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A STUDY ON UNPROCESSED SUGARCANE BAGASSE ASH SILICA FUME BASED HOLLOW CONCRETE BLOCK WITH QUARRY WASTE

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ABSTRACT

The evidence indicates that sugarcane bagasse ash weakens concrete. However, silica fume and sugarcane bagasse ash added to concrete improve its density, limit water absorption, and increase its strength. In almost all of the studies, it was discovered that hollow concrete blocks with sugarcane bagasse ash and 10% silica fume admixture had stronger compressive strength than control concrete. How much control costs for sugarcane bagasse ash silica fume hollow concrete blocks. Durability tests show that sugarcane bagasse ash silica fume concrete has good resistanceto acid, alkaline, and sulphate assault. Analysis and experimentation were found to be more than 80% identical. A cost investigation shows that the SCBA silica fume hollow concrete block is 15% more expensive than the control one. Although,the use of SCBA silica fume concrete, which may be used to lessen industrial waste disposal problems while simultaneously enhancing the performance of masonry projects, may be advantageous for both hollow concrete blocks and masonry buildings.

Keywords: Unprocessed Sugarcane, Bagasse Ash, Silica Fume, Hollow Concrete Block, QuarryWaste, etc.

INTRODUCTION

Bagasse is the fiberous buildup of sugarcane subsequent to squashing and extraction of juice. This ash is utilized for rural purposes however its effect on the ripeness of soil is excessively

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little contrasted with the disposal issues .The disposal of these ashes delivered is related with a few environmental issues and wellbeing dangers. Also, the protected disposal of these ashes is a serious huge test to the sugar business in the ongoing years. Then again concrete is the world's most expended development material since it consolidates great mechanical and solidness properties.[1] Cement which is one of the components of concrete assumes an incredible job yet is the most costly and environmentally antagonistic material. To reduce the increasing expense of materials particularly cement for the production of concrete, empty squares, expanded waste usage, is required through using baggase ash. Every ton of the cement delivers around one ton of CO2 and the cement business is liable for about 5% of worldwide anthropogenic CO2 discharge. These discharges can be considerably decreased if 20% to 30% of bagasse ash is supplanted in concrete industry. Accordingly, this assists with keeping up green effect in environmental conditions.

Silica Fume (SF)

The waste resulting from the bag house filter in silicon and ferrosilicon metal production is known as silica fume. Due to its ultra-fine nature, filler effect, and high amorphous silica content, it acts as good pozzolan. ASTM C 1240 (1999) states that silica fume used in concrete enhances strength, durability, abrasion, and corrosion resistance in addition to reduction inpermeability. With aforesaid wide benefits and good pozzolanic behavior it is used in concrete asa pozzolan. Further it is also used as an admixture in concrete.[2]

Sugarcane Bagasse

Bagasse is the sinewy issue that remaining parts after sugarcane or sorghum stalks are crushed toremove their juice. It is utilized as a biofuel and in the production of mash and buildingmaterials. For every 10 tons of sugarcane crushed, a sugar industrial facility creates about 3 tons of wet bagasse. Since bagasse is a by-product of the pure sweetener industry, the amount of production in every nation is in accordance with the amount of sugarcane created. The high dampness substance of bagasse, commonly 40 to half, is inconvenient to its utilization as a fuel. When all is said in done, bagasse is put away before further preparing. For power production, it

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is put away under clammy conditions and the mellow exothermic reaction those outcomes from the corruption of remaining sugars dries the bagasse heap marginally. For paper and mash production, it is regularly put away wet so as to aid expulsion of the short substance strands, which block the papermaking procedure, just as to expel any residual sugar. Bagasse is a very inhomogeneous material involving around 30-40% of "essence" fiber, which is gotten from the center of the plant and is for the most part parenchyma material, and "best", "skin", or "stem" fiber, which includes the equalization and is to a great extent got from sclerenchyma material. These properties make bagasse especially dangerous for paper fabricate and have been the subject of a huge assemblage of writing.[3] Bagasse is a waste which is produce in gigantic sum from the sugar processes and reuse as a fuel in a similar sugar industry and form an ash which is known as sugarcane bagasse ash (SCBA). Activities are developing worldwide to control and direct the administration of subproducts, residuals and industrial wastes so as to protect the environment from defilement.

Concrete

Concrete is a composite material which is made up of filler and a binder. The binder (cement paste) sticks the filler together to form a manufactured aggregate. The constituents utilized forthe binder are cement and water, while the filler can be fine or coarse total. The properties of concrete, functionality, quality and toughness, make it to be the most flexible and broadly utilized manmade construction materials. The clients of concrete as a rule need it to have such significant properties in conservative manner. The consolidation of various materials, as industrial wastes, in concrete production has been found to assume job in accomplishing the necessary properties of concrete.

Cement

Cement is a hydraulic folio and is characterized as a finely ground inorganic material which, when blended in with water, forms a glue which sets and solidifies by methods for hydration reactions and procedures which, in the wake of solidifying, holds its quality and strength considerably submerged. The historical backdrop of making cementing material is as old as the

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historical backdrop of designing construction. Cementing materials were utilized by Egyptians, Romans and Indians in their old constructions. The early Greeks and Romans utilized cementing materials got by consuming limestone.[4]the striking hardness of the mortar utilized in early Roman brickworks, some of which despite everything exist, presents adequate proof of the flawlessness which the specialty of cementing material had achieved in old occasions. The Greek and Romans had known the way that specific volcanic ash and tuff, when blended in with lime and sand yielded mortar having unrivaled quality and better toughness in new or salt water.

Sugarcane Bagasse Ash (SCBA)

Customary Portland cement is perceived as a significant construction material all through the world. Scientists everywhere throughout the present reality are concentrating on methods for using either industrial or rural waste, as a wellspring of crude materials for industry. This waste, use would not exclusively be prudent, however may likewise bring about remote trade income and environmental contamination control, Industrial wastes, for example, blast heater slag, fly ash and silica smolder are being utilized as advantageous cement replacement materials. Right now, there has been an endeavor to use the enormous measure of bagasse ash, the buildup from an in-line sugar industry and the bagassebiomass fuel in electric age industry. At the point when this waste is scorched under controlled conditions, it additionally gives ash having indistinct silica, which has pozzolanic properties. A couple of studies have been completed on the ashes acquired legitimately from the businesses to examine pozzolanic action and their appropriateness as fasteners, incompletely supplanting cement. Along these lines it is conceivable to utilize sugarcane bagasse ash (SCBA) as cement replacement material to improve quality and decrease the expense of construction materials, for example, mortar, concrete pavers, concrete rooftop tiles and soil cement interlocking square. Therefore, a large portion of the bagasse ash is as yet discarded as waste in landfills, causing environmental and different issues.[5]

Sugar Cane Wastes As Pozzolanic Materials

As of late, the utilization of solid waste got from agrarian products as pozzolans in the assembling of mixed mortars and concrete has been the focal point of specialists in the

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construction materials part. The expansion of ashes from burning of agrarian solid waste to concrete is at present, a regular practice due to the pozzolanic action of the ashes toward lime. One of the most intriguing materials is the ash gotten from the burning of sugar cane solid wastes(sugar cane straw and sugar cane bagasse).significant measures of sugar cane are processed, producing high volumes of solid waste. These wastes are arranged and consumed in openlandfills, adversely affecting the environment. A few investigations that were completed for describing the sugar cane solid waste as pozzolanic material found that bagasse ashes from a heater working in the 1000 to 1100 °C run demonstrated exceptionally poor pozzolanic reactivity.

Compressive Strength of Blended Concrete

The impact of a mineral additive on the strength of concrete varies significantly with thecharacteristics of a pozzolanic material and the concrete mixture used in it. Early strength can be lowered when pozzolanic material is utilised for replacing cement in equal volume. Previous strengths can be enhanced by replacing pozzolanic concrete material on an equal mass basis orby the amount of volume larger than one by one replaced with cement, provided that there is no rise in water content in excess. Using Portland-pozzolan cements containing 10, 20 and 30 percent Santorum Earth, findings of a research on the impact of time on the strength of the compression in ASTM C 109 morter Cube typically show improvement in the compression strength. Studies have revealed that every percentage of the substitution by volume or mass of Portland cements to fly ash resulted in reduced compressive and bending strength during the first three months and increased strength after 6 months.

Long Term Performance of Blended Concrete

More emphasis is paid to the long-term performance of concrete and reinforced concrete. Thisled to significant study and code development to address the long-term performance of the concrete materials and structures as an essential part of the design. The degradation of concrete and refurbished concrete has a great deal of attention given the transportation characteristics of concrete, the quantified ion diffusion process, fluid permeability, capillary absorption and steel

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reinforcement depassivation. It has been extensively established that Portland cement concrete with additional ingredients, such as fly ash, slag, silica fume and rice husk ash has goodmechanical qualities and long-term durable features. It reduces the environmental emission of carbon dioxide, conserves earth's resources and resolves waste management problems. Publishedstudies on these mineral admixtures show that the penetration of chloride ions into concrete is reduced. In these admixtures mixed cement concrete is predicted a better corrosion resistance of the steel reinforcement.

- Performance of Blended Concrete on Water Permeability
- Earlier Studies on Water Permeability of Blended Concrete

Compressive Strength of SCBA Silica Fume Concrete

Concrete testing in UTM at various curing ages was performed according to the procedures specified in IS: 516. (1959). at first, the concrete's compression strength was measured with the addition of unprocessed SCBA at 0%, 10%, 20% and 30%. The tests were done on eachspecimen and the results of the three were averaged at any replacement level for every mixing ratio.[6] The table shows that for all mixing proportions at all substitution levels above the control concrete; the compressive strength of the concretes has been decreased at all ages. Second, by substituting cement with SCBA with 0 per cent, 10 per cent and 20 per cent, 30 per cent together with 10 per cent silica fume, the compressive strength of unprocessed silica fume cement was measured by the addition of all proportions of concrete.

Sugarcane Bagasse Ash-An Indian Scenario

The sugar business is one of India's leading sectors, a windfall for farmers. The Indian Sugar Mill Association figures show that there are now about 538 sugar cane mills in the nation. Most of the sugar industry in India has evolved by various ways as self-sufficient in this century. It is one of the electricity generating enterprises and exporting the power supply to the government. Sugarcane in India is a major Kharif crop and widely grown in the country. India is the second largest producer of sugar cane in the world. The average production of sugar cane in India in the previous five years has reached between 300 and 350 million tonnes. Bagasse, a fibrous sugar

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cane waste, is of extremely high gross calorific value in wet conditions of around 2,250 kcal/kg and hence has a significant potential in electricity production. Boilers have previously been used to use bagasse to generate steam, which in turn is used as fuel. The boilers were operating at about 200 °C to 600 °C temperature. But the burning of bagasse was partial and the fuel waslow. As a result, the cogeneration unit for sugarcane Bagasse began to satisfy the need for power in India in the 1980's. This cogeneration unit is a potential option to power production in the modern period as demand for fossil fuels rises. As a result, nearly every large sugar industry has a bagasse power generating cogeneration unit. In the next years, the Indian Ministry of New and Renewable Energy has predicted that the cogeneration units of sucrier were generate around 7,000 MW of excess power.[7] At very high temperatures and pressures, this unit was used to produce residual of sugar cane bagasse ash.

LITERATURE REVIEW

Murray (2017)[8] clarifies that the Haener block has been available longer than some other dry- stack system. It is an interlocking system; the individual blocks have raised hauls that line upwith the block 4 above. The system requires a similar measure of grout as ordinary concrete brick work unit (CMU) construction. Azar block dividers are a comparative dry-stack interlocking system. The bed and head joints are made to interlock with neighboring blocks. Azar block, in any case, necessitates that all dividers be solid grouted. The sparlock system utilizes one of a kind molded blocks that slide together. The blocks are set in a stack bond courseof action.

Assiamah et al. (2016)[9] did a near investigation of interlocking and sand Crete blocks for building walling systems. The exploration tried to investigate the chance of embracing the interlocking block divider system as methods for making divider construction of structuresreasonable in Ghana. Results indicated that, the utilization of interlocking blocks don't just prompt end of various non-esteem including exercises related with the utilization of the sand create blocks, yet in addition make the divider construction process less expensive and quicker. It was likewise found that the nonattendance of mortar jointing in the interlocking

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system decreased the amount of materials, similar to cement and sand, required in the sandcrete divider construction process.

Sagar et al. (2015)[10]the output of sugarcane bagasse ash was about 10 million tonnes annually. The maximum compressive strength of the treated SCBA and its split tensile strength were 24.89N/mm2, with a SCBA replacement of 15%, respectively.

Sangeetha et al. (2015)[11] Tried a rice husk ash concrete durability research in an attack with sulphate. The results showed that RHA concrete's weight loss was somewhat higher for 2 monthsand 3 months than its controlled mix. The degradation in concrete immersed in 5% Na2SO4 has been lower than in cement immersed in a solution MgSO4. The investigation found that the RHAcement substituted was stronger in compression and superior in sulphate attack resistance. The loss of sulphate mass was also decreased.

Eramma et al. (2015)[12]has carried out a study on Nano-Silica (NS) and bagasse ash strength characteristics of concrete. Cement has been substituted with 10% and 20% of bagasse ash and nano-silica, 2% and 3% of concrete mass. M25 concrete were done with compressive strength, split tensile strength and bending strength test. The bagasse ash and the nano-silica 2 percent blend had higher mechanical qualities than controlled concrete, 10 percent bagasse ash. In order to examine the bond properties, a SEM investigation was also carried out. In comparison to conventional concrete, low emptying, less porosity and a superior packaging structure were seen in 10 percent BA+2 percent NS concrete. However, compared to others, the force of the mix waslow owing to the propensity to enhance BA's water absorption. A substantial type of C-S-H paste, which served as efficient binders in the mixtures were identified using SEM.

Jun-Ho Shin et al. (2015)[13]Alkali-silica concrete experiments have been performed. In the article, silica in dissolved concrete responded to the depolymerized calcium-rich calcium- silicate-hydrate in portlandite (CH), which devoured the next stages of a CH. This enhance the C–S–richness H's in silica and polymerization that could contribute to hydrous ASR gel formation. For the achievement of the pozzolanic reaction this ASR was required. The study also

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showed, however, that a paste consumption of CH and C–S–H reaction needed a temperature of more than 80 oC prior to the creation of an ASR gel.

Abdulkadir et al. (2014)[14]various pozzolanic SCBA indices of M25 mix for 28 days have been studied. The sum of SCBA utilized in the study was SiO2, Al2O3 and Fe2O3, 80.55%. By burning the sugarcane bagasse at 700oC, then shearing it through a 425ozonal diem sieve and grinding it to 45ozonal sieve, we obtained 83.2% of POzzolan's highest PAI. However, even with such high PAI, the optimal compressive strength was less than regular concrete. Sumrerng Rukzon et al. investigated a number of BA high strength concrete characteristics such as compressive strength, the porosity, water absorption coefficient, fast chloride penetration, and concrete chloride diffusion at various substitute levels of BA.

Ahmad et al. (2014)[15] inspected the compressive quality property of interlocking brick work units/blocks and contrasted it and quality conduct of other stone work units. The examination uncovered an expansion in quality by 20% when contrasted and the concrete stone work empty blocks and an expansion of 40% in quality as contrasted and block. Interlocking crystal expands quality by 30% when contrasted with the crystal without interlocking mortar. Further, construction cost was decreased since there was a decrease of the quantity of high gifted artisans required on a construction venture.

OBJECTIVES OF THE STUDY

- To study on the sugar cane bagasse burning in the sugar co-generation cycle of the industry offered a sufficient real-time option for the secure disposal of SCBA.
- To study on Ungrounded, unprocessed SCBA, silica fume and quarry dust composition characteristics and the admixture performance characteristics of SCBA concrete with andwithout silica fume.
- To study on SCBA silica fume concrete toughness in varying circumstances.
- To study on SCBA silica fume load output concrete block prisms and columns hollow concrete blocks prisms.

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RESEARCH METHODOLOGY

The materials, for example, cement, SCBA, silica fume, quarry dust, waterway sand, stone chips and water will utilized in the current work. The procedure utilized for the portrayal of previously mentioned materials and for the testing of SCBA silica fume concrete, SCBA silica fume hollow concrete block and SCBA silica fume hollow concrete block segments and crystals will likewise present.

Sugar Cane Bagasse Ash (SCBA)

SCBA will be a byproduct created from sugar industry. SCBA use right now will acquire from the co-age unit from a rumored Sugar Industry.

Silica Fume (SF)

Natural river sand affirming to Zone II according to IS 383-1987 will use for control concrete.

Preparation of Sugarcane Bagasse ash Silica Fume Concrete

Around 243 cubes and 162 cylinders will caste utilizing M25 mixes utilizing the above extents by supplanting cement with SCBA just as with and without 10% expansion of silica fume on all replacement level. All examples will vibrate in a vibration table to have zero droop as in hollow concrete block production .All the materials use will grouped by weight extents.

Compressive Strength of SCBA Silica Fume Concrete

3 cubes of size 150 mm x 150 mm will take for every replacement level and its normal compressive strength will dirty at 7 and 28 days.

Mineralogical and morphological

The morphological and mineralogical concentrates on typical concrete, silica fume concrete and SCBA silica fume concrete at 28 days will finish utilizing Scanning Electron Microscope (SEM) and EDAX investigation for blend extent.

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Preparation of Hollow Concrete Block

Subsequent to investigating the strength properties of concrete, a similar blend extent willreceive to cast a sum of 950 hollow concrete block examples of various sizes 400 x 150 x 150 mm and 400 x 100 x 200 mm utilizing SCBA silica fume concrete. All fixings will consider clumped. Blending, throwing, and quickened relieving of all hollow workmanship units will perform by the assembling plant adhering to their standard business production system.

Properties of Hollow Concrete Block

The compressive strength test will complete after different restoring ages according to the test methodology detail .The tests will direct for eight specimens and the normal will discharge for each blend extent at all replacement level.

- Compressive strength of hollow concrete block
- Water absorption of hollow concrete block
- Density of hollow concrete block
- Modulus of elasticity of hollow concrete block

Cost analysis of SCBA Silica fume Hollow concrete block

The costs of SCBA silica fume hollow concrete block will be work out after the overarching timetable of rates and compared with the control concrete.

Results

The Unprocessed sugarcane bagasse ash was used as a partial substitute for cement, with silica fume as an addition, in the fabrication of concrete and hollow concrete block masonry units, in the current research. This research on the concrete's long-term durability qualities, such as its resistance to acids, alkalis, and sulphates.

Compressive Strength of SCBA Silica Fume Concrete

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The concrete specimens was subjected to compressive strength tests in a UTM at various curing ages as per the procedure detailed in IS: 516 (1959). Initially, the compressive strength of concrete in which unprocessed SCBA was added at 0%, 10%, 20% and 30% was assessed by testing. The tests were conducted on each specimen and the average of the results of the three was taken for each mix proportion at all replacement level and are shown in Table1. It is evident from the table that the compressive strength of concrete was reduced for all mix proportions at all replacement levels at allages over the control concrete.

Table1: Compressive strength of unprocessed SCBA concrete cubes withdifferent mix proportional different ages

Mixture Designation	**Compressive Strength in MP a at different ages**		
	7 Days	**14Days**	**28Days**
A(Control)	14.02	22.61	31.00
A10	13.68	17.58	25.85
A20	9.82	12.58	19.56
A30	6.77	8.51	10.04
B(Control)	4.25	4.89	6.33
B10	3.50	3.98	4.8
B20	2.9	3.0	3.5
B30	2.5	2.7	3.09

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Durability Test

Among the mixes studied, proportions like1:3:3 and 1:6.5:6.5 at all replacement level of SCBA force meat at 0%, 10%, 20% and 30% along with 10% silica fume as additive was selected for durability studies as cites more suitable for producing hollow concrete blocks. Further, IS: 2185 suggests that hollow concrete blocks not richer than 1:6 and not leaner than 1:13 to be used. The cubes was cast and moist cured over a period of 28 days was considered as reference one. The cubes were cast with zero slum pesos as to resemble the field practice follow concrete block production.

Table2: Durability results of concretes specimens in acid environment (1:3:3mix)

HCL Solution (5%ofHCLin1litreofwater)							
Mixture Designation	**Mix details**	**Average weigh to f cube specimens in kg**				**Weight Loss at 90 days (kg)**	**Decreased weight at 90 days in %**
		Initial	**At the end of 30days**	**At the end of 60days**	**At the end of 90 days**		
D(Control)	Control	0.8940	0.8830	0.8740	0.8800	0.0140	1.56600
D	0%SCBA+10%SF	0.9080	0.8910	0.8890	0.8990	0.0090	0.99119
D10	10%SCBA+10% SF	0.8935	0.8855	0.8795	0.8720	0.0215	2.40627
D20	20%SCBA + 10%SF	0.8955	0.8795	0.8730	0.8690	0.0265	2.95924

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D30	30%SCBA + 10%SF	0.8835	0.8675	0.8630	0.8550	0.0285	3.22581

Characteristic of Hollow Concrete Block

The hollow concrete blocks made of using SCBA, silica fume, quarried stand stone chips was studied forth e evaluation of its properties such as compressive strength, water absorption and density to understand their performance and subsequently, their behavior in hollow concrete masonry structures.

The water content adopted by Bashar et al. (2012) in the production of hollow concrete block of 1:1:2 mixes was reported to be 8% of the total batch weight. In this investigation the water content of 0.45 could not favor's hollow concrete block production. It requires 4% addition of super plasticizeror increase in w/c ratio by 0.55.Hence, the mix is additionally designed for 0.55 w/c ratio sand the strength, durability and micro structural analysis inconcrete mortars as well as the strength, water absorption and density in hollow concrete blocks was also determined. The compressive strengths of different hollow concrete blocks a represented in Table3.

Table3: Compressive strength of hollow concrete block for differentmix proportions at different ages

Sl. No	Size of hollow concrete block in mm	Mixture Proportion	Mixture Designation	Compressive Strength N/mm^2				
				7 days	14 days	28 days	56 days	90 days
1.	400x150x150	1:6.5:6.5	B(Control)	2.3	2.9	3.45	3.91	4.23

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2.			B10	1.5	2.1	2.25	2.46	2.98
3.			B20	0.7	1.8	2.0	2.34	2.87
4.			B30	0.6	1.6	1.9	2.20	2.27
5.	400x150x150	1:2.1:2.4	C (Control)	6.51	7.32	9.4	9.89	10.11
6.			C10	6.18	6.91	9.98	10.24	10.55
7.			C20	4.26	5.76	7.10	8.50	8.90
8.			C30	4.17	5.63	6.80	7.01	7.12
9.	400x100x200	1:3:3	D (Control)	7.0	7.56	9.42	10.1	10.4
10.			D10	6.95	7.12	10.2	10.9	11.4
11.			D20	4.20	5.66	6.93	8.2	8.6
12.			D30	4.00	5.23	6.51	6.92	7.1
13.	400x150x150	1:6.5:6.5	E	5.28	6.36	8.02	9.2	9.6
14.			E10	4.92	5.82	7.48	9.31	9.65
15.			E20	4.36	5.16	6.75	7.35	7.86
16.			E30	4.21	4.86	5.35	6.22	6.45

Using silica fume and SCBA generated at a temperature of 1500^0C as an addition, the researchers found that SCBA may replace some of the cement in concrete. Because of its stronger filler effect, silica fume has improved hollow concrete block strength and durability. Concrete blocks having a mixture of 10% SCA and a further 10% silica fume as an addition have showed stronger compressive strength than the controls in virtually all cases. The SCBA silica fume concrete has improved acid, alkaline, and sulphate resistance, according to the durability

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experiments. In addition, SCBA silica fume concrete has a longer lifespan than conventional concrete because of its higher durability. Furthermore, long-term tests show that up to 20% of SCBA may be replaced by 10% silica fume as an addition.

CONCLUSION

The SCBA is employed as an active pozzolanic material inside most types of study, demonstrating the requirement for controlled bagasse burning fire incineration temperature, controllable burning periods, and adequate ash processing techniques, which have not yet been fully established and applied. As a result, a significant number of SCBAs provide serious challenges in terms of land use, health concerns, and environmental degradation. Therefore, it's critical to protect the environment, the wildlife, and human life. Additionally, it is used far less and has little commercial viability, unlike fly ash. In order to create the hollow concrete block, attempts have been made in the current study to combine an underground, unprocessed ash obtained from a cogeneration unit of the sugar industry with Silica Fume (SF) in the form of an additive at an extraordinarily high temperature of 1500^{o}C.

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