International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2018): 7.426

# A Revolutionary Impact of Sugarcane Bagasse Ash in Concrete

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**Abstract:** ***This Experimental study investigates the compressive strength of concrete using Portland Pozzolana Cement and Sugarcane bagasse ash. Sugarcane Bagasse ash was obtained by burning of sugarcane. This experimental study conducted to examine the potential of sugarcane bagasse ash as a cement replacing material which is similar to that of portland pozzolana cement. Two different concrete mixes with the bagasse ash replacement of 0%,5% to the Portland Pozzolana Cement were prepared for M10 and M20 Grade concrete with water to cement ratio of 0.5 and 300Kg/m3 cement content respectively. In this study an attempt has been made to study the various properties of concrete mix replacing cement by sugarcane bagasse ash in a systematic manner.***

**Keywords:** Sugarcane Bagasse Ash, Concrete, Compressive Strength, Admixture

## 1. Introduction

Portland Pozzolana cement is recognized as a major construction material throughout the world. Portland cement is the conventional building material that actually is responsible for about 5% - 8% of global CO2 emissions. This environmental problem will most likely be increased due to exponential demand of Portland cement. Researchers all over the world today are focusing on ways of utilizing either industrial or agricultural waste, as a source of raw materials for industry. This waste, utilization would not only be economical, but may also result in foreign exchange earnings and environmental pollution control. Several researchers and even the Portland cement industry are investigating alternatives to produce green building materials. Industrial wastes, such as blast furnace slag, fly ash and silica fumes are being used as supplementary cement replacement materials. Currently, there has been an attempt to utilize the large amount of bagasse ash, the residue from an in-line sugar industry and the bagasse-biomass fuel in electric generation industry. When this waste is burned under controlled conditions, it also gives ash having amorphous silica, which has pozzolanic properties. Therefore it might possible to use sugarcane bagasse ash (SCBA) as cement replacement material to improve quality and reduce the cost of construction materials such as mortar, concrete pavers, concrete roof tiles and soil cement interlocking block etc.

## 2. Literature Review

(1) Worell et al (2001) investigated the carbon dioxide emissions from global cement industries. The results showed that the cement industry contributes about 5% to global anthropogenic CO2 emissions from calcination of lime stone and combustion of fuels in a kiln. China has the largest share of total emission (33%) followed by United States (6%), India (5%), Japan (5%) and Korea (4%).

(2) Husem (2006) studied the variation of compressive and flexural strengths of ordinary and high-performance micro-concrete at high temperatures. In the experiment, concrete specimens were exposed to high temperatures (200, 400, 600, 800 and 1000°C) and cooled differently (in air and water). Compressive and flexural strengths of these concrete samples were compared with each other and then compared with the samples which had not been heated. The results indicated that concrete strength decreases with increasing temperature, and the decrease in the strength of ordinary concrete is more than that in high performance concrete. The type of cooling also affects the residual compressive and flexural strength.

(3) Aggarwal et al (2007) studied the effect of coal bottom ash as replacement of fine aggregates in concrete. The various aspects such as workability, compressive strength, flexural and splitting tensile strength were studied in the experiment. Five mix proportions were made by replacing sand with CBA by weight. First was control mix (without CBA), and the other four mixes contained CBA. The proportions of fine aggregate were replaced ranged from 20% to 50%. The 150 mm concrete cubes were cast for compressive strength, 150×300 mm cylinders for splitting tensile strength and 101.4×101.4×508 mm beams for flexural strength. The tests were performed at 7, 28, 56, 90 days in accordance with the provisions of the BIS: 516-1959. The results pointed out that compressive strength, splitting tensile strength and flexural strength of CBA concrete specimens were lower than control concrete specimens at all the ages. The strength difference between CBA concrete specimens and control concrete specimens became less distinct after 28 days. The results also showed that the workability of concrete decreased with the increase in CBA content due to the increase in water demand.

(4) Souza et al (2007) studied the effects of addition of various proportions of SCBA on the properties of mortar and concretes. The ash was partial substituted (0%, 10%, 20% and 30%) with cement at constant w/c ratio of 0.5. The study has been conducted as follows: workability with the flow table test, compressive strength at the ages of 1, 7, 14, 21

and 56 days, total water and capillary absorptions after 28 days of curing, pore size distribution at the age of 28 days, gas permeability at the ages of 1, 7, 14, 21 and 28 days and pore size 5 distribution. The results revealed that SCBA can be replaced up to 20% and water capillary sorption increased as with the addition of SCBA.

## 3. Materials and Properties

This chapter briefly explains the materials used and methods adopted to conduct the study of compressive strength of concrete containing SCBA.

The materials used in this investigation are:

1) **Sugarcane Bagasse:** During the experimental study Sugarcane bagasse has been obtained from the local quarries, which is followed by drying of sugarcane bagasse for about 24 hours. After the drying procedure sugarcane bagasse has been burnt in technical lab at a particular temperature. This results in sugarcane bagasse ash.
2) **Cement:** Portland Pozzolana cement of grade 53 has been used during the experimental study. The testing of cement is done as per IS 1489 PART 1.
3) **Coarse aggregate:** The coarse aggregate used in the study is 10mm and 20mm size locally available crushed stone.
4) **Fine aggregate:** The fine aggregate used in this study for concrete mix is ordinary river sand passing through 4.75mm IS sieve.
5) **Water:** In this project clean potable water was used for both mixing and curing of concrete. It was free from organic matter, silt, oil, sugar, chloride and acidic material.
6) **Admixture:** Ambuja Blockol High strength adhesive has been used in the study. Ambuja Blockol is grey in colour and used in concrete as it provides the high strength to the concrete and it works as an accelerator its compressive strength is 1200 and its ph value is 40 which helps to increase the setting time of cement.

**Figure 1:** Sugarcane Bagasse

## 4. Experimental Programme

During this experimental study 0% and 5% of SCBA was replaced by cement, water cement ratio was 0.5%.Total 8 number of cubes were casted of M10 and M20 grade of concrete. Before performing the concrete mix design, sieve analysis of coarse and fine aggregate has been performed. Different sizes of sieve used during sieve analysis of coarse and fine aggregate are: 63mm, 40mm, 20mm, 10mm, 4.75mm, 2.36mm, 1.18mm, 600mic, 300mic, 150mic.

Cube size used of 150 mm x 150mm x 150mm. Concrete poured in cube mould and was compacted thoroughly with the tamping rod and the surface of cube mould was leveled by using trowel. After 24 hours setting of concrete cube, the cube was removed and cured under water tank for period of 7 and 28 days. The cubes were taken out from the water tank for testing compressive strength, and it was tested using 1000KN compression testing machine.

## 5. Experimental Results

According to the experimental study there is a variation of compressive strength of M10 and M20 grade of concrete after 7 and 28 days with replacement of cement with SCBA(0-5%).

Compressive strength with admixture is higher as compared to compressive strength without admixture.

## 6. Conclusion

In this experimental study it has been observed that with the increase in cement replacement with SCBA (0-5%) there is decrease in compressive strength of M10 and M20 grade of concrete and it has also been experienced during the experimental study compressive strength with admixture is higher as compared to compressive strength without admixture.

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