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Experimental Investigation on Strength Properties of Concrete by Partial Replacement of Natural & Synthetic Fiber

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ABSTRACT: The use of fibers in concrete at relatively low volume fraction has been gaining rising popularity among researchers for the recent years due to its availability, ability to enhance overall performance and cost effectiveness. Fibers are mainly classified according to their origin. Numerous researches have been carried out with natural and synthetic fibers separately to elucidate its effect on the various parameters of concrete. However, a little finding is available about the comparative study among these three distinct types of fibers affecting concrete properties. In this study coconut coir, has been selected natural fiber and Polypropylene has synthetic fiber. Coconut coir and Polypropylene were mixed at different percentage of 1% 2% 3% and 4% respectively. The results were obtained through an experimental investigation that shows the influence of natural and synthetic on rheological and mechanical properties of concrete.

KEYWORDS: Coconut coir, Polypropylene, Compressive strength, Split tensile strength

I. INTRODUCTION

Concrete is a composite material composed of fine and coarse aggregate both together with a fluid cement that hardens over time. It is the main part of any construction work which is composed of gravels or crushed stones, sand hydrated cement etc. it has been used over a century in all construction works. Now a day's construction sector is expanding rapidly on a large scale involving new techniques. The consumption of natural resources in construction is phenomenal and high cost. Polypropylene and coconut coir are two materials that have unique properties and are used in various applications. Polypropylene is a thermoplastic polymer that is widely used in manufacturing because of its excellent chemical resistance, low density, and high tensile strength. It is used to make a wide range of products such as packaging materials, fibers, automobile components, and medical devices. Coconut coir, on the other hand, is a natural fiber that is extracted from the outer husk of coconut fruits. It is a sustainable and biodegradable material that is commonly used as a substrate for growing plants, as well as for making products such as floor mats, brushes, and rope. Polypropylene and coconut coir can also be combined to create composite materials that take advantage of the unique properties of each material. For example, polypropylene-coconut coir composites can be used in the construction industry to create lightweight and durable building materials.

II. LITERATURE SURVEY

Concrete is a versatile engineering material made with cement aggregates and admixtures in some cases to develop in the construction field. The consumption of natural aggregates is very high and at the same time production of solid wastes from the demolition and manufacturing is also very high. The following section gives a brief background and some of the important patient studies that were carried out to the considered work. This provides an overview of the research activities relevant to this research work through references. Ashadul Islam, Ajay Kumar Shuvo[6] the experimental work was carried out on concrete containing natural and synthetic fiber mixed at different proportion by weight of cement, Mechanical and physical properties test were carried. It decreases slump value, incorporation of fiber concrete has little effect on static compressive strength and signified role in flexural strength. Fiber prevents energy absorption in concrete. Jyoti Rashmi Nayak, Jerzy Bochen[4] the various properties of fresh and hardened mortar reinforced with natural fibers (jute and sisal) and synthetic fibers (polypropylene) Mechanical and Physical test porosymetry MIP and SEM test were done. The polypropylene and jute fiber had no effect on the air content. Polypropylene and jute fiber performed well in shrinkage and resistance. It has 1-2% increase compressive strength 8-



10%.**Kavitha S, Dr. T Felix Kala** [5] In this paper, Plant fibers are used as natural fibers, because they are sustainability, Biodegradability, and more Strength and durability, soft and comfort, Versality etc. Mechanical and physical test were conducted. The fibre addition improves significantly the crack resistance. Also, the crack width is reduced. The fracture toughness of natural fibre composites is greatly improved. The tensile strength of natural fiber composites is improved significantly. **Vikranth S. Vairagade and Kavitha S.** Kene Cement, aggregates, steel fibers, polypropylene fibers this are the materials used in this paper. Test on hard concrete , compressive test , tensile strength test are conducted. Based on the laboratory cuber and cylindrical specimens have been designed with metallic and non-metallic group of fibers.

III. METHODOLOGY

In this experimental study M30 grade concrete is designed as per the code. The material are collected i.e. cement, fine aggregate, coarse aggregate, polypropylene and coconut coir with control of concrete, 1%, 2%, 3%, 4% of concrete replaced with polypropylene and coconut coir. The mould sare casted for both conventional concrete and replaced concrete with polypropylene and coconut coir. Casted specimen are cured in water for 7, 14, 28 days respectively. After curing compression strength and split tensile strength test is conducted at 7, 14, 28 days. These specimens are tested for each designation and average of three results will betaken.

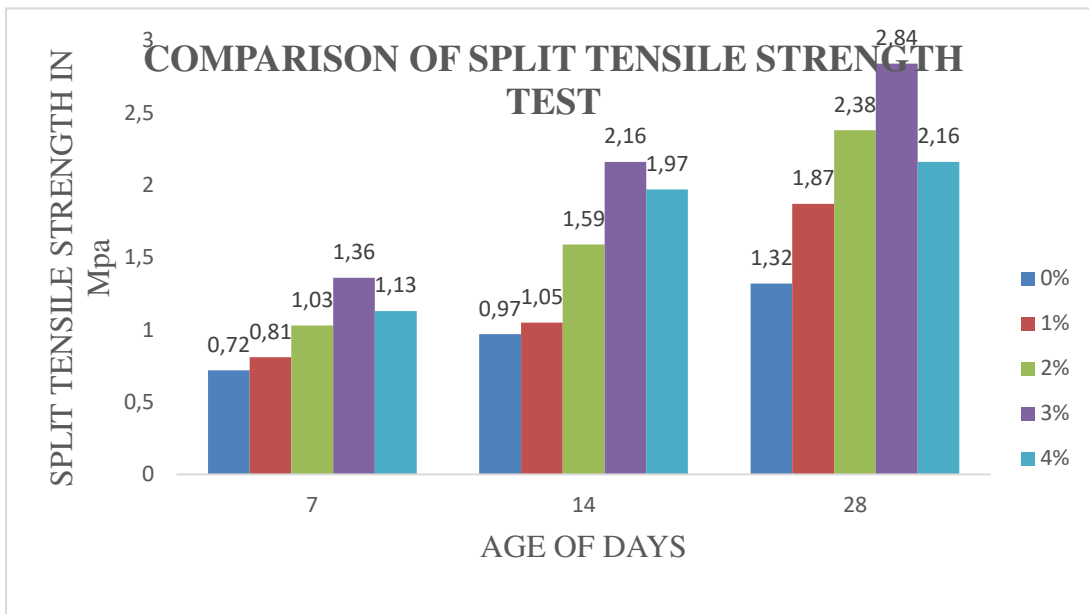
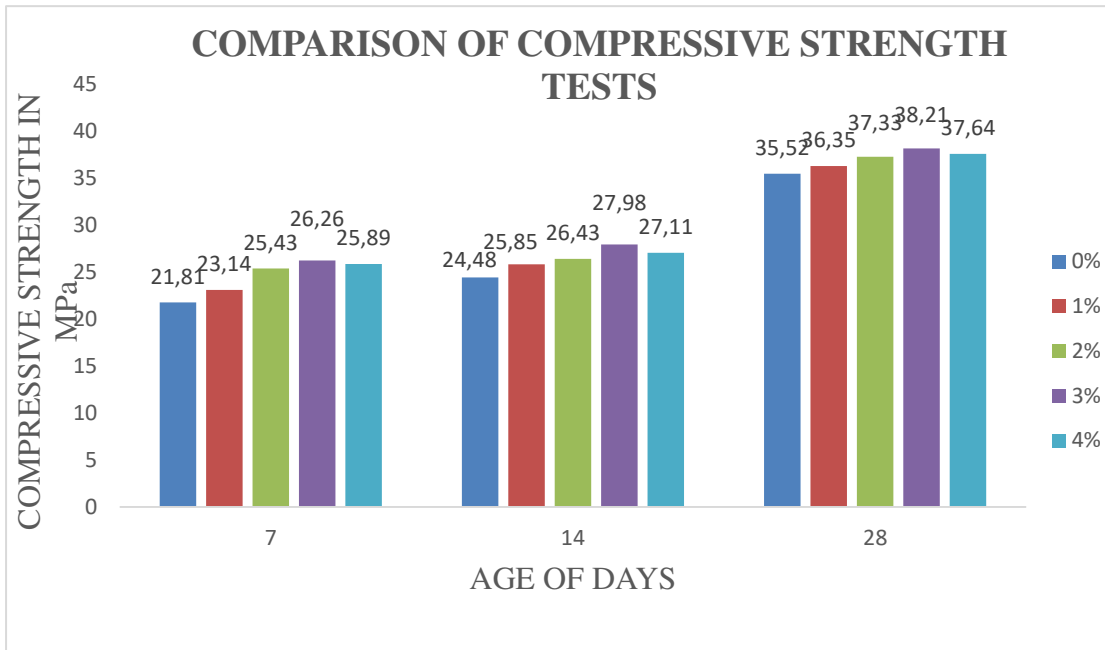
IV. EXPERIMENTAL RESULTS

The normal concrete is casted and with varying proportions of materials by weight of cement is casted. The strength properties are examined and comparison of results are done.

1) COMPRESSIVES TENGTH RESULTS FOR DIFFERENT PERCENTAGE(CUBES ONLY)

1.1 Test results of M₃₀ grade concrete for 7, 14 and 28 days

SL.NO	Grade	Percentage Replacement of Coconut coir and Polypropylene fiber	Age in days		
			7	14	28
			Compressive Strength in Mpa		
1	M ₃₀	0%	21.81	24.48	35.52
2	M ₃₀	1%	23.14	25.85	36.35
3	M ₃₀	2%	25.43	26.43	37.33
4	M ₃₀	3%	26.26	27.98	38.21
5	M ₃₀	4%	25.89	27.11	37.64



The above graph indicates that the compressive strength for 7 and 28 days with varying of percentages from 1% 2% 3% and 4% .The result is increasing upto 3% after that it will starts decreasing. The optimum results is obtained for 3% replacement by weight of cement.



2) SPLIT TENSILE STENGTH RESULTS FOR DIFFERENT PERCENTAGE (SPLIT TENSILE STRENGTHH)

2.1 Testresults ofM₃₀gradeconcretefor7, 14 and 28days

SL.NO	Grade	Percentage Replacement of Coconut coir and Polypropylene fiber	Age in days		
			7	14	28
			Split Tensile Strength in Mpa		
1	M ₃₀	0%	0.72	0.97	1.32
2	M ₃₀	1%	0.81	1.05	1.87
3	M ₃₀	2%	1.03	1.59	2.38
4	M ₃₀	3%	1.36	2.16	2.84
5	M ₃₀	4%	1.13	1.97	2.16

The above graph indicates that the split tensile strength for 7, 14 and 28 days with varying of percentages from 1% 2% 3% and 4% . The result is increasing upto 3% after that it will starts decreasing. The optimum results is obtained for 3% replacement by weight of cement.

V. CONCLUSION

The Compressive strength and split tensile strength of concrete M30 grade mix is obtained by increase with increase in percentage of Coconut fiber and Polypropylene fiber as compared to conventional/normal concrete. Fiber enhances energy absorption capacity of concrete and provide post cracking ductility. It prevents abrupt crushing during failure and carry load even after the first crack is observed at ultimate load.

The Compressive strength and split tensile strength of concrete M30 grade mix is obtained by increase with increase in percentage of coconut coir and polypropylene fiber as compared to conventional/normal concrete. It is noticed that the maximum results is obtained for 3% replacement. The partial replacement of coconut coir and polypropylene fiber in cement with varying percentages as 0%, 1%, 2%, 3% and 4%, the strength results will increase upto 3% replacement of coconut coir and polypropylene fiber and further varying the strength starts to decrease when compared with the conventional concrete. The optimum result is obtained for 3% partial replacement in cement. Coconut coir gives moderate and polypropylene gives high increase in strength when added inconcrete. Combination of both coconut coir and polypropylene induces greater strength than theirindividual strength. Incorporation of fibers in concrete is cost efficient and economical.

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