ISSN:2348-2079

Volume-7 Issue-2

International Journal of Intellectual Advancements and Research in Engineering Computations

Experimental investigation on influence of polypropylene fiber on strength parameter of concrete

K. L. Ravisankar[1], R. Latha[2], T. K. Mohamed Yousuf Kamil[2], A.Alfan[2]& B. Sivaprakash[2]

[1]Assistant Professor, Department of Civil Engineering, Nandha Engineering College, Tamilnadu, India

[2]BE -Final Year, Department of Civil Engineering, Nandha Engineering College, Tamilnadu, India

ABSTRACT

The paper deals with the Experimental Investigation on Influence of Polypropylene Fiber on Strength parameter of concrete (M40). Conventional concrete has two major drawbacks low tensile strength and brittle failure. Fiber reinforced concrete (FRC) is concrete containing fibrous material which increases its structural integrity. In an attempt to increase concrete ductility and energy absorption. Polypropylene fiber is a light weight synthetic material. It prevents crack formation and provides reinforced to the concrete structure. An experimental investigation explored properties such as compressive strength, flexural strength, spilt tensile strength and shear strength of polypropylene fiber reinforced concrete. Polypropylene fiber with 12mm length and five volume fractions of 0%, 0.5%, 0.75%, 1%, 1.25%, 1.5% are used.

Keywords: Polypropylene fiber, Workability, Compressive strength, Flexural strength, Spilt tensile strength.

INTRODUCTION

Concrete is most widely used in the world. Because of ability to get cast in any form and shape. Concrete has better resistance in compression while steel has more resistance in tension. Conventional concrete has limited ductility, low impact and abrasion resistance and little resistance to cracking. Micro cracks are formed due to the variation in temperature, shrinkage and heavy moving loads. Hence, alternative composite materials are used in the conventional concrete,the composite materials such as Polypropylene fibre and super plasticizer. The presence of micro cracks at the mortar-aggregate interface is responsible for the inherent weakness of conventional concrete. The weakness can be removed by inclusion of fiber. This type of fibre concrete is known as “Polypropylene fiber reinforced concrete.”

LITERATURE REVIEW

Kolli.ramujee (2015) [5]

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 of properties of polypropylene reinforced concrete have been presented. The compressive strength, spilt tensile strength of concrete samples made with different fibers amount varies from 0%, 0.5%, 1%, 1.5% and 2% were studied. The samples with added polypropylene fibers of 1.5% showed better results in comparison with the others.

Milind v. Mohod (2015) [10]

The paper presents an experimental study on performance of polypropylene fiber reinforced concrete. In this study deals with the effects of

Author for correspondence:
Department of Civil Engineering, Nandha Engineering College, Tamilnadu, India

addition of various proportions of polypropylene fibre's on the properties of high strength concrete (M30 and M40).An experimental program carried out to explore its effects on compressive, tensile, flexural strength under different curing conditions. In this study polypropylene fiber mix by varying content such as 0%,0.5%,1%,1.5% and 2%.In this study 1.5% shows better results.

Aminuddinjameran.et.al (2015)

This study, steel fiber and propylene is used to achieve the objectives of the study. Polypropylene fiber significantly decrease the plastic shrinkage cracking as well as drying shrinkage cracking, while steel fiber approximately doubled the energy absorption capacity of the unheated concrete. Most of the literature reviews showed that the use of fiber in concrete can significantly improve the concrete resistance. It shows better results in 1.5% to 2% of fiber.

Gonzalo Martinez-Barrera.et.al. (2011) [2]

Investigated the mechanical properties of polypropylene-fiber reinforced concrete after gamma radiation.By using gamma radiation we have further improved mechanical properties of hydraulic concrete elaborated with Portland cement, water, silica sand, marble and polypropylene fiber. The fibers so obtained were mixed into the concrete at 0, 1, 1.5 or 2% by volume.

Serkantapkin .et.al (2007) [4]

In this paper shown that the addition of polypropylene considerably alerts the behaviour of conventional concrete. When the polypropylene fiber content increase the Marshall Stability index has been observed. While using the polypropylene percentage is 1% and it gives better results.

OBJECTIVE OF STUDY

- The main objective is to study the effects of polypropylene fiber in concrete
- To conduct a compressive study on fiber in concrete and conventional concrete.
- To reduce the micro cracks on concrete.

Polypropylene fiber

Polypropylene is a type of thermoplastic polymer resin. Polypropylene fibers synthetic fiber obtained as a byproduct from textile industry. The chemical designation is C3H6. There are four general types of fibers currently available in the market. There are steel fiber, polypropylene fiber, glass fiber and carbon fiber.

Fig.No. 1 Polypropylene Fiber

Advantages Of polypropylene fiber

- Increased tensile strength in concrete
- Slightly improved compressive strength
- Much better bending strength
- Prevention of micro cracks (depends upon the fiber used)
- Increases flexibility and abrasion resistance
- Reduces permeability

- Arrest drying shrinkage
- Suitable for pumped concrete and shotcreting

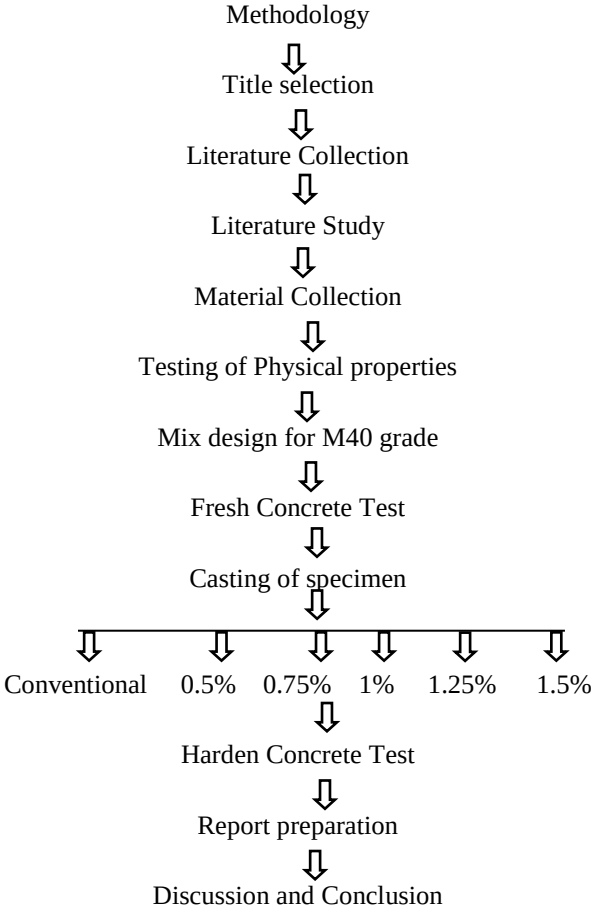
Application of polypropylene fiber

- Polypropylene is a light weight fiber
- It is highly resistant to acid and alkalis
- Its color does not fade
- Plain concrete and wall plastering
- Used in footing, foundations and tanks

Specification of polypropylene fiber

S.NO	SPECIFICATION	PROPERTIES
1	Diameter	33-35 microns
2	Cut length	12mm
3	Width crossing	Circular
4	Specific gravity	0.91 gr/cm^3
5	Melting point	250^{0}C
6	Elongation	45-55%
7	Water absorption	0

METHODOLOGY



MATERIAL PROPERTIES

S.No	Test	Values Obtained
1	Specific gravity of cement	3.14
2	Specific gravity of Fine aggregate	2.6
3	Specific gravity of Coarse aggregate	2.6
4	Water absorption	0.5%

MIX DESIGN

Theconcretemix design has been carried out for various proportions as per ratio and arrived at final mix proportion used for combining the initial materials.After mixing the polypropylene fiber. The dosages of fiber were0%, 0.5%, 0.75%, 1%, 1.25%, 1.5%.

S.No	Materials	Units
1	Water	140lit
2	Cement	350kg/m^3
3	Coarse aggregate	697 kg/m^3
4	Fine aggregate	1238 kg/m^3
5	Water cement ratio	0.4

EXPERIMENTAL INVESTIGATION

Test procedure

Concrete test specimens consists of 150x150x150mm cubes, cylinder of 150mm (diameter) and 300mm (height), prism of 100x100x50mm and 300x300x100mm beams. Concrete specimens were tested at 7 days and 28 days obtain the strength of concrete.

Teston Fresh Concrete

The workability of fresh concrete mix is mainly determined to suit the type of construction .Workability is one of the physical parameters of concrete. Concrete is said to be workable when it's easily placed and compacted. The test for compressive strength on cube is measured at 7 days homogeneously i.e. without segregation. The workability of a concrete is measured by compaction factor test and slump test.

Test on fresh concrete

The test were performed to determine the mechanical properties of control and fiber reinforced concrete using polypropylene fiber under compression, flexural, and spilt tensile. Measured for polypropylene fiber 0% to 1.5% by weight of cement. The test for compressive strength on cube is measured at 7 days and 28 days of curing. The test for flexural strength on prism is measured at 7 days and 28 days of curing. The test for spilt tensile strength on cylinder is measured at 7 days and 28 days of curing.

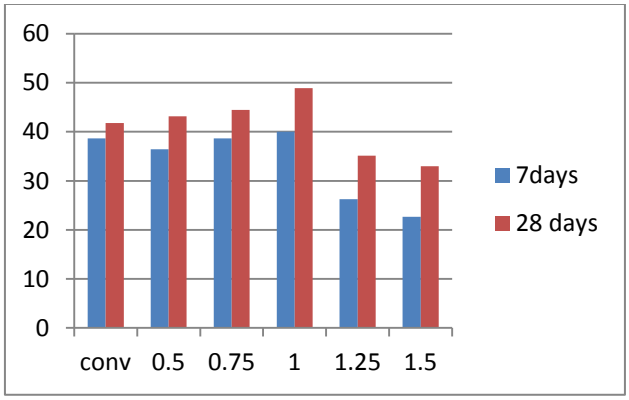
Compressive strength

The important property of concrete is its strength in compression. The aim of this experimental test is to determine the maximum load carrying capacity of the specimen. The cubes of sizes are 150mm x150mm x 150mm was cast. Three numbers of specimens were tested for 7 days and 28 days. The specimens are casted for M_{40} Grade of concrete with different proportions of polypropylene fiber.

Fig No. 2 Compressive Strength Test

Table : Compressive Strength of Cube specimen @ 7 & 28 days

PPF	At 7 days		At 28 days	
%	kN	N/mm^2	kN	N/mm^2
	800	35.11	920	40.88
Conventional	840	37.33	930	41.33
Concrete	870	38.66	940	41.77
0.5	750	33.33	950	42.22
	790	35.11	960	42.66
	820	36.44	970	43.11
0.75	840	37.33	980	43.55
	850	37.77	990	44.00
	870	38.66	1000	44.44
	880	39.11	1050	46.66
1.00	890	39.55	1070	47.55
	900	40.00	1100	48.88
	590	26.22	740	32.88
1.25	570	25.33	790	35.11
	580	25.78	780	34.66
	510	22.67	740	33.00
1.5	500	22.22	720	32.00
	490	21.78	700	31.11



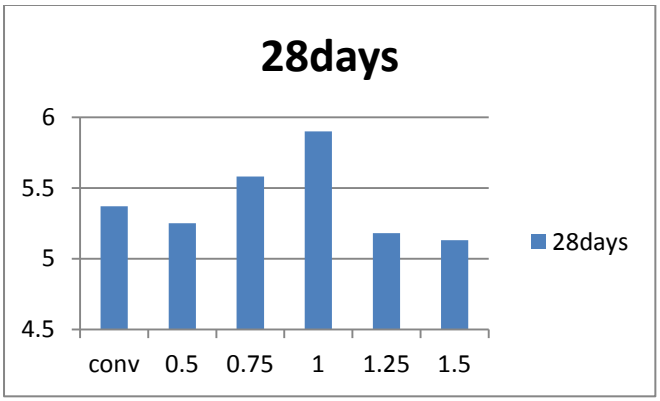
Spilt tensile strength

Cylinders of size 150mm diameters and 300mm height were cast. Three numbers of specimens were tested for 7 days and 28 days. The specimens are casted for M_{40} Grade with different proportions of polypropylene fiber concrete with different proportions of polypropylene fiber.

Fig No. 3 Split Tensile Test

Table : Split Tensile Strength @ 28 days

PPF	At 28 days	
%	kN	N/mm^2
	186	5.28
Conventional	188	5.33
Concrete	189	5.37
	182	5.16
0.5	183	5.20
	185	5.25
	192	5.45
0.75	196	5.53
	193	5.58
	206	5.84
1.00	202	5.74
	208	5.90
	183	5.18
1.25	182	5.16
	180	5.10
	176	5.00
1.5	178	5.05
	181	5.13



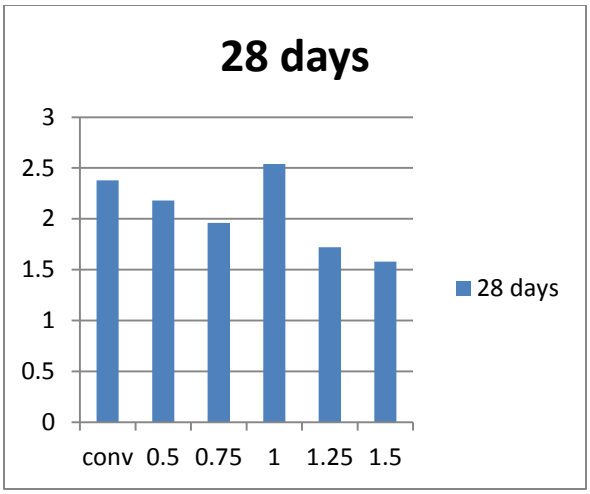
Flexural strength

Prism size of 100mm x 100mm x 500mm was cast. Three numbers of specimens were tested for 7 days and 28 days. The specimens are casted for M_{40} Grade concrete.

Fig No. 4 Flexural strength test

Table : Flexural Strength @ 28 days

PPF	At 28 days	
%	kN	N/mm^2
	11.1	2.22
Conventional	11.3	2.26
Concrete	11.9	2.38
	10.1	2.02
0.5	10.6	2.12
	10.9	2.18
	9.2	1.84
0.75	9.4	1.88
	9.8	1.96
	12.2	2.44
1.00	12.4	2.48
	12.7	2.54
	8.3	1.66
1.25	8.6	1.72
	8.4	1.68
	7.9	1.58
1.5	7.6	1.52
	7.4	1.48



CONCLUSION

The use of polypropylene fibers has increased in recent years due to the property of the fibers to eliminate some defects in concrete. The addition of polypropylene fibers to concrete improves its mechanical properties.

- It is observed from the fig 2 that the cube compressive strength increased upto 1% fiber content
- It is observed from fig 3 that the spilt tensile strength was increased upto 1 % fiber content
- It is observed from fig 4 that the prism flexural strength was increased upto 1 % fiber content

REFERENCES

[1]. Chenon-Goo Hana, Yin-SeongHwanga, Seong-Hawn Yangb, N.Gowripalane, "Performance of Spalling Resistance of High Performance concrete with Poly propylene Fiber Content and lateral confinement" in Cement and Concrete Research 305, 2005, 1747-1753

[2]. Gonzalo Martinez-Berrera, Fernando Urena-nunez, Osman Gencel, WitoldBrostow, "Mechanical Properties FiberReinforced Concrete After Gamma Irradiation" Composite: Part A 42, 2011, 567-572

[3]. Alhozaimy A.M,, and Soroushaiad p., "Mechanical Properties of Reinforced Concrete and Materials Polypropylene Fiber the Effects of Pozzolanic", Cement & Concrete Composites, 18, 1996, 85-92.

[4]. SerkanTapkin,. "The effect of polypropylene fibers on asphalt performance", Building and Environment, 2007, 1065-1071.

[5]. Kolli. Ramujee "Strength properties of polypropylene fiber reinforced concrete" International Journal of Innovative Research in Advanced Engineering [IJIRAE] 2(8), 2013.

[6]. Archana p, "Study of strength of polypropylene fiber reinforced concrete" International Journal of Reasearch and Technology 6(6), 2017.

[7]. Murahari k and R. Rao "Effects of polypropylene fibers on the strength properties of fly ash based concrete"

[8]. Divya S Dharan and AswathyLal "Study the effect of polypropylene fiber in concrete" International ReasearchJournal of Engineering and Technology (IRJET) 3(6), 2016.

[9]. Amsa M and Ariyannan P, "Experimental Study on Polypropylene fiber reinforced concrete". International Reasearch Journal of Engineering and Technology (IRJET) 5(4), 2018.

[10]. Milind V. Mohod "Performance of polypropylene fiber reinforced concrete". IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), 12(1), 2015.