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# PARTIAL REPLACEMENT OF CEMENT WITH SUGARCANE BAGASSE ASH IN CONCRETE: A REVIEW

**Pragalbha Khare[1], Mohd. Afaque Khan[2], Neeti Mishra[3]**

[1] *PG Student, Department of Civil Engineering, Babu Banarsi Das University, U.P., INDIA*
[2,3] *Assistant Professor, Department of Civil Engineering, Babu Banarsi Das University, U.P., INDIA*

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***Abstract-*** *The ever increasing need of development in infrastructure has led researchers and scientists to search for locally available alternate binders that can replace cement partially and are eco-friendly and contribute towards waste management. India being the second most sugarcane producing country in the world, also produces a substantial amount of Sugar Cane Bagasse Ash which is a fibrous waste product of sugar industry and can be used as an alternate binding material in concrete. This would not only help in waste management but also result in saving in cement production equivalent to the alternative binding material used in concrete decreasing the amount of harmful greenhouse gases produced in the process of cement production.*

***Keywords***- Bagasse Ash, Cement, Concrete, Sugarcane, Waste Management.

## 1. INTRODUCTION

Cement is one the most used construction material. It is the conventional building material that actually is responsible for about 5% - 8% of global CO2 (a greenhouse gas) and with the ever increasing demand it could significantly contribute to environmental pollution imposing detrimental effects. Researchers all over the world today are focusing on ways of utilizing industrial or agricultural waste, as a source of raw materials for many industries. Utilization of such wastes as cement replacement materials may reduce the cost of concrete production and also minimize the negative environmental effects with disposal of these wastes.

Sugarcane is main food crop in tropical and subtropical countries. It is the major resource for the sugar production. India is the second largest producer of sugarcane in the world with 361,037,000 Metric Tonnes of production in a year. The processing of it in sugar-mill generates about 10 million tonnes of SCBA as a waste material. One tonne of sugarcane can generate approximate 26% of bagasse and 0.62% of residual ash. The residue after combustion presents a chemical composition dominates by silicon dioxide. Sugarcane bagasse (SCB) is the waste created after juice extraction from sugarcane. The Sugarcane bagasse ash (SCBA) is acquired through the control burning of sugarcane bagasse. The SCB creates the environmental nuisance due to direct disposal on the open lands and forms garbage heaps in that area. Besides SCBA, rice husk ash, palm kernel husk ash, fly ash, ground blast-furnace slag and silica fume have pozollanic properties that can be used in partial replacement of cement. Megat (2011) investigated the effect of silica fume, metakoalin, fly ash and granulated blast fume on workability, compressive strength, elastic modulus and porosity of high strength concrete. Concrete produced from partial replacement of cement with SCBA has reaction formed by silicate, SiO2 from SCBA and slaked lime, Ca(OH)2 from cement to form calcium silicate hydrate which is responsible for the compressive strength (Baguant, 1995). The quality of concrete produced from SCBA beyond an optimum quantity of SCBA will leaches out silicate which does not contribute to the strength of concrete (Baguant, 1995).

## 2. PREPARING CONCRETE USING SUGARCANE BAGASSE ASH (SCBA)

**R. Srinivasan and K. Sathiya** [1] conducted experiments on concrete cube, cylinder, and prism specimens in which cement was replaced with SBCA in 0-25% ratio. It was observed that the strength of concrete under compression, tension, young's modulus, and flexure increased up to 10% of replacement after that strength results was decreased.

**Nidhi Relan and Dr. A.K. Saxena** [2] conducted an experimental study by replacing the cement in concrete by SCBA in 5-25% ratio and conducting compressive strength test and slump test on resulting concrete. The test results indicated that the cement could be advantageously replaced with SCBA up to a maximum limit of 12.5%.for M35 concrete, also the study revealed that the compressive strength increased up to 10% replacement whereas beyond 15% replacement the strength was found to be decreasing.

**Jayminkumar A. Patel, Dr. D. B. Raijiwala** [3] replaced the cement by 0 & 5% SCBA. 150X150X150 mm cubes were casted in M25 concrete and tested the specimen for 7$^{th}$ day, 14$^{th}$ day, 28$^{th}$ day and 56$^{th}$ day of curing in Compressive Testing machine. The results shows that the compressive strength of concrete can be increased reducing the consumption of cement indicating best use of SCBA instead of landfilling and making the environment clean.

**Sirirat Janjaturaphan and Supaporn Wansom** [4] studied on, "The Pozzolonic Activities of Industrial Sugar Cane Bagasse Ash". They find out the chemical composition of the Sugarcane Bagasse Ash and compared them with the other pozzolonic material that is, rice husk ash and concluded that the SCBA is suitable for the partial replacement of cement.

**U.G.Harshali S. Hire, Prof. V.S. Bhalerao** [5]; they studied on "Partial replacement of cement by Sugarcane bagasse ash and there effect on Concrete". The chemical composition of Bagasse Ash was studied and its effects on compressive and tensile strength of concrete after replacement of cement in 0, 5, 10, 15% replacement. They found out that Bagasse ash is a valuable pozzolanic material and it can potentially be used as a partial replacement forcement and make construction cheaper. They also found out that the water requirement increases as the bagasse ash content increases. This could reduce the environmental problems and minimize the requirement of land fill area to dispose Bagasse Ash.

**Prashant O Modania, M R Vyawahare** [6]; they conducted experimental investigation on properties of concrete after the quantities of sugar cane bagasse ash is replaced by 0, 10, 20, 30 and 40% volume of sand. The water cement ratio was kept 0.40 and the dose of superplasticizer was kept constant at 0.8%. The casted concrete specimens were cured under standard condition in the laboratory and tested for 7 days and 28 days compressive strength, 28 days split tensile strength and sorptivity test. It was concluded that the fraction of fine aggregates i.e. 10% to 20% can be effectively replaced with a bagasse ash (untreated) without a considerable loss of workability and strength properties hence in its purest form the bagasse ash can prove to be a potential ingredient of concrete since it can be an effective replacement to cement and fine aggregate.

## 3. CONCLUSIONS

The various methodologies for design and development of SCBA mortar and concrete have been reviewed. Various physico-mechanical and chemical properties of the SCBA are studied in accordance with the revived literature and the Standards. SCBA was a good replacement for cement in concrete as well as mortar. It can be easily replaced up to 20%. The maximum compressive strength was found at 15% replacement level, though 15% replacement gave higher strength 20 could be used because the result from 20% replacement is near about control concrete. In case of split tensile strength 10% replacement gave higher strength. The utilization of bagasse ash in concrete and mortar solves the problem of its disposal thus keeping the environment free from pollution. The improvement in compressive strength of mortar by partially replacing cement by SCBA is due to filler effect and pozzolanic reaction between reactive $SiO2$ from SCBA and $Ca(OH)_2$ from cement hydration. The study in turn is useful for various resource persons involved in using SCBA material to develop sustainable construction material.

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## BIOGRAPHIES:

Mr. Pragalbha Khare was born in 1993 in Lakhimpur city, Uttar Pradesh. He received his Bachelor of Technology degree in civil engineering from Amity University in 2014. He is right now pursuing his Master of Technology in Structural Engineering (Babu Banarasi Das University) Lucknow.

Mr. Mohd. Afaque Khan was born in 1982 in Gonda city. He received his Bachelor of Technology degree in civil engineering from ZHCET, AMU, Aligarh in 2009. In 2012 he received his Master's degree in Structural Engineering from ZHCET, AMU, Aligarh. He joined Babu Banarasi Das University, Lucknow in 2012 as a faculty. He worked as head of the department in Babu Banarasi Das Engineering College, Lucknow and is now working as an assistant professor in Babu Banarasi Das University, Lucknow (Department of civil Engineering) with a total of 6 years of experience.

Mrs. Neeti Mishra received her Bachelor of Technology degree in civil engineering from BBDNITM, Lucknow, in year 2013. In 2016 she received her Master's degree in Structural Engineering from IET, Lucknow. She joined Babu Banarasi Das University, Lucknow in 2016 as a faculty and is now working as an assistant professor in Babu Banarasi Das University, Lucknow (Department of civil Engineering) with a total of 2 years of experience.