An Experimental and Comparative analysis of Compressive Strength and Workability of Basalt Fiber Reinforced Concrete

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1. INTRODUCTION

Industry is always trying to find new, better and economical material to manufacture new product, which is very beneficial to the industry. Today a significant growth is observed in the manufacture of composite material. With this in mind energy conservation, corrosion risk, the sustainability and environment are important when a product is changed or new product is manufactures. Basalt fiber is a high performance non-metallic fiber made from basalt rock melted at high temperature. Basalt rock can also make basalt rock, chopped basalt fiber, basalt fabrics and continous filament wire. Basalt fiber originates from volcanic magama and volcanoes, a very hot fluid or semi fluid material under the earth's crust, solidified in the open air. Basalt is a common term used for a variety of volcanic rock, which are gray dark in colour. The molten rock is then extruded through small nozzles to produce continuous filaments of basalt fiber. The basalt fibers do not contain any other additives in a single producing process, which gives additional advantage in cost.Basalt rock fibers have no toxic reaction with air or water, are non combustible and explosion proof. When in contact with other chemicals they produce no chemical reaction that may damage health or the environment

2. LITERATURE REVIEW

Basalt is defined by its mineral content and texture, and physical descriptions without mineralogical context may be unreliable in some circumstances. Basalt is usually grey to black in colour, but rapidly weathers to brown or rust-red due to oxidation of its mafic (iron-rich) minerals into rust. Although usually characterized as "dark", basaltic rocks exhibit a wide range of shading due to regional geochemical processes. Due to weathering or high concentrations of plagioclase, some basalt rocks are quite light coloured, superficially resembling rhyolite to untrained eyes. Basalt has a fine-grained mineral texture due to the molten rock cooling too quickly for large mineral crystals to grow, although it is often porphyritic, containing the larger crystals formed prior to the extrusion that brought the lava to the surface, embedded in a finer-grained matrix.

3. PROPERTIES OF BASALT FIBER

a) Physical Properties Color:- It is available in golden brown in color. Diameter:- It is available in different diameter like 5.8 micron. Length:-

Available in 6mm,8mm,12mm etc. Density:- density of basalt fiber is 2.75 g/cm^3 Coefficient of friction:- The coefficient of friction may be between 0.42 to 0.50[1]. b)Chemical Properties Basalts are more stable in strong alkalis. Weight loss in boiling water, Alkali and acid is also significantly lower. Possess resistance to UV-Light & biologic and fungal contamination. Are compatible with phenolic resins. Absorption of humidity comes to less[1].

c) Thermal Properties With a thermal range of –260 ◦C to 982 ◦C and melt point of 1450◦C as well as low thermal conductivity 0.031 –0.038w/mk, the basalt fibers are ideal for fire protection and insulation applications. Basalt fibers are most cost effective than the other high-temper Materials including E-glass, silica, ceramics, stainless steel and carboby preventing rapid overheating and improving brake life. Offer three times the thermal efficiency of asbestos with no Mental and heat hazards. Basalt fiber is the best solution for asbestos replacement. Basalt fiber is non-combustible and explosion proof. After exposition less than 400 ◦C the basalt fibers loss on their initial strength, while the E-glass loss more 50%[1]. d) Mechanical Properties The specific tenacity (rupture stress to density ratio) of basalt fibers exceeds that of steel, many times. Basalt fibers are non-capillary and non-hygroscopic, giving good moisture resistance. Basalt has shot content generally less than 3%[1].

4. OBJECTIVE OF STUDY

1. Study the design aspects of the BFRC.

2. Understand the various applications involving BFRC. 3. Perform laboratory test that are related to compressive, tensile and flexure by use of basalt fiber in the concrete.

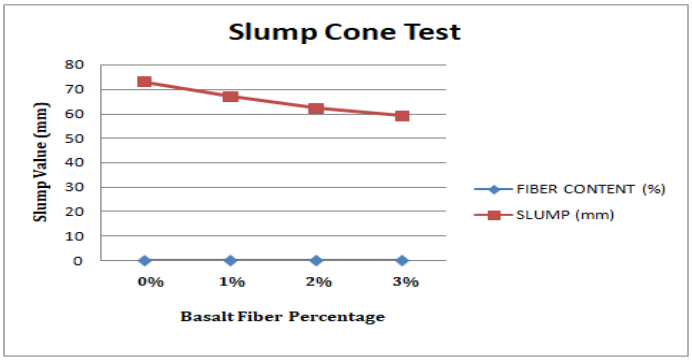
5. RESULT OF STUDY

5.1 Workability

Slump test was carried out on each mix to ascertain workability of BFRC as well as control mixtures. The results of slump tests for M-25 grade concrete with and without Basalt Fibers are shown in table 5.1

Table 5.1 Slump Cone Test Values for BFRC

FIBER CONTENT (%)	SLUMP (mm)
0	73
1%	67
2%	62
3%	59



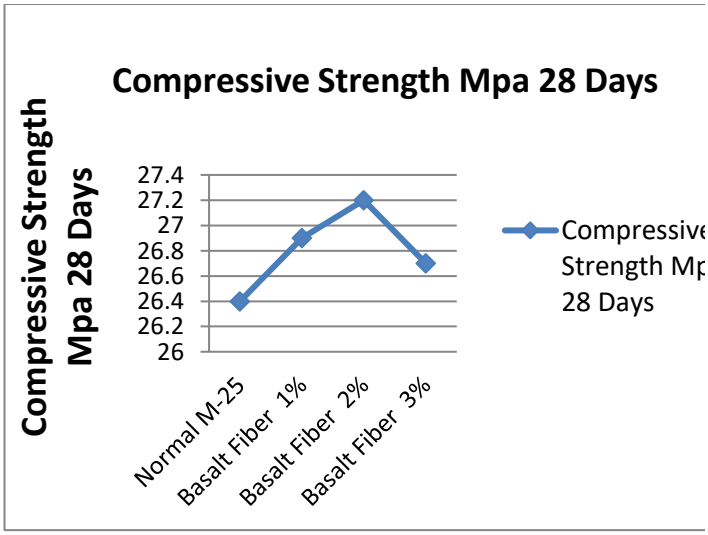
Graph 5.1 Slump Cone Test Values at Different Percentage of BF

5.2 Compressive Strength

Total 9 cubes were casted of Basalt fiber of different percentage (0%, 1%, 2% and 3%). 3 cubes were also casted with plain cement concrete. All the specimens were cured at 28 days. In present study average compressive strength of Basalt fiber reinforced concrete is slightly increased up to 2% of basalt fiber.

Table 5.2 Compressive Strength of BFRC

Mix	Compressive Strength Mpa		
	7 Days	14 Days	28 Days
Normal M-25	-	-	26.4
Basalt Fiber 1%	-	-	26.9
Basalt Fiber 2%	-	-	27.2
Basalt Fiber 3%	-	-	26.7



Graph 5.2 Average Compressive Strength of BFRC Cubes at 28 days

6. CONCLUSIONS

A detailed experimental study was performed to study the effect of addition of Basalt fiber in different percentages by weight of cement in M25 grade concrete. This study was intended to find the effective ways to utilize the high impact Basalt fiber as addition by weight of cement in concrete. Analysis of the results of the effect of using Basalt fiber as addition by weight of cement on the strength of concrete leads to the following conclusions-

(1) The incorporation of Basalt fiber in concrete causes gradual decrease in workability.

(2) 24% decrease in workability is observed when the fiber content is 2% added.

(3) In this experimental study it has been found that the Compressive strength of BFRC increases gradually up to 2.0% and shows optimum result at 2.0% after that Compressive strength of BFRC decreases with increase of Basalt fiber percentage.

6. REFERENCES

[1] basaltex. 2008 The thread of stone, Wevelgem, Beldium. Available from internet:, http://www.basalttex.com [2] Sim, J., Park C., D.Y. Characteristics of basalt fibers asa strengthening material for concrete structure. [3] Indian standard code 516 for test on concrete. [4] Ramakrishan, V., & Panchalan, R. (2005). A new construction material Non-corrosive basalt fiber reinforced concrete. [5] Mufti, A.A, Bakht, B., Banthia, N., Benmokrane, B., Desgagné, G., Eden, R., Erki, M.-A.,Karbhari, V., Kroman, J., Lai, D., Machida A., Neale, K., Tadros, G., &Täljsten, B., 2007 [6] “M. S. Shetty” (A handbook of “concrete technology”)