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Comparative Study of Cement Reinforced Concrete Strengthened with Polypropylene and Coir Fibre At Elevated Temperature

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***Abstract*:- Fire episodes in structures have been a main issue on the planet today. The respectability of cement is generally addressed because of the way that after these fire episodes the strength of the substantial is diminished impressively. Different strategies have been embraced to further develop the imperviousness to fire property of cement. This review zeroed in on the utilization of coconut fiber and polypropylene fiber to accomplish this element. Concrete is known to have great warm resistive property when contrasted with steel. Assuming cement is liable to raised temperatures, substantial masses get separate, bringing about a peculiarity known as "Spalling". This exploration examines the impacts of fire resistance on coconut husk fiber and polypropylene fiber built up Fibre Reinforced Concrete. The assessment work done by various researchers and their choices have been discussed in nuances which includes various test like Compressive Strength and Tensile strength test. In this project work on coir and polypropylene fiber of different percentage (0.2%, 0.4%, 0.6%, and 0.8%) added in concrete. Tests on workability compressive strength, and split tensile strength were conducted on specimens.**

Keywords: Spalling, Fibre Reinforced Concrete, Coconut Husk Fibre, Polypropylene Fibre, Fire Resistance.

1. INTRODUCTION

The fiber scattering into concrete is one of the methods to further develop the structure properties of cement. Polypropylene strands are manufactured fibers got as a result from material industry. These are accessible in various viewpoint proportions and are modest in cost. Polypropylene strands are portrayed by low unambiguous gravity and minimal expense. Its utilization empowers dependable and viable use of inherent ductile and flexural strength of the material alongside huge decrease of plastic shrinkage breaking and limiting of warm breaking. It gives support and safeguards harm of substantial construction and forestalls spalling in the event of fire. The filaments are made either by the pulling wire method with roundabout cross area or by expelling the plastic film with rectangular cross-segment. They show up either as fibrillated groups, mono fiber. The fibrillated polypropylene filaments are framed by development of a plastic film, which is isolated into strips and afterward cut. The fiber packs are cut into indicated lengths and fibrillated. In monofilament strands, the expansion of buttons at the closures of the fiber builds the take out load.

Breaks assume a significant part as they change substantial designs into penetrable components and therefore with a high gamble of consumption. Breaks not just decrease the nature of cement and make it tastefully unsatisfactory yet in addition make structures unavailable. On the off chance that these breaks don't surpass a specific width, they are neither hurtful to a design nor to its functionality.

There has been developing interest as of late in using normal strands for making minimal expense building materials. The improvement relies on various factors, for example, fiber type, structure, volume, perspective proportion, blend configuration, blending strategy, projecting procedure and restoring technique. Further, the examinations did on the utilization of normal strands as supporting material have shown empowering results. Coir fiber is richly accessible in numerous nations like India, the Philippines, Indonesia, Sri Lanka, Malaysia and Thailand. The fiber is acquired from coconut husks either by normal retting or mechanical decortication. The fiber acquired from the retting system is white in variety while precisely decorticated fiber is brown. Yearly creation of the fiber in India is around 1"60 million tons. Coir fiber is modest, solid and tough and along these lines can be an imminent supporting material for the creation of concrete-based building items.

2. LITERATURE SURVEY

1)Anthony Nkem Ede et al. (2015) This exploration researches the impacts of fire on coconut husk fiber and polypropylene fiber built up concrete. A few examples of fiber built up substantial blocks were casted utilizing 0.5% of coconut and polypropylene strands and presented to temperatures of 200◦C, 400◦C, 600◦C, 800◦C and 1000◦C after 7, 14, 21, and 28 days of restoring. Compressive tests on substantial 3D shape tests were directed by guidelines. The rate expansions in compressive strength of the test example show that the coconut strands delivered a higher strength increment over polypropylene filaments and that the imperviousness to fire of coconut fiber is more noteworthy than that of polypropylene fiber for the expanding paces of temperature openness.

2)Gideon Bamigboye et al. (2020) This review zeroed in on the utilization of coconut fiber to accomplish this accomplishment. In this review, shifting rates of treated and untreated coconut filaments were fused into concrete and the compressive strength was tried for both prior to warming and

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in the wake of warming. The rates of substitution were 0.25, 0.5, 0.75 and 1% fiber content by weight of concrete. In the wake of exposing these substantial shapes to 250 ◦C and 150 ◦C for a time of 2 h, the compressive strength expanded when contrasted with the control. The compressive strength expanded up to 0.5% substitution by 3.88%. Past 0.5% fiber, the compressive strength diminished. Concrete having coconut fiber that had been treated with water likewise displayed the most elevated compressive strength of 28.71 N/mm^2. It is presumed that coconut strands are an incredible material in working on the strength of concrete, even after it was presented to a specific level of raised temperature.

3)Divya S Dharan et al (2016) In this task work polypropylene filaments (Blended sort) of various rate (0.5%, 1%, 1.5%, and 2%) included concrete. Tests on functionality, compressive strength, flexural obstruction, split rigidity and modulus of flexibility were directed on examples.

4)Vikas Patel et al (2021) The survey was finished on three water/concrete (w/c) extents (0.47, 0.36 and 0.20) using rock absolute for concluding transitory mechanical properties of Polypropylene fiber upheld concrete interestingly, with control mix. The test program consolidates 100 × 200 mm and 150 x 300 mm chambers with fiber volume of 0.5%, that were presented to temperatures openings of 400 °C and 600 °C for lengths of an hour. From the results, it was seen that no basic improvement in mechanical properties like modulus of adaptability, Poisson's extent, split inflexibility, flexural strength, and compressive strength was seen at room temperature and at raised temperatures.

3. OBJECTIVE OF THE WORK

This study leads to Comparative Study of Cement Reinforced Concrete mixed with Polypropylene Fibres and Coir Fibre to Elevated Temperature. The variation of result is based on different ratios of fibre and testing there compressive and tensile strength at elevated temperature.

4. EXPERIMENTAL WORK

- In this work, different fibre contents of 0.2%, 0.4%, 0.6% and 0.8% by cement mass is being considered to investigate the compressive and tensile strength of Coir FRC and Polypropylene FRC.
- Identifying the specification of material to be considered.
- Collection of materials.
- Determining the properties of the collected materials. Different tests were to be conducted on cement, fine aggregate, coarse aggregate.
- Selection of appropriate concrete grade.
- Preparation of mix design of M25 grade concrete.
- Cubes and cylinder were casted with control mix using natural aggregate.
- Preparation of test specimen by adding 0.2, 0.4, 0.6 and 0.8% of polypropylene fibres and coir fibre.
- Different test including compressive strength test and split tensile strength test of concrete were conducted at 200 degrees Celsius.
- Optimum percentage of fibre addition required in concrete has been determined.

5. MIX DESIGN

Cement = 447kg/m^3
Water = 197 kg/m^3
Fine aggregate = 616.23 kg/m^3
Coarse aggregate = 1096.3 kg/m^3
Water cement ratio = 0.44

Table-1, M25: Mix Ratio – 1: 1.38: 2.45: 0.44

6.EXPERIMENTAL INVESTIGATION

6.1 Test Procedure

Concrete test specimens consist of 150x150x150mm cubes, Cylinders of 150mm diameter and 300mm height and 100x100x500 beams. Concrete cube specimens were tested at 7 and 28 days to obtain the compressive strength of concrete. Cylindrical specimens were tested at 28 days to obtain the split tensile strength and modulus of elasticity of concrete.

6.2 Test on hardened concrete Various tests on hardened concrete is done to ensure the design strength of concrete and quality of concrete construction is achieved. It includes compressive strength test, flexural tensile strength test, split tensile strength test and modulus of elasticity.

7. EXPERIMENTAL RESULTS AND DISCUSSION

7.1 Streamlining of coir and polypropylene fiber in concrete. In this part polypropylene and coir fiber of various rate included concrete.

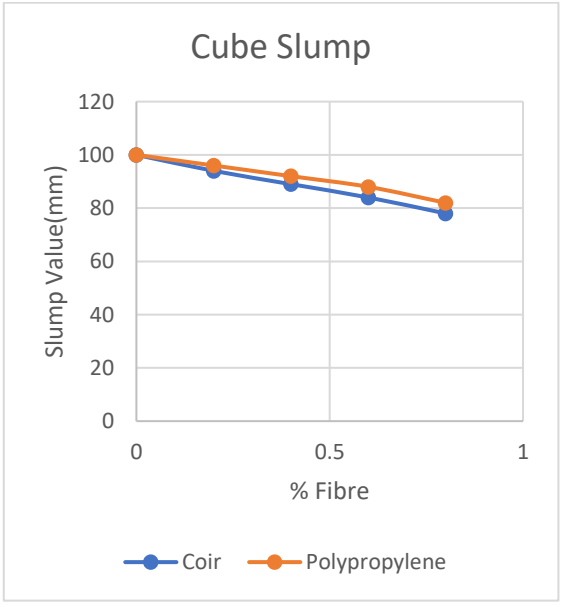

Figure 1

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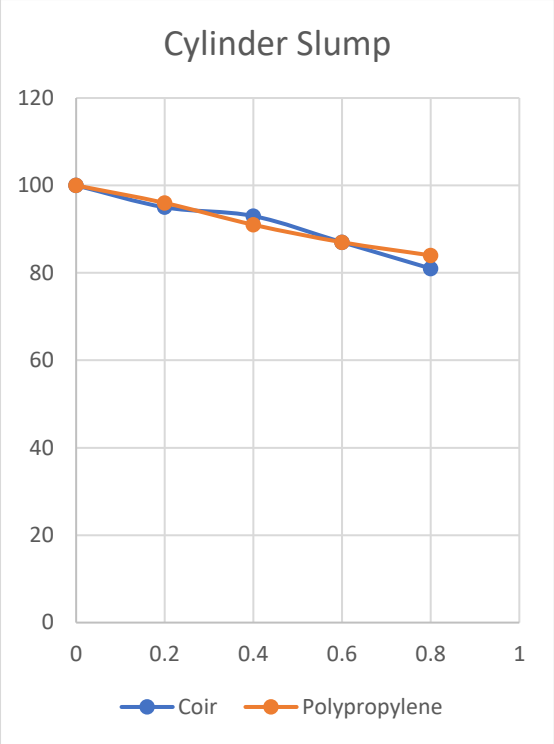

Figure 2

Its workability diminishes because of more expansion of fibers, there is expansions in measure of captured air voids because of the presence of fibers and hence expansion in air content credits in lessening functionality.

Table-2 Compressive strength of the specimen

w/c ratio	% Of Coconut Fibre added	Slump Value (mm)	Compressive Strength at 28 days(N/mm²)	
			At Room Temp	At 200 degrees Celsius
0.44	0	100	32.20	29.20
	0.2	94	32.35	29.35
	0.4	89	32.55	29.40
	0.6	83	32.70	29.65
	0.8	78	32.50	29.45

Table-3

w/c ratio	% Of Poly Fibre added	Slump Value (mm)	Compressive Strength at 28 days(N/mm²)	
			At Room Temp	At 200 degrees Celsius
0.44	0	100	32.18	29.15
	0.2	96	32.20	29.28
	0.4	92	32.45	29.30
	0.6	88	32.65	29.55
	0.8	82	32.40	29.30

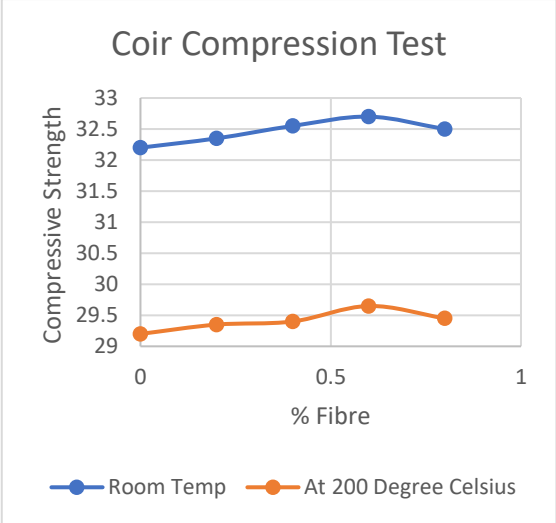

Figure 3

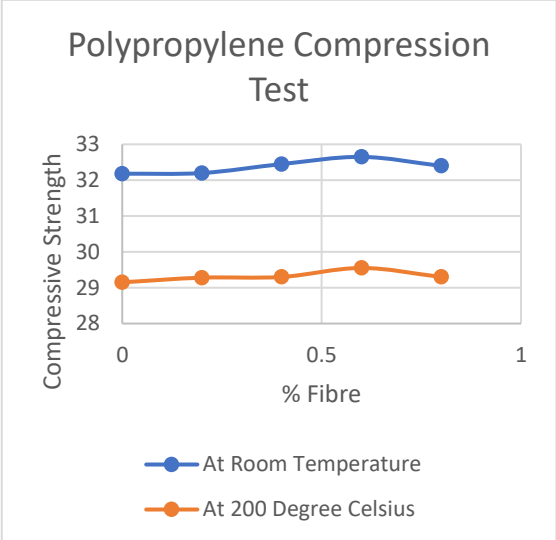

Figure 4

Table 4: Split tensile strength of the specimen

w/c ratio	% Of Coconut Fibre added	Slump Value (mm)	Tensile Strength at 28 days(N/mm²)	
			At Room Temp	At 200 degrees Celsius
0.44	0	100	4.02	3.04
	0.2	95	4.08	3.07
	0.4	93	4.12	3.10
	0.6	87	4.16	3.15
	0.8	81	4.18	3.18

Table-5

w/c ratio	% Of Poly Fibre added	Slump Value (mm)	Tensile Strength at 28 days(N/mm²)	
			At Room Temp	At 200 degrees Celsius
0.44	0	100	4.01	3.01
	0.2	96	4.06	3.04
	0.4	91	4.10	3.07
	0.6	87	4.14	3.10
	0.8	84	4.17	3.14

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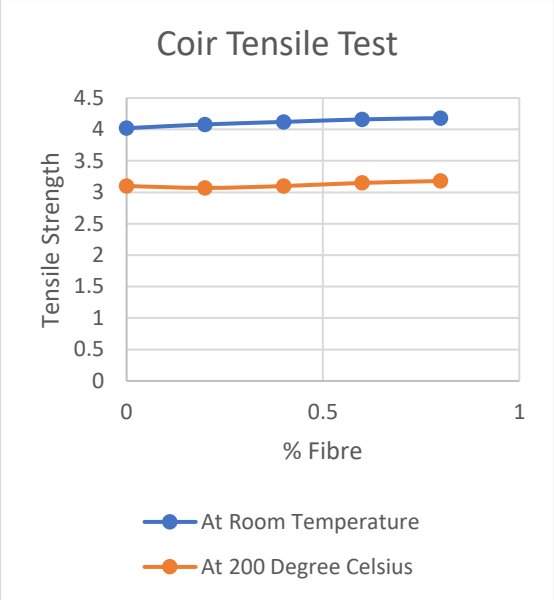

Figure 5

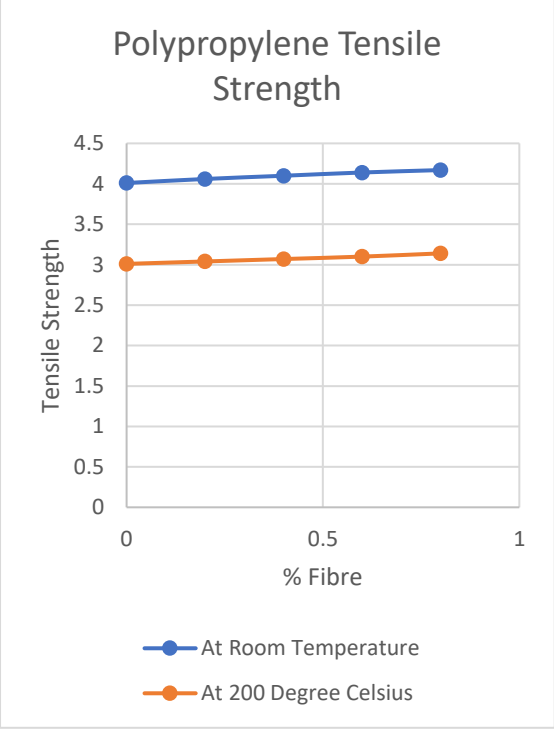

Figure 6

Such examples of parting malleable test show that examples after first breaking don't separate dissimilar to the substantial disappointment. Enormous harm zone is created because of firmly separated miniature breaks encompassing a parting plane. Fiber spanning instrument is answerable for such improved bendable disappointment design.

8. CONCLUSIONS

1.The reduction of slump is noticed with increase in polypropylene and coir fiber content, especially beyond 0.4 % dosage, the mix become fibrous which results in difficulty in handling.

2. The compressive strength tests reveal that, the strengths were increased proportionately with the increase in volume ratios of polypropylene and coir fiber with reference to the control mix without fiber.

3. The percentage increase of compressive strength of polypropylene fiber concrete mixes compared to the mix without fiber is observed from 8 to 12 %.

4. The samples with polypropylene fiber content of 0.6-0.8 % showed optimum results in comparison with other samples in this study.

5. This research tried to provide an understanding of the effect of coconut and polypropylene fibre on the fire resistance property of concrete. Based on laboratory test results obtained, it can be easily concluded that the presences of either of the two types of fibres increases the compressive and tensile strength of concrete especially at the lower temperatures up to 200 degrees Celsius, with greater increase in the coconut fibre samples than polypropylene sample.

6. The percentage increase in the compressive and tensile strength of the concrete samples show that the coconut fibres produce a higher strength increase over the polypropylene fibres. The addition of both fibres did not just increase the compressive or tensile strength, but test results have proven that they also increase the fire resistance property of the concrete. Coconut fibres can therefore not only improve strength for concrete but also improve the fire resistance of concrete more than polypropylene fibres. The presence of coconut fibre confers greater ductility on concrete as it prevents fragile collapse.

9. SCOPE OF FUTURE STUDY

The impact of coconut and polypropylene fiber on high strength cement ought to be examined and along these lines the utilization of fiber can be reached out to modern and business structures. Since the erosion review isn't done, the appropriateness of fiber in built up developments could be tried.

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