

An Experimental Study on Plastic Waste Brick

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Abstract - An experimental investigation were carried out for synthesis of bricks from sand and plastic waste by varying the ratio from Plastic: Sand ratio as 1:3; 1:4; 1:5; 1:6. Physico mechanical parameters like Bulk Density, Water Absorption, Apparent Porosity and Compressive Strength were compared for each ratios. Bricks with ratio of 1:6 were found to perform well in all the parameters compared to other specimens.

Keywords — Waste Plastic, Bricks, Compressive Strength, Water Absorption, Bulk Density, Apparent Porosity

I. INTRODUCTION

Bricks are one of the widely used construction materials in the world. India with 10% of the global brick production, is second largest producer of fired clay bricks [1]. However, production of bricks not only adds to the environmental pollution but also high health hazards for brick kiln workers [2]. It is estimated that the carbon footprint of brick production is 162 g/Kg of CO₂[3].

Plastic has also become one of the integral part of our life. World Production of plastics were estimated to be around 299 million tons in the year 2013 which is expected to rise further [4]. India produces about 1.5 MT of plastic every year, out of which only about 47% are recycled[5,6].

A viable solution to such pollution problem maybe recycling of waste generated from industrial and agricultural activities as building materials [7]. Several researchers report incorporation of waste material like natural fibres, PC and TV waste, marble and granite waste etc. in brick productions[8-10].

The present study attempts to understand the effect of variation of plastic to sand ratio on the physico mechanical properties of the waste plastic brick manufactured.

II. METHODOLOGY

A. Materials

Locally available sand and waste water bottle were used for making the bricks. Sand used in the study has specific gravity of 2.67. The plastic waste bottle was collected from CIPET (Central Institute of Plastic Engineering and Technology), Manipur.

B. Specimen preparation

Plastic waste bottles were cleaned with water, dried, cut into pieces and incinerated at approximately 200°C. Sand was sieved by 4.75 mm IS sieve, washed and sun-dried. It

is then added into the plastics when it turns into hot liquid. The heated materials are mixed together to get a uniform mixture. These mixtures is then poured out into the cube mould of size 70.7×70.7×70.7 mm, compacted with steel rod and surface finished with trowel. Before placing the mixing into the mould, the sides of mould are oiled for easy removal of the bricks. Four series of specimens were prepared by varying the Plastic: Sand ratio as 1:3, 1:4, 1:5 and 1:6 as shown in Table 1

TABLE I NOMENCLATURE OF THE SPECIMENS

Sl.No.	Specimen	Plastics: Sand Ratio
1	BK1	1:3
2	BK2	1:4
3	BK3	1:5
4	BK4	1:6

C. Testing Procedure

The Bricks were tested for Compressive Strength using Universal Testing Machine as per IS: 3495 P (1)1992. Physical test includes Bulk density, water absorption, apparent porosity and Efflorescence. Water absorption and Efflorescence were carried out as per IS: 3495 P (2)1992 and IS: 3495 P (3)1992 respectively.

III. RESULTS AND DISCUSSION

A. Bulk Density

The average values of bulk density are presented in Fig. 4.1. It can be observed that the bulk density of BK4 has the highest maximum values of 19.71 kN/m³ and the BK1 has the minimum value of 16.43 kN/m³. Specimen BK4 has the highest content of plastic and specimen BK1 has the least plastic content among the four specimens.

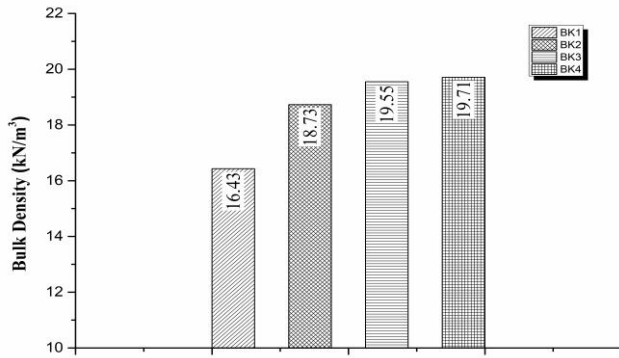


Fig.1. Bulk Density of Brick Specimens

B. Water Absorption

Water absorption test is simple test but has a lot of significance. Fig. 2 represents water absorption values for the specimens. It is observed that BK 1 has the highest value 10.17 % of water absorption due to high amount of porosity as compared to three specimens. BK 4 has the lowest value 6.02% of water absorption. Hence, it is noticed that sand plastic bricks has low water absorption values, even lesser than most of the traditional clay burnt bricks.

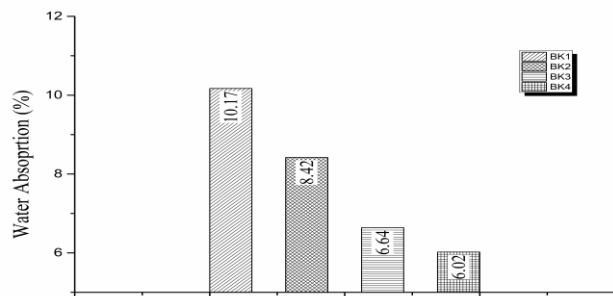


Fig.2. Water Absorption of Brick Specimens

C. Apparent Porosity

A simple test to represent porosity of specimen is by way of identifying the apparent porosity. The values of apparent porosity obtained are shown in Fig.3. From the results, it can be noticed that BK 1 has highest value of porosity at 21.74 % and BK 4 has the lowest porosity of 13.55 %. It may be recalled that BK 1 has least plastic content among the specimens. As the plastic content is increased, the apparent porosity decreases gradually.

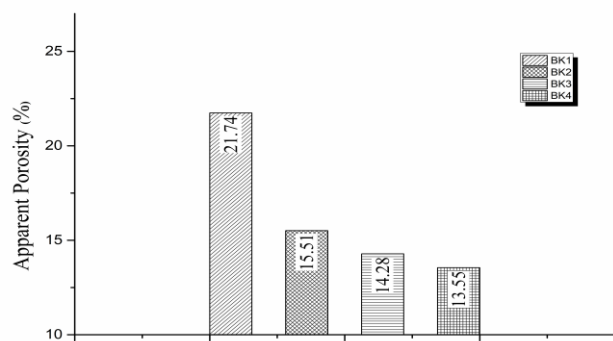


Fig.3. Apparent Porosity of Brick Specimens

D. Efflorescence

After keeping the wet bricks in a shade for 3 days, the specimens were observed for any sign of efflorescence. There is no formation of white or grey patches on the surface of the bricks, when it is observed after 4 days. It proves that alkali is not present in the bricks. All the specimens of bricks showed no efflorescence.

E. Compressive Strength

The specimens were tested for compressive strength at the age of 28 days. The average of three specimens were recorded. From the results obtained in the tests, it is found that BK4 has the highest compressive strength of 6.53 MPa and BK1 has the lowest value of 4.79 MPa. It may be noted that BK 4 has the highest plastic content and least apparent porosity. The greater strength in such specimen can be attributed to its higher bulk density and lower porosity.

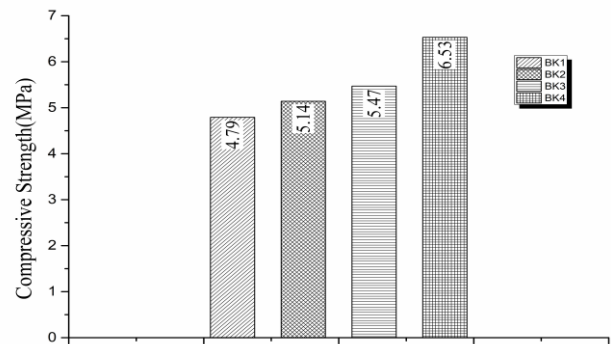


Fig.4. Compressive Strength of Brick Specimens

IV. CONCLUSIONS

The effect of varying the ratio of plastic: sand ratio in waste plastic bricks were studied in this experimental investigation. Among the limited specimens studied, the bulk density of the specimen BK 4 is higher than other specimens. Among the specimen in the present study, water absorption of the specimen BK 1 is higher which can be attributed to its higher porosity. Apparent porosity of the specimen BK 1 is higher in comparison to those of the other specimens. Efflorescence is not observed in the entire specimens. Compressive strength of the BK 4 is comparatively higher than those of the other specimens. However, the specimen can give sufficient strength for construction work even at the age of 28 days. The findings in these study signify the opportunity for converting plastic waste into an economically viable product in the form of construction bricks.

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