INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

A PATH FOR HORIZING YOUR INNOVATIVE WORK

FIBRE REINFORCED CONCRETE

ROSER ROBERT[1], PANKAJ PARKHI[2], SAINATH SATPUTE[3]

1. M.TECH Student (Structure and Construction) Ballarpur Institute of Technology, Ballarpur.
2. M.TECH Student (Structure and Construction) Ballarpur Institute of Technology, Ballarpur.
3. M.TECH Student (Structure and Construction) Ballarpur Institute of Technology, Ballarpur.

Accepted Date: 05/03/2015; Published Date: 01/05/2015

Abstract: Fibre Reinforced Concrete is a convenient, practical and economical method for overcoming micro-cracks, increasing tensile strength and compressive strength of the concrete. Since concrete is weak in tension and good in compression, some measures must be adopted to overcome the deficiency. Fibre is strong in tension; hence it can be used as a reinforcement material. Solid waste also creates environmental problem for its decomposition. Present study has been undertaken to study the effect of solid waste on plain cement concrete by using these solid waste in terms of fibres and analyze on the basis of its compressive strength, tensile strength and cracking control to economize concrete and to reduce environmental problems. Various experiments are conducted on concrete cubes and cylinders with various percentages of fibres i.e. 0%, 1%, 1.5% and 2% by weight of cement. The concrete cubes and cylinders were tested for their mechanical properties of different proportions.

Keywords: Fibre reinforcement concrete, Fibre, Solid waste.

Corresponding Author: MR. ROSER ROBERT

Access Online On:

www.ijpret.com

How to Cite This Article:

Roser Robert, IJPRET, 2015; Volume 3 (9): 1-8

PAPER-QR CODE

INTRODUCTION

Fibre reinforced concrete (FRC) is a concrete containing fibres other than cement, sand and aggregates which increases the compressive strength, tensile strength and workability of concrete. So we can define fibre reinforced concrete as a composite material of cement concrete or mortar and discontinuous discrete and uniformly dispersed fibre.

Fibre Reinforced Concrete is a composite material consisting of mixtures of cement, mortar or concrete and uniformly added suitable fibres. Continuous and long wires or rods are not considered to be discrete fibres. Fibres are of different types such as natural fibres like coir, hair etc. and artificial fibres like steel fibres, glass fibres and synthetic fibres .

Fibre is a class of materials that are continuous filaments or are in discrete elongated pieces, similar to length of thread. The fibre is described by a parameter called aspect ratio. The aspect ratio of the fibre is defined as the ratio of length of the fibre to its diameter. The aspect ratio ranges from 30 to 150.

Fibres help in reducing the shrinkage cracks and also help in increase in tensile strength of concrete. In this project we have used the waste fibre material like human hair, coconut coir and steel fibres having aspect ratio 60, which ease the decomposition of these materials in the environment and economized the manufacture of concrete.

Advantages of fibre reinforced concrete: The advantages of fibre reinforced concrete are that it has high tensile strength, reduces micro cracks and has high durability. FRC is also used in civil structures where corrosion is to be avoided at the maximum. Fibre reinforced concrete is better suited to minimize cavitations /erosion damage in hydraulic structures where high velocity flows are encountered. It is used in bridges and it helps to avoid catastrophic failures. It also reduces human casualties if used in earthquake prone area structures. Fibres reduce internal forces by blocking microscopic cracks from forming within the concrete. So it can be used for flooring tiles

Disadvantages of fibre Reinforced Concrete: The main disadvantage associated with the fibre reinforced concrete is fabrication. The process of incorporating fibres into the cement matrix is labour intensive and costlier than the production of the plain concrete. The advantages of FRC override this disadvantage.

Why Fibres are used in Concrete? Fibres are usually used in concrete for the following reasons:

i. To control cracking due to both plastic shrinkage and drying shrinkage. ii. They also reduce the permeability of concrete and thus reduce bleeding of water. iii. Some fibres also gives greater impact, abrasion and shatter resistance in concrete. iv. The fineness of the fibres allows them to reinforce the mortar fraction of the concrete, delaying crack formation and propagation. This fineness also inhibits bleeding in the concrete, thereby reducing permeability and improving the surface characteristics of the hardened surface.

2. Methodology

The methodology adopted is that the fibres are used for different volumes i.e. 1%, 1.5%, 2.0% with aspect ratio of 60 to test the mechanical properties and strength of fibre reinforced concrete by conducting Compressive Strength test and Tensile Strength test.

Various cubes and cylinders are tested and analyzed for finding the effect of using hair, coir and steel as fibre reinforcement.

Test Performed: For determining the effect of fibre in concrete following tests were performed:

i. **Compression test**: This test is the most common test to find out the compressive strength of concrete. In this test cubes of 15x15x15cm dimension are being casted by filling the mortar in three layers and compacted by tamping each layer 25 times by tamping rod. After 24 hours these hardened cubes are removed from the mould and are kept for 7days, 14days and 28 days curing by submerging under clean fresh water. These cubes are tested on compressive testing machine by applying compressive load and the compressive strength of cubes is obtained for 7days, 14days and 28 days.

ii. Split Tensile Test:

The cylinders of size 15cm (dia.) x 30cm (height) are casted by filling the mortar in three layers and compacted by tamping each layer 25 times by tamping rod. After 24 hours these cylinders are removed from the mould and are kept for curing. The test is carried out by placing a cylindrical specimen horizontally between the loading surface of a compression testing machine and the load is applied until the failure of the cylinder, along the vertical diameter occurs. When the load is applied along the generatrix, an element on the vertical diameter of the cylinder is subjected to a horizontal stress of

$$2P/\pi Ld.$$

Where, P is the compressive load on the cylinder

L is the length of the cylinder

d is diameter of the cylinder

The splitting test is easy to perform and gives more exact results than other tension tests. Splitting strength gives about 5 to 10% higher value than the direct tensile strength.

Days	Cube No.	Load (N)	Area (mm^2)	Compressive Strength (N/mm^2)	Average Compressive Strength (N/mm^2)
	1	231750	22500	10.30	
7D	2	236025	22500	10.49	10.40
	3	248170	22500	11.03	
14D	4	273600	22500	12.16	11.60
	5	330075	22500	14.67	16.79
28D	6	425470	22500	18.91	

3. RESULTS & DISCUSSIONS:

Compression test calculation:

The cubes were tested for compression and tension for 7 days, 14days and 28 days with different fibres. The following table shows compressive test and tensile test results:

Normal Concrete:

Steel Fibres:

S.N	% Fibres	Compressive strength (N/mm^2)		Tensile Strength (N/mm^2)	
1	1	7D	11.40	7D	3.21
		14D	14.52	14D	3.28
		28D	23.40	28D	3.45
2	1.5	7D	13.43	7D	3.52
		14D	17.07	14D	3.61
		28D	21.15	28D	3.85
3	2	7D	11.11	7D	3.65
		14D	16.38	14D	3.72
		28D	29.13	28D	3.9

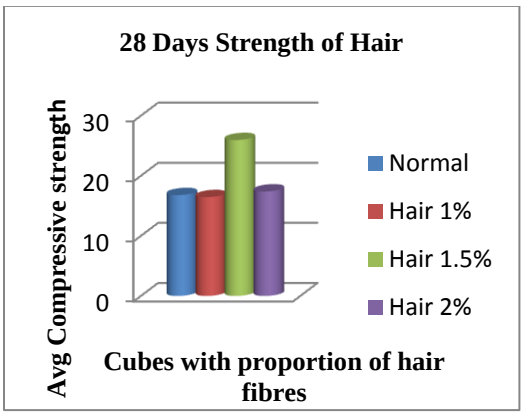
Hair Fibres:

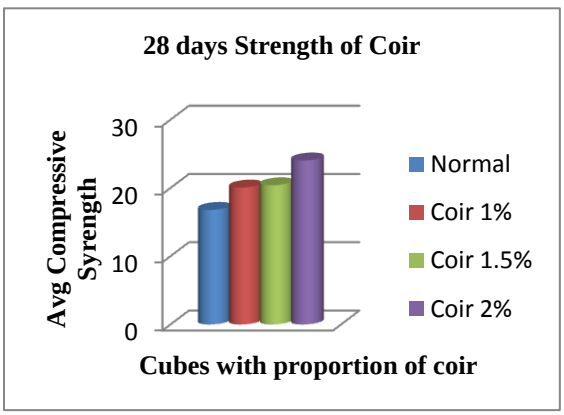
S.N	% Fibres	Compressive strength (N/mm^2)		Tensile Strength (N/mm^2)	
1	1	7D	11.25	7D	2.38
		14D	12.95	14D	2.44
		28D	16.45	28D	2.78
2	1.5	7D	8.29	7D	2.74
		14D	14.31	14D	2.80
		28D	25.95	28D	2.87
3	2	7D	12.88	7D	2.80
		14D	15.61	14D	2.90
		28D	17.39	28D	2.97

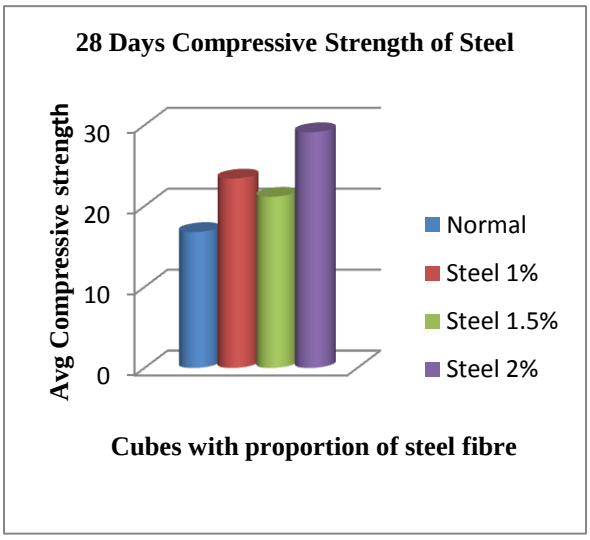
Coir Fibres:

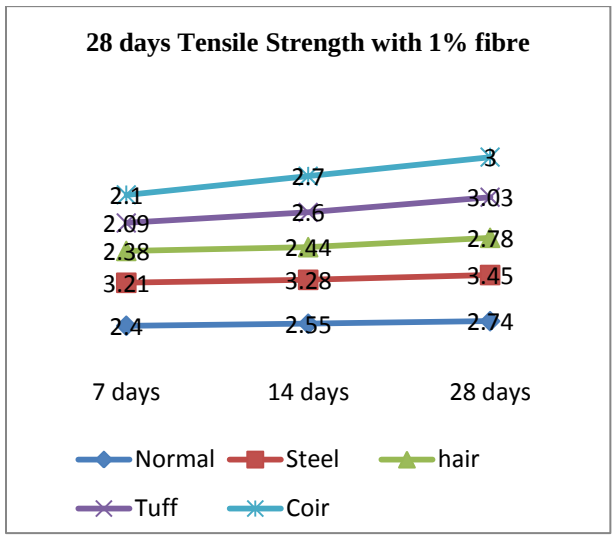
S.N	% Fibres	Compressive strength (N/mm^2)		Tensile Strength (N/mm^2)	
1	1	7D	8.78	7D	2.1
		14D	13.11	14D	2.7
		28D	20.06	28D	3.0
2	1.5	7D	11.48	7D	2.82
		14D	19.37	14D	2.80
		28D	20.4	28D	3.05
3	2	7D	12.62	7D	2.42
		14D	19.39	14D	2.88
		28D	24.03	28D	3.15

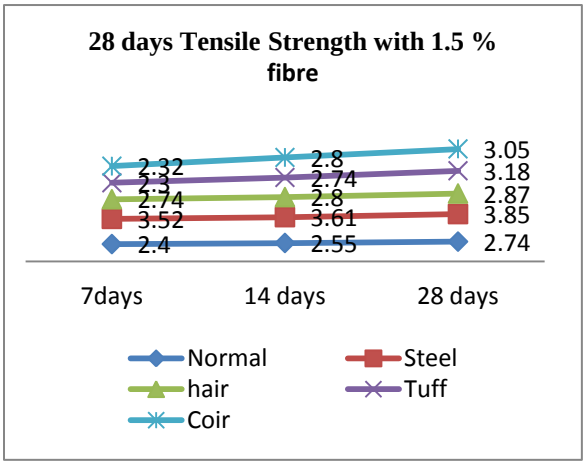
Graphical Representation:

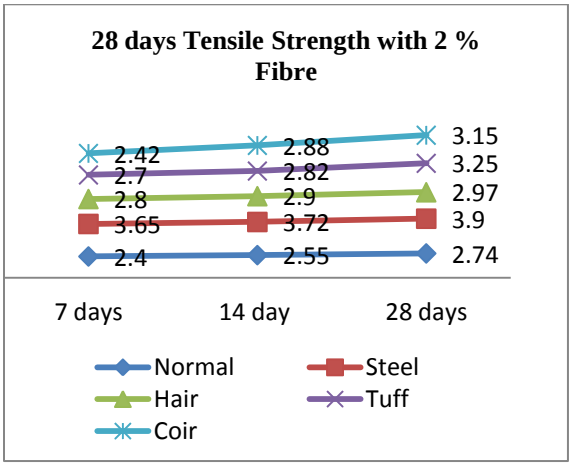












CONCLUSIONS

According to the test performed it is observed that there is remarkable increment in properties of concrete according to the percentages of fibres by weight of cement in concrete. For M-20 concrete:

- With **1% Steel** fibre it is found that there is an increase of **74.39**% in compressive strength and **25.91**% in tensile strength.
- With **1.5% Steel** fibre there is an increase of **33.38**% in compressive strength and **40.51**% in Tensile strength.

- With **2% Steel** fibre there is an increase of 80.82% in compressive strength and **42.33**% in Tensile strength.
- With **1% Hair** fibre there is an increase of **1.25%** in compressive strength and **1.46%** in Tensile strength.
- With **1.5% Hair** there is an increase of **4.82%** in compressive strength and **4.74%** in Tensile strength.
- With **2% Hair** there is an increase of **8.55%** in compressive strength and **8.39%** in Tensile strength.
- With **1% Tuff** there is an increase of **32.58%** in compressive strength and **10.58%** in Tensile strength.
- With **1.5% Tuff** there is an increase of **36.99%** in compressive strength and **16.09%** in Tensile strength.
- With **2% Tuff** there is an increase of **39.48%** in compressive strength and **18.61%** in Tensile strength.
- With **1% Coir** there is an increase of **13.94%** in compressive strength and **9.48%** in Tensile strength.
- With **1.5% Coir** there is an increase of **28.41%** in compressive strength and **11.31%** in Tensile strength.
- With **2% Coir** there is an increase of **42.94%** in compressive strength and **14.96%** in Tensile strength.

From above conclusion it is observed that from the above three fibres,

Steel fibre has more compressive as well as tensile strength.

ACKNOWLEDGMENTS

Steel Wool Pvt. Ltd, Nagpur for providing us with different kinds of steel fibres for our project work, Head of Department (Civil Engineering) B.I.T, Ballarpur for their cooperation

REFERENCES

1. Jain D. and Kothari A "Hair Fibre Reinforced Concrete" Sanghvi Institute of Management and Science, Indore, MP, INDIA (Received 13th November 2011, revised 10th January 2012, accepted 25th January 2012)

2. Vijay Chavada, A. A. Parikh "An application review of coir fiber reinforced concrete P. G. Student (M. E. Structure), Department of Civil Engineering Parul Institute Engineering Technology, Gujarat technological University

3. Yadollah Batebi, Alireza Mirzagoltabar,Seyed Mostafa Shabanian and Sara Fateri "Experimental Investigation of Shrinkage of Nano Hair Reinforced Concrete "Department of Civil Engineering, Babol University of Technology, Babol, Iran

4. M Sivaraja (Kandasamy (N Velmani And M Sudhakaran Pillai "Study on durability of natural fiber concrete composites using mechanical strength and micro structural properties" Department of Civil Engineering, Department of Chemical Engineering, Kongu.

5. Performance of Steel Fiber Reinforced Concrete Milind. V. Mohod, Assistant Professor, Department of Civil Engineering, P.R.M.I.T.& R., Badnera.

6. Indian standard code of practice for plain and reinforced concrete IS 456: 2000, Bureau of Indian standards, New Delhi

7. Indian standard code of practice for recommended guidelines for concrete mix design, IS 10262: 2009, Bureau of Indian standards, New Delhi.

8. "FIBRE REINFORCED CONCRETE USING DOMESTIC WASTE PLASTICS AS FIBRES" R.Kandasamy1 and R. Murugesan Department of Civil Engineering, Bhaktavatsalam Polytechnic College, Kanchipuram, Tamilnadu, India 2 Anna University of Technology Madurai, Madurai, Tamilnadu. India.