Effect of PET Fibers on the Performance of Concrete

[1]Neeraj Agarwal, [2]Satish Parihar, [3]Mohd. Sameer
[1]M. Tech Student, [2]Professor, [3]M. Tech Student
[1]Civil Engineering Department,
[1]Rama University, Kanpur, India.

Abstract : Concrete is a construction substance commonly known as a composite concrete composed of different materials such as cement, coarse aggregate, fine aggregate. The infrastructural requirements at enormous pace have provided a great momentum to the domestic and construction industry. The incessant use of the concrete has constrained many civil engineers to add some relevant constituents in proportion to the cement or any other ingredient in order to have some control over its depleting trend of the concrete from the universe. Moreover, the non-biodegradable waste is growing in leaps and bounds, thus its management and disposal is becoming a serious challenge for the flora and fauna. Throughout our studies, the weight fraction of cement throughout 2 percent, 3 percent, 4 percent and 5 percent is integrated in the M20, M25 and M30 grades of concrete. Concrete compressive strength was compared with traditional concrete and a pattern was found which was evaluated in accordance with civil engineering standards.

IndexTerms **- Concrete, Polyethylene Terephthalate (PET), compressive strength, fiber, environmental degradation**

I. INTRODUCTION

Concrete is a versatile all-round agglomeration of materials consisting of cement, sand, coarse aggregate and water combined in a suitable proportion to accomplish the optimum strength. It has numerous advantages with the property including such excellent compressive power, resilience, basic gravity etc. due to which it has proven its efficiency and metal in the vast field of the construction industry to create a distinctive infrastructural application that include bridges, large and small houses, dams and a number of other essential universe structures.

These demerits have constrained the civil engineers to manipulate its ingredients by the addition of a suitable material to have a considerable effect. A number of products have been around since time immemorial to overcome its disadvantages such as steel, plastic and glass fibers that have provided the equal method.

PET is one of the most significant and vital products which is used extensively in the domestic life, as per the estimates India produces around 500000 tons of PET. At the end of the twentieth century it use in various walk of the life has increased at the much fast rate which resulted in the accumulation of the enormous quantities. The limitation is circumvented by using the steel reinforcement in the concrete which allow the concrete to tolerate the tensile forces and prevents cracking.

II. MIXING AND CASTING

As per IS 10262:2009[10] the concrete grades M20, M25 and M30 were prepared using different proportions of ingredients for the design mix. The PET fibers were added to the concrete by weight of cement in the percentages from 2% to 5% for different specimens of cube size 150 mmx150 mm x150 mm. They were cast as per the requirements of tests laid down by the standard code practices of civil engineering. The castings of the cube specimens were executed in four different groups which comprised of conventional concrete with all the above mentioned grades, The goal of casting all of the above cubes was to determine and compare the impact of PET fibers on concrete's compressive strength.

Grade of concrete	Cement	Fine aggregates	Coarse aggregates (10mm)	Coarse aggregates (20mm)	Water
M20	320 Kg	697	506	760	160
M25	361 Kg	672	510	765	163
M30	378 Kg	658	513	770	159

Table-1 The concrete mix proportion

III. RESULTS AND DISCUSSIONS

In this experimental work detail of the results, trends of various experimental analyses and their effect on the compressive strength with the incorporation of Polyethylene Terephthalate (PET) fibers were found when opposed to traditional concrete. The experimental study review shows a fair variance of the compressive power by the application of PET fibers.

IV. COMPRESSIVE STRENGTH

The compressive strength of normal as well PET fibre concrete composition has been determined at 07 days curing. Once the casting was done and after curing the concrete at 7, 28 and 56 day, the ultimate compressive strength for the average loads of the specimens was obtained.

S.No	Volume fraction PET	Compressive strength at 7 days (N/mm^2)	Compressive strength at 28days (N/mm^2)	Compressive strength at 56days (N/mm^2)
1	0%	19.99	30.96	32.88
2	2%	22.66	32.29	34.51
3	3%	24.58	34.22	36.74
4	4%	22.36	31.85	33.55
5	5%	22.22	31.62	33.48

Table-2 Average compressive strength for M20 PFRC at 7, 28, and 56 days

S.No	Volume fraction PET	Compressive strength at 7 days (N/mm^2)	Compressive strength at 28days (N/mm^2)	Compressive strength at 56 days (N/mm^2)
1	0%	24.44	32.37	33.77
2	2%	25.02	33.03	34.51
3	3%	27.03	34.81	36.14
4	4%	24.53	32.29	34.51
5	5%	24.51	30.81	33.85

Table-3 Average compressive strength for M25 PFRC at 7, 28 and 56 days

S.No	Volume fraction PET	Compressive strength at 7 days (N/mm^2)	Compressive strength at 28 days (N/mm^2)	Compressive strength at 56 days (N/mm^2)
1	0%	28.88	39.11	42.66
2	2%	30.44	40.66	43.58
3	3%	32.0	43.70	46.07
4	4%	30	39.27	43.55
5	5%	29.92	34.26	43.48

Table-4 Average compressive strength for M25 PFRC at 7, 28 and 56 days

V. CONCLUSION

Following are some of the conclusions which can be shown from the research milestones while considering the various grades of concrete and incorporating required PET fibers. When comparing the different percentages of PET fiber concrete with traditional concrete in terms of M20 grade compressive strength for 7, 28 and 56 days, it was observed that the concrete compressive strength initially increased by adding PET fibers from 2% to 3% and then showed a significant downward trend with the addition of 4 % to 5%.

The concrete 's maximum compressive strength was obtained by adding 3 per cent PET fibers. In view of the compressive strength of M25 grade at 7, 28 and 56 days, the experimental measurements of varying volumes of PET fiber concrete were contrasted with traditional concrete, and the compressive strength of concrete was decreased by twenty-eight days relative to conventional concrete with the addition of PET fibers from 4 to 5 percent. Through the addition of 3 per cent PET fibers, the maximum compressive strength of the concrete was obtained and found to be in the same quality as standard concrete without the inclusion in PET fiber.

The data patterns of various percentages of PET fiber concrete were compared to traditional concrete with respect to the compressive strength of grade M30 for 7, 28 and 56 days, it was observed that the compressive strength of concrete initially followed an upward trend by adding PET fibers from 2% to 3% and then demonstrated a major downward trend with the addition of PET fibres. The concrete 's maximum compressive strength was obtained by adding 3 per cent PET fibers.

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