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EXPERIMENTAL STUDY ON PLAIN CONCRETE AND BASALT FIBER REINFORCED CONCRETE

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Abstract-Concrete is the most used construction material. The present trend in concrete technology is towards increasing the strength and durability of concrete to meet the demands of modern construction. Basalt fiber is considered a promising new material. It has good strength characteristics, resistance to chemical attack, sound insulation properties. It has a wide range of applications like soil strengthening, construction of bridges, highways, industrial floors. In this experiment, various proportions of basalt fibers are added with percentages 0, 0.1, 0.2, 0.3, 0.4, and 0.5%. In this experiment, we study the mechanical properties of Basalt fiber reinforced concrete. All the specimens were cured for 28days. The addition of fly ash shows long-term strength. It was found that the ternary system that is ordinary concrete Portland cement, fly ash, basalt fiber increases the mechanical properties of concrete at all ages compared to concrete made with fly ash and basalt fiber.

Keywords: Mechanical properties, Fly ash, super plasticizer Basalt Fiber.

I. 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 a high temperature. Basalt rock can also make basalt rock, chopped basalt fiber, basalt fabrics and continuous filament wire.

Basalt fiber originates from volcanic magma and volcanoes, a very hot 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 producing process, which gives additional advantage in cost. Basalt rock fiber 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 produce no chemical reaction that may damage health or the environment.

Basalt fiber has good hardness and thermal properties. Basalt fiber have been successfully used for foundation such as slabs on ground concrete.

II. PROPERTIES OF BASALT FIBER

a) Physical properties

Colour:- It is available in golden brown colour.

Diameter:- It is available in different diameter like 13micron meters.

Length:- Available in 6mm, 8mm, 12mm etc.

Density:- Density of basalt fiber is 2.7g/cm^3.

b) Chemical properties

Basalt are more stable in strong alkalis.

Weight loss in boiling water, alkali and acid is also significantly lower.

Posses resistance to UV- Light & biologic and fungal contamination.

Are compatible with phenolic resins.

Absorption of humidity comes to less.

c) Thermal properties

With thermal range of -260^{0}C to 982^{0}C and melt point of 1450^{0}C as well as low thermal conductivity 0.031-0.038w/mk, the basalt fibers are ideal for the 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 break 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 then 400^{0}C the basalt fiber loss on their initial strength, while the E- glass loss more 50%.

e) Mechanical properties

- It has High stiffness and strength.
- The specific tenacity of basalt fiber exceeds that of steel, many times.
- Basalt fiber are non – capillary and non- hygroscopic, giving good resistance.

f) Corrosion and fungi resistance

- Basalt fiber has better corrosion resistance.
- It does not under go any toxic reaction with water and air or gases also.
- Moisture regain and moisture content of basalt fiber exist in the range of less than 1%.
- Basalt moisture have strong resistance against the action of fungi and micro organisms.

g) Ecological friendliness

- Basalt fibers have natural raw material, which is basalt rock it does not cause any damage to the health.
- Basalt fibers has no biological hazards and solves waste disposal problems.
- It does not clog incinerator as glass. Hence, it is incinerator friendly.

III. Objectives Of The Study

- Study the design aspects of the BFRC.
- Understanding the various applications involving BFRC.
- Perform laboratory test that are related to compressive, split tensile strength and flexural strength.

IV. Experimental Investigation

Cement

Ordinary – Portland cement of 53-grade is used for casting. The physical properties of the cement as obtained from various tests are listed in table.

S. no	Tests	Results
1	Fine ness	6%
2	Specific gravity	3.12
3	Initial setting time	140minutes
4	Final setting time	230mintues
5	Standard consistency	32%

Table – 1 properties of cement

Coarse aggregate

The locally available crushed stone of 20mm stone used.

S.No	Tests	Results
1	Specific gravity	2.7
2	Fine modulus	7.32
3	Void ratio	0.92
4	Bulk density	1.59g/cm^3
5	Impact value	33.3%

Table -2 properties coarse aggregate

Fine aggregate

For preparation of concrete mix the zone –II sand is used which is locally available.

S.No	Tests	Results
1	Specific gravity	2.45
2	Fine modulus	2.62
3	Bulk density	1.52
4	Zone	II

Table – 3 properties of fine aggregate

Water

The ordinary Portland water is used for mixing concrete and for casting.

Fly ash

Fly ash is a by product from burning pulverized coal in electric generation power plants. when used in concrete mixes, fly ash improves the strength.

Super plasticizer

To provide excellent acceleration of strength gain at early ages and major increase in strength at all stages by significantly reducing water demand in a concrete mix.

To provide improved durability by increasing ultimate strengths and reducing concrete permeability.

V. Mix proportions

Table – 4 mix proportions of M20 grade concrete.

Materials	cement	Fine aggregate	Coarse aggregate	water
Quantity	350	720	1120	140
Proportions	1	2.05	3.2	0.4

Table – 5 mix proportions of M40 grade concrete.

Materials	cement	Fine aggregate	Coarse aggregate	water
Quantity	450	1715	1070	166.5
Proportions	1	3.81	2.37	0.37

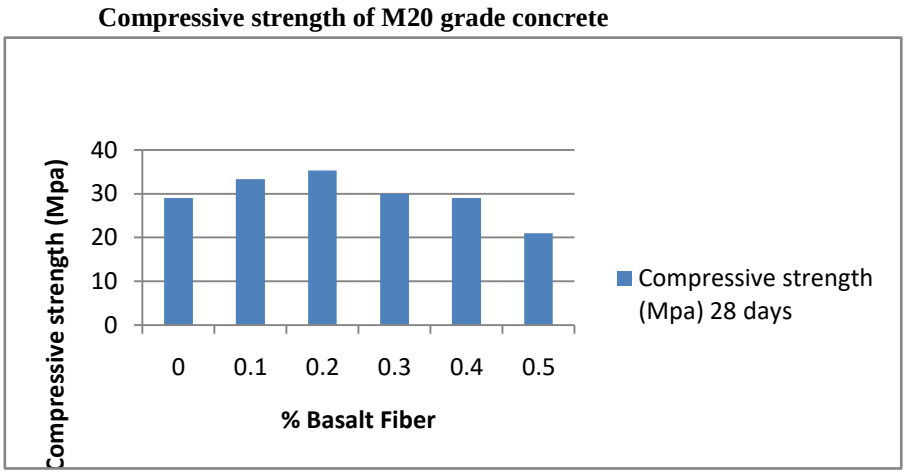
VI. Results and discussions

Table – 6 Compressive strength of M20 grade concrete.

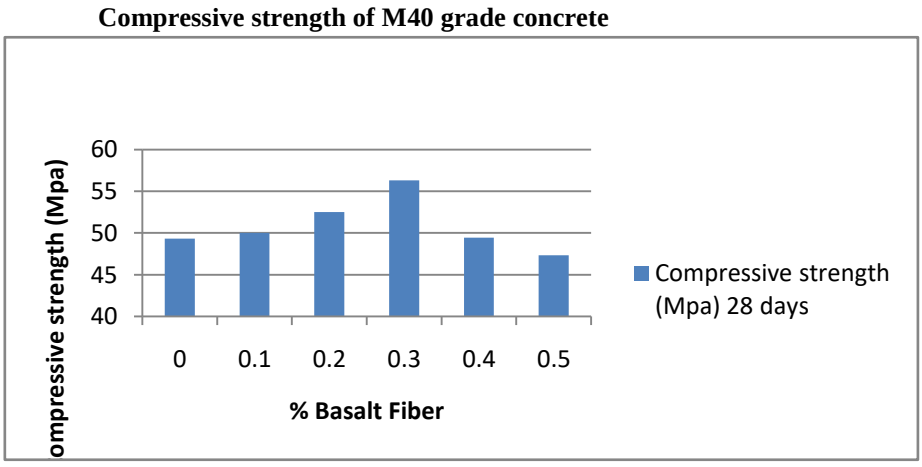
S. No	% Basalt fiber	Compressive strength for 28 days
1	0	29.00
2	0.1	33.33
3	0.2	35.33
4	0.3	30.00
5	0.4	29.00
6	0.5	21.00

Table -7 Compressive strength of M40 grade concrete.

S. No	% Basalt fiber	Compressive strength for 28 days
1	0	49.33
2	0.1	50.00
3	0.2	52.50
4	0.3	56.33
5	0.4	49.45
6	0.5	47.33



Graph : Fig-1 Compressive strength for 28 days



Graph: Fig -2. Compressive strength for 28 days

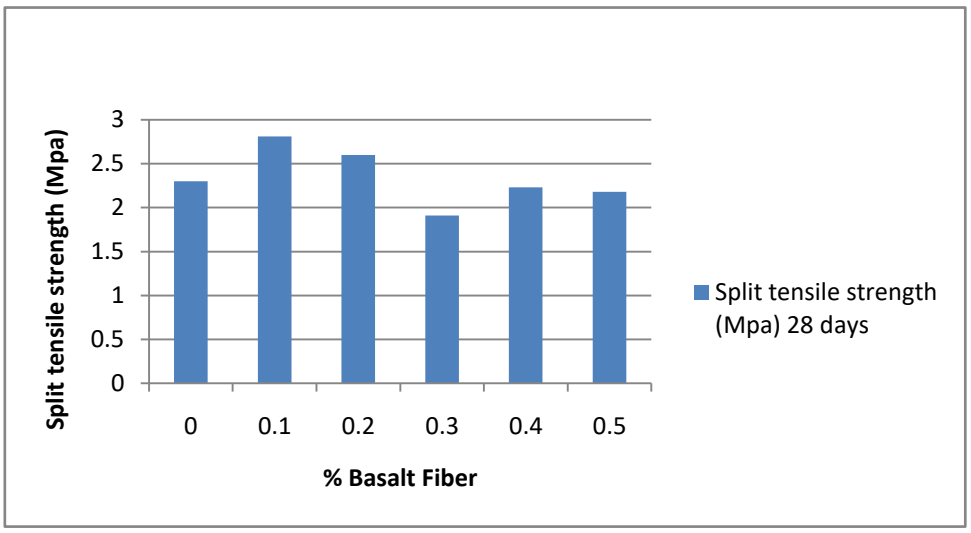
Table -8 Split tensile strength of M20 grade concrete

S.No	% Basalt fiber	Split tensile strength for 28 days
1	0	2.30
2	0.1	2.81
3	0.2	2.6
4	0.3	1.91
5	0.4	2.23
6	0.5	2.18

Table -9 Spilt tensile strength of M40 grade concrete

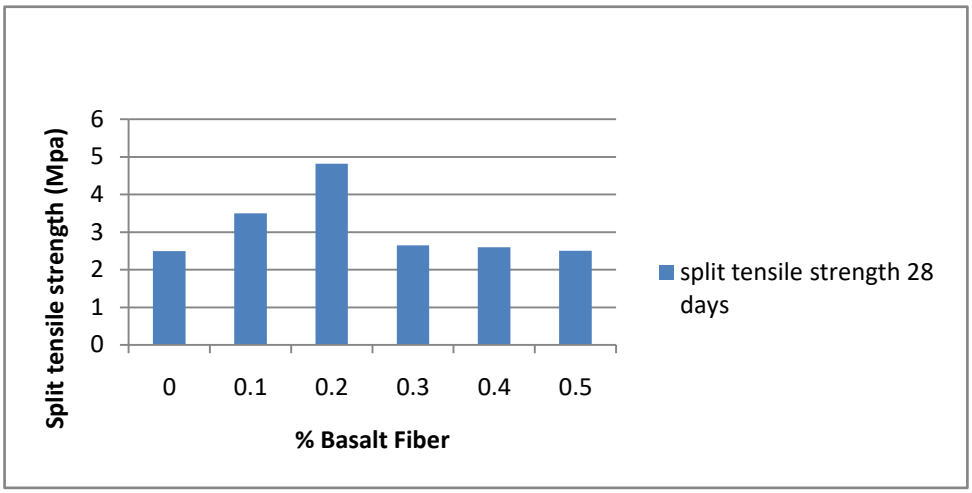
S. No	% Basalt fiber	Split tensile strength for28 days
1	0	2.49
2	0.1	10.52
3	0.2	4.82
4	0.3	2.65
5	0.4	2.60
6	0.5	2.50

Split tensile strength of M20 grade concrete



Graph: Fig 3 split tensile strength for 28 days

Split tensile strength of M40 grade concrete



Graph: Fig 4 split tensile strength for 28 days

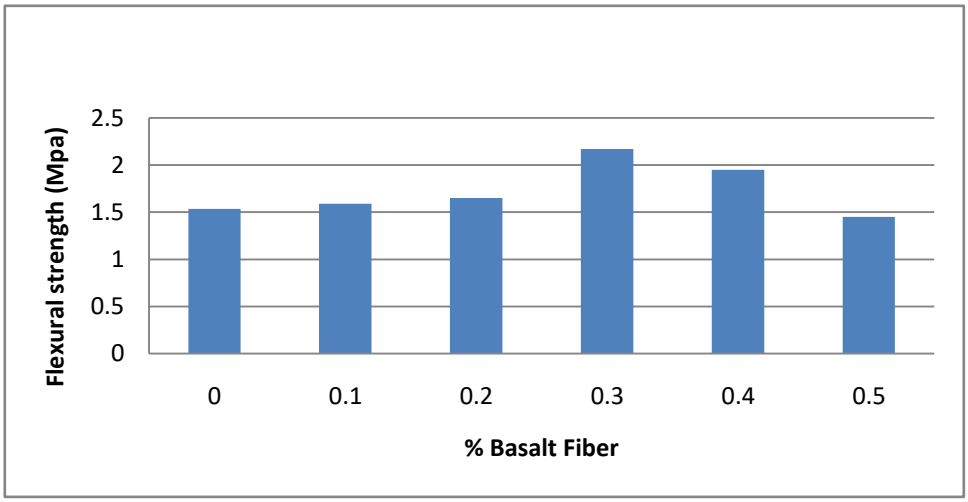
Table-10 Flexural strength of M20 grade concrete

S. No	% Basalt fiber	Flexural strength for28 days
1	0	1.535
2	0.1	1.59
3	0.2	1.65
4	0.3	2.17
5	0.4	1.96
6	0.5	1.45

Table*11 Flexural strength of M40 grade concrete

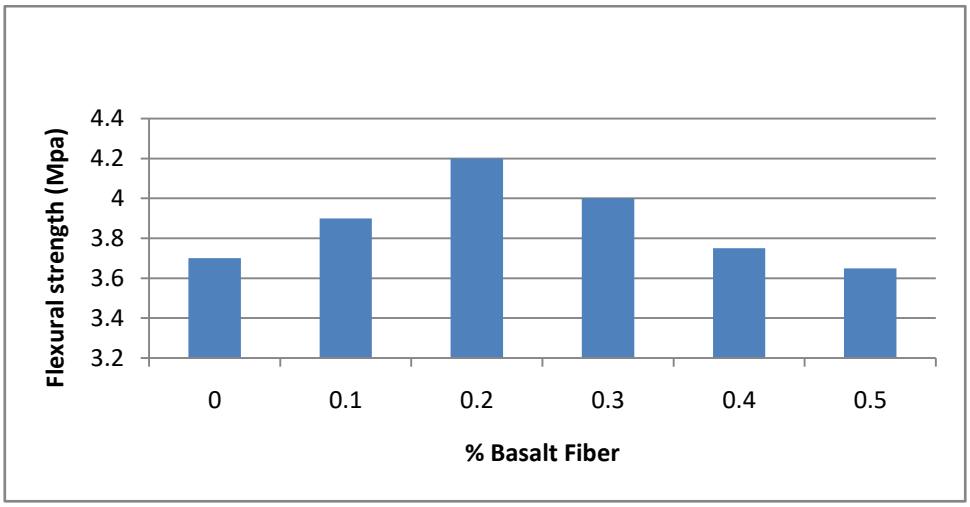
S. No	% Basalt fiber	Flexural strength for 28 days
1	0	3.70
2	0.1	3.9
3	0.2	4.2
4	0.3	4.00
5	0.4	3.75
6	0.5	3.65

Flexural strength of M20 grade concrete



Graph: Fig- 5 flexural strength for 28 days

Flexural strength of M40 grade concrete



Graph: Fig- 6 Flexural strength for 28 days

VII CONCLUSIONS

- The results obtained from this study can be summarized as follows.
- The addition of basalt fiber reinforced concrete improves the mechanical properties the compressive strength of the basalt fiber is increases 0.2%, of M20 grade concrete.
- The compressive of strength of basalt fiber is increases 0.3% of M40 grade concrete.
- The tensile strength of basalt fiber is increase 0.1% and 0.2% of M40 grade concrete.
- The flexural strength of basalt fiber is increase 0.3% of M20 grade concrete and 0.2% percentage increase in M40 grade concrete.
- The basalt fiber rein forced concrete is better than conventional concrete
- .

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