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Agave Vera-Cruz Mill Fiber Reinforced Concrete

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Abstract— The Agave Vera-Cruz Mill (i.e.in Marathi language called KEKTAD plant) fibers, abundantly available in nature specially in semi arid-region of Maharashtra and also this plant called as medicinal plant as it is used against stomach problem diseases. In old days in India this fiber is mostly used for making Ropes, Mats & other useful products in regular lifestyle. This fiber is under Agave species. As we know that one important specie Agave Sisalana that is Sisal plant from that Sisal fibers are occurred, which is used successfully in concrete very well. The difference between Agave Vera-Cruz Mill and Agave Sisalana plant is the height of Agave Sisalana plant is more as compared to Agave Vera-Cruz Mill plant & also the width of leaves of Agave Vera-Cruz Mill plant is more than that of leaves of Agave Sisalana plant. So, as these two plants are from same species, Agave Vera-Cruz Mill plant fiber (i.e.KEKTAD fiber) can be use in concrete as similar to that Agave Sisalana plant (i.e. SISAL fiber). This project presents the effects of Agave Vera-Cruz Mill fiber inclusion on the mechanical properties of concrete matrix in wet and hardened state and durability tests. For checking mechanical properties of Agave Vera-Cruz Mill fiber reinforced concrete used fiber-cement ratios 0.05%, 0.1% and 0.15% in M30 grade of concrete. It is observed that workability reduced with addition of fiber and it is tested by Vee-Bee apparatus. The Vee-Bee time observed as 7 sec, 10 sec, 13 sec, and 17 sec with varying percentage of fiber-cement ratios as 0%, 0.05%, 0.1% and 0.15% respectively. The compressive strength of Agave Vera-Cruz Mill fiber reinforced concrete with fiber-cement ratio 0.05%, 0.1%, 0.15% increased over conventional concrete about 6.05%, 11.92%, 11.45%, 15.9%, 15.62%, 19.63% and 14.79%, 20.57%, 7.76% in 3, 7, 28 days cured cube specimen. The Split Tensile and Flexural Strength of this concrete increases with 9.79%, 9.27%, 12.37% and 3.17%, 3.65%, 1.44% respectively over plain concrete.

Keywords— Fibers, Kektad fibers, Properties of Materials, Workability Test, Compressive Strength Test, Tensile Strength Test, Flexural Strength Test.

INTRODUCTION

Now a days, there is most commonly used structural material for construction is concrete, for that to enhance the strength properties & serviceability requirements by using supplementary materials like steel fibers, glass fibers etc. (as a synthetic fibers) & sisal fibers, coconut fibers, jute fibers etc. (as a Natural fibers) in concrete. Concrete is a brittle material. To improve the mechanical properties like compressive strength, flexural-split tensile strength, impact resistance, for this, different synthetic and natural fibers are using in concrete.

Using above all synthetic fibers in concrete [1-10] through it enhances the mechanical properties of cement and concrete matrix but it is developing rapid degradation of environment. The natural fibers are available more in nature and most of them generate agriculture waste. The most important is natural fibers are renewable, non-abrasive, cheaper, comparatively more flexible. The most important thing behind using natural fiber is they are healthy and safety during handling, processing and mixing into the concrete. If we use of natural fiber increase directly in the rural regions develop economical structure for rural region people. The most of natural fibers has chemical composites like cellulose, hemi-cellulose, lignin, protein, extractive in organics. The sums of natural fibers successfully used in concrete are bamboo, jute, coconut sugarcane, bamboo, human hair, sisal etc. [11]

The **jute fibers** are obtained from the ribbon of stem. This fibers are obtained by following successive process:- retting in water, beating, stripping. The fiber from core and drying In jure fiber cellulose, hemi-cellulose and lignin are the main chemical constituents. The properties of jure fibers are as specific gravity [Kg/m3] = 1460: water absorption [%] = 13: tensile strength [Mpa] = 400-800: Slimness [KN/mm2] = 10-20. It can with and retting easily. These fibers with stand against heat and it have high tensile strength. [12] The jute fiber reinforced concrete shows slump value as 70, 45, and 50 mm with varying fiber-cement values as 0.5%, 1% and 1.5% respectively. [18] The jute fiber reinforced concrete shows compressive strength as 47.24 N/mm2. So it is concluded that, there is increase of compressive strength with addition of jute fiber in concrete. [18] The fracture and impact properties of jute fiber reinforced concrete are also gives good results. The flexural test shows flexural test of JFRC 5.2±0-3Mpa and similarly tests are conducted on plain concrete which shows 4.7±0.2Mpa. [13]

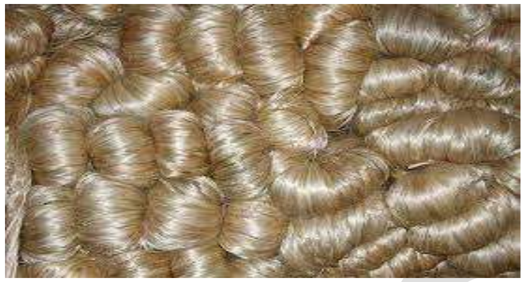

Fig.1.1 Jute Fiber (Source:-Google Image)

The **coconut fibers** made up from the outer shell of a coconut. The common name of a coconut fiber is coir. The plant family name is arecaceae (PALM). The coconut fibers are of two types one is brown fiber which is extracted from matured coconut and second type is white fiber which extracted from immature coconuts. [14] The physical properties of coconut fiber are- Color-Brown/white: fiber length- 10-200mm: fiber diameter- 0.2-0.35mm: tensile strength 80-12N/mm2: Modulus of elasticity-18-25N/mm2: water absorption- 30-40%. [15] The compressive strength of CFRC with 1% of fiber content of 5cm long fiber is 43.2Mpa and it is greater than that of plain concrete is 34.7Mpa. The split tensile and MOR of CFRC shown as 4.27Mpa and 4.51Mpa respectively when adding 1% of fiber content and 7.5cm of fiber. [16] the adding of latex treated coir fiber in concrete shows better bonding and compressive strength results as compared to non-coconut fiber reinforced concrete. [15] SEM (Scanned electron microscope) test and EDX (energy dispersion X-ray spectroscopy) test result gives idea that less susceptible against sulphate attack in term of mass loss and compressive strength detritions. So these fibers are less used in marine areas. [14]

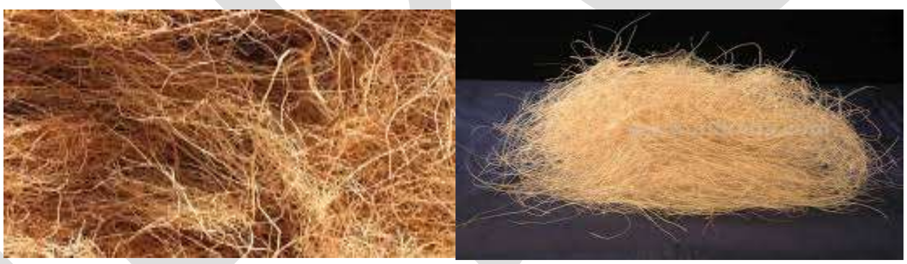

Fig.1.2 Brown Coconut/Coir & White Coconut/Coir Fiber (Source:-Google Image)

Now a day, there is study going on **sugarcane baggage fibers**. This is also used as concrete fiber. It is studied that compressive strength of sugarcane fibrous concrete specimen is 27.6Mpa and to that of plain concrete is 26.5Mpa at 28days. The split tensile strength of sugarcane concrete specimen observed 3.92Mpa and to that of plain concrete is 2.86Mpa at 28days. The modulus of rupture of sugarcane specimen is 4.7Mpa and to that of plain concrete is 4.06Mpa at 28days of curing. The sulphate attack causes 14.5% loss of mass of sugar can fibrous concrete. By result of SEM and EDX test is concluded that impregnation of calcium content on the fiber walls showed better strength enhancement but susceptible sulphate attack. The freezing and throwing affect greatly on sugarcane reinforced concrete. [14]

Fig.1.3 Sugarcane Baggage Fiber (Source:-Google Image)

The new fiber is introduced in natural fiber **Human Hair fiber**. Earlier, Horse hair fiber was used in cement matrix. These fibers are abundantly available as population is increasing day by day. The compressive strength of HHF matrix with water cement ratio 0.6% with using fiber content 0.8% is 7.654Mpa and the plain cement matrix have 6.282Mpa for 7 days curing. The tensile splitting test gives as 0.885Mpa and the plain cement matrix gives 0.700Mpa. Similarly same cement specimen is used as flexural strength gives 4.232Mpa and the plain cement matrix gives 2.653Mpa. It is observed that, energy absorption capacity and ductility factor improved considerably with increase in fiber content of HHF. So it is suitable for seismic force resistance structure.

Fig.1.4 Human Hair Fiber (Source:-Google Image)

Among from all natural fibers, the most useful natural fiber is the **sisal fiber**. In arid and semi-arid regions these fibers are observed. The leaves of sisal plat yield a strong fiber, which is used as making ropes, mats etc. The leaves of sisal plant have the potential that 100Kg leaves produce 30 Kg fibers. It is concluded that these fibers produce economical system in rural areas. [19] The leaves are of 25cm length, 1.8cm wide. [20] There are two extraction methods called the retting process and the mechanical process. In retting process is manual process and by using Rapider in case of mechanical process. From these two methods fibers are extracted from sisal plant. The chemical compositions of sisal plant are cellulose (55-65%), Hemi-cellulose (10-15%), pectin (2-4%), Lignin (10-20%), water suitable methods (1-4%), Fat and wax (10.15-0.3%) and ash (0.7-1.5%). The fibers are also used to make sisal fiber cement rooting sheet which is casted at AMPRI, BHOPAL, INDIA. [19] The physical properties of sisal fiber are specific gravity (Kg/m3) 1370, water absorption (%) 110, Tensile streng th (Mpa) 347-348, modulus of elasticity (Gpa) 15. These fibers have advantage that it is resistant against moisture, good tensile strength, resistant against heat, restrained plastic shrinkage, 72.2% -60.9% restrained strength against sodium hydroxide solution. [12] By experimental study on sisal fiber reinforced concrete have slump values 72mm, 55mm and 60mm with varying water cement ratios as 0.5%, 1%, 1.5% respectively. The sisal compressive strengths are 42.22N/mm2, 46.49N/mm2, and 40 N/mm2 with varying water cement ratios 0.5%, 1% and 1.5% respectively. The plain concrete observes compressive strength as 40.76 N/mm2. Similarly the young's modulus for SFRC are 30.6Mpa, 34.4Mpa, 31.9Mpa with varying fiber cement ratios as 0.5%, 1% and 1.5% respectively. From all above result it is concluded that sisal fibers are successfully used to concrete. [18] From one of the literature studied that mechanical properties of sisal fiber reinforced polymer based composites. To make this polymer matrix they used epoxy resin and hardener. From their study it is concluded that when fibrous are used in 90̊ orientation, the maximum tensile strength observed as 56.6Mpa. the flexural strength observed as 37.133Mpa. In this, they also SEM analysis, from that it is observed that epoxy resin are well bonded in bidirectional fibers than unidirectional fibers. [21] From above all our study on synthetic fibers and natural fibers, we are using agave Veracruz mill plant in concrete. It is observed that sisal plant and kektad plant are from same species as:-

Sr. No.	Botanical name (Family) and local name	Habit	Parts used	Mode of use
1.	Agave sisalana (Agavacease) and sisal	Shrub	Leaf	Rope, mat and fishing nets
2.	Agave Veracruz mill (Agavecease) and kektad (in Maharashtra)	herb	Leaf	Fiber, rope and mat

Tab.no.1.5 Botanical names & local name of Agave species [20]

Fig.1.5 Sisal Plant (Agave sisalana) & Its Fibers (Source:-Google Image)

The above table shows that, **sisal plant and kektad plant** are from same agave family. So we can use kektad plant in concrete as like as sisal plant. The leaves yield a fiber coarser and stronger. It is used in ropes, mats etc. [20] In INDIA as:- Sisalana, Mexicana, Americana, Cantala and Veracruz mill. Especially in Maharashtra- Agave Veracruz mill is available in arid and semi-arid regions [19]. In present study, we are using kektad plant from nearby areas of Ahemednagar district, Maharashtra. From leaves of kektad we can prepare same fiber as like as sisal fiber. The method of extraction of fiber from leaves is retting method. The fibers have cellulose contents 77.43%. By using these **kektad fibers** in concrete, we are finding out properties of concrete in fresh and hardened state as same like as sisal fiber reinforced concrete.

Fig.1.6 Kektad plant (i.e. Agave Veracruz Mill) & its fibers (Source:-Camera Image)

METHODOLOGY

As stated earlier, Agave Veracruz Mill plant and Agave Sisalana plant are from same species. Agave Sisalana plant leaves fibers are abundantly present in Orissa region and less in Maharashtra region. Agave Veracruz mill plant leaves fibers are mainly available in arid and semi arid regions of Maharashtra. Agave Sisalana plant leaves are successfully used in concrete, depending upon that we can try to use Agave Veracruz mill plant leaves fibers in concrete. So, we are finding the properties of Agave Veracruz Mill fibers reinforced concrete in wet and hardened state.

The main ingredients of Agave Vera-Cruz Mill fiber reinforcement concrete are as follows:-

1] Agave Vera-Cruz Mill (Kektad fiber) fibers

2] Cement

3] Fine Aggregate

4] Carouse Aggregate

5] Water

A] Materials and Its Properties

a] Agave Veracruz Mill fiber (i.e.kektad fiber)

Agave Vera-Cruz Mill fibers are obtained from Agave Vera-Cruz Mill plant leaves. The plant leaves are 75-90 cm long, 2.5-5 cm width, and 15-30mm thick. The steps of extraction of fibers from leaves as:-

There are two methods for extraction of fiber:-

(1) Retting process
(2) Mechanical process

We are using Retting Process as machine is not available for mechanical process.

(i) Fresh leaves of Kektad plant are harvested when its leaves are well developed.

(ii) After harvesting, the spines of leaves are removed.

(iii) Then leaves are split into smaller parts by hand.

(iv) For quality control, these leaves dried in sun rays for 2 days due to that separated fibers are got.

(v) These splitted leaves are tied into bundles.

(vi) After making these bundles, the retting is done in water for several days [About 7-15 days] .We are done for 15 days for decomposition of leaves very well. This process is called as Decortications.

(vii) Then finally bundles are removed and hitting it with bat/any other similar material and washed very well so that we get purely whitish Fibers.

(viii) Then dried in sun rays for 2 days, So that all moistures are removed.

(ix) Finally we get purely whitish Kektad fiber and now it is ready to use in concrete.

From above process we get kektad fibers having length in somewhat less than length of kektad leaves because of extraction process and diameter of kektad fiber in micron meter. For our project we used kektad leaves from nearby areas of **Ahemdnagar district of Maharashtra**.

b] Cement:-

The 43-grade 'JK Super' ordinary Portland cement is used throughout the experimental work. Cement is tested in laboratory and results are as follows:-

Sr. No.	Properties	Results
01	Fineness of cement (residue on IS sieve No. 9)	2.40%
02	Specific gravity	3.12
03	Standard consistency of cement	30.50%
04	Setting time of cement a) Initial setting time b) Final setting time	95min 395min
05	Soundness test of cement (with Le-Chaterlier's mould)	1.0 mm

Tab.no.2.1 Characteristic properties of cement

c] Fine Aggregate (Sand):-

The locally available sand, from MULA RIVER, is used as fine aggregate, it confirms to zone II of IS 383-1983 and, other necessary properties are given in below:-

Sr.No.	Properties	Results
1.	Particle Shape, Size	Round, 4.75mm down
2.	Fineness Modulus	3.4
3.	Silt content	2.65%
4.	Specific Gravity	3.11
5.	Bulk density	1849.47 Kg/m3
6.	Surface moisture	1.50%

Tab no.2.2 Characteristic properties of fine aggregates *d]* Coarse Aggregate:-

Locally available crushed stone aggregate with size 12.5 to 20mm and of maximum size 20mm are used. The test results are as follows:-

Sr. No.	Properties	Results
1.	Particle Shape, Size	Angular, 20mm to 12.5mm
2.	Specific gravity	2.83
3.	Water absorption	1.87%
4.	Bulk density of 20mm aggregate	1801.41Kg/m3
5.	Surface moisture	0.62%

Tab.no.2.3 Characteristic properties of coarse aggregates

B] CONCRETE MIX SELECTION

There are various methods of mix design. In the present work, Indian Standard method (IS: 10262 - 1982) is used for Concrete having Natural Sand as a Fine Aggregate.

Assumption:

Characteristics Strength required at 28 days = 30MPa

Maximum size of aggregate =20 mm

Degree of quality control =Good

Type of exposure = Moderate

Procedure of mix design:

Characteristics Strength = fck =30 N/ mm^2

Target mean Strength, ft = fck + t x S

Where, t= 1.65 &

S=standard deviation (table 1 of IS 10262 – 1982 page N0 5)

For M30 grade concrete & good quality control, S=5

Target mean strength = ft = 30 + (1.65 x 5) = 38.25 MPa

Step 1:

To decide water cement ratio, which will give 38.25 MPa refer graph from IS 10262 – 1982 (page No 8)

Select Water/ Cement ratio = 0.42, this is lesser than 0.50 prescribed in IS 456- 2000 for moderate exposure condition for reinforced concrete. (Table 5)

Step 2:

Now from table 4 of IS 10262-1982, page no 9 for maximum 20 mm size of aggregate Water Content per m^2 of concrete is =186 kg and sand as % of total aggregate by absolute volume = 35% (For W/C = 0.42)

Step 3:

To know the cement content,

W/C = 0.42

Water = 186 kg / m^3

Cement = 186 / 0.42

= 442.86 Kg/m^3

Step 4:

To decide naturally entrained air from Table 3 of I.S 10262-1982, For 20 mm Size aggregate, entrapped air % of volume of concrete = 2%

Step 5:

Determination of water & fine aggregate content using equation 3.5.1 of I.S 10262-1982, page no 11, the total aggregate content per unit volume of Concrete may be calculated from following equation,

$$V= \left(W+\frac{C}{Sc}+\frac{1}{P}\ X\ \frac{fa}{Sfa}\right) x\ \frac{1}{1000}$$

$$V= \left(W+\frac{C}{Sc}+\frac{1}{1-P}\ X\ \frac{Ca}{Sca}\right) x\ \frac{1}{1000}$$

Where,

V = Absolute volume of fresh concrete which = Gross volume – volume of entrapped air,

W= Mass of water (Kg) per cum of concrete.

C = Mass of cement (Kg) per cum of concrete.

S_c = Specific gravity of cement

P = Ratio of FA to aggregate absolute volume

Fa, Ca = total masses of FA & CA (Kg) per cum of concrete respectively

S_{fa}, S_{ca} = Specific gravity of saturated surface dry fine aggregate & coarse aggregate respectively.

$$V = (W + \frac{C}{Sc} + \frac{1}{P} X \frac{fa}{Sfa}) x \frac{1}{1000}$$

$$0.98 = (186 + \frac{442.86}{3.12} + \frac{1}{0.35} X \frac{fa}{3.11}) X \frac{1}{1000}$$

$$f_a = 709.70 \ kg/m^3$$

$$V = (W + \frac{C}{Sc} + \frac{1}{1-P} X \frac{Ca}{Sca}) x \frac{1}{1000}$$

$$0.98 = (186 + \frac{442.86}{3.12} X \frac{1}{1-0.35} X \frac{Ca}{2.77}) X \frac{1}{1000}$$

$$c_a = 1173.93 \ kg/m^3$$

The mix proportion then becomes **1: 1.60: 2.65**

Material	**Proportion by weight**	**Weight in kg/m^3**
Cement	1	442.86
F.A	1.60	709.70
C.A	2.65	1173.93
W/C	0.42	186 lit

Table.no.2.4 Quantity of material per cubic meter of concrete

Step 6: Actual quantity of Water required:-

1) For water-cement ratio of 0.42 quantity of water = 21 liters of water

2) Extra quantity of water to be added for absorption in case of coarse aggregate at 0.5 percent by mass =(+) 0.77 liters

3) Quantity of water to be deducted for free moisture present in sand, at 2 percent by mass= (-) 1.42 1iters

4) Actual quantity of water to be added = 21.0 + 0.77 - 1.42 = 20.35 1iters

Material	**Proportion by weight**	**Weight in kg**
Cement	1	50
F.A	1.60	80
C.A	2.65	132.5
W/C	0.42	21.0 + 0.77 - 1.42 = 20.35 liters

Table 2.5: Quantity of material per 50 kg of cement

C] Method and tests on Agave Vera-Cruz Mill fiber reinforced Concrete:-

a] Measurement of Ingredients:

All cement, sand, coarse aggregate, fiber is measured with Digital balance. The water is measured with measuring cylinder of capacity 1 liter and measuring jar of capacity 1000ml, 2000 ml. The kektad fibers are measured with Digital balance of accuracy 1mg.

b] Mixing of Concrete:

The ingredients are thoroughly mix over a G.I.sheet. The sand, cement and aggregate is measured accurately and mixed in dry state for normal concrete. For kektad fiber reinforced concrete, the required quantities of kektad fiber is measured by volume of concrete. The required weighted quantity kektad fiber is then uniformly sprinkled by hands on dry concrete mix containing CA, FA, and cement. Care is taken to avoid balling i.e. agglomeration of fibers. Then required water content is added into the dry mix and prepares wet mix.

c] Workability of Concrete:

At every batch of mixing, the concrete workability is measured and recorded using with Vee-Bee test apparatus as per relevant IS. Workability is measured in terms of Vee-Bee time in seconds.

d] Placing of Concrete:

The fresh concrete is placed in the moulds by trowel. Moulds are cleaned and oiled from inside for smooth molding. It is ensured that the representative volume is filled evenly in all the specimens to avoid segregation, accumulation of aggregates etc. While placing concretes, the compaction in vertical position is given to avoid gaps in moulds.

e] Compaction of Concrete:

Concrete is mixed thoroughly and placed in the mould in three layers and compacted by tamping rod. The tamping is continued till cement slurry just ooze out on surface of moulds. Care is taken of cement slurry not to spill over, due to tamping and segregation.

f] Finishing of Concrete:

After tamping, the moulds are kept on ground for finishing and covering up for any leftover position. The concrete is worked with trowel to give uniform surface. Care is taken not to add any extra cement, water or cement mortar for achieving good surface finish. The additional concrete is chopped off from top surface of the mould for avoiding over sizes etc. The density of fresh concrete is taken with the help of weight balance. Identification marks is given on the specimens by paint over the surface after initial drying.

g] Curing:

All Cubes (3, 7, 28 days), Cylinders (28 days) and Beams (28 days) specimens is cured in the water after 24 hours of casting.

h] Testing of cubes:

To determine the mechanical properties of Agave Vera-Cruz Mill fiber (i.e. Kektad fiber) reinforced concrete, the following tests are conducted on KFRC (Kektad Fiber Reinforced Concrete) as:-

i. Workability Test
ii. Compressive Strength Test
iii. Split Tensile Strength Test
iv. Flexural Strength Test

RESULTS AND DESCRIPTION

a] Workability Test:-

For checking workability, we used Vee-Bee test method. While mixing kektad fiber into the M30 grade of concrete, it is observed that increase in fiber-cement ratio there is increase in Vee-Bee time. That is there is decrease in workability of concrete with varying percentage of kektad fiber. The results are shown in bellow table:-

Type of the Fiber	Vee-Bee time in sec for Fiber-Cement ratio of percentage			
	0	0.05	0.1	0.15
Agave Vera-Cruz Mill (i.e kektad fiber)	7	10	13	17

Tab.no.3.1 Vee-Bee Test Results

b] Compressive Strength Test:-

To perform this test, we prepared 150mm cube of M30 grade of concrete and cured for 3,7 and 28 days of varying percentages 0, 0.05, 0.1, 0.15 for each curing period. The following test results observed as:-

Type of the fiber	Curing periods	Cube Compressive Strength N/mm^2			
		Fiber-Cement Ratio			
		0	0.05	0.1	0.15
Agave Vera-Cruz Mill (i.e kektad fiber)	3	21.30	22.59	23.84	23.74
	7	25.85	29.97	29.89	30.77
	28	37.72	43.30	45.80	40.65

Tab.no.3.2 Compressive Strength Test Results

c] Split Tensile Strength Test:-

The specimen of size 150mm in diameter and 300 mm in length are going to place between the two plates of Compression Testing Machine after 28 days of curing. The load is applied at a uniform rate till the specimen failed by a fracture along vertical diameter. The following test results observed as:-

Type of the fiber	Curing periods	Cylinder Split Tensile Strength N/mm^2			
		Fiber-Cement Ratio			
		0	0.05	0.1	0.15
Agave Vera-Cruz Mill (i.e kektad fiber)	28	1.94	2.12	2.13	2.18

Tab.no.3.3 Split Tensile Strength Test Results *d]* Flexural Strength Test:-

In flexure test, the beam specimens of size 100mm X 100mm X 500mm cured in 28 days are going to place in the machine in such a manner at the load is applied to the upper most surface as cast in the mould. All beams are going to tested under two-point loading in Universal Testing Machine of 100-tonne capacity. The load as increased until the specimen failed and the failure load is recorded. The following test results observed as:-

Type of the fiber	**Curing periods**	**Flexural Strength N/mm^2**			
		Fiber-Cement Ratio			
		0	**0.05**	**0.1**	**0.15**
Agave Vera-Cruz Mill (i.e kektad fiber)	28	10.40	10.73	10.78	10.55

Tab.no.3.4 Flexural Strength Test Results

OBSERVATIONS

While testing, we observed following photographs. From above observation it is cleared that due to addition of kektad fiber into the concrete there is change in failure pattern and reduction of crack width as compared to plain concrete as:-

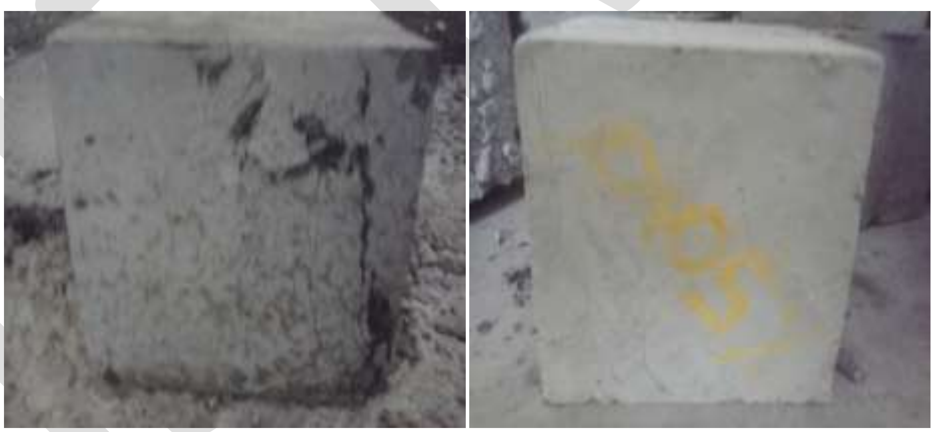

Fig.4.1 Cube failure pattern in M30 plain concrete and Kektad fiber reinforced concrete with 0.05% F-C ratio (28 days curing)

Fig.4.2 Cylinder failure pattern in M30 plain concrete and Kektad fiber reinforced concrete with 0.05% F-C ratio (28 days curing)

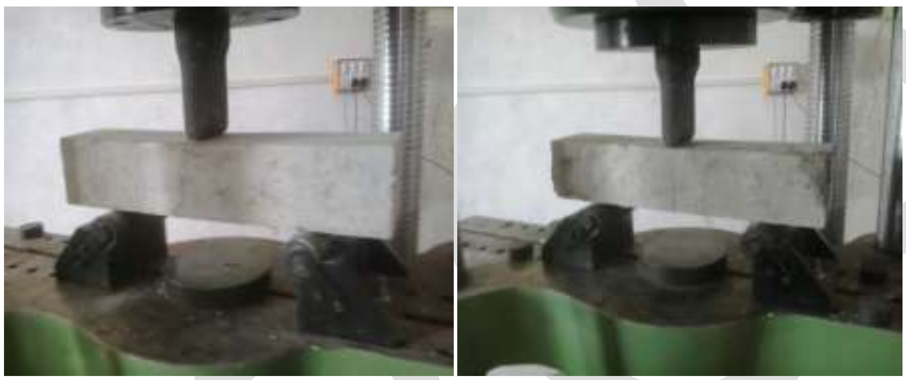

Fig.4.3 Flexural failure pattern in M30 plain concrete and Kektad fiber reinforced concrete with 0.05% F-C ratio (28 days curing)

CONCLUSION

- Vee-Bee time is increasing with the addition of fibers. More the fiber-cement ratio more is the decrease in workability due to absorbency of water by fibers. Hence the use of proper super plasticizer which does not affect other properties except workability is recommended for higher fiber-cement ratios.
- The compressive strength of Agave Vera-Cruz mill fiber reinforced concrete increase with 6.05%, 11.92%, and 11.45% of fiber-cement ratio 0.05%, 0.1%, and 0.15% respectively in 3 days of curing and for 7 days of curing, it is observed that, the compressive strength of Agave Vera-Cruz mill fiber reinforced concrete increase with 15.9%, 15.62%, 19.03% of fiber-cement ratio 0.05%, 0.1%, 0.15% respectively and Similarly for 28 days of curing, the compressive strength of Agave Vera-Cruz mill fiber reinforced concrete increase with 14.79%, 20.57%, 7.76% of fiber-cement ratio 0.05%, 0.1%, 0.15% respectively over plain concrete.
- The Split Tensile Strength of Agave Vera-Cruz mill fiber reinforced concrete specimen after 28 days of curing observed as it increases with 9.79%, 9.27%, and 12.37% of fiber-cement ratio 0.05%, 0.1%, 0.15% respectively over plain concrete.
- The Flexural Strength of Agave Vera-Cruz mill fiber reinforced concrete beam specimen increases with 3.17%, 3.65%, and 1.44% of fiber-cement ratio 0.05%, 0.1%, 0.15% respectively over plain concrete.

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