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Coconut Fiber in Concrete to Enhance its Strength and making Lightweight Concrete

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Abstract:-High cost is the dominating factor of convectional construction material which is affecting the housing system. As an alternative method to overcome this drawback which is decreasing the strength of building, it is necessary to make research on any alternating materials which will decrease the cost and increase the strength of concrete. This convectional construction material also made some problem to the environment cannot lead to proper disposal and many more results on increasing the impact on the environment. But coconut fiber which is natural fiber makes no effect on environment and also increases the strength of concrete compare to use of convectional fiber.

Concrete cylinders of dimension 150mm×300mm were cast to take the compressive as well as tensile strength test and it shows that the compressive strength of concrete increases with curing age but decrease with increase in quantity of coconut fiber ,whereas its tensile strength increases. The optimum tensile strength that we get was 3.0 MPa .This research is carried out to bring awareness in field of Civil Engineering about the coconut fiber as good and hazardous less construction material.

Keywords:-coconut fibres; tensile strengths; concrete;

I. INTRODUCTION

Now a day's many researches are made on the natural fiber which are easily available in large quantity and are very cheap. Among this natural fiber which can be used for construction purpose is coconut fiber which can also be known with other names as Coir, Cocos nucifera, Arecaceae (Palm) .They are available commercially in three forms ,namely decorticated (mixed fiber),bristle (long fiber),mattress(relatively short fiber).They can be taken in use according to their requirement and the brown fiber are mostly used which are obtained from mature coconut .According to the official website of International Year For Natural Fiber 2009 the cultivation of coconut tree are around 12 million worldwide which produces 5,00,000 tonnes of coconut fiber annually.

This coconut fiber can be used in the concrete which is very important part of any construction .Normally, in convectional reinforced concrete we use steel bars which increase the weight as well as the cost of the concrete which cannot be easily affordable to all rulers as well as urban civilians.

Fig. 1. Coconut Tree, Coconut and Coconut fibres

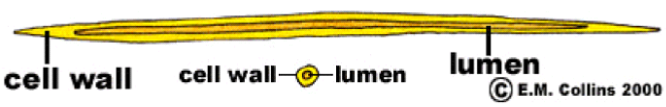

Fig. 2. Longitudnal and Cross-section of a Fibre Cell
[Afa Austin Waifielate Bolarinma Oluseun Abiola (2008)]

As we know that concrete which is usually made by mixing cement, water, fine and coarse aggregate and sometimes admixture in their right proportion is major construction material. As everyone known that we live in concrete age, then branch of Civil Engineering "Concrete Technology" becomes the backbone for development of infrastructure of every country.

But due to increasing in rate of cement it becomes an obstacle for infrastructural development in the developing countries. And also cement procedures greenhouse effect which pollute the air and contribute to environmental as well as human hazardous.

But to overcome this, many researches has been made on coconut fiber flu ash also which reduces the use of convectional cement and reduces the cost of concrete as well.

The overall goal for this research is to make more and more awareness about the advantages and uses of coconut fiber and introducing it as a cheap and easily available natural fiber which did not affect the environment.

II. LITERATURE

Research 1

The investigation by Reis (2006) characterise the mechanical properties of epoxy polymer concrete reinforced with natural fiber (Coconut, Sugarcane bagasse, banana fiber).Which conclude that fracture toughness and fracture energy of coconut fiber reinforced polymer concrete where higher than that of other reinforced polymer concrete and there is 25% increase in flexural strength with coconut fibers only .

Research 2

With different fibers volume fraction ranging from 0.5% to 2% , Baruah and Talukdar (2007) performed an experiment to investigate the static properties of plain concrete (PC) and fiber reinforced concrete (FRC).They use the natural fibers (jute and coir fibers only).

They conclude that CFRC with 2% fiber shows better result that all volume fractions. There is increase in 13.7%, 22.9%, 28.0%, 32.7% in strength, splitting tensile strength, modulus of rupture using four point loud test and shear stress respectively as compare to PC.

Research 3

Scrap tires and polyolefin properties of concrete composites had been determined by Zengh (2008) and Yan (2000) respectively.

Zengh conclude that crushed rubberized concrete and damping ratio grinded will reach as high as 144% and 75% respectively with respect to PC.

With increase in damping decreases in response frequencies for studied FRC composite was founded by Yan

Research 4

After an experiment conducted by Gunasekaran and Kumar in 2008 they found that there is 24% high water absorption by concrete reinforced with coconut fiber compare to PC . They found that compressive strength of concrete increases with 19.1% than PC after curing cube for 28 days.

Research 5

Research carrier out by Adevemi (1998) for one mix ratio (1:2:4) using suitable coconut fiber for either fine or coarse aggregate in concrete production. They conclude that the weight of that concrete is light with compare to PC.

III. RESEARCH METHODOLOGY

By testing the tensile strength of the specimen, the experimental investigation was carried out.

3.1 Material

Ordinary Portland cement conforming to grade 43 was used. The fine aggregate was natural river sand with bulk specific gravity 2.605, while the coarse aggregate was crushed granite having a maximum size of 20mm (passing through sieve 20mm and retained at sieve10mm). The fibres were coconut fibres with diameter ranging between 0.29mm and 0.83mm and length between 6mm and 24mm and having approximate 150 as aspect ratio. Potable drinking water available at laboratory spot was used.

3.2 Mix Design And Casting Procedure

The concrete of grade M30 was designed by same mix design for Plain Concrete. The weight of content required per block is shown in table

Mix Proportions for One Cum of Concrete Block (Volume of One Block=0.0053m^3)	
1. Mass of Cement in kg/block	**2.25**
2. Mass of Water in kg/block	**1.125**
3. Mass of Fine Aggregate in kg/block	**4.68**
4. Mass of Coarse Aggregate in kg/block	**6.93**
•Mass of 20mm in kg/block	**4.62**
•Mass of 10mm in kg/block	**2.31**
5. Water Cement Ratio	**0.45**

The use of coconut fiber in this mixture is 5% by weight of cement in concrete. For plain surface fly ash is used , but its quantity is very small as 2-3% of cement .If the weight of fly ash exceeds it will decrease concrete strength and it cannot be used as cement.

All the materials were mixed properly by adding the water in the Concrete mix pan. The slump test was 60mm. For preparing CFRC, a layer of coir fibres was spread in the pan uniformly so that it should get uniformly distributed all over in concrete. Adding three fourth of water according to water cement ratio the mixture was rotated for 5-6 minutes. But after this the mixture is not workable so some more water is added in increment of 0.04 in water cement ratio to make CFRC workable. CFRC was poured into the cylindrical moulds .After pouring the CRFC up to 50-60 mm in cylindrical mould of 300mm*150mm the concrete is compacted by using rod to remove air voids from the CFRC.This compaction step was carried out after rise of concrete by 50-60 mm in cylindrical block. Like this the three specimens were filled by concrete. This blocks were kept to dry for one day and then all specimens were cured for 28 days before testing.

IV. RESULTS

The results that we get when tensile test is done on the concrete block are as follows:

Sr. No.	Diameter of block (mm)	Length of block (mm)	Load applied (KN)
1	150	300	229.6
2	150	300	208
3	150	300	228.7

To calculate the tensile strength we use formula:

Tensile strength= (2*Load applied)/ (3.14*diameter*length)

We get the strength of those cylindrical blocks as average is **3.1 MPa**.

V. CONCLUDING REMARK

Following conclusions have been derived by the investigation and experimental results:

- Coconut-fiber addition in the concrete increases the many properties of the concrete such as torsion, toughness and notably tensile strength which is the main properties of the concrete.
- Due to the uniform diameter property of the coconut fiber there will be uniform distribution of the reinforcement throughout in the concrete which decrease the voids and make the concrete more tough.
- Sometimes, it is noted that the coconut fiber which is to be used in the concrete will be available priceless or of negligible price which will make the concrete economy and as it is natural it will not create any pollution in the environment.
- It is noted that if there is increase in the percent of coconut fiber in the concrete than 3% of cement there is decrease in the strength of the concrete which make it waste.
- The use of coconut fiber as reinforcement in the concrete will decrease the application of steel nearby 2% which is affordable w.r.t the simply steel reinforced concrete and also increase the strength of the concrete as discussed above.
- But it is not possible to use these fiber in the concrete which is used to build the malls, bunglows, commercial buildings etc. because it will not give the required strength but can de use to reinforce the non-structural components.

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