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Cement is Partially Replaced in Concrete by Sugarcane Bagasse Ash

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***Abstract*— According to studies, every ton of cement produced emits half a ton of CO_2, so there is an essential need to reduce cement consumption. Materials wastes, such as Sugar Cane Bagasse Ash (SCBA), on the other hand, are difficult to dispose of, posing an environmental risk. Bagasse ash gives concrete a high early strength while simultaneously lowering its permeability. During hydration, the silica present in the Bagasse ash combines with cement components, imparting additional qualities such as chlorine resistance, corrosion resistance, and so on. As a result, using SCBA in concrete not only eliminates pollution but also improves the qualities of concrete while lowering the cost. The aim of the research on replacing the cement with SCBA in predetermined quantities and examining the impact of magnesium sulphate on Sugar Cane Bagasse Ash blended concrete. The cubes were cast and cured in normal water for 7, 14, and 28 days using a concrete mix that varied the quantities of Bagasse ash for 0 percent, 5 percent, 10 percent, and 15 percent, and qualities such as slump cone and compaction factor test for fresh concrete, and compressive strength and split tensile strength test for hardened concrete were confirmed and results were analyzed. The specimens were tested after 28 days of curing to determine their maximum compressive strength and split tensile strength. The concrete grade used in this study was M25.**

***Index Terms*— Sugarcane Bagasse ash, Cement, Bagasse ash is used as replacing of cement, M25 Grade concrete, Compressive & Split tensile Strength.**

I. INTRODUCTION

In present era Cement is using as a binding material for construction, from the researchers' investigations using cement is harmful to environment. It releases harmful toxic substances to the atmosphere at the time of production. So that researchers doing analysis by introducing supplementary materials. Sugar cane bagasse ash has been tested for use as a cement substitute in several regions of the world. It was found that improves the properties such as paste, mortar and water tightness and compression strength of the concrete replaced percentage and fineness. The greater silica concentration of bagasse ash has been postulated as the key reason for these improvements. Although the amount of silicate in the ash varies depending upon the burning conditions and other parameters or qualities of the raw materials, such as the type of the soil on which the sugarcane is cultivated.

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TABLE I. PROPERTIES OF SUGARCANE BAGASSE ASH

S. No	Components	%
1.	Silica	63
2.	Alumina	31.52
3.	Ferric Oxide	1.78
4.	Manganese Oxide	0.0039
5.	Calcium Oxide	0.475
6.	Magnesium oxide	0.4

II. LITERATURE REVIEW

Mr. G. Siva Kumar et al., concluded that using sugar cane bagasse ash will results early heat of hydration and the formation of C-S-H gel enhance the strength and hence bagasse ash is a potential replacement material for cement.

Mr. H.S. Otuoze et al., revealed that, an optimum of 10% SCBA blends with OPC could be used for reinforced concrete with dense aggregate.

Urooj Masood The results of this research indicated (10% sugarcane bagasse ash) in blended concrete had significantly higher compressive strength, as compare to 20% sugarcane bagasse ash. Sugarcane bagasse ash is pozzolanic material which may be utilized in the production of pozzolanic cement concrete which leads to reduction.

Vikas Srivastava, In their study of have finalized that the use of fly ash up to 20% increased the compressive strength and beyond that resulted in decrease in the workability and strength of the concrete.

B. Madhusudan Reddy et al., studied the effect of HCl on blended cement (fly ash) and silica fume blended cement and their concretes. They concluded that the compressive strengths reduction of fly ash blended concrete and silica fume blended concrete was 2 to 19% at 28 and 90 days.

III. MOTIVATION

As the cement manufacturing increasing the carbon dioxide content which results in increase of global warming and in the other hand the recycling of SCBA becoming hazardous to the environment. So based on the literature I come to know that SCBA increase the strength of the cement.

IV. PROBLEM DOMAIN

As we know that SCBA increases the strength of the concrete so, we partially replaced the SCBA by 0%, 5%,10% and 15% along with water- cement ratio of 0.5%.

V. PROBLEM DEFINITION

To reduce the environmental hazardous caused by the cement manufacturing and SCBA and to convert SCBA into useful manner in the concrete.

VI. STATEMENT

Replacing of SCBA partially to the cement increases the strength and we can use as alternative for the cement up to some percentages.

VII. METHODOLOGY

The primary goal of this study to replace the cement partially using sugarcane bagasse ash. The cement was replaced by its weight at 0%,5%,10%,15%. By maintaining 0.5 water cement ratio. The main focus of this research is on compressive and split tensile strength.

VIII. MATERIAL PROPERTIES

The following part describes the materials used in this study as per the standards.

A. Cement

In this investigation, 53-grade Portland pozzolana cement [11] was used. The cement properties are given in the table below.

TABLE II. PROPERTIES OF CEMENT

S. No	Characteristics	Values Obtained
1.	Normal Consistency	33%
2.	Initial Setting Time	48 min
3.	Final Setting Time	240 min
4.	Fineness	4.80%
5.	Specific Gravity	3.15

B. Fine Aggregate

The sand utilized in this investigation was local sand that was validated by IS 383-1970 [12]. The fine aggregate properties are shown in the below table.

TABLE III. PROPERTIES OF FINE AGGREGATE

S. No	Characteristics	Values Obtained
1.	Type	Uncrushed (Natural)
2.	Specific Gravity	2.53
3.	Fineness Modulus	2.99
4.	Grading Zone	1

C. Coarse Aggregate

The sand utilized in this investigation was local sand that was validated by IS 383-1970 [12]. The properties of fine aggregate are listed in the table below.

TABLE IV. PROPERTIES OF COARSE AGGREGATE

S. No	Characteristics	Values Obtained
1	Type	Crushed
2	Maximum Size	20 mm
3	Specific Gravity (20 mm)	2.69
4	Total Water Absorption (20 mm)	1.14%

D. Water

Potable tap water was used in this study according to IS 456:2000 [13]

IX. EXPERIMENTAL PROCEDURE

A. Mix Design

Is 10262-2009 [10] and IS 456:2000 [13] were used to design the M25 grade of conventional concrete (CC). For 28 days of curing, the intended strength of M25 grade conventional concrete was around 32Mpa. Sugarcane bagasse ash blended mix made using the intended M25 grade of conventional concrete by replacing the cement and SCBA blended concrete at various amounts of 0%, 5%, 10%, and 15% of CC cement weight while maintaining a consistent liquid-binder ratio (0.5) that impacts compressive strength. The proportions of the design mix are presented below.

TABLE V. MIX DESIGN PROPORTIONS

Ingredients	Quantity in kg/m^3
Cement	360
Water	180
Fine Aggregate	715
Coarse Aggregate	1140
Water- Cement Ratio	0.5

B. Testing of hardened mechanical properties

The mechanical properties of hardened concrete were calculated for design mix and these includes compressive strength, split tensile strength. Three cubes of 150 mm size were casted and tested the compressive strength of each age and each mix. Three cylindrical specimens of 150mm x 300mm in size were casted and tested for each age and each mix. The three samples average were calculated for each mechanical property. The weight and volumes are measured prior to compression and split tensile strength test was determined after 7,14, and 28 days of curing.

X. Results

A. Compressive strength test

The cube compressive strength of concrete mixed is shown in table below. The compressive strength values increased from 0 percent of SCBA to 5 percent of SCBA, 10 percent of SCBA, and slightly dropped from 10 percent of SCBA to 15 percent of SCBA after 7,14,28 days of curing, according to the results.

TABLE VI. RESULTS OF COMPRESSIVE STRENGTH TEST

Quantity of Concrete (percentage of SCBA in Cement) / Days	0	5	10	15
7	19.98	20.51	22.29	21.1
14	25.92	23.433	29.18	21.44
28	31.62	32.51	34.33	32.29

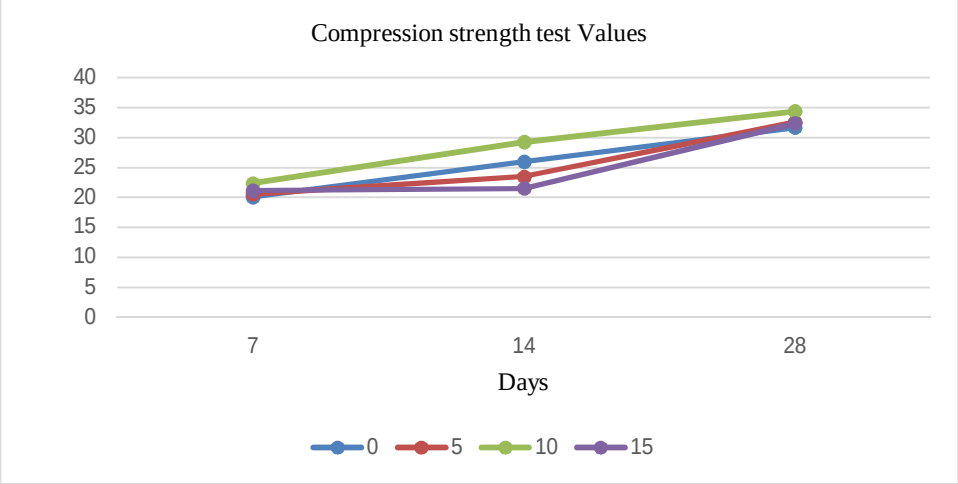

Fig. 1. Graph Showing Results of Compressive Strength values

B. Tensile strength test

The split tensile strength test of the concrete mix is shown below. These values are dramatically enhanced from 0 percent of SCBA to 5 percent of SCBA, 10 percent of SCBA, and a quick decline in the values from 10 percent of SCBA to 15 percent of SCBA after 7,14,28 days of curing, according to the data.

TABLE VII. RESULTS OF TENSILE STRENGTH TEST

Quantity of Concrete (percentage of SCBA in Cement) / Days	0	5	10	15
7	2.47	2.82	4.24	1.94
14	2.82	3.18	4.59	2.47
28	3.11	4.17	5.37	2.68

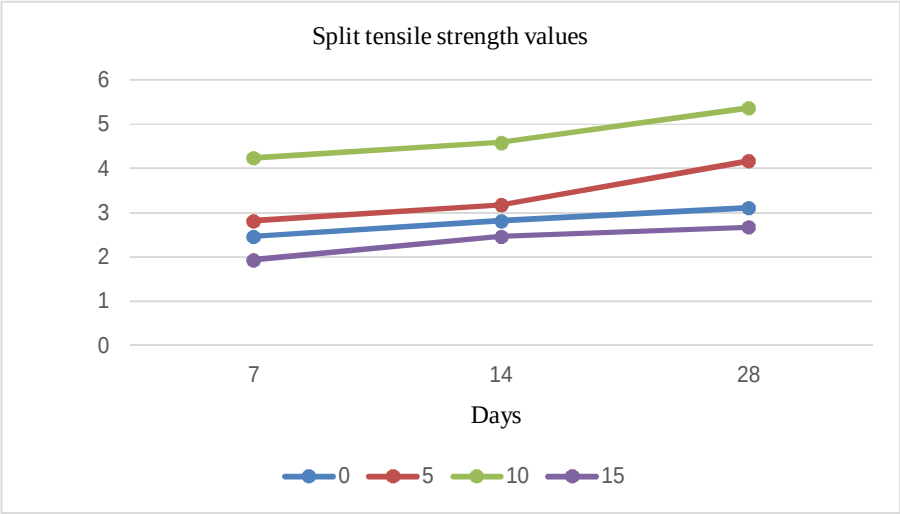

Fig. 2. Graph Showing Results of Tensile Strength values

XI. Conclusion

1. The maximum compressive strength is achieved by replacing cement with waste sugar cane bagasse ash
2. At all curing intervals, the ten percent SCBA has a considerable impact on all mechanical properties of CC
3. 10% of SCBA blended mix has attained the M25 grade CC 28 days desired strength
4. It was found that 10% of SCBA require for construction as it satisfies the compressive strength value but it is noted then 15% of SCBA strength values were decreased in all mechanical properties.
5. It was noted that further increment of 10 % of SCBA leads to decrease in all mechanical properties.
6. This leads to the conclusion that compressive strength can be used to describe mechanical qualities

As Sugarcane bagasse ash was used in this investigation that can says it is recent trends of construction materials.

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