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Experimental Study on Mechanical Properties of Hooked End Steel Fibre Reinforced Concrete Specimens using Bagasse Ash

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Abstract: ***Concrete is a brittle material and hence steel is provided for its tensile strength. Adding steel fibres in concrete enhances the tensile strength. Researches show that Steel fibre reinforced concrete increases the flexural strength, flexural toughness and cracking strength of concrete. In this study, experimental investigation on Steel fibre reinforced specimens has been carried out using bagasse ash as partial replacement for cement. Bagasse ash is a residue resulting from the burning of sugarcane bagasse in boilers for power generation. This ash contains cementitious properties and hence used as a partial replacement for cement. Cement production causes CO_2 emission and hence this partial replacement will minimize the cement quantity production and thereby reducing CO_2 emission. The present work started with design mix calculation for M_{20} and compressive strength of cubes was arrived for various percentage of bagasse ash (10%, 20%, 30%). For the optimum mix, split tensile strength of Steel fibre reinforced specimens were studied for different percentage (0.6%, 0.8%, 1%),of volume fraction. 10 % replacement of Bagasse ash and addition of 1% steel fibre was found to be optimum.***

Keywords: Bagasse Ash, Steel Fibre, Super plasticizers, Compressive strength, Split tensile strength

I. INTRODUCTION

Concrete is a brittle material and adding steel fibres into the concrete may increase the toughness property of concrete matrix[6].Mechanical properties of concrete will improve when fibres are added into the concrete. SFRC is well suitable for heavy loaded structures, dynamic and impact loading structures[8]. Aspect ratio of fibre and orientation of the fibre is very important in SFRC.

Bagasse ash is a residue obtained from the burning of sugarcane bagasse in co. generation plant. Aluminum ion and silica are present in this generated ash[3]. Bagasse ash co. generated plants situated all over the country will yield large quantity of bagasse ash and it can be used in concrete. It is an eco friendly alternative to disposal[4].

II. LITERATURE STUDY

From the review of literature, the following salient points were observed.

A. Early strength of concrete can be achieved by replacing BA for cement [1].
B. 30% replacement of bagasse ash is found to be optimum for producing high strength concrete [2].
C. Microcracks in matrix can be controlled by steel fibres [5].
D. HPFRC improved the seismic performance of non-seismically designed beam-column joints [7].
E. Hybrid fibres of low fiber volume fraction will improve strength and toughness of matrix [6].

III.MATERIALS

OPC 53 Grade cement was used for this study. Bagasse ash was collected from Amaravathi sugar mills, Udumalpet and used for partially replacing cement. Hooked end steel fibres of aspect ratio 55.55 bought from Ms.Stewol steel fibres were used. Superplasticizer Cera Plast 400 by 1% of weight of cement was used to improve the workability of concrete. Fine aggregates passing through 2.36 mm sieve and coarse aggregates of 20 mm were used.

IV.EXPERIMENTAL PROGRAM

Mix design for M20 were carried out and arrived which is given in Table I.

TABLE I

Cement	Fine aggregate	Coarse aggregate	W/C
1	1.87	3.21	0.4

A. Test For Compressive Strength

Bagasse ash were used for partially replacing cement in following proportions (0%, 10%, 20%, 30%).Twenty four numbers of cube specimens (150 x 150 x 150 mm) were casted .Twelve number of cubes were cured for 7 days and another twelve number of cubes were cured for 28 days. Then cubes were tested in Compression testing machine.

B. Test For Split Tensile Strength

Hooked end Steel fibres of length 25 mm and dia 0.45 mm were used for different volume of fraction (0%, 0.6%, 0.8%, 1%).Twenty four numbers of cylinders (150 x 300 mm) were casted. Twelve number of cylinders were cured for 7 days and another twelve number of cubes were cured for 28 days. Then cylinders were tested.

V. RESULTS AND DISCUSSION

TABLE III
Compressive strength

S.No	Replacement % of bagasse ash	Compressive strength @ 7 days MPa	Compressive strength @ 28 days MPa
1	0	13.77	21.34
2	10	15.91	24.83
3	20	13.33	22.38
4	30	11.37	21.64

1) Compressive strength results are given in Table II .
2) It was observed that 10 % replacement of Bagasse ash shows higher values when compared to conventional specimen and 20% and 30 % replacement specimens.
3) Bagasse ash showed 14% increase in compressive strength when compared to conventional specimens. Pozzolanic properties of bagasse ash increases the compressive strength.
4) Graphical representation of compressive strength values were given in figure 1 which shows clearly that 20 % and 30% replacement of bagasse shows decrease in strength when compared to 10 % replacement.
5) For 10 % replacement of bagasse ash, split tensile strength test is carried out for different volume of fraction of steel fibres(0,0.6%,0.8% and 1%).

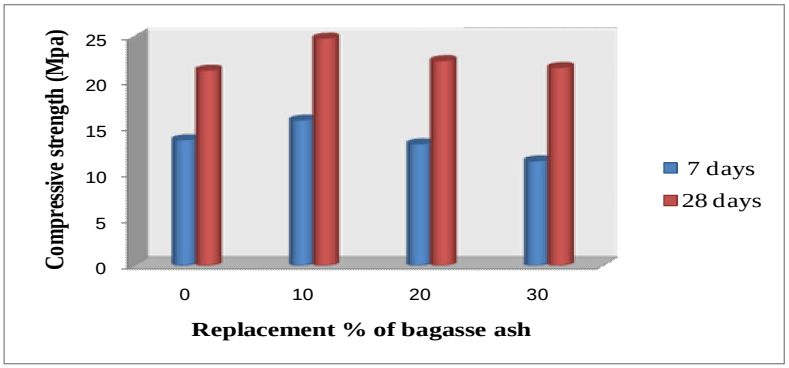

Fig 1.Compressive strength of cubes

TABLE IIIII
Split Tensile Strength

S.No	% of Bagasse Ash	% of steel fibres	Split Tensile strength @ 7 days	Split Tensile strength @ 28 days
1	10	0	1.34	1.83
2	10	0.6	1.91	3.12
3	10	0.8	2.19	3.48
4	10	1	2.32	3.65

6) Split tensile strength results are given in Table III and Figure 2.

7) It was observed that 10 % replacement of Bagasse ash and 1% volume fraction of steel fibre shows higher values and hence it is optimum.

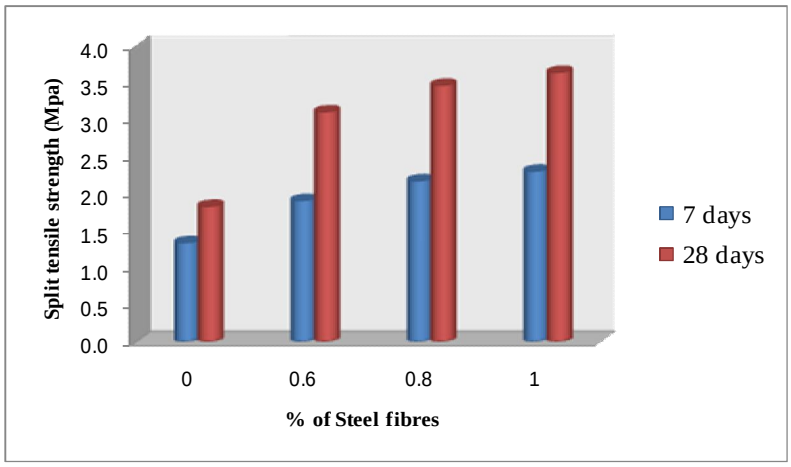

Fig. 2 split tensile strength of cylinders

VI. CONCLUSION

10 % replacement of Bagasse ash and addition of 1% steel fibre was found to be optimum. Pozzolanic properties of Bagasse ash showed 14% increase in compressive strength. Split tensile strength increases when volume of steel fibre increases with constant percentage of bagasse ash. Bagasse ash and SFRC combined specimens showed increase results in terms of tension.

V. ACKNOWLEDGEMENT

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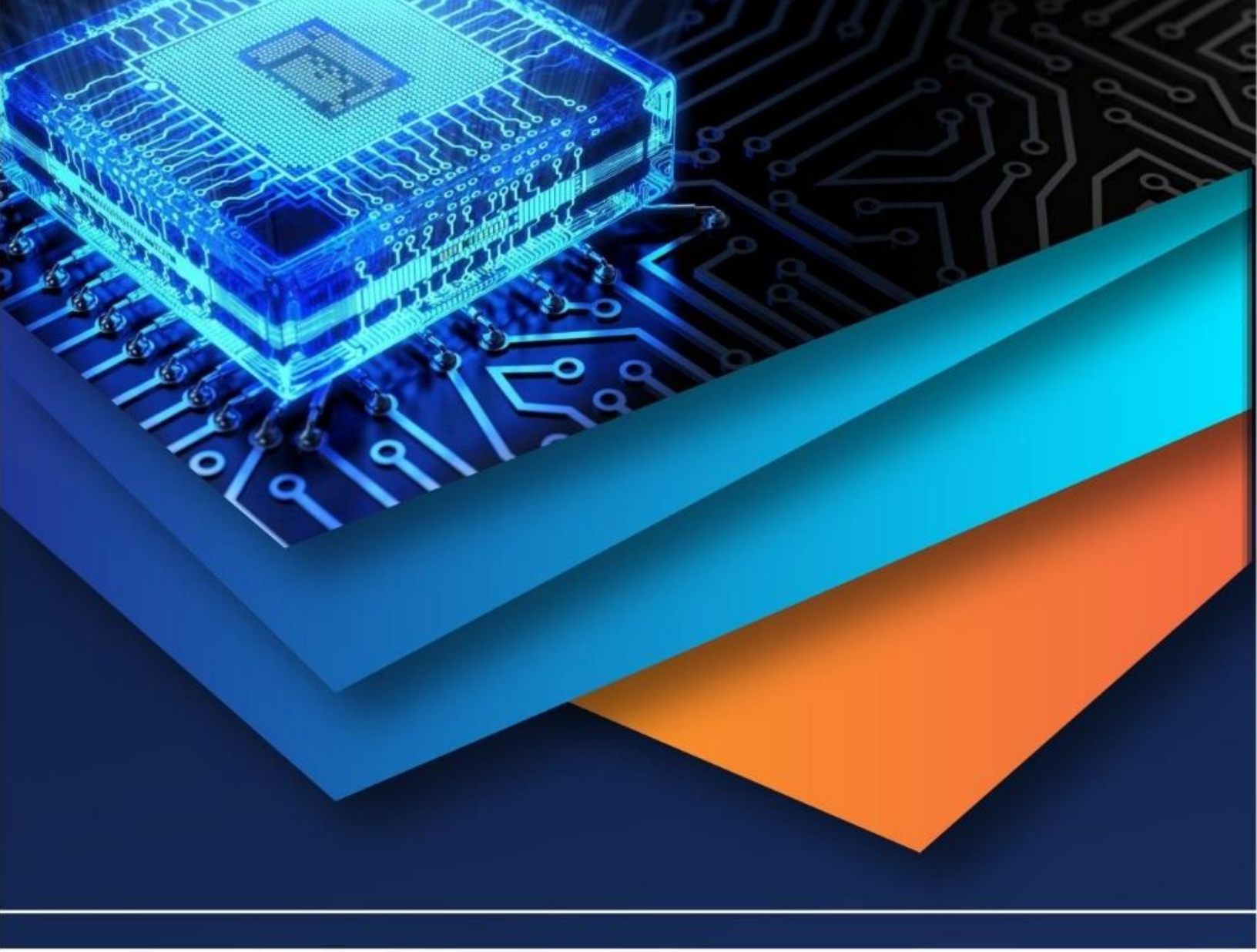

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