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An experimental study on concrete with partial replacement of cement by bagasse ash

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Abstract: With increasing demand and consumption of cement, researchers and scientists are in search of developing alternate binders that are eco-friendly and contribute towards waste management. The utilization of industrial and agricultural waste produced by industrial processes has been the focus on waste reduction. One of the agro waste sugar cane bagasse ash (SCBA) which is a fibrous waste product obtained from sugar mills as by-product. Juice is extracted from sugar cane then ash produced by burning bagasse in uncontrolled condition and at very high temperature. In this paper SCBA has been chemically and physically characterized and partially replaced in the ratio of 10%, 20%, and 30% by weight of cement in concrete. The compressive and split tensile strength test are taken at the age of 7,14 and 28 days. The test result indicate that the strength of concrete increase up to 10 to 15% SCBA replacement with cement.
Keywords: sugar cane bagasse ash (SCBA)

I. Introduction

The BSA in concrete is the partial replacement of bagasse ash in concrete for cement. The bagasse ash is an non-biodegradable waste which is available in all the sugarcane industry. It can able to collect easily and also convert as a ash.

1. Need for bsa in concrete

Ordinary Portland cement is recognized as a major construction material throughout the world. Researchers in all over the world are focusing on ways of utilizing either industrial or agricultural waste, as a source of raw materials for industry. This waste utilization would not only be economical, but may also result in environmental pollution control. Industrial wastes, such as blast furnace slag, fly ash and silica fume are being used as supplementary cement replacement materials. Currently, there has been an +attempt to utilize the large amount of bagasse ash, the residue from an in-line sugar industry. When this waste is burned under controlled conditions, it also gives ash having amorphous silica, which has pozzolanic properties. A few studies have been carried out on the ashes obtained directly from the industries to study pozzolanic activity and their suitability as binders, partially replacing cement. Therefore it is possible to use sugarcane bagasse ash (SCBA) as cement replacement material to improve quality and to reduce the cost of construction materials such as mortar, concrete pavers, concrete roof tiles etc.

2. Bagasse

Bagasse is collected from nearby sugarcane factory and sugarcane juice shop and it is cleaned, grinded and burned to get an ash.

fig 1: Bagasse dumped at road side

Many factories are produced a material like by bagasse but in the sugarcane juice shops bagasse are thrown on the road sides. Its highly create the environmental hazards. In order to resolve this problem attempts have been made for utilization of this waste product in concrete for replacing cement.

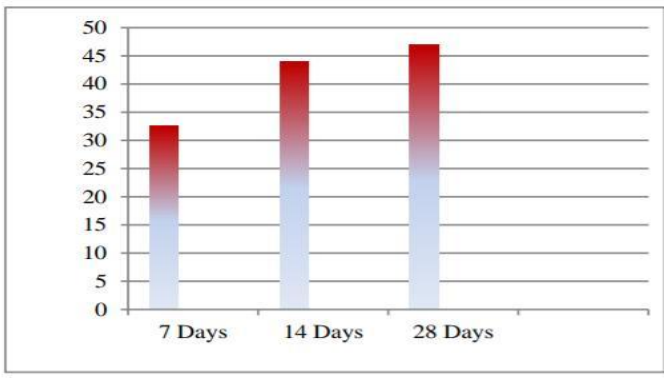
3. Experimental procedure

1. Compressive strength procedure

(I) Remove the specimen from water after specified curing time and wipe out excess water from the surface.
(II) Take the dimension of the specimen to the nearest 0.2m
(III) Clean the bearing surface of the testing machine
(IV) Place the specimen in the machine in such a manner that the load shall be applied to the opposite sides of the cube cast.
2. Align the specimen centrally on the base plate of the machine.
(VI) Rotate the movable portion gently by hand so that it touches the top surface of the specimen.
(VII) Apply the load gradually without shock and continuously at the rate of 140kg/cm2/minute till the specimen fails
(VIII) Record the maximum load and note any unusual features in the type of failure.

1. TABLE for compressive strength of cube for 10% replacement of bagasse ash

grade of Concrete	Days	% of replacement	Compressive strength of concrete		Average load	Stress in (N/mm^2)
			Sample 1	Sample 2		
M30	7	10	740	727	733.5	32.6
M30	14	10	937	1042	989.5	43.9
M30	28	10	1078	1039	1058.5	47.0

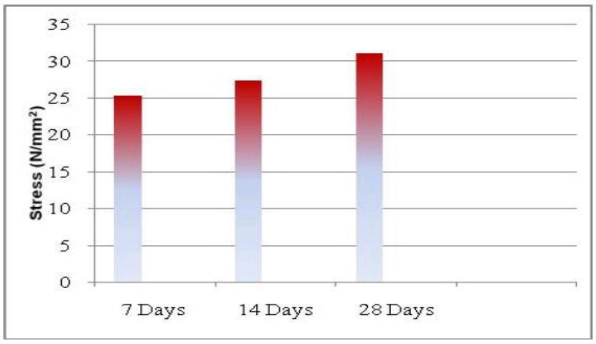


1. CHART results for compressive strenght of cube for 10% replacement of bagasse ash

2. TABLE for compressive strenght of cube for 20% replacement of bagasse ash

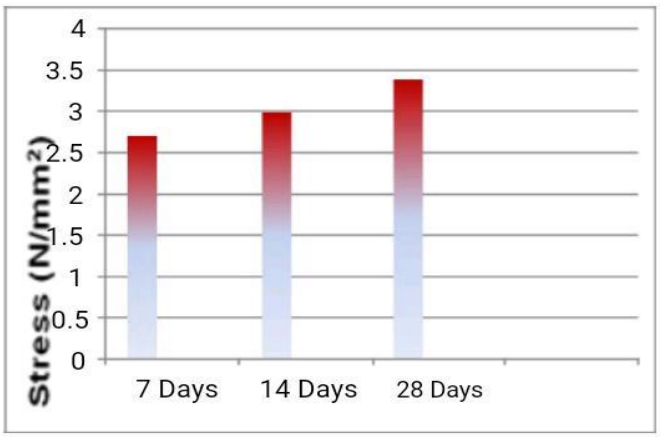
Grade	Days	% of replacement	Compressive strength of concrete		Average load	Stress in (N/mm^2)
			Sample 1	Sample 2		
M30	7	20	550	590	570	25.3
M30	14	20	600	630	615	27.3
M30	28	20	690	710	700	31.1

2. CHART results for compressive strenght of cube -20% replacement of bagasse ash



3 TABLE for compressive strength of cube for 30% replacement of bagasse ash

Grade	Days	% of replacement	Compressive strength of concrete		Average load	Stress in (N/mm^2)
			Sample 1	Sample 2		
M30	7	30	410	430	420	18.6
M30	14	30	558	571	564	25.0
M30	28	30	668	537	602.5	26.7



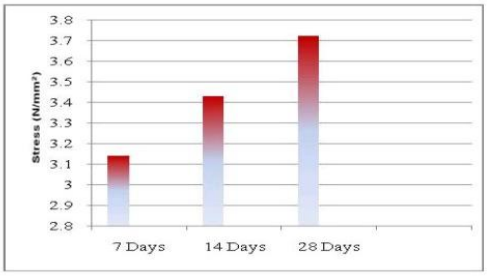
3 CHART results for compressive strenght of cube for 30% replacement of bagasse ash

II. Split Tensile Strength Procedure

1. The load pointer is set at zero by adjusting the initial setting knob.
2. The dial gauge is fixed and the specimen for measuring elongation of small amounts.
3. Measuring the diameter of the test piece by vernier caliper at least at three places and determine the mean value also mark the gauge length.
4. Now the specimen is gripped between upper and middle cross head jaws of the m/c.
5. Set the automatic graph recording system.
6. Start the m/c and take the reading.
7. The specimen is loaded gradually and the elongation is noted until the specimen breaks.

4 TABLE for split tensile strength of cylinder for10% replacement of bagasse ash

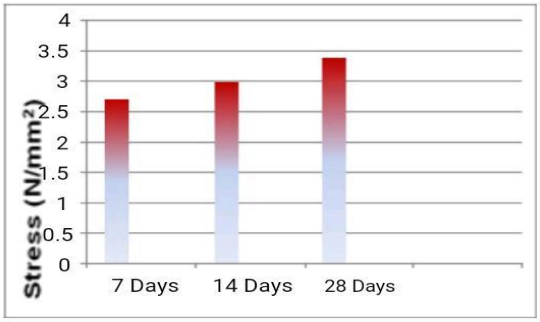
Grade	Days	% of replacement	Compressive strength of concrete		Average load	Stress in (N/mm^2)
			Sample 1	Sample 2		
M30	7	10	196	248	222	3.14
M30	14	10	217	269	243	3.43
M30	28	10	276	251	263.5	3.72



4 CHART for split tensile strength of cylinder for10% replacement of bagasse ash

5 TABLE for split tensile strength of cylinder for20% replacement of bagasse ash

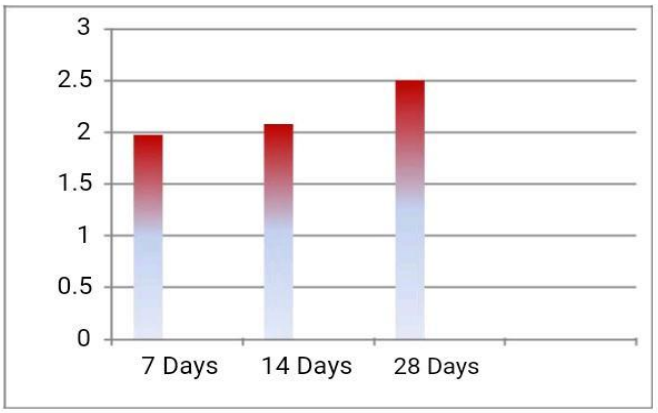
Grade	Days	% of replacement	Compressive strength of concrete		Average load	Stress in (N/mm^2)
			Sample 1	Sample 2		
M30	7	20	188	195	191.5	2.71
M30	14	20	223	210	216.5	3.0
M30	28	20	252	229	240.5	3.4



5 CHART for split tensile strength of cylinder for20% replacement of bagasse ash

6 TABLE for split tensile strength of cylinder for30% replacement of bagasse ash

Grade	Days	% of replacement	Compressive strength of concrete		Average load	Stress in (N/mm^2)
			Sample 1	Sample 2		
M30	7	30	146	133	139.5	1.97
M30	28	30	173	185	179	2.5
M30	28	30	173	185	179	2.5



6. CHART FOR SPLIT TENSILE STRENGTH OF CYLINDER FOR30% REPLACEMENT OF BAGASSE

III. Result and Discussion

1. While comparing the replacement of bagasse ash 10% 20% 30%.the stress at 28 day is 47.0 N/mm2,31.1N/mm2, 26.7N/mm2 respectively.
2. Split tensile strength ranges from 3.72 N/mm, 3.4 N/mm2, and 2.5 N/mm2 at 10% , 20% and 30% replacement of bagasse ash respectively.
3. Thus the strength decreases b the further addition of bagasse ash.

Conclusion

The results show that the SCBA concrete had significantly higher compressive strength compare to that of the concrete without SCBA. It is found that the cement could be advantageously replaced with SCBA up to maximum limit of 10%. Although, the optimal level of SCBA content was achieved with 10% replacement

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