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Fibre Reinforced Concrete Using Nylon & Steel Fibre

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Abstract

This study presents an experimental study on fibre reinforced concrete with steel and nylon fibres. The work involve two type of mixes, the first consists of different percentages(0.5%, 0.75% and 1%) of nylon fibre, the second uses different percentage (0.5%, 0.75%, and 1%) of steel fibre were cast and cured . The length of the fibre was 30 mm. The specimens were tested after the 7 days and 28 days for their compressive strength. As the results shown that the compressive strength of fibre reinforced concrete increase by increasing quantity of steel and nylon fibres.

Keywords: *Fibre reinforced concrete, steel fibre & Nylon fibre*

INTRODUCTION

Fibre reinforced concrete (FRC) is concrete containing fibrous material which increases its structural integrity. It contains short discrete fibres that are uniformly distributed and randomly oriented. Fibres include steel fibres, glass fibres, synthetic fibres and natural fibres. Within these different of fibre that character of fibre reinforced concrete (FRC) changes with varying concretes, fibre materials, geometries, distribution, orientation and densities.

Fibre-reinforced concrete is used in shot Crete, but it can also be used in normal concrete. Fibre-reinforced concrete (FRC) are mostly used for pavements and on-ground floors, but can be used in

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construction parts such as beams, pliers, foundations etc either alone or with hand-tied rebar's [5].

According to many research the addition of various types of fibres such as metallic and non-metallic fibre like (steel), glass, synthetic, and carbon, in plain concrete improves compressive, tensile, split tensile strength and toughness, etc [3]. Steel fibre increases more compressive and tensile strength of the concrete as compared to nylon fibre used in plain concrete [1].

Adding more nylon fibres into the concrete has a limited improvement on splitting tensile strength. It has stepped up the performance after the presence of cracks and have sustained high stresses [2, 4]. However, the establishment has been awaiting as how the steel fibers compete with the nylon rivals in advancing the performance of concrete under compression, tension, flexure, etc.

The merit of non-metallic fibres like nylon is to prevent the expansion of micro cracks in the plastic stage of concrete due to their lower stiffness and increased fibre availability (because of lower density as compared to steel) at a given volume fraction [2]. It is important to have a combination of low modulus (nylon) and high modulus fibres (steel) to arrest the micro and macro cracks, respectively.

METHODOLOGY

In this paper, I construct the cube of grade M 30 which was used to check the compressive strength. As the fibre reinforcement were used at a different percentage such as 0.5%,0.75%,and 1.0% of the cement. When compared to the control sample that contains no fibres, with the increase of fibre ratio, compression strength of concrete increases. The result showed that the steel fibres improve the concrete properties better than the nylon fibre due to their higher tensile strength.

Reinforced fibres which were used to determine the compressive strength of

- Plain concrete
- Steel reinforcement concrete (mild steel)
- Nylon fibre

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The method involves:-

- Use of adhesive to increase the strength
- Limiting weight of the cube
- Use of nylon

Material Used:

- Ordinary Portland cement - 43 grade
- Tap water has been used for all purposes
- Fine aggregate - Natural sand of Zone II
- The maximum size of aggregates – 12.5 mm
- Steel fibre - 30 mm (length)
- Nylon fibre - 30 mm (length)
- Super plasticizer - Master Genelium 8362

Mix Proportion:

Table: 1

Cement (kg/m^3)	**Fine Aggregate (kg/m^3)**	**Coarse Aggregate(kg/m^3)**	**w/c ratio**
328	147.75	895.27	0.45

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Table: 2 Specification of Cement Property

Property	**Ranges of Values**
Normal Consistency 30%	Initial Setting Time 30 minutes
Final Setting Time 5.6 hours	Specific Gravity 3.65
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Final Setting Time 5.6 hours	Specific Gravity 3.65

Table: 3 Specification of Coarse aggregate Property

Property	**Ranges of Values**
Crushing Value	Specific Gravity 2.72
Crushing Value	Specific Gravity 2.72

Results

Results of FRC Mix with Nylon Fibre:

Sr. No.	Sample	% of Fibre	Average Compressive Strength at 7 days (N/mm^2)	Average Compressive Strength at 28 days (N/mm^2)
1.	PCC	0	26.9	33.34
2.	FRCN1	0.5	26.7	32.7
3.	FRCN2	0.75	27.6	33.44
4.	FRCN3	1	29.51	36.58

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Results of FRC Mix with steel fibre:

Sr. No.	Sample	% of Steel	Average Compressive Strength at 7 days (N/mm^2)	Average Compressive Strength at 28 days (N/mm^2)
1.	PCC	0	26.9	33.34
2.	FRCS1	0.5	29.13	37.22
3.	FRCS2	0.75	30.4	38.2
4.	FRCS3	1	32.44	39.7

Comparison of Results:

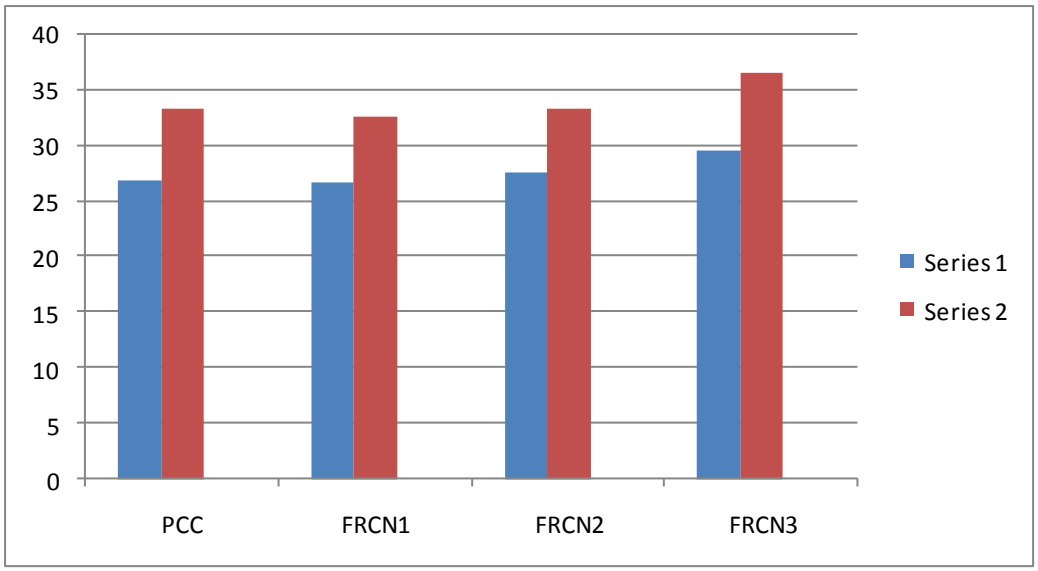


Fig: 1 Strength of FRC at 7 days and 28 days using nylon fibre

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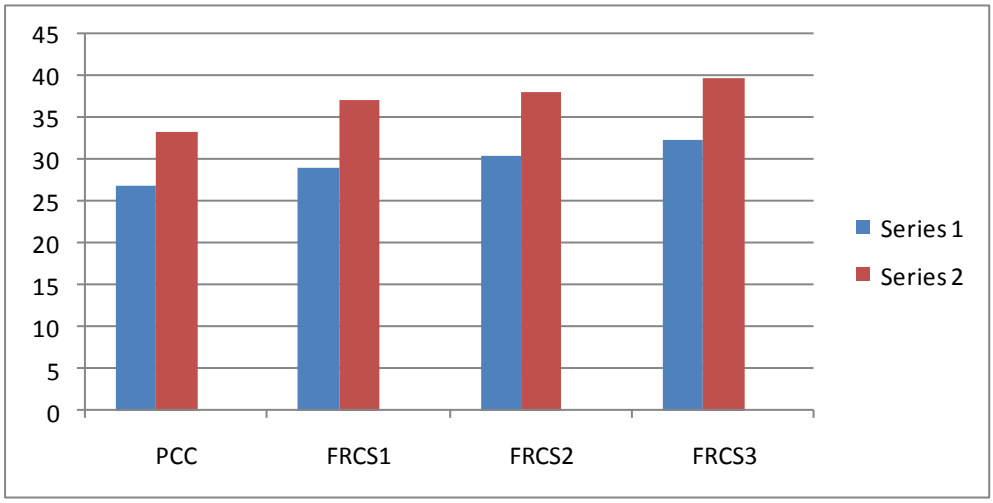


Fig: 2 Strength of FRC at 7 days and 28 days using steel fibre

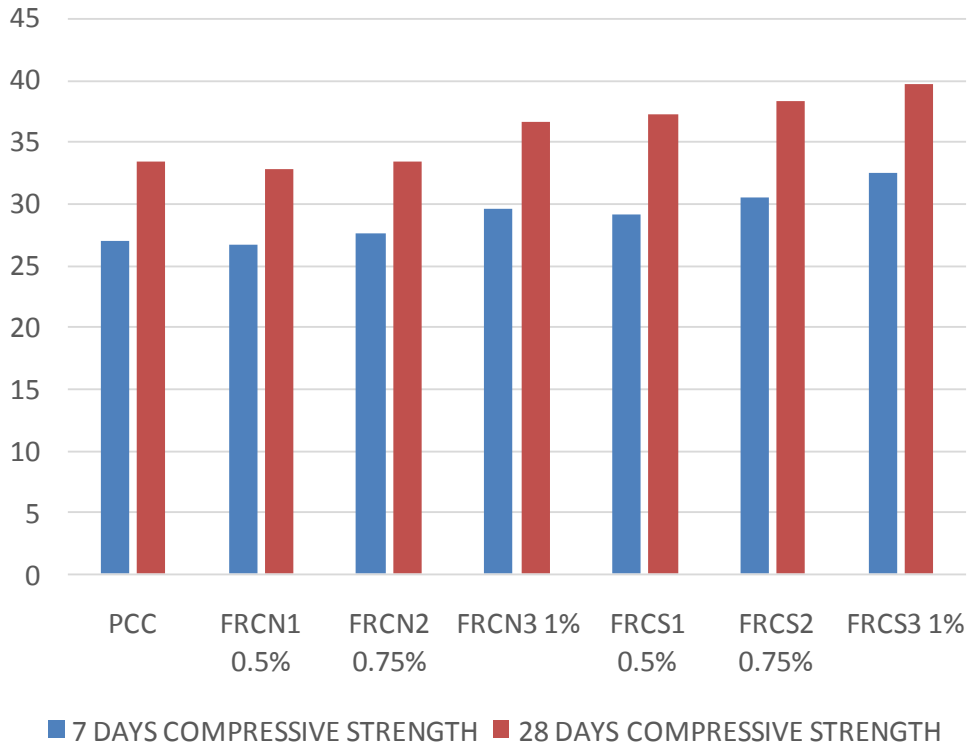


Fig: 3 Comparison of PCC, Steel & Nylon fibres at 7days and 28 days

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DISCUSSION

The compressive strength of concrete was increased 9.3% if 1% of the cement is replaced by nylon fibre as compared to PCC. The compressive strength of concrete was increased 19.07% if 1% of the cement is replaced by steel fibre as compared to PCC. The compressive strength of FRCN2 is almost same as compared to PCC. The compressive strength of FRCN3 is equivalent to FRCS1.

CONCLUSION

- The compressive strength of concrete increases on increasing the percentage of fibre in concrete
- The maximum strength was found at 1% reinforcement with nylon fibre and 1% reinforcement with steel fibre
- Fibre Reinforcement reduces the width of crack in concrete
- Fibre reduces the crack elongation in the process of load application
- Strength of concrete increased with time

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