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Partial Replacement of Cement In Concrete With Sugarcane Bagasse Ash

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Abstract *– Concrete is the mixture of cement, fine aggregate ,coarse aggregate and water, concrete plays a vital role in the development of infrastructure in this experimental study investigation on SCBA (Sugarcane Bagasse Ash)has carried out which is a byproduct of sugarcane and also can be used as partial replacement material with ordinary Portland cement in concrete. The higher amount of silica present on it reacts with the component of cement hence increase the properties of cement. This experimental study focus on strength characteristics analysis of M20 grade concrete with replacement of cement by SCBA 10%, 20%,30% and compare with plane cement concrete mixture in terms of compressive strength of cube for 7 days , 14 days and 28 days respectively.*

It was found that the use of SCBA up to 25% in a concrete mix as replacement of cement gives more strength than the conventional concrete get reduces.

Keywords- *sugarcane bagasse ash, concrete, compressive strength*

INTRODUCTION

Concrete is typically an enormous individual material element in built environment. If the concrete can be reduces without decreasing the performance or increasing the cost, significant environmental and economical benefits may be realized. Concrete mainly comprises of Portland cement, sand, aggregate and water. Sugarcane bagasse ash is cementations material that can act as a partial replacement for Portland cement without significantly compromising that compressive strength. SCBA is a byproduct of sugar factories found after burning sugarcane bagasse.

Sugarcane is one of the major crop grown in 110 country and its total production is over 1500 million tons. India it self produce 300 million tons of sugarcane per year it causes about 30% of sugarcane bagasse and 8 to 10% of bagasse ash. The amount of silica present in a bagasse reacts with component of cement and not only reduce the environmental pollution but also enhance the properties of cement.

The component of SCBA contain Sio2 66.89%, Al_2O_3 29.18%, CaO 1.92%, Mgo 0.83% with can be used as an alternative source to replace cement by SCBA partially. Concrete property will maintained with the advance mineral and mixture such as SCBA powder and partial replacement of cement 0%, 10%,20% and 30% .Compressive strength of SCBA concrete with different dosage of SCBA was studied as a partial replacement of cement .

Environmental sustainability is at steak both in terms of damage caused by the extraction of raw material and Co_2 emission during cement manufacture. these brought presser on the researcher for the reduction of cement consumption by partial replacement of cement by supplementary material which is naturally occurring, industrial waste or byproduct that are less energy intensive.

From the structural point of view, when cement is replace by SCBA , lower heat of hydration and higher obstructed to sulphate and chloride intrusion. Lately some attention has been given to the use of natural pozzolonas like SCBA as partial replacement of cement . the various methods use to improve the durability of concrete, and to achieve high performance concrete, the use of SCBA is relatively new approach. The present paper focus on the investigating characteristics of M20 grade concrete with partial replacement of cement with SCBA by replacing cement 0%,10%,20% and 30% . the cubes and cylinder are tested for compressive strength and split tensile strength respectively.

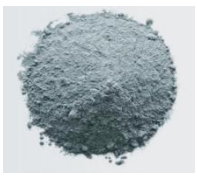
1.2 PROCESS TO OBTAIN SCBA

- bagasse was packed in graphite crucible air tight and place inside electric furnace.
- Burnt an temperature of 1200℃ for 5 hour to obtain black ash .
- This carbonated bagasse was collected and burned for 6 hours at 600℃.
- After burn a layer of light colored ash was observed on the surface and then an ash of black color and heterogeneous composition of observed .
- This bagasse ash is used in the research.
- Before the use of bagasse ash, it is oven dried at 1200℃.
- To remove the moisture in the ash.
- After oven dry ash was sieved in the mechanical shivers to separate unburned particles from ash.
- Sugarcane baggase ash passing through 300µ was used.

1.3 COMPOSITION OF SCBA

Sr. No.	Component	Mass %
1	Silica (SiO2)	66.89
2	Alumina (Al2O3)	29.18
	Ferric oxide (Fe2O3)	
3	Calcium Oxide (CaO)	1.92
4	Magnesium Oxide (MgO)	0.83
5	Sulphur Tri Oxide (SO3)	0.56
6	Loss of Ignition	0.72
7	Chlorode	-





Sugarcane bagasse Burned SCBA After sieving

FIG.1 : Stages Of Sugarcane Bagasse Ash

1.4 SCOPE OF THE STUDY

The increasing demand for producing durable materials in the outcome of past polluting environment . supplementary cementation material proves to be effective to meet most of the requirement of durable concrete. Sugarcane bagasse ash is found to be greater to other supplementary material like silica fume and fly ash. When SCBA is used as partial replacement of cement in concrete reduce the problem associated with there disposal as well as decrees the ignition of green house gasses. It also reduce the production of cement

2. MATERIAL

2.1 CEMENT

Ordinary cement of 43 grade from single batch was used for the entire work. The cement procured was tested for physical requirement in a accordance with IS:12269-1987 and for the chemical requirement in accordance with IS:4032-1977.

Table 2.1 physical properties of OPC

Properties	Value
Consistency	33%
Initial Setting time	75 minutes
Final Setting time	480 minutes
Specific Gravity	3
Fineness of cement	1.33%
Soundness of cement	0.3cm
Compressive strength of cement	
28 days	14.5 N/mm^2

2.1 FINE AGGREGATE

The river sand, passing through 4.75mm sieve and retained on 150µ sieve, conforming zone –I as per IS:383-1970 was used as fine aggregate in the present study. The aggregate was tested for its physical requirement according to IS:2386-1963.

Characteristics	Value
Specific Gravity	2.7
Bulk Density	9.80%
Fineness Modulus	3.66

2.3 COURSE AGGREGATE

Throughout the investigation, crush coarse aggregate of 20mm produced from local crushing plant was used. The aggregate was tested for its physical requirement such as gradation, finesse modulus, sp. Gravity and bulk modulus etc. according to IS:2386-1936 and IS:383-1970.

Characteristics	Coarse aggregate
Specific Gravity	2.64
Fineness Modulus	3.26
Water Absorption (%)	0.42

2.4 SUGARCANE BAGASSE ASH

The sugarcane bagasse consist of approximately 50% of cellulose, 25% of hemicelluloses of lignin. Each ton of sugarcane generate approximately 26% of bagasse (as a moisture content of 50%) and 0.62% of residual ash. The residue after combustion presents chemical composition dominate by silica dioxide (SiO_2). In the sugarcane bagasse ash was collected during the clinging operation of a boiler in the sugarcane factory, Deccan sugar factory pvt. Ltd . mangarul, yavatmal

Table 2.4 properties of cement with replacement of sugarcane bagasse ash

Replacement of sugarcane bagasse ash	Initial setting time	Final setting time	Consistency	Soundness
10%	95	490	30%	3.2
20%	110	475	33%	3.3
30%	105	450	33.50%	3.5

Replacement of sugarcane bagasse ash	Compressive strength 28 days (N/mm^2)
10%	43.5 N/mm^2
20%	45.5 N/mm^2
30%	47 N/mm^2

2.5 Water

The water is required for preparation of mortar, mixing of cement concrete and for curing work etc. during construction work. The quality and quantity of water has much effect on strength of mortar and cement concrete in construction work impuritess free, clean portable water are used for casting of cube. Also curing was done in curing tank as per IS 456-2000.

3. MIX DESIGN

- **MIX PROPORTION OF M20**

Water	Cement	Sand	Aggregate
0.55	**1**	**1.94**	**2.62**
197.16	**297**	**698.13**	**945.45**

- **QUANTITY OF CUBES**

Replacement of cement by SCBA	Cement (KG)	Sand (KG)	Aggregate (KG)	SCBA (KG)	Water
0%	8.52	15.52	23.96	-	3.84
10%	7.67	15.52	23.96	0.85	4.9
20%	6.81	15.52	23.96	1.70	4.9
25%	6.02	15.52	23.96	2.13	4.9
30%	5.96	15.52	23.96	2.56	4.9

- **QUANTITY OF CYLINDER**

Replacement of cement by SCBA	Cement (KG)	Sand (KG)	Aggregate (KG)	SCBA (KG)	Water
0%	4.69	7.81	11.98	-	2.56
10%	3.84	7.81	11.98	1.40	2.56
20%	3.40	7.81	11.98	0.95	2.56
25%	3.01	7.81	11.98	1.06	2.56
30%	2.98	7.81	11.98	1.28	2.56

3. RESULT AND DISCUSION

3.1 result of compressive strength test for different percentage of SCBA

Sr.No	Type Of Specimen	Compressive strength N/mm^2		
		7	**14**	**28**

		days	**days**	**days**
1	Nominal Concrete	21	22.2	21.6
2	Concrete with 10% SCBA	17.66	22.11	23
3	Concrete with 20% SCBA	18.21	22.38	23.89
4	Concrete with 25% SCBA	19.44	24.1	26.33
5	Concrete with 30% SCBA	17.22	17.88	21.51

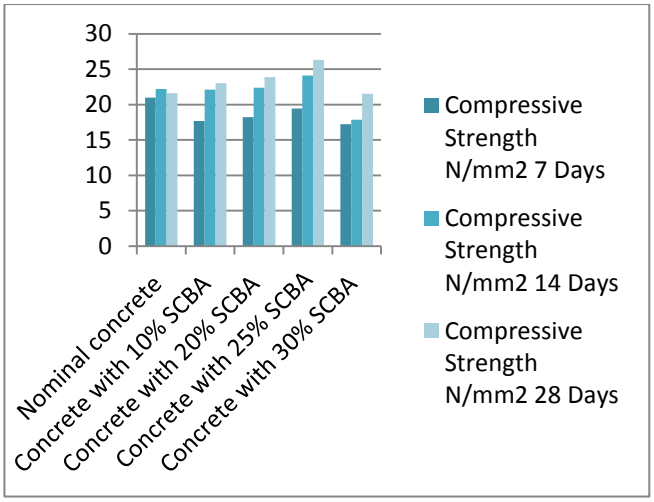


FIG.3.1 Compressive strength test for different percentage of SCBA

3.2 Split tensile strength result for different percentage of SCBA

Sr.No	**Type Of Specimen**	**Split Tensile Strength In N/mm^2(For 28 Days)**
1	Nominal Concrete	4.64
2	Concrete with 10% SCBA	4.82
3	Concrete with 20% SCBA	5.19
4	Concrete with 25% SCBA	6.15
5	Concrete with 30% SCBA	4.09

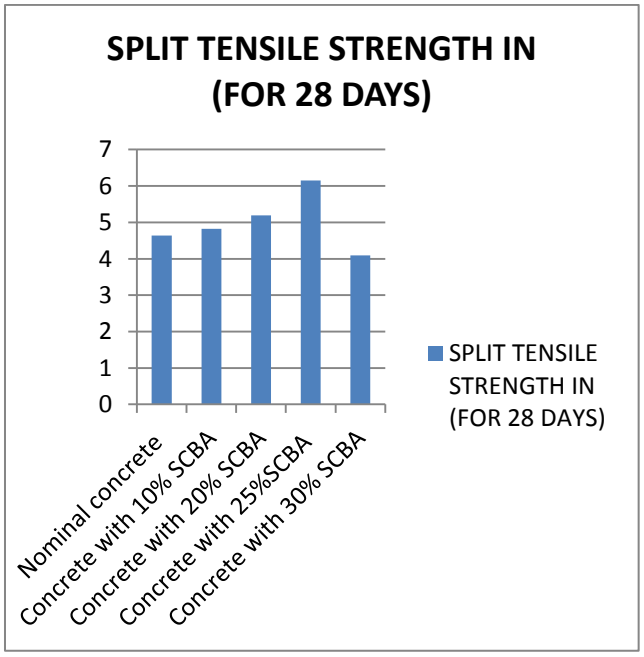


FIG.3.2 Compression of tensile strength for different percentage of SCBA

The above bar chart shows the variations of tensile strength with different percentage of SCBA. The 28 days tensile strength obtained is increasing up to 25% and it slightly reduced at 30%

After 28 days, the maximum tensile strength of 6.15 was achieved for the SCBA of 25% replacement level.

4. CONCLUSION

from present investigation the following conclusion were drawn

- SCBA in concrete gives the higher compressive strength as compare to normal strength concrete, hence optimum results were found at the 25% replacement of cement with SCBA.
- The replacement of cement with SCBA increases the workability of fresh concrete,

therefore use of super-plasticizer is not essential.

- Use of high volume SCBA as a replacement of cement, in any construction work provides lower impact on environment)reduced CO emission (and economical use of resources)energy conservation, use of by-product etc (.
- Use of SCBA in the concrete generates less heat while mixing with the water as against cement .It also helps to reduce the heat of hydration resulting less shrinkage and temperature cracks in the concrete .
- The use of SCBA as a replacement of cement helps to reduce the Energy consumption in the manufacturing of cement .
- It is observed that there is an increase in the compressive strength and split tensile strength at 25 % of SCBA and after replacement of 30 %it gets decreased slightly .The increase in strength is due to high reactivity of SCBA with Cement .
- From the above experimental results, it is proved that SCBA can be used as an alternative material for cement, reducing cement consumption and reducing the cost of construction .Use of industrial waste products saves the environment and conserves natural resources, achieves economy .
- Heat of hydration is slower in case of SCBA cement which lowers the risk of thermal cracking .

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