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STRENGTH AND DURABILITY PROPERTIES OFBASALT FIBER REINFORCED CONCRETE

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ABSTRACT

This paper present the art of knowledge of basalt fiber, it is relatively new material. Basalt fiber is a high performance non-metallic fiber made from basalt rock melted at high temperature. Basalt fiber reinforced concrete offers more characteristics such as light weight, good fire resistance and strength. In future it is very beneficial for construction industry. Presence of fiber in concrete improves the physical properties as well as it acts as crack arresters. In this paper, an attempt is made to predict the impact of basalt fiber in the properties of M30 grade concrete for various proportions of basalt fiber (i.e. 0.2%, 0.25%, 0.3%, 0.4%, and 0.45%).

INTRODUCTION

Concrete is the world's most used man-made construction material today. It is relatively cheap and easy to form when cast in India. The most common reinforcing material for Reinforced Concrete (RC) used until now and is still used today is steel. Using steel as reinforcement has numerous advantages it is strong in tension and has a high modulus of elasticity. The thermal expansion is similar to concrete and it works well with concrete under loading.

The production process for steel is very stable and thus the material properties are also very stable, then steel is easy to form and work with. But using steel as reinforcement has also some disadvantages it can corrode with time and has low fire resistance. The price of steel has also been rising over the last few years.

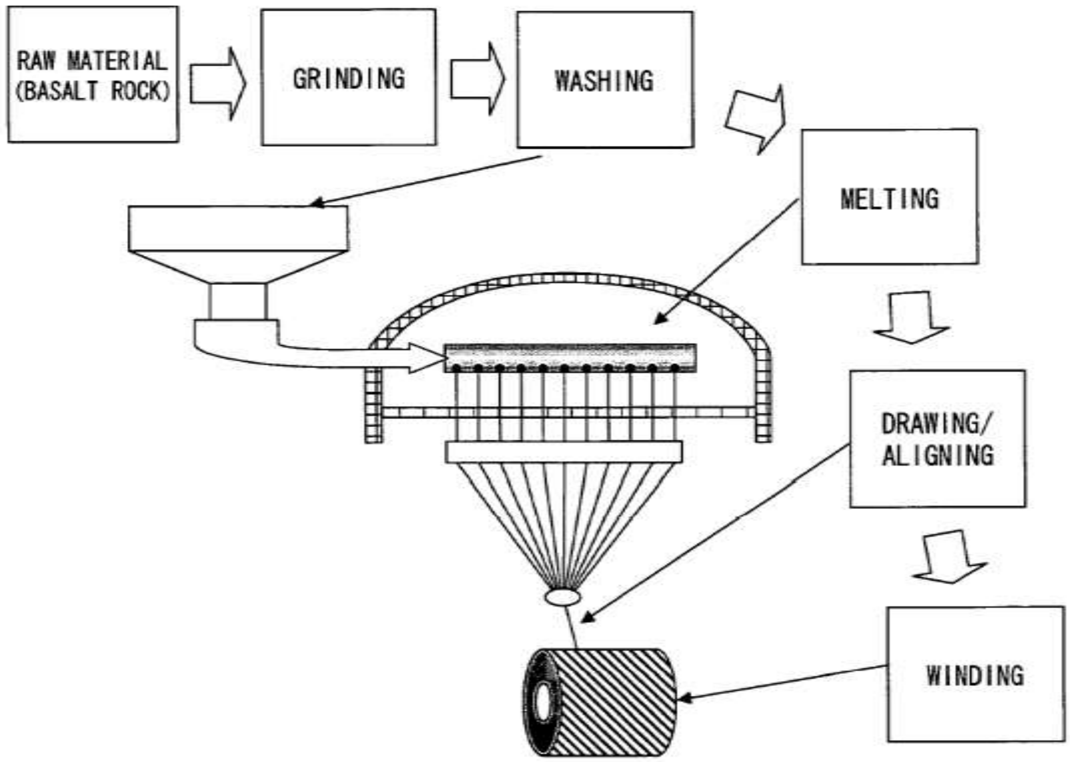
Basalt Fibers

Basalt is a type of igneous rock formed by the rapid cooling of lava at the surface of a planet. It is the most common rock Basalt rock characteristics vary from the source of lava, cooling rate, and historical exposure to the elements. High quality fibers are made from basalt deposits with uniform chemical makeup. The production of basalt and glass in the Earth's crust. fibers are similar. Crushed basalt rock is the only raw material required for manufacturing the fiber. It is a continuous fiber produced through igneous basalt rock melt drawing at about 2,700° F (1,500° C) shown in fig 1.1.

Fig.1.1 Basalt Fiber

Though the temperature required to produce fibers from basalt is higher than glass, it is reported by some researchers that production of fibers made from basalt requires less energy by due to the uniformity of material. Basalt as a fiber used in FRPs and structural composites has high potential and is getting a lot of attention due to its high temperature and abrasion resistance. Compared to FRPs made from glass, aramid and carbon fiber, its use in the civil infrastructure market is very low.

Manufacturing Process Of Basalt Fibers



CEMENT

Cement is defined as the material with adhesive and cohesion properties which make it capable of bonding the constituents of concrete into a compact durable mass. In this project, Ordinary Portland Cement (OPC) 53 grade is used as shown in fig.3.2. The physical properties of cement used in the experimental work are given in Table 3.1.

Fig 3.2 Ordinary Portland Cement

Table 3.1 Physical Properties Of Cement

S.No	Physical Properties	Values Obtained	As Per Is Code
1	Specific gravity	3.15	Should be less than 3.15 (IS 2720- Part 3)
2	Initial setting time	36 minutes	Should be greater than 30 (IS 12269:1987)
3	Final setting time	390 minutes	Should be less than 600 (IS 12269:1987)
4	Consistency	30% (34mm)	

3.4 FINE AGGREGATE

Fine aggregate is added to concrete to assist workability to the concrete mix to prevent segregation of the cement paste and coarse aggregates during its transportation. The aggregate fraction from size 150 micron to 4.75mm is termed as fine aggregate. The fine aggregate is represented by its zone. In this project, natural river sand confirming to IS 383:1970 is used as fine aggregate as shown in fig.3.3. The physical properties of fine aggregate used in the experimental work are given in Table

Fig 3.3 Fine Aggregate

Physical Properties of Fine Aggregate

S.No.	Physical Properties	Values Obtained	As Per Is Code
1	Sieve analysis	Zone II	IS 2386(1963) PART-1
1	Fineness modulus	2.29%	IS 2386(1963) PART-1
2	Specific gravity	2.59	IS 2386(1963) PART-3
3	Water absorption	1.42%	IS 2386(1963) PART-3

COARSE AGGREGATE

The coarse aggregate is used primarily for the purpose of providing bulkiness to concrete. The aggregate fraction from size 4.75mm to 80mm is termed as coarse aggregate. The coarse aggregate is described by its nominal size. In this project, crushed granular aggregate of 20mm size conforming to IS 383:1970 is used as coarse aggregate and as shown in fig.3.4. The physical properties of coarse aggregate used in the experimental work is given in Table 3.3.

Coarse Aggregate

Physical Properties of Coarse Aggregate

S.No.	Physical Properties	Values Obtained	As Per Is Code
1	Sieve analysis	ZONE II	IS 2386-1963 PART-1
2	Fineness modulus	6.12%	IS 2386-1963 PART-1
3	Specific gravity	2.76	IS 2386(1963) PART-3
4	Water absorption	0.66%	IS 2386(1963) PART-3

3.6 WATER

The quality of water is important, because impurities in it may interfere with the setting of the cement and it may adversely affect the strength of the concrete or cause staining of its surface and may also lead to corrosion of the reinforcement. Water used for mixing and curing shall be clean and free from injurious amount of oils, acids, alkali, salts, sugar, organic material they may be deleterious to concrete or steel permission limits.

3.7 BASALT FIBERS

Basalt is a type of igneous rock formed by the rapid cooling of lava at the surface of a planet. It is the most common rock in the Earth's crust. Basalt rock characteristics vary from the source of lava, cooling rate, and historical exposure to the elements. High quality fibers are made from basalt deposits with uniform chemical makeup. The production of basalt and glass fibers are similar. Crushed basalt rock is the only raw material required for manufacturing the fiber. It is a continuous fiber produced through igneous basalt rock melt drawing at about 2,700° F (1,500° C) as already shown in fig 1.1. Though the temperature required to produce fibers from basalt is higher than glass, it is reported by some researchers that production of fibers made from basalt requires less energy by due to the uniformity of material. Basalt as a fiber used in FRPs and structural composites has high potential and is getting a lot of attention due to its high temperature and abrasion resistance. Compared to FRPs made from glass, aramid and carbon fiber, its use in the civil infrastructure market is very low.

Physical Properties Of Basalt Fiber

S.No	Physical Properties	Values
1	Tensile strength (Mpa)	2800-4800
2	Specific gravity	2.7
3	Density (g/m³)	2.67
4	Young's modulus (Mpa)	86-90

BASALT FIBER REINFORCED POLYMER BARS

Basalt fiber is a material made from extremely fine fibers of basalt, which is composed of the mineral's plagioclase, pyroxene, and olivine. It is similar to carbon fiber and fibre glass, having better physico mechanical properties than fiberglass, but being significantly cheaper than carbon fiber. It is used as a fireproof textile in. The aerospace and automotive industries and can also be used as a composite to produce products such as camera tripods. Basalt is a natural, hard, dense, dark brown to black volcanic igneous rock originating at a depth of hundreds of kilometers beneath the earth and resulting the surface as molten magma. And it's gray, dark in colour, formed from the molten lava after solidification. The production of basalt fiber consists of melt preparation, extrusion, fiber formation, application of lubricates and finally winding. This method is also known as spinning. It is do not undergo any toxic reaction with water and do not pollute air also. The main functions of the fibers are to carry the load and provide stiffness, strength, thermal stability and other structural properties in the BFRP.

Physical Properties Of Bfrp Bars

S.No	Physical Properties	Values
1	Tensile strength (Gpa)	4.84
2	Elastic modulus (Gpa)	90-110
3	Elongation at break (%)	3.15%
4	Density(g/cm³)	2.7
5	Specific strength	1.57-1.81
6	Specific modulus	37.7-41.5

MATERIAL USED

MIXING

It is the process of measuring concrete mix ingredients either by volume or mass and introducing them into the mixture. Traditionally batching is done by volume but most of specifications require that batching should be done by mass rather than volume. Percentage of accuracy for measurement of concrete materials is based on the mix proportion. By this we can classify the concrete mixture into two, one is fresh concrete and another is hardened concrete.

FRESH CONCRETE

Fresh concrete is that stage of concrete in which concrete can be molded and it is in plastic state. The potential strength and durability of concrete of a given mix proportion is very dependent on the degree of its compaction. In this project, we have conducted two tests on fresh concrete.

(a) Slump cone test

(b) Compaction factor test

Fig 3.5 Slump Cone Test

Fig 3.6 Compaction Factor

Physical Properties Of Fresh Concrete

S.No	Tests	Value	As Per Is Standards
1	Slump cone	90mm	Medium
2	Compaction factor	0.93	Medium

CASTING AND CURING OF SPECIMENS

The cubes size of 150mm × 150 mm × 150 mm were casted to determine the compression Strength of concrete. The cylinders size of 150mm diameter and 300mm height were casted for split tensile strength test. And the prismatic beam of size 100 mm × 100 mm × 500mm were casted for flexural strength test. After demolding the specimens to be kept for curing of 7 days and 28 days.

HARDENED CONCRETE

Hardened concrete is a concrete which must be strong enough to withstand the structural and service loads which will applied to it and must be durable enough to the environment exposure for which it is designed. It will be the strongest and durable building material. Here three types of tests were conducted on the specimens. They are,

(a) Compression strength test
(b) Split tensile strength test
(c) Flexural strength test

3.13.1 Compression Strength Test

The specimens were tested for compressive strength at the age of 7 and 28 days of curing. These tests were carried using compression testing machine of capacity 2000 kN. Once the specimen is fixed as shown in the experimental setup the load is applied gradually to the cube and the ultimate load at the failure of the cube is noted and the compressive strength of the cube is calculated. The test specimen is shown in the Fig 3.7. Compressive strength of concrete is calculated using the following formula,

$C = P/A$

Where,

P is the maximum load at failure in “N”

A is the area of cube specimen in “mm”

Fig 3.7 Compression Strength Test

3.13.2 Split Tensile Strength Test

The tensile strength of specimen is obtained indirectly by split tensile test. The cylindrical specimens of size 100mm diameter and 200mm height were tested for 7 days and 28days of curing. These tests were carried using compression testing machine of capacity 2000kN as shown in the fig 3.8. Split tensile strength cylinder is calculated using following formula,

$S=2P/\pi DL$

Where,

P is the maximum load at failure in N

L and D are the length and diameter of cylindrical specimen in mm.

Fig 3.8 Split Tensile Strength Test

3.13.3 Flexural Strength Test

Flexural test evaluates the tensile strength of concrete indirectly. It tests the ability of unreinforced concrete beam or slab to withstand failure in bending. The results of flexural test on concrete expressed as a modulus of rupture which denotes as MPa. The beam specimens of size 100 mm × 100 mm × 500 mm were used. Specimens were dried in open air after 7 and 28 days of curing and subjected to flexural strength test under flexural testing assembly shown in Fig.3.9. Apply the load at a rate that constantly increases the maximum stress until rupture occurs. The fracture indicates in the tension surface within the middle third of span length. The flexural strength was obtained using the formula,

$R= Pl/bd^2$

Where,

R= Modulus of rupture (N/mm^2)

P= Maximum applied load (N/mm^2)

l= Length of specimen (mm)

b= Width of specimen (mm)

d= depth of specimen (mm)

Fig 3.9 Flexural Strength Test

3.13.4 DURABILITY STUDIES

The following tests were performed to study the durability properties of concrete

- Water Absorption
- Sorptivity
- Voids Permeability
- Acid Resistance - H_2SO_4Exposure
- Sulphate Resistance

3.13.4.1 Water Absorption

The water absorption capacity for various mixes of concrete was determined on 150mm cubes as per ASTM C 642 – 06. The specimens were taken out of curing tank at 28 days and were wiped with dry cloth to record the water saturated weight (W_s).The drying was carried out in an oven at a temperature of 105°C.The drying process was continued until the difference between two successive measurements become closer. Oven-dried specimens were weighed after they had been cooled to room temperature (W_d). Using these weights, Saturated Water Absorption (SWS) was calculated.

3.13.4.2 Sorptivity

Sorptivity is a material property which characterizes the tendency of a porous material to absorb and transmit water by capillarity. The test setup is shown in Fig 3.10. It can be determined by the measurement of the capillary rise absorption rate of the material. Here water was used as the test fluid. The cube specimens of size 150 mm were cast and immersed in water for curing. After 28 days, the specimens were dried in an oven at 50 c for 7 days. After cooling, the side of the concrete specimen was coated with wax sealant except the test surface on bottom and top of specimen which were kept free of wax sealant. The initial weight of the concrete cube was taken. The concrete cube specimen was kept partially immersed to a depth of 5mm in the water. The specimen's masses were recorded at time intervals of 2min, 4min, 8min, 16min, 30min, 1hr, 2hrs, 4hrs and 8hrs.The specimens were quickly removed from the water and their test surfaces were patted with a paper towel to remove excess water and the sample was weighed. The cumulative water absorption was plotted against the √t. The linear equation arrived was considered as measure of rate of movement of water through the capillary pores and this is called sorptivity. The sorptivity values of concrete specimens were calculated using the following formula

$$i = s\sqrt{t} \quad (4.2)$$

Where,

i is the cumulative water absorption per unit area of inflow surface(m^3/m^2),

s is the sorptivity ($m/s^{1/2}$) and

t is the time elapsed (s).

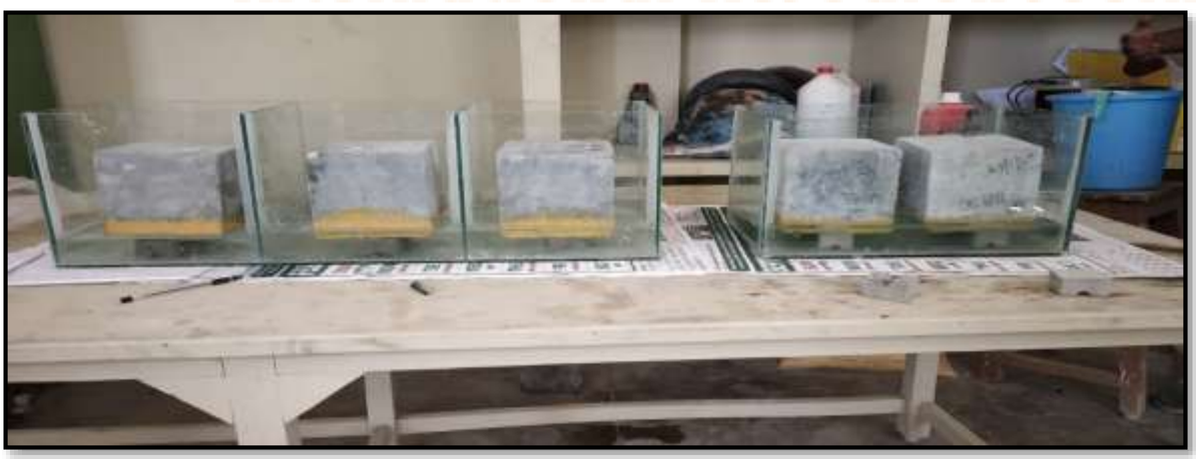


Fig 3.10 Sorptivity test setup

3.13.4.3 Voids Permeability

The percentage of permeable voids was determined as per ASTM C642 –2006. This test was conducted to calculate the percentage of voids present in the concrete specimens. The test was conducted on 150mmcubes. After 28 and 90 days of curing, the cubes were taken out of the curing tank. The surface was cleaned with a dry cloth and the weights of the saturated surface dry cubes were noted. These cubes were dried in hot air oven at a temperature of 105C till constant weight was attained The dried cubes from the hot air oven were weighed (W_{dry}).Then oven dried cubes were immersed in water and the weight gain was measured at regular intervals until a constant weight was reached (W_{sat}).The ratio of the difference between the weight of the saturated surface dry cubes and the weight of the oven dried cubes at 105C to the volume of the cubes gives the permeable voids in percentage. The voids permeability was calculated by the formula.

$$\text{Voids permeability} = \frac{(Wsat - Wdry)}{V} \times 100$$

Where,

W_{sat}- Weight of the saturated surface dry cubes after 28 days in grams

W_{dry}- Weight of the oven- dried cubes in grams

V- Volume of the cubes in mm^3

3.13.4.4 Acid Resistance- H_2SO_4 Exposure

Acid attack test was conducted as per ASTM C267-01(2012). Test specimens of size 150 mm × 150 mm × 150 mm were cast and kept under curing. After 28 and 56 days the specimens were dried and weighed. The Sulphuric acid test was done in accordance with ASTM C267- 01(2012) using 5% of 1molarH_2SO_4solution by volume added to water and the pH observed in the solution was 2.10 at the initial stage. The weight loss and strength loss were tested for 28 and 56days. Normality was uniformly maintained for acid throughout the period. Figure shows the exposure of cubes in H_2SO_4solution. Fig 3.11 shows the exposure of cubes in H_2SO_4solution.

Fig 3.11 The exposure of cubes in H_2SO_4 solution.

3.13.4.5 Sulphate Resistance

Sulphate is present in soil in the form of gypsum $CaSO_4$ H_2O and is also present in ground water. Sulphate can be seen as consequence of industrial waste. Calcium, magnesium and sodium are harmful as they can lead to increase in concrete volume and cracking of concrete. Sulphate resistance test was done in accordance with the ASTM C1012-2004. 150mm cubes were cast and cured in water. After 28 days, the specimen was weighed and immersed immediately in 10% sodium Sulphate (Na_2SO_4) solution and the pH observed in the solution was maintained throughout the test as shown in fig 4.9. The deterioration of concrete specimens was measured as a percentage reduction in weight and compressive strength of concrete at 28 and 56 days after immersion in Na_2SO_4 solution. The specimens were removed from curing tank and cleaned with brush. The average weight loss and strength loss were calculated.

RESULTS AND DISCUSSION

GENERAL

In this experimental study specimens were casted based on the mix proportion with five various percentages of basalt fibers and the beams were casted with the combination of basalt fibers, steel rod and basalt fiber polymer bars and tested to determine the strength parameters such as compression strength, split tensile strength and flexural strength and also the durability properties. Those test results were discussed in this chapter.

TEST RESULTS FOR MATERIALS

Ordinary Portland Cement

Test Results for Ordinary Portland Cement

S.No	Physical Properties	Values Obtained	as Per IS Code
1	Specific gravity	3.09	Should be less than 3.15 (IS 2720- Part 3)
2	Initial setting time	36 minutes	Should be greater than 30 (IS 12269:1987)
3	Final setting time	390 minutes	Should be less than 600 (IS 12269:1987)
4	Consistency	30% (34mm)	

Test Results for Fine Aggregate

S.No.	Physical Properties	Values Obtained	as Per IS Code
1	Sieve analysis	Zone 2	IS 2386(1963) PART-1
2	Fineness modulus	2.29%	IS 2386(1963) PART-1
3	Specific gravity	2.59	IS 2386(1963) PART-3
4	Water absorption	1.42%	IS 2386(1963) PART-3

Test Results for Coarse Aggregate

S.No.	Physical Properties	Values Obtained	as Per IS Code
1	Sieve analysis	Zone II	IS 2386(1963) PART-1
2	Fineness modulus	6.12%	IS 2386-1963 PART-1
3	Specific gravity	2.76	IS 2386(1963) PART-3
4	Water absorption	0.66%	IS 2386(1963) PART-3

Test Results of Fresh Concrete

S.No	Tests	Value	as Per IS Standards
1	Slump cone	90mm	Medium
2	Compaction factor	0.93	Medium

HARDENED CONCRETE

Compressive Strength Test on Cube at 7days and 28days

Compressive strength of cubes casted for 7days and 28days are given below in the table.

Results of Compressive Strength

Volume Fraction (V_f)	Basalt Fiber (N/mm^2)		% of Increase with Control Specimen		% of Decrease with Control Specimen	
	7 days	28 days	7 days	28 days	7 days	28 days
0%	28.67	40.18	-	-	-	-
0.2%	25.50	42.92		6.82	11.06	
0.25%	30.22	47.93	5.4	19.29		
0.3%	31.89	46.45	11.23	15.60		
0.35%	29.15	45.11	2.67	12.27		
0.4%	27.45	44.80		11.49	4.26	

.

Split Tensile Strength Test on Cylinder at 7days and 28days

The split tensile strength of cylinders at 7days and 28days are given in the below table.

Results of Split Tensile Strength

Volume Fraction(V_f)	Basalt Fiber (N/mm^2)		% of Increase With Control Specimen		% of Decrease With Control Specimen	
	7 days	28 days	7 days	28 days	7 days	28 days
0%	2.97	4.23	-	-	-	-
0.2%	3.54	5.53	19.20	30.73		
0.25%	3.70	5.97	24.58	41.13		
0.3%	3.3	6.01	11.11	42.08		
0.35%	3	5.54	1.01	30.97		
0.4%	3.1	5.01	4.38	18.44		

.5 DURABILITY STUDIES

4.5.1 Water Absorption

The water absorption capacity for various mixes of concrete was determined on 150mm cubes as per ASTM C 642 – 06. The results of water absorption test at the age of 28 days and 90 days are given in Table 4.11 and fig 4.5. The water absorption percentage varied between 2.47 % and 2.92 % at 28 days. This indicates that BF acts as a filler material which fills the pores and thereby reduces water absorption.

Table 4.11 Water absorption test results

S.No	Mix designation	Water absorption (%)	
		28 days	**90 days**
1	CC	2.92	2.01
2	BF 0.2%	2.44	1.89
3	BF 0.25%	2.47	1.65
4	BF 0.3%	2.19	1.46
5	BF 0.35%	2.29	1.58
6	BF 0.4%	2.33	1.62

Note:

BF - Basalt Fiber

CC - Conventional Concrete

Sorptivity

Sorptivity is a material property which characterizes the tendency of a porous material to absorb and transmit water by capillarity. The comparison of sorptivity values of CC, BF 0.2%, BF 0.25%, BF 0.3%, BF 0.35% and BF 0.4% at 28 days is shown table 4.12 and fig 4.6. It is observed that in general, there is a decrease in sorptivity value for all the mixtures with BF when compared to CC at the initial stage.

Sorptivity test results

S.No	Mix designation	Sorptivity at 28 days ($mm/min^{0.5}$)
1	CC	0.049
2	BF 0.2%	0.022
3	BF 0.25%	0.022
4	BF 0.3%	0.020
5	BF 0.35%	0.026
6	BF 0.4%	0.029

4.5.3 Voids Permeability Test

As per ASTM C-642-06, the permeable voids are determined at 28 days. From the results it is found that ratio of (BF 0.20%, BF 0.25%, BF 0.3%, BF 0.35% and BF 0.4%) concrete are found to have lesser permeable voids when compared to control concrete. This may due to low fineness modulus of BF that filling up the micro pores in concrete. Voids permeability (%) result are shown in table 4.13 and fig 4.7. Similarly, it is already stated that, the percentage of permeable voids decreased with increased in BF is constant for all mixes.

Volume of Permeable Voids of Various Concrete Mix

S.No	Mix designation	Volume of permeable voids (%)	
		28 days	90 days
1	CC	6.12	5.67
2	BF 0.2%	5.51	4.39
3	BF 0.25%	5.49	4.16
4	BF 0.3%	4.98	3.72
5	BF 0.35%	5.68	4.54
6	BF 0.4%	5.75	4.57

Acid Resistance Test

In H_2SO_4 Environment, the maximum percentage of weight loss is observed for CC at 28 and 56days as 6.15% and 13.27% respectively. Similarly, the percentage weight loss for various percentages are calculated and shown in table 4.14 and fig 4.8. From the test results that the percentage weight loss is higher in CC compared to concrete with other concrete mix. The minimum percentage of weight loss for BF 0.3% is 5.10% and 11.78% at 28 and 56 days respectively.

S.No	Mix designation	5% H_2SO_4solution- Weight loss (%)	
		28 days	56 days
1	CC	6.15	13.27
2	BF 0.2%	6.95	14.35
3	BF 0.25%	7.01	16.89
4	BF 0.3%	5.10	11.78
5	BF 0.35%	5.95	12.56
6	BF 0.4%	6.11	13.16

The concrete cube specimens exposed to H_2SO_4 environment result in leaching of maximum parts of the outer surface of concrete. It is also observed that H_2SO_4 environment fully erodes the mortar exposing the coarse aggregate as shown in fig 4.9.

Fig 4.9 Cubes after exposure toH_2SO_4

The percentage strength loss in H_2SO_4 environment is also found out and the results are shown in table 4.15 and fig 4.10. In H_2SO_4 acid environment, the BF 0.3% mix showed the minimum strength loss percentage compared to remaining mix proportion.

S.No	**Mix designation**	**5% H_2SO_4solution- Strength loss (%)**	
		28 days	**56 days**
1	CC	38.53	49.89
2	BF 0.2%	36.85	50.73
3	BF 0.25%	33.21	48.65
4	BF 0.3%	30.18	44.04
5	BF 0.35%	33.88	47.59
6	BF 0.4%	33.65	47.81

Sulphate Resistance

The Sulphate attack is used to assess the chemical reaction between Sulphate ions and hydrated products. The Sulphate resistance test is conducted by using Na_2SO_4 at a concentration of 10% dilution.

From the test results that the percentage weight loss is higher in CC compared to concrete with other concrete mix. The minimum percentage of weight loss for BF 0.3% mix is 0.88% and 1.38% at 28 and 56 days respectively. Similarly, the percentage weight loss for various percentages of BF are calculated .

Percentage weight loss in Na_2SO_4 solution

S.No	Mix designation	10% Na_2SO_4Solution- Weight loss (%)	
		28 days	56 days
1	CC	0.88	1.38
2	BF 0.2%	0.75	1.25
3	BF 0.25%	0.63	1.14
4	BF 0.3%	0.56	0.93
5	BF 0.35%	0.64	1.05
6	BF 0.4%	0.66	1.11

The percentage strength loss in Na_2SO_4solution is also found out and the results are shown in table 4.17 and fig 4.12. In Na_2SO_4solution, the strength loss percentage and compressive strength percentage was higher. The BF 0.3% mix showed the minimum weight and strength loss percentage compared to remaining mix proportion.

Table 4.17 Percentage strength loss in Na_2SO_4

S.No	Mix designation	10% Na_2SO_4Solution- strength loss (%)	
		28 days	56 days
1	CC	1.36	1.59
2	BF 0.2%	1.28	1.48
3	BF 0.25%	1.17	1.25

4	BF 0.3%	1.03	1.18
5	BF 0.35%	1.15	1.38
6	BF 0.4%	1.18	1.47

CONCLUSION

The following conclusions are obtained from this present study of basalt fiber reinforced concrete are:

- The compressive strength of basalt fiber reinforced concrete with addition of 0.3% of fiber volume fraction is increased by 11.23% (31.89MPa) than control specimen (28.67MPa) at 7days and 0.25% of fiber volume fraction is increased by 19.29% (47.93MPa) than control specimen (40.18MPa) at 28days. Compressive strength has significance effect on basalt fiber addition to M30 grade concrete.

- The split tensile strength of basalt fiber reinforced concrete with addition of 0.25% of fiber volume fraction is increased by 24.58% (3.7MPa) than control specimen (2.97MPa) at 7days and 0.3% of fiber volume fraction is increased by 42.08% (4.23MPa) than control specimen (37.5MPa) at 28days.