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Study on Structural Behaviour of Aluminium Fiber in Concrete

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Abstract: Construction field is experiencing new innovations every day in reinforced concrete. Since, fibers are economic and easily recyclable, different fibers are used in making reinforced concrete depends on the applications and strength requirement. This study is going to deal with the analysis of structural behaviour of aluminium fiber in reinforced concrete. Sample concretes are going to prepared by replacing different percentages of cement with aluminium fiber for finding compressive and flexural strength.

Key words: Aluminium fiber, reinforced concrete, structural behaviour, compressive strength, flexural strength, percentages

INTRODUCTION

Low tensile strength and low strain at fracture are the two main drawbacks of plain concrete. Since, there are many microcracks in plain concrete, its tensile strength is low. Many researches are going to improve the strength of plain concrete. Partial replacement of the cement with fibers while making the concrete helps to improve the compressive and tensile strength of concrete. There are many fibers like steel, glass, etc. are used in this process depends on the application and concrete strength requirement. Properties of fiber reinforced concrete with partial replacement of coarse aggregate by steel slag is experimented and analysed by Manoj and Nandhini (2014). Compressive and tensile strength steel fiber reinforced concrete are explained by Vikrant *et al.* Effect of ordinary glass fiber on concrete is explained by Bhandari and Tajne (2014).

Experimental analysis of aluminium fiber reinforced concrete is dealt in this study. Aluminium is preferred here for analysis due to its properties like, low density, light weight, high strength and easily recyclable. Also, it is having good corrosion resistance. Mechanical properties of aluminium matrix composites, its opportunities and challenges are discussed by Surappa (2005) and Peng *et al.* (2002). Manufacturing of aluminium matrix composite materials are discussed by Wlodarczyk-Fligier *et al.* (2008).

MATERIALS AND METHODS

M20 grade concrete were prepared in different shapes such as cubes and beams by using different percentages of aluminium fiber, locally available OPC 53 grade cement and river sand. The properties of aluminium fiber are listed as:

- Appearance: silvery
- Density: 2700 kg/m^3
- Molecular weight: 26.98
- Thermal conductivity: 2.37 W/cm/K @ 298.2 K
- Poisson's ratio: 0.35

Three cubes and three beams were prepared for each set of concrete and first set of cubes and beams are included for compressive and flexural strength test after 7th day. Similarly the second set of cubes and beams are tested after 14th day and third set of cubes and beams are tested after 28th day. The results are observed and tabulated. Table 1 shows the compressive strength of cubes and Table 2 shows the flexural strength of beams. Figure 1 shows the comparison chart of compressive strength of three set of cubes. Figure 2 shows the comparison chart of flexural strength of three set of beams.

Table 1: Compressive strength of cubes

	Average compressive strength (N/mm^2)			
		Aluminium fiber concrete (%)		
No. of curing days	Control concree	0.8	1.0	1.2
7	22.44	23.72	29.64	30.86
14	28.77	31.64	36.40	40.88
28	36.61	40.67	44.47	45.59

Table 2: Flexural strength of beams

	Average flexural strength (N/mm^2)			
		Aluminium fiber concrete (%)		
No. of curing days	Control concree	0.8	1.0	1.2
7	3.46	3.43	3.74	3.95
14	4.28	4.32	4.21	4.15
28	5.86	5.88	6.23	7.18

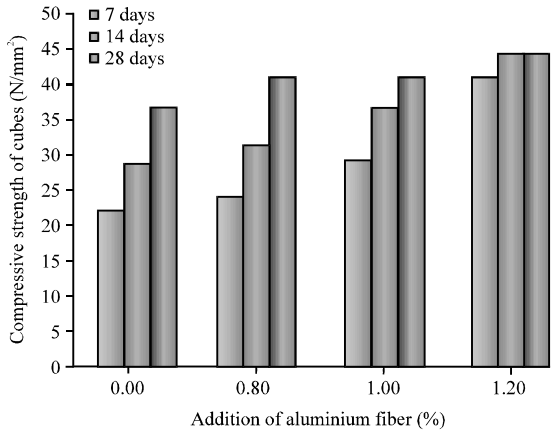

Fig. 1: Comparison of compressive strength of cubes

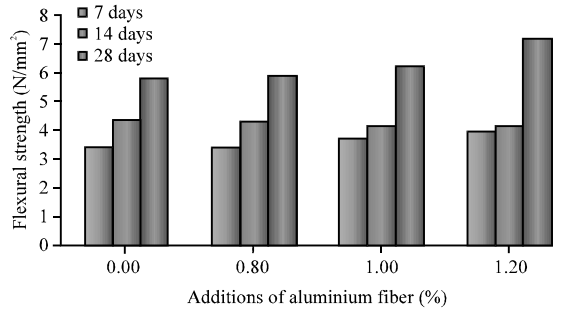

Fig. 2: Comparison of flexural strength of beams

RESULTS AND DISCUSSION

The result shows that the compressive strength of concrete increases while increasing the percentage of aluminium fiber. Also, we can see from the result that compressive strength of aluminium fiber concrete mix is greater compared to conventional concrete.

CONCLUSION

The mix design was prepared for the M_{20} grade concrete with addition of aluminium fiber with various percentages in concrete. The specimens were casted tested. The maximum flexural strength for partial replacement of fine aggregate with aluminium fiber be achieved by 1.2 is found to be greater than the conventional concrete. It achieved maximum compressive strength when there is addition of aluminium fiber 1.2%. So, the optimum percentage of addition of aluminium fiber is 1.2%.

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