A Review on Fiber Reinforcement Concrete

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Abstract— Concrete may be a brittle material with high strength in compression however weak in tension that reinforcement is provided. Fibers are utilized in concrete as reinforcement and strengthening part as they're effective in strengthening the concrete underneath tension similarly like standing the propagation of cracks. The influence of sisal fibers on the strength of concrete is taken because the main objective of this experimental study. The sisal fibers were supplementary in varied percentages of third, 0.5%, 1%, 1.5% and a pair of in 3 grades of concrete specifically M20, M30 and M40 and therefore the mechanical properties like compression, split tensile and flexure were tested. The optimum fiber volume fraction for compressive strength was found to be at one hundred and twenty fifth, whereas the split tensile and flexure strength improved with the rise in volume fraction of fibers. The take a look at results indicated that the sisal fibers were effective in raising the strength of concrete.

Key words: Compression, Concrete, Fibers, Sisal, Split Tensile

I. INTRODUCTION

Many experimental investigations are meted out within the recent years on the mechanical, physical and sturdy properties of concrete strengthened with numerous natural fibers. The most objective of their study was to assess the composites that were made by suspension dewatering technique with varied fibers. Physical properties, mechanical performance and microstructures were evaluated with totally different solidifying regimes.

II. LITERATURE REVIEW

Bessell & Mutuli (1982) have studied the interface bond strength of sisal-cement composites using a tensile test. The interfacial bond strength was computed from 46 specimens and the mean bond strength was found to be 0.6 MPa with a standard deviation of 0.26 MPa.

Schafer & Brunssen (1990) have developed a new low-cost, lost formwork system for floor slabs based on sisal fiber reinforced-cement composites as substitute for structural timber and have studied the load-carrying behavior of the above system having different geometrical shapes. It was observed that among various forms arch-shaped units (sectored) placed in between prefabricated beams have turned out to be the most favorable. In general it was concluded that the production technique of the sisal fiber reinforced units is so simple that unskilled workers can be employed; the units are strong enough to carry the weight of the fresh concrete and all the loads which may occur during the casting of the slab itself.

Canovas et al. (1990, 1992) have studied the durability of sisal fiber reinforced Portland cement mortars composites. To improve the composite durability they added colophony, tannin and Montana wax to the mortar matrix. All mixes had the same consistence. Effects produced by these additives on the mortar porosity, water absorption and flexural and compression strength were studied and compared with those of the control mortar

Savastano & Agopyan (1992) have studied the transition zone of hardened cement paste having sisal fibers. The effects of water-cement ratio (from 0.30 to 0.46) and the age of the composite (up to 180 days) on these zone characteristics were analyzed. It was observed that the transition zone of sisal fiber cement paste composites was porous, thick and rich of random portlandite crystals.

Ghavami & Toledo Filho (1994, 1995), Tolêdo Filho & Ghavami (1996), England and Tolêdo Filho (1997) and Tolêdo Filho (1997) have studied both the short-term and long-term behavior of sisal fiber reinforced mortar composites. The experimental work involved extensive laboratory testing to study the influence of volume fraction, fiber length, fiber arrangement and matrix composition on the mechanical properties of the composite. The workability of the fresh mix was shown to be closely related to the volume fraction and fiber aspect ratio. An increase in fiber volume fraction and fiber length reduced the workability of the mix. It was established that, for volume fractions smaller than 3% and fiber length smaller than 50 mm, the mixes could be manually compacted or vibrated without balling.

Savastano et al. (2005) reported that sisal and eucalyptus grander pulped fibers give satisfactory bonding in OPC matrices.

Kriker et al. (2005) have reported that in water curing, the vegetable fiber reinforced concrete is marginally better in respect of compressive strength.

Ismail et al. (2007) reported that compressive strength and bulk density are slightly increased at low fiber content (0.3 to 1.5% by volume). However beyond a fiber content of 1.5%, a reduction in compressive strength of about 8.2% for every 0.5% fiber volume increase was observed.

Savastano et al. (2009).The fibers can insure the post cracking resistance, high-energy absorption features, and increased fatigue resistance of cement-based composites.

Thakur et al. (2014); Balaguru and Shah(1992); Barr et al. (1996); Meddaha and Bencheikh(2009); Rizkalla and Hassan (2002); Zakaria, et al.(2015). The sustainable development with higher strength is the growing demand of construction industry. Concrete reinforcement by natural fibers are more promising to insure the concrete strength improvement with nonhazardous impact on environment as well as the effective use of available natural assets. To achieve this goal, numerous researchers have used the fiber as well as yarn very effectively as a concrete reinforcing material

III. MATERIALS & METHOD

A. Materials:

The Ordinary cement of forty three grades that is instantly accessible within the market is employed within the project. the higher coarse mixtures of 20mm and 12mm from the near quarry and therefore the fine aggregate of zone II are utilized in the project.SNF primarily based super plasticizer is employed.2.2. Method.

The main objective of this experimental program is to review the influence of strength of concrete once strengthened with sisal fibers in varied volume fractions like third, 0.5%, 1%, 1.5% and a pair of in 3 grades of concrete specifically M20, M30 and M40 severally. The mechanical properties of concrete like compression split tensile and flexural characteristics were tested. From the take a look at results, it will be seen that the fibers were effective in rising the general strength of concrete with one hundred and twenty fifth being the optimum fiber volume fraction for compression whereas the split lastingness improved with increase in fiber volume fraction.

B. Mixing:

The particular ingredients are weighed and mixed dry in electrical concrete miller a pair offer two minutes and so the fibers are unfold into the miller whereas mix and when 2 additional minutes, the actual water is supplementary and mixed totally for three minutes. the proper mixture is currently quickly tested for slump and poured into the moulds that are without delay placed on electrical vibrator in 3 layers. When few seconds of vibration the surface is correctly leveled before it's hardened. Let the moulds dry for

C. Workability:

The slump for all the mixes is meted out during normal slump equipment

D. Cube compressive strength:

Compression take a look at is that the most significant tests, wont to access the fundamental property of concrete. The compression strength of concrete depends on numerous properties like water-cement quantitative relation, the strength of cement used and internal control throughout production. Cube specimens having dimensions of a hundred and fifty x a hundred and fifty x a hundred and fifty metric linear unit were used for the compression take a look at that is in accordance with IS: 516- 1959. The compressive strength was measured exploitation the quality compressive testing machine with a capability of 2000 kN. Forty five cube specimens were tested with varied volume fraction of fiber third, 0.5%, 1%, 1.5% and a pair of for 3 grades of concrete. The results of the compression take a look at ar tabulated as shown in Table – 1

S.No	% of fiber volume fraction	Average compressive strength N/mm2		
		M20	M30	M40
1	0	29.62	36.45	42.65
2	0.5	37.26	41.22	45.77
3	1	40.38	47.56	53.82
4	1.5	35.44	45.12	50.94
5	2	32.26	38.67	43.32

Table 1: Compressive Strength test

E. Split Tensile test:

Concrete is weak in withstanding the tensile masses that reinforcement is provided. This take a look at indicates the resistance to cracks by the fibers in concrete once subjected to tensile masses. The cacophonous lastingness take a look at was meted out with the quality Universal Testing Machine with a capability of 600 kN. forty five cylindrical specimens every of size a hundred and fifty metric linear unit diameter, three hundred metric linear unit long were tested with varied fiber volume fraction from third to twenty for 3 grades of concrete. The split tensile take a look at was meted out as per IS: 5816-1999. The take a look at results of the split tensile take a look at are tabulated as shown in

S.No	% of fiber volume fraction	Average compressive strength N/mm2		
		M20	M30	M40
1	0	2.05	3.12	4.33
2	0.5	2.72	3.57	4.67
3	1	3.57	4.88	5.53
4	1.5	3.78	5.23	5.92
5	2	4.32	5.98	6.79

Table 2: Split Tensile Test

F. Flexural Strength:

The flexural strength take a look at may be alive of the intensity of a beam or block resisting against tensile forces owing to bending. This experiment inferences the capability of the bonding strength of the sisal fibers in concrete. The flexure strength take a look at was meted out on forty five beam specimens every of size500 x 100x 100 mm metric linear unit with varied fiber volume fraction like third, 0.5%. 1%, 1.5% and 2% for 3 grades of concrete. The take a look at was conducted exploitation normal Universal Testing Machine with single purpose loading. The take a look at procedure was used as per IS: 5816-1959.The take a look at results of the flexural strength take a look at are tabulated as shown within the Table - 3.

S.No.	% of fiber volume fraction	Average compressive strength N/mm2		
		M20	M30	M40
1	0	3.06	3.80	4.38
2	0.5	4.22	5.48	6.43
3	1	5.87	6.43	7.27
4	1.5	6.41	6.95	7.62
5	2	7.13	7.44	7.97

Table 1: Flexural Strength Test

IV. CONCLUSION

The take a look at results were analyzed and therefore the following conclusions were made:

- It was discovered that the addition of fibers inflated the compressive strength of concrete, significantly and therefore the most compressive strength of concrete was found to be for a fiber volume fraction of one hundred and twenty fifth altogether the 3 grades of concrete tested.
- As the grade of concrete will increase, the compressive strength additionally will increase that indicates that the grade of concrete incorporates a important influence over the compressive strength of sisal fiber ferroconcrete.

- For all the 3 grades of concrete the lastingness inflated because the proportion of fibers inflated indicating a rise in malleability of concrete.
- The flexural strength inflated with the rise in fiber volume fraction. This concludes that the inflated quantity of fibers in concrete makes the concrete effective in withstanding the larger flexural masses.
- Minimal cracks within the tested specimens indicate that the fibers were effective in raising the cracking resistance of concrete.

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