

“An Experimental study on Concrete using PET Bottles as replacement for Sand”

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Abstract— *The use of waste bottles is serious concern all over the world as it causes environmental problems. In this project the main aim was to utilize the waste pet bottles in concrete as a partial replacement instead of fine aggregate. The use of bottles in concrete makes it economical and moreover it becomes environmental friendly. The strength of concrete with partial replacement of waste tyre rubber chips at various percentages had been investigated. Compression, flexural strength were carried out for three different percentages of pet bottles say, 0%, 1%, 2%, 3%, 4% at 7 and 28 days curing period. The tests results indicate that as the percentage of bottles increases, greater will be the strength of the concrete and in case of 2 % replacement of pet bottles in concrete it shows the maximum strength compared to the other percentage replacement that but it decreases at 3 %.*

Keywords : Waste pet bottles, Fine Aggregate, Compression, Flexural Strength

I. INTRODUCTION

Plastic is one of the materials showing immense potential in our daily lives as it possess low density, high strength, user friendly designs, fabrication capabilities, long life, light weight and low cost characteristics are the factors behind such extraordinary growth. Although, plastics have been used in very large and useful applications, it bestows to an ever increasing amount in the solid waste stream. In the plastics waste, polyethylene forms the largest fraction, which is followed by Polyethylene terephthalate (PET) that represents one of the most common plastics in solid urban waste.

In field of concrete technology India as well as other nation now is seeking for alternative for conventional aggregate that may be recognized as use plastic waste, for it might be realized as PET phase capacities. As per the estimates, India produces 500,000 tons of pet waste every year and due to increasing use of pet bottles in daily Consumption, the amount of waste is going to grow by leaps and bounds. At present, the total recycling capacity in India is around 145,000 TPA, out of which Reliance Industries Ltd. has a capacity of 42,000 TPA and Kanpur-based Ganesh Polytex Ltd (GPL) has a capacity of around 39,600 TPA and rest is with other small local players As such quantity of waste need to have large area of landfill to dump it, its use in concrete mix will prove a better option for land fill that, being non-degradable, remain for long years and cause problem before us. Concrete is the most widely used construction material in the world due to its high compressive strength, long service life, and low cost

II. LITERATURE REVIEW

[1] Sahil Verma and Sahil Arora.(2015)[4], Conduct the experiment on “Replacement of Natural sand in concrete by polyethylene bottle” they observed the effects of PET over the compressive strength of concrete. And compare the strength of PET mix concrete with conventional mix concrete. In this research paper a little try is to use the waste plastic crushed bottles of appropriate size in concrete with partial replacement of fine aggregates and it has the potential of disposing off large quantities of the catastrophic waste in a beneficial way. The environmental effects can be substantially reduced by proper encapsulation of these waste plastic bottles. The study also gives the comparison of compressive strength of normal conventional concrete with the concrete made from the partial substitution of aggregates with Polyethylene Terephthalate bottles. They conduct the tests on compressive strength measured for 7, 14, and 28 days. Up to 2% replacement of fine aggregate with waste PET fiber, there is increase in compressive strength of concrete. For 7 days 22N/mm², for 14 days 26N/mm², for 28 days 28.5N/mm². For conventional concrete compressive strength for 7, 14 and 28 days are 20.5N/mm², 23.2 N/mm² and 25 N/mm² respectively.

[2] **Pramod Sambhaji Patil (2015)[6]**, worked on “Behavior of Concrete which is Partially Replaced with Waste Plastic” He conducted experiments test on compressive and split tensile test for 28 days. He concluded the modified concrete mix, with addition of plastic aggregate replacing conventional aggregate up to certain 20% gives strength with in permissible limit. Modified concrete casted using plastic aggregate as a partial replacement to coarse aggregate shows 10 % it could be satisfy as per IS codes. Density of concrete is reducing after 20% replacement of coarse aggregates in a concrete.

III. EXPERIMENTAL PROGRAMME

3.1 Materials used

In this experimental study, cement, aggregates, water ,pet bottles are used.

Cement

Ordinary Portland Cement (OPC) of 43 grade with specific gravity of 3.12 was used in this experiment.

Sand

Locally available sand of specific gravity 2.59 passing through 4.75 mm IS sieve was used.

Coarse aggregate

Coarse aggregate of specific gravity 2.70 passing through 10 mm sieve and retaining on 4.75mm sieve was used.

Water

Potable water free from impurities was used.

PET Fiber: The polyethylene (PET) bottle which can easily be obtained from the environment with almost no cost is chopped and added into ordinary concrete to examine the strength behavior of various specimens. The size of PET fibres is 10 mm and specific gravity is 2.5

IV. EXPERIMENTAL METHODOLOGY

4.1 Compressive strength test

In this test, the specimens of 150 X 150 X 150 mm were cast for M40 grade concrete. The percentage of PET bottles added were 0, 1,2,3,4,% by weight of fine aggregate After 24 hours the specimens were shifted to curing tank to cure for 7 and 28 days. After the curing period the cubes were tested in UTM. The compressive strength is noted. In each category 3 cubes were tested and their average value is reported.

4.2 Flexural strength test

In this test, the beam specimens of dimensions 500 X 100 X 100mm were cast. The percentage of PET bottles added were 0, 1,2,3,4,% by weight of coarse aggregate After 24 hours the specimens were shifted to curing by weight of fine aggregate After 24 hours the specimens were. After 24 hours the specimens were shifted to curing tank to cure for 28 days. These specimens were tested under 2 point loads. In each category 3 beams were tested and their average value is reported.

V. EXPERIMENTAL RESULTS

5.1 Compressive strength

Table 5.1 a Compression test values for 7 days

SAMPLE NO	% OF MIXING	LOAD (KN)	COMP.STRENGTH IN (N/mm ²)
A1	0%	510	20
		390	
A2	1%	500	22.22
		500	
A3	2%	550	25.22
		585	
A4	3%	560	20.44
		360	
A5	4%	400	15.33
		290	

Table 5.1 b Compression strength for 28 days

SAMPLE NO	% OF MIXING	LOAD (KN)	COMP.STRENGTH IN (N/mm ²)
A1	0%	610	31.11
		790	
A2	1%	690	37.55
		1000	
A3	2%	690	33.33
		810	
A4	3%	550	26.44
		640	
A5	4%	510	19.33
		360	

5.2 Flexural strength

Table 5.2 a. Flexural strength for 7 days

SAMPLE NO	% OF MIXING	LOAD (KN)	FLX.LOAD (N/mm ²)
A1	0%	30	5.95
		32	
A2	1%	32	6.22
		38	
A3	2%	38	7.11
		42	
A4	3%	28	5.33
		32	
A5	4%	26	4.98
		30	

Table 5.2.b. Flexural strength for 28 days

SAMPLE NO	% OF MIXING	LOAD (KN)	FLX.LOAD (N/mm ²)
A1	0%	35	5.95
		32	
A2	1%	35	6.84
		42	
A3	2%	40	7.55
		45	
A4	3%	32	6.40
		40	
A5	4%	34	5.86
		32	

VI CONCLUSIONS

1. Up to replacement of PET by 2% of sand in concrete gives the higher compressive strength is increased 26.10% than conventional concrete for 7 days curing.
2. Up to replacement of PET by 1% of sand in concrete gives the higher compressive strength is increased 20.70% than conventional concrete for 28 days curing.
3. Up to replacement of PET by 2% of sand in concrete gives the higher flexure strength is increased 29.03% than conventional concrete for 7 days curing.
4. Up to replacement of PET by 2% of sand in concrete gives the higher flexure strength is increased 26.89% than conventional concrete for 28 days curing.
5. Nowadays sand availability is less and cost is more hence partial replacing sand by PET bottle pieces will be more economical and environmental friendly.
6. In future PET pieces also became the construction compound.

REFERENCES

- [1] Dora Foti, "Preliminary analysis of concrete reinforced with waste bottles PET fibers", Construction and Building Materials, Volume 25, Issue 4, April 2011, Pages 1906–1915
- [2] . Aditya Raut, Mohammad Salman Patel , Nilesh B. Jadhwar , Uzair khan and Prof.Sagar W. Dhengare "Investigating the Application of Waste Plastic Bottle as a Construction Material" Volume,16 March 2015 , ISSN-3347-4482
- [3] Zainab Z. Enas A. AL-Hashmi, "Ismail Use of waste plastic in concrete mixture as aggregate replacement", Waste Management, Volume 28, Issue 11, November 2008, Pages 2041–2047
- [4] Sahil Verma, Sahil Arora, " Replacement of Natural Sand in Concrete by Polyethylene Bottles" Volume 2 Issue: 01, April-2015, e-ISSN: 2395-0056, p-ISSN: 2395-0072
- [5] Ms. K.Ramadevi, Ms. R. Manju "Experimental Investigation on the Properties of Concrete With Plastic PET (Bottle) Fibres as Fine Aggregates". International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, Volume 2, Issue 6, June 2012)
- [6] Pramod sambhaji patil, International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume 4 Issue-11, April 2015
- [7] P. Ganesh Prabhu, C. Arun Kumar, R. Pandiyaraj, P. Rajesh and L. Sasi Kumar.
- "Study on utilization of waste PET bottle fiber in concrete", International Journal of Research in Engineering & Technology (IMPACT: IJRET) ISSN(E): 2321-8843; ISSN(P): 2347-4599 Volume 2, Issue 5, May 2014, Pages 233-240