International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 07 | July 2018 www.irjet.net p-ISSN: 2395-0072

Study of Sisal Fibre Reinforced Concrete Beam in Pure Torsion

Pawar Akash[1], Dr.Ashok Kasnale[2], Prof. Nikhil Maske [3]

[1]PG student (Dr.DYPSOET, Pune), Maharashtra, India.
[2]Principle of Dr.D.Y.Patil school of engineering & technology, pune
[3] Professor, Dept. of civil Engineering, DYPSOET, Pune, Maharashtra, India.

Abstract - Generally we all knows natural fibre are two type first is inorganic fibres and second is organic fibres. Basalt, asbestos is inorganic fibres and sisal, palm, coconut this are organic fibres Sisal fibre use for construction moderations and also developing properties of reinforced concrete structure. This material should not be pollute an environment it should be help in recycling of farming west into useable material use of easily available and utilize indigenous skills, man power and increase indigenous economy by income generating, it is easily procurable for local people and low monitoring cost.

This study may includes sisal general properties, its characteristics and its capability and also find out relation between fibre content, length, strength and stiffness.

The result shown that sisal fibres reinforced structural members are secure materials to use in practically for constructed in rcc member on civil and rural construction.

Key Words: (Sisal fiber, Torsion strength, Post cracking, cement composite, sisal properties)

1. INTRODUCTION

The introduction of fibers has been rolled in a remedy to accumulate a concrete in view of improving its torsional strength. In these applications, Fibers act to increase both strength and toughness of composite. Sisal fibers use to increase tensional strength of cement composite beam structure. The natural fibers use in element such as slabs, beam, wall and paving to control cracking produced by loads and temperature effect at this condition sisal fibre work as secondary reinforcement. Natural fibers sisal, coconut, bamboo, jute fibers are deliverance reinforce materials and its use more theoretical than technical. Past result it was observed that many investigation reports on reinforced concrete structure using synthetic polymer fibers composite. Aim of this present experimental research to find out tensional effects on sisal fiber reinforcement beam and its behavior under tensional loading, its moment carrying capacity and deflection.

It useful due to cost of natural sisal fibers as comparatively synthetic fibers are economical, its environmental compatibility and bio durability. So many types of natural fibers are used as composite material in concrete structure such as sisal, jute, cotton, palm life, wood etc. During the past years sisal is used as secondary reinforcement in concrete structure. Scientific name of sisal tree is “Agave sisalana.” This type of cactus this plant original from Tanzania. Sisal fiber is type of leaf fiber. Leaf fibers are fibers make from leaf of tree tissues by machine scarping by retting process. The leaf fiber gives high strength as compare to other types of natural fibers. Sisal fibers are generally usage in yarns, ropes, twines cords, rugs, mattresses, and mat and handicraft materials.

1.1 Need of sisal Fiber Reinforced Concrete

In the fulfillment of this need, many challenges remain in path to generate environmentally friendly structure products. These Fibers have advantage of easily available, economical extraction, no hazard to environment and good tensile strength etc.

Natural Fibers such as sisal, jute, coconut etc. have been use as reinforcement of resource matrices in form of short and long fibers but there is no proper study of exact behavior of reinforced with these Fibers. Fibers work as primary reinforcement in thin products like door panels, partitions etc. In which reinforcing steel bars are not used. In these applications, the Fibers act to increase the strength of structure.

1.2 Behavior of sisal fibre against torsion forces.

A tensile strength of sisal fibre is higher than other natural fibres strength and becomes powerful of the post cracking behavior only when natural afield fibres are used or when the structure is greater strength and small volume of fraction of fibres are used. Torsional strength depends upon percentage of fibre addition and also its length. Generally it is observed that when fibres are used with very less percentage (<0.5%); the torsion strength is unaffected. At volume of fraction 2% to 3%, the torsion strength may be get reduced by about 25% to 30%. However Between 0.5% to 2%; however there is definitely increase the torsion strength. When the study was made on steel fibres, up to 1.5% inclusion torsion strength increases up to 30% has been for M30 reinforced concrete.

This improvement in strength, results high tightness of fibres and inside lateral stiffness of fibres. Except at large fibre content, torsional strength of concrete is fully prevalence by mould strength. Tight fibres are given some increase in strength, while soft fibres are not gating effect on concrete structure . After first crack, load is transferred to fibres bridging cracks further behavior may then

depend upon strength, volume of fraction and length of fibres.

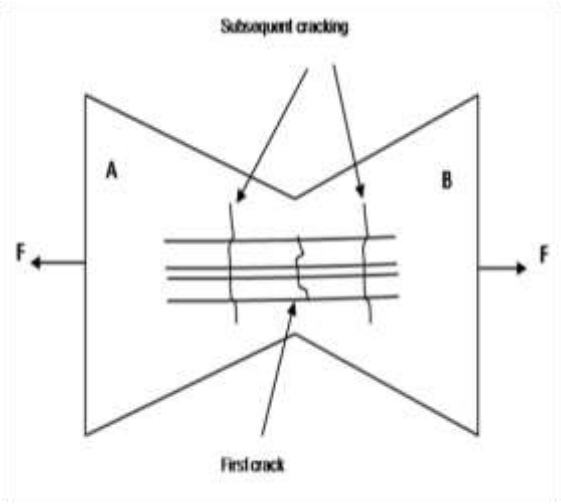


Fig.1 - Fibres Bridging Cracks in the Composites under the action of load.

Fig -1: Fibres bridging

2. Properties Of Sisal Fibre

Fibers have been used to construct tough bricks, external wall plastering and crockery, but only in last two decade have the principles of fiber reinforcement structural element is to be scientifically research . The fibers beyond the cracks and it provide post-cracking ductility. A large diversity of fibers usages with cement based element. They include metal fibers, mineral fibers, polymer fibers and vegetable fibers. The rcc beam mould cast paste or mortar steel reinforced concrete. Most of researches fiber reinforced concrete mould is casted by using ordinary Portland cement. which are structurally safe and durable.

Sisal fibres is attain from leaves of a plant which is name as "Agave sisalana", which is originate from Brazil, Mexico and it is cultivated now in India. Name of sisal fibre is came from Harbor town Yucatan, Mexico. Sisal fibre plants easy to cultivation, it gives short renewing time and easy to grow in all type of environments. 200 leaves yield from one sisal plant each leaves gives 4 to 5% of dry sisal fibre as comparison its weight. Hence the normal leaves weight of sisal plant is around 500grm. Fibre is extracting from a leaf by scraping and a diameter of sisal fibre varied from 0.2 to 0.3 mm.

2.1 Use of Natural Fibers in Cement Based Composites

A Number of fiber plants are exploited for their capability to get Fibers directly from their natural form, particularly in western countries. While a great number of species are employed in fiber production, relatively little category show high quality, good yield and hence are of commercial importance. Classification system of vegetable Fibers, is based on various major aspects, such as ,

- Final uses (end - use of fiber in commercial terms) such as, textile Fibers, bags &canvasses etc.
- Anatomical origin of vegetable Fibers, such as, bark fiber, leaf fiber, fruit fiber and root fiber.
- Chemical origin (cellulose - producing Fibers, lingo - cellulose - producing Fibers).

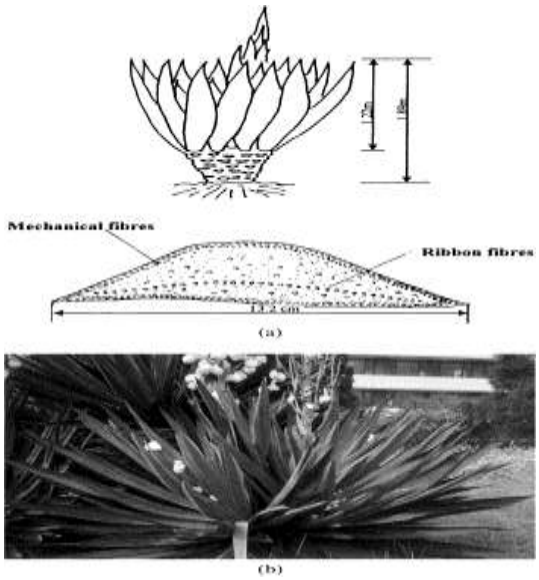


Fig.no.2 sisal plant

3. Aim and objectives

The main aim and scope of this investigation is find out the behavior of the sisal fibre in reinforced concrete beam structure against the torsion forces with different percentage and aspect ratio of sisal .Following are the main objectives behind this study.

- To improve the torsional strength of reinforced elements by variation in percentage and aspect ratio of fibres by using sisal fibres.
- To check various physical properties of sisal fibres like density, moisture content, percentage elongation etc.
- To evaluate practical applicability, economy & stress strain relationship of reinforced elements by using sisal fibres.
- To study ductility and stiffness of a RCC elements by using sisal fibres as a supplementary cementations material.

4. Methodology.

Perform any research work, the preliminary preparation is necessary. Preliminary planning, procedures and methods wisely chosen and rigorously implemented. The criteria is assess properties of ingredients of the mix are based on activities to be planned and preparation is to be done. Hence

before starting present work following steps are decided and followed.

1. Collect required material for study like cement, sand, aggregate, fiber etc. in required quantity.
2. Perform different laboratory testing quality of each material.
3. Prepare Mix Design for material used for 7, 28, days target strength 30MPa (M30 Mix) IS 10262.
4. Casting beam using plain concrete M30 mix and testing them for their torsional strength etc. for 7,28and 56 days and collect results obtained.
5. Providing steel reinforcement in concrete beam.
6. Casting beam for different percentage and various aspect ratio sisal fibre. Testing them for 7, 28 and days against torsional collecting results.
7. Comparing results obtained.
8. Conclusion regarding suitability of sisal fibre for reinforcement.

5. Result and discussion

5.1 General

To find strength of sisal fiber reinforced concrete beam, different combinations of percentage of sisal and Aspect ratio are used. Sisal percentage in M30 mix 0.5 %, and 1% are selected as in the previous researches it was found that for the fibers used less than does not affect the strength, also after 2% the strength starts decreasing. Here above percentages for different Aspect ratio or length fibers were used. While casting the PCC, the fibers are randomly spread in the plastic concrete mix. Generally the average diameter of sisal fiber is about0.3 to 0.4 mm therefore Aspect ratio used are 50, 75 and 100.With these combination Concrete specimen are casted, cured and tested for Torsional.

Tests conducted on the M30 grade Concrete beam of standard 150mm X 150mm X 700mm size was conducted for different percentage and aspect ratios of sisal fiber, results after 7days, 28 days a curing are given in the table below.

5.2 RESULTS FOR TORSIONAL TEST

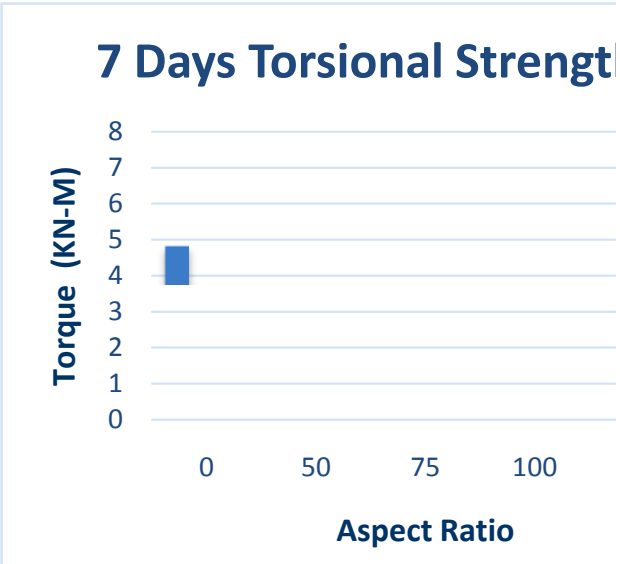
Torque = Load x Eccentricity

= 35.46 x 0.137

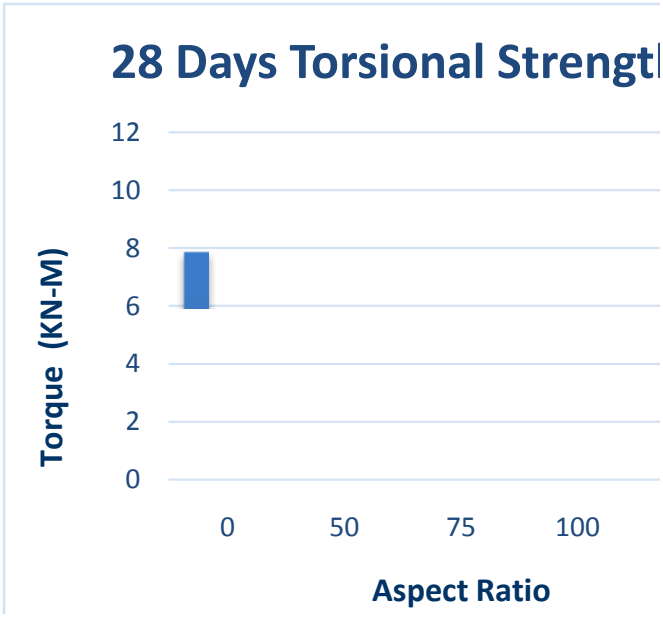
= 4.86 KN-M

Table 5.1 Average Torsional load.

Details of sisal insertion	7day torsion load (kN)	28day torsion load (kN)	Torque (KN-M) 7days	Torque (KN-M) 28days
0% RCC M30 concrete	35.46	57.15	4.86	7.90
0.5% - 50 A.R,	46.08	70.15	6.31	9.61
0.5% - 75 A.R,	46.11	71.53	6.32	9.80
0.5% - 100 A.R	48.73	73.21	6.68	10.03
1.0% - 50 A.R,	48.20	73.08	6.60	10.01
1.0% - 75 A.R.,	48.60	74.58	6.66	10.22
1.0% - 100 A.R	51.2	76.51	7.01	10.48



Graph no. 5.1:Torsional Strength of Beam variation with different aspect ratios and percentage of fiber (7 days)



Graph no. 5.2: Torsional Strength of Beam variation with different aspect ratios and percentage of fiber (28days)

CONCLUSION

6.1 General

It is found that use of fiber in concrete decreases workability of fresh concrete to some extent. Though workability decreases, strength parameters give promising results.

Addition of sisal fiber in concrete reduces water cement ratio which is need to be increased for better performance.

After obtaining the results of Torsional following conclusions can be made:

6.2 Conclusion

6.2.1 Torsional Strength

- The torsional strength increased with the increased in fiber percentage, there seen to be gradual increase in the strength from 0.5 % to 1 % .
- The torsional strength though increased, but not shown very high or marginable difference in the strength, the strength is shown to be increased by about 25 to 30 % for the obtained results.
- The maximum torsional strength is at 1 % sisal fiber reinforced concrete beam with aspect ratio 100 which is 35 % more than the normal reinforced concrete beam.

REFERANCES

1. Experimental investigation on the strength sisal fibre reincforced concrete by Dr.Y.K.Sabapathy, J.Rekha, Ramya.Sajeevan (2017) IJSTE, Volume 4, Issue 4, ISSN 2349-784X, PP 21-25.

2. Experimental study assessing the strength and crack resistance characteristics of sisal fibre reinforced concrete by P.Loganathan, Dr.G.S.Thirugnanam (2016) IJASER, Volume 1, Issue 1, ISSN 2455-9288, pp 734-744.

3. Sisal fibre reinforced concrete by Kunamineni Vijay, Chintha Umamaheshwar (2016) IJAERS, Volume 3, Issue 3, ISSN 2349-6495, Pp 14-18.

4. Improvement of torsional resistant in ultra high performance fibre reinforced concrete beam by Karim FR, AbuBakar BH, Choong KokKeong. (2016) JSSC, Volume 2, Issue 1, ISSN 2472-0437.

5. Effect of fibre length and percentage of sisal on strength of concrete by Mr. Jitendra. D.Dalvi, Dr.Uttam.B.Kalwane, Mrs.Pallavi.Pansur (2016) MJERT, Volume 3, Issue 1, ISSN 2348-6953, Pp 923-931

6. Behaviour of fibre reinforce concrete beam in pure torsion by c.arvind kumar, madan mohan, d.v.s.p rajesh, prathik kulkarni (2015) IJRET, Volume 4, Issue 5, ISSN: 2321-7308 Pp 551-556

7. Strengthening of R.C. Beam using Carbon Fibre to Study its Torsional Behavior bySanket.Rathi, Sachin.Kandekar, Dr.R.S.Talikoti. (2015) IJSRD, Volume 3, Issue 7, ISSN 2321-0613, Pp 416-419.

8. Study on properties of sisal fiber reinforced concrete with different mix proportions and different % of Fiber addition by Abdul Rahuman, SaikumarYeshika (2015) IJRET, Vol 4, Issue 3, ISSN 2321-7308, Pp 474-477.

9. Experimental study on flexural behaviour of sisal fibre in reinforced concrete beam by Athiappan.K, Vijaychandrakanth. S (2014) IJERT, Vol 3, Issue 5, ISSN 2278-0181, PP 1500-1505.

10. Torsional Behavior of Reinforced Concrete Beams Strengthened with FRP Composites by Saravanan. Panchacharam, Abdeldejelil. Belarbi. (2002)

11. Kuruvilla Joseph, Romilldo Dias Tolêdo Filho, Beena James, Sabu Thomas & Laura Heckerde Carvalho ,Are view on sisal fiber reinforced polymer composites, Revista Brasileira de Engenharia Agrícolae Ambiental, v.3, n.3, 1999, Campina Grande, PB, DEAg/UFPB P.P. 367-379.

12. Comparative Experimental Study on Torsional Behavior of RC beam using CFRP and GFRP Fabric Wrapping by Shradha.B.Tibhe, Vijaykumar.R.Rathi. (2015) ICETEST, PP 140-147.

13. An Experimental study on properties of natural resin concrete with addition of sisal fibre by M.A.Ash, A.Thangadurai, S.Gobhiga. (2017) IJSRT,Volume 3 Issue 10,ISSN-2349-6002.

14. An experimental study on properties of self compacting concrete with sisal and coir fibres by E.Gowthaman, M.Seethapathi. (2016) Volume 4, Issue 5 (P)3221 568X.