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Experimental and comparative Study on Natural and Artificial Fiber Reinforced Concrete

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Abstract:

Fibre Reinforced concrete (FRC) is a combination of concrete and randomly distributed discrete fibres. Use of fibres in concrete enhances its mechanical properties. Fibres are basically distinguished on basis of its origin. Various papers have been published before on use of natural and artificial fibres in concrete. An experimental study is carried to analyze the strength of concrete by using fibres from different origin. Fibrous material like bamboo, coir etc are in abundant around us. We are unaware of fact that these materials can be used in concrete to enhance its properties. So we decided to use bamboo,coir as our natural fibre due its easy availability. Also we have used steel,glass as artificial fibre. We further experimented with combination of both natural and artificial fibres. Our basic aim was to increase compressive strength of concrete and to make it more crack resistant. The properties studied include compressive strength ,workability and split tensile strength. The studies have been conducted as per recommended procedures of relevant IS codes on M20 mix. Fractions of 1%,2%, 3% and 4% of fibres by weight of cement have been used for comparative study of compressive strength of concrete and results are obtained.

Keywords **—Fiber Reinforced Concrete, Fiber content, Slump test , compression strength , split tensile strength, Results and discussion , conclusion, reference**.

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I. INTRODUCTION

The construction industry is revolutionizing in two major ways. One way is the development of construction techniques, such as using automated tools in construction. The other is the advancement in high-performance construction materials, such as the introduction of high strength concrete. Among these high-performance construction materials, Fiber reinforced concrete (FRC) is gradually gaining acceptance from civil engineers. In recent years, research and development of fibers and matrix materials and fabrication process related to construction industry have grown rapidly. Their advantages over other construction materials are their high tensile strength to weight ratio, ability to be molded into various shapes and potential resistance to environmental conditions, resulting in potentially low maintenance cost.

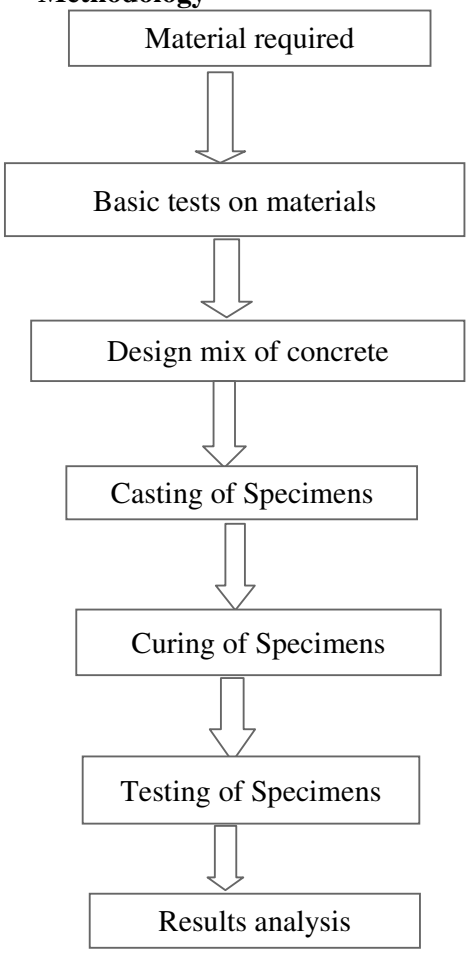
These properties make FRC composite a good alternative for innovative construction. Their application in construction includes both upgrading existing structures and building new ones, which can apply to various type .

II. OBJECTIVES:

- To prepare specimens of suitable standard dimension and conduct test to identify mechanical behavior under Compression and split tension of different fibers concrete.
- To arrive at optimum value of fibers which have better mechanical property and economically feasible alternative fibers.

- To analyze and study the behavior of artificial fiber concrete and natural fiber concrete for cracks for different fiber combination.
- To gain a better understanding of the structural behavior under the action of the applied loading.

Methodology



III. TESTS ON SPECIMENS

Test on fresh concrete

Aim: To determine the slump for the concrete mix.

Apparatus Required: Iron Pan, Spatula, Trowels, Slump Test Apparatus, Tamping Rod, Balance.

Procedure:

- Prepare four different mixes of water-cement ratio of 0.5 and for each mix collect 1kg of cement, 1.5 kgs of fine aggregate and 3 kgs of coarse aggregate.
- Mix the dry constituent thoroughly and then add water and thoroughly mix it to a uniform concrete.
- Fill the slump cone with the concrete in four equal layers tamping each layer 25 times and level the top surface with trowel.
- Remove the slump cone immediately, raising it slowly and carefully in vertical direction.
- A soon as the concrete settlement to a stop, measure the subsidence of concrete in mm which gives the slump.

Fig. 2. Slump test (a) mould preparation (b) slump value measurements

Compression test

Aim: To determine the compressive strength of concrete cubes.

Apparatus Required: 150mm Cube Moulds, Ramming Rod, Weighing Machine, Mixer, Base Plate and Compression Testing Machine.

Procedure:

- Collect the required quantity of material to prepare 9 concrete cubes of 1:1.6:2.49 mix proportion with required water cement ratio.
- Dry mix of cement, fine aggregate and coarse aggregate are mixed thoroughly add water to the dry mix and obtain uniform concrete.
- Fill the cube moulds in 3 layers by giving 35 blows for each layer. Keep the mould with concrete in moist condition for 24 hrs and put it for pond curing.
- The cubes are tested for compressive strength

Fig.2 COMPRESSION TESTING MACHINE

Fig.3 CUBE SPECIMEN

Split tensile test

The split tensile strength is one of the basic and important properties of concrete. The concrete is not usually expected to resist the tension because of its low tensile strength and brittle nature. However, the determination of split tensile strength of concrete is necessary to determine the load at which the concrete members may crack. The cracking is a form of tension failure. The result of the split tensile strength was obtained for 7 days, 14 days and 28 days.

Fig.4 SPLIT TENSILE STRENGTH TEST IN CTM

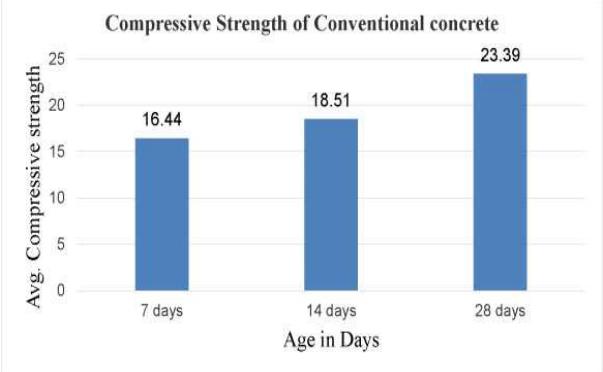
Fig.5 CYLINDER SPECIMENS

RESULT AND DISCUSSION

The properties and the quantity of proportions remain same for all the mixes but the percentage of fibers changes for every mixes. The strengths of fiber reinforced concrete concrete is compared to the strengths of normal concrete.

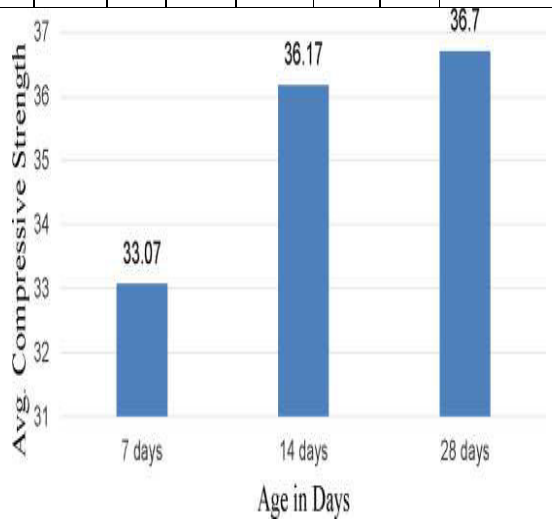
Test results of M20 grade Conventional Concrete for 7,14 and 28 days

Age in days	Load at failure in KN			Compressive Strength in N/mm²			Avg. Compressive strength in N/mm²
7	390	370	350	17.33	16.44	15.55	16.44
14	410	400	440	18.22	17.77	19.55	18.51
28	525.5	530.5	500	24	25.12	22.22	23.39



Test results of M20 grade Steel fiber Reinforced Concrete for 7,14 and 28 days.

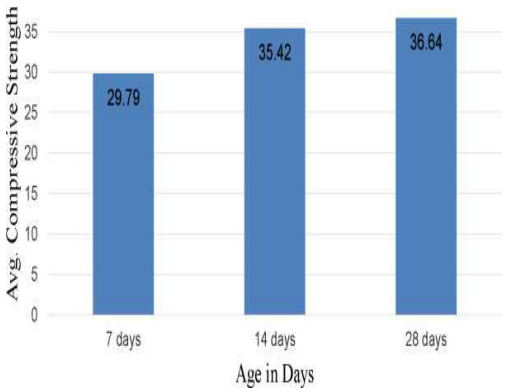
Agein days	LoadatfailureinKN			CompressiveStrength inN/mm²			Avg. Compressive strengthin N/mm²
7	780.3	700.9	751.4	34.68	31.15	33.39	33.07
14	810	801.01	830.5	36	35.6	36.91	36.17
28	820	810	850	36.4	36	37.7	36.7



Comprehensive strength of Steel fibre reinforced concrete

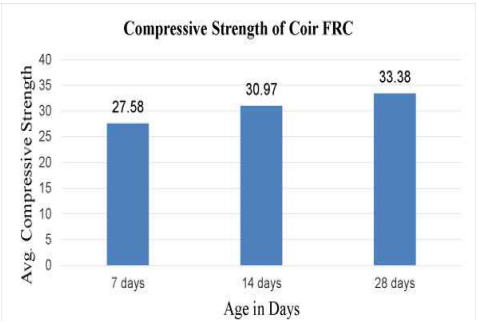
Test results of M20 grade Glass fiber Reinforced Concrete for 7,14 and 28 days.

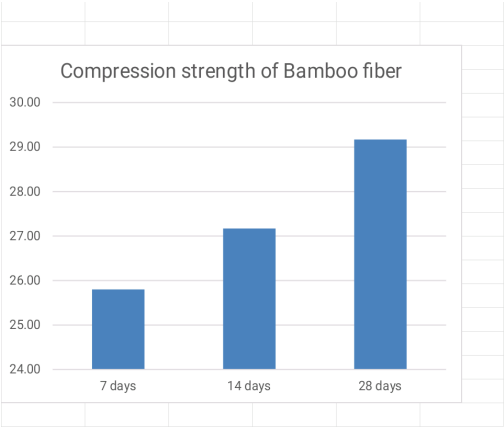
Agein days	LoadatfailureinKN			CompressiveStrengthinN/mm²			Avg. Compressive strengthin N/mm²
7	659.2	619.5	733.0	29.29	27.53	32.57	29.79
14	800.1	771.0	820.5	35.56	34.26	36.46	35.42
28	819	804.6	850	36.4	35.76	37.77	36.64



Comprehensive strength of Glass fibrere in forced concrete

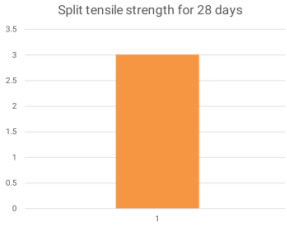
Agein days	LoadatfailureinKN			CompressiveStrength inN/mm^2			Avg. Compressive strengthin N/mm^2
7	600.2	650.8	610.9	26.67	28.92	27.15	27.58
14	680.1	700.9	710.1	30.22	31.15	31.56	30.97
28	710.9	760.5	782.4	31.59	33.8	34.77	33.38





Test results of M20 grade Bamboo fiber Rein forced Concrete for 7,14 and 28days.

Split tensile strength:



Test results of M20 grade Conventional Concrete for 28 days.

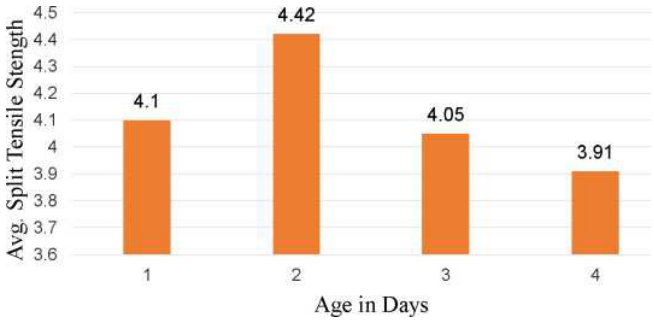
Agein days	LoadatfailureinKN			CompressiveStrength inN/mm^2			Avg. Compressive strengthin N/mm^2
7	570.8	590.2	580.1	25.36	26.25	25.81	25.80
14	610.1	624.1	600.1	27.11	27.73	26.67	27.17
28	620.1	658.4	690.7	27.56	29.26	30.69	29.17

Test results of M20 grade Coir fiber Reinforced Concrete for 7,14 and 28 days.

Age in days	Load at failure in KN			Split tension Strength in N/mm^2			Avg. Split tension strength in N/mm^2
28	230	210	200	3.25	2.97	2.82	3.01

Test results of M20 grade Fiber Reinforced Concrete for 28 days.

Nameof fiber	Agein days	Loadatfailurein KN			SplittensionStrengthinn/mm^2			Avg.Splittension strengthinn/mm^2
Steel	28	300	290	280	4.24	4.10	3.96	4.1
Glass	28	320	315	309	4.52	4.38	4.37	4.42
Bamboo	28	300	290	270	4.24	410	3.81	4.05
Coir	28	270	275	285	3.81	3.89	4.03	3.91



IV. CONCLUSIONS

- BycomparingcompressionstrengthofNormalreinforcedconcreteandfiberreinforcedconcrete,wecanobservethatfiberreinforcedconcretehavemorecompressionstrengththannormalreinforcedconcrete.
- Thetensilepropertycanbeincreasedbyaddingofsmallvolumeoffibers like 1%,2%,3%,&4%..
- Additionaloffibersnotonlyincreasetensilestrengthbutalsoincreasebondingstrengthanddecreasepermeability,alsoresisttheseismicloadingaswellthroughitsductility.
- Splittensilestrengthalsoincreaseinfiberreinforcedconcretethannormalreinforcedconcrete.

APPLICATIONS

- Fiber-reinforcedconcreteincreasesthestaticanddynamictensilestrength,energyabsorbingcharacteristics,andbetterfatiguestrengthso,itisnowadayusingoverlaysoftheairfield,roadpavement,refractorylinings,etc.
- Industrialfloors,forimpactresistanceandresistanceto thermalshock.
- Foundationslabsforresidentialbuildings.
- Steelfiberreinforcedshortcrete(SFRS)arebeingusedtolineundergroundopeningsandrockslopestabilization.Iteliminatestheneedformeshreinforcementandscaffolding.
- FRCisbeingusedfortheconstructionandrepairofdamsandotherhydraulicstructurestoprovideresistancetocavitationandsevereerrosioncausedbytheimpactoflargeWaterborodebris.
- Theseincludemachinetoolframes,lightingpoles, waterandoiltanksandconcreterepairs.

REFERENCES

- IS:456-2000, Indian standard "Plain and reinforced concrete"- code of practice.
- IS:10262-2009, Indian standards "Recommended guidelines for concrete mix design proportioning"- code of practice.
- IS:383-1970, "Specifications for coarse and fine aggregates from natural source of concrete", (second revision), Bureau of Indian standards, New Delhi, India.
- Mr. Nilraj Y. Patne, Ms. Bhagyashree B. Bagu, Ms. Dhanashri S. Bhosale, Mrs. Ashwini Patil, 'Study on Comparative strength of Natural, Artificial, and Combination fibre reinforced concrete'. International Journal of Engineering Research & Technology IJERT) ISSN: 2278-0181 (BERTV)4IS030763 Vol. 4 Issue 03, March-2015.
- Prajwal S. Dudhbale and Chetan A. Botfole, 'Comparative of Natural Fiber Reinforced

Concrete', International Journal of Advanced Innovative Technology in Engineering (IJAITE), Vol.6, No.3, May 2021 E-ISSN: 2455-6491.

- Grija.S, Shanthini.D and Abinaya.S study on 'A REVIEW ON FIBER REINFORCED CONCRETE' International Journal of Civil Engineering and Technology (UCIET /Volume 7, Issue 6, November-December 2016, pp. . 386-392.
- Dharani,,N., Prince Arulraj, G and Goutham, J., 2015, Study on Mechanical Properties of Concrete with Industrial Wastes, 2321-7308, 04(03), pp. 447 - 453.
- Gurunaathan, K., Seenivasan, G., and Thirugnanam, G.S, 2014, Experimental study on strength and durability properties of fiber reinforced concrete, Proc, of the Inti. Conf, on Advances in Civil, Structural and Mechanical Engineering, ISBN: 978-1-63248-025-5, 1(5), pp. 38-42.

