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STUDY ON SUGAR CANE BAGASSE ASH IN CONCRETE BY PARTIAL REPLACEMENT OF CEMENT

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***Abstract*—Admixtures are commonly used in concrete to improve the properties of both fresh and hardened concrete. Mineral admixtures include Fly Ash (FA), Silica Fume (SF), Ground Granulated Blast Furnace Slag (GGBFS), Metakaolin (MK), and Rice Husk Ash (RHA) etc, which possess certain characteristics through which they influence the properties of concrete differently. In this study Sugar Cane Bagasse Ash (SCBA) has been used as a Mineral Admixture to improve the properties of concrete. Approximately 1500 Million tonnes of sugarcane is annually produced over all the world which leave about 40-45 % bagasse after juice crushing for Sugar Industry giving an average annual production of 675 Million tonnes of bagasse as a waste material.**

The utilization of industrial and agricultural waste produced by Industrial processes has been the focus of waste reduction, research for economic, environmental, and technical reasons. Sugarcane bagasse ash is one of the main byproduct can be used as mineral admixture due to its high content in silica (SiO2). In this study concrete Cubes, Cylinders and Prisms are casted with different percentages of Sugar cane bagasse ash replaced with cement by weight and Compressive strength, Split tensile strength and Flexural strength have been tested for 7 days, and 28 days.

Keywords— **Sugar Cane Bagasse Ash, Admixture, Environment, Strength.**

I. INTRODUCTION

In view of global warming, efforts should be made to reduce the emission of CO2 to the environment. Cement industry has a major contribution to the global warming, so in this study an attempt has been made to reduce the percentage of cement in making concrete by adding supplementary material called as Sugar Cane Bagasse Ash (SCBA). SCBA is also having a great disposal problem again it leads to the great environmental pollution. The use of SCBA in concrete can reduce the consumption of cement in making concrete and also reduce the disposal problem. For the experimental work, we have collected the SCBA from Dudhaganga sugar factory, which is near to Chikodi Tq. Belagavi Dist. Karnataka.

II. INGREDIENTS USED IN MIX DESIGN

Cement:

In this study 43 grade Ordinary Portland Cement conforming to BIS 12269 was used, the test results on cement sample are shown in below Table.

Table 1. Specific gravity of cement

Properties	Results
Specific gravity	3.15
Finess of Cement	3%
Specific surface area	3564.025 sq. cm/gm

Coarse Aggregates:

Aggregates are the important constituents in concrete. They give body to the concrete. In the present study Crushed stones of 20 mm down size were used as coarse aggregate. Properties of coarse aggregates are shown in below Table.

Table 2. Physical properties of Coarse Aggregates

Properties	Results
Aggregate impact value	11.70%
Aggregate crushing value	14.88%
Specific gravity	2.5
Water absorption	0.61%

Fine Aggregates:

Those fractions from 4.75mm to 150 microns are termed as fine aggregates. The river sand and crushed sand is to be used in combination as fine aggregate conforming to the requirements of IS: 383. In this study local river sand was used as fine aggregate in the concrete mixtures. Properties of fine aggregates are shown in below Table.

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Table 3. Physical properties of Fine Aggregates

Properties	Results
Specific gravity	2.42
Finess modulus	4.70%

Water:

Water is an important ingredient of concrete as it actually participates in the chemical reaction with cement.

Bagasse Ash:

Bagasse is a by-product during the manufacture of sugar and it has high calorific value. It is utilized as a fuel in boilers in the sugar mills to generate steam and electricity. The obtained Sugarcane Bagasse Ash causes a great disposal problem. Using waste SCBA as a pozzolanic material to replace cement can reduce the consumption of cement and reduce landfill area requirements. This is turn helps solve environmental issue caused by cement production, decreasing both energy based and CO2 emissions. Below Figure shows the production of Bagasse Ash in the Industry.

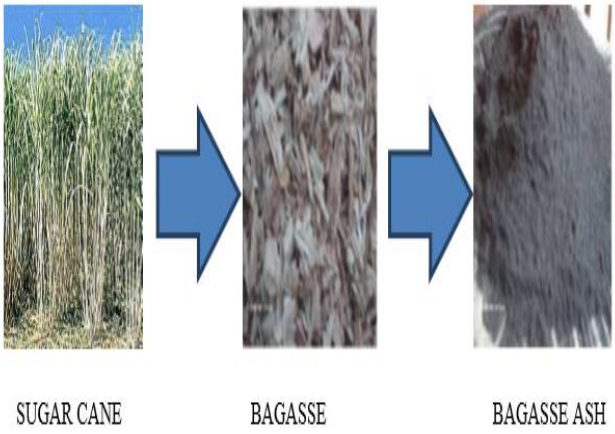

Fig. 1. Flow Diagram of Bagasse Ash Production

For the present study the Sugar Cane Bagasse Ash is collected from Dudha Ganga Sugar Industry, Nandi, Chikodi Tq. Belagavi Dist. Karnataka.

III. EXPERIMENTAL WORK

Mix Design:

Mix design can be defined as the process of selecting suitable ingredients of concrete and determining their relative proportions with the object of producing concrete of certain minimum strength and durability as economically as possible.

A mix M30 grade was designed as per Indian Standard (IS 10262-1982) method and the same was used to prepare the test samples.

Mix calculation:

Cement	= 438 Kg/m3
Water	= 197 litres/m3
Coarse aggregate	= 1111.481 Kg/m3
Fine aggregate	= 710.619 Kg/m3

Proportion:

M30 grade	= 1:1.51:2.40

Concrete cubes, Cylinders and Prism have been prepared by varying percentage of Sugar Cane Bagasse Ash (SCBA) as a cement replacement material by 0%, 10%, 20%, 30% respectively and compressive strength, Split tensile strength and Flexural strength test had been conducted on samples for 7 and 28 days.

Compressive strength test is the most common test conducted on hardened concrete as it is an easy test to perform and also most of the desirable characteristic properties of concrete are qualitatively related to its compressive strength. The compression test is carried out on specimen cubical in shape.

Following Table shows average 7 days & 28 days compressive strength of cubes prepared with varying percentage of Bagasse Ash.

Table 4. Average Compressive Strength of Concrete Cubes with varying percentage of Bagasse Ash (BA).

Type of Concrete	Compressive Strength in MPa	
	7 days	28 days
Normal concrete	17.18	31.62
5% BA concrete	18.15	33.92
10% BA concrete	20.14	39.69
20% BA concrete	24.84	42.19
30% BA concrete	24.03	34.50

Similarly Table 5 and 6 shows average 7 days & 28 days split tensile strength and flexural strength of concrete prepared with varying percentage of Bagasse Ash.

Table 5. Average Split Tensile strength of concrete cylinders with varying percentage of Bagasse Ash (BA).

Type of Concrete	Split Tensile Strengths in MPa	
	7 days	28 days
Normal concrete	1.35	2.44

5% BA concrete	1.4	2.88
10% BA concrete	1.45	3.53
20% BA concrete	1.67	3.81
30% BA concrete	1.17	2.8

Table 6. Average Flexural Strength of Concrete Beam with varying percentage of Bagasse Ash (BA).

Type of concrete	Split Tensile Strength	
	7 days	28 days
Normal concrete	2.01	2.41
5% BA concrete	2.00	2.62
10% BA concrete	2.55	2.81
20% BA concrete	2.53	3.25
30% BA concrete	1.69	2.62

IV. CONCLUSION

Sugar Cane Bagasse Ash is a waste product from Sugar Factory, available in huge quantity and have a great disposal problem leads to environmental pollution. Utilization of this waste product in the preparation of concrete is economical and also solve some environmental pollution issues.

From the experimental results it is concluded that, the Sugar Cane Bagasse Ash can be effectively utilized as cement replacement material up to 20%. Because addition of SCBA as a cement replacement material has increased the compressive strength, Split Tensile strength and Flexural Strength of concrete up to 20%, further addition of SCBA have an effect on strength and workability of concrete.

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