

Experimental Study on Strength Properties of Sisal Fiber Reinforced Concrete

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ABSTRACT: There has been a growing interest in utilizing natural fibres for making low cost construction materials in recent years. This research study has experimentally performed on the compressive strength, split tensile and durability test methods also emphasized in various mixes of high performance concrete. The maximum compressive strength of concrete was noted by different curing days. The production of concrete requires a various materials like cement, fine aggregate, and coarse aggregate. Due to extensively use of concrete which leads to an increase the cost of materials. There fore alternative materials are used for partial replacement and additive by percentage cement, sand and aggregates to reduce the cost of construction.

KEYWORDS: MAGNETIZED WATER, WATER ACTIVITY, COMPRESSIVE STRENGTH, SPLIT TENSILE STRENGTH.

I. INTRODUCTION

Concrete is a versatile material which has the possibility of moulding into geometric shapes which can be manufactured easily. Utilizing the resilient nature of this material, expeditious progress has been made in the field of construction in the recent years. When the matrix of the concrete is modified like lowering water content, use of super-plasticizers, use of natural and synthetic fibers, optimization of grain size distribution has emanated striking improvements in its many properties such as strength, ductility, compactness and durability. The main aim of using fibers as reinforcement in concrete is that they are capable of enhancing the mechanical properties such as fracture toughness, impact, tension, fatigue, thermal shock, spalling and much more.

Many experimental investigations have been carried out in the recent years on the mechanical, physical and durable properties of concrete reinforced with various natural fibers. Fibers are usually used in concrete to control cracking due to both plastic shrinkage and drying shrinkage.

II. OBJECTIVES

- To determine the Compressive strength of concrete using fiber.
- To determine the Tensile strength of concrete using fiber.

III. METHODOLOGY

The process carried out by following steps

- 1) The sisal fibers, conventional coarse aggregates, sand as fine aggregates and cement are weighed as per calculated mix design for various replacements for different ratios. These weighed materials should be clean and free from external materials.
- 2) The weighed materials are dropped into the drum mixer and mixed in a dry condition until uniform dry mix is obtained.
- 3) Add calculated amount of water to the drum mixer containing dry mix. The mixture is mixed thoroughly until proper workable mix is obtained.
- 4) Then concrete mixture is taken into the large tray if we have to cast concrete cubes, cylinders and beams means fill the concrete into them in 3 layers, each layer is compacted by using needle vibrator.
- 5) The step 4 is same for casting cylinders of dia 15cm.
- 6) After 24 hours, demould the samples and are then cured for 3 days, 7 days and 28 days.

MATERIALS USED:

It is well known that strength of the concrete dependent on the properties of its ingredients, the materials used in the present investigation are as follows

- 53 grade O.P.C(M-35grade)
- fine aggregate
- coarse aggregate
- Potable water
- Sisal fiber

Cement

A cement is a binder, a substance used for construction that sets, hardens and adheres to other materials, binding them together. Cement is seldom used on its own, but rather to bind sand and gravel together.

Fine Aggregate

The aggregates passing through I.S. sieve 4.75 mm sizes is termed as fine aggregate. The sum of percentage of all types of deleterious materials in fine aggregate should not exceed 5%. Natural sand or crushed stone dust is the fine aggregate mainly used in concrete mix.

M-sand is used as fine aggregates.

Coarse Aggregate

Coarse aggregate, or simply aggregate, is a broad category of coarse to medium grained particulate material used in construction, including sand, gravel, crushed stone, slag, recycled concrete and geo synthetic aggregates. Aggregates are the most mined materials in the world.

Water

The water is more and easily available material for forming the concrete. The very small amount of water is utilized for cement hydration process and remaining water is behaves like a grease material between the aggregates and it makes the concrete workable. The used material must be free from external agents.

Sisal Fiber

Sisal fiber is a sort of agave. Naturally the plant is known as agave sisilana. Filaments are gained from the leaves of the plant. The use of sisal, a natural fiber with enhanced mechanical performance, as reinforcement in a cement based matrix.

III.TESTS CONDUCTED

Fresh and hardened concrete tests

- Concrete workability
 - Slump test
 - Compaction factor test

Slump Test



Figure 1 : Slump Test

The workability of fresh composite property which includes the diverse requirements stability, mobility, compactibility, placeability & finishability. There are different methods of measuring the workability.

Unsupported fresh concrete flows to the sides & a sinking in a height takes place .This vertical settlement is known as slump .In this fresh concrete is filled into mould of specified shape & dimensions & the settlement is measured when supporting mould is removed. Slump increases as water content is increased

SL NO	PERCENTAGE	SLUMP IN MM
1	0%	104
2	0.1%	98
3	0.3%	95
4	0.5%	90
5	0.7%	86

Table :Slump Values for Different Mixes

The following test were conducted

- 1) Compression Test
- 2) Split Tensile Test

Compression Test

Concrete cubes of 150mm*150mm*150mm size are casted to check the compressive strength. Specimens are subjected to ambient curing for 3,7 and 28 days. Specimens are tested as per IS(part 5).The point at which specimen fails is considered as maximum load (N),and cross section of specimen is known. Thus compression strength is calculated by the formula,

Compression strength or stress= [Load/Area] N/mm²



Figure 2 : Split Tensile Test

For these test cylinders of 150mm diameter (D) and 300mm height (H) are casted. These specimens are placed horizontally between the plates of compression testing machine and maximum load(P) at which specimen fails is noted and tensile strength is calculated using formula,

Split tensile test=2 X P/ [π D L]

Where,

P = applied weight in kN
 D= Dia of the cylinder in mm
 L = Span of the cylinder in mm



Figure 3: Tensile Test

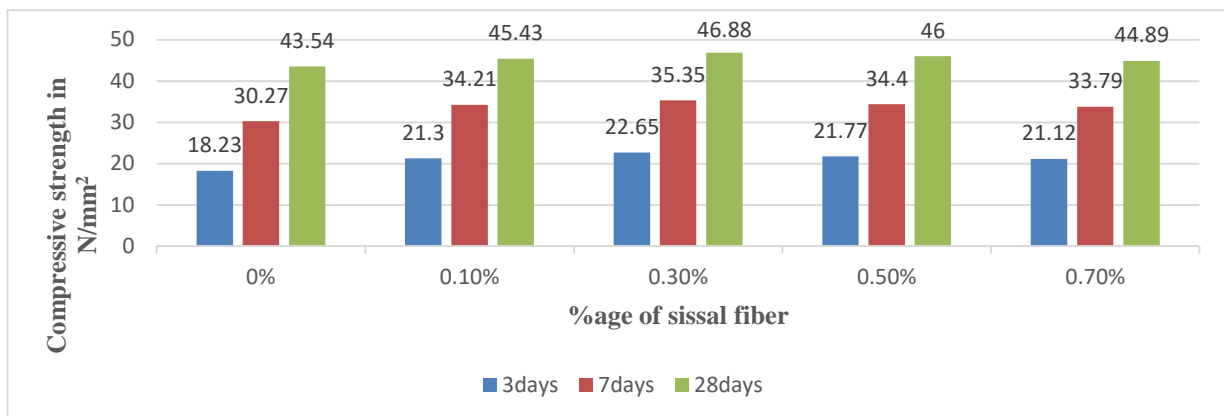


Figure 4 : Comparison of Compressive Strength

IV.RESULTS AND DISCUSSION

The test results cover the effect of age on the compressive strength, tensile strength and flexural strength test. The test specimens are made with differing percentages of 0%, 0.5%, 1%, 1.5% and 2% of sisal fiber by the weight of cement. Each test result plotted in the figures or given in the tables is the mean value of results obtained from at least three specimens

Compressive strength in N/mm ²	Age(days)		
	3	7	28
0%	18.23	30.27	43.54
0.1%	21.30	34.21	45.43
0.3%	22.65	35.35	46.88
0.5%	21.77	34.40	46.00
0.7%	21.12	33.79	44.89

OBSERVATION

- From the above graph we can conclude that for 0.3% fibers we got maximum value.
- For 0.5% and 0.7% the strength goes on decreases.
- By comparing sisal fibre concrete with normal concrete, the strength is more for 0.3% sisal fibre concrete.

SPLIT TENSILE STRENGTH TEST

Tensile strength in N/mm ²	Ages(days)		
	3	7	28
0%	1.27	2.47	3.11
0.1%	1.76	2.75	3.81
0.3%	2.19	3.04	4.24
0.5%	2.40	3.46	4.59
0.7%	2.68	3.74	4.88

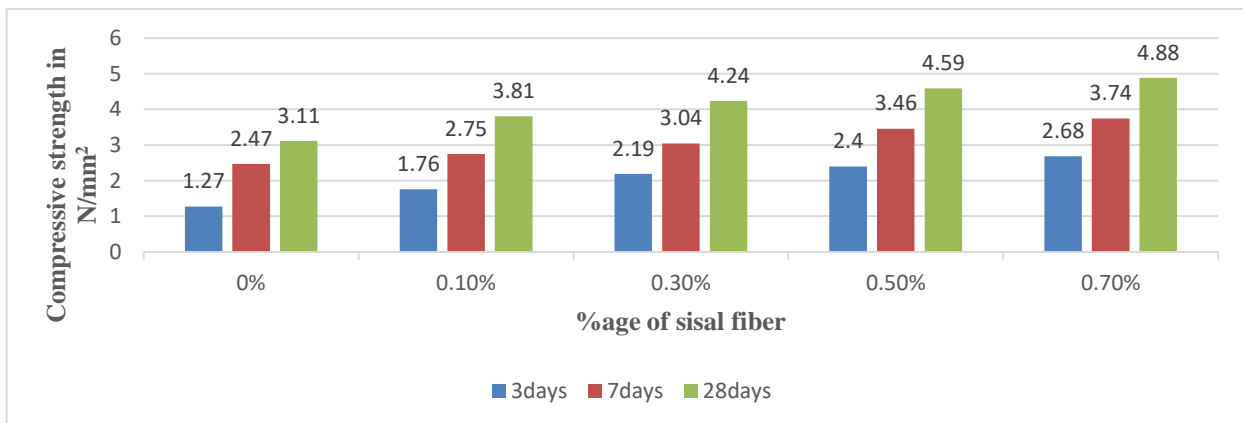


Figure 5 : Comparison of Tensile Strength

OBSERVATION

- From the above graph we can conclude that for 0.7% fibers we got maximum value.
- By adding fibres the split tensile strength goes on increase.
- By comparing it with compressive strength the maximum strength is more for 0.7% fibres.

V.CONCLUSION

The following broad conclusion can be drawn from the experimental study on development strength of concrete using sisal fiber.

- Sisal fiber can act as reinforcement because as it has high tensile strength compared to other natural fiber, the fiber is strong due to the properties of lignin in it which act as lignified cellulose fibers which retains its strength when its goes to hydration process compared to other natural fibers.
- Maximum compressive strength is achieved at 0.3% then after it decreases.
- We can replace sisal fiber up to 0.3% only to the concrete, incase if we increase the amount of fiber beyond that it leads to failure.



REFERENCES

1. Vijaychandrakanth S-“studied on flexural behavior of sisal fiber in reinforced concrete beam”
2. Gollapallepriyankarani , DR P Srichandhan –“studied on experimental investigation on effects of sisal fiber reinforced concrete”
3. Dr Y K Sabbapathy , J Rekha –“ study on the strength of sisal fiber reinforced concrete beam”
4. MarutheshaM , Dr Ramesh Manoli-“study on strength property of concrete using fibers and GGBS as partial replacement of cement”
5. Balasubramanian M –“ study on durability of concrete by use of sisal fiber”