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EXPERIMENTAL STUDY ON CONCRETE USING FLY ASH AND COCONUT COIR FIBER

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Abstract - *In fast growing today's world, development of new building material, new technique and industrial or agricultural waste is being given the top priority. This is important for conservation of scarce resources and for achieving maximum disposal of waste. Energy generation is increasing day by day due to rapid industrialization. Energy generation through Thermal Power plants are very common now a days. Fly-ash is the by-product of thermal power plant which is available in large quantity in fine and course form. Fine Fly ash can be used as a binding material in concrete in the place of cement because fly ash is having Pozzolana property. The workability test, compressive and tensile strength tests were examined from the previous research papers at 7th, 14th and 28th day of curing. 5% and 10% replacement of cement with fly ash gives better result and by replacing 15% of fly ash the strength decreases. Then for improving tensile strength of concrete for 5% and 10% replacement of fly ash with cement is performed by adding coconut coir natural fibre of length 6mm and 12mm with quantity of 0.15% and 0.25% by weight of cement for M20 grade of concrete. All testing were performed for the comparison with natural concrete.*

Key Words: Fly ash, Coconut Coir fibre, Cement, compressive Strength and Tensile Strength.

1. INTRODUCTION

Concrete made with Portland cement has certain characteristics: Concrete relatively strong in compression where as weak in tension and tends to be brittle. Another reason behind weakness of the concrete is that cracks start to form when concrete is placed and before it gets fully hardened. The cracks are major factor which affects strength of concrete in large onsite applications leading to failure, generally lack of fracture and durability. The weakness in tension of concrete can be overcome by the use of conventional steel bar reinforcement and to some inclusion of a sufficient volume of fibers. In this study we are comparing natural concrete and fly ash concrete with natural fiber. Fly ash is a waste material of thermal power plant abundantly available in India. Coconut Coir (CC) is a Natural fiber available in abundant quantity. Coir is a locally available material of low cost. Use of fibers enables reliable and effective utilization of intrinsic tensile strength of the material. This study is focussing on the effects of introducing various proportions of fly ash and coir fiber on concrete. An experimental study was carried out to find its effects on compressive and tensile strength.

2. LITERATURE REVIEW

It was reported that application of polypropylene and Coir fibers improves the properties of plain concrete including tensile strength. Alhozaimy et al. observed that an addition of 0.1% of fibers in the plain concrete can increase 45% in flexural toughness of the concrete. Some researchers also reported some evidence on favourable effects of fiber addition on toughness. Mindessetal(1988) reported that compressive strength increased by about 0.25% at 0.5% volume fraction of fibers in the concrete mixture design. According to researchers investigation this project deals with the comparison of between conventional concrete, PP concrete and Coconut Coir concrete.

3. MATERIAL AND METHODOLOGY

Concrete consists of three major components, viz. water, Portland cement, and aggregates. Properties of the final product i.e. cement changes according to the change in the ratio of its components and hence consequentially help the engineer in deciding the proper use of the same according to his need. To get a certain specific property in cement, Admixtures are added and hence enhance its required characteristic.

3.1 Water: The water in the concrete mix should be clean and free of impurities. The change in water content with respect of cement decides the properties of the cement like how easily the concrete flows, but also affects the final strength of the concrete. Excess water implies to easier flow of concrete, but decreases its strength.

3.2 Portland cement: On mixing the water, cement hardens and hence all the ingredients are bounded together. Portland cement is the most common cement used and is composed of alumina, silica, lime, iron, and gypsum. Small amounts of other ingredients are also included.

3.3 Aggregates: Most of the concrete mixtures consist of both coarse and fine aggregates, and help in increasing the

strength of concrete with respect to what cement can provide alone. Nowadays, sand, gravel, crushed stone, recycled materials, including blast furnace slag, glass (mostly for decorative purposes), and ground-up concrete are used as aggregates.

3.4 Fly ash: It is a by-product of thermal power plant which is obtained from burning coal in electric power generating plant. After burning it gets cooled and solidifies into spherical glassy partial which is called as fly ash. The ash has the property similar to cement but slight change in chemical property. As compared to cement setting time, fly ash setting after adding water is slower resulting in delayed in hardening of the concrete.

Two type of fly ash are commonly used in concrete:

- Class C

- Class F

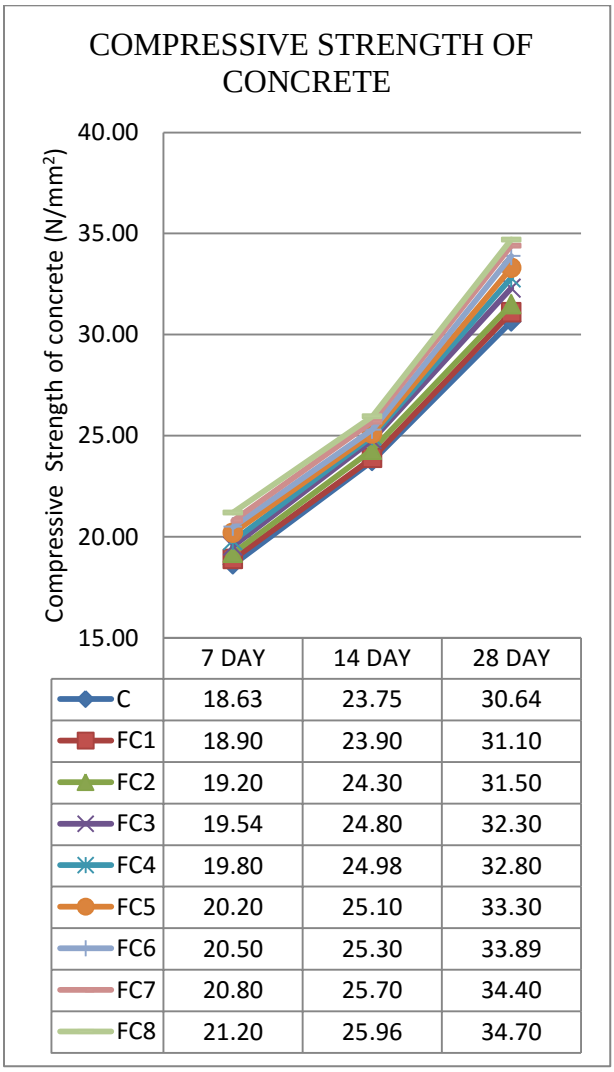
Class C are having high calcium fly ashes with carbon content less than 2%. whereas class F is having less then high calcium ashes with 10%. Class C ash is produced by burning sub-bituminous or lignite coal. Class F ash is produced by bituminous or anthracite coals. Performance properties between Class C and Class F are varying depending upon its physical and chemical properties of the ash and how ash reacts with cement when adding in concrete. Class C Fly ash has the properties as cement ie. when ash is added with water it becomes hard like cement but Class F fly ash does not.

3.5 Coconut Coir Fibre: Coir is a natural fiber extracted from the husk of Coconut fruit. Coir fiber and a corky tissue in the husk called pith. India the second highest in the world after Philippinest where fiber is abundantly available. It consists of water, fibers and small amounts of soluble solids. Because the lignin content is high, coir is more durable hano other natural fibers. Various applications of natural fibers and coir based composites will lead to improvement in the quality of life of people engaged in coir cultivation and will also ensure international market for cheaper substitution. The advantage of natural fiber is low density, low cost and biodegradability. But the main disadvantage of natural fibers is the relatively high moisture absorption. Therefore, chemical treatments are considered in modifying the fiber surface properties.

4. RESULT AND ANALYSIS

4.1 Compressive Strength of Concrete:

NAME	Fiber Size	Fly Ash	% Of Coir Fiber w.r.t	Compressive Strength Of Concrete		
				7 Day	14 Day	28 Day
C	-	0%	-	18.63	23.75	30.64
FC1	6 mm	5%	0.15%	18.9	23.9	31.1
FC2	6 mm		0.25%	19.2	24.3	31.5
FC3	6 mm	10%	0.15%	19.54	24.8	32.3
FC4	6 mm		0.25%	19.8	24.98	32.8
FC5	12 mm	5%	0.15%	20.2	25.1	33.3
FC6	12 mm		0.25%	20.5	25.3	33.89
FC7	12 mm	10%	0.15%	20.8	25.7	34.4
FC8	12 mm		0.25%	21.2	25.96	34.7



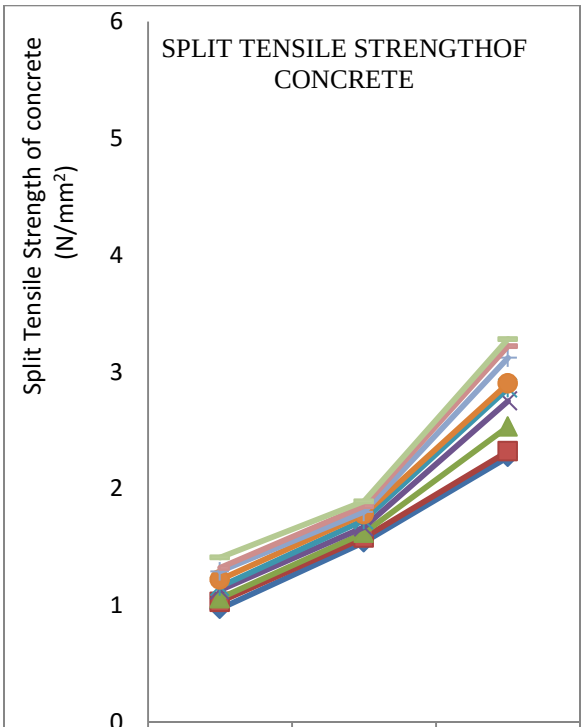
	7 DAY	14 DAY	28 DAY
C	18.63	23.75	30.64
FC1	18.90	23.90	31.10
FC2	19.20	24.30	31.50
FC3	19.54	24.80	32.30
FC4	19.80	24.98	32.80
FC5	20.20	25.10	33.30
FC6	20.50	25.30	33.89
FC7	20.80	25.70	34.40
FC8	21.20	25.96	34.70

Graph 1: Compressive Strength of Concrete

The Coconut Coir is used as reinforcement with fly ash, with two sizes of coir used 6mm and 12mm with 0.15% and 0.25% of quantity by weight of cement. The compressive strength is increases as length and quantity of fibre increases. The Compressive Strength are 30.64N/mm2, 31.10 N/mm2, 31.50 N/mm2, 32.30 N/mm2, 32.80 N/mm2, 33.30 N/mm2, 33.89 N/mm2, 34.40 N/mm2 and 34.70 N/mm2 for C, FC1, FC2, FC3, FC4, FC5, FC6, FC7 and FC8 respectively at 28th day of curing. The maximum Compressive strength gained in the ratio of FC8, the strength is 21.20 N/mm2, 25.96 N/mm2 and 34.70 N/mm2, which is more than normal concrete 'C' that is18.63N/mm2, 23.75 N/mm2 and 30.64 N/mm2 at 7th , 14th and 28th day of curing respectively. It indicates that the Compressive Strength increases as size and quantity of fibre reinforcement increases.

4.2 Tensile Strength of Concrete:

NAME	Fiber Size	Fly Ash	Quantity Of Coir Fiber w.r.t cement	Split Tensile Strength Of Concrete		
				7 Day	14 Day	28 Day
T	-	0%	-	0.97	1.54	2.27
FC1	6 mm	5%	0.15%	1.03	1.58	2.32
FC2	6 mm		0.25%	1.06	1.62	2.53
FC3	6 mm	10%	0.15%	1.13	1.67	2.75
FC4	6 mm		0.25%	1.16	1.73	2.86
FC5	12 mm	5%	0.15%	1.22	1.78	2.9
FC6	12 mm		0.25%	1.29	1.8	3.12
FC7	12 mm	10%	0.15%	1.32	1.85	3.22
FC8	12 mm		0.25%	1.41	1.89	3.28



	7 DAY	14 DAY	28 DAY
T	0.97	1.54	2.27
FC1	1.03	1.58	2.32
FC2	1.06	1.62	2.53
FC3	1.13	1.67	2.75
FC4	1.16	1.73	2.86
FC5	1.22	1.78	2.9
FC6	1.29	1.8	3.12
FC7	1.32	1.85	3.22
FC8	1.41	1.89	3.28

Graph 2: Split Tensile Strength of Concrete

The Coconut Coir is used as reinforcement with fly ash, with two sizes of coir used 6mm and 12mm with 0.15% and 0.25% of quantity by weight of cement. The Split Tensile strength is increases as length and quantity of fibre increases. The Split Tensile Strength are 2.27N/mm2, 2.32 N/mm2, 2.53 N/mm2, 2.75 N/mm2, 2.86 N/mm2, 2.9 N/mm2, 3.12 N/mm2, 3.22 N/mm2 and 3.28 N/mm2 for C, FC1, FC2, FC3, FC4, FC5, FC6, FC7 and FC8 respectively at 28th day of curing. The maximum Split Tensile strength gained in the ratio of FC8, the strength is 1.41N/mm2, 1.89N/mm2 and 3.28 N/mm2, which is more than normal concrete 'C' that is0.97 N/mm2, 1.54 N/mm2 and 2.27 N/mm2 at 7th , 14th and 28th day of curing respectively. It indicates that the Split Tensile Strength increases as size and quantity of fibre reinforcement increases.

5. CONCLUSION

Many researchers have worked on fly ash replacing the cement in concrete. As the fly ash is a waste product of thermal power plant and its available in amble amount. researchers have proved that 5% and 10% replacement of cement by fly ash gives better result. thus to increase the tensile as well as compressive strength we are using coconut coir fiber of two lengths that is 6mm and 12mm and two proportions 0.15% and 0.25%. the results were obtained as following:

1. Coconut nut coir is used in two lengths and two proportions of 6mm and 12 mm length and 0.15% and 0.25% respectively. 0.25% of coir fiber used with 12mm length givers better result fo both 5% and 10% replacement of cement.
2. Fly ash replacing cement by 10% and 0.25% coconut coir in 6mm length and 12mm length, the compressive strength is 33.80N/mm2 and 34.70N/mm2 respectively at 28th day of curing, FC8 gives high compressive strength.
3. Fly ash replacing cement by 10% and 0.25% coconut coir in 6mm length and 12mm length, the tensile strength is 2.86N/mm2 and 3.28N/mm2 respectively at 28th day of curing, FC8 gives high tensile strength.
4. From the above result we get to know that 10% of fly ash repalced with cement with 0.25% of coconut coir fiber gives the best result for both compression and tension.
5. Use of coconut coir and fly ash reducing the cost of construction as well as the environmental issues.

6. REFERENCE

1. Gopalan, M. K., Haque, M. N. (1986), ―Strength development of fly ash concretes‖, Engineering Materials and Structures, Vol.19, No.1, pp. 33-37.
2. Mehta, P. K. (1985), ―Influence of Fly Ash Characteristics on the Strengthof Portland FlyAsh Mixtures‖, Vol.15, pp.669 – 674.
3. Agopyan, V, Vegetable fibre reinforced building materials- development in Brazil and other Latin American countries. Concrete Technology and Design Natural Fibre Reinforced Cement and Concrete, 5, 1998, pp. 208-240.
4. Bhowmick B.B. and Debnath C. R., Properties of coir, Indian coconut journal, 15, (5), 1984. p. 12.

7. BIOGRAPHIES

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