AN EXPERIMENTAL STUDY ON FIBER CONCRETE USING COCOUNT COIR

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ABSTRACT

Investigations to overcome the brittle response and limiting post-yield energy absorption of concrete led to the development of fiber reinforced concrete using discrete fiber within the concrete mass. Out of the commonly used fiber, easily available low cost natural fiber is renewable source materials. Though these fiber are ecologically advantageous. Utilizing coconut coir in concrete production not only solves the problem of disposing this solid waste but also helps conserve natural resources.

The major quantity of wastes generated from agricultural sources are sugarcane molasses, paddy, wheat straw husk, vegetables wastes, food products, tea, oil production, jute fiber, groundnut shell, wooden mill waste, coconut husk, cotton stalks etc. The new and alternative building construction materials developed using agro-industrial wastes have ample scope for introducing new building components that will reduce to an extent the costs of building materials. One such alternative is coconut coir which is a form of agricultural solid wastes. It is one of the most promising agro wastes with its possible uses as pond ash in the production of concrete

This project presents adding and coir fibers to the percentage of 0.5, 1.0, 1.5, 2.0, % to the weight of the concrete. Physical and chemical properties of and coir fibers have been studied. A concrete mix has been designed to achieve the grade of M30 as required by IS 10262-2009. In the phase two contains to determine the Compressive Strength, Split Tensile Strength and Flexural Strength of the concrete at 7, 14 and 28 days.

***Keywords**: Concrete, Coir Fiber, Compressive Strength, Split Tensile Strength, Flexural Strength*

INTRODUCTION

Fiber reinforced concrete (FRC) is concrete containing fibrous material which increases its structural integrity. It contains short discrete fibers that are uniformly distributed and randomly oriented. Fibers include fibers, glass fibers, synthetic fibers and natural fibers. Within these different fibers that character of fiber reinforced concrete changes with varying concretes, fiber materials, geometries, distribution, orientation and densities.

Fiber reinforced concrete with mono fiber system provides limited enhancement of properties. Therefore for improved performance combining two different fibers at suitable proportion in concrete can offer more attractive engineering properties because the presence of one fiber enables the more efficient

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utilization of the potential properties of other fiber.

The fibers used are mainly fibers, coconut coir fibers. Among these fibers , polypropylene and polyolefin fiber shave attracted most attention due to the outstanding toughness of concrete reinforced with them. But it has been found that fibrous concrete has more toughness by preventing and controlling the initiation and propagation of cracks. However, fibers in concrete contribute more in resisting flexural and impact loads and prevents propagation of cracks only after concrete is hardened and can stop the development of micro cracks due to drying shrinkage. The coconut coir fibers (low modulus fibers) have got big advantage in resisting impact loads, because they have longer elongation under a given load which means they can absorb more energy without fracture. They are very good in resisting shrinkage and temperature cracks in fresh concrete. Therefore the low modulus fibers can be combined with fibers advantageously.

LITERATURESURVEY

S.Kandasamy (2009)

From this extensive experimental study, it is well known that natural fibers enhance all the strength and flexural performance of concrete. The effect of curing ages on mechanical properties such as compressive strength, split tensile strength, modulus of rupture and flexural performance and micro structural properties have been ascertained and discussed. The following conclusions are drawn from this investigation:

At all the curing ages, both the natural fibers such as coir and sugarcane fibers enhance all the three mechanical strength properties such as compressive strength, split tensile strength, modulus of rupture and flexural Performance. Though the natural fibers enhance the strength properties at earlier curing ages, the rate of increments are lower than conventional concrete specimen at later curing ages. The flexural performance of the natural fiber reinforced concrete beam specimens do not yield much difference at the three curing ages such as 28 days, 1 year and 2 years. They possess a little bit difference at the yielding stage only. The tensile strength of conventional concrete is 2.86 Mpa at 28 days of curing age. Coir fibrous concrete specimen gives the 28 days tensile strength as 3.28-3.92 Mpa..

Bujang I.Z., Awang, M.K, Ismail A.E (2010)

The goal of this paper is to determine the mechanical properties and dynamic characteristics of a proposed combined polymer composite which consist of a polyester matrix and coconut fibers (also known as coir fibers). The influence of fibers volume on the mechanical properties and dynamic characteristic of the composites was also evaluated. Composites with volumetric amounts of coconut fiber up to 15% were fabricated and they were arranged in randomly oriented discontinues form. Tensile test was carried out to determine the strength of

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material, while experimental modal analysis was executed to obtain the dynamic characteristics of the composite material.

The effect of coir fibers volume on mechanical properties and dynamic characteristic of composite were studied. The results were found that the mechanical properties have a strong association with the dynamic characteristic. Both of the properties are greatly dependent on the volume percentage of fibers. In general, the composite having a coir fibers volume of 5% showed the best result

Jia Yao , Yingchang Hu, Wen lu (2012)

The present review focuses on the progress of coir fiber in the development of composites, an effort to utilize the advantages offered by renewable resources for the development of bio composite materials. It is a challenge to the creation of better materials for the improvement of quality of life with better mechanical properties elasticity.

G.Ramakrishna, T.Sundararajan and Usha Nandhini (2014)

Flow value, cohesion and angle of internal friction were determined for three different mix ratios and four different aspect ratios and fiber contents. Based on the rheological properties of fresh mortar, it was recommended to use shorter fibers with low fiber-content for achieving workability and higher fiber content for better cohesiveness in wet state.

Experimental investigations on the compressive strength and elastic modulus of coir and fiber reinforced concretes for various volume fractions. It was observed that both the experimental and analytical values of elastic modulus had shown 15% discrepancy, which can be regarded as comparatively small.

MATERIALPROPERTIES

Cement

Cement used is a Dalmia cement 53 grade (OPC53). Setting time and specific gravity of cement is determined. Initial setting time of cement is 30 minutes and the final setting time of cement is 10 hours. The specific gravity of cement is 3.15.

Fine Aggregate

Specific gravity and sieve analysis of fine aggregate is determined. The specific gravity of fine aggregate is 2.76. By using sieve analysis test result the river sand confirming to Zone-2 as per IS383-1970.

Coarse Aggregate

Specific gravity of coarse aggregate is determined. The specific gravity of coarse aggregate is 2.8.

Super plasticizer

In the marsh cone test, cement slurry is made and its flow ability is found out. The do seat 1% of super plasticizers is optimum dose for that cement.

MIX DESIGN

It is defined as the process of selecting suitable ingredient so concrete and determining the irrelative proportion with the objects of

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producing concrete of certain minimum strength and durability as economically as possible.

Mix Design Calculation

Mix design is prepared by using IS10262-2009.

1) Water = 158L/m^3

2) Cement = 351kg/m^3

3) W/c ratio = 0.4

4) aggregates

Coarse aggregate fraction = 0.64

Fine aggregate fraction = 1-0.64 = 0.36

5) Volume of concrete = 1m^3

a) Volume of cement = 351/3.51x1000 = 0.1114m^3

b) Volume of water = 158/1x1000 = 0 .158m^3

c) Volume super platicizers = 0.004m

d) Volume of fall in aggregate= 1-(0.1114+0.158+0.004) = 0.726m^3

e)Volume of coarse Aggregate

= 0.726x0.442x2.65x1000 = 850.36kg/m^3

f) Mass of fine aggregate

= 0.726x0.558x2.6x1000 = 1081.36kg/m^3

Mix Proportions

Table-1 Mix proportion table

Wat	Cem	Fine	Coars
158	351	850.3	1081.

EXPERIMENTAL WORK ON CONCRETE

Slump Test

The slump values of concrete with various fiber proportions are tabulated.

Table-2 Slump test table

Percentage addition of coir fiber	Slump (mm)
0	22
0.5	18
1.0	16
1.5	14
2.0	12

Compressive Strength Test

The compressive strength values of concrete with various fiber proportions are tabulated.

Table-3 Compressive strength test table

Percentage addition of coir fiber	Age at curing (days)	Compressive strength (N/mm)
0	7	22.34
	14	26.98
	28	32.81
0.5	7	23.11
	14	30.12
	28	34.12
1.0	7	28.45
	14	34.56
	28	37.23
1.5	7	24.78
	14	31.45
	28	33.45
2.0	7	24.34
	14	29.50
	28	32.90

Split Tensile Strength Test

The split tensile values of concrete with various fiber proportions are tabulated.

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Table-5 Split Tensile Strength Test Table

Percentage addition of coir fiber *fiber*	Age at curing *(days)*	Split tensile strength *(N/mm)*
0	*7*	*1.56*
	14	*1.89*
	28	*2.61*
0.5	*7*	*2.12*
	14	*2.68*
	28	*3.33*
1.0	*7*	*2.42*
	14	*3.27*
	28	*3.85*
1.5	*7*	*2.21*
	14	*2.99*
	28	*3.51*
2.0	*7*	*2.04*
	14	*2.72*
	28	*3.21*

Fig.1: compressive Strength Test

Fig.2: Split Tensile Strength Test

CONCLUSION

Compressive strength of M1, M2, M3, M4, M5 and M6 at 28th days is 37.85, 36.42, 37.21, 37.84, 38.21 and 38.95 N/mm^2 respectively. From the results, it is shown that compressive strength of the cubes increases, when the percentage of coconut coir increases. It is well known that natural fiber coconut coir enhances all the strength performance of concrete. Lots of environmental benefits as coconut coir are eco-friendly organic material. Replacement of cement by pond ash decreases the problem of scarcity of cement. In addition to that pond ash can be eco friendly.

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