Middle-East Journal of Scientific Research
24 (Recent Innovations in Engineering, Technology, Management & Applications): 148-151, 2016
ISSN 1990-9233; © IDOSI Publications, 2016
DOI: 10.5829/idosi.mejsr.2016.24.RIETMA123

Experimental Studies on High Performance Concrete Using Natural Fibre (Coir Fiber)

[1]G. Venkatesan, [2]R. Regupathi, [3]V. Padmashri, [3]T. Neelambari and [3]D. Monisha

[1]Department of Civil Engineering, Priyadarshini Engineering College,Vaniyambadi, India
[2]Department of Basic Engineering, College of Fisheries Engineering,
Tamil Nadu Fisheries University, Nagapattinam, India
[3]UG Students, Department of Civil Engineering, Priyadarshini Engineering College, Vaniyambadi, India

Abstract: The aim of this project is to acquire knowledge for designing low cost but safe buildings using natural fiber can be one possible material which are cheap and locally available. Among all natural fiber coir fiber are selected because of its highest ductility strength. The dynamic behavior of coir fiber reinforcement concrete (CFRC) structural member is practically unknown.in this work the effect of fiber content on properties of CFRC is studied. To evaluate the efficiency of coir fiber in improving the properties of concrete the high performance of plain concrete is used as reference compressive strength, splitting tensile strength, modulus of rupture were determined for all CFRC and PC specimens.

Key words:

INTRODUCTION

Generally concrete is good in compression but weak in tension. Natural fiber reinforcement concrete structural can be solution,which requires suitable quantities of fiber in concrete [1]. Certain quantity of fiber can be beneficial for enhancing the properties of plain concrete but it is not necessary that all properties will be improved, the additional of fiber may increase certain properties and at the same time may decrease other once [2]. Therfore the fiber in appropriate quantity should be selected(i.e)fiber content of 2% and 3% by weight of cement and having a length of 7.5cm are used to prepare CFRC [3]. The trend goes beyond the practice of design and construction, since the awareness of the current population is a crucial factor for the success of this tendency. Sustainable building systems can have a direct implication on the betterment of livelihood conditions of communities [4]. Unfortunately,the extraction of natural aggregates has lead to establishing human-made quarries thathavedrastic environmental impact on the nature and surroundings. This Therefore, aim of this research is to focus on creating or leading the way to find solutions and means for a better sustainable construction design. To overcome the difficulty, an economical but safe constructional material is needed [5]. Natural fibers can be one possible material, as they are cheap and locally available in many countries [6]. The paper reports on preliminary tests performed to produce a sustainable "green" concrete material using natural fibers.

Objective and Scope of the Study: The main aim of the project is to improve the tensile properties of concrete by adding coir fibre. To produce a sustainable "Green concrete material "using natural fibre (coir) will increase the ductile strength and reduce the life cost of the structure. This project will make others to increase the interest in research natural fibre and increase the use of naturally available materials

Ingredients Used in Concrete

Cement: Cement is the most important ingredient in concrete. One of the important criteria for the selection of cement is its ability to produce improved microstructure in concrete.

Properties of Cement

Specimen:	OPC 53 GRADE
Normal consistency:	30.5%
Initial setting time:	1 hr 31 min
Final setting time:	2 hr 37 min
Specific gravity:	3.12

Corresponding Author: G. Venkatesan, Assistant Professor, Department of Civil Engineering, Priyadarshini Engineering College, Vaniyambadi, India.

Fine Aggregate: The sand obtained from river beds is used as fine aggregate. The fine aggregate along with the hydrated cement paste fill the space between the coarse aggregate. River sand was used as the natural fine aggregate. Its properties were tested as per IS: 2386.The test results of sieve analysis are presented in below tables

IS Sieve Designation	Zone I	Zone II	Zone III	Zone IV
10 mm	100	100	100	100
4.75 mm	90-100	90-100	90-100	95-100
2.36 mm	60-95	75-100	85-100	95-100
1.18 mm	30-70	55-90	75-100	90-100
600 µm	15-34	35-59	60-79	80-100
300 µm	5-20	8-30	12-40	15-50
150 µm	0-10	0-10	0-10	0-15

Grade Limits of Fine Aggregate as per IS 383 – 1970

IS Sieve Size (mm)	Percentage of Passing	Requirement as per zone II (IS 383-1970)
10mm	100	100
4.75mm	98	90-100
2.36mm	83.27	75-100
1.18mm	67.1	55-90
600 microns	39.7	35-59
300 microns	15	8-30
150 microns	3.4	0-10
75 microns	2.10	

Sieve Analysis of Fine Aggregate

Properties of River Sand: The physical properties fine aggregate of were done according to IS 2386-1963.

Bulk density: 1.760 Kg/lit

Specific gravity: 2.53 (Surface Saturated dry Condition Method)

Coarse Aggregate

50% of 20mm and 50% of 10mm aggregate for the preparation of concrete.

Properties of coarse aggregate: For 20mm

Bulk density: 1.628 kg/lit

Specific gravity: 2.75(Surface Saturated Dry Condition Method)

Specific gravity: 2.72 (Pycnometer method) By using Sieve Analysis we confirm the 20mm

Aggregate as per code IS 383-1970

Water: Water conforming to the requirements is found to be suitable for making concrete. It is generally stated that water fit for drinking is fit for making concrete. For the present investigation, locally available potable water is used.

Water absorption test Results

- For fine aggregate -1.320%
- For 20mm coarse aggregate-0.220%
- For 10mm coarse aggregate-0.536%

Admixture

Properties of Admixture

Name - Rheobuild -1125

Type -Water reducing agent

Manufactured company-BASF product

Base- Napthalene

Workability --Produce high workable flowing concrete mix and require no compaction

Chloride --NIL as per BIS:456 and BS:5075

Coir fibre

Coconut fibre is extracted from the outer shell of the coconut.

Common Name - Coir

Scientific Name - Cocos Nucifera

Plant Name - Arecaceae

There are two types of coconut fibre brown fibre extracted from matured coconut and white fibre from immature coconut. Brown fibre are thick, strong and high ductile strength but white fibre are smoother and finer but also weaker. So in engineering brown fibre are mostly used.

Percentage of coir fibre added:

- 2% coir fibre by the weight of cement
- 3% coir fibre by the weight of cement

METHODOLOGY

Test done for the specimens

- Compression test
- Flexural strength or modulus of rupture
- Split tensile test

Requirement of materials for one meter ^{3} of concrete

Grade – M40

Water/cement ratio - 0.40

Cement – 450kg/m^3

Coarse aggregate:-

For 10mm – 557.57kg/m^3

For 20mm - 575.95kg/m^3

Fine aggregate – 694.11kg/m^3
Free water – 180
Admixture – 0.5-1.2%

Mix ratio
Cement: F.A: C.A: Water
1: 1.52: 2.52: 0.4

RESULT AND DISCUSSIONS

Compressive Strength for 28 Days: Concrete cube of size 150mm x 150mm x 150mm were cast for M40 grade of concrete. The plain concrete, 2% of CFRC and 3% of CFRC were tested for 7days and 28th days' compressive strength. The 28days results were compared in below charts.

Flexural Strength for 28 Days: Concrete beams of size 150mm*150mm*700mm were cast for M40 grade of concrete. The plain concrete, 2% of CFRC and 3% CFRE were tested for 7 days and 28 days flexural strength. The 28 days results are given in charts. The flexural strength of concrete was compared.

Split Tensile Strength for 28 Days: Concrete cylinder of diameter 100mm dia*200mm height were cast M40 grade of concrete. The plain concrete, 2% of CFRC and 3% CFRC were tested for 7days and 28 days split tensile strength. The 28 days results are given in charts. The split tensile strength of concrete was compared.

Comparison of Results
Compressive Strength: Concrete cube of size 150mm x 150mm x 150mm were cast for M40 grade of concrete. The plain concrete, 2% of CFRC and 3% of CFRC were tested for 7days and 28th days compressive strength.The7 days and 28 days results were compared in below charts.

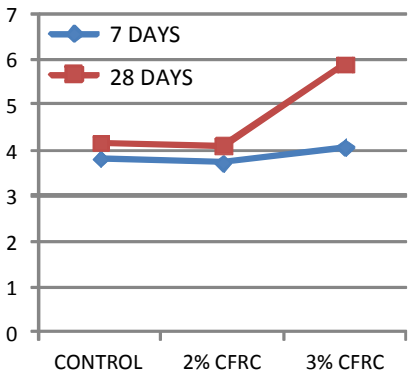

Fig. 1: Comparison of compressive strength in line charts

Flexural Strength: Concrete beams of size 150mm*150mm*700mm were cast for M40 grade of concrete. The plain concrete, 2% of CFRC and 3% CFRE were tested for 7 days and 28 days flexural strength. The 7 days results are given in charts. The flexural strength of concrete was compared.

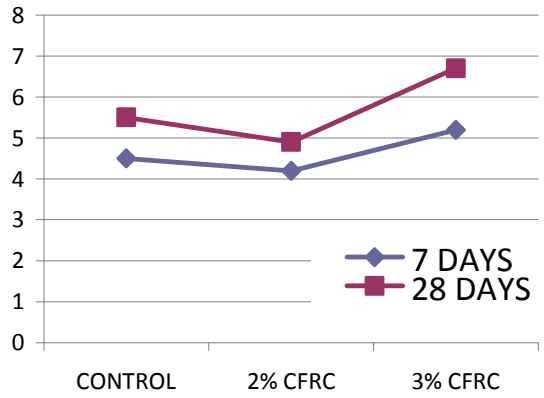

Fig. 2: Comparison of flexural strength in column charts

Split Tensile Strength: Concrete cylinder of diameter 100mm dia*200mm height were cast M40 grade of concrete. The plain concrete, 2% of CFRC and 3% CFRC were tested for 7days and 28 days split tensile strength. The 7 days results are given in charts. The split tensile strength of concrete was compared.

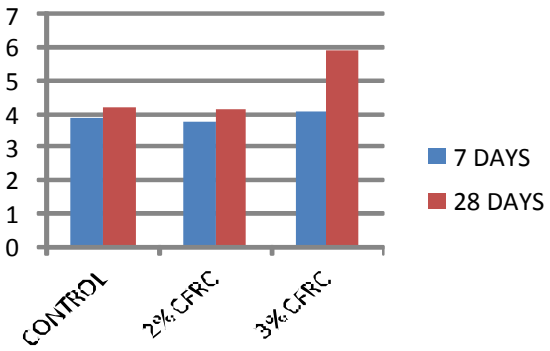

Fig. 3: Comparison of split tensile strength in line chart

CONCLUSION

The study has presented the results of an experimental program investigating, the mechanical properties such as compressive strength and split tensile strength and flexural strength for rain forced concrete incorporating different volume percentage of coconut fibre. Based on the experimental results and observations, the following conclusions can be stated.

- The curing period of 7 days and 28 days results shows that the 3% CFRC are higher in strength(compressive, split tensile and flexural) when compared to 2% CFRC and the plain concrete. The comparison showed that the volume of 3% coe fibre reinforce concrete had the optimum set of mechanical properties.
- Coconut fibre reinforced concrete has shown less number of crack developments. So it can be a good alternative in construction area. Further work needs to be done in order to observe the effects of coconut fibre with various lengths and volume.
- Based on the comparison of weight it is concluded that coconut fibre has the potential to be used in the production of light weight concrete.

Future Suggestion:

- The workability on the replace of 2% and 3% coir fibre were not optimum without the presence of admixture. Future investigation on the reduction of admixture along with the coir fibre can be done to increase the workability in concrete.
- Further work need to be done in order to observe the effect of coconut fibre on concrete with various length and volumes.

REFERENCES

1. Singh Manindra Kumar, Chandraul Kirti, 2015, Experimental Study of Light Weight Concrete using Natural Fiber, at International Journal for Research in Applied Science & Engineering Technology, Vol 3, Issuse 2, PP. 83-89.
2. Dr. H.M. Somasekharaiah Danagouda, 2015. Experimental Investigation on Strength Characteristics of Metakaolin Based High Performance Concrete with Steel and Polypropylene Fibres, at International Journal of Innovative Research in Science, Engineering and Technology, 4(9): 8565-8574.
3. Yasir, Khan and M. Anwar Ansari, 2014. A Critical Review on Experimental Studies of Strength and Durability Properties of Fibre Reinforced Concrete Composite, at International Journal of Research in Engineering and Technology, 2: 20-26.
4. Subbulakshmi, T., Dr. B. Vidivelli and K. Nivetha, 2014. Strength Behaviour of High Performance Concrete using Fibres and Industrial by Products, at International Journal of Engineering Research & Technology, 3(8): 1219-1224.
5. Shende, A.M. and A.M. Pande, 2012. Experimental Study on Steel Fiber Reinforced Concrete for M-40 Grade, at International Refereed Journal of Engineering and Science, 1(1): 043-048.
6. Shende, A.M. and A.M. Pande, 2011. Experimental study and prediction of tensile strength for steel fiber reinforced Concrete, at International Journal of Civil and Structural Engineering, 1(4): 910-917.