

STUDY ON UTILIZATION OF PLASTIC BOTTLE WASTE -A REVIEW

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ABSTRACT

Disposal of large quantity of plastic bottle has emerged as an important environmental challenge, and its recycling is facing a big problem due to non-degradable nature. Due to plastic does not decompose biologically, the amount of plastic waste in our surroundings is steadily increasing. The proposed sand bricks which is made up by adding plastic bottle waste in crush form in sand bricks may help to reuse the plastic bottle waste as one of the additives material of bricks, and to help the disposal problem of plastic waste. The properties of sand bricks which contain varying percentages of plastic were tested for compressive strength, water absorption and efflorescence. It shows that an appreciable improvement in the performance of bricks can be achieved by introducing crush type of plastic waste into sand bricks. In view of utilization of plastic waste material for developing sustainable construction material, the present paper reviews plastic waste materials in different compositions of 0% to 15% that were added to the raw material to develop plastic waste sand bricks. The compression strength of the bricks is reviewed and recommendations are suggested as the outcome of the study. It was found that the reduction in compressive strength, due to replacement of sand by waste plastic bottle, is minimal and can be enhanced by addition of super plasticizer. The water absorption and efflorescence however showed excellent performance.

Keywords :Plastic Waste, Compressive Strength, Water Absorption, Efflorescence, Environmental Issue

I.INTRODUCTION

Plastic is a very common material that is now widely used by everybody in this world. Plastic has many advantages as it is compact and light in weight. Common plastic items that are used are bags, bottles, containers and food packages. The great problem with plastic is its disposal. Plastic is made of polymer chemicals and they are not bio degradable. This means that plastic will not decompose when it is buried. Though plastic is a very useful material that is flexible, robust and rigid they become waste after their use and they pollute the atmosphere.

Recycling is processing used materials (waste) into new products to prevent waste of potentially useful materials. The increase in the popularity of using environmental friendly, low cost and lightweight construction materials in building industry has brought about the need to investigate how this can be achieved by benefiting to the environment as well as maintaining the material requirements affirmed in the standards. To protect the environment as well as to take advantage of plastic, recycling procedure is used.

II. REVIEW

The increase in the popularity of using environmental friendly, low cost and lightweight construction materials in building industry has brought about the need to investigate how this can be achieved by benefiting to the environment as well as maintaining the material requirements affirmed in the standards. Nowadays, large amount of plastic bottles are wasted and disposed every day. People are thrown away them without considering that what those plastic bottles can have impact on the humans and/or environment. Andreas Froese, the founder of Eco-Tec Environmental Solution, in searching for finding an inventive solution to junk, established the innovation of building plastic bottle houses. The first bottles house was built using 10000 glass beer bottles by William F. Peck in 1902 in Tonopha, Nevada [5]. After that the newer innovative concept has been using plastic bottle instead of glass bottles in constructing the houses. This innovative idea took to account for some reasons such as providing a cost-efficient construction method for pauperized third-world countries, reusing the plastic bottles due to their not indecomposable characteristic, and etc. The first plastic bottles house in Africa was constructed in the village of Yelwa in Nigeria by Andreas Forese. Forese used the plastic bottles instead of bricks, bound the bottles together with string and at the end applied the plaster

III. BASIC CONSTRUCTION MATERIAL AND PROPERTIES

This construction requires some of the basic materials which ensures a stable, eco friendly structure and also results in cheap construction as compared to brick wall. Materials used for Bottle wall masonry construction are

(A) Soil (B) plastic (C) Cement (D) Nylon rope (E) Water

A. Soil: Soil is the basic element in any construction project so before using it in our project we have to study the basic properties of the soil and go through different tests, so as to check whether the soil sample selected is suitable for the given project

Soil texture: Soil texture can have a profound effect on many other properties and is considered among the most important physical properties. Texture is the proportion of three mineral particles, sand, silt and clay, in a soil. These particles are distinguished by size, and make up the fine mineral fraction.

B. Plastic bottle: In this paper plastic bottles are used as a fundamental element, so we have gone through every property of the PETE bottles so as to ensure a stable structure.

Properties of PETE bottle: Polyethylene Terephthalate Ethylene (PETE) bottles are thermoplastic materials. This type of plastic are polymers and with or without cross linking and branching, and they soften on the application

of heat, with or without pressure and require cooling to be set to a shape. Following are properties of plastic bottle:

- a. Wax like in appearance, translucent, odorless and one of the lightest plastics.
- b. Flexible over a wide temperature.
- c. Heat resistance.
- d. Chemically stable.
- e. Do not absorb moisture.
- f. Transparent

C.CEMENT:

Cement is the important binding material. In these paper it is use to bind the plastic bottles to make the masonry wall more durable so that the quality of cement is check by following properties. Properties of cement:

i. Fineness:

Fineness or particle size of Portland cement affects Hydration rate and thus the rate of strength gain. The smaller particle size, and the greater the surface area-to volume ratio so that the more area available for water cement interaction per unit volume. The effects of greater fineness on strength are generally seen during the first seven days.

ii. Soundness:

Soundness is defined as the volume stability of the cement paste. Cement paste strength is typically defined in three ways: compressive, tensile and flexural. These strengths can be affected by a number of items including: water cement ratio, cement-fine aggregate ratio, type and grading of fine aggregate, curing conditions, size and shape of specimen, loading conditions and age.

iii. Setting Time:

The initial setting time is defined as the length of time between the penetration of the paste and the time when the needle penetrates 25mm into the cement paste.

D.NYLON

ROPE Nylon rope has a very high tensile strength so that it is use as the main binder for PETE bottles masonry

Properties of Nylon rope

- a) Good abrasion resistance.
- b) Tough and strong but flexible too.
- c) High impact strength.
- d) Absorb water which causes reduction in strength and impact properties
- e) Resistant to most of the solvents and chemicals
- f) High softening temperatures and thus molding becomes difficult.

E. WATER

Water is in a similar way like cement, an active component in mortar. For cement-sand mortar, without water no hydration can be attained, hence no strength can be achieved. Water is responsible for the workability of a fresh mortar. 20% of the overall weight of the cement and soil was used to determine the quantity of water to be used in the mix.

V. BACKGROUND

The first bottle house was constructed in 1902 by William F. Peck in Tonopah; Nevada. The house was built with 10,000 bottles of beer, which were 90% alcohol and 10% opium. The Peck house was demolished in the early 1980's.

VI. METHODOLOGY

Construction Process Collection and cleaning of waste plastic bottle The gathering phase is the simplest, requiring the homeowner to calculate the number of bottles they will require and to then collect the bottles and necessary equipment.

The prepare phase then requires the homeowner to fill the collected bottles with sand and prepare the ground upon which the construction will take place.

DESIGN

1. Lay, 2cm (3/4 inch) of cement onto the foundations of which the wall is being built
2. Place plastic bottles on top of this cement with a 1cm (1/3 inch) space between bottles.
3. Pour cement on top of these bottles being careful to fill in all gaps, ensuring that the cement is 2cm (3/4 inch) above the top of the bottles.
4. Place the next layer of plastic bottles in between the bottles below, as shown in Figure 7 (over).
5. Pour cement on top of these bottles being careful to fill in all gaps, ensuring that the cement is 2cm (3/4 inch) above the top of the bottles.

6. Repeat steps 1-5 until the wall is at the desired height.

7. Once the wall is built and dried completely render the sides to achieve the desired outward aesthetic look.

VII. BENEFITS OF PLASTIC BOTTLE

Masonry wall The most important benefits of these alternative innovative materials compared to conventional materials such as brick can include:

A. Good construction ability : The walls built by these bottles are lighter than the walls built by brick and block, and that makes these buildings to show a good response against earthquake. Due to the compaction of filling materials in each bottle, resistance of each bottle against the load is 20 times higher compared to brick. And these compressed filling materials, makes the plastic bottle to be prevented from passing the shot that makes the building as a bulletproof shelter.

B. Low cost : Constructing a house by plastic bottles used for the walls, joist ceiling and concrete column offers us 45% diminution 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% compared to building the walls using the brick and concrete block. It must be noted that the sophisticated manpower can lead to reducing the construction time and the relative costs also become lower.

C. Non-brittle characteristic: Using the non-brittle materials can reduce construction waste. Unlike brick, plastic bottle is non-brittle. So due to the frangibility property, the percentage of producing construction waste in brick is more than plastic bottles.

D. Absorbs abrupt shock loads: Flexibility is a characteristic which makes the buildings performance higher against the unexpected load. Since the plastic bottles are not fragile, they can be flexible and tolerates sudden loads without failure. This characteristic can also increase the buildings bearing capacity against the earthquake.

E. Green Construction: Plastic bottles can cause the green construction by saving energy and resources, recycling materials, minimizing the emission, having significant operational savings and increasing work place productivity.

VIII. CONCLUSIONS

1. Use of innovative materials with sustainable application such as plastic bottles can have considerable benefits including finding the best optimization in energy consumption of the region, reducing environmental degradation.
2. Generally the bottle houses are bio-climatic in design, which means that when it is cold outside is warm inside and vice versa.
3. Plastic bottles can cause the green construction by saving energy and resources, recycling materials, minimizing the emission, having significant operational savings and increasing work place productivity

4. Cost compression between bottles wall is roughly half than conventional brick masonry. i.e., Total cost of 10 m² Brick masonry wall is Rs. 7444.25 and total cost of 10 m² Bottle masonry wall is Rs. 3879.2
5. Use of innovative materials with sustainable application such as plastic bottles can have considerable benefits including finding the best optimization in energy consumption of the region, reducing environmental degradation.

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