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EXPERIMENTAL INVESTIGATION ON CONCRETE USING BAMBOO FIBRE AND METAKAOLIN

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Abstract - *Concrete is an extensively used construction material for its various advantages such as low cost, availability, fire resistance etc. But it cannot be used alone everywhere because of its low tensile strength. Today construction industries are facing problems of cracking and tensile strength problems, for that we have to add something in concrete to improve concrete to increase tensile capacity. This study presents the use of bamboo fibre and metakaolin in concrete Use of bamboo fibre in concrete will reduces the compressive strength while increasing the percentage of bamboo fibre. So the metakoalin is used to increase the compressive strength of fibre reinforced concrete. It is reported that the Bamboo Fiber is used as additives to increase tensile strength and Metakaolin is used as a replacement of Cement has shown increased compressive strength. This study includes the performance of concrete by using both Bamboo Fiber and Metakaolin with respect to tensile strength and compressive strength.*

Keywords- bamboo fiber, metakaolin, properties of material, compressive strength, tensile strength.

1. INTRODUCTION

Concrete possess a very low tensile strength, limited ductility, and little resistance to cracking. In plain concrete and similar brittle material structural crack (micro crack) develop even before loading particularly due to drying shrinkage or other causes of volume change. To overcome all of this problem bamboo fiber is used, while excessive addition of bamboo increases tensile strength but reduces compressive strength of concrete. Bamboo fibber is used to increase tensile strength and reduce cracks in the concrete, when used in excessive amount it tends to increase its tensile strength further but reduces the compressive strength. So we look for a better option to increase its compressive strength by adding mineral admixtures.

2. MATERIAL AND PROPERTIES

2.1 CEMENT: It can be defined as the material having adhesive and cohesive properties which make it capable of binding material fragments into a compact mass. Cement is obtained by burning together in a definite proportion, a mixture of naturally occurring calcareous (containing calcium carbonate or lime) and argillaceous (containing alumina) material to be partial fusion at higher temperature. The four major compounds are, Tricalcium silicate (3CaO.SiO2), Dicalcium Silicate (2CaO.SiO2), Tricalcium aluminate (3CaO.Al2O3), Teracalcium alumina ferrite (4CaO.Al2O3.Fe2O). Ordinary Portland cement 53gade of cement is used.

PROPERTIES: specific gravity of OPC 53 grades is 3.05 and the initial setting time of cement is 30 minutes.

2.2 FINE AGGREGATES: Aggregates stability and wear resistance for provide dimensional concrete. Not only they provide strength and durability to the concrete, but also influence the mechanical and physical properties of concrete. Aggregates act as filler materials and lower the cost of the concrete.

PROPERTIES OF FINE AGGREGATE: The specific gravity of fine aggregate is 2.67

2.3COARSE AGGREGATE: Coarse aggregate is used to describe particles larger than 4.75 mm. coarse aggregates from 4.75 to about 40 mm, except for mass concrete which may contain particles up to 150 mm.

PROPERTIES OF COARSE AGGREGATE: the specific gravity of coarse aggregate is 2.8. And also shape, texture and durability is also considered

2.4 METAKOLIN: Metakaolin is refined kaolin clay that is fired (calcined) under carefully controlled conditions to create an amorphous aluminosilicate that is reactive in concrete. Like other pozzolans (fly ash and silica fume are two common pozzolans), metakaolin reacts with the calcium hydroxide (lime) by products produced appearance and performance are relatively consistent. It reacts rapidly with the calcium hydroxide during cement hydration.

ADVANTAGES OF USING METAKOALIN: increase the compressive strength and split tensile strengths. Reduce the permeability. Reduce the potential for efflorescence. Increase resistance to chemical attack. Increased durability. Reduce effects of alkali- slica reactivity. Enhanced workability and finishing of concrete. Reduced

shrinkage, due to "particle packing" making concrete is more denser.

2.5 BAMBOO FIBER: Bamboo Fibre is a natural fibre which is get from the bamboo plant.

ADVANTAGES OF BAMBOO FIBRE: Reduce the cracks. Increase the tensile strength and flexural strength. Increase the durability of concrete.

2.6 WATER: It establishes/increases the bond between the cement, the aggregate and the admixture. Water is also responsible for the process of hydration that leads to the hardening of concrete to form different structures. The water used for concrete should be free from the undesirable salts that may react with cement and reduce their efficiency.

3. METHODOGY

For each test that was conducted, cubes, and cylinders were prepared. Cubes and cylinders were prepared to obtain the compressive strength and splitting tensile strength respectively.

The specimens were casted and cured for 28 days. The 28 days cured specimens were subjected to testing and the results were obtained. Due to the compressive force, the cube of size 150 X 150 X 150 mm is subjected to a large magnitude of compressive strength near the loading region. The compressive strength was computed by the standard stress formula P/A, where P is the ultimate load in KN and A is the area in m^2. The split tensile strength was conducted by the cylinder specimen 150 X 300 mm and computed by using the expression $f_t = 2P/ \pi LD$, where P is the ultimate load in KN, L is the depth of the cylinder in m and D is the diameter of the cylinder in m. The test for modulus of elasticity is done by using the cylinder specimen and modulus of rigidity is done by using the cube specimen.

4. RESULT AND DISCUSSION OF HARDEND CONCRETE

4.1 COMPRESSIVE STRENGTH:

For cube compression testing of concrete 150 X 150 X 150 mm cubes was used. All the cubes were tested in saturated condition after wiping out the surface moisture. Three cubes for each mix were tested at the age of 28 days curing using universal testing machine.

The compressive strength for cubes at 28 days is shown in FIGURE1 and TABLE 1.The observed result of compressive strength.

TABLE 1compressive strength of concrete

S.NO	Bamboo fibre %	Metakoalin %	COMPRESSIVE STRENTH IN 28 DAYS (N/MM^2)
1	0	0	28.9
2.	1	0	27.54
3.	2	0	24.90
4.	3	0	20.43
5.	1	5	32.49
6.	2	5	28.43
7.	3	5	23.73
8.	1	10	35.08
9.	2	10	31.05
10.	3	10	28.30

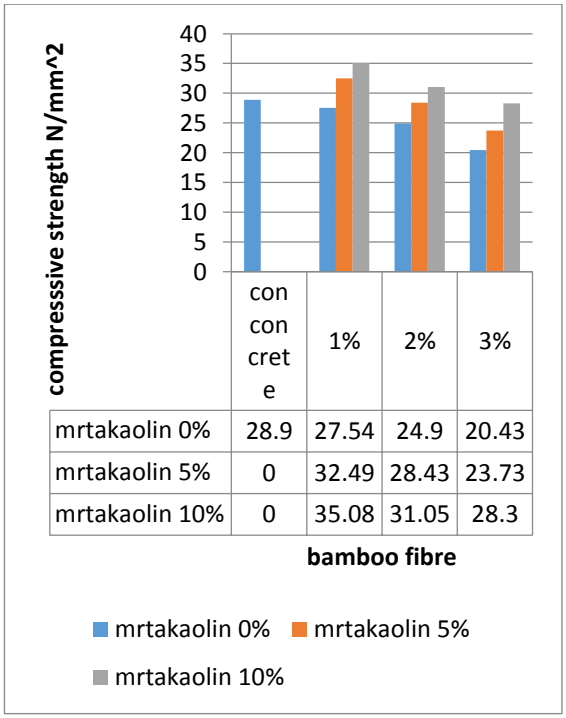

Figure 1

4.2 Spilt tensile strength

This is an indirect test to determine the tensile strength of cylindrical specimens. Splitting tensile strength tests were carried out on cylinder specimens of

size 150 x 300 mm length at the age of 28 days curing, using universal testing machine. The load was applied gradually till the specimens split and readings were noted. The results of split tensile strength of cylinders for 28 days are shown in figure 2 and table 2

TABLE 2 split tensile strength

S.NO	Bamboo fibre %	Metakoalin %	COMPRESSIVE STRENTH IN 28 DAYS (N/MM^2)
1	1	0	2.07
2.	2	0	2.23
3.	3	0	2.44
4.	1	5	2.17
5.	2	5	2.35
6.	3	5	2.57
7.	1	10	2.29
8.	2	10	2.71
9.	3	10	3.05

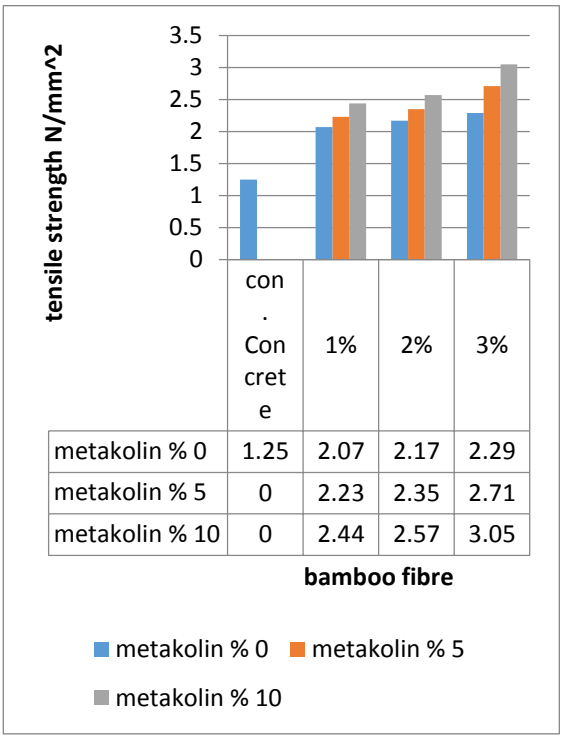

Figure 2

V CONCLUSIONS

- The following are the conclusions derived from the experimental investigation carried out the present research aims at studying the behaviour and mechanical property of bamboo fibre and metakaolin with partially replacement of cement.
- The compressive strength of cubes is increased with addition of bamboo fibre at 1% and further any addition of bamboo fibre decreases the compressive strength of concrete
- The addition of metakaolin along with the cement has increased the compressive strength when compared to the bamboo fibre concrete at addition of bamboo more than 1%
- Partially replacement of cement with metakaoklin has increased the split tensile strength when compared to addition of bamboo fibre in concrete
- The problem of decreases in compressive strength of concrete is increased 40% by using of metakolin

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