Experimental Study on Sisal Fiber Reinforced Concrete for Finding Strength Properties

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Abstract-The present research was intended to check the workability and quality properties of sisal fiber strengthened cement with various levels of fiber addons. The materials were improved the differed quality properties of the structure to get property and elevated quality structure. Ordinarily Concrete is solid in compression and frail in tension. Significantly steel is utilized as the fortification. A significant number of examines are in advancement to locate a substitute to this material.

In this investigation we might want to take the normally accessible fiber named sisal fiber is taken as a substitute material to the fortification and concentrated the properties. Level of workability of concrete blend with 0.2% super plasticizer and water bond proportion 0.50 had great workability with slump 58mm and compaction factor 0.97, which is powerful, was acquired. Materials were hand blended with 0.5%, 1% 1.5% expansion of fiber in M25 design and place in cubes and cylinders. The got examples were exposed to tests meant to check the compressive and elasticity. An expansion in compressive quality by 25.22%, elasticity by 4.15% and water assimilation by 1.04% was watched for 1.5% expansion of fiber in M25 blend structure for 7days separately. An expansion in compressive quality by 30 % watched for 1.5% and water ingestion by 3.54% was watched for 1.5% expansion of fiber in M25 mix design for 28days respectively.

Keywords: M25 mix design, sisal fiber, super plasticizer, workability

1. INTRODUCTION

Mix of cement, fine and coarse aggregates and water is concrete, which are mixed in a particular proportion to get a particular strength. The cement and water react along with chemicals to create a paste, which binds the aggregate particles together. The blend sets into a stone like strong mass, which has impressive compressive strength however little opposition in tension. The concrete likewise bear three basic properties namely workability, strength and durability. Amount of helpful inward work important to conquer the interior friction to deliver compaction is named as workability. Solidness is sustenance of shape, size and quality, protection from introduction conditions, deterioration and wearing under antagonistic condition. Appropriately compacted and restored concrete utilized in RCC keeps on being significantly water tight and strong till slim pores and small scale breaks in the inside are interconnected to frame a pathway up to the surface.

The compressive quality of concrete is similarly a standout amongst the most imperative properties of concrete. In most basic applications, concrete is used basically to oppose compressive anxieties. Compressive strength is additionally utilized as a subjective measure for different properties if a hardened concrete. The materials used in the concrete are equally responsible for its strength, durability and workability. The constructional materials like sand, cement, coarse aggregates are available in abundance but their production has certainly produced harmful gases and by products. Also the availability of resources is decreasing. The conventional concrete manufacturing depends intensely on the particles like granite, sand, etc., but along with the increase in the demand of these materials and their heavy use their cost and abundance has been increased and decreased respectively. The construction industry is in the need of huge raw material and hence the cost of construction has been increasing dramatically. Also the increased pollution during the manufacture of these materials has aided more problems. This has led the new world to

think about the renewable and sustainable use of raw materials and has challenged researchers and engineers to seek new materials to be used instead for less pollution and economical construction.

This test will likewise investigate the likelihood of making sisal fiber attachment which can emulate that of the trees by blending its bond utilizing concrete.

2. MATERIALS

The materials used to make concrete hold high importance. These materials provide the body of concrete and ultimately aids to its strength. During this project various materials were used like cement, fine aggregates, coarse aggregates, etc.

2.1 Raw materials

- Aggregates
- Coarse aggregates
- Fine aggregates
- Cement
- Water
- Sisal fiber
- Super plasticizer (0.2 % of cement content)

2.2 Sisal fiber

Fibers have been utilized to toughen blocks and earthenware since the specific start of development, yet just in the last a quarter century have the standards of fiber support of fragile frameworks started to be experimentally comprehended. Broad change in the direct of the material was watched once the lattice has been split. They incorporate metallic filaments, polymeric strands, mineral filaments and vegetable filaments. Fibers can be added to cement based matrices as primary or secondary reinforcement.

Vegetable fibers, including sisal, bamboo, wood, coconut and jute specialized. They have been endeavored as fortress for solid grids in making countries generally to convey insignificant exertion thin segments for use in hotel designs.

Vegetable fibers require only a low dimension of industrialization for their taking care of and in examination with an indistinguishable weight of the most broadly recognized manufactured fortifying strands, the vitality required for their creation is little and subsequently the expense of manufacturing these composites is additionally low (Aziz et al., 1984).

Fig. 1 Sisal fiber

In these applications, the fibers act to increment both the quality and the durability of the composite. In parts, for example, pieces and asphalts, filaments are added to control breaking initiated by mugginess or temperature varieties and in these applications (Toledo Filho, 1997). Sisal fiber strengthened cement is the solid with haphazardly conveyed filaments. The disappointment strength and modulus of elasticity depends on the amount of cellulose and the orientation of the micro-fiber.

2.3 Sisal fiber properties

Sisal fiber is types of Agava. It is scientifically known as Agave sisalana. The material is improved the distinctive quality properties of the structure to acquire supportability and better quality structure. Short discrete vegetable fiber (sisal) was analyzed for its reasonableness for joining in bond concrete. The physical property of this fiber has demonstrated no weakening in a solid medium. Leaves are dried, brushed and baled to frame fiber. Concrete is a blend of paste and fillers, bond and water go about as paste and coarse and fine total are the fillers.

Table.1 Sisal fiber properties

S.NO	Physical Properties		Chemical Properties	
1	Density	1.41 (g/cm3)	Cellulose	71.5%
2	Elongation at break	6–7 (%)	Hemi cellulose	18.1%
3	Cellulose content	60–65 (%)	Lignin	5.1%
4	Young's modulus	12.8 (GPa)	Pectin	2.3%
5	Diameter	205–230 (µm)	Lignin	0.5%

2.4 SUPER PLASTICIZER

Super plasticizers, also called high range water reducers are compound admixtures utilized where well-dispersed particle suspension is required. These polymers are utilized as dispersants to keep away from molecule isolation (rock, coarse and fine sands), and to enhance the stream attributes (rheology) of suspensions, for example, in concrete applications.

Their expansion to cement or mortar enables the decrease of the water cement ratio, not influencing the workability of the mixture, and empowers the creation of self-solidifying concrete and elite cement. This impact definitely enhances the execution of the solidifying new glue. In the event that the water cement ratio is diminishes and the quality of cement is increase.

2.4.1 Conplast sp430

The conplast SP430 is utilized where a high level of workability and its maintenance are required. It has been uncommonly planned to give high water decreases up to 55 without loss of workability or to create top notch cement of decreased porousness. The ideal dose is best dictated by site trails with the concrete mixture which empowers the impacts of workability, quality gain or cement reduction to be estimated.

3. EXPERIMENTAL INVESTIGATIONS

The experimental investigation consists of casting and testing of the control mix. The sisal fiber is utilized in the investigation with different percentages. Cube section dimension of 150×150×150 mm & Cylinder dimensions of 150 dia x 300 height. The molds are connected with an unguent before setting the concrete. Following multi day of throwing, the molds are evacuated and the solid shapes are moved to the curing tank deliberately.

4. RESULTS AND DISCUSSIONS

The test results of all the 36 cubes that were tested in compressive strength and tensile strength in universal testing machine. Each set of cubes and cylinder prisms have different curing periods being 7 days and 28 days. Also difference in the percentage of the Sisal fiber composition in cubes and cylinder is also there which are 0%, 0.50%, 1.00%, 1.50%, . All the test values are shown and their comparative study is done with the help of graphs.

4.1 Slump cone test & Compacting factor test

Slump cone test was conducted for each concrete batches before they were casted to check the workability of the concrete. Concrete having the least value of 50 mm was deemed to be workable.

Compaction factor test was also carried out for workability. The results of the test are below:

Table.2 Slump cone test& Compacting factor test

S.No	Percentage of Fiber Addition in Concrete	Slump Value (mm)	Compacting Factor
1	0	51	0.89
2	0.5	55	0.90
3	1.0	56	0.93
4	1.5	58	0.95

Fig1 Slump Cone test & Compacting factor test

4.2 Compressive strength test & Tensile strength test

Compressive Strength & Tensile Strength of M-25 Grade Concrete with different percentage of Sisal fiber for 7 days curing & 28 days curing.

Table.3 Compressive strength test & Tensile strength test

S.No.	Percentage of Sisal fiber	Compressive Strength (N/mm^2) 7 days	Compressive Strength (N/mm^2) 28 days	Tensile strength (N/mm^2) 7 days	Tensile strength (N/mm^2) 28 days
1	0	16.88	32.13	2.86	4.4
2	0.5	18.13	33.64	3.0	4.56
3	1.0	19.41	35.36	4.04	5.6
4	1.5	21.07	36.86	4.15	5.8

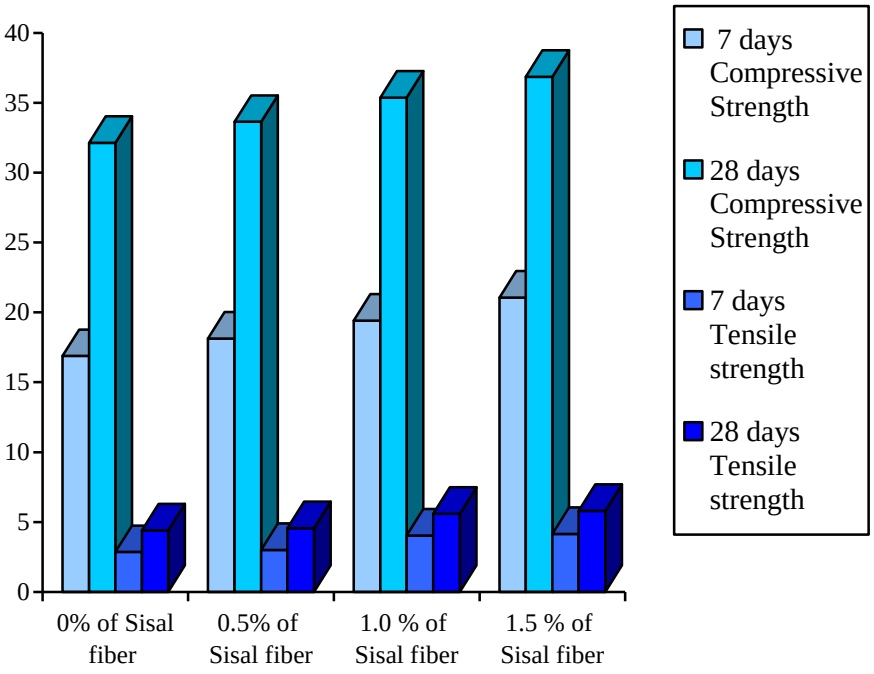

Fig.2 Compressive strength test & Tensile strength test

5. CONCLUSIONS

The strength and durability properties of concrete mixtures have been determined in the present experiment by addition of 0.5%, 1.0% and 1.50% sisal fiber with the Cement. The experiment has concluded that there was an increase in slump value from 51mm to 57mm after mixing of super plasticizer. Early gain of compressive strength for sisal fiber concrete proves to be better option for repair work. Mixing of fiber in small amounts will increase both the tensile & compressive strength. Grade of workability for concrete mixture with 0.2% super plasticizer and water cement ratio 0.50 gave great workability. Compaction factor increased by 0.02 to 0.03 after increase of super plasticizer. Compression strength increased by 45% after addition of 1.5% fibers for M25 mix design.

6. REFERENCES

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