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USE OF SUGAR CANE BAGASSE ASH IN FIBRE REINFORCED CONCRETE – A REVIEW

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ABSTRACT

The current scenario researchers all over the world are mainly focusing on the ways of utilizing either industrial or agricultural wastes as a source of raw materials for the construction industry. These waste utilization would be economical, may also help to create a sustainable and eco-friendly environmental. Sugar cane bagasse ash (SCBA) is one such fibrous waste from sugar cane, which contains ethanol vapours, aluminium and silica. The fibres will play a major role to increase the properties of toughness and which is suitable for structural concrete. SCBA is highly rich in silica content that can play the major role of an effective pozzolanic materials leading to strength gain properties in the cementitious systems. This review paper discusses on how to use agriculture waste of sugar cane bagasse and the current status of research work. The combination of different percentage of Ordinary Portland cement with sugar cane ash with inclusion of various percentage of waste steel fibres by volume fraction for various mixes of conventional concrete. Many references which shows the latest work processing, properties and application have been cited in this review.

Keywords*:* Solid waste Sugar industry bagasse ash, waste steel fibres and strength enhancement.

1. INTRODUCTION

Sugarcane is one of the major crops grown in over 110 countries and its total production is over 1500 million tons. Only in India, every year the production of SCBA is over 300 million tons/year that cause about 10 million tons of sugarcane ash. After the extraction of all the economical sugar from sugarcane, about 40-45% fibrous residue is obtained, which is reused in the same industry as fuel for boilers in heat generation leaving behind up to 8 -10 % ash as waste, known as sugarcane bagasse ash. The SCBA contains high amounts of un-burnt matters like silicon, aluminium and calcium oxides. But the ash obtained is directly from the mill are not reactive because these are burnt under an uncontrolled conditions and at very high temperatures.

A few studies which has been supporting out in the past on the consumption of bagasse ash which was obtained directly from the industries to study pozzolanic activity index and their suitability as binders by partially replacing the Ordinary Portland cement.

The present study focuses on studying the use of Sugarcane bagasse ash as a partial replacement of cement in concrete as a result of ecological and environmental limitations.

2. LITERATURE REVIEW

There are several experimental studies which has been examining the various mixes of fresh concrete of slump cone measurement and compaction factor, various mixes of mechanical/durability properties of high strength concrete for different age curing in concrete.

Jojo James et al. concluded that it has been utilized in the manufacture for different shape of blocks as well as tiles in the form of an auxiliary additive as well as a primary stabilizer. It is also noted that the sugarcane bagasse ash not only has improved the hardened properties and also reduced the cost of the materials is economy and highly productive solution for waste management.

Rajkumar et al. concluded that the usage of sugar cane bagasse ash paver blocks suitable for low traffic road pavements. This paper deals for designing and testing four trial mixes with SCBA in accordance with BIS and IRC standards. It's followed by design of a flexible pavement for low traffic volume roads. The pavement design with bagasse ash paver blocks was cheaper, when compared conventional flexible pavement around 24.15%.

Priyadarshini et al. focused that the influence of sugar cane bagasse ash by replacing cement along with silica fumes as admixture. The test programme was investigated two mix ratios of concrete in which bagasse ash 30% replaced by weight of binder content with silica fumes as admixture. The casted hollow blocks for various mixes then dried with natural atmospheres then subjected to compressive strength and water absorption tests was carried out. It was concluded that the suitable up to 10% replacement with bagasse ash with silica fume admixture was showed better performance, when compared to control specimens. It was also noticed that the cost effective analysis for various mixes showed upto 63.70% profits, when compared to normal conventional concrete blocks.

Hariharan et al. investigated that the preparation and characterization of ceramic products with sugarcane bagasse ash waste. Tile compositions of 50% clay, 15% quartz, and 35% feldspar were obtained from a local manufacturer with addition of sugarcane bagasse ash was used as a replacement for feldspar. The amended composition included 20% bagasse ash in lieu of feldspar, whose composition was reduced to 15% of the total.

Mangesh V. Madurwar et al. Concluded that the potential application of agro-waste as the ingredient for alternate sustainable construction materials due to availability of agro-waste materials, However, sustainable construction materials are evaluated for their physico-mechanical properties, methods of production and environmental impact.

Loh et al. carried out on the impacts, performances and applications of waste by product treated with appropriate chemicals and processes for various stages in combination with materials of distinct properties and manipulation of manufacturing methods have been duly considered. This review paper attempts to summarize overall extensive studies that have been undertaken in an attempt to explore possible applications and potentials usage of sugar cane bagasse ash for suitable composite material.

Piyanut et al. carried out the compressive strength, flow ability and chemical composition of cement mortar. The replacement of SCBA was varying from 0 to 40%. For strength test water/cement ratio was 0.5:1 and specimen was tested as per accordance of codal provision for different age of curing period days. The main process reaction between calcium hydroxide (CH) and calcium silicate hydrate (C-S-H). And also will play the major role CSH gel increasing the strength gain properties up to 20 to 25 N/mm^2. Amount of SCBA influence the compressive strength of cement mortar by replacing with 20% SCBA as the most appropriate ratio.

Kulkarni et al. observed that the ability of sugar cane bagasse ash in fly ash bricks as a replacement for fly ash along with lime. The size of bricks 200 x 100 x 100 mm were manufactured with various mixes, in which bagasse ash was used to replace fly ash around 60 percentage and lime content up to 20% by weight binder content in increments of 10% and 5%, respectively. The strength gain for various curing days showed better improvement and also less percentage of water absorption. It is clearly indicated that increasing the SCBA content as resulted in a reduction in strength. It was also concluded that up to 10% industrial waste of bagasse ash as replacement for fly ash produced the near strength up to 5%, when compared to control concrete.

Lima et al. observed that the potential of modified cement stabilized soil blocks amended with bagasse ash. Two cement contents of 6% and 12% were adopted for making the blocks which were amended with 2%, 4%, and 8% bagasse ash. Compressive strength and water absorption tests were performed on the stabilized blocks. Masonry prisms were also prepared with the stabilized blocks for testing. The blocks produced with 12% cement amended with 8% bagasse ash met the standards for stabilized blocks. The prisms made with modified blocks also produced better performance in axial and diagonal compression tests when compared to blocks without ash.

Shende et al. investigated that the utilization of bagasseash in reducing the cement content of stabilized bricks. Three different replacement level bagasse ash used for 5%, 15%, and 25% by weight of binder content. In this research performance in increasing the compressive strengthand reducing water absorption in achieving a cost-effectivestabilized brick. The addition of25% bagasse ash produced the highest compressive strength with less production cost around 32.50% than that of conventional concrete but resulted in an increase in water absorption.

Murali et al. Concluded that the influence of addition of waste materials like lathe waste, soft drink bottle caps, empty waste tins, waste steel powder from workshop at a dosage of 1% of total weight of concrete as fibres. A part of waste fibres mostly resulted from warm milling and mild steel had desirable flexibility and tensile strength. But the waste fibres recovered from brittle steel milling and machining were cracked and did not have functionality to be used in concrete.

M. Balakrishnan and V. S. Batra noticed that the state-of-the-art in innovative value added products that can be obtained from the industrial solid wastes by usingvalorization solutions were clearly indicated. It was observed that the extent of research and adoption of these solutions vary considerably.

Pourkhorshidi et al. noted the following experimental test results of physical and chemical properties of sugar cane bagasse ash are given below in the Tables 1, Table 2 and Figure 1 shows the waste product of sugarcane ash respectively.

Table: 1 Physical Properties of SCBA

Sl.no.	Property	Value
1.	Specific gravity	2.16
2.	Density (g/cm^3)	2.2
3.	Specific surface area (cm^2/g)	4710
4.	Average size (µm) (where 50% of the particle passes)	40.1

Table: 2 Chemical Compositions

Oxides	% Composition By Mass
SiO_2	72.853
Fe_2O_3	6.961
Al_2O_3	1.077
PbO	ND
Na_2O	1.968
CaO	9.968
MgO	6.491
K_2O	6.768
CuO	0.096
LOI	4.233

Figure 1: Snapshot for waste by product of sugar cane bagasse ash

3. METHODOLOGY FOR MAKING OF SCBA FOR VARIOUS MIXES

The different percentage SCBA and inclusion of waste tin fibres in M30 grade of concrete for various mixes. The following detailed schematic flowchart as shown in the Figure 2.

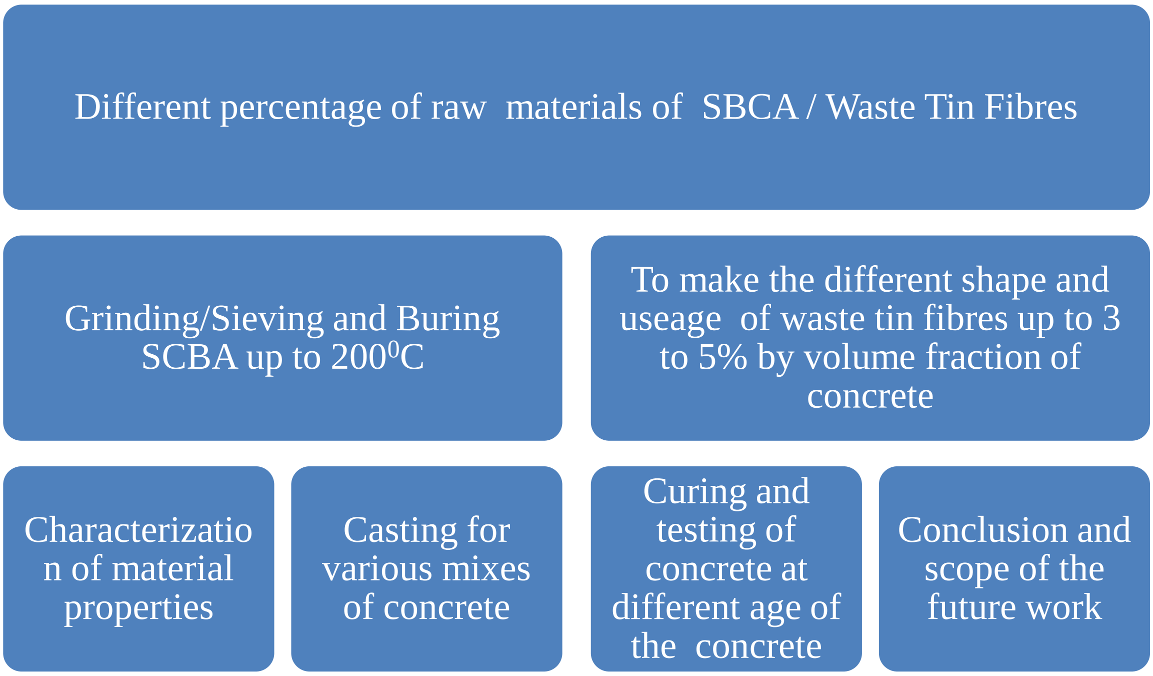

Figure 2: Schematic flow chart SCBA

In this study will be focusing on the waste tin which are cut manual cutting gadget. The fibres after being cut into suitable lengths are shown in Figure 3. Some sample fibres were randomly selected and tested so that their mechanical characteristics can be determined.

Figure 3: Snapshot for waste tin fibres as well as industrial waste steel fibres

4. CONCLUSIONS

From this review article provides a brief overview of potential usage of sugarcane bagasse ash in concrete, which can be implemented to reduce the degradable environment impact. The following parameters will be study in further work.

Several researchers have been attempted to characterize the sugar cane industrial solid waste and concluded that it is rich in silica content. It can contribute to more suitable bonding cementitious materials reacts in conventional concrete.

To find out optimum amount of SCBA partially replacement of cement, which produce the high strength concrete for various mixes. It is more suitable replacement for cement to produce the quality of handed concrete without affecting the durability as well as mortar content. It can be easily replaced up to 20% for various mixture proportions in structural concrete.

To check the different properties of concrete with variation of SCBA content for various mix. Also it is vulnerable use of SCBA instead of land filling and make a environmental clean.

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