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Plastic Bottle Strips as Additives to Cement-bonded Floor Tiles

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Abstract

Objectives: To determine the compressive strength of cement-bonded floor tiles with plastic bottle strips using 1:2 mixture after 28 days curing period. **Methods/Analysis:** Cement-bonded floor tiles were manufactured with 0.5%, 1% and 2% plastic bottle strips as additives using a design mixture of 1:2 with the control sample. Compression test was conducted. **Findings:** All cement-bonded floor tile samples passed the allowable compressive strength with that control sample, 0.5%, 1% and 2% plastic bottle strips that yielded an average value of 8.83 MPa, 8.63 MPa, 11.9 MPa and 9.3 MPa respectively. **Improvement:** Addition of the plastic bottle strips yielded an increase in terms of the compressive strength of the cement-bonded floor tiles.

Keywords: Additives, Cement-bonded, Floor Tiles, Plastic Bottles, Strips

1. Introduction

Plastic pollution is alarmingly increasing in cities and municipalities. The major reason for this is the improper disposal and unsustainable throw-away habits. All over the world, many researchers are coming up with invention of materials which can be suitably added into concrete for enhancing its properties. The utilization of materials like waste Polyethylene Terephthalate (PET) bottle fibers in cementations matrix improves the mechanical response of the resulting product; commonly known as PET Fiber Reinforced Concrete (PFRCs), have the potential of exhibiting higher flexural strength and ductility in comparison to unreinforced mortar or concrete, which fail in tension immediately after the formation of a single crack[1]. This facts addresses to recycle and reuse plastic bottles in their fiber form as aggregates in concrete to develop an improved mechanical properties over the traditional concrete and thereby mitigate problems on wastes management and disposal.

Landfill areas are becoming a problem in the country and even more expensive for any wastes procedure, such that whenever possible, plastics for disposal should be minimized. Most PET bottles are used for beverage container and are thrown away after single usage and disposed by burning it, which create serious environmental problems.

If the production of waste cannot be prevented, it is just advisable for us to create alternative to utilize these possible wastes like plastic bottles in another process before considering disposal. The benefits of this recycling can be considered as eco-friendly.

In addition to the advantage of recycling Municipal Solid Wastes (MSW), the incorporation of wastes plastics in concrete is essential as a light weight aggregate. The reduction of unit weight of concrete is one of the goals of production of earthquake resistant structures[2]. PET Fiber Reinforced Concrete has experimentally been proven to perform better[3,4].

The waste plastics that will be utilized in this study are the mineral water drinking bottle or the Polyethylene Terephthalate (PET) bottles. This is to develop a method to transfer it to a valuable product that would somehow solve the problem of dumping tons of plastic wastes elsewhere.

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It is a time to come up with an alternative method for disposing wastes plastic bottles. The utilization of plastic bottle strips as additives to cement-bonded floor tiles would somehow give us an alternative to utilize it and at the same time give protection to our environment.

1.1 Objectives

To determine the compressive strength of cement-bonded floor tiles utilizing plastic bottle strips as additives after 28 days curing period with the following composition:

M1 - Cement-bonded floor tiles without Plastic bottle strips (control sample);

M2 - (0.5% Plastic bottle strips);

M3 - (1% Plastic bottle strips);

M4 - (2% Plastic bottle strips).

2. Methodology

2.1 Preparation of Materials

Wastes plastic bottles were collected and prepared by cleaning it with water to eliminate any chemical or dirt and have it dried in an open space. The plastic bottles were cut or shredded into strips at an approximate length of 1 inch. It was mixed with cement and sand (fine aggregates) and water based on the design mixture. The concrete mix was poured in a tile molder to attain the desired shape or design. It was casted-out and released in an open space for drying. After 28 days curing, these were subjected to compression test. Table 1 shows the composition of materials.

2.2 Experimental Procedure

Wastes plastic bottle strips were utilized as additives to the production of cement-bonded floor tiles in 0.5%, 1% and 2%. N the other hand, the suitability for either utilizing plastic strips as additives was explored in the study. Hence, for the strength test, samples are subjected for laboratory tests.

2.3 Experimental Design

Wastes plastic bottle strips at approximately 1 inch length.

Cement-bonded floor tiles with plastic bottle strips as additives:

M1 mixture without plastic bottle strips (control);

M2 mixture with 0.5% plastic bottle strips;

M3 mixture with 1% plastic bottle strips;

M4 mixture with 2% plastic bottle strips;

The 1:2 mixtures were utilized in the study. Materials utilized were 10 kgs of cement and 0.50 cubic foot of sand per mix for the purpose of coming up with at least 3 or 5 replications or samples per mix with the corresponding amount of PET bottle strips additives of 112 grams for M_2, 224 grams for M_3 and 448 grams for M_4.

3. Results and Discussion

Table 2 shows the data that resulted during the compressive strength test where all passed the allowable compressive strength. The cement-bonded floor tiles with 1% plastic bottle strips additives yielded the maximum strength having an average strength of 11.9 MPa.

Table 1. Materials for the cement-bonded floor tiles

Mixtures	Cement (kgs.)	Sand (ft3.)	PET Bottle Strips (grams)	Water (Liters)
M_1 (control)	**10**	**0.50**	**-**	**3**
M_2 (0.5% Plastic bottle strips)	**10**	**0.50**	**112**	**3**
M_3(1% Plastic bottle strips)	**10**	**0.50**	**224**	**3**
M_4 (2% Plastic bottle strips)	**10**	**0.50**	**448**	**3**

Table 2. Compressive strength test results after 28 days curing period

Treatment	Compressive Strength (MPa)			Average (MPa)	Allowable Compressive Strength (MPa)	Remarks
	1	2	3			
M_1 (Control)	7.5	8.1	10.9	8.83	8.5	Passed
M_2 (0.5% PBS)	7.2	10.3	8.4	8.63	8.5	Passed
M_3 (1% PBS)	8.7	12.1	14.9	11.9	8.5	Passed
M_4 (2% PBS)	10.7	8.6	8.6	9.3	8.5	Passed

4. Conclusions

Based on the results obtained, it can be concluded that the utilization of wastes plastic bottle strips as additives increases the compressive strength of the produced floor tiles especially the M3 having 1% which yielded the highest result.

5. References

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