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Effect of Sugarcane Bagasse Ash in Concrete

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ABSTRACT: Concrete, as a major construction material, is being used all around the world. Ordinary Portland Cement (OPC) is used as Primary binder in concrete, where production of cement releases large amount of Carbon di-oxide (CO_2) to atmosphere. So in order to reduce the Environmental impact and sustainable use of agricultural wastes efficiently, in this experimental research Sugarcane Bagasse Ash (SCBA) is used as partial replacement of cement. M30 Grade Cubes, Cylinders were casted as per Indian Standards with Replacement of SCBA proportions (0%, 5%, 10% and 15%) of Cement. At 28 days testing it is found that with 5% replacement the compressive strength increases about 12% and Splitting tensile strength increases about 8%.

KEY WORDS: Concrete, Sugarcane Bagasse Ash,Compressive strength, Split Tensile Strength test.

I. INTRODUCTION

Concrete is the most widely used building material which is a mixture of cement, sand, coarse aggregate and water. Ordinary Portland Cement (OPC) is conventionally used as the primary binder to produce concrete. Production of one tonne of cement requires about 2 tonnes of raw materials of shale and limestone, and also releases large amount of carbon dioxide (CO_2) to the atmosphere that significantly contributes to Greenhouse gas emissions. The amount of Carbon dioxide released during the manufacturing process of OPC is in the order of 1 ton for every ton of OPC produced. Globally, the OPC production contributes about 7% of the world's Carbon dioxide. This is adding about 1.6 billion tonnes of Carbon dioxide to the atmosphere. Therefore there is a need to find an alternative type of binders to produce more environmental friendly concrete. The construction industry forms a vital sector of the nation's economy. Utilization of the Agricultural Waste in a Sustainable way reduces the environmental impact. Sugarcane is the largest crop by production quantity in the world. A large amount of wet bagasse is yielded and the management of this residue is of great importance from an environmental point of view. The combustion of this bagasse is one of the most common practices, resulting in the production of an additional residue, the sugarcane bagasse ash (SCBA). Chemical composition of SCBA makes it a potential supplementary material in Portland cement blends and also in geopolymeric binders. Fineness, crystallinity, and the presence of unburned particles are crucial for the development of pozzolanic reactivity and for having good mechanical performance.

1.1 SCOPE OF THE WORK

The objectives of this study are:

- To study and compare the mechanical and durability properties Sugarcane Bagasse Ash (SCBA) replaced concrete with conventional concrete.
- Necessary materials are to be collected (Cement, Sand, Fine aggregate, Coarse aggregate, Bagasse Ash,) and the test are done (Finess test, Specific gravity, Moisture test, Aggregate test).
- Mix design as per requirements is prepared based on the test values as per code book.
- Fresh concrete tests are carried over and the quality of concrete is found.
- The specimens are then casted & Cured for 28 days test in required shapes i.e. Cubes, Cylinders.
- Standard hardened concrete test are done to find strength of concrete.The test results are then compared with standard values and Concrete nature found.
- To control the adverse effect of pollution because of disposal of Agricultural waste (bagasse ash) in a effective way.

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II. LITERATURE REVIEW

Sajjad Ali Mangi.,et al., (2017), presented the s the suitability of sugarcane bagasse ash (SCBA) in concrete used as partial cement replacement. Two grades of concrete M15 and M20 were used for the experimental analysis. The cement was partially replaced by SCBA at 0%, 5%, and 10%, by weight in normal strength concrete (NSC). The innovative part of this study is to consider two grades of concrete mixes to evaluate the performance of concrete while cement is replaced by sugarcane bagasse ash. The cylindrical specimens having size 150 mm x 300 mm were used and tested after curing period of 7, 14 and 28 days. It was observed through the experimental work that the compressive strength increases with incorporating SCBA in concrete. Results indicated that the use of SCBA in concrete (M20) at 5% increased the average amount of compressive strength by 12% as compared to the normal strength concrete. The outcome of this work indicates that maximum strength of concrete could be attained at 5% replacement of cement with SCBA. Furthermore, the SCBA also gives compatible slump values which increase the workability of concrete.

S.Praveenkumar.,et al., (2017**),**studied the use of supplementary cementitious materials has become an integral part of high-strength and high-performance concrete mix design, which may be natural by-products or industrial wastes. Some of the frequently used supplementary cementitious materials are fly ash, silica fume, ground granulated blast furnace slag, rice hush ash and bagasse ash (BA). BA (sugarcane industry waste product) is considered to be an active pozzolan because of its large surface area with significant amount of amorphous SiO_2. The mix design for high-performance concrete is done as per the method proposed by P. C. Aitcin. This method is simple and follows the same approach as ACI 211-1 standard practice for selecting proportion of normal, heavy and mass concreting. Ordinary Portland cement was replaced at different levels of 0%, 5%, 10%, 15% and 20% by BA. This investigation presents results on the strength and durability properties of high-performance concrete with and without BA, which includes cube compressive strength, splitting tensile strength, flexural strength, saturated water absorption, sorptivity, porosity, impact test and alkalinity measurement. The test results indicate that the incorporation of BA up to 10% provides improved properties of hardened concrete.

Nasir shafiqet al., (2018),investigated the effects of refined sugarcane bagasse ash (SCBA) as partial replacement for cement on the properties of fresh and hardened concrete. The study verified that SCBA shows promising results of its use as a cement replacement material (CRM). The potential of SCBA as a CRM was found because of its chemical composition, fineness and well-controlled incineration process. The availability of bagasse is also a positive indicator for the sustainable supply of SCBA as CRM. In the world, approximately 1500 Mt of sugarcane is annually produced, which yields approximately 40–45% bagasse after juice extraction in sugar mills. In this study, SCBA content was varied from 5 to 50% as partial replacement of cement. The effects of SCBA on the workability, compressive strength, splitting tensile strength and bond strength of concrete were investigated. The results showed that the addition of SCBA (5–50% content) increased the slump value of fresh concrete. The mechanical properties (compressive strength, splitting tensile strength and bond strength) of concrete made of 5–30% SCBA showed a reasonable enhancement in the results in comparison with the 100% cement concrete.

Omar Dahham et al., (2020), presented on the use of bagasse debris for sugarcane in concrete cement. The bagasse ash for sugarcane waste product. The bagasse ash is the waste material of the combustion of bagasse for energy in sugar plants. The bagasse debris is normally arranged in landfills and is presently effecting on a natural environment. Experimental work included pouring a concrete of C30 grade were and testing to investigate the concrete mechanical properties, slump test, elevated temperatures test and bond strength test. The bagasse ash was partially replaced with cement in percentages of (0, 3, 5, 7 and 10) % by of cement weight. The results of tests indicated that the best quantity was 7% by weight of cement gives the best compressive and tensile strength.

III. MATERIALS USED

3.1 Cement

Ordinary Portland Cement (OPC) of 53grade conforming to Indian standard code IS: 12269 are used in concrete.

3.2 Sugarcane Bagasse Ash (SCBA)

Sugarcane Bagasse Ash collected from the nearby sugar mill. A large amount of sugarcane processed on sugar mill and sugarcane bagasse is burn in boiler around at temp 400C to 600 C. The samples were collected from the landfill of the sugar mill. The Sieving is done in the laboratory to remove other dust particles and the fine sugarcane ash obtained.

3.3 Fine Aggregate

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The fine aggregate used for the experimental program was locally procured and conformed to Indian Standard Specifications IS: 383-1970.

3.4 Coarse Aggregate

The crushed stones are collected from nearby areas. The nominal size of these aggregates is 12 mm, Spherical in shape.

IV. CONCLUSIONS

From the present investigations, the results are concluded as

- At 5% replacement of cement with sugarcane bagasse ash, the compressive strength of concrete increases about 12% and the Split Tensile strength of concrete increases about 8%. There is a decrease in strength beyond 5% replacement of cement with sugarcane bagasse ash.
- The weight of specimen decreases by the increase in proportions of Sugarcane Bagasse Ash.

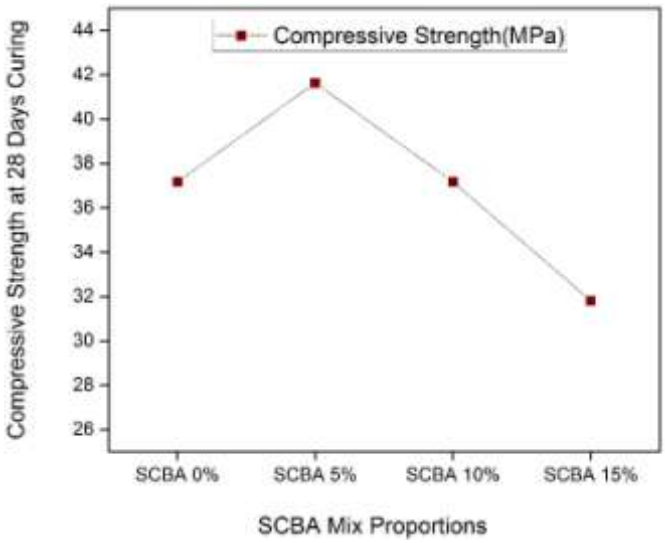

Chart – 1: Compressive Strength of Cubes

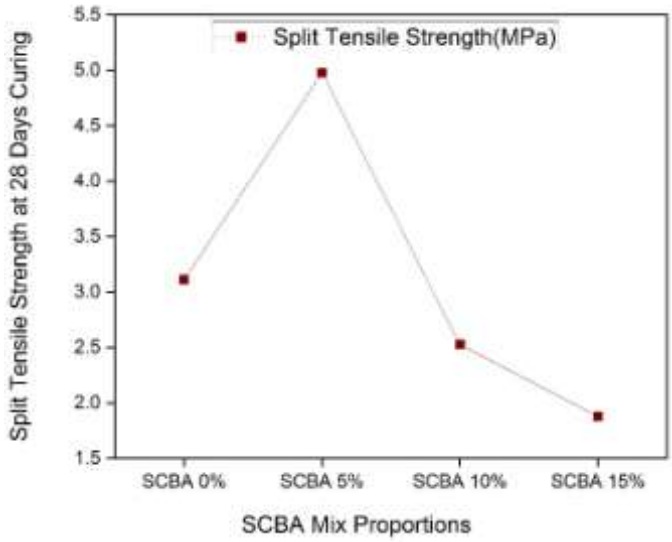

Chart – 2: Split TensileStrength of Cylinders

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