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EXPERIMENTAL STUDY OF JUTE FIBER WITH OPTIMUM REPLACEMENT OF NATURAL SAND WITH ARTIFICIAL SAND

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Abstract – *The huge quantity concrete is consumed by construction industry all over the world. In India, the conventional concrete is produced by using natural sand, cement, coarse aggregate and water. A concrete is said to be effective when it gives the required strength and hence to increase its strength various fibers such as jute, polypropylene and glass polymers are used to enhance the properties of concrete.Simultanesouly it should be economical, environment friendly and durable.*

Hence we are using jute fiber in concrete due to its high performance environment friendliness, large availability and low cost. Now a day's natural sand is not radially available. These resources are exhausting very rapidly. So it is a need of time to find some substitute to natural sand. Hence we are replacing with cement.3%, 4%, and 5% of jute fiber are respectively replaced with the total volume of cement.

***Key Words*: Jute fibre, Natural sand, Artificial sand, Durability, Strength.**

1. INTRODUCTION

1.1 General

Development of world is mainly based on the infrastructure of various nations in large scale. In India, the conventional concrete is produced by using natural sand, cement, coarse aggregate and water. One major challenge facing the civil engineering community is to execute project in harmony with nature using concept of sustainable development involving high performance, environment friendly material produced at reasonable cost .In the context of concrete , which is the predominant building material , it is necessary less expensive substitutes. Concrete is specified as good concrete when it gives the required strength.

Nowadays, sand is not readily available as it is to be transported from long distance. Those resources are also exhausting very rapidly. With natural sand deposits the world over drying up, there is an acute need for a product that matches the properties of natural sand in concrete. In the last 15 years, it has become clear that availability of good quality natural sand is decreasing .With a few local expectations, it seems to be a global trend also dwindling sand resources poses the environmental problem and hence government restrictions on sand quarrying resulted in scarcity and insignificant increase in its cost. So it is a need of the find some substitute to natural river sand.

Hence we are replacing 100% natural sand with artificial sand. Jute fibers are replaced simultaneously with cement. Firstly 3% of jute fiber is replaced with total volume of cement followed by 4% and 5%.Concrete is specified as good concrete when it gives the required strength.

We are using concrete of M30 grade to carry out this entire project.

1.2 INGREDIENTS OF CONCRETE

CEMENT: Cement of DALMIA brand of 53 grade is used. Cement is Protland Pozzolona cement and used for mix proportion of M30 grade. Supplementary cementations material is replaced with jute fiber at about 3%, 4%, 5% with cement. The text conducted on cement are initial setting time, final setting time, soundness, specific gravity test.

SAND : Naturally black colored locally available sand is used for the study. The Zone of sand is taken as Zone II.

ARTIFICIAL SAND: Artificial sand is used from pune site. The exposure of sand is mild and is taken as Zone II.

COARSE AGGREGATE: 20mm mix coarse aggregate is used. The exposure of
Is mild and Zone II is adopted.

WATER : Tap water is used for mix designing.

FIBERS: jute fibers of certain aspect ratio are used.

Table No.:-1.1Chemical composition of jute fiber

CHEMICAL COMPOUND	% CONTENT
Cellulose	65.2%
Hemicellulose	22.2%
Lignin	10.8%
Water soluble matter	1.5%
Fat and wax	3-1%

Table No.:-1.2 Physical properties of jute fiber

Sr.no.	Parameter	Value/Result
1	Tenacity(g/den)	3.5-4.5
2	Length	0.2-30inch
3	Stretch and elasticity	Not good and 2% elongation at break
4	Resiliency	Not very good
5	Dimensional stability	Good
6	Moisture regain	13.75%
7	Specific gravity	1.48-1.50
8	Color	Yellowish, yellow, brown, golden
9	Heat resistance	Good
10	Specific heat	0.324
11	Diameter	18 micron
12	Cross section	Uneven thick cell wall

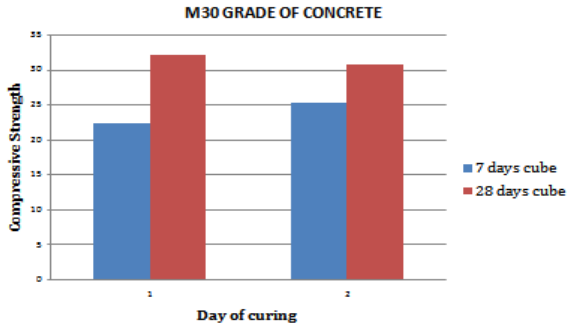
2. EXPERIMENTAL DETAILS

In this experiment number of cubes, beams and cylinder 30, 15 and 15 were respectively. The size of the moulds of cubes, beams and cylinder were 150x150x150 mm and 150x300 mm respectively. The mix design was made using IS 10262-2009 for M30 grade concrete in which mix proportion 1:1.36:2.69 for 1m concrete. Water cement ratio used is 0.45. SCBA was partially replaced in concrete by 3%, 4%, and 5% by the weight of cement. Compaction of concrete specimen was done using and compaction and vibrator. The specimens were removed after 24hrs from the time of casting and kept in curing tank for 7, 28 days for cubes and 28 days for beams and cylinders.
Compression test for cubes were conducted on compression testing machine (CTM) of capacity 2000KN .flexural and split tensile test were conducted on universal testing machine (UTM) of capacity 600KN.

Fig No.:-2.1 showing moulds of cube

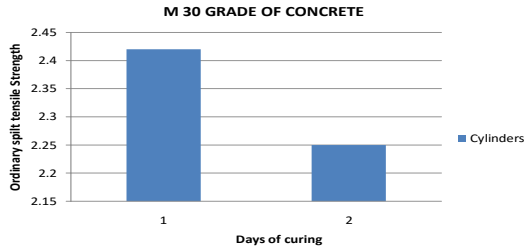
3. RESULT

After casting and testing M30 grade of concrete specimens for compressive, split, flexure strength was carried out. Results of compressive are showing in table compressive strength for 4%. We observe that as the percentage of fiber increases the strength of concrete increases significantly.



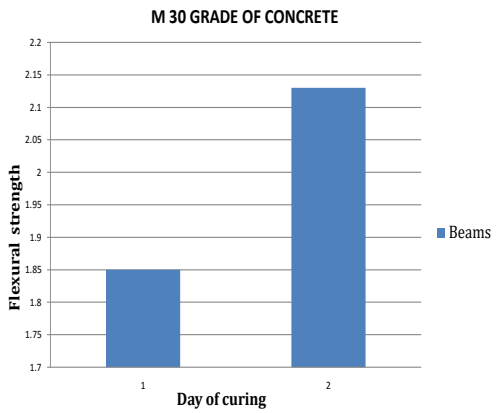
	7 Days	28 Days	
M 30	25.3	31.5	

Graph No. 3.1:- Showing results for M30 grade of ordinary concrete for compressive Strength.



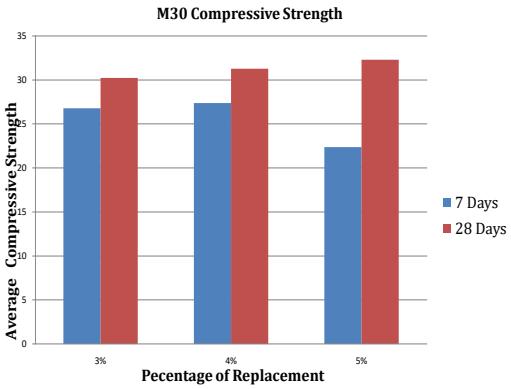
	28 Days	
M 30	2.41	2.25

Graph No. 3.2:- Showing results for M30 grade of ordinary concrete for spilt tensile strength.



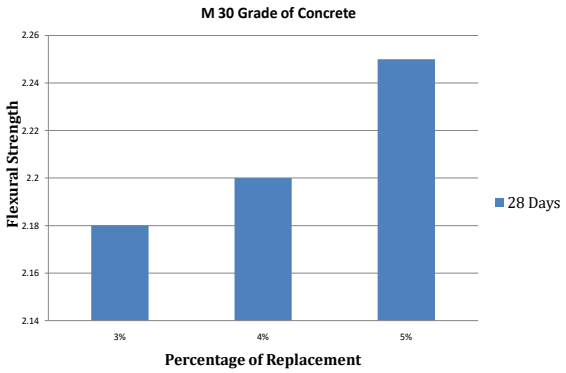
	28 Days	
M 30	2.09	2.15

Graph No.3.3:- Showing result for M30 grade of concrete for flexural strength.



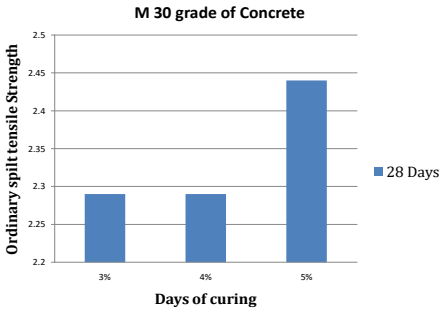
	3%	4%	5%
7 days	26.8	27.4	22.37
28 days	30.26	31.28	32.3

Graph No.3.4 Showing results for M30 grade of concrete for various % replacement of compressive strength.



	3%	4%	5%
28 Days Beam	2.18	2.21	2.25

Graph No.3.5 Showing result for M30 grade of concrete for various % replacement of flexural strength



	3%	4%	5%
28 Days Cylinder	2.29	2.43	2.44

Graph No.3.6 :-Showing results for M30 grade of concrete various % replacement for Spilt tensile strength.

4. CONCLUSION

The result shows that jute fiber was added in M30 grade concrete in 3%, 4% and 5% replacement from this experimentation we have obtained various result of compressive strength , split tensile strength and flexure strength was increase 4% for M30 grade concrete as compeered to ordinary concrete. Initially the strength of concrete cubes of 5% replacement did not have durable strength but it gradually increase after 28 days and gave strength up to its permissible limit. As the strength was increased we also observe that the displacement which depicted the breakage of sample also varied rapidly. The displacement for ordinary cubes was less as compared to that of jute fiber concrete. Hence it improved durability by stabilization of macro crack.

Due to its high displacement and the ability to bind firmly it can be used in earthquake resistance structures in the region with high seismic intensity. As it is cheap in cost and readily available in abundance; in most of the country it can be used as a green building material due to reuse of jute fiber and simultaneously decreasing the use of polymer fibers which are non-degradable.

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