An Experimental Investigation On Properties Of Sisal Fiber Used In The Concrete

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Abstract- *Ordinary Portland Cement (OPC) is the traditional binding agent used in concrete. However, the energy-intensive process of making cement releases additional CO2 into the environment. Since OPC's utility is growing at an exponential rate, this issue is getting worse every day. Natural fibers are favored for a number of reasons, including their affordability, accessibility, minimal energy requirements for manufacturing, renewable nature, and lack of toxicity. Furthermore, compared to plain cement mortar or concrete, natural fiber composites with cement and cementations composites perform better in terms of flexural strength, toughness, fatigue, ductility, and post cracking strength. The performance of cement composites will be hampered by the addition of natural fiber. These impacts could impact the matrix's fresh and hardened characteristics.*

Finding the ideal percentage of sisal fiber and aspect ratio to provide optimal compressive strength is the goal of this research project.

Keywords- Natural fibres are, sisal fiber, green house, Ordinary Portland Cement ,(OPC). Geo Polymer Concrete (GPC).

I. INTRODUCTION

The most used building material in the world is concrete, which exhibits a brittle character and a higher compressive strength but a lower tensile strength behavior. The primary purpose of steel reinforcement is to satisfy the ductility and tensile strength characteristics of concrete components. One of the main issues facing civil engineers in the building sector is the corrosion of steel reinforcement. However, steel reinforcement is still expensive today and is produced with a lot of energy and a non-renewable resource. For every cubic meter of reinforced concrete elements, about 200 kg of steel reinforcement is needed. In order to attain sustainable concrete and structures, it is necessary to create new sustainable materials to reduce the use of steel reinforcement for concrete elements.

The use of natural fibers to replace synthetic fibers in the application of Fibre Reinforced Concrete (FRC) composite materials has become increasingly popular in recent decades as a result of growing environmental consciousness. Concrete that contains fibrous material to improve its structural stability is known as fiber-reinforced concrete. It has distinct, small-length fibers that are dispersed randomly and have a consistent spherical form. One way to describe fiber-reinforced concrete is as a composite material consisting of cement, coarse and fine aggregate, and discrete intermittent fibers. The function of intermittent fibers that are dispersed randomly is to bridge over the cracks that form and offer some "ductility" after they have cracked. The fiber's sincere goal is to increase the concrete's strength under various loading scenarios.

The fiber reinforcement will be used as a component of the randomly dispersed, three-dimensional fibers throughout the structural member. Shear resistance and crack management are two benefits of the fiber in concrete. In India, fiber-reinforced concrete has been in use for many years. The structural applications are very limited, though. The fibers have been used to give the concrete its mechanical qualities. In India, fiber-reinforced concrete is used for slope stabilization and tunneling operations.[5] In comparison to traditional concrete, fiber-reinforced concrete has significant and improved qualities in the areas of durability, workability, compressive strength, tensile strength, modulus of elasticity, flexure, toughness, splitting tensile strength, fatigue strength, and impact resistance. [6] Fiber-reinforced concrete has the following benefits:

Good mix cohesion. • Enhanced pumping capacity over long spans. • Improved freeze-thaw resistance. • High fire resistance. 1.2 • Good abrasion resistance. • The increase is imperviousness nature. • Improvement in ductility.

NATURAL FIBRE

Natural fibers are those that come from plants, animals, and geological processes. Natural fiber composites are more cost-effective, lightweight, robust, rich, renewable, acoustic, thermally insulated, energy-sufficient, and health-

safe. the source of fibers categorized according to plants and animals. Wool and silk are examples of animal-based fibers. The plant provides sisal, coir, and jute as natural fibers. 3. Significant efforts have been undertaken over the past three to four decades to examine the impact of adding natural fibers to cement and concrete matrix in order to provide cost-effective building materials. Horse hair is one of the natural fibers used in mortar and straw for mud bricks. Large, long materials from plants and animals that can be spun into fibers, thread, or rope are known as natural fibers. They create materials that are vital to society using knitting, bonded, matting, and woven techniques. Fibers like coir, jute, and sisal were created many years ago. However, the methods and capabilities of texture creation have evolved significantly in recent years. As seen in Figure 1.1, the most common filaments are still utilized to produce clothing and roofing materials.

Figure 1 Roof Covering Material

II. LITERATURESURVEY &BACKGROUND

H.S. Suresh Chandra, R.M. Mahalinge Gowda, and Mr. Mithun K1 (2019). In this project, the impact of treating sisal fibers with Na2CO3 for five days on the strength metrics of regular concrete was investigated. For M30 grade concrete design, use IS10262-2009, 0.5%, 1%, 1.5%, and 2%. After they have finished curing, concrete cubes and cylinders are tested 7, 14, and 28 days later. According to experimental research, the optimal proportion of sisal fiber treated with Na2CO3 for M30 grade is 1%.

Y. Stalin Jose b, Biju C. Thomas a (2022) Since natural fiber is more accessible, it receives more focus in this study. The fiber used for reinforcement is called SISAL Fiber [SF], a substitute material in mount. The chemistry, physics, and structural properties of the fibers are investigated in detail. The sisal fiber reinforced composite has solid structural roots in both urban and rural buildings, according to the SF analysis. Since steel is poisonous to both people and animals, this can be used as a substitute. The production of SF is compared to that of mineral asbestos and synthetic fibers. This sisal fiber is thought to be economical to manufacture and to provide social and economic benefits.

Thomas Biju and Stalin Y. Jose (2024) The survey being given to analyze the functioning of sisal fibers includes a number of articles. The sisal and concrete components included in the architectural marvel are also taken into consideration while evaluating the selected papers. There is also an example of sisal fiber that is not made of the same material as concrete. The compositional percentages and contributions to the tensile and compression strengths of the adopted papers are examined. Furthermore, a comprehensive examination of the development of the adopted products and their many applications is carried out

III. OBJECTIVE

To examine experimentally the addition of fibres on the mechanical behaviour of Sisal Fibre Reinforced Concrete (SiFRC) based on composites with various fibre fraction and to find out the optimum dosage and aspect ratio of the sisal fibre.

To evaluate the mechanical strength and durability behaviour of Conventional Concrete (CC) and Sisal Fibre Reinforced Concrete (SiFRC).

IV. RESULT

COMPRESSIVE STRENGTH OF SISAL FIBRE REINFORCED CONCRETE

Compressive strength is computed using the guidelines given in IS516: 1959[39] for reinforced concrete. Nine concrete cubes were cast for each grade of concrete, i.e., M40 respectively.

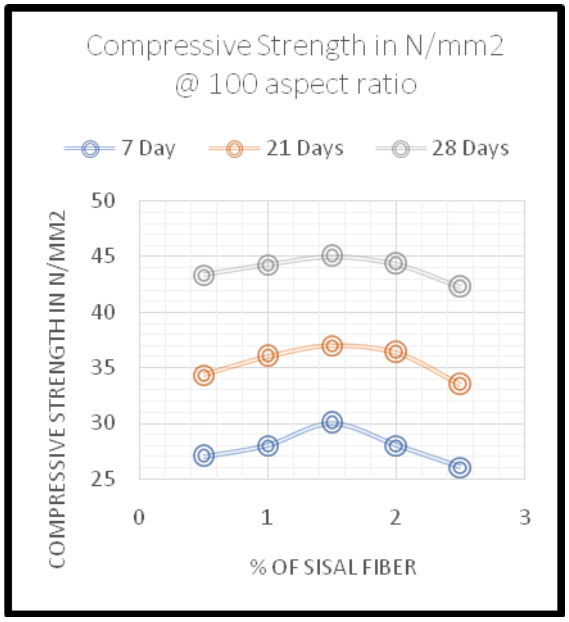

Figure 1 Compressive Strength on SiFRC at 100 aspect ratiofor M40 Concrete

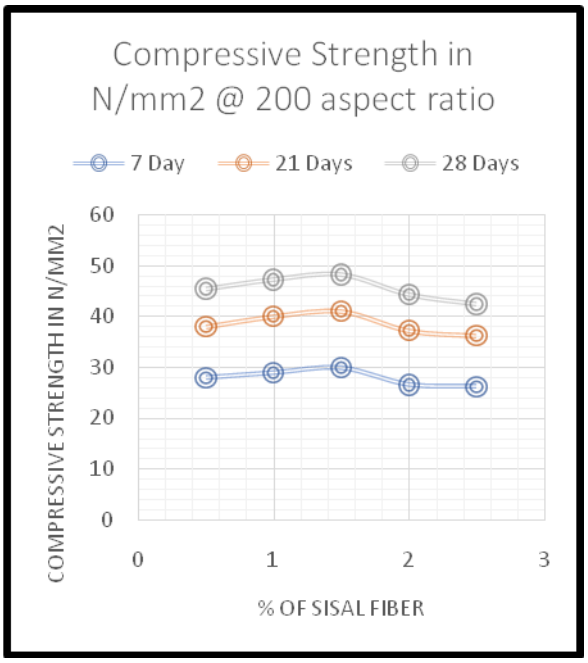

Figure 2 Compressive Strength on SiFRC at 200 aspect ratio for M40 Concrete

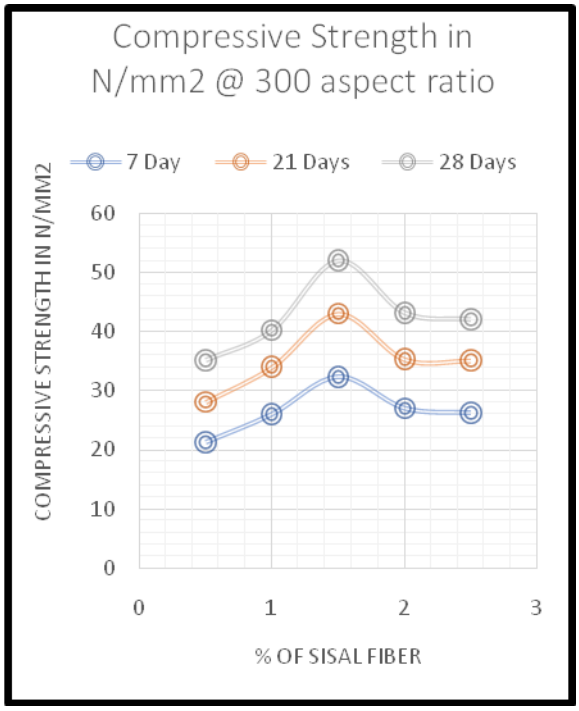

Figure 3 Compressive Strength on SiFRC at 300 aspect ratio for M40 Concrete

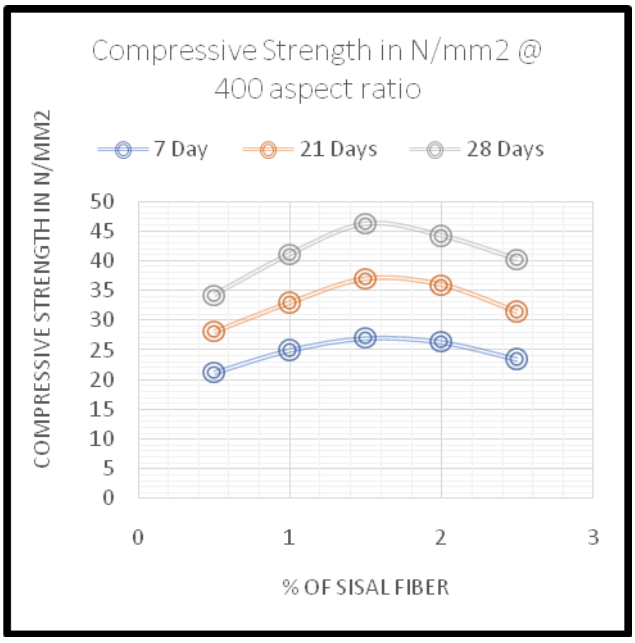

Figure 4 Compressive Strength on SiFRC at 400 aspect ratio for M40 Concrete

Since the optimum dosage and aspect ratio of sisal fibre is found 1.50% and 300 respectively for the M40 grade of concrete it was perceived that the compressive strength value for SiFRC is higher than CC irrespective of grade. On the 7th day, the compressive strength of M40 grade SiFRC is 7% more than that of M40 grade conventional concrete. The compressive strength on the 14th day of M40 grade SiFRC is 7% more than that of M40 grade CC. On the 28th day, the

compressive strength of M40 grade SIFRC is 10% more than that of M40 grade CC.

V. CONCLUSION

In the present investigation sisal fibre are incorporate in the conventional concrete and calculated the aspect ratio and volumetric ratio of the sisal fibre. Mechanical properties such as compressive, split tensile, flexural for M40 grade of concrete are evaluated as per the Indian standards.

The compressive strength, split tensile strength and flexural strength of sisal fibre reinforced concrete for the fibres having aspect ratio of 100, 200, 300 and 400. In which on each aspect ratio, the percentage of sisal fibre is about 0.5, 0.1, 1.5 and 2.0. From the results, it was found that aspect ratio of 300 and fibre dosage of 1.5% is the optimum among all other dosage

M40 grade sisal fibre reinforced concrete obtained a compressive strength more than 13% of M40 conventional concrete. The sisal fibre reinforced concrete gives a good initial strength more than conventional concrete. This is achieved due to mechanical bonding between the fibre and matrix.

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