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COCONUT FIBRE IN CONCRETE – A Review

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Abstract—*Concrete is the most widely used construction material all over the world. Concrete is weak in tension and flexure, most commonly, it is reinforced using steel reinforcing bars. However usage of steel reinforcement is expensive. Many efforts have been made world-wide to add various types of fibres to concrete so to make it more strong, durable and economical. Natural fibre such as coconut fibre has certain physical and mechanical characteristics that can be utilized effectively in the development of reinforced concrete material. Sometimes, these coconut fibres are dumped as agricultural waste, so it can be easily available in large quantity hence making them cheap.*

This paper studies the research works carried out in the field of concrete reinforced with coconut fibres. Coconut fibre is low in density and it reduces the overall weight of the fibre reinforced concrete thus it can be used as a structural light weight concrete. From this study, it is found out that the optimum percentage of fibre is 3%. Fibre content was used up to a maximum of 7%. However, it has been seen that the compressive strength is adversely affected by the addition of fibres. Despite its excellent properties, coconut fibre as an enhancement of concrete is unlikely to replace steel for the vast majority of structures. Coconut fibre has the ability to resist cracking and spalling.

1. INTRODUCTION

Concrete is the furthermost broadly utilized structure material everywhere throughout the whole world. With advancements in science and innovation in construction industry, the scope of concrete as a structural material, has enlarged. Since concrete is weak in tension and flexure, most commonly, it is strengthened utilizing steel reinforcement bars. However, use of steel support is costly. In the structure of international research, a significant work is going on in the utilization of fast growing, annually sustainable, cheap agricultural crops and crop deposits as likely fiber reinforcement in concrete. Coconut fiber being the most ductile among all natural fibers and it is potential to be utilized as reinforcement substantial in concrete. The fundamental favorable circumstances of natural fibers are that they are low expense. They are biodegradable, non-abrasive and there will be no distress with wellbeing and safety. Natural reinforced materials are eco-friendly materials which produce less greenhouse gas emissions and pollutants.

2. EXPERIMENTAL FINDINGS OF VARIOUS RESEARCHERS

Anthony Liu et.al.[1]presents that the Compressive strength can increase upto 24% when compared to plain concrete. It increase only with 7.5 cm long fibers having 2% to 3% fibre content. Split tensile strength first increases and then slightly reduces with increase fibre length. In the case of 1% fibres, Split tensile strength increases with fibre length. Coconut fibre reinforced concrete with 5% fibre content and 5 cm long fibres has the highest toughness index of 10.1.

V.Sai Uday et.al.[2] presents that the compressive strength of 1% coconut fibre reinforced concrete was slightly higher than plain concrete. In addition of the coconut fiber, the compressive strength goes on decreasing. Tensile strength was found at 1% of coconut fibre which is found to be slightly higher than the plain mix concrete. Tensile strength of the cylinder will decrease if the percentage of the coir is increased.

Parmeshwar lal Sahu et.al.[3] experimented by 3% addition of coconut fibre with a water cement ratio of 0.48, compressive strength tests yielded best results.

Syed Intikhab Zia et.al.[4] presents that the compressive Strength enhancement ranges from 1.30% to 7.0% when % of fiber increases from 0.1% to 0.3% when compared to the concrete paver block at 28 days. Flexural strength is significantly improving from 5.00% to 22.00% when compared to the concrete paver block at 28 days, as the top layer thickness is varies from 10mm to 40mm.

Achudhan et.al.[5] experimented by adding 1% coir fibre in a regular manner the strength get increased linearly. The flexural strength of coir fiber reinforced concrete will get increased when compared with conventional concrete values.

M.A. Othuman Mydin et.al.[6] experimented by adding 0.4% Coconut fibre , and has found the highest compressive strength (8.63N/mm2) and the lowest strength is control foamed concrete (6.84N/mm2) at 28 days**.** It is observed that the flexural strength increase with fiber percentage 0.2% and 0.4% for all the ages. It is observed that 0.4% addition of

coconut fibre has the highest splitting tensile strength amongst all the samples tested.

Noor Md. Sadiqul hasan et.al.[7] presents that the compressive strength with coconut fibre volume is 18.85Nmm^{-2} at 28days and satisfies the structural requirement of light weight concrete. The average strength of coconut fibre is 19.51Mpa and strain to failure is 2.83, it was observed the strength and strain to failure does not depended on the area of fibre.

P. Purnachandra Sai et.al.[8] presents that the compressive strength of concrete gradually decreases with increase in coir fibre content except at 2% level the strength tends to increase.

Kshitija nadgouda et.al.[9] investigated by taking 3%, 5%, and 7 %, compressive strength of concrete goes on decreasing with an increase in the fibre content of the concrete mix. Flexural strength of concrete goes on increasing with an increase in the fibre content. It was found that at 1% and 2% fibre content there was increase in tensile strength of concrete.

Yalley, P. P. et.al.[10] experimented the ability to resist cracking and spalling were enhanced. The addition of fibres adversely affected the compressive strength, as expected, due to difficulties in compaction which consequently led to increase of voids.

3. MATERIALS USED

The materials used by different researchers are:

Ordinary Portland Cement (OPC), fine aggregate, coarse aggregate, water and Coconut fibre.

Coconut fibre has been utilized to upgrade concrete and mortar, and has demonstrated to enhance the compressive strength and toughness of concrete and mortar. Coconut fibre being the most ductile among all natural fibres and it can potential to be used as a reinforcement material in concrete.

4. RESULTS AND DISCUSSIONS

Adding 5% fiber content by mass of cement and fiber length 5 cm improving the properties of concrete[1]

Addition of fibres in the concrete the strengths of the specimens get decreasing and the authors conclude that the fiber should not be used beyond 1% [2]

Addition of 5% & 7 % fibres do not show favourable results, it can be concluded that fibre content should not be used beyond 3% [3]

Compressive Strength enhancement ranges from 1.30% to 7.0% when % of fiber increases from 0.1% to 0.3% when compared to the concrete paver block at 28 days [4]

Adding fibre upto 3% slightly increases the strength. The flexural strength of coir fibre reinforced concrete increases for 1%, 2%, 3% of fibre used for M20 grade when compared with conventional concrete. So finally, it is concluded that coir fibre reinforced concrete is more effective than conventional concrete[5]

Lightweight foamed concrete mix added with 0.4% CF shows the highest strength compared to others mixes [6]

Addition of 3% coconut fibre volume reinforced concrete had the optimum set of mechanical properties in comparison with other fibre volume reinforced concrete[7]

The Usage of coir fibre is not at all recommended since it reduces the strength of concrete with an increase in content and 5% is the optimum percentage replacement as per the experimental results[8]

Addition of 5% & 7 % fibres do not show favourable results, it can be concluded that fibres content should not be used beyond 3 [9]

Despite its excellent properties, coconut fibre as an enhancement of concrete is unlikely to replace steel for the vast majority of structures[10]

5. CONCLUSION

When Fibres are added in the concrete, it results in the marginal increase in compressive strength property. A better performance can be archived for 3% coir fibre reinforced concretes. Similarly the compressive strength and split tensile strength and properties are improved by adding coir fibre along the concrete. Addition of coir fibre results in good strength properties as compared to conventional concrete. Coconut fibres proved to a good source of natural plant based fibre whose optimum replacement percentage being 5%.

REFERENCES

[1] Ali Majid, Anthony Liu, HouSou, Nawawi Chouw, “Mechanical and Dynamic Properties Of Coconut Fibre Reinforced Concrete.” *Construction and building Materials*. Reed Business Information, Inc (US). 2012. High Beam Research. 5sep. 2013.

[2] . Sai Uday, B.Ajitha(2017)”Concrete Reinforced with Coconut Fibres”. *International Journal Of Enigineering Science and Computing* (April2017).

[3] Parmeshwar Lal Sahu, P. Baghmare, S.Pandey(2017)”Use of Coconut Fibre in Fibre Reinforcement Concrete”. International Seminar On Non-Conventional Energy Sources for Sustainable Development of Rural Areas, IJAERD- *International Journal Of Advance Engineering & Resarch Development* e-ISSN:2348-4470, p-ISSN:2348-6406 Impact Factor:4.72, DOI:10.21090/ijaerd(March2017).

[4] Syed Intikhab Zia(2015)" Use of coconut fiber concrete" *International Research Journal of Engineering and Technology* (IRJET) e-ISSN: 2395 -0056 Volume: 02 Issue: 06 | Sep-2015

[5] Achudhan, M.J.I. H. Ali, S.S. Sankar, K.Saikumar(2018) “Experimental study on coir fibre mixed concrete” *International Journal of Pure and Applied Mathematics* Volume 118 No. 20 2018, 2913-2929 ISSN: 1314-3395

[6] M.A. Othuman Mydin, N.A. Rozlan, S. Ganesan(2015)" Experimental Study on the Mechanical Properties of Coconut Fibre Reinforced Lightweight Foamed Concrete " Othuman Mydin et al. ISSN : 2028-2508 CODEN: JMESCN

[7] Noor Md. Sadiqul. Hasan, H.R. Sobuz, Md. S. Sayed and Md. S. Islam,(2012) "The Use of Coconut fibre in the Production of Structural Lightweight Concrete". *Journal of Applied Sciences*, ISSN: 2320-2092, 12: Pages 831-839(2012) .

[8] P. Purnachandra Sai, K. Murali, G S. Kumar, K V. Teja(2018) "study on properties of natural fibre reinforced concrete made with coconut shells and coir fibre" International *Journal of Civil Engineering and Technology* (IJCIET) Volume 9, Issue 1, January 2018, pp. 416–422.

[9] Kshitija nadgouda (2015) " Coconut fibre reinforcement concrete". *International Journal of Mechanical And Production Engineering*, ISSN: 2320-2092,Volume- 3, Issue-1(Jan.-2015).

[10] Yalley, P. P. and 2Kwan, A.S K. " Use of coconut fibres as an enhancement of concrete".

[11] Bhowmick B.B. and Debnath C. R., Properties of coir, *Indian coconut journal*, 15, (5), 1984. p. 123

[12] Mohr, B.J., Nanko, H. and Kurtis, K.E. Durability of pulp fibre-cement composite to wet/dry cycling, *Cement and Concrete Composite*, June 2003.

[13] Nanayakkaza, N.H., Characterisation and determination of properties of Sri Lanka coconut, *Journal of Natural Fibres*, 2, (1), 2005, pp 69-81.

[14] Romildo, D., Toledo, F., Karen, S., England, G. L. And Ghavami, K., durability of alkali-sensitive sisal and coconut fibres in cement mortar composite, *Cement and concrete composite*, 22, (2), 2000, pp. 127-143.

[15] Al-Oraimi SK, Seibi AC. Mechanical characterisation and impact behaviour of concrete reinforced with natural fibres. *Compos Struct* 1995;32(1–4):165–71.