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Experimental Investigation on Strength of Concrete by Agave Sisalana (Sisal Fibers)

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Abstract: ***Concrete is strong in compression but weak in tension. So we will provide the reinforcement to the concrete. Majorly steel is used as the reinforcement. Many of the researches are in progress to find a substitute to this material. Many investigations proposed artificial fibres. The study focuses on the compressive strength, split tensile strength, performance of the blended concrete containing Na2CO3 treated sisal fibre. In this project study of Na2CO3 treated sisal fibres, the strength parameters normal concrete had been carried out by varying percentages of 0%, 0.5%, 1% and 1.5% for M30 grade of concrete design by using IS10262-2009. Concrete cubes and cylinder are tested at the age of 14, and 28 days of curing. From the experimental investigations, it has been observed that, the optimum percentage of Na2CO3 treated sisal fibre is 1% for M30 grade.***

Keywords: Sisal Fibre, Compressive strength, Tensile Strength and Flexural Strength.

I. INTRODUCTION

The increase in global population is putting rising demand on the construction industry, now more than ever. The industry heavily relies on concrete that happens to be the most widely used construction material because of its unique inherent properties, such as high compressive strength, good durability, fire resistivity, and low permeability. Aside from these positive properties are adverse characteristics, such as low tension strength, brittleness, low resistance to cracking, and low impact resistance.These defects made it necessary to find out ways to improve the properties of concrete; some of these deficiencies, such as low tensile strength, can be improved by using conventional reinforcement steel bars and, to a reasonable extent, by incorporating optimum amount of certain fibre in concrete: Fiber-reinforced concrete (FRC). Natural fibres are prospective reinforcing materials and their use until now has been more traditional than technical. They have long served many useful purposes but the application of materials technology for the utilization of natural fibres as the reinforcement in concrete has only taken place in comparatively recent years.

The distinctive properties of natural fibre reinforced concretes are improved tensile and bending strength, greater ductility, and greater resistance to cracking and hence improved impact strength and toughness. Besides its ability to sustain loads, natural fibre reinforced concrete is also required to be durable. Durability relates to its resistance to deterioration resulting from external causes as well as internal causes.

Applications of fiber reinforced concrete are becoming increasingly popular and are exhibiting excellent performance. Fiber-reinforced concrete (FRC) is concrete containing fibrous material which increases its structural integrity Therefore, as a research effort on the development of green materials in civil engineering, this paper describes an experimental study of a improve the durability of natural fiber reinforced concrete by Na2CO3 treated for varies percentage of sisal fiber. Mechanical behaviour of the FRC is determined for the Na2CO3 treated sisal fiber.

A. Scope

Concrete is strong in compression and week in tension. To increase the tensile strength of concrete we are adding sisal fibre. Also it resists the plastic shrinkage cracks. This sisal fibre is a natural product that is available in the fields and if this could replace the reinforcement in the concrete it would be a relatively change in the construction industry.

B. Objective

The main objective is to study the effect on utilization of sisal fibre in the concrete as the reinforcement and in this investigation the fibre is mixed in different proportions by cutting it into small pieces of size 3 to 5 cm. To study the mechanical and transport properties of concrete

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1) Compressive test on concrete cubes (150× 150× 150 mm)
2) Split tensile strength on cylinders (Ø 150 mm & 300 mm long)
3) Workability test.

II. MATERIALS AND METHOD

A. Materials

1) Cement

Cement is a material that has cohesive and adhesive properties In the presence of water. This consists primarily of silicates and aluminates of lime obtained from limestone and clay. Ordinary Portland Cement (OPC) is the basic Portland cement and is best suited for use in general concrete construction. It is of three types, 33 grade, 43 grade and 53grade. Cement is basically used as a binding material for concrete. Here ordinary Portland cement of grade 53 is used. The properties of cement are shown in Table.

Sr. No	specifications	Result
01.	Type	OPC
02.	Specific gravity	3.0
03.	Initial setting time	30 min.
04.	Fineness	4%

2) Fine Aggregate

Fine aggregate used in the experiments was locally available river sand conforming to IS 383- 1970(6).The physical properties of the fine aggregates were tested in accordance with IS 2386(10).

Sr. No	specifications	Result
01.	Specific gravity	2.4
02.	Water Absorption	1%
03.	Fineness	30.40
04.	Density	1.57

3) Coarse Aggregate

The coarse aggregate used in this study was crushed granite of maximum size 20 mm obtained from the local crushing plant. Rocks with a water absorption of 0.8% and specific gravity of 2.6 is used.

Sr. No	specifications	Result
01.	Aggregate Size	20mm
02.	Specific gravity	2.6
03.	Water Absorption	0.8%

4) Sisal Fibre

The Sisal fibre plants consist of a rosette of sword-shaped leaves about 1.5 to 2 meters tall. Young leaves may have a few minute teeth along their margins, but lose them as they mature. The sisal fibre plant has a 7–10 year life-span and Typically produces 200–250 commercially usable leaves. Each leaf contains an average of around 1000 fibres. The fibres account for only about 4% of the plant by weight. Sisal fibre is considered a plant of the tropics and subtropics, since production benefits from temperatures above 25 degrees Celsius and sunshine.

Sisal fibre is one of the most commonly used natural fibres and is easily grown. Sisal is a hard fibre derived from the leaves of the sisal plant (Agave sisalana). Sisal is a completely biodegradable and highly renewable energy resource. The material is chosen to biodegradable enhance the various strength properties of the structure in order to achieve durability and a higher quality structure. There are three types of sisal fibres, arch fibres, conductive fibres and structural fibres. The structural fibres are often taken out of because of their toughness as they do not break during the extraction process.

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Sr.No.	Fiber Property	Result
01	Fiber length	30mm
02	Fiber diameter	0.10–0.13 mm
03	Aspect ratio	230–300
04	Tensile strength	371 ± 28 MPa
05	Shape	Straight
06	Color	Creamy white
07	Density	0.113 g/cm3

5) Water

Ordinary portable water available in the laboratory conforming to ASTM C1602 [17] requirements with a pH of 8.1 was used in the study for the mixing and curing of concrete mixes.

B. Specimen Preparation

Standard grade concrete design mix is made and cubes of 150MM*150MM*150MM are made. The cubes are cast with sisal fibers and without sisal fibers. After casting, the specimens are demoulded after 24 hours.

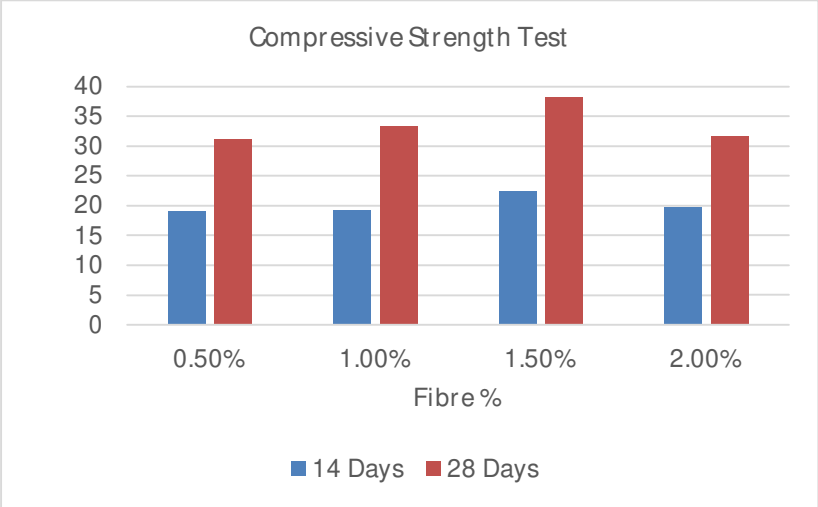
Basic material tests were conducted the materials such as cement, fine aggregates, coarse aggregates and fibers. Based on the materials test values cement, fine aggregate, coarse aggregate and sisal fiber using IS10262- 2009 we design for M30 grade concrete. In order to improving the degradation resistance of sisal fibers are immersed in Na2Co3 solution. With varying percentage of Na2Co3 treated sisal fibers such as 0.5%,1.0%,1.5%&. cubes and cylinders are casted for 14 days and 28 days. Compressive strength and tensile strength are determined for the above casted cubes & cylinders based on the compressive and tensile strength.

Sr.No.	Mix Proportions Materials	Quantity (kg/m3)
01	Fine Aggregate	636
02	Coarse Aggregate	1127
03	Cement	448
04	water	192.56lit

III. RESULT AND DISCUSSION

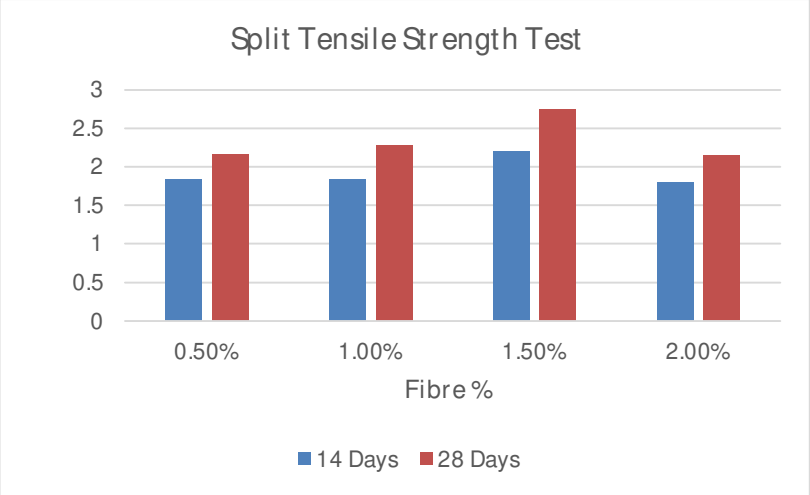
A. Compressive Strength Test

Sr.No.	Percentage(%)	Compressive Strength (N/mm^2)	
		14 Days	28 Days
01	0	19.16	31.11
02	0.5	19.21	33..33
03	1.0	22.34	38.12
04	1.5	19.63	31.66



B. Split Tensile Strength

Sr.No.	Percentage(%)	Split Tensile Strength (N/mm^2)	
		14 Days	28 Days
01	0	1.834	2.160
02	0.5	1.833	2.285
03	1.0	2.198	2.750
04	1.5	1.800	2.150



IV. CONCLUSION

Based on the results of our investigation, the following conclusions were Arrived , using the natural sisal fiber increase the strength of concrete. The optimum percentage of sisal fiber for maximum strength was 1% for compressive strength and split tensile strength. Workability decreases with increase in percentage of sisal fiber replaced with o.5%.1.0%,1.5% of weigth of cement.

Sisal fiber is treated with NA2CO3 proportion.The recommended optimum mix based on the physical and mechanical parameters In this study is 1% sisal fiber addition, which gave 38.12 N/mm^2 compressive Strength and 2.75N/mm^2 split tensile strength at 28 days of curing, 22.34 N/mm^2 Compressive strength and 2.19 N/mm^2 split tensile strength at 14 days of curing.

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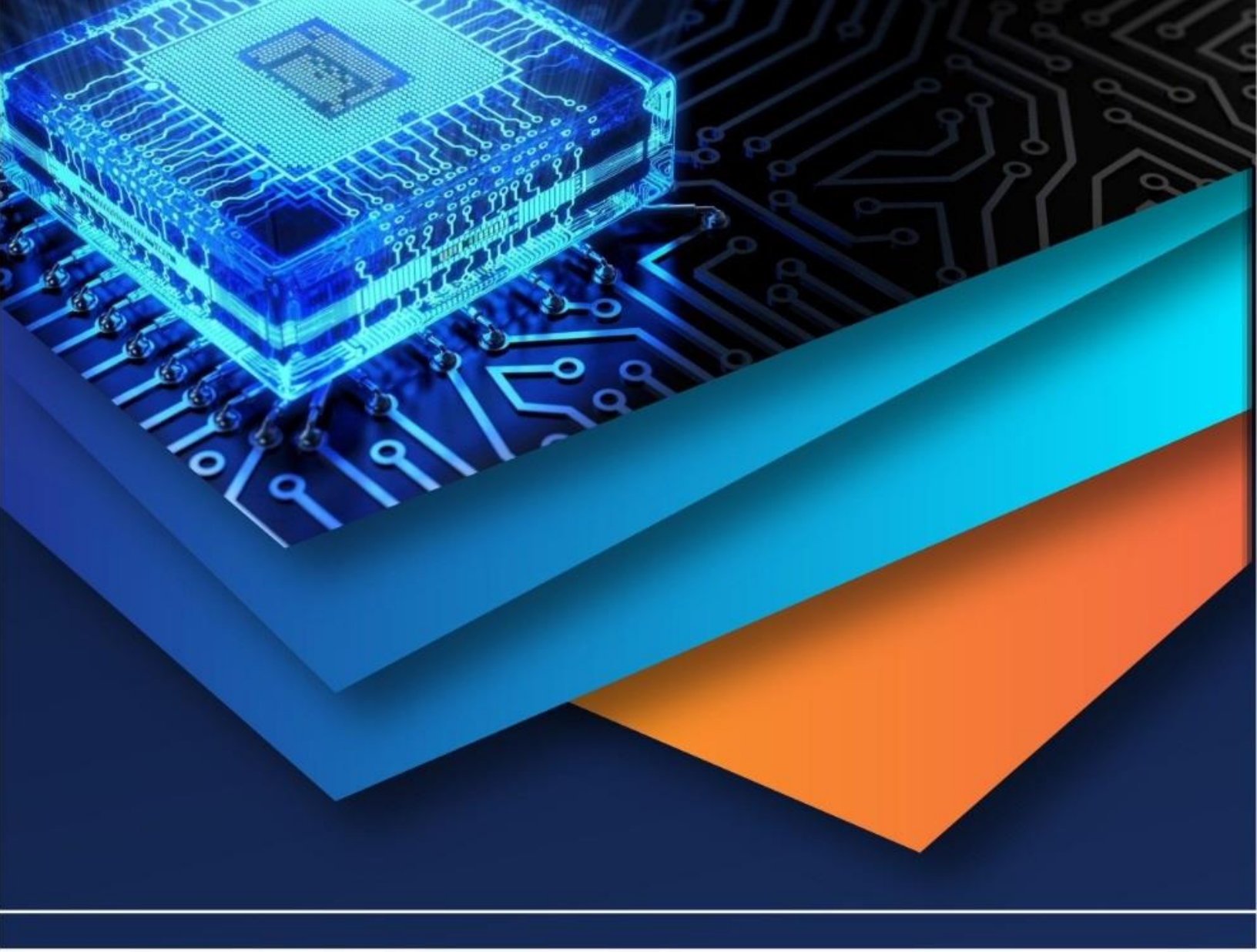

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