Journal of Mechanical
and Construction Engineering, 2021,
Vol. 01, Iss. 01, S. No. 001, pp. 1-4

Green Mortar by Partial Introduction of Shredded Waste Plastic

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How to cite this paper: A. Agarwal, D. Ojha (2021) Green Mortar by Partial introduction of Shredded Waste Plastic. *Journal of Mechanical and Construction Engineering,*1(1), 1, pp. 1- 4.

https://doi.org/10.54060/JMCE/001.01.001

Received: 23/02/2021
Accepted: 08/03/2021
Published: 10/03/2021

Abstract

Plastic products have become an integral part of our daily life as a basic need. It is produced on a massive scale worldwide and its production crosses 150 million tons per year globally. In India, approximately 9 million tons of plastic products are consuming every year (2010) which is expected to rise to 12 million tons by 2012 and estimates say it would double this value in 2025. Its broad range application is mainly in packing films, wrapping materials, fluid containers, clothing, household, and industrial products and building materials. This project deals with an effective method of dumping plastic waste that has accumulated. Using plastics in building mortar and plasters can be employed in an effective manner that is completely environment friendly.

Keywords

Green mortar, waste plastic, environment friendly

1. Introduction

Plastics or polymers substances experienced significant rise in the 1970s, 80s, and 90s, rising at 2.5 times the pace of India's GDP. Plastic raw material consumption increased to more than quadrupled from 3.3 million metric tons to 6.8 million metric tons in 2010, owing to growing urbanization, the development of retail networks, plastic-based wrapping, and consumer goods. Plastic packaging has their advantages, but because of their non-biodegradability and inefficient recovery facilities, they, like solid waste garbage, get to be a nuisance because of the higher exposure. This project deals with an effective method of dealing with this plastic waste that has accumulated. Using plastics in building mortar and plasters it can be used in an effective manner which is completely environment friendly [1].

2. Objectives

Utilization of waste plastic in such a way that it does not pose any harm to the environment. To evaluate the extent of possible replacement of sand with plastic in mortar and comparing its properties with that of conventional mortar. Reducing the amount

of sand required in mortar for brickwork and plastering so that overall cost of the project could be reduced and could check degradation of natural resources from where sand is extracted [2-3].

3. Materials and their Properties

3.1. Cement

Cement, in its broadest sense, is a sticky and tough substance capable of keeping together molecules of tough material into a small, stable mass. They are limited to calcareous cement having mixtures of lime as their principal ingredient for constructive development work, with the vital capacity of tying the fine (sand) and coarse complete components collectively. Non-pressure-driven and water-powered cement are two types of cement used in the construction sector. Non-pressure driven lime, for example, does not set and solidify in water [4].

3.2. Fine Aggregate

Mud is composed of a variety of chemically active elements such as illite, kaolinite, and others, whereas silica is primarily quartz. Fine aggregate is sand that is within the range of 4.75 mm and 0.150 mm in length, and it is utilized to make plaster concrete, and mortar. It is often utilized to fill basements that are below ground level. To save money on building, local sand that is suitable for the job should be used as much as feasible. Consequently, transportation costs will account for a significant portion of the sand price. The pits or regional riverbeds are the good source of natural sand. Natural sand is getting increasingly tough to obtain by and much more expensive as a result of rising infrastructural development. As a result, the hunt for sustainable building supplies is a hot study topic [5].

3.3. Water

To convert into the concrete through the chemical process with cement, water is found an essential component of concrete. Water utilized throughout studies and building sites should be of excellent standard because it aids in the formation of the cement gel's toughness.

3.4. Plastics (Pet)

The plastic utilized was the waste plastic jugs, LDPE/HDPE sacks, coverings, gathered from the close by houses and condos and from the landfill yards.

Steps associated with the plastic reusing measure:

•Selection/investigation: The recyclers/reprocesses need to choose and examinations of the waste/piece, which are appropriate for reusing/reprocessing.

•Collection/isolation: The plastics squander gathered/isolated according to the codes 1-7 referenced in the BIS rules (IS: 14534:1998).

• Shall be washed, destroyed, agglomerated, expelled, and granulated.

4. Methodology

The methodology which will be followed during this report will be firstly to examine all the raw materials that are cement (PPC grade43) and sand to ensure that the quality of material which is to be used is good and acceptable. After testing of raw materials, cubes of dimensions 150mmx150mmx150mm will be casted. For each mix 3 cubes will be casted which will be then cured and tested at 28, 14 and 7 days for determining compressive toughness. There are total of 3 mixes in which all mix are

for high strength mortar(10N/mm^2). After all test results are compiled and noted, the results will be analyzed for the best performing mix. Then, all the cost-based calculations will be carried out with respect to that mix.

- Determining the best quantity of plastic which could be induced into the mortar by trying different ratios (40% replacement, 50% replacement and 60% replacement).
- Testing of raw materials to ensure good quality of materials.
- Performing compressive test on each mix and analyzing their results.
- Performing Adhesion test on the mix which qualifies compressive strength test.
- Comparison between cost of conventional mortar and the mortar mix which contains waste plastic in it.

5. Observations

- . Note: All samples are calculated with respect to cement of grade 43.
- Standard cube of 150 mm is used.
- 9 cubes casted for testing at 7, 14, 28 days.
- For 10 N/mm2 strength of ratio 1:3 (Strength Type: HIGH).

Table 1. Mix ratio proportions

MIX NO.	CEMENT (KG)	SAND (KG)	PLASTIC (KG)
01(40% plastic replacement)	1.5	2.7	1.8
02 (50% replacement)	1.5	2.25	2.25
03 (60% replacement)	1.5	1.8	2.7

6. Conclusion and Results

There was no change in any property of mortar with addition of plastic. Thus, waste plastic can be used to make mortar which is an environmentally efficient way of disposing of plastic. Also, sand which is being replaced is a clear indication of conservation of natural resources from which it is extracted. The compressive toughness of the cubes will be determined by splitting the optimal axial load utilized to the cubes for the duration of the experiment by the region of cross section; the mean measurements of the segment will be used in the computation, and it will be represented to the closest 0.5 N/mm2.

Table 2. Specifications of cubes and curing

SR. NO	PERCENTAGE OF PLASTIC	AGE OF SPECIMEN	CURING CONDITION
1	40%	7days	Good
2	40%	14days	Good
3	40%	28days	Good
4	50%	7days	Good
5	50%	14days	Good
6	50%	28days	Good
7	60%	7days	Good
8	60%	14days	Good
9	60%	28 days	Good

After 28 days, the mean compressive toughness of the mortar specimen was determined to be 9.6 N/mm^2. Which is 96% of the strength the project aimed. Thus, we can conclude that green mortar can be safely used in residential buildings. Based on the findings, the study also concludes that:

1. Plastic (PET) can be replaced with sand to make mortar which indicated that natural resources from where sand is extracted could be conserved.
2. There was no effect on properties of mortar.
3. The cost of mortar might be significantly decreased if sand was replaced with plastic wastes.

Acknowledgements

We want to thank our institution Amity School of Engineering and Technology, UP, for providing us with all the necessary facilities which were required in completion of this paper. Also, would like to acknowledge the support of our peers and family.

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