

STUDY THE EFFECT OF POLYPROPYLENE FIBER IN CONCRETE

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ABSTRACT –

India leading developing country in world. In future high strength high performance concrete required for construction work .Fiber-reinforced concrete (FRC) is concrete containing fibrous material which increases its structural integrity. The character of fiber-reinforced concrete changes with varying concretes fiber materials, geometries, distribution, orientation, and densities. Polypropylene fiber is a light weight synthetic fiber. It prevents crack formation and provides reinforcement to the concrete structure. In this project work polypropylene fibers (Blended type) of different percentage (0.5%, 1%, 1.5%, and 2%) added in concrete. Tests on workability, compressive strength, flexural resistance, split tensile strength and modulus of elasticity were conducted on specimens.

Key Words: Polypropylene Fiber, workability, compressive strength, flexural resistance, split tensile strengths etc

1.0.INTRODUCTION

The fiber dispersion into concrete is one of the technique to improve the building properties of concrete. Polypropylene fibers are synthetic fibers obtained as a by-product from textile industry. These are available in different aspect ratios and are cheap in cost. Polypropylene fibers are characterized by low specific gravity and low cost. Its use enables reliable and effective utilization of intrinsic tensile and flexural strength of the material along with significant reduction of plastic shrinkage cracking and minimizing of thermal cracking. It provides reinforcement and protects damage of concrete structure and prevents spalling in case of fire. The fibers are manufactured either by the pulling wire procedure with circular cross section or by extruding the plastic film with rectangular cross-section. They appear either as fibrillated bundles, mono filament. The fibrillated polypropylene fibers are formed by expansion of a plastic film, which is separated into strips and then slit. The fiber bundles are cut into specified lengths and fibrillated. In monofilament fibers, the addition of buttons at the ends of the fiber increases the pull out load.

Cracks play an important role as they change concrete structures into permeable elements³ and consequently with a high risk of corrosion. Cracks not only reduce the quality of concrete and make it aesthetically unacceptable but also make structures out of service. If these cracks do not exceed a certain width, they are neither harmful to a structure nor to its serviceability. Therefore, it is important to reduce the crack width and this can be achieved by adding polypropylene fibers to concrete. Thus addition of fibers in cement concrete matrix bridges these cracks and restrains them from further opening. In order to achieve more deflection in the beam, additional forces and energies are required to pull out or fracture the fibers. This process, apart from preserving the integrity of concrete, improves the load-carrying capacity of structural member beyond cracking. In this project polypropylene fibers of blended (24mm, 40mm, 55mm) type is used. The project deals with the effects of addition of various proportions of polypropylene fiber on the properties of concrete

in fresh and hardened state. An experimental program was carried out to explore its effects on workability, compressive, flexural, split tensile strength and modulus of elasticity of concrete.



Fig-1: Blended (24mm, 40mm, 55mm) Polypropylene fiber

1.1. OBJECTIVE

The objective of this experimental program is

- To study the effect of polypropylene fiber in concrete.
- To conduct a comparative study on fiber in concrete and conventional concrete.

2.0. LITERATURE REVIEW

Milind V. Mohod (2015), presents an experimental study on performance of polypropylene fiber reinforced concrete. In this study deals with the effects of addition of various proportions of polypropylene fibers on the properties of High strength concrete (M30 and M40 mixes). An experimental program was carried out to explore its effects on compressive, tensile, flexural strength under different curing condition. The main aim of the investigation program is to study the effect of Polypropylene fiber mix by varying content such as 0% ,0.5%,1%,1.5% & 2% and finding the optimum Polypropylene fiber content. A notable increase in the compressive, tensile and flexural strength was observed. However, further investigations were highly recommended and should be carried out to understand more mechanical properties of fiber reinforced concrete

Kolli.Ramujee (2013), the interest in the use of fibers for the reinforcement of composites has increased during the last several years. A combination of high strength, stiffness and thermal resistance favorably characterizes the fibers. In this study, the results of the Strength properties of Polypropylene fiber reinforced concrete have been presented. The compressive strength, splitting tensile strength of concrete samples made with different fibers amounts varies from 0%, 0.5%,1% 1.5% and 2.0% were studied. The samples with added Polypropylene fibers of 1.5 % showed better results in comparison with the others.

3.0.METHODOLOGY

The methodology of the work consist of

- 1) Identifying the specification of material to be selected.
- 2) Collection of materials.
- 3) Identifying the properties of collected materials. Various tests were conducted on cement, fine aggregate, coarse aggregate.
- 4) Selection of concrete grade.
- 5) Preparation of mix design of M30 grade concrete.
- 6) Cubes, cylinder and beams were casted with control mix using natural aggregate.
- 7) Preparation of test specimen by adding 0.5, 1,1.5and2% of polypropylene fibres in concrete.
- 8) Workability tests,compressive strength, tensile strength, flexural strength & modulus of elasticity of concrete were conducted.
- 9) Optimum percentage of fibre addition in concrete was determined.

4.0.PROPERTIES OF MATERIALS

The properties of materials are determined to find mix proportions

Table-1: Material Testing Results

Test	Material	Equipment used	Results
Specific gravity	OPC 43 grade	Le Chatelier flask	3.2
Specific gravity	Fine aggregate	Pycnometer	2.61
Specific gravity	Coarse aggregate	Wire basket	2.77
Water absorption	Coarse aggregate	Vessel	0.6%
Workability	M30 Concrete	Slump cone apparatus	100mm

5.0.MIX DESIGN

Table-2: M30 Mix Proportioning

Cement (Kg/m3)	438
Fine aggregate (Kg/m3)	695

Coarse aggregate (Kg/m ³)	1107
Water (li/m ³)	197
Water cement ratio	0.45

The mix proportion obtained is =Mix ratio 1: 1.59: 2.52: 0.45

6.0. EXPERIMENTAL INVESTIGATION

6.1. Test Procedure

Concrete test examples comprise of 150x150x150mm blocks, Chambers of 150mm measurement and 300mm tallness and 100x100x500 bars. Concrete solid shape examples were tried at 7 and 28 days to get the compressive quality of concrete. Barrel shaped examples were tried at multi day to acquire the split rigidity and modulus of versatility of concrete. Pillar examples were tried at multi day to get the flexural quality of concrete.

6.2. Test on fresh concrete

Usefulness is one of the physical parameters of concrete which influences the quality and sturdiness just as the expense of work and presence of the completed item. Concrete is said to be functional when it is effectively put and compacted homogeneously for example without draining or Isolation. The usefulness of concrete is estimated by compaction factor test and droop test.

6.3. Test on hardened concrete

Different tests on hardened concrete is done to guarantee the plan quality of concrete and nature of concrete development is accomplished. It incorporates compressive quality test, flexural rigidity test, split elasticity test and modulus of versatility.

7.0. RESULTS

7.1. Improvement of polypropylene fiber in concrete

In this segment polypropylene fiber (mixed sort 24mm, 40mm, 55mm) of various rate included concrete.

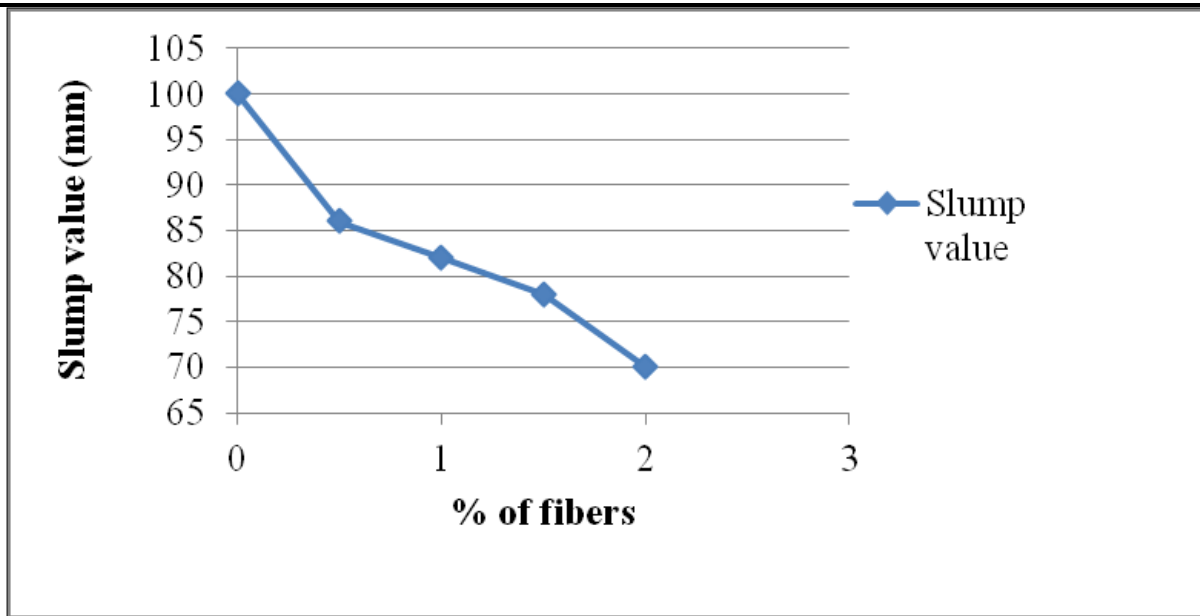


Fig-2: Slump Cone value

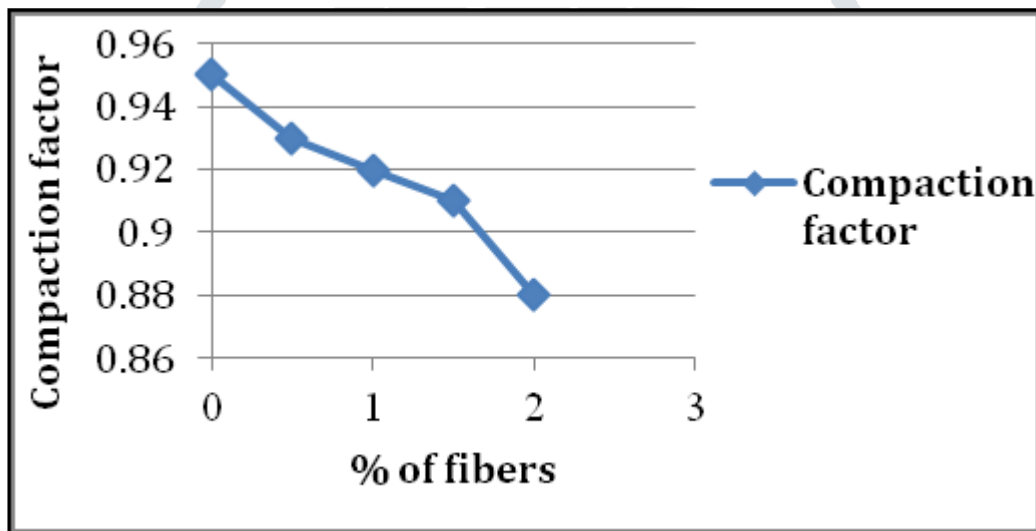


Fig-3: Compaction factor value

Functionality diminishes because of more expansion of fibers, there is increments in measure of captured air voids because of the nearness of fibers and thusly increment in air content traits in decreasing usefulness.

Table-3: Compressive strength of the specimens

S.No	% of fibers	7days Compressive strength (N/mm ²)	28days compressive strength (N/mm ²)
1	0	25.20	38.50
2	0.5	27.90	42.14
3	1	28.83	44.61
4	1.5	29.91	46.00
5	2	27.12	41.72

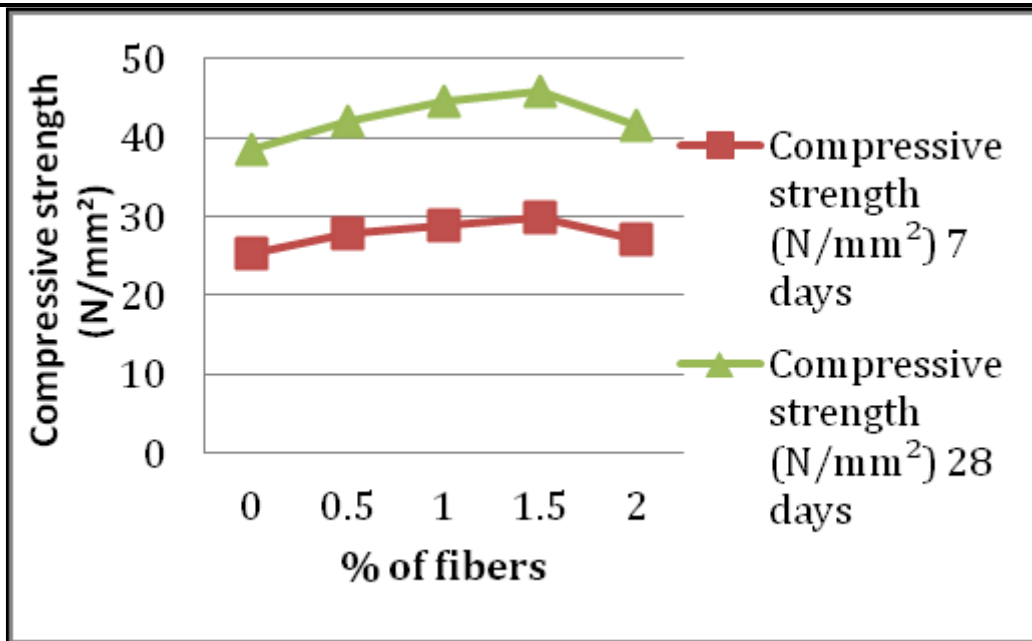


Fig-4: Compressive strength of concrete for 7 days and 28 days

Compressive strength increases for all dosages of fibers due to confinement provided by fiber increases bonding characteristics of concrete.

Table 4: Split tensile strength of the specimens

S.No	% of fibers	28days Split tensile strength (N/mm ²)
1	0	3.42
2	0.5	3.86
3	1	3.98
4	1.5	4.38
5	2	3.66

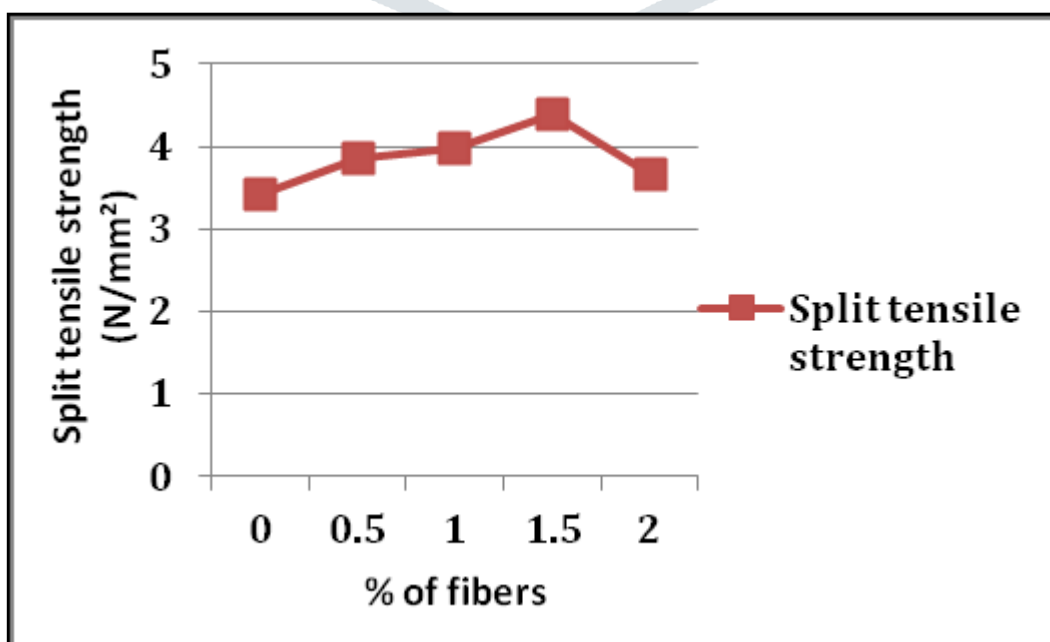


Fig-5: Split Tensile strength of concrete

Failure patterns of splitting tensile test indicate that specimens after first cracking do not separate unlike the concrete failure. Large damage zone is produced due to closely spaced micro cracks surrounding a splitting plane. Fiber bridging mechanism is responsible for such enhanced ductile failure pattern.

Table 5: Flexural strength of the specimens

S.No	% of fibers	28days Flexural strength (N/mm ²)
1	0	4.34
2	0.5	5.21
3	1	5.48
4	1.5	5.71
5	2	4.82

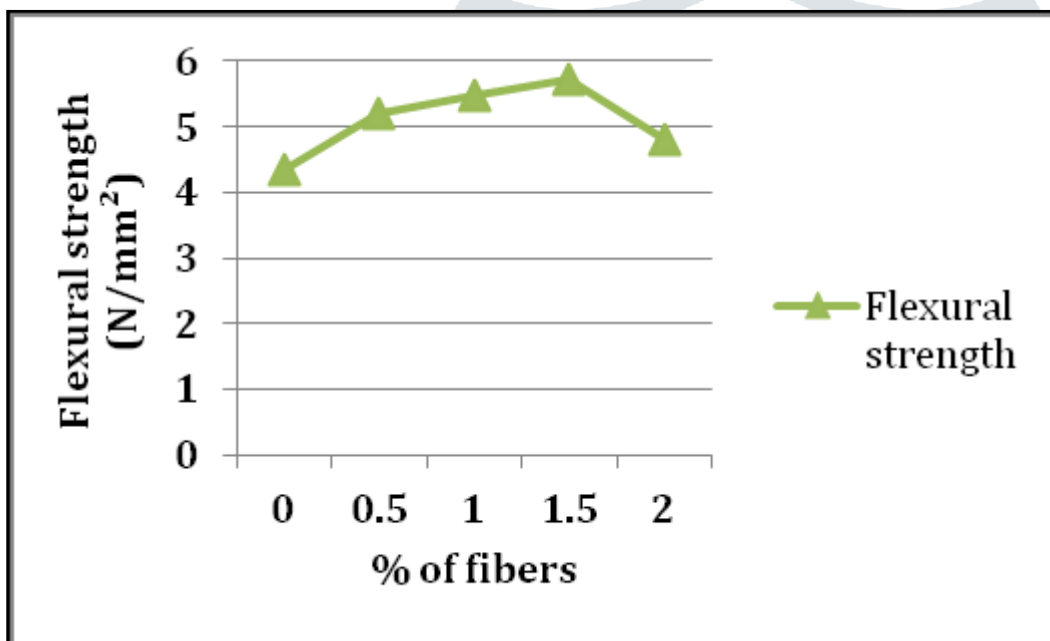


Fig-6: Flexural quality of concrete

The enhancement in flexural quality is accomplished because of progress in mechanical bond between the cement glue and fiber. As measure of fiber increments in blend, it incredibly decreases extending of splits all the more successfully.

9. CONCLUSIONS

Compressive quality of 1.5% of mixed length polypropylene fiber strengthened concrete has observed to be 17% expansion in quality, when contrasted with that of Ordinary concrete. Quality enhancement in split rigidity is 22%, flexural quality is 24% and modulus of versatility is 11% contrasted with that of Regular concrete. The exploratory investigations ended up being the best technique or path in giving solid and sturdy concrete. It is watched 1.5% fiber in concrete yields max. quality.

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