International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 05 | May-2018 www.irjet.net p-ISSN: 2395-0072

EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF SAND WITH SUGARCANE BAGASSE ASH IN CONCRETE

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Abstract: *In present situation all over the world are seeking on utilization of industrial waste in the useful manner. By avoiding disposal problems and land filling cost. Nowadays the scarcity of sand is the bigger problem in construction industry and due to less availability of sand the cost is also high. So this research were conducted for potential use of sugar factory waste such as sugarcane bagasse ash was partially replaced by sand in the ratio of ,10%,20%,30%,40% by conducting freshened and hardened stage tests prove that the SCBA can be replaced with sand up to 10% will give the better result as normal concrete and it found economical.*

Key Words: sugarcane Bagasse ash, Concrete, Workability Strength,

1. INTRODUCTION

Study says that all over the world more than 100 countries will grow sugarcane as a main crop. Every year the total production is over more than 1000 million tons. In the list of production India is in 2nd place the states like Maharashtra, Punjab, and Bihar are the largest producer states in India sugarcane production is over 341 million tons/year that cause about 9.8 million tons of sugarcane bagasse ash as waste material. After the removal of all profitable sugar from sugarcane, about 39-44% fibrous waste is obtained, which is used in the same industry to produce the electricity waste is used as fuel in boilers for heat generation leaving behind 10-15% ash as waste, known as sugarcane bagasse ash (SCBA). The SCBA contains high contents which are un-burnt matter, silicon, aluminum oxides. But the ashes obtained from the factory are not reactive because of these are burnt under at very high temperatures. The ash, therefore, becomes an industrial waste and poses disposal problems. A few studies have been carried out in the past on the utilization of bagasse ash obtained directly from the industries to study pozzolanic activity and their suitability as binders by partially replacing cement. The present study

Was carried to study the use of SCBA as a partial replacement of fine aggregate in cement concrete since the availability of natural sand is less in the last decades as a result of ecological and environmental conditions. The experimental study shoes that the workability properties of fresh concrete such as slump and also 7 and 28 days compressive strength, 7 and 28 days tensile strength and flexural strength with 10%, 20%, 30% and 40% replacement of bagasse ash by fine aggregate with volume.

2. Materials

2.1 Cement

Ordinary Portland cement (Grade 43) was used. Its physical properties are as given in Table 1.

Table 1. Physical Properties of Cement

Physical property	Results obtained
Fineness (retained on 90-µm sieve) cm2/gm	2890
Normal Consistency	34%
Vicat initial setting time (minutes)	49
Vicat final setting time (minutes)	451
Specific gravity	3.13

2.2 Aggregates

Nearby available local natural sand with 4.50 mm maximum size was used in and as fine aggregate, having s fineness modulus, specific gravity and unit weight as given in Table 2 and crushed stone with 18-20mm maximum size having specific gravity, fineness modulus and unit weight are given in Table 2 was used in and as coarse aggregate. Both fine aggregate and coarse aggregate confirmed to Indian Standard Specifications IS: 383-1970.

Table2. Physical properties of Coarse and Fine Aggregates

Physical tests	Coarse aggregate	Fine aggregate	
		River sand	SCBA
Specific gravity	2.83	2.64	1.25
Fineness modulus	6.86	3.08	2.12
Bulk density(kg/m^3)	1363	1428	837

2.3 Sugarcane bagasse ash

The sugarcane bagasse ash used in the experimental investigation is obtained from a Sugar Factory MAYLAR SUGARS which is nearby. The sugarcane bagasse consists of approximately 45-50% of cellulose, 20-25% of hemicellulose and 25% of lignin approximately in Each ton of sugarcane generates about 26% of bagasse (at a moisture content of40- 50%) and 0.6% of waste in the form of ash. The residue after combustion shows a chemical composition dominates by (SiO2) silicon dioxide. Table3. shows the chemical composition of bagasse ash.

Table3. The Chemical Composition of Bagasse Ash

Sl no	chemical properties	Values (%)
1	SiO_2	58.6
2	Al_2O_3	3.8
3	Fe_2O_3	6.1
4	CaO	1.1
5	MgO	0.8
6	Na_2O	0.3
7	K_2O	3.1
8	Loss on ignition	17.3
9	TiO_2	3.6
10	P_2O_5	0.9

3. Experimental Work

The work consists of performing the sieve analysis of sugarcane bagasse ash as per the Indian standard procedure and use the results for the concrete mix design to get the concrete of required strength and quality. Thereafter the concrete is tested for ability parameters by performing the slump cone test followed by casting the cubes of concrete for further investigations. For carrying out the strength investigations a total 45 number of concrete cubes and 15 cylindrical specimens, 15 beams were prepared. Based upon the quantities of ingredient of the mixes, the quantities of sugar cane bagasse ash for 0%, 10%, 20%, 30% and 40% replacement by amount of sand were estimated. The water cement ratio was kept 0.40 and the dose of super plasticizer was kept constant at 1%. The casted concrete specimens were cured under standard condition in the laboratory and tested for 7 days and 28 days flexural strength, 7 and 28 days split tensile strength and compressive strength.

Mix proportion								
Mix no	Cement kg/m^3	CA kg/m^3	FA kg/m^3		% SCBA by vol of RS	W/C ratio	SP %	Slump mm
			RS	BA				
M0	430	1260	650	00	0	0.4	0.8	110
M10	430	1260	585	33	10	0.4	0.8	75
M20	430	1260	520	65	20	0.4	0.8	63
M30	430	1260	455	99	30	0.4	0.8	32
M40	430	1260	390	130	40	0.4	0.8	7

4. Test Methods

At the end of every curing period, a total of 3 specimens were tested for all 3 concrete property. The compressive

strength test was carried out on the 150mm cube specimens, while the split tensile strength test was conducted out on the 150mm diameter and 300mm height cylindrical specimens and flexural strength test carried on 100mm*100mm*500mm as per Indian standard.

5. Results and Discussion

The table 5 gives the results of various tests performed on the samples.

Sample	Avg compressive strength, N/mm^2		Avg split tensile strength N/mm^2	Flexural strength N/mm^2
	7 days	28 days	28 days	28 days
M0	13.91	22.36	4.21	4
M10	12.14	23.82	3.94	4.1
M20	10.34	21.93	3.82	3.85
M30	10.05	19.15	3.34	3.6
M40	6.17	14.6	3.13	3.53

5.1 Compressive Strength

The results obtained from compressive strength test for all the mixes are given in fig 1. It can be known from the figure that the compressive strength results of specimens at 10% replacement of SCBA were high than those at 0% SCBA. Further increase in SCBA percentage results in decreasing strength along with significant fall in properties of concrete. It is also know that the rate of

increase of strength of mixes with SCBA is higher at later days that is due to pozzolanic properties of SCBA.

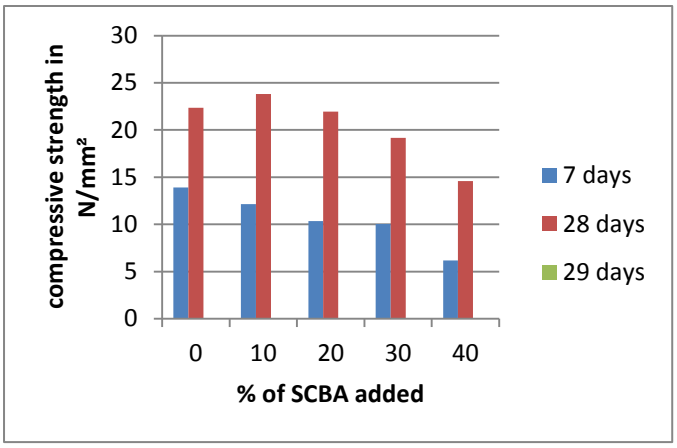

Fig. 1. 7 & 28 Days Compressive Strength for All Mixes

5.2 Tensile Strength

The tensile strength results for all the mixes for 28 days curing are shown in fig.2. When the influence of SCBA on the tensile strength of concrete was examined, it was observed that the development of tensile strength of mixes decreases as the replacement of SCBA increases.

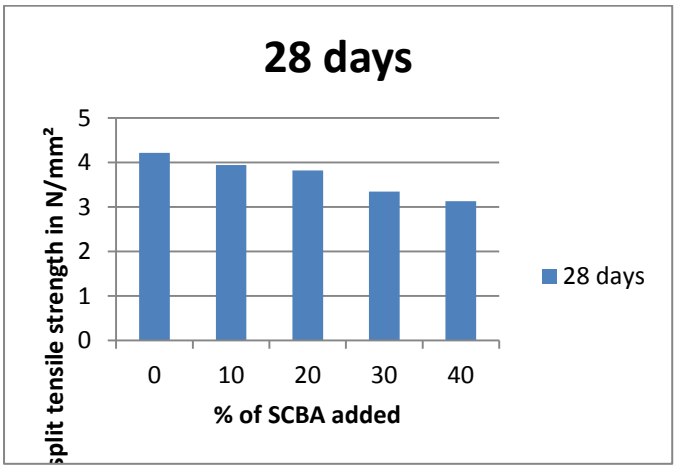

Fig.2. 28 Days Split tensile Strength Results for All Mixes

5.3 Flexural strength

The flexural strength results for all the mixes for 28 days curing are shown in fig5.3. When the influence of SCBA on the flexural strength of concrete was examined, it was observed that the development of flexural strength of mixes decreases as the replacement of SCBA increases.

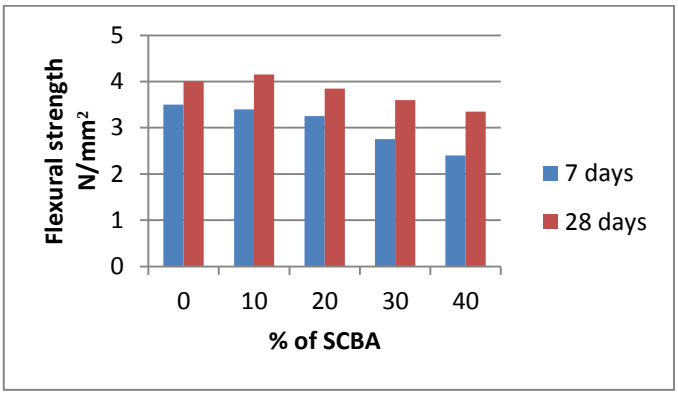

Fig.3. 7and 28 Days flexural Strength Results for All Mixes

6. Conclusions

From the experiments and analysis of results of findings in this research work, we established the following facts. Due to scarcity of natural sand and of high cost. As finer aggregate in cement concrete for various reasons, search for alternative material like SCBA qualifies itself as a suitable substitute for sand at low cost.

On the basis of experimental investigation carried out, the following conclusions can be drawn.

i) The amount of fine aggregates i.e. 10% to 15% can be easily replaced with a bagasse ash without a considerable loss of workability and strength properties.

ii) The compressive strength results show that, the strength and workability of the mixes with 10% and 15% SCBA increases at later days (28 days) as compared to 7 days that is due to pozzolanic properties of SCBA.

iv) In its purest form the SCBA can prove to be a potential ingredient of concrete since it can be an effective. Replacement to sand in fine aggregate.

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