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A REVIEW OF GREEN BUILDING CONSTRUCTION BY USING WASTE PET BOTTLE AND FLY ASH

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Abstract: This paper proposes the use of waste plastic PET bottles as construction entity to standardized bricks. As plastics are non- biodegradable its disposal has 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. Fly ash, a waste generated by thermal power plants is as such a big environmental concern.^[7] The investigation reported in this paper is carried out to study the utilization of fly ash in plastic bottle as a partial replacement of soil as well as an additive so as to provide an environmentally consistent way of its disposal and reuse. This project deals with the possibility of using waste PET bottles as a partial replacement. It can be concluded that benefit of the use of PET bottles include both improved ductility in comparison with raw blocks and inhibition of crack propagation after its initial formation. The solution offered in the paper is one of the answers to long standing menace of waste disposal.

Key words: Fly ash, Plastic bottle



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INTRODUCTION

Plastics are produced from the oil that is considered as non-renewable resource. Because plastic has the insolubility about 300 years in the nature, it is considered as a sustainable waste and environmental pollutant. Fly ash, a waste generated by thermal power plants is as such a big environmental concern. So reusing or recycling of it can be effectual in mitigation of environmental impacts relating to it. When the society gets affected, then it will be uneconomical for the nation to create sustainable development [7]. Plastic bottle can assist to obtain a social equity by avoiding the gap between the rich and the poor people in the society. With population growth in today's world, the need to the building has increased and to respond to this demand, the countries tend to use the industrial building materials and decline the use of indigenous and traditional materials. These factors in spite of increasing the energy consumption in the industry section; they can also raise the cost of homes and are considered as the barrier for users to obtain the basic needs of the life. [3]

Fly ash is the best known, and one of the most commonly used, pozzolans in the world. Fly ash is the notorious waste product of coal-based electricity generating thermal power plants, known for its ill effects on agricultural land, surface and sub-surface water pollution, soil and air pollution and diseases to mankind. Researchers have proposed few ways of reusing fly ash for variety of application. At the present time, the possibility of utilizing the renewable resources such as solar, wind, geothermal has been provided 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 [4]. Various kinds of homes have been built from plastic bottles and fly ash such as: ecological house constructed using

Hundreds of plastic bottles were filled with fly ash and then linked together at the neck by an intricate network of string. The bottles were then strategically laid and packed down with a combination of sand and cement, creating a building material that is stronger than blocks. Thus in relation to the various experiments conducted till now by various researchers, in this research paper we have tried to explore the relative strength and cost of the bottle brick as compared to the conventional brick

2. OBJECTIVES

- a) To evaluate the possibility of recycling waste PET bottles and Fly ash.
- b) To investigate the mechanical behavior of the unit.

c) To test and compare the compressive strength of brick bottle with brick. 3.

3. MATERIALS AND METHODOLOGY

In this study, the first step taken was collection of waste PET bottles from stores, waste collectors and other possible resources. Once the bottles are collected they have to be filled with local available fly ash from plant so as to provide them the structural strength. Once all the collected bottles are filled with fly ash and tamping it in installment they are tightly capped and sealed. Now to check the structural strength various tests are performed and comparison is made against those for a brick. A comparative economic analysis is also done.

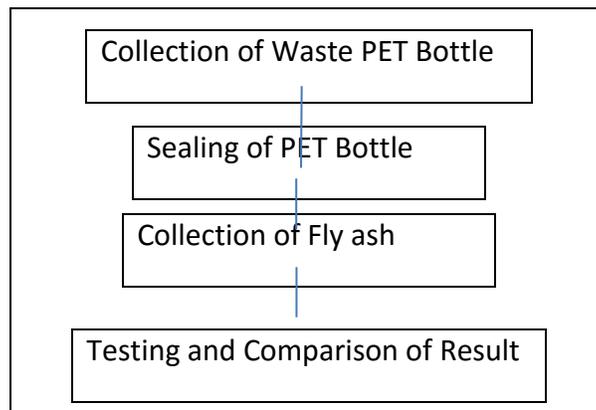


Fig. 1. Process Steps of methodology adopted

4. 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. Similarly, compressive strength of brick was calculated by taking the average value and the results were compared and analyzed.

The formula used is:

Compressive strength = P/A (N/mm^2) Where

P = Load at failure in N.

A = Area subjected to compression in mm^2



Fig. 2. Weighing balance to weigh Sealed PET bottle before testing



Fig. 3. Sealed PET bottle before testing



Fig. 4. Test applied on a waste PET bottles filled with soil and sealed tightly

5. RESULT AND DISCUSSION

After compressive strength testing done on about 8 bottles an average calculation for concluding a result is done. The Data obtained as per universal testing machine is tabulated in table 1.

TABLE 1: EXPERIMENTAL TESTING DATA

Load (kg)	Area (mm ²)	Compressive strength (MPa)	Average
12000	16100	7.31	
12000	16115	7.30	7.30
12000	16100	7.31	
12000	16112	7.30	

Sample Calculation of first reading: Load in kg = 12000 kg Load in N. = $12000 \times 9.81 = 127530$ N
Area = 16100 mm² Compressive strength = $127530 / 16100 = 7.31$ Mpa

5.2. Cost calculation:

Calculation of bottle market price:

Average wt. of 600ml PET bottle = 40gms. Cost of waste plastic bottles in market is Rs.8/kg. =>
($1000 \div 40$) = 25 nos. of bottles in 1kg. => ($8 \div 25$) = 0.32 paisa (approx. =0.2)

Cost of fly ash to be filled: Quantity & Cost of 1 trolley Fly ash = 2.8 m³ (say =3m³) is free of Cost

- Total cost of bottle brick:

Wt. of empty bottle= 40gms Wt. of bottle with soil= 1525gms So, wt. of soil in 1 bottle = 1565gms

Therefore total cost of bottle brick = Rs.0.32

- Calculation of Profit:

Cost of a unit brick = Rs 5 Therefore it shows a direct profit of ($6 - 0.32$) =Rs. 5.68

Thus based upon these observations we can infer that wall made of PET bottle can be use as partition wall or secondary walls and in frame structure as external wall. These are very useful in construction of yarn, warehouses etc.

CONCLUSION

From the above experimental observations we can infer that no curing time is required if waste PET bottles are used as building material as compared to bricks which require 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 generally have a durability of over 300 years which is more as compared to standard bricks. Cost of construction in case of brick bottle is more economical than standard bricks. Weight of a unit bottle brick was found to be less than that of a standard brick. Compressive strength of the bottle brick is also nearly equal than that of a 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 a Green construction.

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