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Experimental Study on Compressive Strength of M20 and M30 Concrete by Replacing Sugarcane bagasse ash against Cement

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ABSTRACT: The second largest country of sugar production after Brazil is India. As a result of which, there is an increase in the amount of bagasse as a by-product from the sugar mill. Sugar cane bagasse ash is the waste product of the combustion of bagasse for energy in sugar factories due to which it is easily available and cheap. Sugar cane bagasse ash is disposed of in landfills and is now becoming an environmental burden. . In these trial examination work concrete cubes, cylinders and beams of M-20 and M-30 grade were casted and tested to inspect different properties of concrete like workability, compressive strength, flexural strength and split tensile strength test. The test results shows that Sugarcane Bagasse Ash can be utilized for partial replacement of cement up to 15% by weight of cement without any major loss in strength.

KEYWORDS: Sugarcane Bagasse ash (SCBA), concrete, Sustainable development, eco friendly environment

I. INTRODUCTION

A.Sugarcane bagasse ash-an Indian scenario

The sugar industry is one among the well established industries in India which is a boon to farmers. As per the statistics of the Indian Sugar Mill Association, around 538 sugarcane factories are in operation in the country presently. In this century, most of the sugar industries in India have been developed as self-sustained ones by various means. It is one among the industries that generate electricity and export the excess to the government through the power grid. Sugarcane is a chief kharif crop in India and is cultivated on a large scale in the country. In the world, India has secured the second position in sugarcane production. On an average, sugarcane production in India is about 300 -350 million tons in the last five years



Fig. 1.1 Sugarcane bagasse ash

II. LITERATURE REVIEW

R Srinivasan and K. Sathiya had concluded that blended SCBA in concrete had higher compressive strength, tensile strength and flexural strength in comparison to that of without SCBA .They came to a conclusion that cement can be partially replaced by SCBA upto a extent of 10%.They even concluded that with addition of more SCBA the density of concrete will decrease and low weight concrete will get produced.

M. VijayaSekhar Reddy,I.V.Ramana Reddy, studied the behaviour of High Performance Concrete (HPC) which is being the most used type of concrete in the construction industry. They replaced cement with Supplementary cementing materials (SCM) like fly ash, silica fume and metakaolin.



Asma Abd Elhameed Hussein et al. This study presents the results of an experimental research study on the effectiveness of Sugar Cane Bagasse Ash (SCBA) as a cement replacement material in concrete production. The ordinary Portland cement was replaced with 0, 5, 10, 15, 20, 25 and 30%, respectively bagasse ash, the effect of Sugar cane Bagasse Ash on workability, compressive strength and microstructure of Interfacial Transition Zone (ITZ) of concrete was examined.

III. SCOPE OF THE WORK

- To determine the fresh property i.e. workability of M20 and M30 grade concrete by partially replacing cement with Sugarcane Bagasse Ash.
- To study the effect of Sugarcane Bagasse Ash. on hardened properties of concrete such as compressive, Split tensile and Flexural strength of concrete at 7, 21 and 28 days.
- The objective of this study is to search alternatives material which can fully or partially replaced naturally available material in construction
- The main purpose of this study is to reduce the use of conventional material for making the concrete.

IV. MATERIALS AND METHODOLOGY

Materials that are used for making concrete for this study will be tested before casting the specimens. The preliminary tests will be conducted for the following materials.

- Cement
- Fine aggregate
- Coarse aggregate
- Water
- Bagasse ash

A. METHODOLOGY

- 1] Mix design (M 20&M30 grade) as per IS 10262:2009
- [2] Preparation of specimens
 - Concrete Cube of size 150x150x150
 - Concrete Cylindrical columns of Dia 150mm and length 300 mm.
 - Concrete beams Of size 150x150x700 mm.
- [3] Workability Test .
- [4] Testing of cubes for compressive strength.
- [5] Testing of beams for flexural strength.
- [6] Testing of cylindrical columns for Split tensile strength

V. RESULTS AND DISCUSSION

A. Workability test

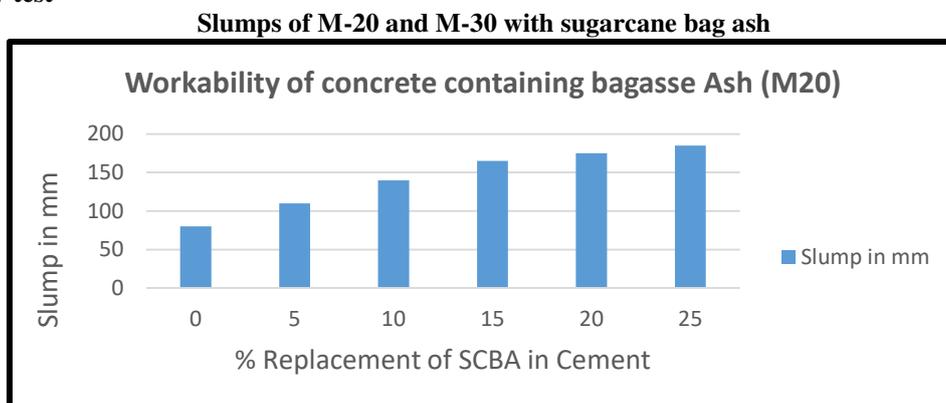


Fig. 5.1 Slumps of M-20 at different percentage SCBA



Fig. 5.2 Slumps of M-30 at different percentage SCBA

From the above graph, it was found that slump value increases from sample CC to R15 for M20 and M30 grade of concrete

B.COMPRESSIVE STRENGTH

The effect of Sugarcane bag ash used in the present study on compressive strength of concrete for M30 & M20 grade of concrete with varying dosages as 0%, 3%, 6%, 9%, 12% and 15% of Sugarcane bag ash

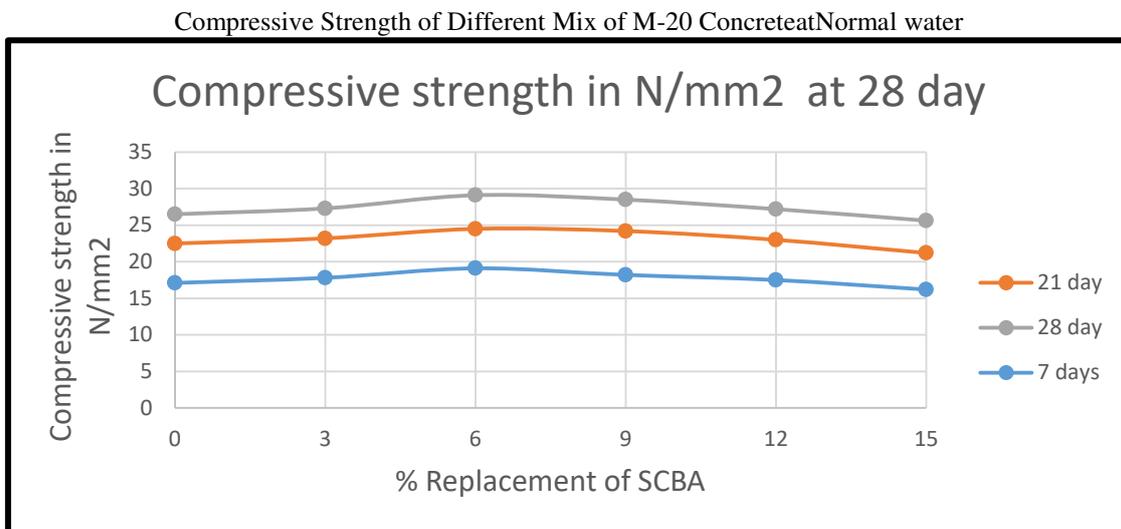


Fig. 5.3 Effect of SCBS on compressive strength of concrete at 7-days, 21-days and 28 days

From the above table is seen that the compressive strength in M 30 & M20 grade of concrete at 7, 21, and 28 days increases when the percentage of the SCBA from 0% to 6%. At 6% replacement of SCBA strength observed to be maximum and after strength is decreasing. The strength increase at 28 days is up to 9.8%, for M20 grade of concrete, After 6% of SCBA Replacement compressive strength decrease,

Compressive Strength of Different Mix of M-30 Concrete at Normal water

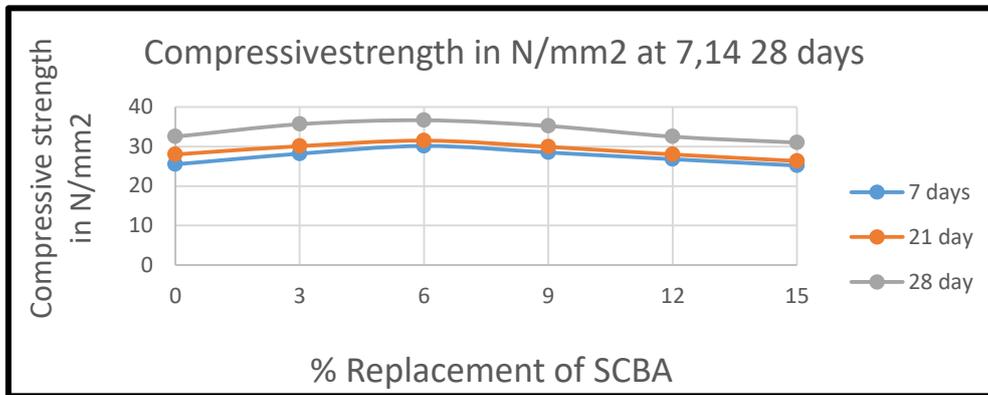


Fig. 5.4 Effect of SCBS on compressive strength of concrete at 7-days, 21-days and 28 days

From the above table is seen that the compressive strength in M 30 grade of concrete at 7, 21, and 28 days increases when the percentage of the SCBA from 0% to 6%. At 6% replacement of SCBA strength observed to be maximum and after strength is decreasing. The strength increase at 28 days is up to 9.8%, for M30 grade of concrete, As the percentage of sugarcane bagasse ash increases the compressive strength of concrete tends to increase up to certain percentage and then start's decreasing with the increase of ash content. This increase in strength in Sugar cane bagasse ash concrete is due to presence of Silica in Sugar cane bagasse ash. Silica in Sugar cane bagasse ash react with residual CH after the formation of C-S-H gel, and increase the amount of C-S-H gel and results in increase the strength

C.SPLIT TENSILE STRENGTH

Split Tensile Strength of Different Mix of M-20 Concrete

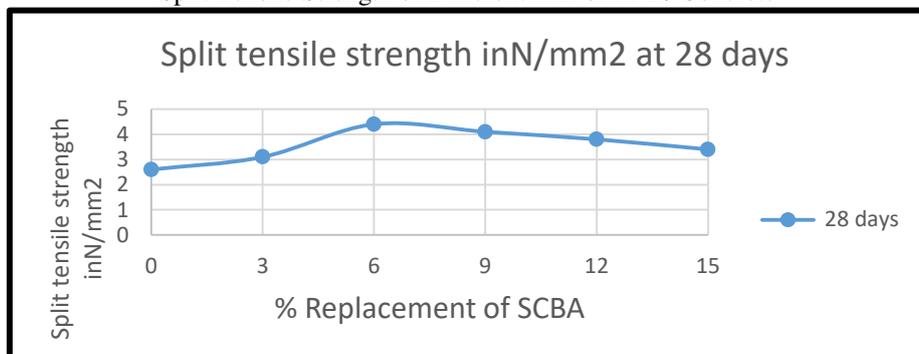


Fig. 5.5 Effect of Sugarcane Bag ash on Split tensile strength of concrete at 28-days

Split Tensile Strength of Different Mix of M-30 Concrete

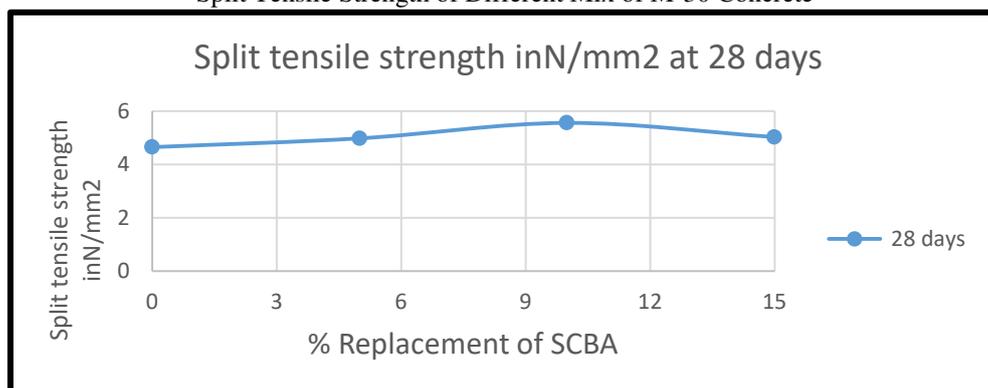


Fig. 5.6 Effect of Sugarcane Bag ash on Split tensile strength of concrete at 28-days



From the test results it has been observed that the Split tensile strength of M20 and M30 grade concrete increases gradually up to 6 % of SCBA, At 6% replacement of SCBA strength observed to be maximum and after strength is decreasing. At 28 day Maximum spilt tensile strength of M20 & M30 grade of concrete is 4.3 N/mm² and 5.5 N/mm²,

D.FLEXURAL STRENGTH

Flexure Strength of Different Mix of M-20 Concrete

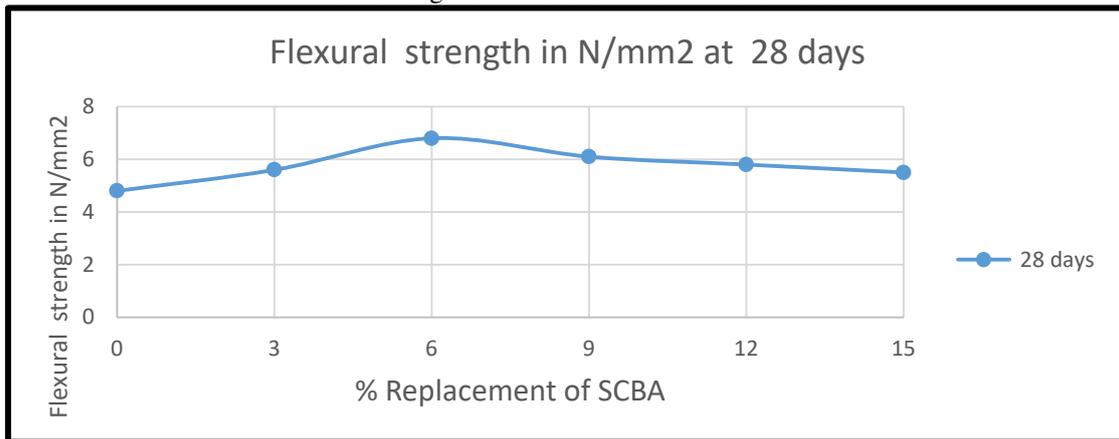


Fig. 5.7 Effect of Sugar cane Bag Ash on Flexure Strength of concrete at 28-days

Flexure Strength of Different Mix of M-30 Concrete

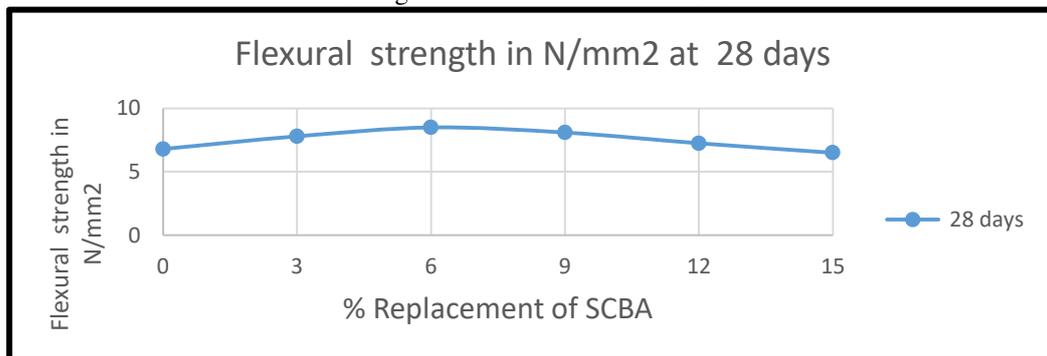


Fig. 5.8 Effect of Sugar cane Bag Ash on Flexure Strength of concrete at 28-days

From the test results it has been observed that the Split tensile strength of M20 and M30 grade concrete increases gradually up to 6% of SCBA, At 6% replacement of SCBA strength observed to be maximum and after strength is decreasing. At 28 day Maximum spilt tensile strength of M20 & M30 grade of concrete is 6.4 N/mm² and 8.5 N/mm²,

VI. CONCLUSION

- As we increase the percentage of SBA workability of concrete also increases for M-20 and M-30.
- From the above Experiment is seen that the compressive strength in M 30 & M20 grade of concrete at 7, 21, and 28 days increases when the percentage of the SCBA from 0% to 6%. At 6% replacement of SCBA strength observed to be maximum and after strength is decreasing. The strength increase at 28 days is up to 9.8%, for M20 grade of concrete, After 6% of SCBA Replacement compressive strength decrease,
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- From the test results it has been observed that the Flexural strength of M20 and M30 grade concrete increases gradually up to 6% of SCBA, At 6% replacement of SCBA strength observed to be maximum and after



strength is decreasing. At 28 day Maximum split tensile strength of M20 & M30 grade of concrete is 6.4 N/mm² and 8.5 N/mm²

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