Comparative Study of FRC For Same Aspect Ratio With Different Percentage Of Polypropylene Fiber

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Abstract:-

The paper deals with the effects of addition of various proportions of polypropylene fibers on the properties of High strength concrete (M25). 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% ,0.15%,0.25%,0.35% & 0.45%,0.55%,0.65% and finding the optimum Polypropylene fiber content. The concrete specimens were tested at different age level for mechanical properties of concrete, namely, cube compressive strength, split tensile strength, flexural strength. A detailed study was carried out for curing conditions. Half of the concrete specimens were left exposed to the surrounding to cure by themselves and the remaining half were cured in a curing tank. Initially the concrete specimen's shows appreciable strength for irregular curing but as the days advances the curing specimens gave satisfactory strength. 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.

INTRODUCTION

Concrete is a mixture of port-land cement or any other hydraulic cement, fine aggregate, coarse aggregate, and water, with or without admixtures. Concrete has relatively high compression strength but low tensile strength. For this reason it is usually reinforced with materials that are strong in tension. In concrete stone and gravels are used as reinforcement.
We also use fiber as a reinforcement of concrete to optimize the quality of concrete.

FIBERS USED TO OPTIMIZING CONCRETE PROPERTIES

The concept of using fibers as reinforcement is not new. Fibers have been used as reinforcement since ancient times. Historically, horsehair was used in mortar and straws in mud bricks the 1900s,asbastos fibers were used in concrete. In the 1950s, the concept of composites material come into being and fiber-reinforced concrete was one of the topics of interest. Once the health risk associated with asbestos were discovered, there was a need to find a replacement for the substance in concrete and other building materials. By the 1960s, steel, glass (GFRC) and synthetic fibers such as polypropylene fibers were used in concrete. Research into new fiber-reinforced concretes continues today. **Fiber-reinforced concrete** (FRC) is **concrete** containing fibrous material which increases its structural integrity. It contains short discrete **fibers** that are uniformly distributed and randomly oriented. Fibers are usually used in concrete to control cracking due to plastic shrinkage and to drying shrinkage. They also reduce the permeability of concrete and thus reduce bleeding of water. Some types of fibers produce greater impact–, abrasion–, and shatter–resistance in concrete. Generally fibers do not increase the flexural strength of concrete, and so cannot replace moment–resisting or structural steel reinforcement. Indeed, some fibers actually reduce the strength of concrete.

DIFFERENT TYPES OF FIBER REINFORCED CONCRETE

- Steel Fiber Reinforced Concrete.
- Polypropylene Fiber Reinforced (PFR) cement mortar & concrete.
- GFRC Glass Fiber Reinforced Concrete Asbestos Fibers.
- Carbon Fibers.
- Organic Fibers.

OBJECTIVES OF PROJECT

1) To compute the effect on compressive strength of M25 mix concrete due to Polypropylene fiber.
2) To carry out experimental investigations for comparative study with varying Polypropylene fiber and water-cement ratio.

NECESSITY

INCREASES	DECREASES
Durability	Weight
Anti-breaking capacity	Plastic shrinkage
Abrasion resistance	Cracks
Strength	Permeability
	Absorption of water, chemicals & dusting
	Corrosion

- **POLYPROPYLENE FIBRE REINFORCED CONCRETE**

MATERIALS REQUIRED

CEMENT
↓
COARSE AGGREGATE
↓
FINE AGGREGATE
↓
POLYPROPOYLENE FIBER
↓
WATER

POLYPROPYLENE FIBRE CONCRETE

GRADE OF CONCRETE	RATIO OF CONCRETE MIX
M20	1 : 1.5 : 3
M25	**1 : 1 : 2**
M30	1 : 0.75 : 1.5
M35	1 : 0.5 : 1
M40	1 : 0.25 : 0.5

These Concrete Mix Design Should Be Consistence Throughout Construction Projects.(Reference Civil_Eblog.Com) & And This Project We Preferred M25 Grade**.**

METHODOLOGY OF PREPARATION OF P.P. FIBER CONCRETE

1) Preparation of Mix : The mix proportion taken from the above table & material taken by weigh batching.

2) Mixing of Materials: The mixing of material are done step by step, first of all dry mix is prepared; by adding cement, sand, aggregate and water soaked Polypropylene fiber.

3) Addition of Water: The water is added to this mix material as per water/cement ratio observed.

4) Casting of Sample: After preparation of concrete mix done and slump cone test for workability is done then, the mould of size 150x150x150 filled by the compact well with help of tamping rod and finishing the edges with help of trowel.

5)Curing of Specimen: after 24 hours of setting of specimen the specimen removed from mould and it is taken into water tub for further curing.

AURTHORS NAME	RESERCH PAPER	EXPERIMENTAL WORK
T.Aly, J.G. Sanjayan, Colins	Effects of Polypropylene fibers on Shrinkage & cracking's of concrete.	Focused on the plastic shrinkage incorporating PP fibers that are subjected to restrained conditions.
Rana A. Mtasher, Dr. Abdulnasir Abbas, Najaat.	Strength prediction on Polypropylene Fiber Reinforced Concrete .	Investigate on a study fiber on the compressive and concrete
K. Murari& Rama Mohan Rao	Effect of polypropylene fibers on strength properties of fly ash based concrete.	Deals with strength of concrete with PP fiber & class C fly ash.

MATERIAL DISCRIPTION

1) CEMENT – (OPC 53 S GRADE)

A) Fineness , M²/Kg , Min. = 225 Req. & 370 For 53 S Grade

B) Setting Time

I) Initial , Min. = 30 (60 For 53 S Grade)

Ii) Final , Min. = 600

C) Compressive Strength , Mpa

I) 72 ± 1 H , Min. = 27

Ii) 168 ± 2 H , Min. = 37 (37.5 For 53 S Grade)

Iii) 672 ± 4 H , Min. = 53

2) AGGREGATE (COARSE AGGREGATE)10 MM & 20 MM

PHYSICAL PROPERTIES	10MM	20MM
1) Specific Gravity	2.883	2.878
2) Water Absorption	0.97	0.83

3)Flakiness Index = 15.56 %

4) Elongation Index = 12.81 %

3) FINE AGGREGATE (KANHAN RIVER SAND)

A) Specific Gravity = 2.605

B) Water Absorption = 1.23 %

4) POLYPROPYLENE FIBRE

A) Size = 12 mm

B) Melting Point = 170° C

C) Tensile Strength = 390-590 Mpa

D) Specific Gravity = 0.91

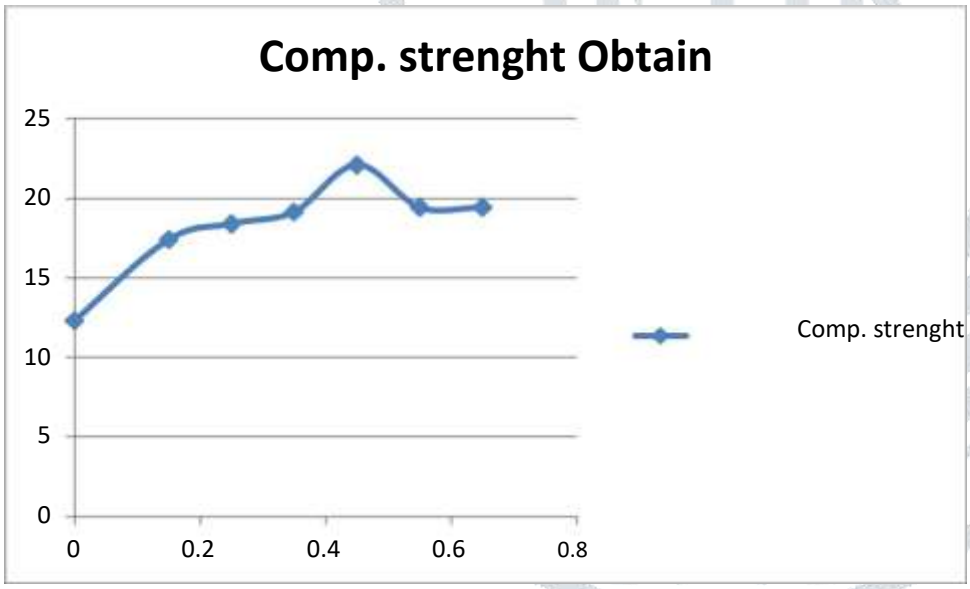
E) Water Absorption = 0

5) WATER

Normal (Potable) Water

ANALYSIS OF SPECIMEN AFTER 7 DAYS OF CURING

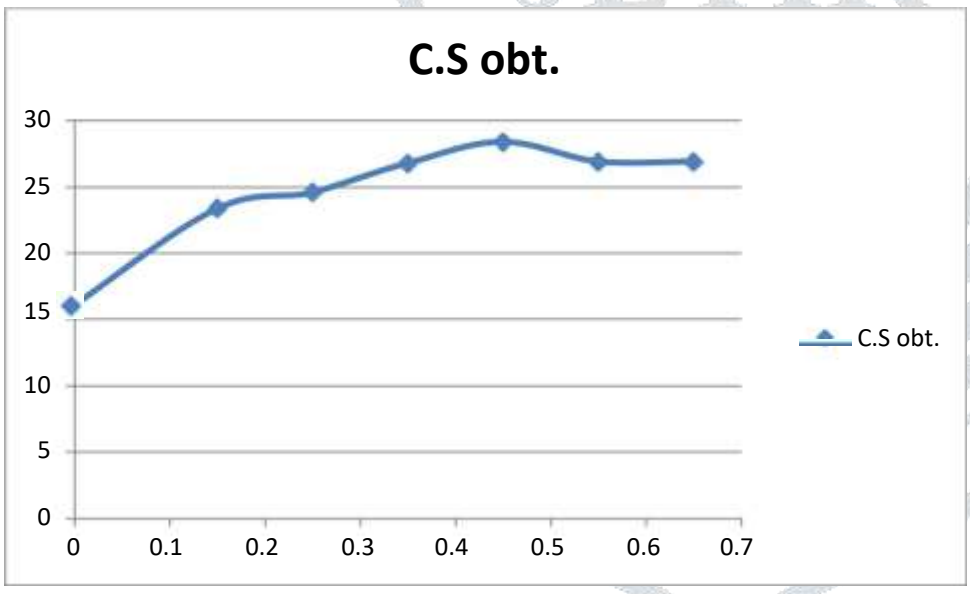
S. No.	Wt of specimen	% of P.P. fiber	Compressive strength
Sample 1	8.48kg	0	12.3 N/mm²
Sample 2	8.400kg	0.15	17.39 N/mm²
Sample 3	8.360kg	0.25	18.38 N/mm²
Sample 4	8.280kg	0.35	19.13 N/mm²
Sample 5	8.260kg	0.45	22.08 N/mm²
Sample 6	8.246kg	0.55	19.42 N/mm²
Sample 7	8.18kg	0.65	19.42 N/mm²



Graph % of Polypropylene fiber V/S Compressive Strength.

ANALYSIS OF SPECIMEN AFTER 14 DAYS OF CURING

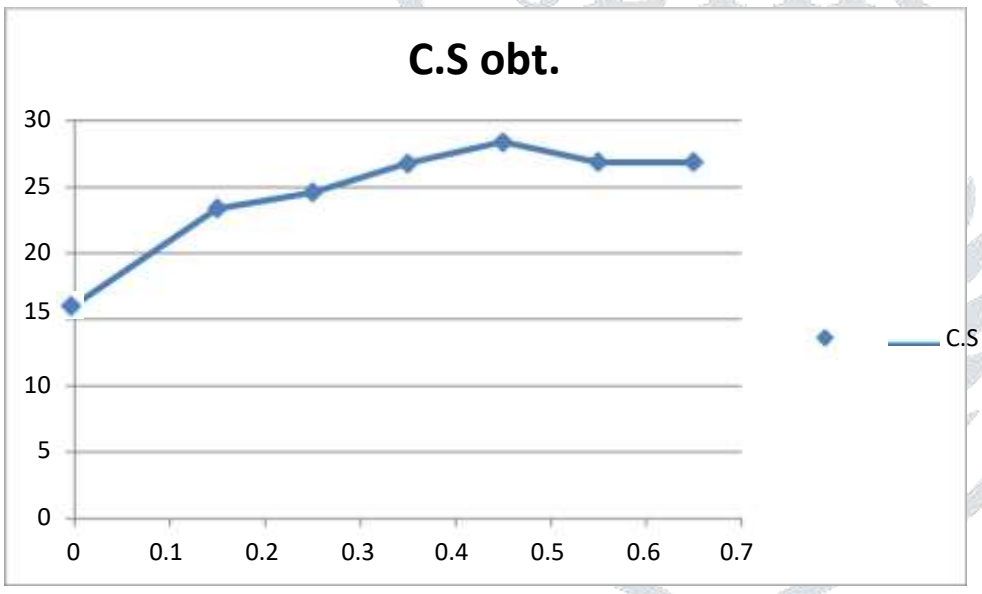
S. No.	Wt of specimen	% of P.P fiber	Compressive strength
Sample 1	8.280kg	0	16.08 N/mm^2
Sample 2	8.240kg	0.15	23.38 N/mm^2
Sample 3	8.230kg	0.25	24.58 N/mm^2
Sample 4	8.225kg	0.35	26.78 N/mm^2
Sample 5	8.200kg	0.45	28.39 N/mm^2
Sample 6	8.180kg	0.55	26.84 N/mm^2
Sample 7	8.160kg	0.65	26.84 N/mm^2



Graph % of Polypropylene fiber V/S Compressive Strength.

ANALYSIS OF SPECIMEN AFTER 28 DAYS OF CURING

S. No.	Wt of specimen	% of P.P fiber	Compressive strength
Sample 1	8.180kg	0	23.69 N/mm^2
Sample 2	8.350kg	0.15	27.5 N/mm^2
Sample 3	8.300kg	0.25	28.89 N/mm^2
Sample 4	8.200kg	0.35	28.92 N/mm^2
Sample 5	8.195kg	0.45	29.31 N/mm^2
Sample 6	8.185kg	0.55	28.87 N/mm^2
Sample 7	8.170kg	0.65	27.48N/mm^2



Graph % of Polypropylene fiber V/S Compressive Strength.

(**NOTE** : We Replaces The Cement With Polypropylene Fiber In %.)

CONCLUSION :

We can conclude that,

1) With addition of Polypropylene Fiber, the compressive strength of concrete is increased by almost 55.07% after 7 days & 56.83% after 14 days of readings.
2) As we go on increasing the % of Polypropylene fiber, there is reduction in compressive strength.
3) The maximum compressive strength will be at 0.45% of Polypropylene Fiber which is about greater than 60% of normal (without fiber) Concrete.

APPLICATIONS

- Pavements & Guard rails of highway & expressway.
- Airport runway and parking apron.
- Sprayed concrete at the wall surface and top of tunnel and mine revetment.
- Major structure of bridge and deck.
- Composite floor in building construction.
- Waterproof layer, floor, inner & outer wall of industrial and civil construction.

REFRENCES

- IS 516:1959 Method of test for strength of concrete.
- IS 10262:2009 Concrete mix proportioning [Guideline].
- Rana A. Mtasher, Dr. Abdulnassir Abbas, [2011] "Strength prediction of Polypropylene Fiber Reinforced concrete". Eng. & tech. Journal, Vol.29, No.2, PP 305-311,2011.
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