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Experimental Study on Sisal Fiber Reinforced Concrete with Addition of Fly Ash

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Abstract: ***Concrete is strong in compression but weak in tension. So we will provide the reinforcement to the concrete. Fiber Reinforced Concrete FRC can be used for a variety, of applications. Sisal is a natural fiber that is renewable, inexpensive, and readily accessible. SSF is a potential reinforcement for use in concrete because of its cheap cost, low density, high specific strength and modulus, negligible health risk, easy accessibility in certain states, and renewability. The manufacturing process of cement .emits considerable amount of carbon dioxide (CO2) . Therefore there is an urgent need to reduce the usage of cement. Fly ash is produced from the combustion of coal in electric utility or industrial boilers. The concrete in which the cement is replaced up to 40%. The study focuses on the compressive strength, split tensile strength, performance of the blended concrete containing Na2CO3 is treated with sisal fiber for 5 days on the strength parameters normal concrete had been carried out by varying percentages of 4%, 6%, 8%, 10% for M30 grade of concrete design by using IS10262-2009. Concrete cubes and cylinder are tested at the age of 7, 14, and 28 days of curing***

Keyword: Fibre reinforced cement (FRC), Sisal, Fly ash, Sodium carbonate (NA2C03)

I. INTRODUCTION

Natural fiber has a special appeal in the field of civil engineering. Natural fibers are a good reinforcement material .Sisal fiber is a promising reinforcement for use in composites due to its low cost, easy availability, low density, no health hazards and high specific strength and modulus.

Previous research revealed that sisal fiber reinforced concrete has improved the characteristics of concrete such as strength, durability, and workability.

The addition of the fiber in small amounts will increase the tensile strength .addition of fibers not only increases the tensile strength but also increases the bound strength, decreases permeability. Toughness of concrete also increases by the addition of the fiber . The result obtained by Jianqiang wei showed that. Na2CO3 surface treatment for seven days were shown to have the potential of improving the durability of sisal fibers with less potential hazards. Fibers were treated with alkali solutions to partially remove the lignin, hemicelluloses and other residues from the fiber surface

Therefore as a research effort on the development of green materials in civil engineering, this paper describes an experimental study of a improve the corrosion resistance of sisal fiber in the alkali environment of concrete and the durability of natural fiber reinforced-concrete in aggressive environment by Na2CO3 treated for varies percentage of sisal fiber. Mechanical be behavior of the fibers is determined for the Na2CO3 treated sisal fiber.

II. LITERATURE REVIEW

Mr. Mithun K,R.M. Mahalinge Gowda. , H.S Suresh Chandra - Concrete is strong in compression but weak intension. 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 fibers. The study focuses on the compressive strength, split tensile strength, performance of the blended concrete containing Na2CO3treated sisal fiber. In this project study of Na2CO3 treated sisal fibers for 5 days on the strength parameters normal concrete had been carried out by varying percentages of 0%,0.5%, 1%, 1.5%and 2% for M30 grade of concrete design by using IS10262-2009. Concrete cubes and cylinder are tested at the age of 7, 14, and 28 days of curing. From the experimental investigations, it has been observed that, the optimum percentage of Na2CO3 treated sisal fiber is 1% for M30grade.

Keywords- Natural fiber reinforced cement (NFRC), Sisal Manufactured sand, Sodium carbonate (NA2C03)

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Tanveer Ansari, Abhishek Mishra, Kumar Vanshaj - Concrete is a mix of cement, water, fine and coarse aggregate that may be poured and hardens to become a sturdy building material. The globe over, concrete is crucial construction material that is used extensively. Tension is weak in concrete. Different types of fibers are added to concrete in varying quantities to increase its tensile strength. Concrete that self-compacts can spread and flow into the form without the use of mechanical vibration. It maybe utilized in situations where compacting freshly laid concrete would be laborious, such as underwater concreting, pile foundations, and walls with crowded reinforcing. The primary goal of this project is to use natural fiber to improve the performance of self-compacting concrete (sisal fiber). In order to halt the cracks, the aforementioned fibers are used; fibers might continue to hold the matrix together even after a crack is developing. The machine-decortications technique produces the fibers. This study examines the qualities of freshly-poured and hardened concrete with reinforced sisal fiber SCC at various fiber adding rate. In order to improve the mechanical properties of concrete it will be replaced by sisal fiber as 0.5% ,1% and 1.5% by volume for M-45 design mix. The concrete specimens will be tested for compressive strength at 7 ,14 and 28 days respectively and Split tensile Strength at 7 and 28 days and Compressive Strength test at28 days also the results obtained will be compared with those of traditional concrete.
Key Words: Sisal fiber, concrete, compressive test, aggregate, flexural test.

Iniya.M.P , Nirmal kumar Fiber Reinforced Concrete FRC can be used for a variety, of applications. Fibers are utilized in concrete crack requiring reduction of physical property protection, drying reduction and improved strength and toughness, increased service life and decrease bleeding from water, concrete permeability, and construction value. The utilization of sisal, a natural fiber with increased mechanical efficiency, as reinforcement in an exceeding matrix based on supported cement. The proportion of sisal fiber used in concrete ranged from 0.1% to 2% of concrete and length of fiber 50mm to 60mm fiber length in concrete with aspect ratio. By adding short fibers ,tensile strength is improved, thaw resistance is frozen, impact resistance, and concrete brittleness are reduced. In general, fiber does not enhance the concrete strength, as the replacement moment is reduced in the reinforcement of structural steel. This paper also represents fiber limitation content, environmental aspects, and FRC is the modern technical enhancement in the civil substructure .This review paper also describes the compressive strength test, flexural strength test, tensile strength test, impact strength test of FRC sisal fiber effect strength test
Keywords: Sisal fiber, flexural strength, Compressive strength, Split tensile strength, Impact strength test.

Jawad Ahmad , Ali Majdi , Ahmed Farouk Deifalla , Nabil Ben Kahla and Mohammed A. El-Shorbagy - Concrete is a commonly used building material; however, it is subject to abrupt failure and limited energy absorption when yielding. The use of short discrete fibers has displayed a lot of potential in overcoming these issues. Sisal is a natural fiber that is renewable, inexpensive ,and readily accessible. SSF is a potential reinforcement for use in concrete because of its cheap cost , low density, high specific strength and modulus, negligible health risk, easy accessibility in certain states, and renewability. In current centuries, there has been growing importance in discovering new uses for SSF-reinforced concrete, which is normally utilized to make ropes, mats, carpets , and other decorative items. This article gives an overview of current advancements in SSF and composites. The qualities of SSF, the interface between SSF and the matrix, and SSF-reinforced properties such as fresh, mechanical strength, and durability have all been examined. The results show that SSF increased strength and durability while decreasing its flow ability. The review also provides suggestions for further work.
Keywords: concrete; sustainable concrete; natural fibers; durability; compressive strength

Samantha Acosta-Calderon , Pablo Gordillo-Silva , Natividad García-Troncoso , Dan V. Bompa and Jorge Flores-Rada - This paper presents a focused comparative case study considering the influence of natural and synthetic fibers on the fresh and mechanical properties of concrete. Locally sourced 19 mm long sisal fibers from sisalana leaves and manufactured polypropylene fibers were incorporated in a normal strength concrete matrix with fiber volumetric contents of 1%. After describing the measured aggregate characteristics, mix designs, and fresh concrete properties, several destructive and non-destructive tests on hardened concrete were undertaken. The former included compression tests on cylinders and flexural tests on prismatic samples, and the latter included ultrasonic pulse velocity and rebound number tests. The workability of sisal-fiber reinforced concrete was generally lower than the nominal concrete and that provided with polypropylene fibers by about 20%, largely due to the hydrophilic nature of the natural fibers. Test results showed that the presence of sisal fibers can improve the compressive strength by about 6%, and the tensile strength by about 4%, compared with the non-reinforced counterpart. This was due to the sisal fibers storing moisture that was released gradually during hydration, helping with the strength development. The concrete with polypropylene had virtually identical properties to the reference concrete. In addition to fresh and mechanical properties, environmental impacts associated with

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the production of fiber and concrete were also identified and discussed. Based on the assessments from this paper, overall, from the two fibers investigated, the sisal fiber showed more promising results, indicating that natural fibers can be a more sustainable alternative to plastic fibers, providing a good balance between workability and strengths

Keywords: fibers; sisal; polypropylene; fresh properties; mechanical properties

III. MATERIALS USED

A. Cement

Cement is a dry powdery substance made by calcining lime and clay, mixed with water to form mortar or mixed with sand, gravel and water to make concrete. It is a binder material. Once hardened, cement delivers sufficient strength to erect large industrial structures. Cement is corrosive to metals and therefore any metals in contact with cement should be corrosion resistant.

A normal type of cement that is used in the construction industry is also known as hydraulic cement because this powdery substance is generally mixed with water before use.

Table 1 Properties of Cement

Property	Value
Fineness Test	5%
Consistency Test	34%
Intial and final setting time	35 min and 450min
Soundness Test	5.3mm

B. Fine Aggregate

Manufactured sand is also called as mechanical sand. It possesses similar properties as similar grading as per the river sand. Due to this reason, manufactured sand normal sand. Mechanical sand contains can be used in the region where normal sand limited in availability.

Table 2 Properties of Fine Aggregate

`Property	Value
Specific Gravity	2.69
Fineness modulus	2.68

C. Coarse Aggregate

The coarse aggregate for structures consists of material between the sizes of 5 mm and 150 mm. Rocks with a water absorption value of more than 3% or a specific gravity of less than 2.5 are not known to be suitable for mass concrete. In practice, however, mixtures with the same workability for round shaped aggregates needed less water than angular shaped aggregates. The properties of fine aggregate

Table 3 Properties of Coarse Aggregate

Property	Value
Specific gravity	2.63
Water Absorption Test	0.59
Crushing strength test	24.54%
Abrasion and Attrition test	3.4%

D. Sodium Carbonate Solution

Utilizing the water absorption of sisal fiber, Na2Co3solution was introduced to soak the dry fiber. After treatment in sodium carbonate saturated solution for seven days, there will be a large number of Na+ and Co32- ions deposited on the fiber surface. When fibers are added to fresh concrete, there will be a chemical reaction on the fiber surface, due to the Ca2+ in the cement.

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E. Sisal Fiber

Sisal fiber is species of Agava sisilana. The material is mainly used for applications like rope manufacture in marine and construction industry. As it possesses high strength compared to other fiber materials, this fiber is selected for the present research work. Concrete paste is done with the help of cement, filler materials, aggregates is prepared. Here, Sisal Fibers are used as reinforcing agent for cement.

Table 4 Properties of Sisal Fiber

Property	Value
Diameter	1. 22–80 µm
Fiber length	1. 1000–1250 mm
Density	1.16g / cm3
Moisture regain	11 %
Breaking strength	30–45 cN/tex
Elongation	2–3 %

F. Fly Ash

Fly ash is produced by coal-fired electric and steam generating plants. Typically, coal is pulverized and blown with air into the boiler's combustion chamber where it immediately ignites, generating heat and producing a molten mineral residue. Boiler tubes extract heat from the boiler, cooling the flue gas and causing the molten mineral residue to harden and form ash. Coarse ash particles, referred to as bottom ash or slag, fall to the bottom of the combustion chamber, while the lighter fine ash particles, termed fly ash, remain suspended in the flue gas. Prior to exhausting the flue gas, fly ash is removed by particulate emission control devices, such as electrostatic precipitators or filter fabric baghouses

Table 5 Properties of Fly ash

Property	Value
color	Whitish grey
Bulk density (g/cm3)	0.994
Specific Gravity	2.288
Moisture(%)	3.14
Average particle size	6.92

IV. TESTS TO BE CONDUCTED

Fresh concrete tests such as slump cone test, Vee-Bee Test are to be performed. Compressive strength test, split tensile test and Flexural strength test are also proposed to be conducted.

V. CONCULSION

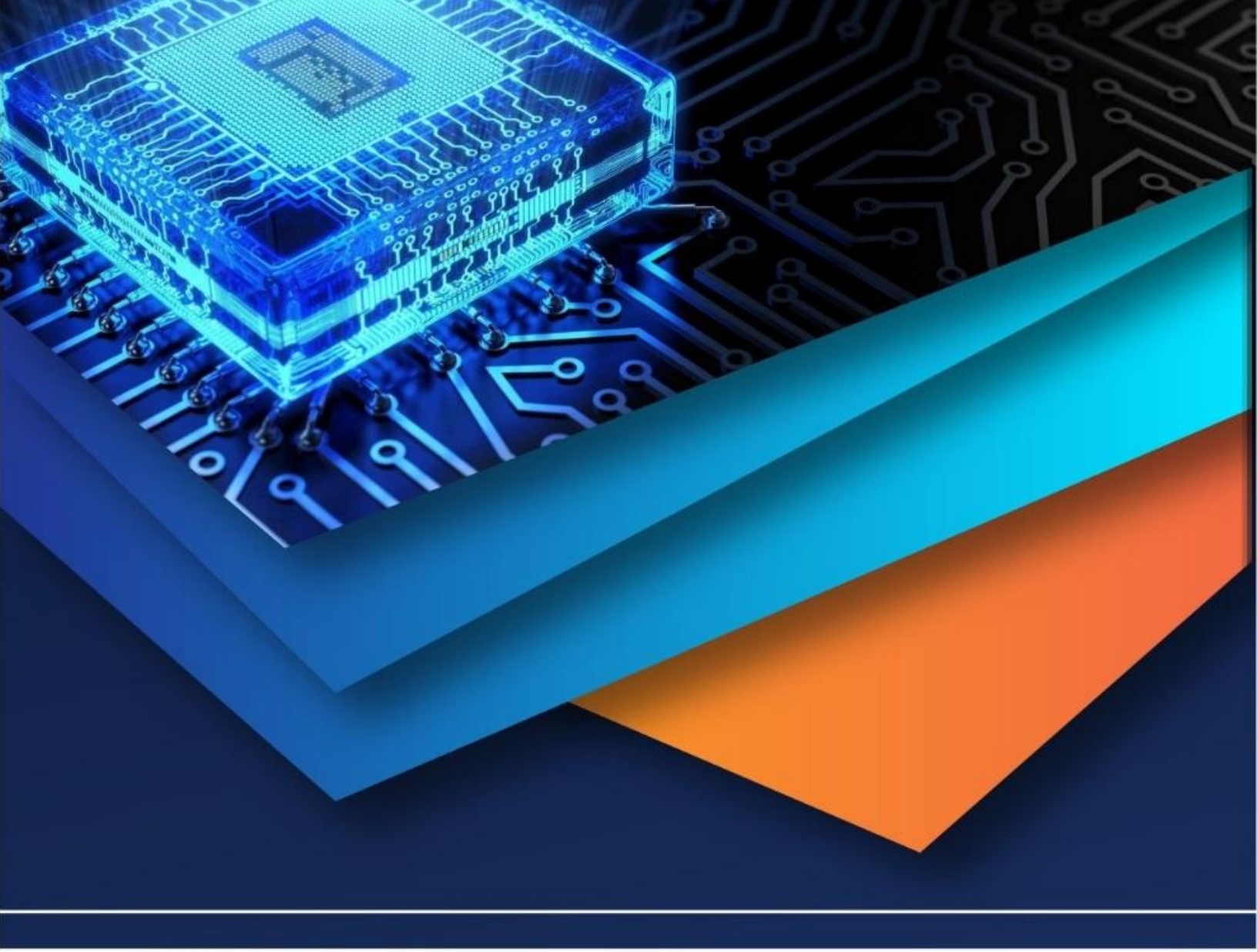
A. The basic property cement, fine aggregate, coarse aggregate and fiber has been found out.
B. The workability test for concrete such as Slump test, Flow test, Vee Bee Apparatus test, should be found out with adding of fiber.
C. Further the results of mechanical properties of concrete should be done and compared with conventional concrete.

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