International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 03 | Mar 2020 www.irjet.net p-ISSN: 2395-0072

EXPERIMENTAL INVESTIGATION ON FLEXURAL BEHAVIOUR OF REINFORCED CONCRETE WITH MILLED CARBON FIBRES

Gautam Baalaji. S[1], Mr. Yacop Raja. A[2]

[1]Post Graduate Scholar, Oxford Engineering College, Tiruchirappalli, Tamil Nadu, India
[2]Assistant Professor, Dept of Civil Engineering, Oxford Engineering College, Tiruchirappalli, Tamil Nadu, India

---

Abstract – *This paper focuses on the effect of addition of milled carbon fibres to the concrete in different proportions i.e. 0.5,1,1.5 and 2% by the weight of the cement. In this paper the mechanical properties of concrete such as compressive strength, split tensile strength and flexural strength were found loading frame is used to find the flexural strength of the beam (milled carbon fibre-reinforced cement concrete). The deflection at the center of the beam (milled carbon fibre-reinforced cement concrete) is found out with the help of dial gauge.*

Key Words: **Milled Carbon Fibre, Milled Carbon Fibre-Reinforced Cement Concrete, Compressive Strength, Split Tensile Strength, Flexural Strength**

1. INTRODUCTION

Structural concrete is the largest used construction material because of its lowest cost to strength property as compared to other materials available. To increase some of the structural undesirable properties of the concrete addition of admixtures (or) fibres are been practised. Fibre concrete is acknowledged to be a relatively brittle material when subjected to normal stresses and impact loads, where tensile strength is approximately one tenth of its compressive strength. The introduction of fibres was brought in as a solution to develop concrete in view of enhancing its flexural and tensile strength, which are a new form of binder that could combine Portland cement in the bonding with cement matrices. Fibres are most generally discontinuous, randomly distributed throughout the cement matrices. The term of 'Fibre reinforced concrete' (FRC) is made up with cement, various sizes of aggregates, which incorporate with discrete, discontinuous fibres. In case of structures it is important that strength should be combined with toughness. Toughness is detailed by term "Ability of the member to withstand load in its plastic range". A lot of researchers show good toughness when fibres are added to reinforced concrete. The behaviour depends on the type of fibre and also the volume in which it is added. Recent researches show that the addition of carbon fibres increases the flexural and tensile strength. The addition of short randomly dispersed fibers to cement and concrete, significantly improves the mechanical properties of the material. These improvements are attributed to the fibre success in arresting microcracks and preventing further widening of the cracks in the cementitious matrix. Numerous types of fibers may be added to the cement paste matrix, including steel, glass, polymer, natural, etc.

1.1 MILLED CARBON FIBRE

Milled Carbon fibre is a very short fiber of 6mm length. This type of fibre can be used in variety of applications to improve the mechanical properties. Carbon fibre consists of carbon greater than 96%.

Fig-1: Milled carbon fibre

1.2 ADVANTAGES OF FIBRE-REINFORCED CONCRETE

- Higher flexural and shear strength
- Control in cracking
- Increased Durability
- Reduction in Creep
- Increased load carrying capacity in Plastic range

2. LITERATURE REVIEW

Saifudin et.al (2018) In his paper presented the key mechanical properties and microstructures of carbon fibre-reinforced self-consolidating concrete with two different water cement ratios. In this paper he also found that compressive strength of the concrete was considerably reduced by up to 36% whereas the split tensile strength increases by 13.1-17% for different volume additions and also there is 3.6% increase in the flexural strength of the beam and toughness increased by 41.4% respectively. Also, the load deflection behavior was good when carbon fibres are added by 0.25% of its volume.

Weimen Song et.al (2019) In their Paper investigated concrete with binary blends of Portland cement and granulated blast furnace slag and carbon fibres. They concluded that the fibre and ggbs decreased the compressive strength of the concrete. GGBS promoted the drying shrinkage development, while CF obviously restrained the drying shrinkage. Similar to drying shrinkage, CF alleviated the creep development and GGBS helped increase the creep

coefficient. Three-way ANOVA tests were performed to evaluate the effect of time, the content of GGBS and content of CF on their effects on drying shrinkage and creep behaviors. Results show that time, GGBS content and CF content were all significant factors influencing the drying shrinkage and creep behaviors.

Prashant Muley et.al (2015) discussed the effect of chopped carbon fibre in their paper. Five different mix proportions were made to analyze the mechanical properties of concrete. There is 19.4 MPa increase in compressive strength when compared with control mix. There is also a increase of tensile strength by 44% and flexural strength increases by 53% respectively.

3. METHOLODOLOGY

- Review of Literature
- Selection of materials
- Testing of materials.
- Preparation of mix design for M30.
- Adding percentage of fiber (0.5%, 1%, 1.5% and 2%).
- Casting of specimens (cube, cylinder, beams).
- Testing of specimens (compressive strength, split tensile strength, flexural strength).
- Analysis of the test results.
- Conclusion and suggestion for future study.

4. EXPERIMENTAL INVESTIGATION

4.1 SIZE OF SPECIMENS

Cube-150*150*150mm
Cylinder- 150*300mm
Beam- 700*230*150mm

4.2 COMPRESSION TEST RESULT

Fig-2: Compression testing machine

Table -1: Compression test results

Description	7 days (N/mm²)	14 days (N/mm²)	28 days (N/mm²)
CM	20.1	27.6	29.87
0.5% CF	20.67	29.39	31.95
1% CF	21.03	28.55	32.35
1.5% CF	22.33	32.65	34.35
2% CF	26.54	32.5	39.44

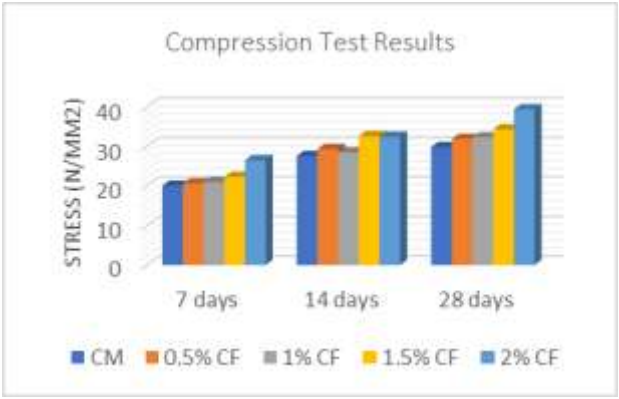

Chart-1: Compression test results

4.3 SPLIT TENSILE TEST RESULT

Fig-3: Split tensile test

Table -2: Split tensile test results

Description	7 days (N/mm²)	14 days (N/mm²)	28 days (N/mm²)
CM	0.26	1.8	3.1
0.5% CF	1.3	2.75	4
1% CF	2.4	3.1	5.5
1.5% CF	3	3.6	5.6
2% CF	3.9	4.7	6.4

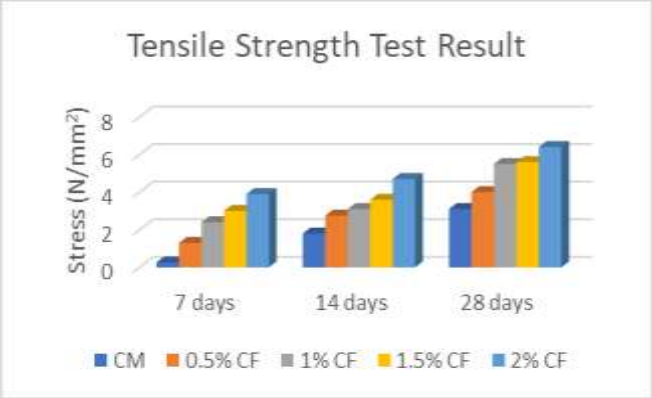

Chart-2: Split tensile test results

4.4 FLEXURAL STRENGTH TEST RESULT

Table -3: Flexural strength test results

Description	load (KN)	Flexural Strength(N/mm²)
CM	8.5	24.99
0.5% CF	12.4	36.46
1% CF	13	38.22
1.5% CF	13.2	38.81
2% CF	13.8	40.57

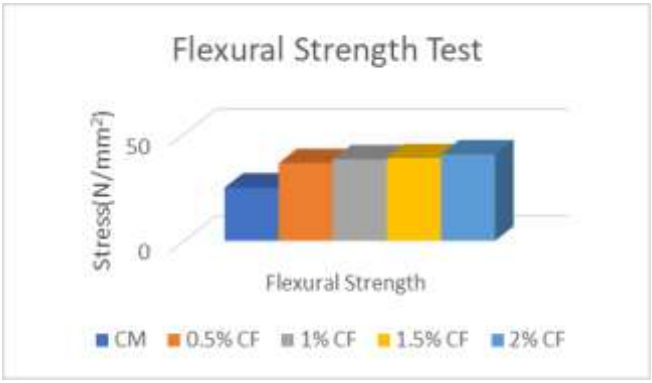

Chart-3: Flexural strength test results

Table -4: Load-deflection

Description	load (KN)	Deflection(mm)
CM	8.5	19
0.5% CF	12.4	17
1% CF	13	12
1.5% CF	13.2	11.5
2% CF	13.8	7

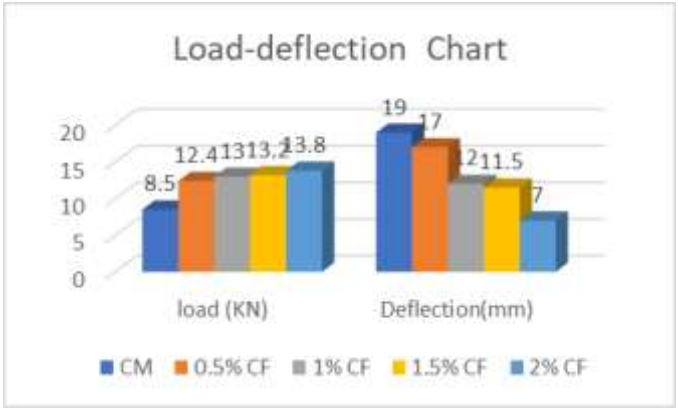

Chart-4: Load-deflection chart

5. CONCLUSIONS

- There is an increase in compressive strength by 32% when carbon fibres are added in 2% by weight of the cement.
- Increase in Tensile strength is also noted by more than 100% when 2% of carbon fibres are added.
- Deflection also reduces considerably whwn fibres are added.
- Flexural strength of the concrete is also increased by 62.5% when carbon fibres are added by 2%.
- Slump value of the concrete reduces when fibres are added therefore workability reduces which can be rectified by adding super plasticizers to the concrete.

REFERENCES

[1] Al-Oraimi S.K. and Seibi A.C. (1995), 'Mechanical characterization and impact behavior of concrete reinforced with natural fibres', Composite Structures, Vol 32, pp.165-171.

[2] Devi. V. and Soundhirarajan. K. (2018), 'Experimental Study on Structural Behavior of Shear Beam with Different Fibers Thesis', International Journal of Science and Engineering Research, Vol 6, Issue 5, pp.5687-5695.

[3] Dipti Ranjan Sahoo. and Apekshit Solanki. (2014), 'Influence of Steel and Polypropylene Fibers on Flexural Behavior of RC Beams', American Society of Civil Engineers, Vol 04014232, pp.1-9.

[4] Fatih Altun. and Tefaruk Haktanir. (2006), 'Effect of steel fibre addition on mechanical properties of concrete and RC beams', Construction and Building Materials, Vol 21, pp.654-661.

[5] Holschemacher and Mueller. T. (2010), 'Effect of steel fibre on mechanical properties of High-Strength concrete', Materials and Design, Vol 31, pp. 2604–2615.