pan and allowed to melt. The mixture was stirred with a steel rod. When all plastics had melted the mixture was poured into the mould. After 4 hours specimen was being demoulded. Then the tests required for standard brick and tiles were conducted on Plastic sand blocks
Mould size and tests list are given in the roadmap of the study.

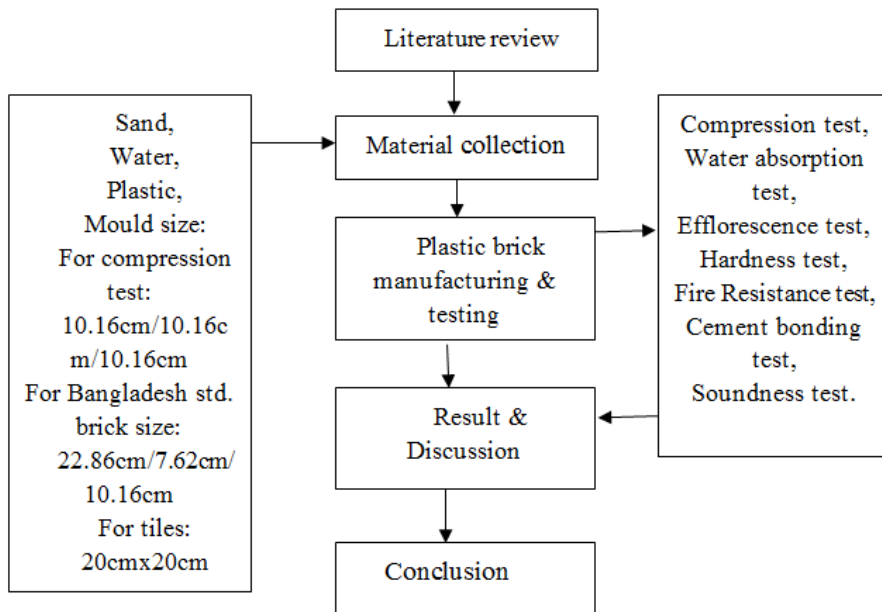


Fig.1: Roadmap of the adopted method.



Fig 2: Demolded specimen.



Fig 3: Bangladesh standard sized Bricks



Fig 4: Cemented plastic sand bricks



Fig 5: Cemented plastic sand brick

Materials Specifications:

Sand:

Table 1: Properties of sand

Serial number	Tests	Results
1	Specific Gravity	2.53
2	Bulk Density	1578 kg/m ³
3	Fineness Modulus	2.31

Plastic properties:

Table 2 : Plastic properties. (For general plastic)

Serial	Properties	Results
1	Density at 23°C	0.958 kg/m ³
2	Elastic modulus	9 N/m ²
3	Tensile creep strength	8 N/m ²
4	Bending creep modulus	1 N/m ²
5	Tensile strength at 23°C	2 N/m ²
6	Thermal conductivity	0 W/(m. K)
7	Ignition temperature	3°C

Equations

$$\text{Compressive Strength} = \frac{P}{A} \quad (1)$$

$$\text{Water absorption} = \frac{W_2 - W_1}{W_1} \times 100 \quad (2)$$

Where, W_1 = Weight of dry brick (kg)

W_2 = Weight of wet brick (kg)

RESULTS AND DISCUSSIONS

Table 3: Test results of Plastic Sand blocks

Test Name	Result
Compressive strength test	4 N/mm ² for 1:3
For difference plastic sand ratio	5 N/mm ² for 1:4 5.57 N/mm ² for 1:5
Water absorption test	0.921% for 1:3 0.701% for 1:4 1.04% for 1:5
Efflorescence test	Nil
Hardness test	Hard (tested with steel rod)
Fire resistance test	Increase due to presence of sand
Soundness test	Ringing Sound (Good)
Cement bonding test	Good
Physical properties	Size: 22.86 cm/7.62 cm/10.16 cm Weight: 3000 gm. Colour: Deep Brown

According to test plastic sand blocks give satisfactory results. The minimum compressive strength of clay bricks is 3.5 N/mm². A grade (1st Class) bricks compressive strength is 7 to 14 N/mm². Result show that the plastic sand bricks compressive strength is minimum 4 N/mm². It is increased with the plastic ratio. Hence it can be used as a compressive block. Also plastic sand blocks durable, long lasting and recyclable.

COMPARISON:

Table 4 : Comparison of Plastic-sand bricks & Clay bricks.

Compressive strength			
Plastic sand bricks		Clay Bricks	
Plastic: Sand	Strength	Category	Strength
1:3	4 N/mm ²	1 st Class	>10 N/mm ²
1:4	5 N/mm ²	2 nd Class	>7 N/mm ²
1:5	5.57 N/mm ²	3 rd Class	>3.5 N/mm ²
Remarks: Required Strength can be gained by controlling plastic sand ratio.			
Water absorption			
Plastic sand bricks		Clay Bricks	
Plastic: Sand	Percentage	Category	Percentage
1:3	less than 1%	1 st Class	<12%
1:4	less than 1%	2 nd Class	<20%
1:5	less than 1%	3 rd Class	<25%
Remarks: Plastic sand bricks showed the significant reaction of water absorption.			
Efflorescence			
Plastic sand bricks		Clay bricks	
Nil		Can be slight, moderate and heavy.	
Remarks: Resist salt attack			
Hardness			
Plastic sand bricks		Clay bricks	
No impression on the surface while scratching.		1st class bricks are good but 3rd class isn't.	
Remarks: Hard.			
Soundness			
Plastic sand bricks		Clay bricks	
Ringing sound.		Ringing sound by 1 st class bricks.	
Remarks: Good.			
Fire resisting ability			
Plastic sand bricks		Clay bricks	
Not good. Slightly increased by the presence of sand.		Excellent fire resisting ability.	
Remarks: Not good.			

CONCLUSIONS

From the studies and tests results we came to the conclusion

- (I) It is seen that plastic blocks made of waste plastic bottles have its suitability for civil construction uses with a few reservations. The made-up blocks showed strength similar to 3rd class clay brick as per Bangladesh standard in accordance with other properties, is provable.
- (II) The plastic that used in making bricks will not pollute the water. It is highly recommended that controlling the melting of the plastic while mixing because of the burning of plastic can cause an environmental effect by emitting harmful gas. For this reason Plastic should be grinded into small pieces to control the burning of plastic.
- (III) Since plastics are volatile to fire and heavy weight it is recommended that according to the test result, not to use these blocks in the residential building, factory, hospital, school, market, etc. We can use it as a pavement block in footpath and decoration purpose like a garden wall.

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Rai, B., S.T. Rushad, B. Kr, and S.K. Duggal.Study of Waste Plastic Mix Concrete with Plastic.

Raju and R. Chauhan[4] did an Experimental Study on Strength Behaviour of Cement Concrete with Use of Plastic Fibre.