International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 07 | July - 2021 ISSN: 2582-3930

INCORPORATION OF SUGARCANE BAGASSE ASH AS PATIAL REPLACEMENT OF CEMENT AND SAND BY M-SAND

K.ASHALATHA [1] , M.PURUSHOTHAM [2]

[1] Assistant Professor , Department of Civil Engineering , Siddharth Institute Of Engineering & Technology, Puttur ,Andhra Pradesh, India.

[2] M.Tech Student, Department of Civil Engineering , Siddharth Institute Of Engineering & Technology, Puttur Andhra Pradesh, India.

ABSTRACT

In present trending generation for the construction of all the infrastructural developments concerte plays an vital role in the civil engineering construction field. As in growing present era the need of concrete demand as so far increased which resulted in lot of treatens causing to the environment and has a great impact on the nature. So far inorder to overcome this major problem an alternate solution has chosen by number of engineers as they collected various industrial waste materials which are experimentally proven with good cementatious and silicieous properties such materials so far observed are sugar cane bagasse ash, rice husk ash, silica fume,glass powder ,marble powder etc., as they could able to replace in the present using materials soi t has reduced cost of construction of using present using ,materials nad also helped to reduce environmental impact.

In India one of the major agro based industry is Sugar manufacturing. It is the most fibrous residue which is usually extracted from sugar cane in mills during the production of sugar cane juice. This residue is burnt down to get sugar cane bagasse ash which is rich in silica, alumina oxides and it is major used in the replacement of cement while preparing concrete.as it usually acts as a filler material.

The concrete cubes are casted with the replacement of bagasse ash as substitute of cement 10%,20%, 30%)and sand with M-Sand. The fresh concrete pastes were first cured at 100% relative humidity for 24 hours and then cured in water for 28 days. And these cubes are exposed to different elevated temperatures and cooled in open air area for room temperature. The strength differences between cubes which are not exposed to elevated temperatures and cubes exposed to elevated temperatures and cooled by room temperature and observed by testing them under compression machine. Strength difference is observed for different proportions of cement substitute. the compressive strength and split tensile strength of M35 grade of concrete after 7 days and 28 days curing period for various combinations of SCBA and M-Sand (10%, 20%, and 30%) are conducted. The results showed that the addition of Bagasse Ash to OPC improves the performance of the produced blended concrete when exposed to elevated temperatures up to 600^0c.

.

KEYWORDS: Concrete,Sugar cane Bagasse ash,M-Sand

1.INTRODUCTION

The use of cementations materials has been elaborated to the increment of high performance concretes which are used for developing high specified material. The enomourous application of cementations materials in processing concrete production develop major impact on the surrounding nature, as using numerous amount of cement in factories there is a lot of problem developing and within expose of materials effects the nature and also the air which is contaminated by the dangerous gases like and effecting global warming. Per an annum some tones of cement is manufactured in the industries so far affecting the nature.

In order to overcome the problem the best way to generate the cementatioius products in the industry is by developing and using mineral admixtures and replaced in the place of many cementations materials so far and it gives the best results when compared with the old technology so it can be able to attain an environmental friendly material

Mineral admixtures are available in numerous ways I present application field in the form of BFS, FA, and SF. With the usage of these the usually improves its strength, seepage structure, pores are decreased and also the major consideration is increment of hydration time.

The Bagasse is a major by-product of the sugar industry, which is utilized in the same industry as an energy source for sugar production. Sugarcane contains 25–30% bagasse, whereas industry recovered sugar is about 10%. Bagasse is also used as a raw material for paper making because of its fibrous texture, and about 0.3 tons of paper can be made from one ton of bagasse. A limited amount of bagasse ash has been used as soil while the rest of the bagasse ash is useless causing serious environmental impacts.

Though, SCBA is one of the wastage materials from the sugar industry and with its pozzolonic materials it has been concerned to be used in the replacement of the cement as it has very good chemical composition of SiO_2 and hydration is increased. The C-S-H from pozzolanic reaction is one of the supplementary cementatious material which may increase the strength of cement. SCBA usually acts as a mineral admixture.

In the past, natural cementations materials such as volcanic earths, tuffs, clays, and shale, in raw or calcined form, has been advancing used in building various types of structures such as aqueducts, monuments and water retaining structures. Natural cementations materials are still used in some parts of the world. in recent advancement many industrial waste by-products such as fly ash, slag, silica fume, red mud, and rice husk ash are most rapidly became the major source of mineral admixtures for replacement in cement and concrete.

. In order to has a very high performance concrete SCBA, is eventually mixed as a replacement of cement, as SCBA major component is silica ,it may acts as pozolonic material and fineness of silica results in increasing durability and good performance under elevated temperatures.

2. LITERATURE REVIEW

Mr. G. Siva Kumar et al. (2013) stated "Preparation of Bio-cement using Sugarcane bagasse ash and its Hydration behavior". In this experimental investigation they have replaced 10% of cement by SCBA. It given results that the strength has been increased due to pozzolonic properties an hence bit developed a strength based concrete.

Mr. H.S. Otuoze et al. had stated on "Characterization of Sugar Cane Bagasse ash and ordinary Portland Cement blends in Concrete" , The SCBA was partially replaced with 0% ,5%, 10%, 15%, 20%, 25%, 30%, 35%, 40% by net weight in concrete. It given results that the strength has been increased due to pozzolonic properties an hence bit developed a strength based concrete. The obtained values meet some requirements from increasing SCBA and iecreases Strength of bonding.

Mr. Lavanya M.R et al. has given an investigation report on on "A Experimental Study on the Compressive Strength of Concrete by Partial replacement of Cement with Sugar cane bagasse ash". The ease usage of sugar cane bagasse ash as, partial increment up to 30% of cement with different water cement (W/C) ratio. It given results as partial replacement of cement with SCBA up to 15% has increased the strength. Sugar cane bagasse ash is most valuable cementatious material and it is very much suitable partial replacement of cement.

Mr. R. Srinivasan et al. given report on "Experimental Study on Bagasse Ash in Concrete". The density of concrete decreases with increase in SCBA content. In this experimental investigation they have replaced 10% of cement by SCBA. Sugar cane bagasse ash is most valuable cementatious material and it is very much suitable partial replacement of cement.It given results that the strength has been increased due to pozzolonic properties an hence bit developed a strength based concrete.

Mr. U.R. Kawade et al. had given report on "Effect of use of Bagasse ash on Strength of Concrete" in this present experimental investigation it is partial replaced in the different ratio of 0%, 10%, 15%, 20%, 25% and 30% by weight of cement in concrete. Sugar cane bagasse ash is most valuable cementations material and it is very much suitable partial replacement of cement. It given results that the strength has been increased due to pozzolonic properties an hence bit developed a strength based concrete

Abdolkarim Abbasi and Amin Zargar et given an investigation report "Using Baggase Ash in Concrete as Pozzolan". The main intention of the project is to use SBCA as cemetatious material in the place of cement. In this experiment the percentage of moisture and the steps involving in burning of bagasse, its physical composition , chemical combination and specific area of ash were experimentally worked out and compared with cement. As cement is replaced by 10% of bagasse ash in finer composition, the workability and flowbility is minimized and the study given results that it has been increased at 25% when compared with normal concrete.

Lourdes M. S. Souza et al., given experimental report on "Hydration Study of Sugar Cane Bagasse Ash and Calcium Hydroxide Pastes of Various Initial C/S Ratio" in the they done many investigations on reactions between calcium hydroxide (CH) and sugar cane bagasse ash (SCBA).They worked on the product analysis of thermal analyses, X-ray diffraction, scanning electron microscopy and energy dispersive spectrometer.

Piyanut Muangtong et al., given experimental report on "Effects of Fine Bagasse Ash on the Workability and Compressive Strength of Mortars" It was enhanced with increase in the percentage pf SCBA increases water cement ratio. Sugarcane bagasse ash is cementatious material which is used in developing cement concrete will increase in the production of cement and reduces the cost of material.

Asma Abd Elhameed Hussein et al., given experimental report on "Compressive Strength and Microstructure of Sugar Cane Bagasse Ash Concrete" The cement was replaced with 0, 5, 10, 15, 20, 25 and 30%, with the bagasse ash,. The experimental results show that usage of Sugar cane Bagasse Ash in concrete up to 20% level significantly has increased the strength.

Kanchana lata Sigh and S.M Ali Jawaid, ., given experimental report on "utilization of sugarcane Bagasse ash (SCBA) as Pozzolanic Material in concrete". The experimental results of this report has proved with increase in 10% of SBCA in partial replacement of cement as shown good results when compared with the 20% replacement of the cement. Sugarcane bagasse ash is cementatious material which is used in developing cement concrete will increase in the production of cement and reduces the cost of material.

3. MATERIALS AND METHODS :

3.1 Cement:

Ordinary Portland Cement of 53 Grade (Ultra tech brand) satisfies the requirements as per IS 12269: 2013 was used in the present investigations.

Table 1. Physical properties of the cement

S.No.	Property	Test value	Standard value (IS 12269: 2013)	Method of the test, Ref. to
1	Specific gravity	3.13	---	IS 4031 (Part 11) : 1988
2	Fineness, m^2/kg	370	Min. 225	IS 4031 (Part 2) : 1999
3	Soundness, mm (By Le-Chatelier method)	6	Max. 10	IS 4031 (Part 3) : 1988
4	Normal consistency	33%	---	IS 4031 (Part 4) : 1988
5	Initial setting time, min	42	Min. 30	IS 4031 (Part 5) : 1988
	Final setting time, min	350	Max. 600	
6	Compressive strength, MPa (After 28 days curing)	53	Min. 53	IS 4031 (Part 6) : 1988

3.2 Fine Aggregate:

Manufactured sand (M-sand) obtained by demolishing and making powder hard stone was used as fine aggregate in the present investigations. River sand gives many problemsin its availability, cost, and natural impact.

Table 2.Physical properties of M-Sand

S.No.	Property	Test value	Standard value (IS 383: 2016)	Method of the test, Ref. to
1	Specific gravity	2.61	Max. 3.2	IS: 2386 (Part III) - 1963

	2	Water absorption, %	0.72	Max. 5	IS: 2386 (Part III) - 1963
	3	Bulk density, kg/m^3	1659	---	IS: 2386 (Part III) - 1963
3.3	4	Grading Zone	Zone II	Zone I to IV	IS: 2386 (Part I) - 1963

Coarse Aggregate:

Table 3.Physical properties of coarse aggregate

S.No.	Property	Test value	Standard value (IS 383: 2016)	Method of the test, Ref. to
1	Specific gravity	2.64	Max. 3.2	IS 2386 (Part III): 1963
2	Water absorption, %	0.45	Max. 5	IS 2386 (Part III): 1963
3	Unit weight, kg/m^3	1593	---	IS 2386 (Part III): 1963

3.4 Sugarcane Bagasse Ash :

Sugarcane bagasse consists of mainly 50% of cellulose, 25% of hemicelluloses of ligin. Every ton of sugarcane produces approximately 26% bagasse) and 0.62% of residual ash. The ash after combustion gives a chemical by silicon dioxide (sio2. In this sugarcane bagasse ash is obtained during the finalizing and finishing of a boiler in the sugar factory, located in the town of Anakapalli, Andhra Pradesh.

Table 4. Physical Properties of SCBA:

S. No.	Property	Value
1.	Density	575Kg/m^3
2.	Specific Gravity	2.2
3	Mean particle size	0.1-0.2 µm
4.	Min specific surface area	2500m^2/ kg
5.	Particle shape	Spherical

Table 5. Chemical Properties of SCBA:

S No	Component	Symbol	Percentage
1.	Silica	S_iO_2	63
2.	Alumina	Al_2O_3	31.5

3.	Ferric Oxide	Fe_2O_3	1.79
4.	Manganese Oxide	M_nO	0.004
5.	Calcium Oxide	C_aO	0.48
6.	Magnesium Oxide	M_gO	0.39
7.	Loss on Ignition	LOI	0.71

3.5 Super Plasticizer Varaplast PC-432:

VARAPLAST PC 432 is initially improved in the ready mixed and precast concrete industries where the greatest durability and performance is required. Super plasticizing action of VARAPLAST PC 432is very much different compared with the conventional super plasticizers based on sulfonated melamine and naphthalene formaldehyde condensate, which create electrostatic repulsion of particles

4. MIX PROPORTION

Table 6. Mix Proportions of M35 Grade Concrete

CONCRETE MIX	BINDER		FINE AGGREGATE		COARSE AGGREGATE	DESCRIPTION OF SAMPLE	NUMBER OF CUBES	NUMBER OF CYLINDERS
	CEMENT	SCBA	SAND	M-SAND				
M 35	100%		100%		100%	Controlled mix	9	9
	90%	10%	90%	10%	100%	Replacing binder+FA	9	9
	80%	20%	80%	20%	100%	Replaceing binder+FA	9	9
	70%	30%	70%	30%	100%	Replaceing binder+FA	9	9

5. RESULTS AND DISCUSSIONS

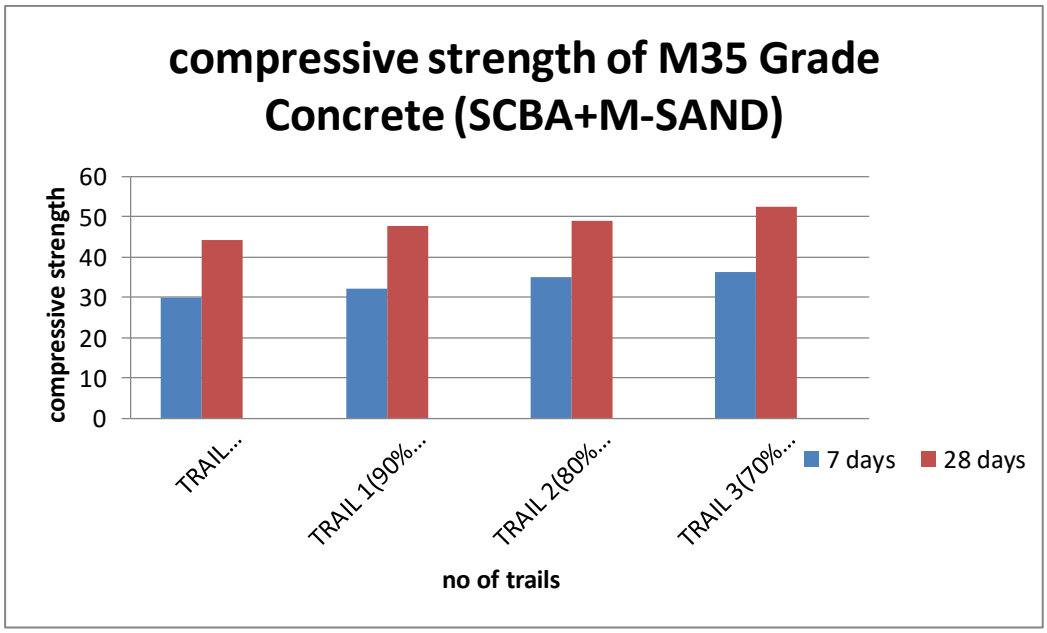
Compressive strength of concrete:

The results of the compressive strength of M35 grade of concrete after 7 days and 28 days curing period forvarious combinations of SCBA and M-Sand (10%, 20%, and 30%) are obtained along with a nominal mix

Table 7: Compressive strength of concrete for various proportions of Sugar cane bagasse ash and M-Sand for M35 grade concrete

Mix proportion	TRAIL(sugar cane bagasse ash+ M-Sand)	Compressive strength (N/mm^2)	
		7 days	28 days
M35	TRAIL 0	29.84	44.29
	TRAIL 1(90% cement+10%SCBA+90%sand+10%M-Sand)	32.09	47.64
	TRAIL 2(80% cement+20%SCBA+80%sand+20%M-Sand))	34.91	49.18
	TRAIL 3(70% cement+30%SCBA+70%sand+30%M-Sand)	36.21	52.63

Graph :1. Compressive strength of concrete for various proportions of Sugar cane bagasse ash and M-Sand for M35 grade concrete



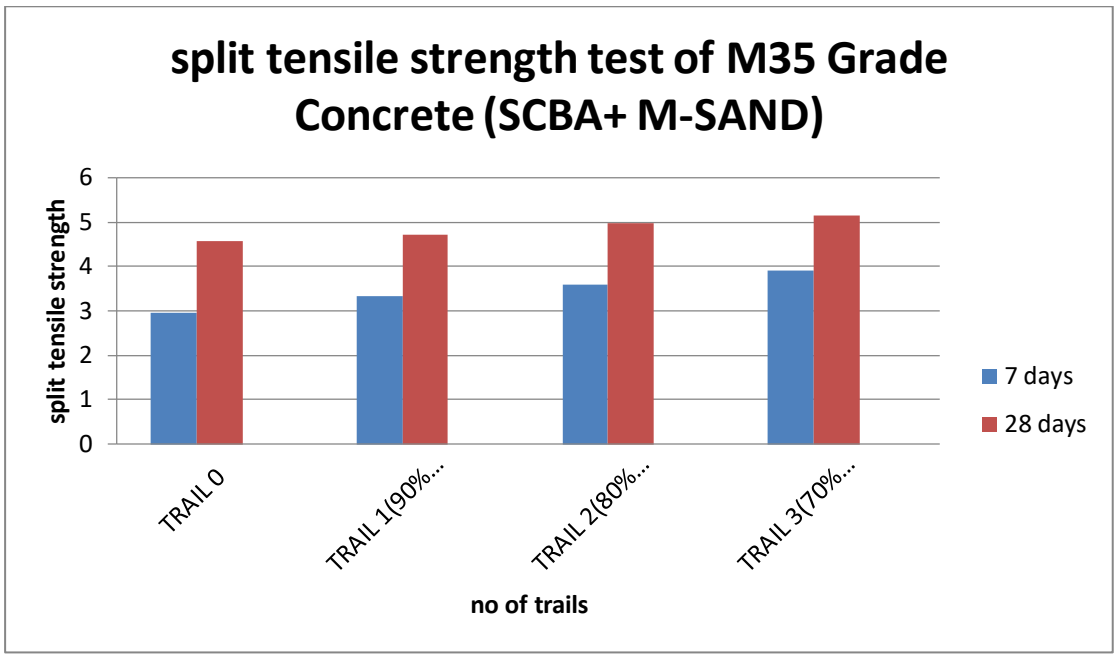
Split Tensile Strength of concrete:

The results of the split tensile strength of M35 grade of concrete after 7 days and 28 days curing period for various combinations of SCBA and M-Sand (10%, 20%, and 30%) are obtained along with a nominal mix.

Table 8.Split Tensile strength of concrete for various proportions of Sugar cane bagasse ash and M-sand for M35 grade concrete

Mix proportion	TRAIL(sugar cane bagasse ash+ M-Sand)	Split tensile strength (N/mm^2)	
		7 days	28 days
M35	TRAIL 0	2.96	4.56
	TRAIL 1(90% cement+10%SCBA+90%sand+10%M-Sand)	3.34	4.71
	TRAIL 2(80% cement+20%SCBA+80%sand+20%M-Sand))	3.58	4.98
	TRAIL 3(70% cement+30%SCBA+70%sand+30%M-Sand)	3.91	5.16

Graph: 2. split tensile strength test of concrete for various proportions of Sugar cane bagasse ash for M35 grade concrete



6. CONCLUSIONS

- The partial replacement of cement with sugar cane baggase ash and sand with M-Sand for all the grade concrete up to 30% has resulted in increased strength in compression and split tensile strength by conventional curing.
- The investigation results ensures that the max compressive strength for 7 and 28 days curing period achieved are 36.21 N/mm^2 and 52.63 N/mm^2 with 30%replacement of cement with sugar cane baggase ash and sand with M-Sand for M35 Grade concrete.
- The investigation results ensures that the max split tensile strength for 7 and 28 days curing period achieved are 3.91 N/mm^2 and 5.16 N/mm^2 with 30% replacement of cement with sugar cane baggase ash and sand with M-Sand for M35 grade concrete.
- As the water cement ratio is low, the super plasticizer of suitable dosage is used to increase the workability.
- In its purest form the SCBA can prove to be a potential ingredient of concrete since it can be an effective replacement to cement

References:

1. G. Siva Kumar et al, "Preparation of Bio-Cement using SCBH and its Hydration Behaviour" International Journal of Science, Engineering and Technology Research (IJSETR) Volume 2, Issue 10, October 2013 .
2. H.S Otuoze et al, Characterization of SCBH and ordinary Portland Cement blends in concrete.

3. Lavanya M.R et al, "A Experimental study on the compressive strength of concrete by partial replacement of cement with SCBA". International Journal of Engineering Inventions ISSN: 2278-7461, ISBN: 2319-6491 Volume 1, Issue 11 (December2012) PP: 01-04 .
4. R.Srinivasan et al, International Journal for Service Learning in Engineering Vol. 5, No. 2, pp. 60-66, Fall 2010 ISSN 1555-9033.
5. U.R.Kawade et al, International Journal of Innovative Research in Science, Engineering and Technology Vol. 2, Issue 7, July 2013.
6. Lourdes M.S Souza et al., "Hydration study of SCBA and Calcium Hydroxide pastes of various initial C/S ratios".
7. Abdolkarim Abbasi and Amin Zargar," Using Bagasse Ash in Concrete as Pozzolana".
8. Piyanut Muangtong et al., "Effect of Fine Bagasse Ash on Workability and Compressive Strength of Mortars".
9. Asma Abd Elhameed Hussein et al., "Compressive Strength
    a. and Microstructure of Sugar Cane Bagasse Ash Concrete".
10. Kanchana lata Sing and S.M Ali Jawaid,(August 2013) , "Utilization of sugarcane bagasse ash (SCBA) as pozzolanic material in concrete".