

REUSE OF PLASTIC BOTTLES AS A CONSTRUCTION MATERIAL

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ABSTRACT

In this paper we have proposed the use of waste plastic PET (Polyethylene Terephthalate) bottles as construction entity to standardized bricks. As plastics are non-biodegradable its disposal as always been a problem. Waste plastic bottles are major cause of solid waste disposal. Polyethylene Terephthalate is commonly used for carbonated beverage and water bottles. This is an environmental issue as waste plastic bottles are difficult to biodegrade and involves processes either to recycle or reuse. Today the construction industry is in need of finding cost effective materials for increasing the strength of structures. This paper deals with the possibilities of using waste PET bottles as a partial replacement. When the bottles are filled with soil or sand they work as a bricks and form a framework for walls or pillars in which cement-sand mortar fills the space between all the bottles. This paper intends to investigate application of plastic bottles as one of the urban wastage in building construction and that how it can lead to sustainable development. This paper also includes different factors such as reducing waste, energy efficiency, flexibility, load capacity and cost.

Keywords : *Construction Material, Innovative Wall Construction, Plastic Waste PET(Polyethylene Terephthalate) Bottles, Sustainable Material, Urban Wastage.*

I. INTRODUCTION

Plastics are produced from the oil that is considered as non-renewable resource. Because plastic has insolubility about 300 years in the nature, it is considered as sustainable waste and environmental pollutant. So reusing and recycling of it can be effectual in mitigation of environmental impacts relating to it. When the society get affected then it will be uneconomical for the nation to create sustainable development. At the present time, the possibility utilizing the renewable resources such as solar, wind, geothermal has been providing for us more than before, and development of this science is making progress. But those energies can be chosen as one of the renewable and alternative energies instead of

fossil fuels which are cheap as possible and have fewer environmental impacts. The Development Association for Renewable Energies an NGO based in Nigeria-decided to built an incredible two bedroom bungalow entirely out of plastic bottles which is bullet proof earthquake resistance and maintains a comfortable interior temperature of 64 °F (about 18 °C) year around. Hundreds of plastic bottles are filled with sand or soil or any other construction waste (here we used the demolished bricks bats coba as filling material) and the bottles were then strategically laid and packed down with the cement-sand mortar creating the single storied building thus in relation to the various experiments conducted till now by various researchers, in this research paper we have tried to explore relative strength and cost of bottle brick as compared to the conventional bricks.

II. OBJECTIVES

- a) To evaluate the possibility of reusing waste PET bottles.
- b) To investigate the mechanical behavior of the unit.
- c) To test and compare the compressive strength of brick bottle with conventional brick.
- d) To create the awareness amongst the people for reusing plastic bottles as a construction material.

III. METHODOLOGY

In this study, the first step taken was collection of waste PET bottles from stores, commercial buildings (hotels, malls, theatres, railway stations, bus stands, airports, IT Companies, marriage halls, etc) waste collectors and other possibleresources. Once the bottles were collected, they were filled with local available soil so as to provide them the structural strength. In our experiment work we taken 350 bottles (as per our estimate for the construction of bench) and filled with demolished work bat coba (construction waste). The filled material was first screened by a sieve shaker properly so as to remove any unwanted foreign large size particles. Once all the collected bottles filled with this prepared soil and compacted them in instalment they were tightly capped and sealed. And then the structural strength was checked. A compressive economic analysis with respect to brick was also done.

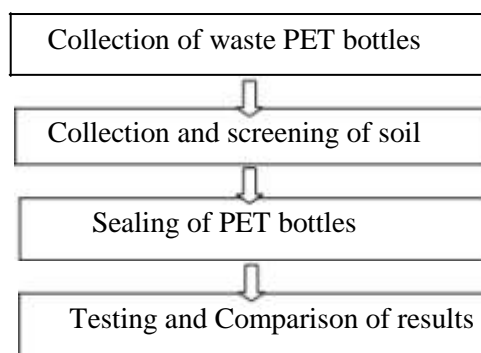


Fig. 1.process steps of methodology adopted

IV. EXPERIMENTAL TESTING

Compressive strength test for each bottle was determined on universal testing machine and the average value was considered for analysis. Weight of empty PET bottles and completely filled PET bottles were noted and amount of soil used was calculated for the same.

The formula used is:

$$\text{Compressive strength} = 2P/A \text{ (N/mm}^2\text{)}$$

Where, P = Compressive load at failure in N.

D = Diameter of bottle in mm.

L = Length of bottle on which the load acts in mm.

V. RESULTS

After compressive testing done on about an average calculations for concluding a result is done.

The data obtained as per universal testing machine is calculated in Table 1.

Table 1:- Experimental Testing Data

Weight of bottle (gm.)	Load	Area (mm ²)	Compressive strength (N/mm ²)	Average strength (N/mm ²)
1870	74750	49480	3.02	
1930	77990	49480	3.15	3.09
1900	77010	49480	3.11	

5.1 Sample calculation of first reading:

Load in N = 7620 x 9.81 = 74750 N

Area of bottle = 49480 mm²

Compressive strength = $2 \times 74750 / 49480 = 3.02 \text{ N/mm}^2$

5.2 Cost calculation:-

5.2.1 Calculation of bottle market price:

Average weight of 1000ml PET bottle = 20 gms.

Cost of waste plastic bottle in market = RS. 8/kg

Therefore, (1000/20) = 50 nos. of bottles per kg.

Cost of one bottle = (8/50) = 0.160 (16 paise)

5.2.2 Cost of Filling material to be used :

The Filling material is the construction waste which can be available at very reasonable cost. Here we used the demolished material which was available at Rs. 0. Hence the cost of material has been incorporated in cost calculations.

5.2.3 Total cost of bottle brick :

Therefore, total cost of bottle brick = cost of empty bottle + cost of filling material (soil)

$$= 16 + 0$$

$$= 16 \text{ paise}$$

Calculation of profit:

Cost of unit brick = Rs. 8.00

Therefore, it shows a direct profit of $= (8-0.16) = \text{Rs. } 7.84$

Thus based on these observations we can infer that wall made up of PET bottle can be used as partition wall or secondary wall and in frame structure as external wall. It can also be used in compound walls.

VI. CONCLUSION

- From above experimental observations we can infer that less curing time is required if waste PET bottles are use as building material as compared to bricks which required 28 days curing time.
- Also while baking of bricks there is a major issue of carbon emission which is negligible in using PET bottles.
- PET bottles have durability of over 300 years which is more as compared to standard construction commences bricks.
- Cost of construction in case of brick bottle is more economical than standard bricks. ○ The use of plastic bottles gives the opportunities of employment to the locality.
- Compressive strength of bottle brick is also nearly equal than that of standard brick.
- Thus we can conclude that using the concept of brick bottles is cost effective, energy efficient and commercially feasible. Using PET bottles is also Bio-climatic and thus we can say it is GREEN construction.

VII. ACKNOWLEDGEMENT

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