Experimental Study on Hybrid Fibre Concrete

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ABSTRACT

The hybrid fibre concrete explained to the fibre objects is used to additional material in concrete. The use of fibres is to increase the ductility performance, fatigue strength and to resist the shrinkage cracks. In our project is we use basalt fibre and Aloe-Vera fibre in concrete and a comparison of which with conventional concrete mix and also find out the optimum dosage of fibre in the hybrid concrete. The strength properties are studied for the conventional concrete. In our experimental investigation, Concrete grade of M30 has been designed with natural fibre is used. Also for each 0.5 % of basalt fibre, aloe-vera fibre was added in concrete.

Keywords: Experimental, Study, Hybrid, Fibre and concrete.

1. INTRODUCTION

The used of fibres have be carry out since historic times. There are different forms of fibre bolstered concrete that are labeled based totally at the fibre that is employed. If the natural fibre is used we get herbal fibre reinforced concrete. Further, nylon bolstered concrete, glass fibre bolstered concrete, carbon fibre strengthened concrete and so on. are some of the kinds. A composite may be said as a hybrid whilst two or greater kinds of fibres are used in a blended matrix to provide a composite so as to replicate the gain of every of the individual fibre used. This may subsequently offer a synergetic response to the complete structure. It's miles a sort of fibre strengthened concrete characterized by way of its composition and additionally regarded to the interaction and/or co-operation of the 2 or extra fibres that acts as a secondary reinforcement in the concrete in which synergy effect is carried out to produce a mixed impact. Whilst two different fibres are jumbled in a not unusual matrix we name it hybrid fibre reinforced concrete. The fibres are chosen such that their houses complement each other. That is if one form of fibre is stiff and robust we are able to choose the second one fibre as bendy and ductile. With this combination, we will acquire improved first crack strain, final electricity and progressed stress and durability after cracking. This Hybrid fibre bolstered concrete has completed first rate consequences in bridging the early micro cracks and macro cracks within the later levels by means of deciding on the appropriate fibre. The crack bridging functionality will make low modulus fibre to boom the strength of the matrix. However the immoderate presence of fibre is also harmful as it can lead to illness at some stage in production because fibre and debris will no longer reap the desired packing as a consequence reducing the energy. So the first-class of fibre will be cautiously selected.

1.1 Objectives

- This study attempt to match up to the strength parameters of HFRC with conventional concrete.
- To perform the experiments on the time-dependent compressive strength, split tensile strength of concrete containing mixed basalt fibre and aloe vera fibre and its strength was measured
- To study the break striking ability of fibres in concrete.

2. METHODOLOGY

Figure 1 shows the methodology of the study.

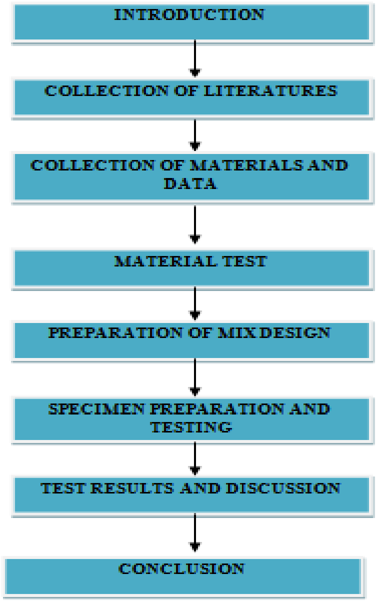

Figure 1 Methodology

3. MATERIAL COLLECTION

3.1 Basalt Fibre

Basalt fibre is identified in favor of its confrontation to high temperature .energy& durability. Basalt fibre is extruded from molten basalt rock at diameter generally in between thirteen-20 µm BFRP fibres products are to be had in diverse forms together with bars, mesh, cages, spirals, material& chopped fibres, it used as reinforcement in concrete structures. Basalt fibre houses: basalt fibres reinforced concrete has good traits inclusive of, volume balance, correct workability, exact stability, top notch thermal resistance, anti-seepage, crack resistance & effect resistance. Figure 2 shows the Basalt fibre.

Figure 2 Basalt Fibre

4. MATERIAL PROPERTIES

4.1 Cement

The fresh cement is used for research work having a grade of cement is 43grade (OPC) all properties of cement are tested by conforming IS -12269-1987. Table 1 shows the properties of cement.

Table 1: Properties of cement

S.no.	Description of materials	Properties
1	Specific gravity	3.15
2	Initial setting time	90min.
3	Final setting time	180 min
4	Standard consistency	33%

4.2 Fine Aggregate

Table 2 shows the properties of fine aggregates.

Table 2: Properties of Fine aggregates

S.no.	Description of materials	Properties
1	Specific gravity	2.8
2	Fineness modulus	4.44
3	Loose bulk density kg/m^3	2500
4	Compacted bulk density kg/m^3	2890
5	Water absorption %	0.46

4.3 Coarse Aggregate

Locally available, aggregate passing through 20 mm sieve and retained on 12.5 mm sieve . Table 3 shows the properties of coarse aggregate.

Table 3: Properties of Coarse aggregate

S.no.	Description of materials	Properties
1	Specific gravity	2.69
2	Fineness modulus	7.950
3	Loose bulk density kg/m^3	1290
4	Compacted bulk density kg/m^3	1584
5	Water absorption %	1.343

4.4 Basalt Fibre

Table 4 shows the properties of basalt fibre.

Table 4: Properties of Basalt fibre

Density gr. m-3	**2.6-2.8**
Failure stress, Gpa	**1.9-2.6**
Extension at failure, %	**3.5-4.5**
Elasticity modulus Gpa	**70-90**
Tensile strength（MPa）	**3000-3500**

4.5 Mix Proportions

Table 5 shows the Mix Proportions.

Table 5: Mix Proportion

Cement	FA	CA	Water

(kg)/m³	(kg)/m³	(kg)/m³	(liter)/m³
531.43	639.048	1068.09	186

5. TEST RESULTS

5.1 Sorptivity Test

$I=S.t^{½}$ therefore $S=I/ t^{½}$

Table 6 shows the sorptivity test.

Table 6: Sorptivity test.

GRADE OF CONCRETE	SAMPLES	Dry Wt In Grams	Wet Wt In Grams	Sorptivity Value in 10^{-5} mm/min$^{0.5}$
M30	M0%	1108	1108.7	1.15
	(0.5 +0.5)	1022	1022.9	1.47

Figure 3 shows the graph of sorptivity test.

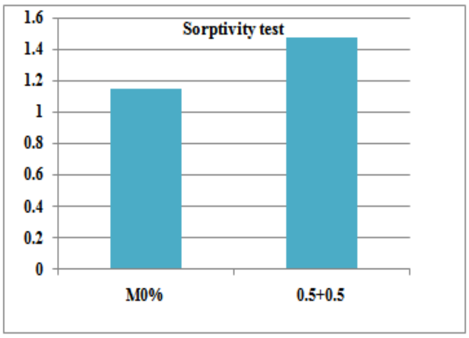

Figure 3 Graph of sorptivity test

5.2 Compressive Strength Test

For compressive strength test, both cube specimens of cube were cast for M30 grade of concrete. The moulds have been full of HFRC fibres. The vibration changed into given to the moulds using desk vibrator. The pinnacle surface of the specimen turned into levelled and finished. These cubes had been examined on virtual compression checking out system as in keeping with I.S. 516-1959. The failure load turned into referred to. In each category, 3 cubes were tested and their common price is pronounced.

Compressive strength (MPa) = Failure load / cross-sectional area.

Table 7 shows the compressive strength test.

Table 7: Compressive strength test

Mix Design	% Of Replacement	Compressive Strength (N/mm²)		
		7days	14 Days	28days
M_{30}	0	26.77	31.01	37.96
	(0.5 +0.5)	28	38.6	43.16

Figure 4 shows the graph of compressive strength test.

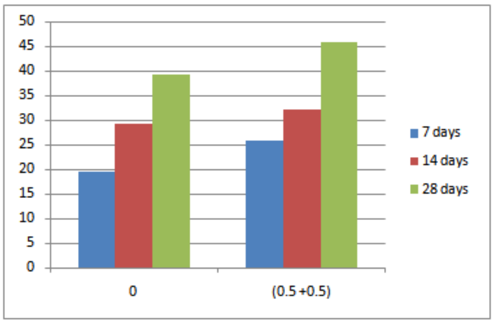

Figure 4 Graph of compressive srength test

5.3 Split Tensile Test

Tensile strength is the capability of a objects or structure to resist tension. It is measured on concrete cylinders of standard dimensions using a Universal Testing machine. Both conventional and fibre reinforced specimens were tested at varying percentages of fibre and the average value was obtained. Split tensile test 7, at 14 and 28days of curing. Table 8 shows the split tensile test.

Table 8: Split tensile test

Mix design	% of replacement	Split tensile test (N/mm²)		
		7 days	14 days	28 days
M_{30}	0	1.78	2.91	3.75
	(0.5 +0.5)	3.1	3.9	4.3

Figure 5 shows the graph of split tensile test.

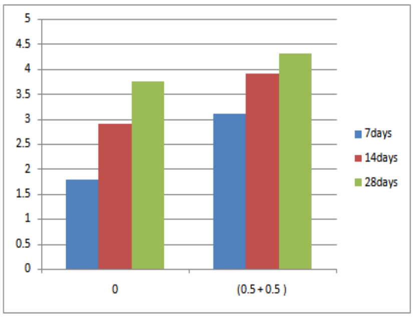

Figure 5 Graph of Split tensile test

7. CONCLUSION

- The addition of fibres elevated compressive electricity with zero.5% fibre-cement ratio and little boom for 1% of a fibre-cement ratio compared to straightforward concrete. The addition of Basalt & Aloe vera fibre with 0.5% in concrete will increase the compressive energy of concrete.
- The most compressive energy of the specimen after 28 days is 43.16 N/mm² with 1% of hybrid fibres (Basalt fibre and aloe vera) comparisons of ordinary concrete and other mixes. It is 10% growth overcome with regular concrete.

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