

Effect of Coconut Fiber in Workability and Compressive Strength of Concrete

Bhupendra Kumar¹ Dr. S S Kuswah² Dr. Amit Vishwakarma³

¹M.E. Scholar ²HOD ³Assistant Professor

^{1,2,3}Department of Civil Engineering

^{1,2,3}UIT RGPV, Bhopal, M.P., India

Abstract— This research paper discusses the comparative study between coconut fibre concrete with plain cement concrete of M40 grade. This research paper deals use of the agricultural waste material into concrete, which enhanced the properties of concrete and makes environment eco-friendly. The coconut fibres are added additionally by weight of cement in the proportions of 0, 1, 1.5, 2 2.5, 3%. The diameter and length of coconut fibre is taken 0.4 mm and 40 mm respectively. The results show increment in compressive strength and decrement in workability of concrete by adding coconut fibre into concrete.

Key words: Coconut Fiber, Workability, Compressive Strength

I. INTRODUCTION

In developing countries economical construction material can play very important role in making its infrastructures economical. Waste material in construction can play tremendous role to make its economical and also durable because of its specific properties. In that natural fibers are a very important natural waste material also having very good property and easily available material in the atmosphere which can enhance the properties of concrete.

In the natural fibres the coconut fibre or coir fibre gives better results by adding in concrete than other natural fibres. A large amount of coconut fibre produced in Asian countries mainly in India, Bangladesh, and Malaysia etc. India is the largest producer of coconut and jute fibre in the Asian countries. So coconut fibre is easily available waste material in India.

II. AIMS AND OBJECTIVE

The aim of this research paper is to conduct comparative study between coconut fibre based reinforced concrete with plain cement concrete. Coconut fiber in a fixed ratio increase compressive strength of concrete and also makes environment eco-friendly. Coconut fiber is easily available in the atmosphere as a waste material. Coconut fiber consist lots of properties which can enhance the properties of concrete.

III. LITERATURE SURVEY

Aiqin Wang et al did theoretical and experimental analysis of the morphological effect of different fly ash in mortar. The morphological effect consists of filling, surface role, and lubricating role. They take class A and class F fly ash and found that fly ash particles fill the space between the cement particles that's the water quantity is reduced. Due to finer surface of fly ash particles water requirements is increased.[1]

Nikhil T.R. conducted an experimental study on high volume concrete by adding fly ash in concrete. He

found that 50% replacement of fly ash with cement gives maximum durability and strength and also make concrete economical. The flexural strength of such concrete also improved by 6.27%. [2]

P.R. Wankhede et al discussed about the effects of fly ash in concrete they take 10, 20, and 30% replacement of fly ash with cement. They found that 10 and 20% replacement of fly ash shows very good result in case of compressive strength for 28 days but at 30% replacement of fly ash shows ultimate strength of compressive strength. [3]

V.R. Prasath Kumar et al did an experimental study by replacing coarse aggregate with fly ash coarse aggregate and discussed the result at 7 and 28 days. They investigated that both concrete with natural aggregate and with fly ash aggregate shows same result. [4]

Aman Jatale et al conducted an experimental investigation by replacing fly ash with cement in the ratio of 20, 40, and 60 %. They conducted experiment on M15, M20, M25 grades of concrete. They investigated that workability has improved, density and air content of concrete remained unaffected, bleeding and shrinkage of concrete got reduced, durability of concrete improved, modulus of elasticity got reduced, compressive strength of concrete got reduced as increase in fly ash. [5]

Nikhil T.R. et al 2014 conducted an experimental study on compressive strength of concrete by using different water samples in the concrete. They saw the effects of water qualities into the concrete. They investigated that the PH value of water is inversely related to the strength of the concrete if PH of water increases than the strength of concrete decreases and vice versa. If sewage water is used for preparing the concrete than it decreases the strength of the concrete due to presence of suspended solids in the sewage water because of PH of sewage water.[6]

Amir M. Alani et al 2013 conducted an experimental study by using steel fibre into the concrete and discussed about the mechanical properties of the fibre reinforced concrete. They take different type of steel fibre in the concrete and investigated their effect on the concrete properties. They took URW1050 steel fibre and HPP45 synthetic fibre to instigate their effect in concrete. They made 9 cube specimens for conducting compressive strength at 7, 14 and 28 days respectively and make cylinders for split tensile strength and beams for flexural strength. They investigated that split tensile strength found same for both types of fibres used in concrete. The same strength also recorded in case of flexural testing for both type of fibres and same results also found in case of compressive strength. [7]

Aiswarya Sukumar and Elson John, 2014 conducted an experimental investigation by using steel fibre into the concrete. They investigated that steel fibre give better strength as compared to polypropylene fibre and also

give the most strength in all types of fibres. Steel fibres also enhanced the ductility of the concrete whose concrete gets elastic properties. [8]

Ramkrishna and Sudaranjan conducted a study on coconut fibre based concrete in which they investigated that coconut fibre increased the impact resistance of concrete by 3-18 times. [9]

Gram found by doing a study on coconut fibre based concrete in which he found that the coconut fibre enhanced toughness of the concrete. [10]

Milind V. Mohod 2012 conducted an experimental study by using steel fibres into the concrete. He conducted compressive, Split tensile strength and flexural strength test on the concrete specimens. He took fibre content by 0.25, 0.5, 0.75, 1, 1.5, and 2% by volume of the cement. He investigated that workability of the concrete gets reduced by increasing the fibre content into the concrete. The compressive strength increased by increasing the fibre content into the concrete. The ultimate compressive strength found at 1% fibre content. The flexural strength also increased by increasing the fibre content into the concrete, the ultimate flexural strength found at 0.75 % fibre content into concrete. The ductility of the concrete increased by adding steel fibres into the concrete. [11]

IV. METHODOLOGY

A. Raw Material

Cement: OPC 43 grade cement has been taken for the experimental programme.

Fine Aggregate: Zone II sand has been taken having specific gravity as 2.61.

Coarse Aggregate: 20 mm nominal size aggregate has been taken having specific gravity as 2.655.

Water: Potable water from tap has been taken which is free from acids, base, suspended solids etc.

Coconut Fiber: Dry slightly reddish brown coconut fiber from gufa mandir lalghatibhopal has been taken. Fibre length and fibre content are taken as 40 mm and 0, 1, 1.5, 2, 2.5, and 3% by weight of cement. Properties of coconut fiber used in the experiment are as follows:

Fibre length	40 mm
Fibre diameter	0.4 mm
Relative density	1.14
Water absorption	120-180%

B. Mix Design

As per IS 10262-2009 the Ratio of Mix Proportion for plain cement concrete

= water: cement: fine aggregate: coarse aggregate

= 160:400:687: 1141

= 0.4:1:1.72: 2.85

C. Experimental Programme

Following Experiments are conducted on the concretes are as follows:

- Workability by Slump Cone Apparatus
- Compressive Strength by Compressive Testing Machine

1) Workability by Slump Cone Apparatus

- The slump cone apparatus determines workability of concrete. The procedures for finding slump of concrete are as follows:
- First mix all the ingredients which are using in concrete
- Fill the concrete into the slump cone apparatus in three layers and compact it by the compaction rod up to 25 time for each layer
- Put up the slump cone apparatus
- The concrete poured down at the base
- The height of poured concrete is determined from top by the scale
- This height is called the slump of the concrete



2) Compressive strength by Compression Testing Machine

Compressive strength of concrete is determined at 7 and 28 days of curing as per IS code the steps involved in finding compressive strength of concrete are as follows:

- Cure the cube for 7 and 28 days in the curation tank
- Put the cube into the compression testing machine
- The load at which cube gets cracked has been recorded
- Load/Surface Area of the cube mould is the compressive strength of concrete

The determinations of compressive strength are shown in diagram below:

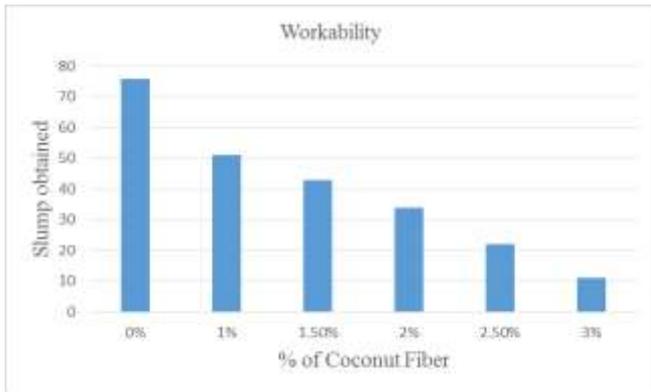


V. RESULTS AND DISCUSSION

S No	Coconut Fibre %	Mix Name	Workability in mm	Compressive Strength in MPa	
				After 7 days	After 28 Days
1	0%	A1	76	38	50
	1%	B1	51	30	45
	1.50%	C1	43	26	43
	2%	D1	34	29	46
	2.50%	E1	22	25	40

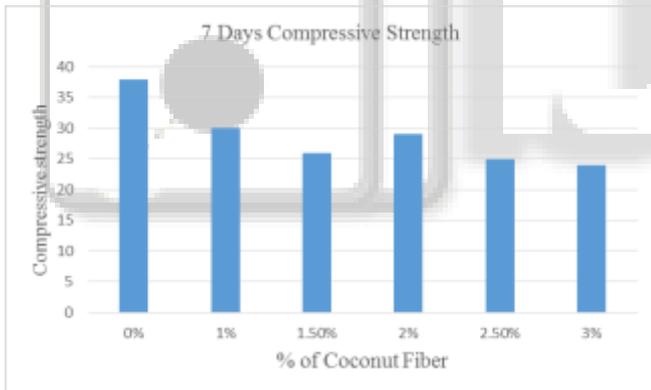
Table 1: Results

A. Workability



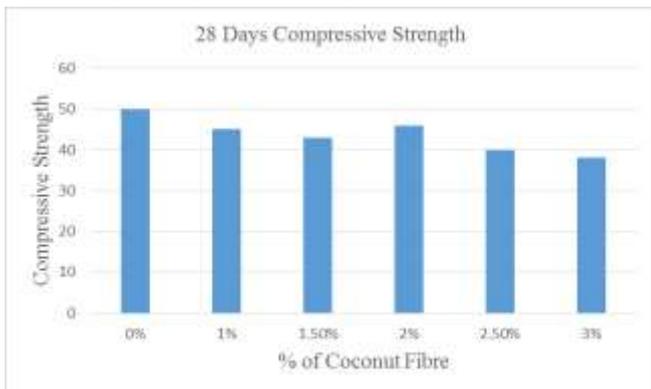
Workability of concrete drastically decreases by adding coconut fiber into concrete.

B. 7 Days Compressive Strength



Compressive strength of concrete enhanced at 2% of coconut fiber ratio into concrete but shows better results in 1, and 1.5% of coconut fiber after 2% extra addition gave decrement in compressive strength of concrete.

C. 28 Days Compressive Strength



Compressive strength of concrete enhanced at 2% of coconut fiber ratio into concrete but shows better results in 1, and 1.5% of coconut fiber after 2% extra addition gave decrement in compressive strength of concrete.

VI. CONCLUSION AND FUTURE PROSPECT

A. Conclusion

Addition of coconut fibre enhanced the compressive of concrete at 2% ratio of coconut fiber.

Increment of coconut fibre shows decrement of compressive strength after 2% ratio of coconut fibre into concrete.

Addition of coconut fibre into concrete decreased workability of concrete.

B. Future Prospect

This study discussed effect of coconut fiber into concrete for a fixed ratio of coconut fiber except this ratio we can use other natural fiber in different ratio into concrete and analyzed their effects into concrete.

Poly fibres can also be used with fly ash to reduce environmental pollution and to make concrete economical, durable and stronger.

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