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Title **STUDY ON COMPRESSIVE AND FLEXURAL STRENGTH OF CONCRETE WITH CERAMIC POWDER MATERIAL AS PARTIAL REPLACEMENT OF CEMENT**

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A STUDY ON "NATURAL FIBRE REINFORCED CONCRETE"

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ABSTRACT

Studies to overcome the fragile response and limit the absorption of energy by concrete after yield led to the development of fiber-reinforced concrete with the application of discrete fibres. Natural fibers are renewable sources of fibres, which are easily available at low cost. While these fibers are ecologically advantageous, their durability is lower and their strength is less. Recent research has, however, provided a number of treatment procedures for improving natural fiber durability. In this paper an experimental examination was conducted which reported the durability of natural fiber such as cocoa coir and sugar cane bagasse. There are two parts to this study. The first section is concerned with determining the mechanical strength properties of natural fibre, reinforced concrete specimens once every 3 months, such as a compressive, tensile, rupture module, and flexural properties, during 2 years, in alternate conditions of weathering and drying. Composite concrete gain or loss in strength at 9 intervals has been calculated and reported. The second part deals with the microstructural characteristics of fresh natural fibers as received and the natural fibers reacted for two years in fast curing conditions with concrete. Examination of SEM and EDAC test results.

1. INTRODUCTION

Betons are weak and have a fragile character. The concept that fibers should be used to improve building material characteristics is very old. In 1849, the French gardener Joseph Monier invented and patented the fiber reinforced concrete in 1867. Addition of straw into mud bricks for early applications, horse hair to strengthen plaster and asbestos, to strengthen pottery using continuous reinforcement in concrete (reinforcement concrete), enhances strength ductility. The introduction of discrete fibers into a single concrete or reinforced concrete can, as an alternative, offer a better solution. Modern fiber-forced concrete (FRC) development started at the beginning of the 1960s. The addition of fibers to concrete makes it uniform and isotropic. The random-oriented fibers begin functioning, stop crack formation and propagation, thus improving strength and ductility when concrete cracks are created. FRC's failure modes are either a fiber- or matrix- or material failure bonding failure. The hair fiber reinforced concrete project is tested and the results are compared with standard concrete.

FIBER REINFORCED CONCRETED

Body heard almost ever about concrete, but few people heard of reinforced concrete from Fiber. The fiber reinforced concrete is defined by its use in concrete of certain materials to increase the strength of concrete, known as reinforced fiber concrete and known as fiber. The concrete is more resistant to compression and less resistant to stress. The fibers are generally more tensile in strength and thus increase the strength of concrete by adding fibers to concrete. The two types of fibers are natural and artificial fibers. The natural fibers are natural, but artificial fibers are man-made. The natural fibers are natural. In the artificial fiber the horse hair, sisal, coir, bamboo, jute, conscious grass etc. are found, as well as the natural fibers, i.e. steel, asbestos, glass, carbon, synthetics etc. The remaining fibers in the natural fibers are plants other than horse hair. Concrete strength and ductility are interconnected. That is, higher concrete strength with lower ductility. Inverse proportional ductility is strength. It is the serious disadvantage for the use of concrete of high strength. Reduce this property to add concrete fibers. The fiber concept is used to improve building material characteristics and is old. Adding the fibers to concrete makes them more homogeneous and isotropic and makes them more ductile. If the micro cracks in the concrete are formed, the fibers are arrested. This will increase strength and ductility and expand more than concrete under loading reinforced fibers.

HAIR FIBER REINFORCED CONCRETED

Keratin is the main element of the hair structure. Keratins are proteins which form the cytoskeleton of all cells in the outer shell with long amino acid chains. The sulfur is the main reason for the strength of the hair cords before disappearance, faced with environmental stress, and this sulfur compound is associated with a very high degree of amino acids in hair cords. Sulfur is adjacent to keratin protein til forming the chemical disulphide chain in amino acid molecules (chains are very strong and resistant to breakage). These chains are resistant to the performance of disulphide acids, but they can decompose in alkaline solutions. Actually the haircords are lost by the alkaline environment. The possible impact of reduced strength in the cement mortar remains notable, but we must note that it is aimed at examining the impact of hair cord control in normal concrete shrinkage and cracke. These cords are able to react purposefully to the functions to prevent shrinkage before the alkaline environment looses the hair cords. The external hair surface which has been examined with electron micro scope is shown in Figure 1. Figure 1. The outer layer of hair known as a cuticle is very similar and has bumps to tree trunks.

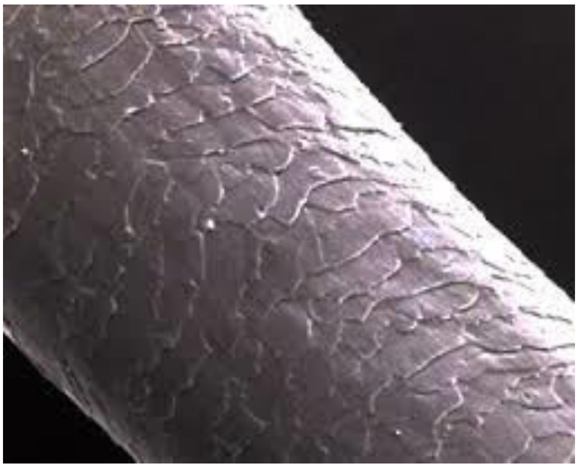

Fig 1.1: Details of external portion

THE HAIR USED AS A FOLLOWING REASONS

- The hair has a high strength that is equivalent to that of a similar diameter copper wire.
- In decomposition, hair creates environmental problems.
- It is an issue which cannot be degraded.
- It's also very cost-effective.
- It strengthens the sapling morter and paves it.

2. LITERATURE REVIEW

MECHANICAL PROPERTIES OF FIBERS

Fibers are added to the concert that significantly affects its mechanical properties. Depending on fiber type and proportion. The mechanical characteristics of fibers with end anchorage and a large aspect relationship have improved fibers added to a concert, which have a significant impact. Crimped end fibers can achieve the same

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properties with 40 percent less fibres, for the same length and diameter. The same equipment and process as for conventional concerts can also be utilized to determine the mechanical characteristics of the FRC. Below are certain FRC properties determined by various research

Compressive strength: The presence of fibers can change the cylinder mode of failure, but the fiber effect on compressive strength values will be reduced (0 to 15 percent).

Modulus of elasticity:

The FRC elasticity module increases slightly as the fiber content increases. The fiber content increased by volume by 1 percent and the elasticity module increased by 3 percent.

Flexure: The flexural strength was reported to be increased by 2.5 times using 4 percent fibers.

Toughness: For FRC, toughness is about 10 to 40 times that of a plane concrete.

Splitting tensile strength:

There was a reported increase in the division strength of tensile morter by volume of 3 percent of fibre approximately 2.5 times the strength of the unreinforced.

Fatigue strength:

Added fibers increase fatigue strength by approximately 90% and 70% at 2 to 1106 cycles, respectively, to ensure full reversal of loading.

Impact resistance: Depending on the volume of fiber, the impact force of fibrous concrete is usually five to 10 times that of simple concrete.

Corrosion of steel fibers:

The 10 years of exposure to external weather in an industrial atmosphere of the steel fibrous mortar showed adverse effects on the strength properties. Only fibers that were actually exposed to the surface were found to contain corrosion. Steel fibrous mortar continuously divested in seawater 10 years showed a 15% loss compared with a 40% decrease of the strength of the plain mortar.

Structural behavior of FRC:

Fibers combined with reinforcing bars are widely used in the future in structural components. Some of the structural conduct are as follows.

Flexure: Increased ductility, strength, momentum and stiffness by using fibres in reinforced concrete flexure components. The fibers enhance crack control and maintain the structural integrity of members after cracking.

Torsion: The use of fibers avoids the sudden failure of flat concrete beams. This improves rigidity, torsional strength, ductility, rotational capacity, and a smaller number of cracks.

Shear: Fiber addition increases reinforced concrete beam shear capacity to 100%. Increase shear friction, first crack strength and ultimate strength with the addition of randomly distributed fibers. The increase in axially loaded specimen fiber content increases the ductility slightly.

Column: The application of fibers helps reduce the type failure of the explosive.

3. MATERIALS AND TEST METHODS

MATERIALS

Constituent materials used to make HRC can have a significant influence on the fresh and hardened characteristics of the HRC. The following sections discuss constituent materials used for manufacturing HRC .Chemical and physical properties of

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constituent materials are presented in this section.

Cement: Cement of 53 grade ordinary portland (penna cement) was utilized in accordance with IS 12269 (1987). Table 3.1 presents the chemical properties of the cement produced by the manufacture

Table 3.1: chemical composition of cement

Particulars	**Test results**	**Requirements per IS: 12269-1987**
Chemical composition		
% silica(SiO_2)	19.79	
% Alumina (Al_2O_3)	5.67	
% iron oxide (Fe_2O_3)	4.68	
% lime(Cao)	61.81	
% magnesia(Mgo)	0.84	Not more than 6.0%
% sulphuric anhydride(So_3)	2.48	Max. 3.0% when C_3A >5.0 Max. 2.5% when C_3A<5.0
% chloride content	0.003	Max. 0.1%
Lime saturation factors $Cao-0.7SO_3/2.8SiO_2+1.2Al_2O_3+0.6Fe_2O_3$	0.92	0.80to 1.02
Ratio of alumina /iron oxide	1.21	Min. 0.66

Summary of physical properties and various tests conducted on cement as per IS4031 (1988) are presented in the Table 3.2

Table3.2: Physical properties of cement

Physical properties	**Test results**	**Test method/Remarks**	**Requirement as per IS 12269(1987)**
Specific gravity	3.15	IS 4031(1988)-part 11	-
Normal consistency	30%	IS 4031(1988)-part4	
Initial setting time(min)	90	IS 4031(1988)-part 5	Min.30 min
Final setting time(min)	220	IS 4031(1988)-part5	Max.600 min
Soundness Lechateliar expansion (mm)	0.8	Manufacturer data	Max.10 min

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TESTS ON CEMENT

Fineness of Cement by Dry Sieving Method

The degree of cement fineness is a measure of the average cement grain size. The finer cement is faster with water and early strength is not affected by its ultimate strength. The thinness of cement will increase however, the shrinkage and cracking of concrete. Apparatus used to determine the sieve analysis are I.S. Sieve No. 9 (90 Microns), Weighing Balance capacity 5 kg as per IS: 4031(part 1)-1996.Weigh 100 grams of the given cement and sift it continuously for 15 minutes on IS. Sieve 9 no air set lumps may be broken down by fingers but nothing should be rubbed on the sieves. Find the weight of residue of the sieved after the sifting is over and report the values as a percent of the original sample taken.

Normal Consistency

Initially, approximately 400 g cement was mixed with 30 percent water mix. The paste was filling in Vicat's mold and care was taken to prevent forcing of the cement paste in the mold and to smooth out and levell the surface of the filled paste. A 1mm/1mm square nad must be attached to the dip and then gently lowered onto the cement paste surface and released quickly. The readings on scale were recorded as the plunger penetrated the cement paste. The experiment was carried out with attention away from the vibrators and other disorders. The test procedure was repeated by increasing the mixing water rate by 0.5% to 5 to 7 mm from the bottom of the mold. When this condition is achieved, a correct percentage of water for normal consistency has been taken from the amount of water added. The whole test was performed in 3 to 5 minutes if the duration of the tests is longer than 5 minutes. The test sample was refused and a new sample was taken. For every repetition of the test, fresh cement was taken. Every time the test was done, the plunger was cleaned.

4. RESULTS AND DISUSSIONS

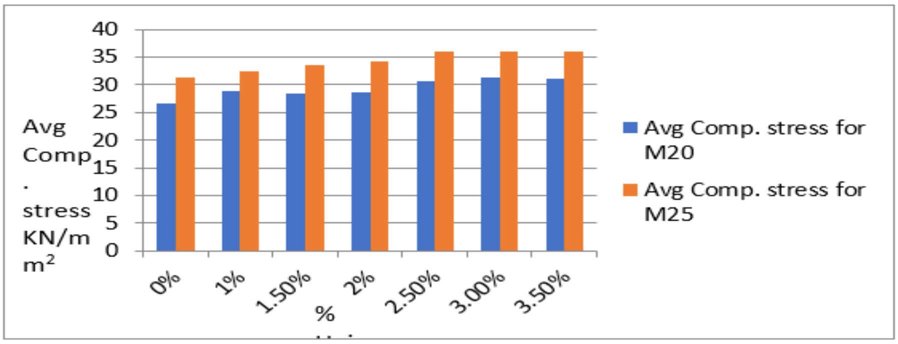
The findings are tabled briefly and displayed in the table below. The test results for compressive strength and split tensile strength on cubes with different proportions of concrete varying percentages of hair-fiber by weight of cement

S.NO	Mix	% hair	Compressive strength(N/mm^2)			Avg. compressive strength (N/mm^2)
			Cube No.1	Cube No.2	Cube No.3	
1	M-20	0%	26.55	26.88	26.55	26.66
2	M-25	0%	31.24	31.17	31.33	31.24
3	M-20	1%	25.81	27.53	27.12	26.82
4	M-25	1%	32.72	32.64	31.81	32.39
5	M-20	1.5%	28.65	27.96	28.75	28.45
6	M-25	1.5%	33.56	33.25	33.78	33.53
7	M-20	2%	28.93	28.36	28.94	28.74
8	M-25	2%	34.74	33.97	34.24	34.31
9	M-20	2.5%	30.86	30.21	31.16	30.74
10	M-25	2.5%	36.01	35.56	36.27	35.94
11	M-20	3%	31.04	31.18	31.54	31.25
12	M-25	3%	36.21	35.64	36.47	36.10
13	M-20	3.5%	31.01	31.12	31.24	31.12
14	M-25	3.5%	36.10	35.25	36.41	35.92

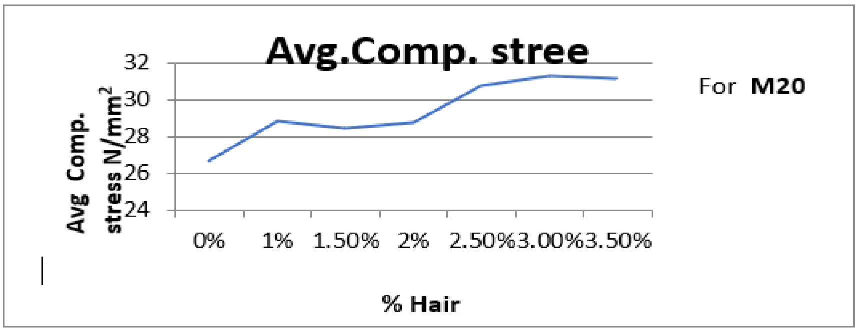
COIMPRESSIVE STRENGTH TEST:

GRAPHS:

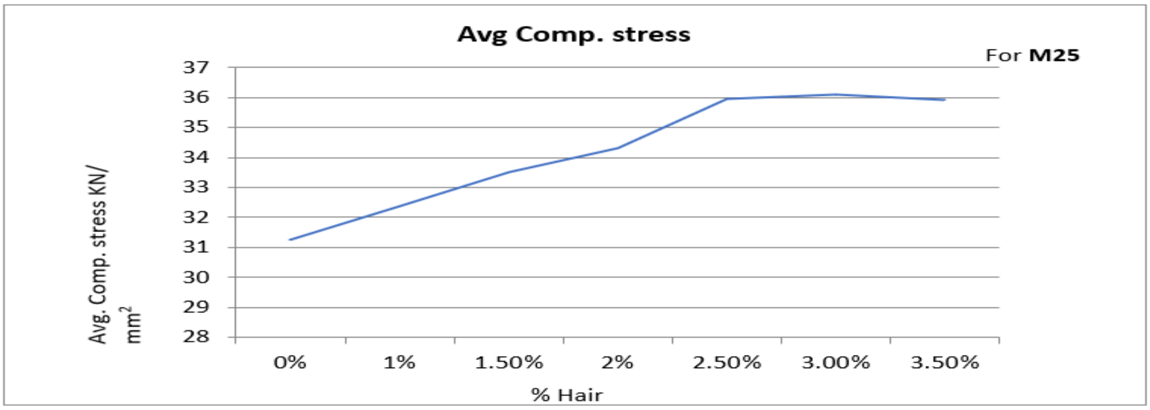
Hair in %	0%	1%	1.50%	2%	2.50%	3.00%	3.50%
M20	26.66	28.82	28.45	28.74	30.74	31.25	31.12
M25	31.24	32.39	33.53	34.31	35.94	36.1	35.92



Bar Graph



Graph for M20



Graph for M25

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SPLITTING TENSILE STRENGTH TEST:

S.NO	Mix	% of hair	Split tensile stress(N/mm^2)
1	M-20	0%	3.81
2	M-25	0%	4.09
3	M-20	1%	3.91
4	M-25	1%	4.21
5	M-20	1.5%	4.02
6	M-25	1.5%	4.26
7	M-20	2%	4.13
8	M-25	2%	4.38
9	M-20	2.5%	4.26
10	M-25	2.5%	4.42
11	M-20	3%	4.39
12	M-25	3%	4.58
13	M-20	3.5%	4.31
14	M25	3.5%	4.47

GRAPHS:

Hair %	0%	1%	1.50%	2%	2.50%	3.00%	3.50%
M20	3.81	3.91	4.02	4.13	4.2	4.39	4.31
M25	4.09	4.21	4.26	4.38	4.42	4.58	4.47

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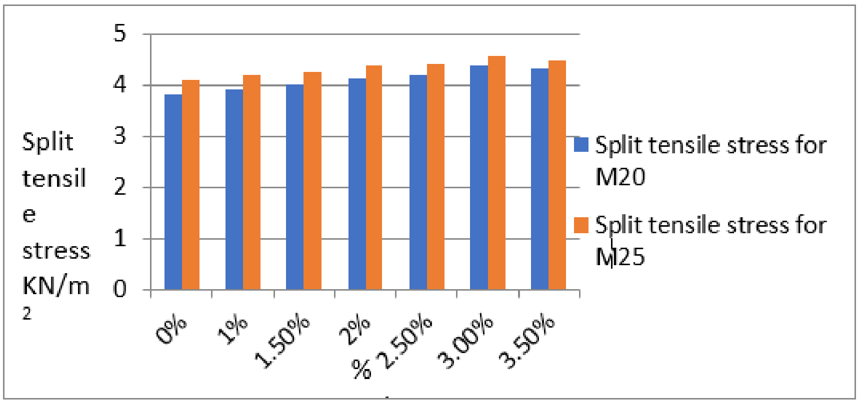
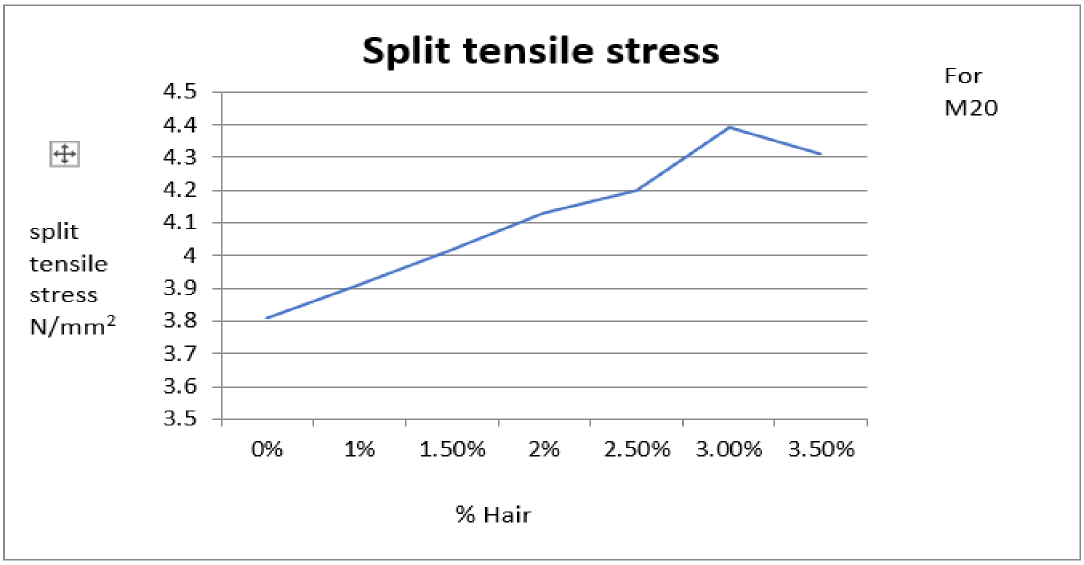


Bar Graph



Graph of M20

CONCLUSION:

According to the test carried out, the strength of concrete is increased by an increase of 0% to 3% in the hair percentage by weight. The concrete strength began to decrease at 3.5 percent. Thus the 3% hair is the average value for the addition of the hair percentage in cement by weight. The results are similar in compressor tests and tensile fracturing, e.g. 3 percent of the hair by weight of concrete is mean point to concrete failure in the compression test and tensile splitting test.

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