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Influence of Corn Starch as Admixture in Coconut Fiber Concrete.

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ABSTRACT: *In the past few years much more attentions in the construction industry for the development of construction techniques and improving high performance construction materials. As per Increasing environmental awareness and economical mindset in construction leads to adoption of natural material. Coconut fiber is one of the natural materials which is used in construction. Features of coconut fiber are reasonable, non-corrosiveness, low thermal conductivity, high strength and low weight ratio as compare to traditional concrete. This project paper discusses the enhancement of fiber reinforced concrete by partial replacement of cement with coconut fiber in the proportions of 0, 1, 1.5, 2, 2.5, 3% on M30 grade concrete with the addition of 1% corn starch which enhance the workability of concrete. The diameter and length of coconut fiber is taken 0.4 mm and 30 mm respectively.*

KEYWORD*: Coconut fiber, Composite Materials, Corn starch, Compressive strength, Split tensile strength.*

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I. INTRODUCTION:

Concrete is the second highest consumed material after water in the world, plays an important role in the construction field because of the versatility in its used., In ancient times, navigators widely use these coconut fiber-based ropes for their ships over it is decompose after a long period, so it is usable in concrete. In mega-construction, materials is only of the manage factor affecting housing system around the world.

Coconut fiber is extracted from the outer shell of a coconut where these fibers are thick and durable. Coconut fiber are agricultural waste products that obtained by the processing of coconut oil and easily available in large quantities in the tropical regions in the world. Coconut fiber are not commonly used in the construction industry but as term of agricultural wastes. During the developments to last decade has shown a marked that increment of the coconut fiber which make improvement in the strength of concrete as shown in the previous research paper. Although the coconut fiber produces the decrement in workability of concrete. For enhancing of workability of concrete there will need of an admixture because of admixtures are basically used to modify the concrete properties. Corn starch one of the natural admixtures which can replace the use of chemical admixtures. It also reduces the additional cost of using chemical admixtures. This natural admixture is helpful to improvement of workability of concrete.

In this paper the addition of corn starch to concrete which is more suitable for the workability characteristics of concrete and for this research show the workability relatively depend upon admixture.

II. LITERATURE REVIEW

- The effect of starch on some properties of concrete has been examined in this paper. It is found to increase the strength of concrete especially in early ages and may good use for works where early strength is required such as concrete repairs, pavement construction. Less adverse effect on concrete with regards to creep and shrinkage retarding the heat of hydration at some certain percentage addition.
- The compressive strength of concrete increases in the addition of 1% of corn and further addition of corn starch reduce the compressive strength. Since corn is locally available and are cheaper than chemical admixtures, we can replace chemical admixtures by these starch admixtures effects are currently being investigated.

III. METHODS AND MATERIAIL

The present study considers the workability of reinforced concrete on replacement of cement with coconut fiber having addition corn starch admixture.

Concrete consists of three primary components are Portland cement, aggregates and water. Properties of the final product depend upon cement changes according to the change in the ratio of its components. Hence these are consequentially help the engineer in making the proper decision in use of the same according to his need. To get a certain specific property in cement like to add an admixture. Admixtures enhance its required characteristic properties of concrete.

MATERIAL PROPERTIES

1) CEMENT-

Cement, in general the binding materials used in building and civil engineering construction. Cement of this kind are finely ground powders that, when mixed with water, set to a hard mass. In this project work, Ordinary Portland Cement (OPC) of 43 grade of brand Konark Cement. Cement is preferred according to (Indian Standard) IS: 8112-1989**.** Physical properties of OPC is given in following table.

Table 1: Physical properties of OPC

S.NO	Properties	Experimental Values
1	Normal Consistency %	30%
2	Initial setting time	40 min
3	Final setting time	225 min
4	Soundness of cements	2.75 mm
5	Fineness of cement (% age retained on 90 microns IS Sieve)	3.77%
6	Specific gravity of cement	3.15
7	Compressive strength at 7 days and 28 days	31.71 MPa 45.25 MPa

2) AGGREGATE-

Aggregate refers to the constituent of a composite material that resists compressive load and provides bulk to the composite material. It is mostly used in construction and for coarse aggregate we will use aggregate of size 10mm and 20mm conforming to IS: 383-1970, were locally available in Bihta, Dist- Patna(Bihar) and physical properties were found through various laboratory tests conducted in Concrete and Road material lab, NSIT Bihta. Physical properties of aggregate are given in table.

Table 2: Physical properties of Aggregate

S. NO	Properties	Experimental Values of coarse aggregates	Experimental Values of fine aggregates
1	Water Absorption	0.30%	0.45%
2	Specific gravity	2.74	2.61
3	Crushing Value	18.05%	-
4	Impact Value	12.55%	-
5	Fineness Modulus	6.15	2.70
6	Bulking Of Sand	-	24%
7	Unit weight	-	1.72 gm/cc
8	Color	Dark	Dark
9	Shape0.30%	Angular	Angular

3) **FIBER-**

The coconut fiber, obtained from unripe coconut is a natural fiber extracted from the husk of coconut. Addition of coconut fiber improves the compressive strength, flexural strength and split tensile strength of concrete. Properties of Fiber are given in table.

Table 3: Physical properties of Fibre.

S.no	Properties	Experimental Values of coconut fiber
1	Water Absorption	104%
2	Density	2057 kg/m^3
3	Tensile strength	205 MPa
4	Specific gravity	0.87

4) WATER-

Water is an important component of concrete participates in the chemical reaction with cement. The pH value of water will be 6. The portable water can be used for mixing and curing IS 456:2000. In general, water fit for drinking is suitable for mixing concrete. Impurities in the water may affect concrete setting time, strength, shrinkage or promote corrosion of reinforcement.

5) **ADMIXTURE**

Admixtures are natural or artificial materials added to the concrete besides cement, water and aggregate to improve certain property of concrete during casting or setting or service stage. This experimental test corn starch admixture is to be used. This admixture provides the high slump value with increase in strength, require low water/ cement ratio concrete.

IV. DESIGN MIX

As per mix design of concrete of grade of M-30 the mix ratio is considered **1:1.26:2.80** as per IS code 10262-2009.

Figure 1: Concrete mixing

- The mix proportion is calculated and the value of different ingredients for one cubic meter by mass is given as in table

Table 4: Mix Design of Concrete.

Aggregate (kg/m^3)	7.63
Sand (kg/m^3)	3.43
Cement (kg/m^3)	2.72
Admixture(kg/m^3)	0.16
Fiber (percentage)	3%
Water cement Ratio	0.442

1) Preparation of Test Specimens:

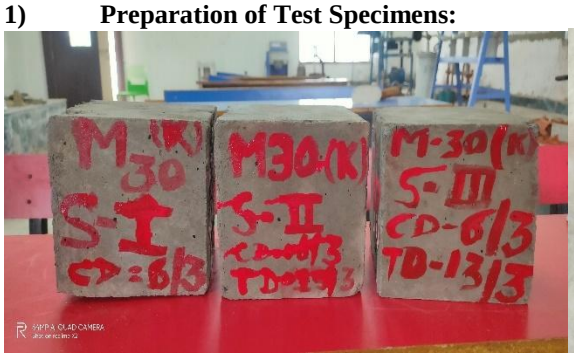

Figure 2: Cube specimen

Figure 3: Cylinder specimen

In the experimental concrete specimen are tested, Concrete specimen is prepared by the aggregate, cement, water & coconut fiber with the help of corn starch admixture which the enhance the workability of concrete. concrete is casted in cube block of size 150mm X 150mmX150mm for the examine compressive strength. And one the other hand perform split tensile strength test that require cylinders of size 150 mm diameter and 300mm height in which concrete casted and after that casting all samples and leaves 24 hours in mould , then remove the sample from the mould after that dip in curing tank and some sample are remove in 7 days for examine the compressive strength and split tensile test and again examine in 28 days.

V. EXPERIMENTAL TEST

Experiments are conducted on the concretes are as follows:

1) Workability by Slump Cone Apparatus

Figure 4: Slump Cone test

The slump cone apparatus determines the workability of concrete and procedures for finding slump of concrete are as follows, First mix all the materials which are using in concrete. Fill the concrete into the slump cone apparatus in 3 layers and compact with the help of compaction rod up to 25 time for each layer. The concrete poured down in the slump cone apparatus. The height of poured concrete is determined from top by the scale, this height is called the slump of the concrete.

2) Compressive strength by Compression Testing Machine:

Figure 5: Compressive test

- Cure the cube for 7 and 28 days in the curing tank.
- Put the cube into the compression testing machine and the load at which cube gets cracked has been recorded.
- Load/Surface Area of the cube mould is the compressive strength of concrete.

3) Spilt tensile by Digital compression testing machine (DCTM):

Figure 6: Spilt tensile test

- Cure the cube for 7 and 28 days in the curing tank.
- In Standard cylinder of 150mm Diameter and 300mm length were supported with the observation made that the upper pate is in parallel to the lower plate and the specimen was tested out with the help of DCTM Machine.
- The cylinder is tested in DCTM machine along to horizontally and divide into four equals having apply the load continuously and without shock.

- And crack unsymmetrical in any four divided section, record the data.

VI. RESULT AND DISCUSSION

Workability:

- Workability of concrete without corn starch with different percentage of coconut fibre is given as in table.

Table 5: Workability of concrete mix without corn starch.

S.No	Mix design name	%age of coconut Fiber	Workability(slump value in mm)
1	A1	0%	80
2	A2	1%	62
3	A3	1.5%	50
4	A4	2%	41
5	A5	2.5%	29
6	A6	3%	24

- Workability of concrete with corn starch with different percentage of coconut fibre is given as in table.

Table 6: Workability of concrete mix with 1% corn starch as admixture.

S.No	Mix design name	%age of coconut Fiber	Workability(slump value in mm)
1	M1	0%	130
2	M2	1%	120
3	M3	1.5%	112
4	M4	2%	105
5	M5	2.5%	85
6	M6	3%	80

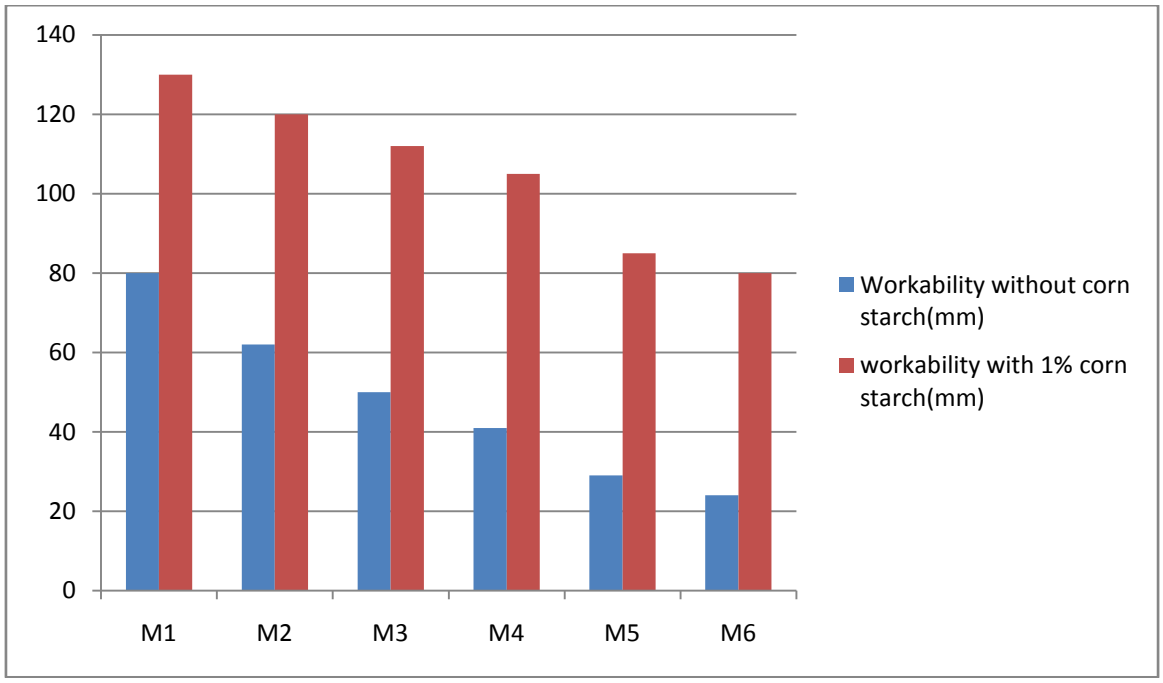

Figure 7: Workability of concrete with and without corn starch.

Compressive Strength : The compressive strength of concrete with different proportion of fiber, without corn starch at 7days and 28days are given in table.

Table 7: Compressive strength of concrete mix without corn starch.

S.NO	%age of Fiber added	Compressive Strength (MPa) at 7days	Compressive Strength(MPa) at 28days
1	0%	45	57
2	1%	48	61
3	1.5%	50	65
4	2%	52.5	67
5	2.5%	55.5	70
6	3%	53	66

- The compressive strength of concrete with different proportion of fiber with 1% corn starch at 7days and 28days are given in table.

Table 7: Compressive strength of concrete mix with 1% corn starch as admixture.

S.NO	%age of Fiber added	Compressive Strength (MPa) at 7days	Compressive Strength(MPa) at 28days
1	0%	56	68
2	1%	46	70
3	1.5%	40	72
4	2%	31	73
5	2.5%	28	75
6	3%	24	71

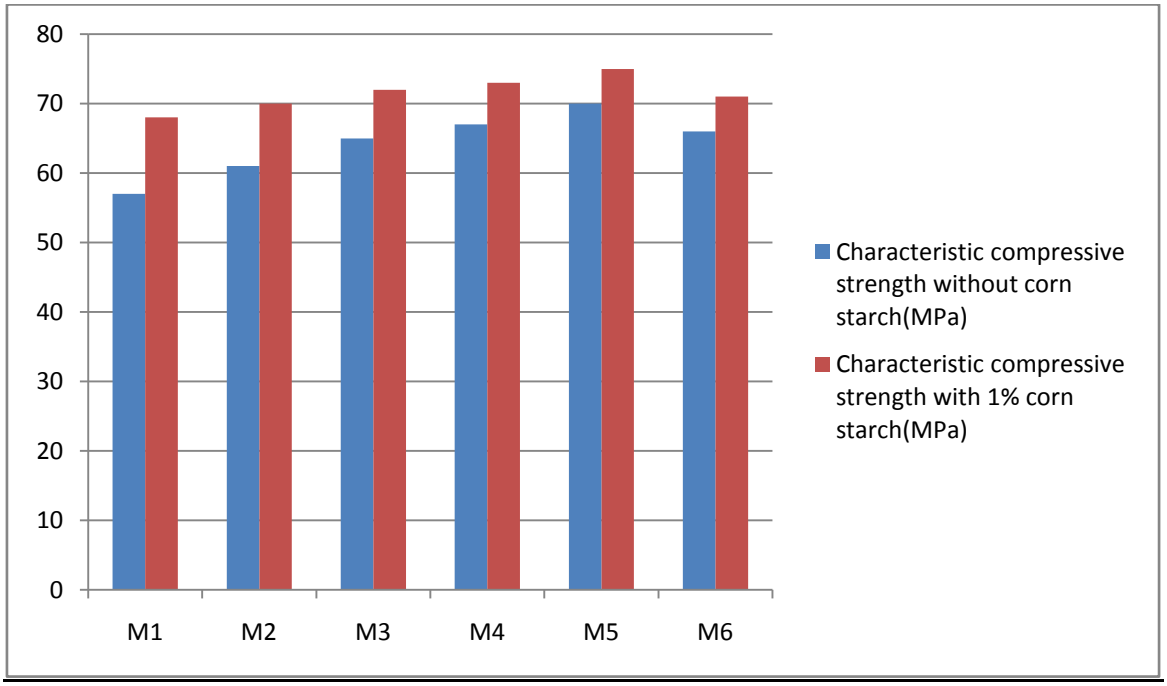

Figure 8: Characteristic compressive strength of concrete with and without corn starch.

Split Tensile strength: -The split tensile strength of concrete with different proportion of fiber at 7days and 28days are given in table.

Table 8: Compressive strength of concrete mix without corn starch as admixture.

S.NO	%age of Fiber added	Split Tensile strength in MPa at 7days	Split Tensile strength in MPa at 28days
1	0%	1.70	2.84
2	1%	1.79	2.90
3	1.5%	1.90	3.26
4	2%	2.22	3.75
5	2.5%	2.48	4.0
6	3%	2.45	3.65

Table 7: Split Tensile strength of concrete mix with 1% corn starch as admixture.

S.NO	%age of Fiber added	Split Tensile strength in MPa at 7days	Split Tensile strength in MPa at 28days
1	0%	1.80	2.96
2	1%	1.89	3.00
3	1.5%	2.00	3.35
4	2%	2.32	3.75
5	2.5%	2.58	4.20
6	3%	2.50	3.75

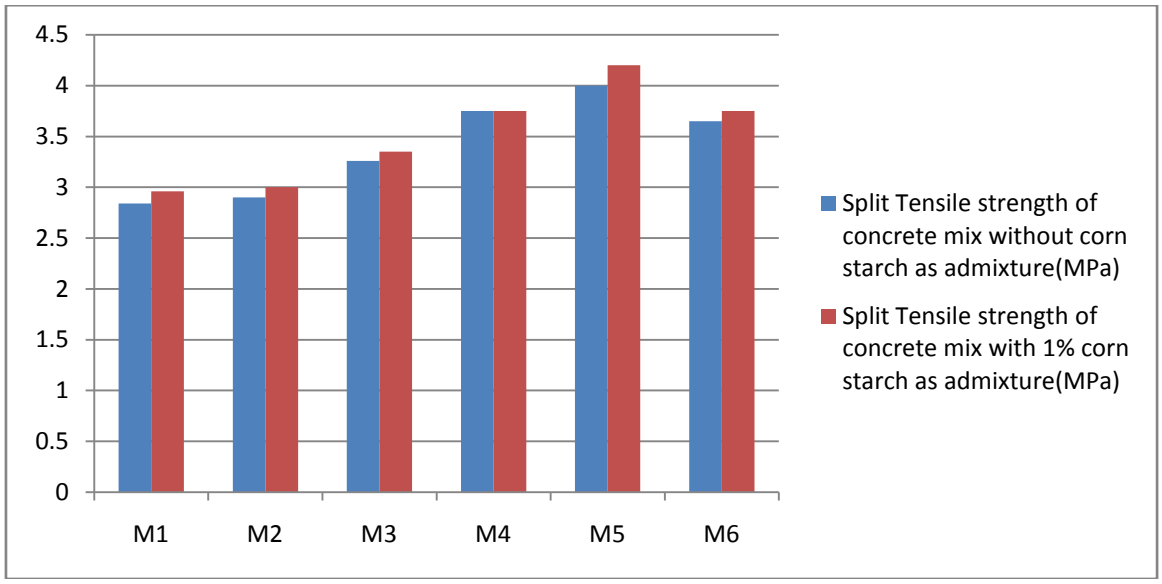

Figure 9: Split tensile strength of concrete with and without corn starch.

VII. CONCLUSION:

1. Due to addition of concrete fiber workability of concrete decreases drastically. So need to mix the corn starch at natural admixture that enhances the workability of concrete as shown in figure 7.
2. The addition of coconut fiber up to 2.5% enhanced the concrete compressive as well as split tensile strength but thereafter it decreases as shown in figure 8.
3. The addition of 1% corn starch in concrete enhanced the compressive as well as split tensile strength as shown in figure 9.

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