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Experimental Investigation of Concrete Strength Properties Using Natural and Artificial Fibers

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ABSTRACT: Concrete being brittle is weak in tension. The inclusion of fibres in concrete have significantly improves its compressive as well as tensile strength. The use of different types of fibres & their orientation in the matrix have shown positive responses among the researchers. In the present study alkali resistant glass fibres and coir fibres were used in the concrete mixes. However the workability of concrete mixes is not much affected by the addition of fibres. In this study, M 40 grade of concrete was produced by adding coconut fiber (coir) and glass fibres.

KEYWORDS: Fibre Reinforce Concrete, Glass Fibre, Strength, Split Tensile strength , workability.

I. INTRODUCTION

Now-a-days Concrete is world's most widely used construction material. The utilization of concrete is increasing at a higher rate due to development in infrastructure and construction activities all around the world. Glass fibre concrete (GFC) consists basically of a matrix composed of cement, sand, water, and admixtures, in which short length glass fibres are dispersed. The advantage of reinforcing and pre stressing technology utilizing steel reinforcement as high tensile steel wires have helped in overcoming the incapacity of concrete in tension but the durability and resistance to cracking is not improved. These properties can be improved by the use of fibres in the concrete.

II. RELATED WORK

In work done by Md.Abid Alam, Imran Ahmad, Fazlur Rehman the compressive strength of concrete mixes was observed to be increasing as the inclusion of fibers increases. The addition of 0.02% glass fibers by weight of concrete mix, increases the strength to 26.6% for M 20 grade of concrete and 25.78% for M 30 grade of concrete. On further addition of 0.02% of fibers the average increase in strength is reported as 7% for M 20 grade & 8.8% for M 30 grade of concrete mix. This shows that as we go for higher grade of concrete, increases in percentage of fibers increases the strength rapidly.

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III. OBJECTIVES OF PROJECT

1. To study the strength properties of fibre reinforced concrete when compared to conventional concrete.
2. Strength parameters of Glass fibre and Coir fibre will be tested.
3. Compressive strength and Split tensile strength is to be studied.
4. Percentage of fibre used will be varied in concrete, with respect to weight of cementitious material.
5. Percentage to be varied 0.8%, 1%, 1.2%, 1.5%.

IV. EXPERIMENTAL MATERIALS USED

A. Fine Aggregate

Coarse sand locally available to us was used as fine aggregate. The test procedures as mentioned in IS-383(1970) were followed to determine the physical properties of fine Aggregate.

B. Coarse Aggregate

Two single sized crushed stone aggregates ranging from 10mm and 20mm sizes were used in respective proportions in concrete mixes. The aggregates were tested in accordance to IS-383: (1970).

C. Glass Fibre and Coir Fibre

Cem-Fil Anti-Crack, HD-12mm, Alkali Resistant glass fibres were used throughout the experimental work. Coconut fibres (COIR) which are the waste products of paddy and agricultural industry.

D. Water

As per recommendation of IS: 456 (2000), the water to be used for mixing and curing of concrete should be free from deleterious materials. Therefore potable water was used in the present study in all operations demanding control over water quality.

E. Fly Ash

Fly ash of Techpozso Company was used in this research. Which was mix 18% weight of cement content.

F. Superplasticizer

These are known as high range water reducer .BASF 1126 admixture was used as superplasticiser.

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V. MIX DESIGN

The mix was designed for M25 grade as per IS: 10262:2009 at ratio of 1:2.007:3.2 for water cement ratio of 0.36. Table:1 shows various percentage replacement of fibre.

Batch no.	% replacement of fibers
1	Control mix= 0%
2	Coir fibre= 0.8%
3	Coir fibre= 1%
4	Coir fibre= 1.2%
5	Coir fibre= 1.5%
6	Glass fibre= 0.8%
7	Glass fibre= 1%
8	Glass fibre=1.2%
9	Glass fibre=1.5%

VI. METHODOLOGY

- Selection of Materials.
- Basic Tests performed on cement and aggregate.
- Prepare mix design for M40 grade of concrete.
- Prepare conventional concrete sample for cylinder and cube.
- Curing of specimen.
- Testing of conventional concrete specimen.
- Result of conventional concrete.
- Addition of coir fibre and glass fibre in proportion of 0.8%, 1%, 1.2%, 1.5%.
- Curing and testing process of fibre reinforced concrete.
- Result for fibre reinforced concrete.
- Comparison between Conventional concrete and fibre reinforced concrete.

VII. EXPERIMENTAL INVESTIGATION

A. Compressive strength test:

Compression Testing Machine is used for Compressive strength test. Cube size of 150 x150x 150 mm was used. Three cubes of each batch were tested.

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Figure 1 compressive strength test

B. Split tensile strength:

Split tensile test was carried out on Compression Testing Machine. Cylinder specimen of 150 mm diameter and height 300mm are used. Three cylinder of each batch were tested.



Figure 2 split tensile strength

VIII. RESULTS

Test were conducted at 7 & 28 days. A comparative study was made on concrete with addition of coir fibre and glass fibre results are reported in Tables below for the conventional concrete and fibre reinforced concrete. Workability of each trial was also noted.

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Table 1 workability

Sr. No.	Trial No.	Value(in mm)
1	Trial 1	140-145
2	Trial 2	130-135
3	Trial 3	120-130
4	Trial 4	120-130
5	Trial 5	145-150
6	Trial 6	145-150
7	Trial 7	155-160
8	Trial 8	155-160
9	Trial 9	165-170

Table 2:-Results for conventional concrete

Specimen	7 days (N/mm ²)	28 days(N/mm ²)
Cube	36.42	42.76
Cylinder	2.3	4.102

Table 3:- 7 days Results for coir fibre

Specimen	0.8%	1%	1.2%	1.5%
Cubes	41.082	31.775	35.911	40.93
Cylinder	1.94	1.83	2.32	1.54

Table 4:- 28 days Results for coir fibre

Specimen	0.8%	1%	1.2%	1.5%
Cubes	48.66	43.577	39.84	46.019
Cylinder	3.955	3.818	4.383	3.536

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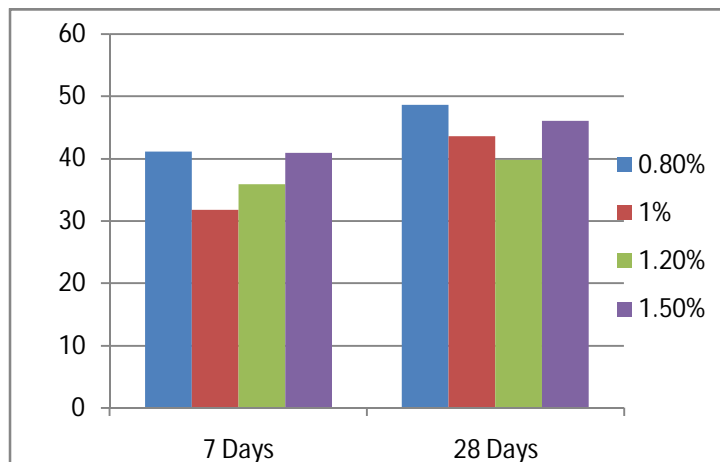
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Table 5:- 7 days Results for glass fibre

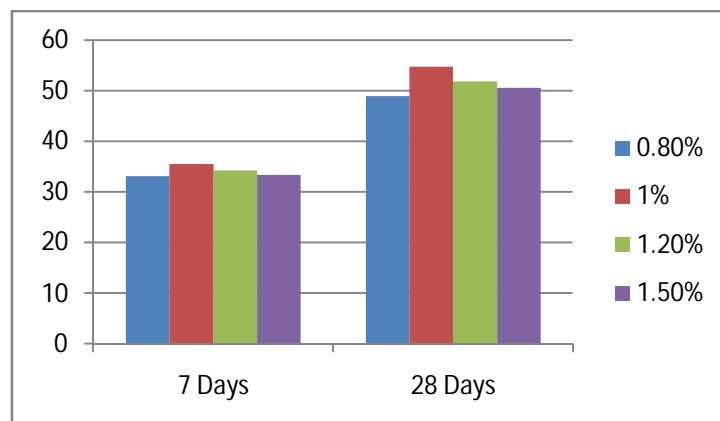
Specimen	0.8%	1%	1.2%	1.5%
Cubes	33.152	35.458	34.260	33.285
Cylinder	2.43	2.33	2.14	3.90

Table 6:-28 days Results for glass fibre

Specimen	0.8%	1%	1.2%	1.5%
Cubes	48.914	54.705	51.840	50.531
Cylinder	4.596	4.521	4.175	4.102



Graph 1:- Compressive Strength For Coir Fibre



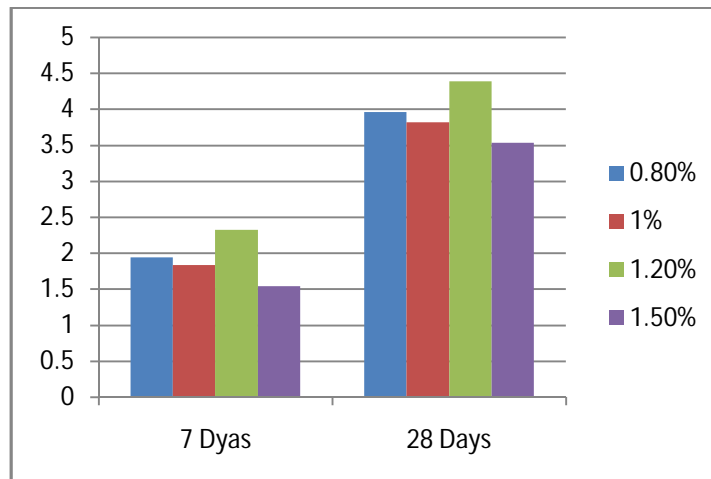
Graph 2 :- Compressive Strength For Glass Fibre

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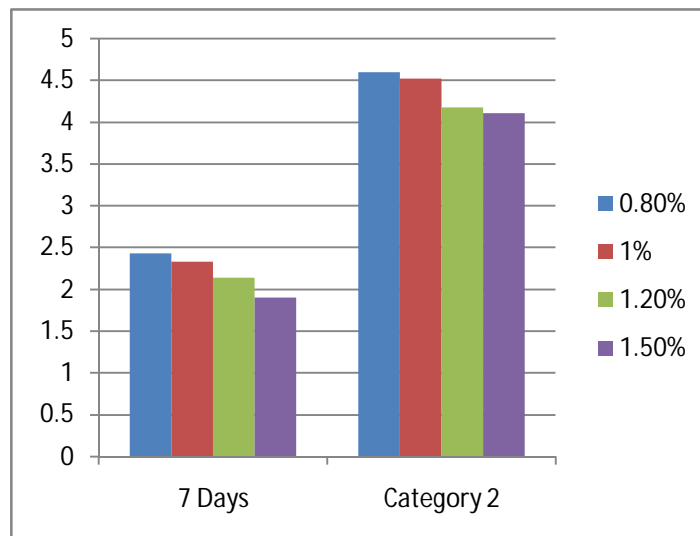
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Graph 3:-Split Tensile For Coir Fibre



Graph 4:- Split Tensile For Glass Fibre

IX. CONCLUSION

- The optimum dosage for maximum compressive strength for coir fibre is 0.8%. i.e maximum compressive strength increases by 21% (compared to control mix)
- The optimum dosage for maximum compressive strength for glass fibre is 1%. i.e. maximum compressive strength increases by 36% (compared to control mix)
- Less cracking was observed in coir fibre compared to glass fibre
- Initially compressive for coir fibre is more compared to glass fibre for 7 days, then strength of glass fibre increases rapidly and acquires greater compressive strength than the coir fibre
- The optimum dosage for split tensile strength for coir fibre is 1.2%

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- f) The optimum dosage for split tensile strength for glass fibre is 0.8%
- g) Not much effect was seen in workability for glass fibre, but as the percentage of coir fibre increased workability decreased.

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