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EXPERIMENTAL INVESTIGATION ON NORMALCONCRETE BY ADDING JUTE FIBER AS AN ADMIX

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Abstract:- *Concrete is so far the most widely used construction material today. This project deals about the influence of Natural (Jute) fiber as an admix in normal concrete mix. The jute fiber is used as admix to the concrete. Mix design is to be prepared for M20 concrete grade and different proportion to which jute fibre can be used. For this three trial mixes with varying proportions of fibre has been chosen. We calculated the strength results of cubes, beams, cylinders at the age of 7days and 28 days.*

1) INTRODUCTION

1.1 General

Concrete is a composite material made out of course aggregate bonded together with fluid cement which solidifies after some time. Most concretes utilized are lime-based concretes, for example, Portland cement concrete. Concrete is the safest durable and sustainable building material. It provides imperviousness to fire, quality pick up and has an amazingly long administration life. Concrete is the most widely used construction material as a part of the world with yearly utilization of 21 to 31 billion tons. Concrete has been used for constructions in various ancient civilizations. During Roman Empire, roman concrete was made from quick lime, pozzolanic ash. In modem times, researchers have experimented with addition of other materials to create concrete with improved properties, such as high strength, self compaction. Concrete sets and solidifies subsequent to blending with water and position because of a chemical process known as Hydration. Concrete is used to make pavements, pipes, foundations, roads, bridges, walls, footings, architectural structures. Concrete is used more than any other man material in the world. Concrete production is the process of mixing together the various ingredients such as water, aggregate, cement, and any additives to produce concrete. Once the ingredients are mixed, workers must put the concrete in place before it hardens.

In modem usage, most concrete production takes place in a large type of industrial facility called Concrete plant. In order to increase the strength, natural fibers is to be added in normal concrete mix and alternatively cement content decreases. Some of the natural fibers are coconut fibre, Baggashe,

Jute fibre. Addition of fibers can increase strength and also reduce plastic shrinkage and drying shrinkage by arresting the propagation of crack. The development of steel reinforcement has overcome the problem of poor tensile strength. But it doesn't completely solve the problem of micro cracks due to drying and plastic shrinkage owing to weathering condition.

1.2 Present study Execution:

In this present study, various materials are used to prepare the concrete mix. Mix proportion of this Study is 0.5:1:1.74:2.95.Three trial mixes with varying proportions of Jute fibre had been used.

- Mix B1 = Cement + F.A+C.A
- Mix B2 = (Cement+1%Fibre) + F.A+C.A
- Mix B3 = (Cement+2%Fibre) + F.A+C.A
- Mix B4 = (Cement+3%Fibre) + F.A+C.A

2. CONSTITUENT MATERIALS

2.1 Fine aggregate:

Sand is a normally happening granular material made out of finely isolated rock and mineral particles. It is characterized by size, being better than rock and coarser than residue. Sand can likewise allude to a textural class of soil or soil sort; i.e. a dirt containing more than 85% sand-sized particles. Set up of sand we can likewise utilize base fiery remains which can be a substitution of sand up to a level of 20% substitution of sand gives a decent compressive quality.

2.2 Coarse aggregate:

Coarse aggregates are particles greater than 4.75mm, but generally range between 9.5mm to 37.5mm in diameter. They can either be from Primary, Secondary or Recycled sources. Primary, or 'virgin', aggregates are either Land- or Marine-Won. Gravel is a coarse marine-won aggregate; land-won coarse aggregates include gravel and crushed rock. Gravels constitute the majority of coarse aggregate

used in concrete with crushed stone making up most of the remainder. Additionally where the coarse total ought to adjust to IS-383-1970.

2.3 Water:-

Water plays a major role in mixing of concrete. The amount of water is required about 20 to 25% of weight of cement is used. To get a good and proper workability of concrete, more water is used. The amount of water in concrete can controls the fresh and hardened concrete. For these reasons, the amount of water in concrete is important for constructabiliiy and service life. The water used for mixing and curing should free from injurious amounts of oils, acids, salts that may be harmful to concrete. Ph value of water should be more than 6.

2.4 Jute Fibre: -

Jute is a long, soft, shiny vegetable fibre that can be spun into coarse, strong threads. Jute is the name of the plant or fibre that is used to make gunny cloths. It is the one of the most affordable natural fibres. Jute fibers are mainly composed of plant materials like cellulose and lignin. Jute is great demand due to cheapness, softness and uniformity of its fibre. Jute is used where low cost is more important than durability. In this present context, jute fibers are to be sliced in the middle of 5cm to 10cm due to high bonding.

Figure-2.1: Jute Fibre

3. EXPERIMENTALINVESTIGATIONS

3.1 Tests on Aggregates:

Coarse aggregate of 20mm is obtained by passing through 25mm and retained on 20mm IS sieve was taken at 60% of total coarse aggregate and 10mm is obtained by passing through 12.5mm and retained on 10mm IS sieve was taken at 40% of total coarse aggregate.

Fine aggregate is passing through 4.75mm sieve is tested as per IS: 2386 part-3. The properties of aggregates are listed below

Table – 3.1: Properties of aggregates

Properties	Fine Aggregates	coarse Aggregates
Specific gravity	2.56	2.66

3.2 Tests on Cement:

The cement is tested as per IS:431 (part-4)-1988 and properties are listed below

Table-3.2: properties of cement

Properties	Value
Specific gravity	3.15

3.3 Design Mix:

As per Indian standard codes Mix design is to be prepared for M20 concrete grade to get a target mean strength of 26.6 N/mm^2. Mix proportion of this study is 1:1.74:2.95:0.5

4. TESTS ON HARDENED CONCRETE:

In order to determine the workability of Normal concrete and jute fibre concrete, Tests on Hardened concrete was carried out as per IS:1199-1959.

4.1 Materials Used:

- Cement - OPC53 grade
- Sand (F. A) - passing through 4.75mm
- Coarse Aggregate - 20min and 10mm Sieve
- Water-cement ratio - 0.5
- Mix proportions - 0.5:1:1.74:2.95
- Fibers added - 1%,2%,3%

4.2 Curing of specimens:

Resultant specimens are to be casted and curing process is to be done at the age of 7 days and 28 days.

4.3 Test of specimens:

The test on hardened concrete to be conducted and it described below.

4.3.1 Cube Compression Test:

Resultant samples are to be casted in a cube set of specimen's size of 150mm*150mm*150mm are used. The test is to be conducted on cubes with different ages of curing and figure shows below.

Figure-4.1: Compression Strength Samples

4.3.2 Flexural Strength Test:-

Resultant samples are to be casted in a cylinder set of specimen's size of 150mm*300mm are used. The test is to be conducted on cylinders with different ages of curing and figure shows below.

Figure-4.2: Flexural Strength Samples

4.3.3 Split Tensile Strength Test:

Resultant samples are to be casted in a cylinder set of specimen's size of 150mm*300mm are used. The test is to be conducted on cylinders with different ages of curing and figure shows below.

Figure-4.3: Split Tensile Strength Samples

5. RESULTS AND DISCUSSIONS

5.1. Concrete Cube Strength:

Specimens are to be tested at the age of 7 days, 28 days and their test results are to be tabulated in below table -1 and table -2 respectively.

Table -5.1: Cube strength for 7 days

Mix	% Fibre	Sample			
		1	2	3	Avg.
B1	0%	19.1	19.9	19.5	19.5
B2	1%	20.7	20.9	19.9	20.5
B3	2%	20.3	20.1	22.3	20.9
B4	3%	21.5	19.5	19.3	20.1

From the above results, the compression test results are to be compared with nominal mix of concrete for 7 days. The compression strength of,

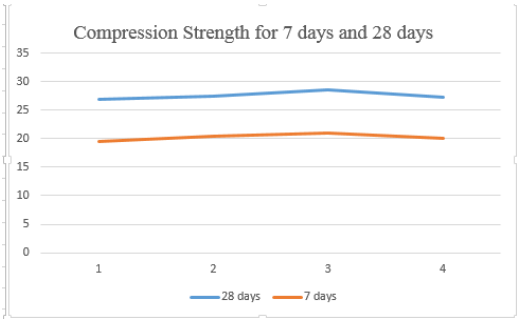
- B2 mix is 5.1% greater than nominal mix (B1).
- B3 mix is 7.1% greater than nominal mix (B1).
- B4 mix is 3% greater than nominal mix (B1).

Table -5.2: Cube strength for 28 days

Mix	% Fibre	Sample			
		1	2	3	Avg.
B1	0%	26.7	27.5	26.5	26.9
B2	1%	27.7	26.9	27.9	27.5
B3	2%	28.3	29.2	28.5	28.6
B4	3%	27.3	27.6	27.3	27.3

From the above results, the compression test results are to be compared with nominal mix of concrete for 28 days. The compression strength of,

- B2 mix is 2.2% greater than nominal mix (B1).
- B3 mix is 6.3 % greater than nominal mix (B1).
- B4 mix is 1.4% greater than nominal mix (B1).



Graph-5.1: Compression Strength for 7 & 28 days.

5.2 Flexural Strength:

Specimens are to be tested at the age of 7 days, 28 days and their test results are to be tabulated in below tabl-3 and table-4 respectively.

Table -5.3: Flexural Strength for 7 days

Mix	% Fibre	Sample			
		1	2	3	Avg.
B1	0%	3.82	3.63	3.62	3.69
B2	1%	3.79	3.65	3.71	3.71
B3	2%	3.79	3.65	3.77	3.73
B4	3%	3.69	3.67	3.53	3.62

From the above results, the flexural test results are to be compared with nominal mix of concrete for 7 days. The flexural strength of,

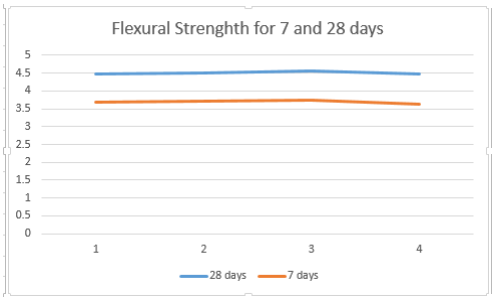
- B2 mix is 0.54% greater than nominal mix (B1).
- B3 mix is 1.08% greater than nominal mix (B1).
- B4 mix is 1.89% lower than nominal mix (B1).

Table -5.4: Flexural Strengh for 28 days

Mix	% Fibre	Sample			
		1	2	3	Avg.
B1	0%	4.5	4.2	4.71	4.47
B2	1%	4.49	4.51	4.53	4.51
B3	2%	4.49	4.7	4.63	4.56
B4	3%	4.68	4.41	4.35	4.48

From the above results, the flexural test results are to be compared with nominal mix of concrete for 28 days. The flexural strength of,

- B2 mix is 0.89% greater than nominal mix (B1).
- B3 mix is 2.01% greater than nominal mix (B1).
- B4 mix is 0.2% greater than nominal mix (B1).



Graph - 5.2: Flexural strength for 7 & 28 days

5.3: Split Tensile Strength

Specimens are to be tested at the age of 7 days, 28 days and their test results are to be tabulated in below table -1 and table -5 respectively.

Table 5.5: Split Tensile Strength Test For 7 days:-

Mix	% Fibre	Sample			
		1	2	3	Avg.
B1	0%	1.79	1.65	1.93	1.79

B2	1%	1.67	1.82	1.91	1.80
B3	2%	1.76	1.90	1.86	1.84
B4	3%	1.89	1.66	1.87	1.81

From the above results, the Split Tensile test results are to be compared with nominal mix of concrete for 28 days. The flexural strength of,

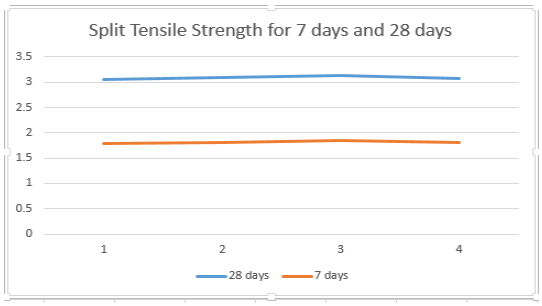
- B2 mix is 0.55% greater than nominal mix (B1).
- B3 mix is 2.79% greater than nominal mix (B1).
- B4 mix is 1.1% greater than nominal mix (B1).

Table -5.6: Flexural Strengh for 28 days

Mix	% Fibre	Sample			
		1	2	3	Avg.
B1	0%	3.01	2.97	3.21	3.06
B2	1%	3.05	3.15	3.07	3.10
B3	2%	3.09	3.19	3.14	3.14
B4	3%	3.17	3.09	2.99	3.09

From the above results, the Split Tensile test results are to be compared with nominal mix of concrete for 28 days. The flexural strength of,

- B2 mix is 0.1.3% greater than nominal mix (B1).
- B3 mix is 2.6% greater than nominal mix (B1).
- B4 mix is 0.9% greater than nominal mix (B1).



Graph - 5.3: Split tensile strength for 7 & 28 days

6. CONCLUSION

From the investigation the overall objective was very feasible of incorporating natural fibre as an additive material to concrete mix. According to this experimental result we observed that behavior properties like Compression strength, Flexural strength, and Split tensile strength of concrete with admixture of Jute fibre which gets higher strength to the nominal mix. At 2% as an admix of jute fibre. Increases the strength properties. After adding more percentages of jute fibers, the strength properties will be decreases. Hence we concluded that Concrete with natural fibers can be used as admix in structural elements. Usage of jute as an admix, increases many properties like strength., setting time. And this can be used in sunny areas due to its setting time this is due to water absorption property of jute. The soft and silky nature of the jute increases the load bearing capacity of concrete. The results obtained are beneficiary, so it can be used for construction purpose as it is cheap material. As Jute is a natural material, it will not create any pollution in the environment.

7. REFERENCES

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