Incorporation of Sugarcane Bagasse Ash as Partial Replacement of Cement in Concrete

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***Abstract*— Sugarcane Bagasse ash is a by-product of sugar mills found after burning bagasse which is found after extracting all the economical sugar from sugar cane. On the other hand, the strengthening of construction activities in the country has led to a shortage of most of the concrete manufacturing materials, especially cement, which has led to anincrease in prices. This study examined the potential use of sugarcane ash as an alternative material for cement. In this paper we obtained an optimal percentage of 2%, which means that we obtained high workability and strength from locally available cheap materials such as sugar cane bagasse, in contrast to cement sugar cane bagasse, which is also environmentally friendly. The study also indicates that sugarcane bagasse ash can be effectively used as a cement substitute (up to 10%) without significant change in strength. This project is mainly concerned with replacing cement with bagasse ash in solid proportions and analyzing the effect of HCL onSCBA mixed concrete.**

***Index Terms*— *Sugarcane bagasse, Silica Flume,* sugar mills, Cement**

I. INTRODUCTION

Bagasse ash is a by-product of sugarcane milling process in sugar factories and is an agricultural/industrial waste. Sugarcane is a primary crop that is grown in the regions of Mysore and Mandya. Around 8 sugar mill plants in and around the Mysore and Mandya districts create sugar by extracting cane juice from around 30 lakh m tons of sugarcane every year.

The test result shows that the strength of the concrete increasesby up to 10%. Sugar cane bagasse ash replacement with cement. The experimental investigation shows that SCBAcan be effectively used as a substitute for cement in about 10% to 15% to achieve better concrete strength. The aim of this project is to investigate the influence of the partial replacement of Portland cement with sugar cane bagasse in concrete exposed to different curing environments-(1). Sugarcane bagasse (SCB) is a substantial by-product manufactured by sugar mills when sugarcane juice is extracted. A sugar mill generates about 300kg of bagasse forevery tons of sugarcane crushed. Bagasse is a by-product ofthe sugar cane industry, so its quantity is restricted. It is, however, widely used as a fuel to heat furnace in thesame sugar factory which produces 3-5 percent bagasse ash,which contains a high amount of incomplete combustion materials, silicon, aluminum, iron, and calcium oxides. As aconsequence, bagasse ash is categorized as an industrial or agricultural waste, presenting disposal difficulties. Several tests were conducted to determine the optimum burning time and temperatures for obtaining crystalline and reactive bagasse ash (BA). BA was produced in this study by burningBA at 600°C-800°C under controlled conditions and then evaluating its physical, chemical, and mineral characteristicsand see if it can be used as a binder in concrete applications.Within Mysore and Mandya regions, bagasse ash is a locallyavailable cementitious material**. (2)**

Concrete is a widely used materials in the production of buildings and special structures. In the case of an unexpectedfire, the concrete in a building change both its physical and chemical properties. As a consequence, it is critical to comprehend the properties of concrete exposed to higher temperature changes (200°C, 400°C, 600°C, and 800°C) for2 hours. Cracks can result in formation of extreme temps. These cracks, like any other crack, can lead to the loss of strength, structural stability, and service life reduction. This significant effect was primarily driven by unfavorable $Ca(OH)_2$ that can be minimized by using admixtures like SCBA, Silica Fume, and Fly Ash.

In number of countries like tropical and subtropical regions the important food crop is sugarcane. One of the major sources from sugar production is sugarcane. We get sugarcane bagasse ash as unusable material after the extraction of sugarcane juice. By control burning of sugarcane bagasse, we can obtain bagasse ash. Inconvenience can be occurred by disposing it straight into open land garbage can get accumulated in that area. We can get 280 kg of bagasse waste from 1000 kg of sugarcane. It leads to the formation of environmental and economics related problems huge efforts are gear up in global in bagasse waste management i.e., Application, disposing method, and handling. By using the waste material in concrete, we can decrease the burden to environment. The sugarcane industry produces a sugarcane bagasse ash waste or non-usable material. We can replace the concrete sugarcane bagasse ash and in south Asian region this is called as cash crop because of high worth in it for relating sugar and production it is an important.

Sugarcane is a member of grass. The renewable resource from sugarcane is tree-free and in hot regions sugarcane is foremost cultivated agricultural plant. "Carbon neutral (i.e., energy generated is. Equivalent to emission in manufacture of fossil fuels it is the product of choice because of energy conversion rate is more. Yellow-colored tiny light particles are formed by the treatment of lateral production of sugarcane. Cellulose fiber, water and some soil dissoluble materials like cube sugar are the chemical composition for this. Alcohol is formed by passing time cube sugar and methane gas is formed by bagasse fiber evaporation. Which may lead to catch fire in some circumstances. (**3**)

The most commonly used material in construction is concretein all over the world. Because it has properties like durability, workability, mechanically good and low-cost rate. In a built environmental concrete is typically enormous individual material element. We may realize economic benefits and significant environmental, without increasing cost and decreasing performance concrete can be reduced. Concrete consists materials such as Portland cement, aggregate, sand and water. Production of cement emits greenhouse gases; global anthropogenic emission of carbon dioxide is of 5% which being responsible in the production of cement.

II. LITERATURE REVIEW

G Dinesh and G Swathi (2017) investigated an **"experimental study of bagasse ash as a partial substitutefor cement in concrete"**. This project revolves around the use of sugarcane bagasse ash which is a by-product extractedfrom the sugarcane industry. When the juice is extracted fromthe sugar pulp, the bagasse is packed into an airtight graphitecrucible and placed inside an electric control burner oven at 1200°C for 5 hours to obtain black ash. The composition is siliceous oxide and alumina. Bagasse ash is a light material and a highly oxidized compound compared to cement compounds. We took concrete of M30 grade, for this grade we poured cubes of 150 mm * 150 mm * 150 mm and cylinders of 150 mm * 300 mm. We replaced the cement withbagasse ash 2%, 4%, 6% and performed tests for the compressive strength of cubes and split tensile strength of cylinders.

Dr M Vijaya Sekhar Reddy, M. Madhuri (2015) has contemplated the "Utilization of sugar stick bagasse debris (SCBA) in concrete by halfway substitution of concrete". This paper presents that conventional Portland concrete is perceived overall as a significant structure material. Specialists all over the planet are currently zeroing in on ways of involving modern or horticultural waste as a wellspring of unrefined substances for industry. This waste usage wouldn't just be practical, yet can likewise bring about unfamiliar trade profit and contamination control since modern squanders, for example, impact heater slag, fly debris and silica rage are utilized as valuable establishing materials (SCMs). Endeavors are as of now being made to use the huge measure of bagasse debris, the deposits from the sugar business and the bagasse. Biomass fuel in the power age industry. Usage of modern and rural squanders created by modern cycles has been the focal point of waste decrease research for monetary, natural, and specialized reasons. Sugarcane bagasse debris is a stringy side-effect of the sugar refining industry, alongside ethanol fume. Bagasse debris principally contains aluminum and silica particles.

Balaji (2015): explored the "halfway supplanting of concrete in concrete with sugar stick bagasse debris". In this task, they see that a great deal of harm is caused to the climate during the production of concrete. This includes a ton of fossil fuel byproducts related with different synthetic substances. Research has shown that every huge amount of concrete assembling discharges a portion of a lot of carbon dioxide, so it is important to promptly control concrete utilization. Then again, squander materials, for example, sugarcane bagasse debris are challenging to discard, which thus represents a risk to the climate. Bagasse debris gives high early solidarity to concrete and furthermore diminishes the porousness of cement. Silica present in bagasse debris responds with concrete parts upon hydration and bestows extra properties like chloride opposition, erosion obstruction, and so on. Consequently, the utilization of bagasse debris in concrete lessens ecological contamination, yet additionally works on the properties of cement and furthermore diminishes the expense. It makes substantial more strong.

Dr. Y.M. Manjunath, Dinakar. K (2016) investigated **"thebehaviour of concrete exposed to elevated temperature bypartial replacement of cement with bagasse ash"**. The present work aims to study the mechanical properties of concrete using bagasse ash as an alternative to cement exposed to high temperatures. Concrete is made by partially Substituting 0%, 5%, 10%, 15%, 20%, 25% and 30% sugar cane (SCBA) cement. The grade of concrete used is M25. Concrete samples (cubes and cylinders) are poured and exposed to various elevated temperatures (200°C, 400°C, 600°C, 800°C) for two hours using an electric furnace and then tested. Mechanical properties such as compressive strength, split tensile strength and modulus of elasticity of concrete are determined.

III. OBJECTIVES OF THE STUDY

1. The main objective of the project is to study the effectiveness of SCBA as a cement replacement in concrete.
2. The other objectives are to study the basics tests oncement, SCBA, Fine Aggregates, coarse Aggregates.
3. To study the tests on concrete (workability, Compressive Strength and Split Tensile strength).
4. Reviewing the literature, we are comparing the test results and selecting the best from it.
5. Mix design is also calculated for M20 grade concrete.

Mix Proportion: **1: 1.55: 3.0**

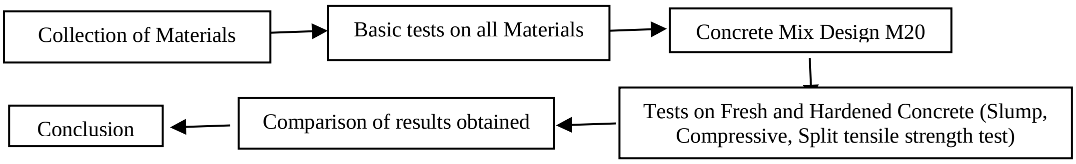
IV. MATERIALS AND METHODOLOGY

Cement:-The most common cement is used is OPC. OPC of 53 grades from a single batch was used for the entire work.
Fine Aggregate: - In the present study the sand conforms tozone II as per the Indian standards (IS).

Coarse Aggregate: - Locally available Coarse Aggregate used of 20 mm and down size.

Sugarcane bagasse ash: - Sugarcane bagasse debris which is gotten in the wake of consuming of sugarcane it is a side-effect which can be helpful as somewhat supplanting concrete due different substance properties.

METHODOLOGY



V. RESULTS

Sample Designation	% of SCBA	Compressive strength 7 days (N/mm2)	Compressive strength 28 days (N/mm2)	Compressive strength 60 days (N/mm2)
C0	0	35	45	51.38
C1	5	39	48.8	49.6
C2	10	39.5	52.3	52.5
C3	15	35.5	48.5	50.66
C4	20	31.66	44.83	45.5
C5	25	32.83	43.66	40.3

Table 1: Compressive Strength Results of SCBA concrete At 7, 28 And 60 Days

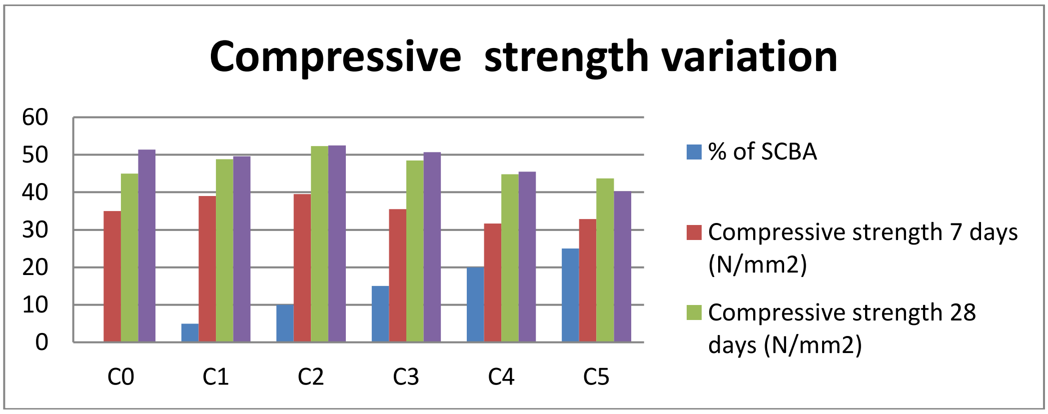


Fig 1: Variation of Compressive strength results

Sample Designation	% of SCBA	Split tensile strength 7 days (N/mm2)	Split tensile strength 28 days (N/mm2)
C0	0	3.42	4.17
C1	2	3.54	4.39
C2	4	3.14	3.92
C3	6	2.83	3.53

Table 2: Split tensile Strength Results of SCBA concrete At 7 & 28 Days

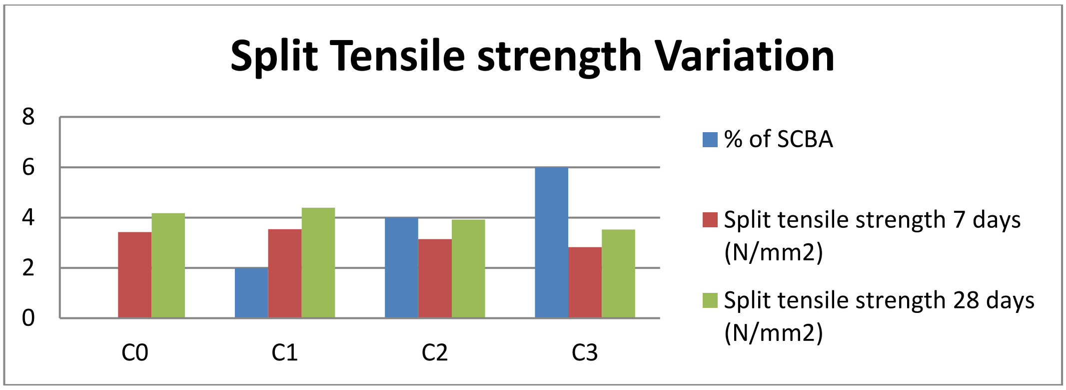


Fig 2: Variation of split tensile strength results

VI. CONCLUSIONS

1. SCBA concrete performed better when contrasted with customary cement up to 10% substitution of sugar stick bagasse debris is the best rate to deliver the effective cement and it can diminish the expense of development.
2. Increment of solidarity is chiefly to presence of high measure of Silica in sugarcane bagasse debris. SCBA up to greatest furthest reaches of 10%. Incomplete substitution of concrete by SCBA expands functionality of new concrete; accordingly utilization of super plasticizer isn't significant.
3. Compressive strength is increased for 7, 28 and 60 dayswhen cured in water. Split tensile strength is high at theages of 7 days and 28 days.
4. From the study, it can be concluded that concrete produced with bagasse ash as replacement to cementcan better when compared to normal concrete.

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