International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in

Vol.4., Issue.2., 2016
(Mar-Apr)

RESEARCH ARTICLE

ISSN: 2321-7758

AN EXPERIMENTAL INVESTIGATION ON THE STRENGTH PROPERTIES OF POLYPROPYLENE FIBER REINFORCED CONCRETE

SANCHIT SINGH[1], ANAND.N[2], SUPREETH.N[3], RUDRASWAMY.M.P[4]

[1,2,3] UG STUDENT, RRIT, BANGALORE, KARNATAKA, INDIA

[4]ASSISTANT PROFESSOR OF CIVIL ENGINEERING DEPARTMENT, RRIT,BANGALORE, KARNATAKA, INDIA

ABSTRACT

Concrete is the most popularly used material but it has high compressive strength, low tensile strength. Hence, it cannot be used in all the structural members. The research has shown that there in forcing of concrete in the tensile zone can improve the tensile capacity by mixing of fibers in the concrete. This product is called Fiber reinforced concrete. Innovations in engineering design, which often establish the need for new building materials, have made fiber reinforced concrete very popular. Polypropylene fiber reinforced concrete plays an important role in the development and progress of construction industry. Through concrete have some limitations it can overcome by modern scientific research. Field observations conducted for survey on the concrete slabs, beams and column etc. Suggests the micro cracks will develop and will lead to reduce strength and other defect occurs. So that overcome the micro cracks in concrete poly propylene fibers is used in the concrete to arrest the micro cracks. The main objective of this experimental investigating is study the effect of strength properties of polypropylene fiber reinforced concrete with varying percentages of polypropylene fibers in it. Different percentages of polypropylene fibers studied are0%,0.5%,1%,1.5%,2% and2.5%. The main investigation carried out in this work shows that the addition of polypropylene fibers in the concrete will yield a concrete which shows better strength when cured for 7days and 28days. From the results of the experimental work it can be conclude that addition of 1.5% of polypropylene fibers in the concrete improves the characteristics properties both after 7days and 28days curing. Hence the polypropylene fiber reinforced concrete show shigher strength than conventional concrete.

©KY Publications

SANCHIT SINGH

ANAND.N

SUPREETH.N

RUDRASWAMY.M.P

INTRODUCTION

Concrete is one of the most important materials among the building materials in all types of civil engineering works. Since the adaptation of concrete as a building material, lot of researches and studies has been made to improve the quality, strength and durability of it. By the same time efforts are also being made to economize concrete construction compared to other materials.

Plain concrete is good in compression but weak in tensile strength with very limited ductility and little resistance to cracking. Internal micro cracks are inherently present in concrete and its poor tensile strength is due to propagation of such micro cracks, eventually leading to brittle fracture of concrete. Generally in case of rigid pavements cracks are formed due to the variation in temperature, shrinkage and heavy moving loads. Attempts have been made to reduce the cracks and impart improvements in tensile property of concrete members using conventionally reinforced steel bars and also by applying restraining techniques. Although both these methods provide tensile strength to concrete members, they however do not increase the tensile strength of concrete itself. In plain concrete and similar brittle materials, structural micro cracks develop even before loading due to drying and shrinkage or other causes of volume changes. When loaded these micro cracks propagate and open up owing to effect of stress concentration.

It has been recognized that the addition of small closely spaced and uniformly dispersed fibers to concrete would act as crack resistance and substantially improve its static and dynamic properties. This type of concrete is known as fiber reinforced concrete. In these dissertations an attempt will be made to view the behavior of concrete mixed fiber with polypropylene fiber reinforced concrete in comparison with plain concrete.

OBJECTIVES OF THE WORK

The main objective of this experimental investigation is to find out the effect of addition of polypropylene fiber in different percentage.The different percentage addition of polypropylene fiber in volume fraction adopted in the experimentation are 0%, 0.5%, 1%, 1.5%, 2%, 2.5%.

- To achieve the above objective, the following different experimentations are planned on M 30 grade of concrete with 7 days and 28 days of curing period.
- To find out the strength characteristics like compressive strength, tensile strength, flexural strength for different percentage addition of polypropylene fiber.

Mix proportion

Cement	=	413.33 Kg/m^3
Water	=	186.00 Kg/m^3
Fine aggregate	=	636.82 Kg/m^3
Coarse aggregate	=	1153.17 Kg/m^3
W/C	=	0.45

M 30 was designed using IS10262-2009 method of mix design. The mix proportion for M 30 grade concrete is given in the following table.

Mix proportion for M 30 grade concrete

Sl. No.	Grade of concrete	Cement	Fine aggregate	Coarse aggregate	W/C
1	M 30	1	1.54	2.79	0.45

Mixing and casting of specimens

Calculate the material required for 3 cubes, 3 cylinders, 3 beam and specimen using the mix proportion by mass.

The mixing procedure was done according to following steps:

- The cement and polypropylene are weighed as per the calculated amount and blended uniformly later mixed with weighed quantities of fine and coarse aggregates with required amount of water in a batching tray.
- Dry mix the sand and cementitious materials.
- Add coarse aggregate to it and mix it thoroughly to achieve cement particles on each and every coarse aggregate.
- Add the calculated quantity of water to the dry mix and mix thoroughly to get homogeneous mix.
- It is filled in 3 layers with 16mm diameter rod with 25 blows each otherwise mould is

vibrated on vibrating table or tray. It is reminded that third layer quantity concrete is filled in such a way that after compaction no concrete is excess in cube and just leveled by trowel.

- Mould data and grade is marked on specimen after initial set or final set by paint.
- After 24 hours after filling concrete specimens are kept in water.

STRENGTH TESTS

Compressive strength test

The following procedure is adopted to conduct the compressive strength test.

- Size of the test specimen is determined by averaging perpendicular dimensions at least at two places. The size of the cube specimen is 150x 150 x 150 mm.
- Place the specimen centrally on the compression testing machine and load is applied continuously and uniformly on the surface perpendicular to the direction of tamping.
- The load is increased until the specimen fails and record the maximum load carried by each specimen during the test as shown in fig.

Fig. Compression Test on Cubes

- Compressive stress was calculated as follows

Compressive strength= P / A× 1000

Where,

P = Load in kN

A = Area of cube surface = 150 x 150 mm^2

Tensile strength test

The following procedure is adopted to conduct thetensile strength test.

Fig. Split Tensile Test on Cylinders

- Draw diametrical lines on two ends of the specimen so that they are in the same axial plane.
- Determine the diameter of specimen to the nearest 0.2 mm by averaging the diameters of the specimen lying in the plane of pre-marked lines measured near the ends and the middle of the specimen. The length of specimen also shall be taken be nearest 0.2 mm by averaging the two lengths measured in the plane containing pre marked lines. The size of the cylinder specimen is of 150 mm diameter and 300 mm length.
- Centre one of the plywood strips along the centre of the lower platen. Place the specimen on the plywood strip and align it so that the lines marked on the end of the specimen are vertical and centered over the plywood strip. The second plywood strip is placed length wise on the cylinder centered on the lines marked on the ends of the cylinder.
- Apply the load without shock and increase it continuously at the rate to produce a split tensile stress of approximately 1.4 to 2.1

N/mm^2/min,until no greater load can be sustained. Record the maximum load applied to specimen.

- Computation of the split tensile strength are as follows:

  Split tensile strength = 2P / (3.142 × dl) × 1000

  where,

  P = Load in kN

  d = Diameter of cylinder = 150 mm

  l = Length of cylinder = 300 mm

Flexural strength test

The following procedure is adopted to conduct theflexural strength test.

- Brush the beam clean. Turn the beam on its side, with respect to its position as molded and place it in the breaking machine. The size of the beam specimen is 150 x 150 x 700 mm.
- Set the bearing plates square with the beam and adjust for distance by means of the guide plates furnished with the machine.
- Place a strip of leather or similar material under the upper bearing plate to assist in distributing the load.
- Bring the plunger of the jack into contact with the ball on the bearing bar by turning the screw in the end of the plunger.
- After contact is made and when only firm finger pressure has been applied, adjust the needle on the dial gauge to "0".

Fig. Flexural Test on Beams

- Here we are applying loadon the beam specimen till it breaks and note the value as failure load.
- Computation of the flexural strength are as follows:

  Flexural strength = PL / bd^2× 1000

  Where,

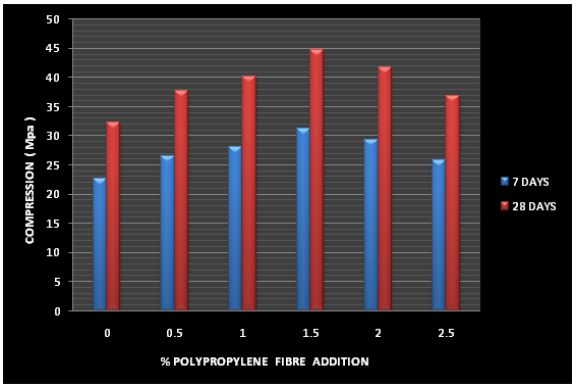
  P = Load in kN

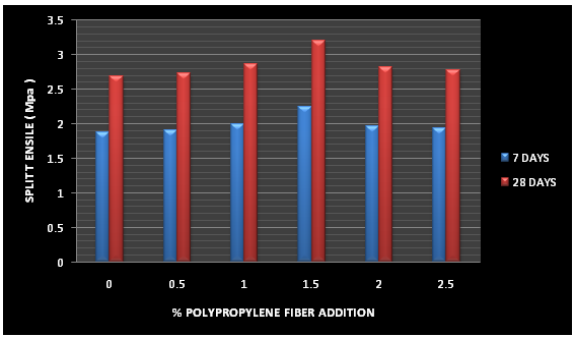
  L = Effective length of beam = 700 mm

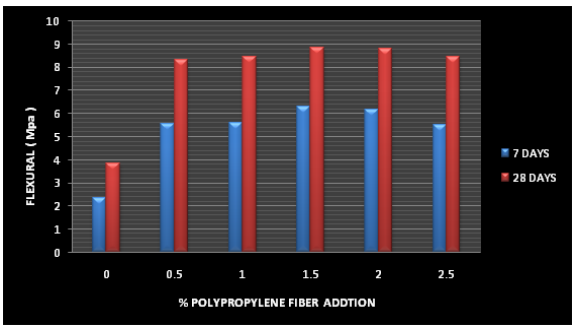
  b = Width of the beam = 150 mm

  d = Depth of the beam = 150 mm

EXPERIMENTAL RESULTS







CONCLUSIONS

Following conclusions can be drawn based on the experimentations conducted on the polypropylene fiber reinforced concrete.

- Strength properties goes on increasing with the addition of fiber till its peak value and it starts decreasing after that simultaneously for both 7 days as well as 28 days of curing period.
- Compressive strength of concrete goes on increasing up to 1.5% addition of fiber. Therefore addition of fiber is allowed up to 1.5%.
- Tensile strength of concrete goes on increasing up to 1.5% of fiber addition.
- Flexural strength of concrete goes on increasing up to 1.5% of fiber addition.

REFERENCES

[1]. Saeed Ahmed, Imran A Bukhari, javed Iqbal Siddqueand Shahzad AliQureshi 35thConference onour worldinconcrete &structures: 25-27August 2010, Singapore

[2]. PritiA. Patel, Dr.Atulk. Desiand DR. JatinA.Desai International Journal of Advanced Engineering Technology. IJAET/Vol.III/IssueI /January-March,2012/42-45.

[3]. Roohollah Bagherzadeh, Hamid RezaPakravan, Abdol-hosseinsadeghi, Masoud Latifiand AliAkbarmerati, journal ofengineeringfibersandfabricsvolume7, issue4-2012.

[4]. ChandramouliK, SrinivasRao P, Pannirselvam N, Seshadrisekhar T, and sravana P 2006-2010AsianResearchPublishing Network(ARPN), VOL.5,NO.4, APRIL2010.

[5]. RamakrishnaV. Balagura P,kostaneskiL and Johnston DAug13-15, 1990,Co; Ed.ByBruceA.suprenant ASCE NewYork, 1990,vol.2,pp903-912.

[6]. Vikranth S,Vairagade, KavithS.kene; International Journal of Engineering Research and Applications (IJERA),Vol.2,Issue3,May-Jun 2012,pp.1037-1041.

[7]. Deshmukh S.H.Bhusari J. P andZendeA.M.IOSR Journal of Engineering, June. 2012,Vol.2(6)pp: 1308-1312.

[8]. Uroojmasood,B.L.P. Swami and A.k.Asthana; International Journal ofEarth SciencesandengineeringISSN0974-5904,Volume04,No06 SPL,October2011, pp.1004-1008.