International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 03 | Mar 2020 www.irjet.net p-ISSN: 2395-0072

Study on Strength Parameters of Concrete by adding Banana Fibers

Mir Firasath Ali[1], Syed Haseeb Ali [2], Mohammed Tanveer Ahmed [3], Shaik Khaja Patel[4], Mir Wahib Ali[5]

[1]Assistant Professor, Dept of Civil Engineering, ISL Engineering College, Hyderabad
[2,3,4,5]B.E Students, Dept of Civil Engineering, ISL Engineering College, Hyderabad

---

Abstract - *This research describes experimental studies on the utilization of banana trunk fiber to reinforce the strength and applications of concrete. These natural fibers have excellent physical and mechanical properties and may be utilized more effectively. They're economical, with no chemicals. The addition of banana fibers significantly improved many of the engineering properties of the concrete notably compressive strength, tensile strength and flexural strength. The flexibility to resist cracking and spalling were also enhanced. Thus it acts as a natural admixture giving additional properties to the ordinary cement concrete. During this context different percentages of banana fibers 0%, 0.5%, 1%, 1.5%, having 50mm length were used. M30 concrete and ordinary portland cement of grade 43 was used. The banana fiber reinforced concrete is tested for compressive strength, splitting tensile strength, flexural strength at different ages.*

***Key Words*: Banana Fibres, natural admixture, High strength concrete, reinforced concrete**

1. INTRODUCTION

Fiber reinforced concrete (FRC) is a material created with Portland cement, aggregate, and incorporating separate discontinuous fibers. Traditional unreinforced concrete is brittle with an occasional tensile strength and strain capability. The addition of Banana fibers to concrete makes it additional homogenized and isotropic and transforms it from a brittle to additional ductile materials. Conventional concrete includes varied micro cracks that are quickly exaggerated below the applied stresses. These cracks are liable for the low tensile, flexural strength, and impact resistance of concrete. Concrete strengthened with Banana fibers impedes the crack growth and so enhances its strength and impact characteristics however it'll conjointly reduce the workability, the addition of super plasticizer (Sp) is useful to resolve the potential drawback of
Tangling or balling of fibers.

1.1 Importance of Current Research

Despite the fact that concrete is a extensively used construction material, it has important risks which includes low tensile strength, impact resistance, and it's prone to cracking. It is commonly assumed that the better the strength of Concrete, the decrease its ductility in order that the found inverse relationship among strength and ductility is taken into consideration in a few structural application.

1.2 Research Objective

The plain concrete being brittle in nature there is a need to make concrete a ductile material is of great importance. The incorporation of Banana fibers as a randomly dispersed reinforcement is an alternative answer, the presence of fiber improve the tensile, flexural strength, ductility and much extra efficient at controlling cracking at the aggregate – matrix interface , however it is going to be also lessen the workability . The addition of super plasticizer can enhance the workability.

2. MATERIALS

Cement: Ordinary Portland cement of grade 43 is adopted for this work. The brand of cement used was Ultra Tech OPC with grade 43. The cement was gray and free from lumps.

Aggregates: In this research work fine aggregates used was river sand zone II and coarse aggregates used were crushed stones. These materials were easily available from local market.

Water: Clean tap water was used for washing aggregates, and mixing and curing of concretes.

Banana Fibers: The Banana trunk fibers used for this work are from the local village, Tamilnadu region. The fibers are available in processed and ready-to- use fibers. Uniform length of fibers was obtained by using cutting machine.

Fig -1: Sample banana trunk fibers

Chemical treatment of Banana Fibers: Banana fibers have a tendency to absorb water especially during the first few hours after immersion in water. Alkali treatment of fibers increases surface roughness which results in better mechanical bonding and reduces water absorption. Hence

fibers are treated by immersing in 6% NaOH solution for 2 hours and then thoroughly washed by immersion in a clean water tank to make fibers alkali free. Then fibers are dried in oven at 80 degree centigrade for 24 hours.

Fig -2: Chemical treatment of fibers

3. METHODOLOGY & EXPERIMENTAL PROGRAMME

1. Properties of various constituents of concrete viz, Cement, fine aggregates, coarse aggregates and Banana fibers were determined, by carrying out various tests.
2. Grade M30 concrete was designed as per IS: 10262 -2009, which was used as reference mix.
3. Banana Fibers were added in 0%, 0.5%, 1%, and 1.5% by volume of Concrete.
4. Cube, cylinders and beams were casted and curing was done.
5. Compressive strength test, split tensile strength test and Flexural test was done.

Mix Proportions for M30 grade of Concrete

Cement = 394.32 kg/m^3
Water Content = 197.16 Liters
Fine aggregate = 623.45 kg/m^3
Coarse aggregate 20mm = 1097.81 kg/m^3
Fibers in kg/m^3
0.5% = 11.56
1.0% = 23.12
1.5% = 34.69
Super plasticizer = 9.38 Liters

Fig -3: Chemically treated fibers

Fig -4: Mixing of Concrete with Fibers

The specimens of standard sizes and required shapes of different mix proportions were casted for 7, 14, 28, days and curing process is carried out after 24hrs from casting time.

Fig -5: Casted Specimens

5. RESULTS AND DISCUSSIONS

All the tests have been performed in standard procedures and the results and load values obtained were tabulated and calculated in following sections.

5.1 Compressive Strength

Compressive strength tests were conducted on cured cube specimen at 7 days and 28 days age using a compression testing machine of 200 kN capacity. The cubes were fitted at center in compression testing machine and fixed to keep the cube in position. The load was then slowly applied to the tested cube until failure.

Sl.no	Mix (days)	Fiber Content	Cube Compressive strength (N/mm²)
1	7	0%	34.7
		0.5%	43.85
		1%	42.3
		1.5%	37.9
2	28	0%	49.5
		0.5%	58.5
		1%	55.6
		1.5%	52.1

Table -5.1: Compressive Strength values

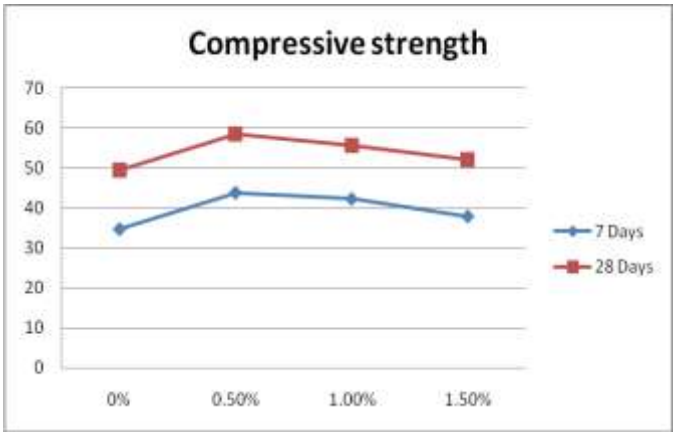

Chart -5.1: Compressive Strength

5.2 Split Tensile Strength

The split tensile test were conducted as per IS 5816:1999. The size of cylinder is 300mm length with 150mm diameter. The specimen were kept in water for curing for 7 days and 28 days and on removal were tested in wet condition by wiping water and grit present on the surface. The test is carried out by placing a cylindrical specimen horizontally between the loading surfaces of a compression testing machine and the load is applied until failure of the cylinder along the vertical diameter.

Sl.no	Mix (days)	Fiber Content	Cylinder Split Tensile strength (N/mm²)
1	7	0%	3.15
		0.5%	3.55
		1%	3.26
		1.5%	2.90
2	28	0%	4.26
		0.5%	4.65
		1%	4.50
		1.5%	4.0

Table -5.2: Split Tensile Strength values

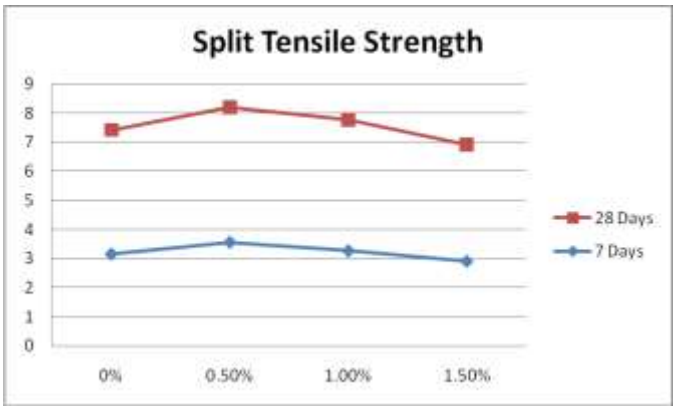

Chart -5.2: Split Tensile Strength

5.3 Flexural Strength

The Flexural test were conducted as per IS 516:1959. The size of beam is 150mm*150mm*700mm. The specimen were kept in water for curing for 28 days and on removal were tested in wet condition by wiping water and grit present on the surface. The test is carried out by placing a Beam specimen horizontally such that the load shall be divided equally between the two loading rollers, and all rollers shall be mounted in such a manner that the load is applied axially and without subjecting the specimen to any torsional stresses or restraints.

Sl.no	Mix (days)	Fiber Content	Beam Flexural strength (N/mm²)
1	28	0%	5.40
		0.5%	6.3
		1%	5.85
		1.5%	5.22

Table -5.3: Flexure Strength values

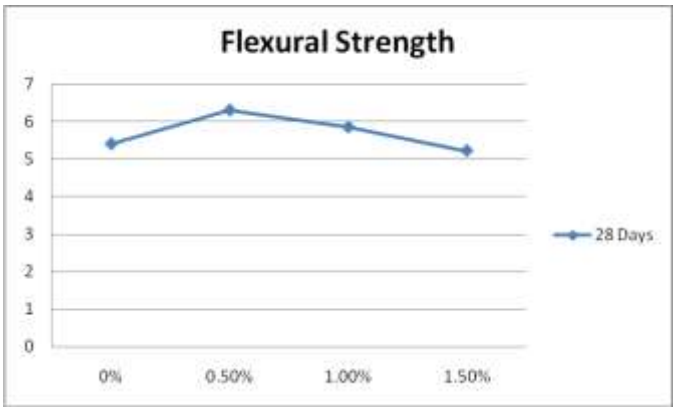

Chart -5.3: Flexural Strength

6. SUMMARY AND CONCLUSIONS

The main objective of this study is to analyze the performance of addition of commercially available Banana trunk fibers as an additive in cementitious materials to

improve the mechanical properties of conventional concrete and to enhance the flexibility to resist cracking and spalling of concrete structures.

The following conclusions were obtained as a result and performance for the tests conducted..

The experimental tests unconcealed that the strength properties of concrete improved with the addition of banana trunk fibers to the concrete.

The conventional mix & M30 achieves a compressive strength of 34.17 N/mm2, Split tensile strength values of 3.15 N/mm2 and Flexural strength of 5.40 N/mm2 for 28 days of curing.

Compressive, flexural and split tensile strength of Banana Fiber Reinforced Concrete are maximum at 0.5% fiber content with 50mm fiber length.

The compressive strength obtained at 0.5% fiber content is 58.5 N/mm2 which is 18.18% higher than the reference concrete strength with 0% fiber content.

The maximum split tensile strength attained at 0.5% fiber content is 4.65 N/mm2, which is 9.1% higher than the reference concrete strength with 0% fiber content.

The maximum flexural strength obtained at 0.5% fiber content is 6.3 N/mm2, which is 16.64% higher than the reference concrete strength with 0% fiber content.

It was observed that cracking resistance of the concrete specimens improved to a greater extent and the specimens were intact with each other even after the failure of specimen under loading thus making it a non brittle failure.

ACKNOWLEDGEMENT

We are thankful to **Dr. Mohammed Masood,** Principal, ISLEC, for his encouragement throughout the project. We would also like to express our heartfelt thanks to **Ms. K. Nanchari,** Head of Civil Engineering Department, ISLEC for her help and unending cooperation with us during completion of this work.

REFERENCES

[1] Chandramouli, K. & Narayanan, Pannirselvam & Pardhu, D.V.V. & Anitha, V.. (2019). Experimental investigation on banana fibre reinforced concrete with conventional concrete. International Journal of Recent Technology and Engineering. 7. 874-876.

[2] Mouli, K. & Narayanan, Pannirselvam & Anitha, V. & Kumar, D. & Rao, S.. (2019). Strength studies on banana fibre concrete with metakaolin. International Journal of Civil Engineering and Technology. 10. 684-689.

[3] S. KESAVRAMAN, 2017. STUDIES ON METAKAOLIN BASED BANANA FIBRE REINFORCED CONCRETE.International Journal of Civil Engineering and Technology (IJCIET).Volume:8,Issue:1,Pages:532-543.

[4] Ramakrishna G, Sundararajan T, "Impact strength of a few natural fibre reinforced cement mortar slabs: a comparative study," Cement & Concrete Composites 27 (2005) 547–553.

[5] Solomon Ikechukwu Anowai and Olorunmeye Fredrick Job, "Influence of Lengths and Volume Fractions of Fibre on Mechanical Properties of Banana Fibre Reinforced Concrete" International Journal of Recent Innovation in Engineering and Research, Scientific Journal Impact Factor - 3.605 by SJIF, e- ISSN: 2456 – 2084.

[6] Mr. Solomon Ikechukwu Anowai, Prof. Olorunmeye Fredrick Job, "Durability Properties of Banana Fibre Reinforced Fly Ash Concrete", International Research Journal of Engineering and Technology, 4 (11), Nov - 2017, e-ISSN: 2395-0056, p-ISSN: 2395-0072.

[7] Forood Torabian Isfahani, Elena Redaelli, Federica Lollini, Weiwen Li, and Luca Bertolini, "Effects of Nanosilica on Compressive Strength and Durability Properties of Concrete with Different Water to Binder Ratios", Hindawi Publishing Corporation Advances in Materials Science and Engineering, Volume 2016, Article ID 8453567, 16 pages

BIOGRAPHIES

Mir Firasath Ali, Assistant Professor, Department of Civil Engineering, ISLEC, Hyderabad, India

Syed Haseeb Ali, Student, Department of Civil Engineering, ISLEC, Hyderabad, India

Mohammed Tanveer Ahmed, Student, Department of Civil Engineering, ISLEC, Hyderabad, India

Shaik Khaja Patel, Student, Department of Civil Engineering, ISLEC, Hyderabad, India

Mir Wahib Ali, Student, Department of Civil Engineering, ISLEC, Hyderabad, India