

AN EXPERIMENTAL STUDY OF POLYPROYLENE FIBER REINFORCED CONCRETE

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Abstract - Concrete is most widely used in construction material due to its strength performance and durability. For increasing the strength and performance of the concrete we are adding polypropylene fibers. We are adding fibers in different proportions. Polypropylene fiber content varies from 0%, 0.25%, 0.5%, 0.75%, 1% by weight of concrete. Thus, we are going to study the effect of polypropylene fiber properties on M30 concrete by carrying compressive strength test and split tensile test. By plotting the test results for cube for compressive test and cylinder for split tensile strength test for 7, 14 and 28 days.

Key Words: Polypropylene fibers, Compressive strength, Split tensile strength.

1. INTRODUCTION

Concrete could be a terribly sturdy and versatile mouldable construction material.

It consists of cement, fine aggregate and coarse aggregate (e.g., gravel or crushed rock) mixed with water. Concrete is one among the foremost vital materials among the building materials in all varieties of technology works. Since the variation of concrete as a artifact, lot of researches and studies has been made to improve the quality, strength and durability of it. By constant time efforts also are being created to economize concrete construction compared to alternative materials.

Plain concrete is good in compression but weak in tension. For increasing the strength of concrete reinforcement is provided. There is an increase in strength and tension after that cracks are forming in concrete. For eliminating of cracks we are adding polypropylene fibers to reinforced concrete.

Tests were conducted to know the suitability of these materials in concrete production and the design mix is prepared for M30 grade concrete. A total of FIVE mix proportions were made including nominal mix. The size of the cube used for compressive strength test is 150X150X150mm and the size of the cylinder used for the

split tensile strength test is 150X300mm. Tests were conducted on the specimens at an age of 7 days, 14 days and 28 days. The results are plotted on a graph by comparing the strength and mix proportion.

Polypropylene Fibers

Polypropylene is the first stereo regular polymer to have achieved industrial importance. Polypropylene is a 100% synthetic fiber which is transformed from 85% propylene. The monomer of polypropylene is propylene. Polypropylene is a by-product of petroleum. Polypropylene (PP) is a thermoplastic. Polypropylene fibres are composed of crystalline and non-crystalline regions. The spherulites developed from a nucleus can range in size from fractions of a micrometer to centimetres in diameter. Polypropylene fibres are used as a concrete additive to increase strength and reduce cracking and spalling.

2. MATERIALS USED

- Cement
- Fine aggregates
- Coarse aggregates
- Polypropylene Fibers
- Mix proportion

Cement:

The cement used was ordinary port land cement of 53 grade conforming to IS 12269-1987. The cement should be fresh and of uniform consistency. Where there is lumps or any foreign matter in the material, it should not be used.

Fine aggregates:

River sand shall be obtained from a reliable supplier and shall comply with ASTM standard C-33 for fine aggregates. It should be clean, hard, strong and free of organic impurities and delirious substance. It should be inert with respect to other materials used and of suitable type with regard to strength, density, shrinkage and durability of mortar made with it.

Coarse aggregates:

Machine crushed hard granite chips of 67% passing through 20mm sieve and retained on 12mm sieve and 33% passing through 12mm and retained on 10mm sieve were used as coarse aggregate throughout the work.

Polypropylene fibres

As concrete is the most commonly used material in construction, improvement of cement material become more and more essential. Conventional concrete has two major drawbacks: low tensile strength and a destructive and brittle failure. In an attempt to increase concrete ductility and energy absorption, polypropylene fibre reinforced concrete (PFRC) has been introduced.

Specific Gravity of Polypropylene fibers: 0.91

Length of polypropylene fibers: 6mm

Mix proportion

Cement	Fine aggregate	Coarse aggregate	Water-cement ratio
1	1.5	2.7	0.40

3. TESTS CONDUCTED

Compressive Strength

Compressive strength of concrete cube test provides an idea about all the characteristics of concrete. For cube test two types of specimens either cubes of 15cmX15cmX15cm relying upon the scale of mixture area unit used.

This concrete is poured within the mould and tempered properly thus as to not have any voids. After twenty four hours these moulds area unit removed and check specimens area unit place in water for activity.

The top surface of the specimen should be made even and smooth. This is done by golf shot cement paste and spreading swimmingly on whole space of specimen.

These specimens are tested by compression testing machine after 3days, 7 days, 14 days or 28 days curing. Load ought to be applied bit by bit at the speed of one hundred forty kg/cm2 per minute until the Specimens fails.

Load at the failure divided by space of specimen offers the compressive strength of concrete.

$$\text{Compressive Strength} = P/A = \text{Ultimate Load} / \text{Cross Sectional Area.}$$

Split tensile strength

The strength is one amongst the fundamental and necessary properties of the concrete. The concrete isn't sometimes expected to resist the direct tension thanks to its low strength and brittle nature. However, the determination of tensile strength of concrete is necessary to determines the load at which the concrete members may crack. The cracking is a form of tension Failure. The ripping tests square measure documented indirect tests used for determinant the strength of concrete generally stated as split strength of concrete.

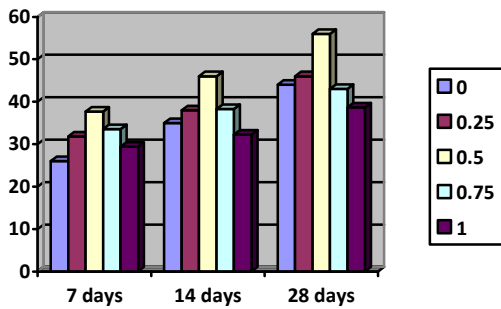
The take a look at consists of applying a compressive line load on the alternative generators of a concrete cylinder placed with its axis horizontal between the compressive platens. Due to the compression loading a reasonably uniform tensile stress is developed over nearly 2/3 of the loaded diameter as obtained from AN Elastic analysis.

Cylinders of 300mm X150mm were cast for different mixes. Apparatus used in Split tensile test is Compression testing machine, tamping rods. Pour concrete in moulds oiled with medium viscosity oil. Fill the cylinder mould in four layers each of approximately 75 mm and tamp each layer more than 35 times with evenly distributed strokes. Remove the surplus concrete from the top of the moulds with the help of the Trowel.

All specimens were removed 24 hours after casting and subsequently water cured for 28 days.

Table -1: Compressive Strength Test

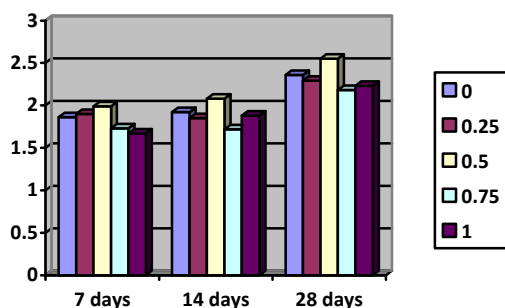
S.No	Percentage of Fibers	7 Days (N/mm ²)	14Days (N/mm ²)	28Days (N/mm ²)
1	0	26	35	44
2	0.25	31.8	38	46
3	0.5	37.68	46	56
4	0.75	33.55	38.27	43
5	1	29.37	32.25	38.67



Graph 1: compressive strength test

Table -2: Split tensile Strength test

S NO	Percentage of Fibers	7 Days (N/mm ²)	14Days (N/mm ²)	28Days (N/mm ²)
1	0	1.86	1.92	2.36
2	0.25	1.9	1.85	2.29
3	0.5	1.99	2.08	2.55
4	0.75	1.73	1.72	2.18
5	1	1.67	1.88	2.23



Graph 2: split tensile strength test

CONCLUSIONS

The purpose of this project is to study the strength properties of concrete by addition of polypropylene fibers. The addition of polypropylene fibers to cement is done by percentages are 0%,0.25%,0.5%,0.75%and 1%. Strength of the concrete is observed by conducting compressive strength test and split tensile strength test at an age of 7, 14 days and 28 days.

From the test results we conclude that,

- The maximum compressive strength and split tensile strength is obtained at 0.5% addition of polypropylene fibers to cement.
- From the compressive strength test results on 28th day of M30 concrete cube specimen there is an increase in strength of 27.27% which is obtained from addition of 0.5% of polypropylene fibers when compared with nominal mix.
- From the split tensile strength test results on 28th day of concrete specimen there is an increase in strength of 5% which is obtained from addition of 0.5% of polypropylene fibers when compared with nominal mix.

Finally we conclude that polypropylene fibers can be used to increase the strength of concrete in construction.

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