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Utilization of Waste PET Bottles as Fine Aggregate in Concrete with the Help of SCBA

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***Abstract*: Previous investigations already confirmed the potential of pet bottle waste in replacing fine aggregates in concrete which is one of the best way to utilize pet bottle waste. It is beneficial because the amount of exploiting natural sand for construction activities can be reduced. Earlier studies show that up to 2% replacement of fine aggregate with waste pet fiber gives the best result in case of compressive strength of concrete. But it is not sufficient utilization of pet bottle waste being produced presently. So in this research work we have tried to increase the percentage of pet bottle waste usage in concrete production, which can be possible only if a new waste i.e. Sugar Cane Bagasse Ash(SCBA) is added as replacement of cement in PET fiber concrete. SCBA has properties similar to the cement. For this reason, it can be utilized in place of cement. It is not less than a miracle to utilize these two wastes simultaneously in a productive manner. The fibers have been obtained by simply shredded the bottles and then added to the mix concrete. First we started with the casting of cubes with M20 grade of concrete. Concrete specimens with 2.5% replacement of fine aggregates with PET Fiber and 2.5% replacement of cement with SCBA then with 3% PET Fiber and 2.5% SCBA and finally with 3.5% PET Fiber and 2.5% SCBA were prepared. The cubes were of size 150mm X 150mm X 150mm.For each percentage of PET fiber total nine cubes were prepared in which three set of cubes were fixed, each set having three cubes. One set was kept for 7days of curing and the second one for 14. After performing the various experiments, it is noted that with the help of SCBA we can utilize up to 3.5% by weight of waste PET fiber as a replacement of fine aggregate i.e. natural sand in PET fiber concrete which is a bounteous amount. Comparison has also been made of compressive strength of normal conventional concrete with the concrete made from the partial substitution of fine aggregate and cement with waste PET fiber and SCBA respectively.**

***Keywords*: Compressive Strength, Polyethylene terephthalate (PET), Sugar Cane Bagasse Ash (SCBA), Specific Gravity.**

1. Introduction

All through history, plastics may have been viewed as a noteworthy specialized leap forward in the XX Century, principally because of the way that they have gone before new creations and have substituted different materials in officially existing items. They are light, solid, and adaptable, and additionally impervious to moistness, concoction items, and corruption. In any case, such properties constitute a test for strong and unsafe waste operators. Plastics reusing the world over have expanded impressively because of the need to tackle the issue of amassing of strong urban waste, which has advanced creating elective reusing frameworks and surveying the estimation of waste, especially non-returnable compartments. By methods for the consolidated utilization of cement and polyethylene terephthalate (PET) in building, an innovation hardly examined in Mexico is being anticipated. There exists inquire about driving us to consider PET as a total and not as substitute in the blend [1]. Worldwide research seeing the utilization of PET as a total as of now demonstrates some advance worth considering. The amount of plastics of various types devoured yearly everywhere throughout the world has expanded generously. The assembling forms, city strong squanders (MSW) and administration ventures create a lot of waste plastic materials. With a ceaseless development for more than 50 years, the worldwide generation of plastics ascended from 204 million tons in 2002 to 299 million tons in 2013 (Plastics the Facts - 2014) and is consistently expanding. The overall creation of PET surpasses 6.7 million tons/year and demonstrates an emotional increment in the Asian area because of late expanding requests in China and India (M. L. Anoop Kumar et.al. 2014). In India around 40 million tons of strong waste is created each year. This is expanding at a rate of 1.5 to 2% every year. Plastics include 12.3% of aggregate waste created most of which is from disposed of PET water bottles (K. Ramadevi et. al. 2012).

We are likewise mindful that a considerable measure of harm is done to condition in the make of bond. It includes part of carbon discharge related with different chemicals. The investigates has demonstrated that each one ton of bond fabricate discharges half ton of carbon dioxide, so there is a quick need to control the utilization of concrete. Then again materials squanders, for example, Sugar Cane Bagasse Ash is hard to arrange which consequently is natural Hazard. The Bagasse fiery remains bestows high early quality to concrete and furthermore lessen the penetrability of cement. The Silica show in the Bagasse cinder responds with parts of concrete amid hydration and bestows extra properties, for example, chloride protection, erosion protection and so forth.

Till now scientists have reasoned that upto 2% of pet fiber can give best outcomes in compressive quality of concrete as contrasted and conventional cement. Yet, in this examination tests have been led to deliver the way that upto 3.5% of pet fiber with the assistance of SCBA can give us great outcomes in compressive quality. On the off chance that this training is followed in development works it will be valuable not just in lessening the request of concrete and sand which are ending up rare step by step yet in addition in altering different natural squanders which are generally representing a risk to every single living being.

2. Materials, proportion and methods

A. Raw materials

- *Cement:* The bond utilized ought to have a base compressive quality at various ages as indicated by the applicable IS specification– IS:269– 1987 (33 review OPC).
- *Aggregate:* The extent of the total, molecule shape, shading, surface, thickness (heavyweight or lightweight), pollutions, all of which have an effect on the sturdiness of cement, should fit in with IS: 383–1970.
- *Water:* Portable water was used for casting the specimen in present study. The water was relatively free from the organic matter, silt, oil, sugar, chloride and acidic material as per Indian Standard.
- *PET Fiber:* The polyethylene (PET) bottle which can without much of a stretch be acquired from the earth with no cost is destroyed and added into conventional cement to look at the quality conduct of different examples.
- *Sugarcane Bagasse Ash(SCBA):* The sugarcane bagasse comprises of around half of cellulose, 25% of hemicellulose and 25% of lignin. Every ton of sugarcane produces roughly 26% of bagasse (at a dampness substance of half) and 0.62% of remaining fiery debris. The deposit after ignition shows a substance organization commands by silicon dioxide (SiO2).

B. Mix proportions

According to IS10262:2009, for M20 Grade of Concrete the mix proportions by (saturated surface dry) mass will be

Water		Cement		fine aggregate		coarse aggregate	
191.6	:	383	:	546	:	1188	(kg/m^3)
0.50	:	1	:	1.425	:	3.10	

C. Test methods

Compressive Strength: Compressive strength tests were conducted under compressive testing machine in accordance with IS 516-1959 (Indian Standard, 1959) at the curing ages of 7& 14 days.

3. Result and discussion

The compressive quality of concrete of all blends was resolved at the ages of 7 and 14 days for the different substitution levels of fine totals and expansion of PET fiber. The estimation of normal compressive quality with various substitution levels of fine totals (2.5%, 3%, 3.5%) and expansion of PET fiber (2.5%, 3%, 3.5%) toward the finish of various curing periods (7 & 14 days) are given in Tables. These qualities are plotted in Figure 1, which demonstrates the varieties of compressive quality due expansion of PET fiber with various rates.

Table 1
Compressive Strength of concrete with 2.5% supplanting of fine totals with PET fiber and 2.5% SCBA with Cement at the curing time of 7 days

S. No.	Compressive strength (N/mm^2)
1	12.06
2	15.07
3	17.06
4	13.80
Average	14.50

Table 2
Compressive strength of concrete with 3% replacement of fine aggregates with PET fiber and 2.5% SCBA with Cement at the curing period of 7 days

S. No.	Compressive strength (N/mm^2)
1	16.62
2	15.04
3	16.36
4	14.54
Average	15.64

Table 3
Compressive strength of concrete with 3.5% replacement of fine aggregates with PET fiber and 2.5% SCBA with Cement at the curing period of 7 days

S. No.	Compressive strength (N/mm^2)
1	16.22
2	17.68
3	14.58
4	13.89
Average	15.59

Table 4
Compressive strength of concrete with 2.5% replacement of fine aggregates with PET fiber and 2.5% with Cement at the curing period of 14 days

S. No.	Compressive strength (N/mm^2)
1	19.53
2	20.14
3	15.37
4	18.45
Average	18.37

Table 5
Compressive strength of concrete with 3% replacement of fine aggregates with PET fiber and 2.5% with Cement at the curing period of 14 days

S. No.	Compressive strength (N/mm^2)
1	19.86
2	17.06
3	20.05
4	20.75
Average	19.43

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Table 6
Compressive strength of concrete with 3.5% replacement of fine aggregates with PET fiber and 2.5% with Cement at the curing period of 14 days

S. No.	Compressive strength (N/mm^2)
1	16.25
2	17.30
3	16.80
4	17.10
Average	16.86

Table 7
Average Compressive strength of concrete with replacement of fine aggregates with different percentages (2.5%, 3%, and 3.5%) PET fiber at the curing period of respective days

Percentage of PET fibre with 2.5% SCBA			No. of days
2.5%	3%	3.5%	
13.80	15.64	15.75	7 Days
18.37	19.43	19.50	14 Days

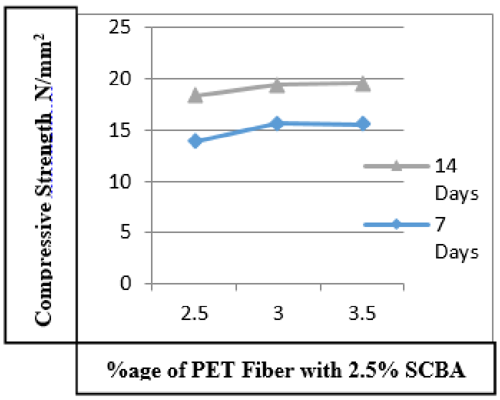

Fig. 1. Compressive strength with various %age of PET fiber at different curing periods

From the above Table 7 and Fig. 1 it is apparent that the replacement of fine aggregates with 2.5%, 3% and 3.5% PET Fiber and 2.5% SCBA with Cement, we have obtained the requisite results as prescribed by the IS 516-1959.

4. Conclusions

According to the discussion of results the following conclusions are derived by this study:

1. The concrete with PET fibres reduces the weight of concrete.
2. As percentage of plastic increases workability also increases because the plastic which is
3. used as aggregate is smooth.
4. The density of concrete decreases when plastic content increases.
5. This type of aggregate replacement is useful where aggregates are in crisis. By this we can conserve natural resources.

References

[1] Ashraf Shalaby, Azza Ward, Abeer Refaee, Salwa Abd-El-Messieh, Kamal Abd-El-Nour, Doaa El-Nashar and Hamdia A. Zayed, Compressive Strength and Electrical Properties of Cement Paste Utilizing Waste Polyethylene Terephthalate Bottles, 2013.
[2] A. Mohd Mustafa Al Bakri, G. Che Mohd Ruzaidi, M.N. Norazian, H. Kamarudin and S. Mohammad Tarmizi (2007) "Effects of hdpe plastic waste aggregate on the properties of concrete".
[3] Fernando Pelisser, Oscar Rubem Klegues Montedo, Philippe Jean Paul Gleize and Humberto Ramos Roman (2012) Mechanical Properties of Recycled PET Fibers in Concrete. Materials Research.:5(4): 679-686.
[4] F.J. Baldenebro-Lopeza, J.H. Castorena-Gonzalezb, J.I. Velazquez-Dimas, J.E. Ledezma-Sillasa, R. Martinez-Sancheza and J.M. Herrera-Ramireza, (2013) Mechanical properties enhancement of a concrete reinforced with recycled PET fibers: PROFAPI 2012/4
[5] Fernando Fraternali, Saverio Spadea, Valentino P. Berardi (2014) Effects of recycled PET fibres on the mechanical properties and seawater curing of Portland cement-based concretes: Construction and Building Materials 61, (2014), 293–302.
[6] T. Senthil Vadivel and M. Doddurani, "An Experimental Study on Mechanical Properties of Waste Plastic Fiber Reinforced Concrete," 2013.