Comparative Analysis of Concrete using Agricultural Waste as Additives

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Abstract - The load at which the control specimen ultimately fails is noted. Compressive strength of concrete mixes made with and without fly ash and coconut fiber with different percentage and variation in length of fiber were determined at 7, 14, and 28 days of curing. The maximum compressive strength was obtained for a mix having a fiber length of 40 mm, 10% fly ash and fiber content of 0.25% by weight and increase in strength over plain concrete and fly ash concrete without fiber content. The compressive strength of concrete is one of the most important Properties of concrete. In most structural application, concrete is used primarily to resist compressive stress. In this investigation, conventional concrete and fly ash based coconut fiber composite, concrete cubes of 150mm x 150mm x 150mm sizes were used for testing the compressive strength. The cubes are tested in a compression-testing machine of capacity 2000KN. The load has been applied at a rate of 315KN/mm. The load applied in such a way that the two opposite sides of the cubes are compressed.

Keywords - Cement replacement, Compressive strength, Workability, FRC, Coconut Fiber, Fiber Reinforcement, Fly ash, Slump, Coir.

I. INTRODUCTION

The infrastructure needs our country is increasing day by day & with concrete is a main constituent of construction material in a significant portion of this infra-structural system, it is necessary to enhance its characteristics by means of strength & durability[1]. It is also reasonable to compensate concrete in the form of using waste materials and saves in cost by the use of admixtures such as fly ash, silica fume etc. as partial replacement of cement, one of the many ways this could be achieved by developing new concrete composites with the fibers which are locally available[2].

II. METHODOLOGY & EXPERIMENTAL PROGRAM

The aim of this experimental investigation is to study the variation in strength characteristics of concrete structural elements, for the proportion of M20 grade[3]. In each mixes containing different percentages of fly ash is replaced by means of cement starting from 0% as normal concrete, i.e. controlled concrete 10%, 20% and 30%, and two percentages of natural coconut fibers 0.25% with different lengths of 20mm 40mm 60mm were used. The number of specimens casted for each case is as follows.

1. Workability of concrete test like slump cone test and compaction factor test.
2. Mechanical properties like Compressive strength,

Ordinary Portland Cement of 53 Grade confirming to IS: 8112-1989 was used in the investigation.

Cement in general can be defined as a material which possesses very good adhesive and cohesive properties which makes it possible to bond with other materials to form compact mass. Fly ash obtained from Satana Thermal Power Plant, M.P with specific Gravity = 2.3.The Aggregate which is passing through 4.75mm sieve is known as fine aggregate. Locally available river sand which is free from organic impurities is used. Sand passing through 4.75mm sieve and retained on 150micron IS sieve is used in this investigation. The coarse aggregate used in this investigation in 20mm downsize crushed aggregate and angular in shape as per Indian Standard specifications IS: 383 – 1970 [4].

Compressive Strength of Concrete (IS: 516-1959)

The compressive strength of concrete is one of the most important Properties of concrete in most structural application concrete is implied primarily to resist compressive stress[5].

In the investigation, conventional concrete and fly ash based coconut fiber composite, concrete cubes of 150mm x 150mm x 150mm sizes were used for testing the compressive strength. The cubes are tested in a compression-testing machine of capacity 2000kn. The load has been applied at a rate of 315kn/mm. The load applied in such a way that the two opposite sides of the cubes are compressed. The load at which the control specimen ultimately fail is noted. The average of three cubes is taken as compressive strength.

Compressive strength is calculated by dividing load by area of Specimen.

$$Fc = p/a$$

Table No: 32: Compressive Strength of Grade M20 as M1, M2, M3, M4, M5, M6

Mix	M-1	M-2	M-3	M-4	M-5	M-6
Fly as (%)	0	10	20	30	10	20
FIBER (%)	0	0	0	0	0.25	0.25
FIBER LENGTH	0	0	0	0	20mm	20mm
7	12.0 12.5 12.0 **Av=12.1**	12.6 12.5 12.6 **Av=12.56**	13.3 13.2 13.4 **Av=13.3**	13.7 13.8 13.9 **Av=13.8**	15.3 15.5 15.1 **Av=15.3**	14.8 14.0 14.4 **Av=14.4**
14	15.0 15.0 15.6 **Av=15.2**	16.7 16.8 16.9 **Av=16.8**	17.7 17.8 17.9 **Av=17.8**	18.4 18.3 18.5 **Av=18.4**	19.0 21.8 20.4 **Av=20.4**	19.2 20.5 18.5 **Av=19.2**
28	19.5 19.0 19.5 **Av=19.3**	20.0 21.0 22.0 **Av=21**	22.2 22.3 22.4 **Av=22.3**	22 23 21 **Av=23**	26.5 24.5 25.5 **Av=25.5**	25.0 23.0 24.0 **Av=24**

Table No. 33: Compressive strength of grade M20 as M7, M8, M9, M10, M11, M12

Mix	M-7	M-8	M-9	M-10	M-11	M-12
Fly as (%)	30	10	20	30	10	20
FIBER (%)	0.25	0.25	0.25	0.25	0.25	0.25
FIBER LENGTH	20mm	40mm	40mm	40mm	60mm	60mm
7	14.0 13.1 15.2 **Av=14.1**	17.9 18.0 17.8 **Av=17.9**	14.9 16.5 16.3 **Av=15.9**	14.5 14.4 15.2 **Av=14.7**	15.5 13.5 14.5 **Av=14.5**	13.0 15.3 14.6 **Av=14.3**
14	19.6 18.0 18.8 **Av=18.8**	22.8 22.9 22.7 **Av=22.8**	22.2 21.0 20.4 **Av=21.2**	19.5 20.7 18.6 **Av=19.6**	19.4 19.5 19.0 **Av=19.3**	19.0 20.2 18.1 **Av=19.1**
28	24.5 22.5 23.5 **Av=23.5**	26.0 28.0 27.0 **Av=27**	26.0 27.0 26.5 **Av=26.5**	24.5 23.5 25.5 **Av=24.5**	24.0 23.4 25.2 **Av=24.2**	25.0 23.8 22.9 **Av=23.9**

III. DISCUSSIONS & CONCLUSION

Compressive strength of concrete mixes made with and without fly ash and coconut fiber with different percentage and variation in length of fiber were determined at 7, 14, and 28 days of curing. The test results are given in table. The maximum compressive strength was obtained for a mix having a fiber length of 40 mm, 10% fly ash and fiber content of 0.25% by weight and increase in strength over plain concrete and fly ash concrete without fiber content.

The 7 day compressive strength of fly ash based coconut fiber concrete was found to be high as 17.9 Mpa. Which is more than ordinary concrete and fly ash concrete. Similarly 28 day compressive strength was found to be about 27 Mpa which is more than that of ordinary concrete and fly ash concrete.

The effect of replacement of cement with three percentages of fly ash and addition of coconut fibers on the compressive strength of concrete. It is clear that the replacement of cement with 30 % of fly ash reduced the compressive strength of concrete.

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