

To Study and Analysis Partial Replacement of Fine Aggregate With PET, PP, PE & Admixture in Concrete

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Abstract: In recent time there is large amount of plastic waste produced in India. This plastic waste is also non-biodegradable. The amount of plastic waste increasing rapidly and hence to create human health and environmental problem. In this paper we are focusing the use of PP, PET, PE in percentage of 2% 4% 6% to partial replacement of fine aggregate. After using these materials, we performed all experiment like compressive strength test, flexural test, split tensile test, heat resistance test at (160°C) on concrete and also, we found that the 2% & 4% replacement gives reasonable results in all experimental test. We found that the use of 6% of the materials detour quality of concrete, it shows the lower results so to enhance the results we used admixture get the results which are further we compare with the previous one. After taking results we found that the material PET shows better compressive strength and behave same like normal concrete and also in heat resistance property. Remaining two material PP and PE (6%) replacement in concrete and added admixture we found that it improves compressive strength slightly as compared to normal concrete. After performing Split and Flexural test we found that PE & PET material gives better results in both test but polypropylene (PP) does not give desirable results.

Keywords: PET, PP, PE, Plastic, Compressive Test.

I. INTRODUCTION

The plastic waste material was produced from different sources it becomes create serious health and environmental problem. Plastic waste very harmful to human most of the plastic waste is burnt after burning create carbon dioxide this is very dangerous to environment.

Hence to overcome the above said problems plastic waste products should be used as a construction material. Fine aggregate used in concrete is replaced partially by PET (Polyethylene terephthalate), polyethylene, polypropylene. In known percentages and properties are tested, the optimum percentage at which higher strength is obtained is calculated.

This project is particular deals with the possibility of using the waste polyethylene, (PET) [polyethylene terephthalate), polypropylene as partial replacement of fine aggregate in concrete. Concrete with 2%, 4%, 6% material is prepared after doing the mix design. And also, Various tests on cement like specific gravity, fineness, setting time, etc., tests on coarse and fine aggregates like sieve analysis, fineness modulus, specific gravity, etc. are performed. Mix design using IS Code method is done and cubes, beams and cylinders are cast for M20 grade concrete tests on concrete like slump, cube tests and cylinder tests are performed to understand their behaviour and usefulness as replacement. The standard properties of concrete like compressive strength, split tensile strength, flexural test, heat resistance test is tested and compared with the results of standard specimen.

The plastic material is to be used in our project firstly we crushed this plastic waste 6mm Size and then plastic waste is to be used in our project. And also, important part of these project we use admixture to improve the properties of concrete.

II. METHODOLOGY

1. literature review
2. Collecting the waste plastic to be used.
3. Study the properties of PET, Polyethylene, Polypropylene plastic waste materials.
4. Testing of Cement, Coarse Aggregate, Fine Aggregate.
5. Designing the Concrete mix Design.
6. Casting the cubes cylinder and beams.
7. Testing of the specimen.
8. Result Analysis & Comparison with Standard Specimen.
9. Conclusion.

III. OBJECTIVES OF THE PROJECT

- 1) To study the various properties of polyethylene terephthalate, polypropylene & polyethylene.
- 2) To conduct the various test on fine aggregate, coarse aggregate and cement.
- 3) To study replacement of 2%, 4%, 6%, of PET (polyethylene terephthalate), polyethylene, polypropylene material to the fine aggregate.
- 4) To analysis of the compression test, heat resistance test, split tensile test, flexural test on the concrete.
- 5) To analysis of the use of admixture in concrete with plastic waste materials.

IV. EXPERIMENTAL INVESTIGATION

TABLE NO. 1 TEST RESULTS OF CEMENT

Test	Results	Permissible by IS	IS Code
Fineness	4.7%	10%	IS:4031-Part 1-1996
Standard consistency	34mm	33mm to 35mm	IS:4031-Part 4-1988
Initial setting time	35min	30min	IS:4031-Part 5-1988
Final setting time	410mon	600min	IS:4031-Part 5-1988
Soundness	1.92mm	10mm	IS:4031-Part 3-1988
Specific gravity	3.15 g/cc	3.1 to 3.16 g/cc	IS:4031-Part 11-1988

TABLE NO. 1 TEST RESULTS OF SAND

Test	Results	Permissible by IS	IS Code
Sieve analysis of fine aggregate	[zone II]	Accepted limit as per (IS:383-1970)	(IS: 383:1970)
Fineness modulus of fine aggregate	2.71	2.6 – 2.9 Medium sand	(IS: 383:1970)
Specific gravity of fine aggregate	2.76	2.76 – 2.79	(IS:2386-Part 3-1963)
Water absorption of fine aggregate	0.88%	0.3% - 2.5%	(IS:2386-Part 3-1963)
Silt content	2.85%	8%	(IS:2386-Part 2-1963)

TABLE NO. 1 TEST RESULTS OF AGGREGATE

Test	Results	Permissible by IS	IS Code
Impact strength	4.7%	10 –20%	(IS:2386- Part 4- 1963)
Flakiness index	19.07%	<35%	(IS:2386- Part 1- 1963)
Elongation index	11.78%	<35%	(IS:2386- Part 1- 1963)
Water absorption	1.15%	<3%	(IS:2386- Part 3- 1963)
Specific gravity	2.78	2.5 to 3	(IS:2386- Part 3- 1963)
Abrasion test	25.8%	30%	(IS:2386- Part 3- 1963)
Fineness modulus of coarse aggregate	6.83	5.5-8	(IS:383- 1970)
Sieve analysis of coarse aggregate	Limit as IS:383-1970 (20mm) Aggregate		(IS:383- 1970)

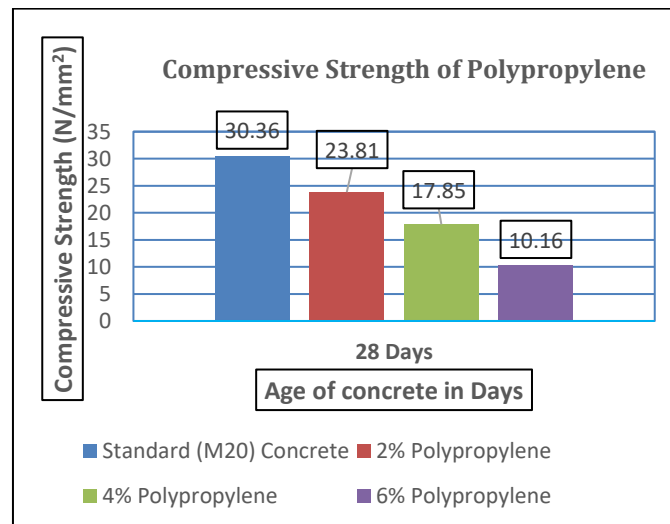


Fig. 1 Compressive Strength of Polypropylene

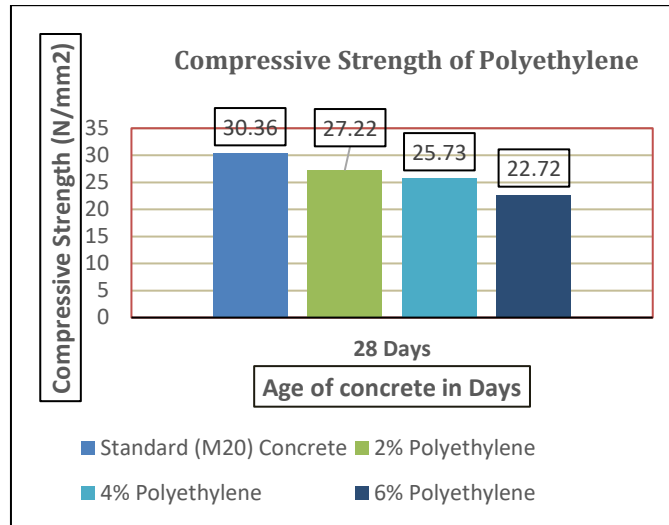


Fig. 2 Compressive Strength of Polyethylene

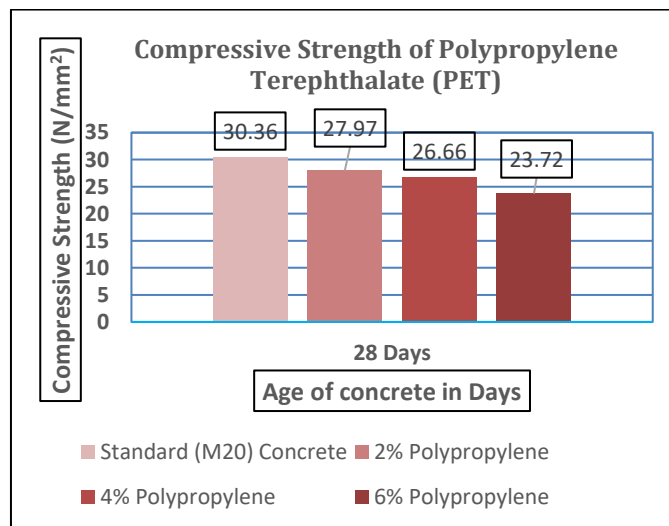


Fig. 3 Compressive Strength of PET

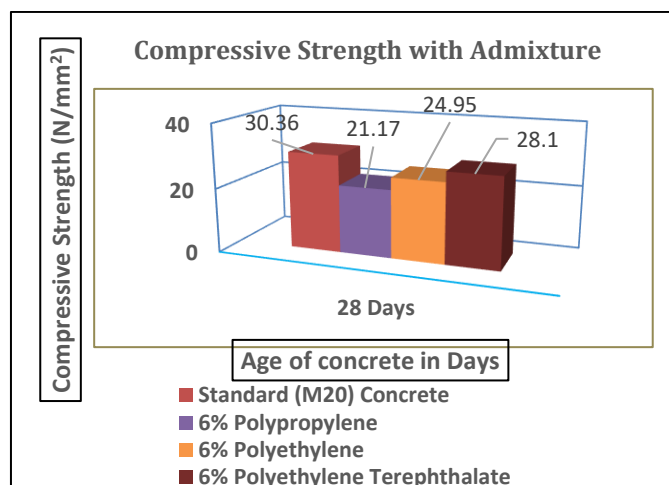


Fig. 4 Compressive Strength with Admixture

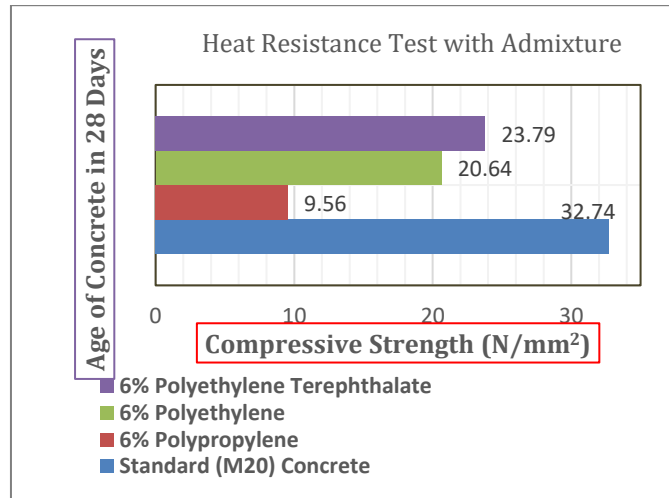


Fig. 5 Heat Resistance Test with Admixture

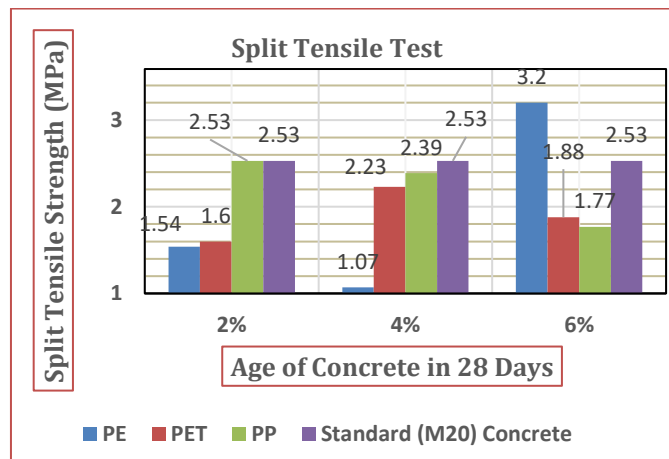


Fig. 6 Split Tensile Strength of Polypropylene

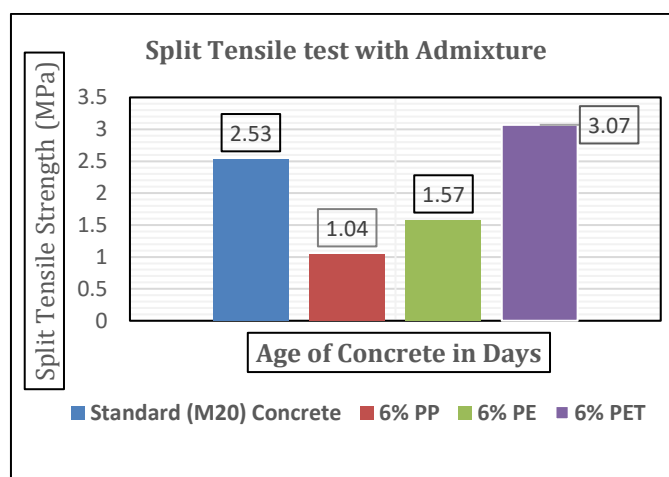


Fig. 6 Split Tensile Strength with Admixture

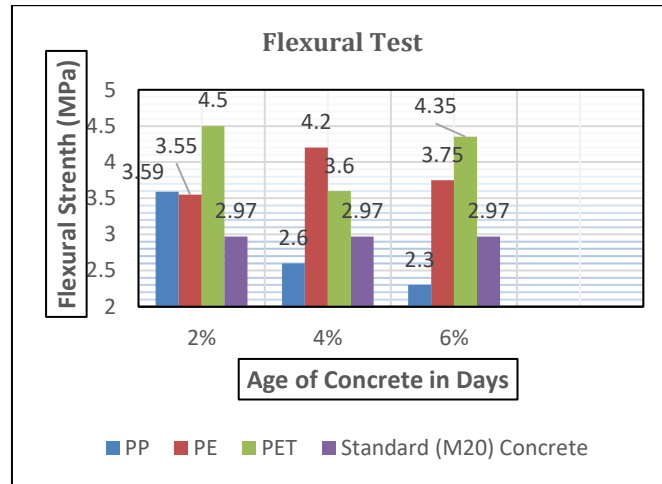


Fig. 6 Flexural test Strength

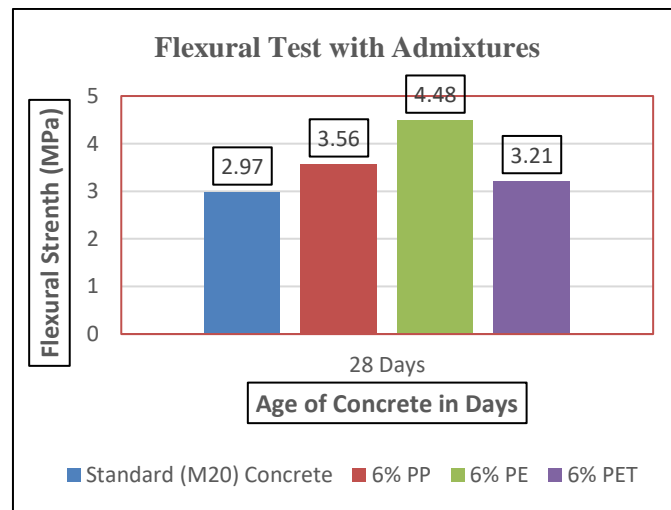


Fig. 6 Flexural test with Admixture

V. RESULTS AND DISCUSSION

- After performing compressive strength test on polypropylene, we seen that for 2% replacement strength is slightly decrease but 4% & 6% replacement is failed but important property of this material is crack resistance and also bind the concrete ingredients.
- The concrete show decrease in the strength when the materials is added at the percentage of 6%, comparing to the 2% and 4% to the normal concrete.
- The material PET shows high compressive strength comparing to other materials is that PP & PE. When it added with admixture, we found 16% strength are increased are compare to normal mix.
- When admixture is added with the materials, we found that the compressive strength of concrete with 6% replacement is improved.
- After performing Split & Flexural test on concrete we found that it shows desirable results comparing to normal concrete.

- After performing heat resistance test on concrete, we found that the test results PE & PET material are capable to resist heat up to 160 °C but polypropylene material is not giving the reasonable results after performing the heat resistance test.
- Also perform the heat resistance test with admixture then we found that the polypropylene material does not improve strength.

VI. CONCLUSION

- Waste plastic material like PP, PET & PE can effectively use in concrete with considerable amount i.e., 2%, 4% & 6% is used when it added with the admixture.
- The PET material shows relative properties of fine aggregate and can be obtain the characteristic strength of concrete mix design. It shows 16% increment in strength when added with admixture comparing to normal mix.
- The concrete enhances its Spilt tensile strength, Flexural strength when the plastic material (PP, PET, PE) is added, compared to the normal concrete.
- PP is a crack resistance material and have good binding property but fails in compressive strength.
- PE & PET material shows better heat resistance, but PP does not give satisfactory result.

VII. REFERENCES

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