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STUDY ON STRUCTURAL STRENGTH OF BASALT FIBER CONCRETE UNDER CHEMICAL CURING CONDITION

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ABSTRACT:- *This paper investigated the structural properties of concrete by using basalt fiber. The size of basalt fiber is 12 mm long and 13μ diameters were used in M 25 grade of concrete at 0% to 3%. In this study the compressive and split tensile strength was determined after introducing basalt fibers in the concrete. Basalt fibers increase the structural strength of conventional concrete, while adding upto 5%. The preliminary tests are done for basalt fibers, and the physical properties like density, specific gravity and fineness modulus for raw materials are calculated. The cubes and cylinders of basalt fiber reinforced concrete are casted cured and tested for 7 days and 28 days. Finally this paper discuss about the strength variations and effects of basalt fibers in concrete under chemical curing conditions.*

Keywords: *Basalt fiber, alternative material, structural strength,M25 Grade*

1. INTRODUCTION

Concrete is the most important and composite construction material. It can be moulded into any structural element and also possess a wide range of beneficial properties like high strength to structures, good fire resistance and water resistance, long service life and low maintenance. It is a low cost building material which is readily available in urban areas. Concrete is strong in compression but weak in tension, so that the reinforcement is provided especially in tension zone of the member.

In this regard many researches have been done to improve the properties of concrete. One of these attempts by researchers leaded to introduce fiber reinforced concrete. In fiber reinforced concrete, the fibers are uniformly or randomly distributed throughout the concrete structure. Therefore they offer tensile strength to concrete, which is its limitation. There are various kinds of fibers like glass fibers, steel fibers, synthetic fibers etc. Among these basalt fibers are new introduced in fiber reinforced concrete.

Basalt fiber is a new kind of material used in fiber reinforced concrete. This is made from basalt rock which is originated during volcanic eruptions. It is a different kind of fiber ocucuring naturally other than glass, steel and synthetic fibers which are artificially made. This basalt rock which is in the form of molten volcanic magma is allowed to pass through small nozzles. Later these filaments are cooled and gain strength. As this basalt fiber is new invention to fiber reinforced concrete, the cost of fiber is more. But in the later stages this will come more cost effective to fiber reinforced concrete.

2. PROPERTIES OF RAW MATERIALS

Cement:

Fineness of cement = 7%
Standard consistency of cement = 31%
Initial setting time of cement = 35min
Specific gravity of cement = 3.1

Aggregates:

Specific gravity of fine aggregate = 2.80
Specific gravity of coarse aggregate = 2.70

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

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

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 0.0310 - .038w/mk, the basalt fibers are ideal for fire protection and insulation applications.

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.

Fig 1: Basalt Fiber

3. EXPERIMENTAL RESULTS

Fig 2: Casted and Testing of Basalt Concrete Cubes

Table 1: Compressive Strength of Basalt Fiber Concrete

S.NO	Percentage Of Basalt Fiber	Load in kN		Compressive Strength in N/mm^2		Avg. Compressive strength in N/mm^2	
		7 days	28 days	7 days	28 days	7 days	28 days
1	0%	426.37	736.18	18.95	32.71	18.22	32.61
		346.95	738.08	15.42	32.80		
		465.52	727.82	20.69	32.34		
2	1%	553.82	858.80	24..61	38.16	27.37	37.57
		597.15	836.39	26.54	37.17		
		700.88	841.40	31.55	37.39		
3	2%	510.70	735.63	22.69	32.69	23.02	33.65
		542.06	755.08	24.09	33.59		
		501.80	771.93	22.30	34.30		
4	3%	394.29	440.30	17.52	19.56	15.38	19.75
		323.90	412.93	14.39	18.35		
		320.81	480.80	14.25	21.36		

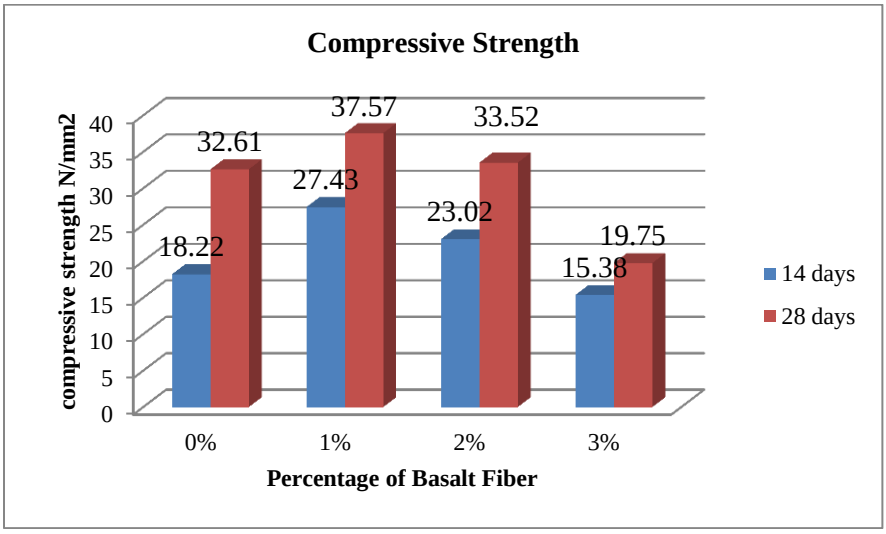

Fig 2: Compressive Strength of Basalt Concrete Cubes

Table 2: Split Tensile Strength of Basalt Fiber Concrete

S.NO	Percentage Of Basalt Fiber	Load in kN	Split Tensile Strength in N/mm^2	Avg. Split tensile strength in N/mm^2
1	0%	191.94	2.71	2.40
		150.39	2.12	
		168.73	2.38	
2	1%	208.30	2.94	3.00
		218.90	3.09	
		210.64	2.98	
3	2%	186.12	2.63	2.68
		178.60	2.52	
		205.66	2.90	
4	3%	148.30	2.09	2.30
		152.59	2.15	
		152.29	2.15	

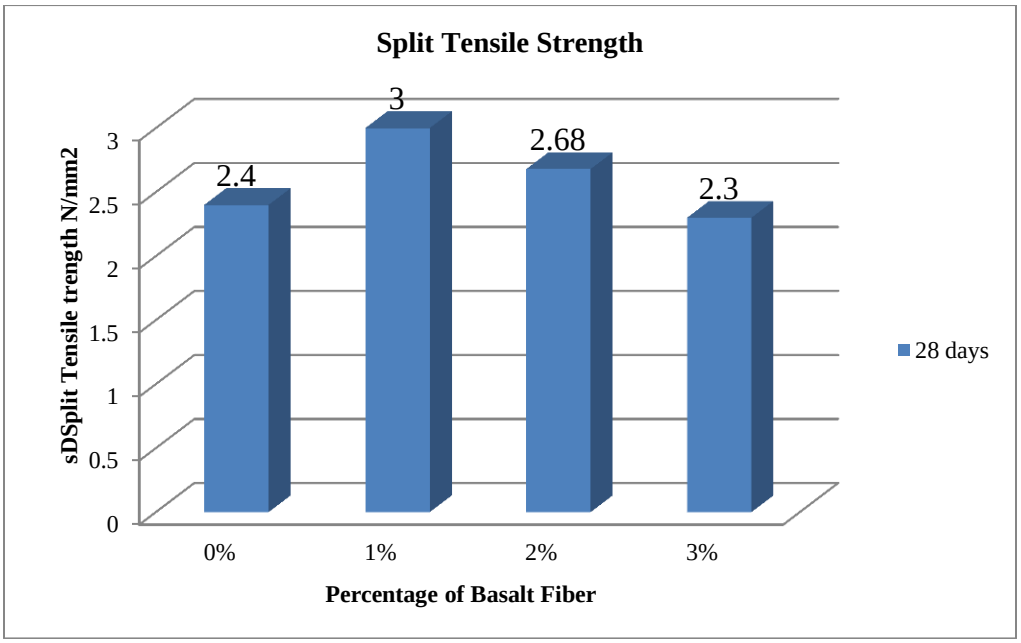

Fig 3: Split Tensile Strength of Basalt Concrete Cylinders

4. CONCLUSION

- The addition of basalt fibre in the concrete effects both compressive strength and tensile strength of concrete.
- Addition of 1% basalt fibre increases the 7 days compressive strength by 50.54% and 28 days strength by 15.21% which is highest increment seen among all the test observations.
- Similarly, 28 days tensile strength due to 1% basalt fibre also increases by 25% when compared to 0% BFRC which is also the highest increment.
- Increasing the fibre content to 2%, 7 days and 28 days compressive strength increased by 26.34% and 2.79% respectively and also 28 days tensile strength increased only by 11.67% which is less compared to above case.
- The addition of 3% basalt fibre rather decreases the compressive and split tensile strength by 39.34% (28 days) and 11.25% respectively when compared to 0%BFRC. Therefore, it is not recommended.
- There is decrease in strength of concrete as the volume of fibre increases to 2% and 3% because the higher percentage of fibre is likely to cause segregation and harshness of concrete. So the measures to reduce segregation and harshness should be adopted.
- Basalt fibre concrete cylinders continue to sustain load and large deformations without shattering into pieces. Thus prevents the brittle failure.
- Basalt fibre tends to increase the post cracking strength of concrete as it was observed that cubes continue to bear load even after appearance of cracks.
- Higher quantities of fibre produce concrete with poor workability and segregation, higher entrapped air and lower unit weight.
- Basalt fibre is relatively new fibre and has potential to be best alternative to existing fibres in terms of properties and cost. So, it can be used to improve the quality of concrete in construction industries.

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