EFFECT OF CHOPPED BASALT FIBRE ON THE PROPERTIES OF CONCRETE

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ABSTRACT

To investigate the compressive, flexural, and split tensile strength of basalt fibre reinforced concrete. Basalt fibre offers more characteristics such as light weight, good fire resistance and strength. The main aim of this investigation is to study the effect of different proportion of basalt fibre in the mix. In this study trial test for concrete with basalt fibre and without basalt fibre are conducted to show the difference in compressive strength and flexural strength by using cubes, cylinders and concrete beams of grade M30

Cement concrete is weak in tension limited ductility and little resistance to cracking, as the cement holding the aggregate can crack, causing concrete to break. An effective way to improve the tensile strength of concrete and reduce the number of defects is by adding different fractions of small, closely spaced and randomly oriented fibers, dispersed uniformly in the matrix. The concrete specimens were casted using basalt fiber of 6 mm length and varying fibre dosage from 0% to 1.2 % by weight of cement at interval of 0.4%. All specimens were cured in water tank for 28 days. It provided the significant improvement in compressive,flexural and split tensile strength with the inclusion of basalt fibres in plain concrete.

Key Words: Concrete, Chopped basalt , Strength, carbon dioxide.

1. INTRODUCTION

Chopped basalt fibre is a cementitious material used as admixture to produce high strength concrete. In Korea, the utilization of this material remained mainly limited to fireproof walls but began recently to find applications as a replacement for silica fume in the manufacture of high performance concrete. In order to evaluate and compare the mechanical properties and durability of concrete using chopped basalt, the following tests were conducted on concrete specimens using various replacements of chopped basalt ; mechanical tests such as compressive, tensile and flexural strength tests. Strength tests revealed that the most appropriate strength was obtained for a substitution rate of chopped basalt to binder ranging between 10% and 15%. The filler effect resulting from the fine powder of binders was seen to ameliorate substantially the resistance to chemical attacks in comparison with ordinary concrete The tests implemented in this study confirmed that chopped basalt constitutes a promising material as a substitute for the cost prohibitive silica fume.

2. PROCEDURE

2.1 Materials

2.1.1 Basalt Fibres

In this experiments chopped basalt having particle size 6mm was used. Basalt is well known as a rock found in virtually every country round the world. Its main use is a crushed rock in construction, industrial and high way engineering. However, it is not commonly know that basalt can be used in manufacturing and made into fine, superfine and ultrafine fibres. Comprise of single-ingredient raw materials melt basalt fibres are superiors to other fibres in terms of thermal stability, heat and sound insulation properties, vibration resistance and durability. Basalt continuous fibres offer prospect of a completely new range of composite materials and products. Basalt have no toxic reaction with air or water, are non-combustible and explosion proof. When in contact with other chemicals they produce no chemical reactions that may damage health or the environment. Basalt base composites can replace steel and known reinforced plastics (1 kg of basalt reinforces equals 9,6 kg of steel)

Figure 1- Chopped Basalt Fibre

2.1.2 Cement

Ordinary Portland cement of 53 Grade which was available in local market is used in this investigation. The cement used has been tested for various properties as per IS: 4031-1996 and found to be confirming to various specifications of IS: 12269-1987 having specific gravity of 3.15.

2.1.3 Fine Aggregate

In our investigation we had used locally available natural sand confirming to zone II according to IS-383. Specific gravity of sand was found out to be 2.66.

2.1.4 Coarse Aggregate

The coarse aggregate is strongest and porous part of concrete. Presence of coarse aggregate reduces the drying shrinkage. In our investigation coarse aggregate having size less than 20mm and specific gravity is 2.70

3. EXPERIMENTAL WORK AND TEST

3.1 Mix Design

Mix design carried out for M30 grade of concrete by IS 10262:2009, resulting to a mix proportion of 1:1.52:2.76 with water cement ratio of 0.45 The addition of basalt fibre is 0% to1.2 % by the weight of cement at increment of 0.4% each.

3.2 Workability Test

Slum cone used to measure the workability of concrete. In this experiment slum value of fresh conventional concrete is in the range of 120mm.

3.3 Compressive And Flexure Test

Concrete prepared with different percentage of chopped basalt by weight of cement at increment of 0.4% each up to 1.2% was cured under normal condition and were tested at 3 days, 7 days and 28 days for determining the compressive and flexural strength and compared those with the results of conventional concrete.

3.4 Spilt Tensile Strength

It is measured by testing cylinders under diametral compression. Split tensile strength is carried out on cylinders after 28 days curing. A measure of ability of material to resist a force that tends to pull it apart. It is expressed as the minimum tensile strength needed to split the material apart.

4. TEST RESULT

4.1 Workability Test

Table 1 shows the results of workability of concrete with addition of chopped basalt fibre by the weight of cement in various percentages ranging from 0% to 1.2% in increments of 0.4%.

Table 1- workability of concrete

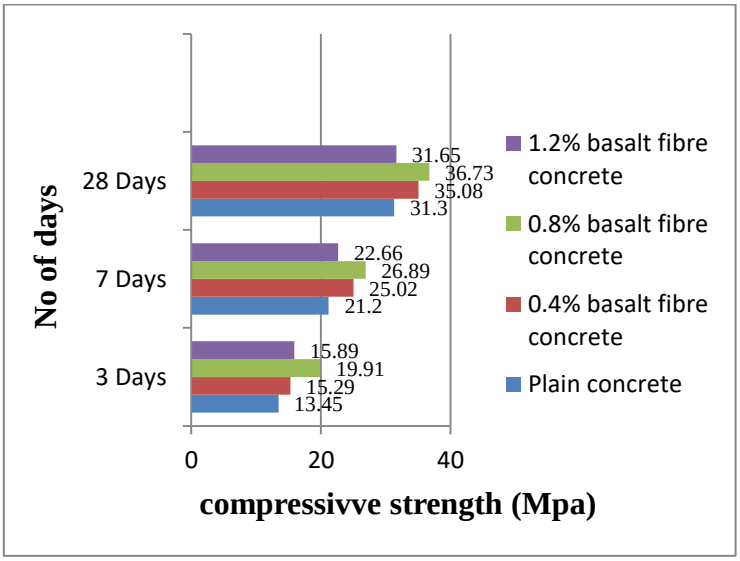
Mix Designation	Basalt fibres %	Slump (mm)
A1	0	120
A2	0.4	112
A3	0.8	107
A4	1.2	100

4.2compressive Strength Test

Table 2 show the compressive strength of conventional concrete and % of addition of basalt fibre compressive strength.

Table 2- compressive strength test

Mix designation	Basalt fibre %	3 day (Mpa)	7 day (Mpa)	28 day (Mpa)
A1	0	13.45	21.20	31.30
A2	0.4	15.29	25.02	35.08
A3	0.8	19.91	26.89	36.73
A4	1.2	15.89	22.66	31.65



Graph 1 Plain Concrete Vs.0.4, 0.8, 1.2% Basalt Fibre Concrete

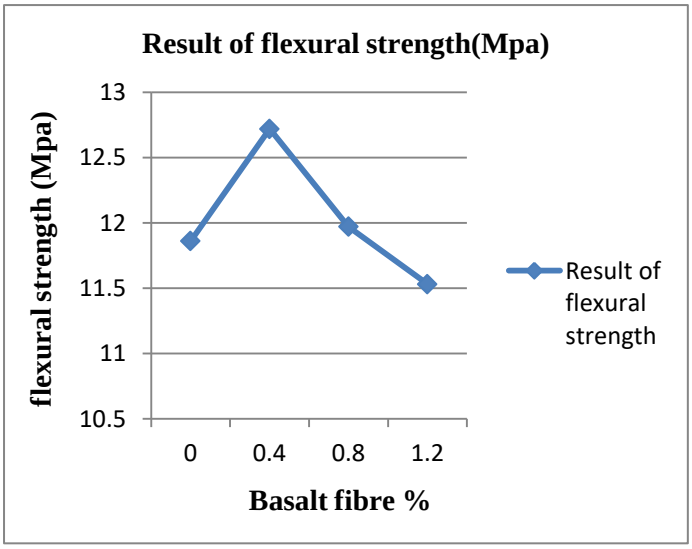
4.3 Flexural Strength Test

Table 3 shows the variation of results for flexural strength of concrete with addition of basalt fibre by

weight of cement for 28 days. It is clear that flexural strength of concrete with 0.4% of aadition of basalt fibre by cement weight showed a higher value compared to control concrete for 28 days respectively.

Table 3 Flexural strength results

Sr no	Basalt fibre %	Flexural strength at 28 days (Mpa)	Remark
1	0	11.86	As Per IS Code 456:2000 0.7√Fck=0.7√ 30 =3.82
2	0.4	12.72	
3	0.8	11.97	
4	1.2	11.53	



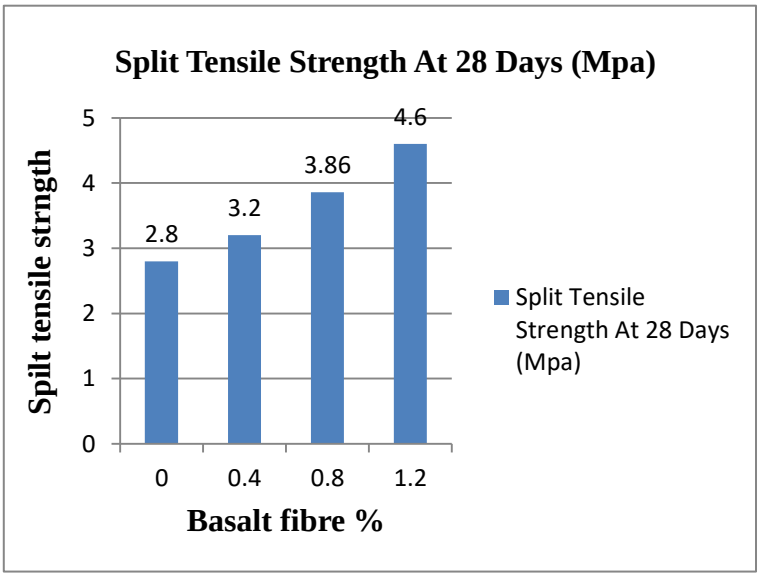
Graph 2 flexural Strength At 28 Days (Mpa)

4.4 Split Tensile Strength

Table 4 shows the variation of results for split tensile strength of concrete with addition of basalt fibre by weight of cement for 28 days.

Table 4.2 Split tensile strength results

Mix designation	Basalt fibre %	28 day (Mpa)
A1	0	2.80
A2	0.4	3.20
A3	0.8	3.86
A4	1.2	4.60



Graph 3 Split Tensile Strength At 28 Days(Mpa)

5. DISCUSSION ON TEST RESULTS

5.1 Workability

As addition of basalt fibre in concrete then workability of concrete is decreases. As there is a reduction in fineness modulus of cementatious material, quantity of cement paste available for providing lubricating effect is less per unit surface area of aggregate.

5.2 Strength

As the percentage of basalt fibres increases then strength of concrete is increases up to 1% addition of basalt.

6. CONCLUSION

Based on the present experimental investigation the following conclusion is drawn

- The investigation program of concrete of grade M30 with locally available ingredient with different proportion of basalt fibre shows variations in compressive strength of concrete, but at basalt fibre 1.0% in concrete the compressive strength takes maximum of its strength n compression test.
- It is found that compressive strength is increased by 12.07% and 16.93% when the addition of 0.4% and 0.8% basalt fibre respectively.
- It is found that compressive strength is decreases when the addition of basalt fibre more than 1%.
- Split tensile strength is increased by 43.33% for 1.2% basalt fiber content.
- Based on the above mentioned tests it is concluded that basalt fibers of great interest for the building industry

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