

Analysis of Plastic Bottles Filled with Waste Mortar as an Alternative Material for Brick Work

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Abstract— This paper deals with “An experimental investigation on wall made with plastic bottles bricks”. One of the main problems faced by the construction industry is the high cost of the building materials. Materials are primary requirement for construction. In places where people are below poverty line, the high cost of building materials is becoming the most significant problem. Clay bricks are commonly used for the construction of small houses. Production of clay bricks results in liberation of Oxides of Sulphur and Carbon. Even though fly ash bricks avoid the liberation of the greenhouse gases, But it is beyond the reach of poor peoples. At the same time, urbanization generates waste materials, especially the non-degradable. An attempt has been made to build low cost houses using waste plastic bottles along with providing adequate thermal comfort while being sustainable. The innovative idea reduces the requirement of clay and fly ash bricks and at the same time protects the environmental pollution. Strength of bottle blocks were determined and strengths were compared with that of clay brick masonry. It was found that the strength of bottle masonry was more than that of the conventional second class brick. The cost of bottle masonry is also comparable with that of brick masonry.

Keywords: Brick bottle, polyethylene terephthalate, Eco-friendly, strength, sustainable

I. INTRODUCTION

Due to rise in development of construction waste generation rates rise faster than ever, urban development specialists warns that the growth will peak this century and will not start to decline without transformal changes in how we use and reuse materials. Among several waste reduction stragities one that is gaining momentum is the development of construction materials that use a number of solid wastes. The BRICK BOTTLE is one such invention. Waste polyethylene terephthalate PET bottles packed with dry solid wastes or sand and earth has been successfully used in a number of countries around the world. This study looked into the strength properties of waste filled plastic bottles in comparison to conventional bricks commonly used in construction.

II. LITERATURE REVIEW

- 1) The first plastic bottles house was constructed in the village of Yelwa in Nigeria by Andreas Froese. Froese used the plastic bottles instead of bricks, bound the bottles together with string and applied the plaster
- 2) A.S.Sajane - This report has finding that density of material is increases the compressive strength of material also increases and it is observed that cost of

bottle masonry is 35% less than convectional brick masonry.

- 3) Prince Arulraj G. - The quantity of 1:6 cent mortar required for the construction of the bottle masonry is approximately 46.16% more than the quantity 1:6 cement mortar required for equivalent brick masonry.
- 4) Yosi Agustina Hidayat - This research finds that the root cause of plastic management problem is the absence of an effective system in managing plastic waste.
- 5) Mohammed Jalaluddin. - Plastic bottles can cause the green construction by saving energy, resources, recycling material, minimizing the emission, having significant operational savings and increasing workplace productivity

III. MATERIALS USED AND THEIR PROPERTIES (USED PET BOTTLES WITH CAPS)

The full form of PET bottle is Polyethylene Terephthalate bottle and the molecular formula is $(C_{10}H_8O_4)_n$. The structural composition of PET is Polyester of the Terephthalic acid and Ethylene Glycol. PET is used for making high impact resistant containers for packaging of soda, edible oils and peanut butter. It is used for cereal box liners, microwave food trays and for the plastic vessels. Plastic is resistant of heat and chemically stable. PET resist to acid, base, some solvents, oils and fats. Density of PET is $1.389/cm^3$ and the melting point is $260^\circ C$.

Preparation of plastic bottle bricks:-Waste PET bottles of same or different sizes were collected and washed. Fine sand was filled into these bottles in three layers; each layer compacted with 20 blows using tamping rod.

IV. EXPERIMENTAL PROGRAM

Compressive strength tests for plastic bottle brick The desired bottle brick inserted between loading plates of the machine. The bottles didn't break but did deform. The load was increased until the reading showed a sudden drop of force. The load at which it started to drop was recorded as the maximum load.



V. TEST RESULTS

Bottle no.	Mass (gm)	Load (N)	Area (mm ²)	Compressive Strength (N/mm ²)	Average (N/mm ²)
1	1590	118000	14300	8.25	7.83
2	1690	120000	14300	8.39	
3	1786	98000	14300	6.85	

Table 1: Compression Strength Calculations

VI. BENEFITS OF PLASTIC BOTTLE MASONRY WALL

Good construction ability: The walls built by this bottles are lighter than the walls built by brick and block, and that makes these buildings to show good response against earthquake. Due to compaction of filling materials in each bottle, the resistance of each bottle against the load is much higher as compared to brick and these compressed filling materials make the plastic bottle to be prevented from passing the shot that makes the building as a bulletproof shelter. Low cost constructing a house by plastic bottles used for the walls, joist ceiling and concrete column offers us 45% reduction in the final cost. Separation of various components of cost shows that the use of local manpower in making bottle walls can lead to cost reduction up to 75% as compared to building walls using the brick and concrete block. It is noted that the sophisticated manpower can lead to reducing the construction time and the relative costs also become lower.

VII. CONCLUSION

This technique of using waste PET bottles as bricks become popular in low income communities around the world. In the recent study, the bottle bricks were found to be stronger than conventional bricks and concrete cylinders. These bottle bricks are also cheaper than that of conventional bricks. Considering the strength and the relatively low cost of construction, they can very successfully become the next construction material of choice for all over world. This houses would be a positive change in our urban fringe and slum areas' landscape.