International Journal of Engineering Research and Reviews ISSN 2348-697X (Online)
Vol. 10, Issue 3, pp: (1-5), Month: July - September 2022, Available at: www.researchpublish.com

EFFECTS OF ADDING PET FLAKES TO CONCRETE BLOCKS

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DOI: https://doi.org/10.5281/zenodo.6973591

Published Date: 08-August-2022

Abstract: **Plastic, being one of the common material in our daily activities and we couldn't imagine a day without it. plastic contributes to major pollution as it involves many components like PELD,PELLD,PEHD,PP, ,PET and many other .major plastic pollution is due to single use plastic which is either trashed or crushed . Single use plastic involves many kinds of polymers out of which PET (Polyethylene terephthalate) is major with an average of 6.8% of total plastic pollution. This study involves determining the mechanical properties of concrete blocks added with PET flakes. It was observed that an optimum cracking and crushing strength of 7.2Mpa and 7.78 Mpa respectively at a proportion of 1:4(plastic: cement). An optimum flexural strength of 2.1 MPa was observed at a proportion of 1:2 (plastic: cement) and it was observed that the dry density of pet flakes added concrete blocks decreases as the weight of the plastic added to the block increases .**

Keywords: **Cracking strength, Crushing strength, Flexural strength, PELD, PET.**

I. INTRODUCTION

The major challenges of present generation is Plastic pollution as the used plastic is either trashed or scraped .As plastic is composed of organic polymers like nylon,PVC etc, it takes hundreds of years to decompose and in addition to its time to decompose the growing demand has increased its pollution and thus affecting natural environment. An average daily estimate of 8 million pieces of plastic pollution flows into oceans and by 2050 the plastic weight would be more compared to fishes weight. Plastic pollution consists of different types of polymers like PELD, PELLD, PEHD, PP,PVC, PS, PET, OTHER. PELD and PPLLD contributes to 17.5% of plastic pollution. PEHD is 12.1% of plastic pollution. PP comprises 18.9% of total plastic pollution. Other polymers like PET, PS, PVC are nearly 50% of total plastic pollution. Common usage plastic involves packed water bottles, soft drink bottles, food trays, roasting bags, medicine jars, food packaging, daily accessories packaging etc., In India around 43% of plastic is due to packaging and or of single use in nature. The effective ways of reducing this plastic pollution involves three R's i.e., Reduce, Reuse and Recycle.

Civil engineering structures are composed of many components like columns, beams, slabs ,walls and many others. Columns are designed for compressive and bending actions. Beams are designed for flexural and shear actions. Slabs are designed for flexural actions similar to the beams with wider area. A wall are designed as slabs in case of laterally resisted structures, but does not participate in any structural action of small buildings. These are generally used for partitions and safety purposes. As walls do not take part in transferring the loads and contribute to major volume in a structure. Reusing of PET plastic in these walls does not affect the structure but in case of laterally resisted structures the flexural strength of concrete blocks with PET flakes has to be found out to determine the optimum proportions of plastic cement ratio for maximum flexural action.

II. MATERIALS AND METHODOLOGY

The main ingredient of concrete is cement which binds sets, hardens and adheres to other materials. Cement with fine aggregate is used as mortar for masonry. Cement with sand, gravel and water is termed as concrete. Cement used for preparation of these concrete blocks is of 53 grade ordinary Portland cement confirming to IS:12269-1987.

Sand usually called as fine aggregate is replaced with robo sand in this study. Robo sand is a sand manufactured in stone quarries. This robo sand neither consists of organic impurities nor harmful impurities. This robo results in high compressive strength and is economical with superior quality when compared to river sand based concrete blocks.

Coarse aggregate are of 4mm to 8mm in size generally known as baby chips and was used to increase the crushing strength of concrete blocks.

Plastic flakes are shredded form of pet bottles into tiny pieces. These pet flakes are either prepared manually or mechanically. These pet flakes have an average size length of 2cm and are irregular in shape.

Water is used for better mixing, placing, compacting and curing. Portable water is used in the preparation of concrete blocks.

Batching is the process of quantifying the ingredients for preparation of specimen. To prepare a concrete block of size 40cm*20cm*10cm it requires 0.85kg of cement, 11kg of robo sand, 7.5kg of baby chips and 30 liters of water. PET flakes are well dried to ensure that it is moisture free and is added in its natural form without any moulding or melting. These plastic flakes added to be uniformly while mixing.

Table 1 gives the weights of ingredients required for preparing concrete blocks.

Mixing of ingredients involves dry state mixing and then adding water to attain a homogeneous mix.care must be taken such that the mix does not start setting during mixing stage.

Moulding can be performed either in moulds or through moulding/vibrating machine which consists of moulds which are separated by thin plates and is operated mechanically. In case of using moulds the wet concrete should be compacted through vibrator or by using tamping rod.

The prepared specimens are unmoulded after 24 hrs and set to dry.

After proper drying of samples, these are cured for 14days.

III. EXPERIMENTAL WORK

Cracking, crushing, flexural strength of the cured samples are found at 14 days are performed under UTM of 1000 .and are compared with strengths of normal concrete block. Thus the variation in mechanical properties on addition of pet flakes was observed proportions of 1:1,1:2,1:3 and 1:4.

Other experiments includes water absorption test and dry density calculations.

IV. DETERMINATION OF EXPERIMENTAL RESULTS OF CONCRETE BLOCKS

4.1 Crushing strength

Concrete blocks of size 40cm*20cm*10cm were casted by adding pet flakes and tested after 14 days of curing with proportions of 1:1,1:2,1:3 and1:4. These results are represented in table 2.

4.2 Cracking strength

Concrete blocks of size 40cm*20cm*10cm were casted by adding pet flakes and tested after 14 days of curing with proportions of 1:1,1:2,1:3 and1:4. These results are represented in table 3.

4.3 Flexural strength

Concrete blocks of size 40cm*20cm*10cm were casted by adding pet falkes and tested after 14 days of curing with proportions of 1:1,1:2,1:3 and1:4.flexural strength are calculated using flexural equation. These results are represented in table 4.

4.4 Water absorption test

Concrete blocks made of different proportions of pet flakes are tested for water absorption and the results are represented in table 5.

4.5 Dry density test

Density of concrete blocks are found out for different proportions of plastic and are represented in table6.

V. FIGURES AND TABLES

Table 1: Mix proportions for concrete blocks

Material	Weights for Normal 1 brick (Kg)	Weights for 4 bricks (Kg)	Weights for1:4 ratio (Kg)	Weights for1:3 ratio (Kg)	Weights for1:2 ratio (Kg)	Weight for 1:1 ratio (Kg)
Cement	0.85	3.4	3.4	3.4	3.4	3.4
Robo sand	11	44	44	44	44	44
Baby chips	7.5	30	30	30	30	30
Plastic	-	-	0.85	1.14	1.7	3.4
water	0.75	3.0	3.0	3.0	3.0	3.0

Table 2: Crushing strength of concrete blocks

Plastic:cement ratio	Crushing strength(MPa)
Normal block	10
1:4	7.78
1:3	7.5
1:2	6.1
1:1	5.53

Table 3: Cracking strength of concrete blocks

Plastic:cement ratio	Cracking strength (MPa)
Normal block	9
1:4	7.2
1:3	6.75
1:2	5.55
1:1	5.12

Table 4: flexural strength of concrete blocks

Plastic:cement ratio	Flexural strength(MPa)
Normal block	1.8
1:4	1.133
1:3	1.65
1:2	2.1
1:1	1.333

Table 5: water absorption test on concrete blocks

Plastic:cement ratio	Percentage of water absorbed
Normal block	7.5%
1:4	7.24%
1:3	6.78%
1:2	6.57%
1:1	4.32%

Table 6: Dry density of concrete blocks

Plastic:cement ratio	Percentage of plastic(%)	Dry density(kg/cu.m)
Normal block	-	2337.5
1:4	25	2025.83
1:3	33.33	2020.63
1:2	50	2018.75
1:1	100	2015

Fig 1: Flexural failure of concrete block

Fig 2: compression failure of concrete block

VI. CONCLUSIONS

- Specific Gravity of PET flakes is less than all other materials used for blocks. Thus the addition of PET flakes to bricks reduces the self-weight of structural component as a whole.
- Densities of blocks with waste PET decreases with increase in percentage of PET flakes to bricks as the volume of bricks is composed of PET flakes compared to normal brick.
- The optimum Cracking strength and crushing strength of 7.2MPa and 7.78MPa respectively are obtained for a plastic: cement ratio of 1:4.
- The optimum flexural strength of 2.1MPa is obtained for plastic: cement ration of 1:2 this strength is higher than normal brick due to the reason that plastic flakes acts like fibers under bending conditions.
- Water absorption of bricks with PET flakes decrease as compared to water absorption of normal brick due to the reason that the PET flakes added, blocks the pores of block.
- Brick with plastic waste can be used for less important works where brick is not to bear more loads.
- The use of Recycled plastic Waste PET aggregate in blocks which is one of the best option for the disposal of plastic & ultimately it reduces the plastic pollution in the Environment.

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