International Journal of Engineering, Management & Technology (IJEMT)
www.ijemt.com, Volume 1 Issue VI, August 2022, PP 10-16, ISSN (Online): 2583 – 4517

STUDY ON COMPRESSIVE STRENGTH OF COCONUT FIBRE REINFORCED CONCRETE AND PLAIN CEMENT CONCRETE

Suraj Singh Bisht[1], Ankit Singh[2] ,Somnath Suman[3] , Manvendra Bahadur Singh[4] , Ashwani kumar[5] , Khushboo Tiwari[6]

[1,2,3,4,5] *Student, Civil Engineering, Bansal Institute of Engineering & Technology, Lucknow, UP, India*
[6]*Assistant Professor, Civil Engineering, Bansal Institute of Engineering & Technology, Lucknow, UP, India*
Corresponding Author Email: surajsbisht777@gmail.com

ABSTRACT: *High cost is dominating factor of conventional construction material which affecting in the housing system as an alternative method to overcome this drawback. Natural fibres, coir fibre has maximum amount of lignin giving maximum strength as well as are durable in nature. This paper presents an experimental study of coir fibre concrete and its strength comparison with plain cement concrete. Reinforcement of concrete is necessary to enhance its engineering properties. For this study, coconut fibres were used as they are freely available in large quantities. It is necessary to make research any alternative material. The study comprises of comparative statement of properties of coconut fibre reinforced concrete with conventional concrete based on experiments performed in the laboratory. The coir fiber concrete decreases the cost and increase the strength of concrete. In the study found the optimum fibre content to be 1% ,3%,5% by weight of cement) The addition of coconut fibres improved the compressive strength of concrete by about approximately 13% they also formed good bonding in the concrete. Further work is required by changing the fibre content and aspect ratio to determine the optimum range of fibre content so that fibre reinforced concrete can be used where high compressive required.*

KEYWORDS: *Compressive strength, Coir Fibre, FRC (fibre reinforced concrete)*

I. INTRODUCTION

Foresight groups around the world have acknowledged the future need for construction materials that are light durable. simple to use, economic and yet more environmentally sustainable are the suggestion in the vanguard has been the sourcing development and use of alternative non-conventional local construction material. Concrete is one of the most widely and commonly used building material in civil engineering around the world. Concrete is strong in compression, however, is a very brittle material, and has low strain capacity in tension and consequently low toughness. Adding fibres to concrete matrix has been long recognized as a way to enhance the energy absorption capacity and crack resistance of the plane concrete. In fibre reinforced concrete (FRC), by bridging fibres across the cracks a post-cracking ductility is provided, and consequently, the toughness of concrete is considerably enhanced. Consideration of toughness. It determines the ductility and crack resistance of the structure assuring the safety and integrity of the structural element prior to its complete failure. Some agricultural waste as a construction material natural reinforcing material can be obtained at low cost and low level of energy using local manpower technology.

[1]Corresponding Author: Suraj Singh Bisht
Corresponding Author Email: surajsbisht777@gmail.com

Found concrete known to be comparatively brittle material when subjected to normal stresses and impact load where its tensile strength is just about $1/^{10th}$ of its compressive strength Concrete is typically reinforced with steel or synthetic fibres like carbon, glass, or aramid. Despite of their advantages, the high material costs, the high energy-consuming process by the production and their adverse environmental impact has initiated the search of new environmentally friendly and sustainable alternatives. The basic advantage of natural fibres is that they are a low cost and widely available resource in many agricultural areas. They are biodegradable, non-abrasive and there is no concern with health and safety during handling. Natural fibre reinforced materials are environmentally friendly materials producing less green-house gas emissions and pollutants. The use of natural fibres as reinforcement is a way to recycle these fibres and to produce a high-performance material.

Basically, coconut fibre in huge amount derived from Tamil word “kayiru” is a natural fibre obtained from the husk of coconut. Coir possesses about 48% of lignin increasing strength and elasticity of fibre; Coir is produced in India at a large scale, references say more than 90% of the world coir production is from India. Kerala leads in India with producing more than 60% of the Indian production alone.

Fig1: Coconut fibre

II. LITERATURE REVIEW

According to the research conducted by Majid Ali, et.al, from New Zealand, the mechanical and dynamic properties of coconut fibre reinforced concrete (CFRC) members were well examined. A comparison between the static and dynamic moduli was conducted. The influence of 1%, 2%, 3% and 5%fibre contents by mass of cement and fibre lengths of2.5, 5 and 7.5 cm is investigated. Noor Md. Sadiqul Hasan, et. al from Malaysia, have investigated the physical and mechanical characteristics of concrete after adding coconut fibre on a volume basis. They conducted a micro structural analysis test using a scanning electron microscope for understanding the bonding behaviour of the coconut fibres. Mahyuddin Ramli, et. al, from

Malaysia studied the strength and durability of coconut fibre reinforced concrete in aggressive environments. Their aim was to mitigate the development of cracks in marine structures by introducing coconut fibres which would provide a localized reinforcing effect. Yalley et.al, from United Kingdom performed various tests to study the enhancement of concrete properties after addition of coconut fibre. Their study focused on the coconut fibre obtained from Ghana Africa.
B. National Status Domke P. V. from Nagpur, Maharashtra has investigated the use of natural and agricultural waste products such as coconut fibres and rice husk ash toto enhance the properties of concrete IS: 10262:2009 at a suitable water content and design mix was obtained. The mixing was carried out according to standard procedure given in IS code with sufficient care to ensure that no bleeding occurred throughout the entire process slump test were carried to ensure that the mix was workable the cubes were then cured for 7 and 28 days and work properly dried in sunlight before testing.

III. METHODOLOGY

Materials: M-20 grade concrete was adopted for casting CRFC and PCC. Cement opted is PPC 53: J K Lakshmi Cement with specific gravity 3.15 g/cc. Fine aggregates are confirming to Coir fibres adopted for study are of size 2mm with 3 different % by weight of cement viz. 1%, 3% and 5% respectively.

Test methodology: The mix design is carried out on the basis of IS 10262: 1982. The mix proportion obtained as per mix design is water: cement: fine aggregates: coarse aggregates = 0.48: 1.00: 1.69: 3.13. The proportion for casting remains same for both PCC and CFRC. Only difference in the methodology for casting CFRC was that cement, aggregates and random chopped coir were mixed in a dry state (dry mixing) followed by addition of water so that uniform mixing can be achieved whereas PCC was casted by conventional concrete mixture method.

Fig2: Simple concrete cube

Fig3: Mixing of Coconut fiber concrete

Concrete cubes, cylinders and beams were casted for both PCC and CFRC at different proportions of coir and several tests were performed the result of which can be discussed in next segment.

Fig 4 : Cube specimen placed on vibrator

Fig5. Finishing moulds

IV. RESULTS

Firstly, diameter of coir fibre for two different samples were evaluated using semi-graphical method in which micro image of coir fibre was captured with the help of Nicon eclipse TS 100 inverted microscope; diameter was calculated in pixels using SPIP (Scanning Probe Image Processor) and finally converting the pixels into mm analytically with the help of AutoCAD software. The values for fibre 1 and fibre 2 were 0.8899 mm and 1.020 mm respectively. Both values were close to 1 mm (theoretically available in different references). Compressive strength test, splitting tensile test and flexural strength test were performed on cubes, cylinders and beams for PCC and CFRC of different fibre proportions viz. 1%, 3% and 5% respectively.

Fig7: Compressive strength test

Fibre content at 2 mm average length of fibre.

The results are following:
-

Percentage of coir	**Strength after 7 days (N/mm^2)**	**Strength after 28 days (N/mm^2)**
0%	13.45	22.5
1%	11.8	23.85
3%	12.1	23.5
5%	15.02	25.9

V. CONCLUSION

[1]. Due to its relatively higher strength and ductility, it can be good replacements for asbestos fibres in roofing sheets, which being natural in origin pose zero threat to the environment.

[2]. It is observed that CFRC can be used to increase ultimate strength, durability because the satisfactory improvement in strength is observed with the inclusion of coconut fibres but the gain in strength is found to depend upon the amount of fibre content.

[3]. While testing the specimen, the plain cement concrete specimens have shown a typical crack propagation pattern but when CFRC specimen were tested, cracks get ceased which results into the ductile behaviour of CFRC.

[4]. Coconut fibre being low in density reduces the overall weight of the fibre reinforced concrete thus it can be used as a structural light weight concrete.

[3]. When fibre content increases compressive strength increases and it gives maximum compressive stress at 5% of fibre (to the weight of cement).

Fig 8: Cubes of CFRC and PCC

VI. FUTURE SCOPE

[1]. Hand mixing becomes very tedious and leads to formation of a non-homogeneous mix. Certain chemicals can be added so as to replace hand mixing by machine mixing.

[2]. The workability of the concrete with fibres was found to be very less. Hence, it can be improved to have a better slump value. Thus, certain admixtures such as air entraining agents and super plasticizers can be used so as to improve the flow characteristics of concrete.

[3]. It was found that the results did not improve by addition of fibres beyond 5% of the weight of cement in the mix. Hence, the optimum increase in the strength of concrete by addition of fibres lies between addition of fibres between 0% and 5% of the weight of cement in the mix.

[4]. Admixtures can also be used to reduce the number of voids which are formed to the present of fibres in the concrete. It may help improve the strength characteristics of concrete.

REFERENCES

[1].Paramasivam P., Nathan G. K., and Das Gupta N. C. (1984). "Coconut fibre reinforced corrugated slabs." International Journal of Cement Composites and Lightweight Concrete, 6(1), 19-27.
[2]. Majid Ali et. al. (2012),"Mechanical and dynamic properties of coconut fibre reinforced concrete" Building and construction materials 30 (2012).
[3]. Mohammad Hashim (2005). "Coconut Fiber Reinforced Wall Panelling System" Thesis Master of Engineering (Civil-Structure), Faculty of Civil Engineering, University of Technology- Malaysia.
[4]. Munawar S.S. et. al. (2007),"Characterization of the morphological, physical and mechanical properties of seven non-wood plant fibre bundles" Journal of Wood Science, 53(2), pp.108-113.
[5]. Anoopsingh Chandel et. al. (2016),"A conspectus on serviceability of coir fibre in civil engineering" Volume 6, Issue 1, IJSRP 2016.
[6]. Rao, K. M. M., and Rao, K. M. (2007). "Extraction and tensile properties of natural fibers: Vakka, dateand bamboo." Composite Structures, 77(3), 288-295.
[7]. Reis, J. M. L. (2006)."Fracture and flexural characterization of natural fiber-reinforced polymer concrete"Construction and Building Materials, 20(9), 673-678.
[8]. Satyanarayana K. G. et. al. (1990), "Natural fibre-polymer composites" Cement and Concrete Composites, 12(2), 117-136.
[9]. Ramakrishna, G., and Sundararajan, T. (2005b). "Impact strength of a few natural fibre reinforced cement mortar slabs: A comparative study." Cement and Concrete Composites, 27(5), 547-553.