Effect of the Partial Replacement of Cement by Sugarcane Bagasse Ash in Mortar

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Abstract— Due to pozzolanic reactivity, Sugarcane Bagasse Ash is used as a supplementary cementing material in mortar. It has economical and technical advantages to be used in mortar. I am going to partially replace cement by the use of Sugarcane Bagasse Ash by 5%, 10%, 15%, 20% and 25% by weight of cement in four different experimental procedure to find out the maximum strength and compare it with the strength of normal brick masonry mortar by using the grade of ML at the days of 7days, 14days & 28 days. This research therefore is an investigation of the performance of the brick masonry mortar made of partially replacing OPC with Sugarcane Bagasse Ash on the structural integrity and properties of SCBA mortar.

Key words: Sugarcane Bagasse Ash, Mortar, OPC, OMC, MDD, Admixture, water

I. INTRODUCTION

Utilization of agricultural, industrial and agro-industrial by-products in concrete production has become an attractive option to the researchers over all the world. Utilization of such wastes as cement replacement materials can reduce the cost of concrete and also minimize the negative environmental effects associated with the disposal of these wastes. Silica fume, rice husk ash, fly ash, Metakaolin and ground granulated blast furnace slag are well established pozzolans because of high silica contents in their chemical composition. The calcium hydroxide (unfavorable product from the cement hydration) released during the hydration of Portland cement reacts with the silica content present in the pozzolans and water to form additional calcium silicate hydrate which is responsible for the compressive strength in concrete. Sugarcane Bagasse Ash is the waste produced after juice extraction in Sugar industry, which is usually used as a fuel for boilers in the sugar mills and alcohol factories which produce high amounts of ash annually. Previously the sugar cane bagasse was burnt as a means of solid waste disposal, with increasing of the cost of natural gas, electricity, and fuel oil and with calorific properties of these wastes; since last decade the bagasse has been used as the principal fuel in cogeneration plants to produce electric power. Sugar cane bagasse ash is recently accepted as a pozzolanic material, study of using bagasse ash as a pozzolanic material is not well-known and its uses are limited and most of bagasse ash is disposed in the landfills , and "only a few studies have been reported on the use of Sugarcane bagasse ash as a pozzolanic material in respect of the cement paste".

II. MATERIAL

A. *Sugarcane Bagasse Ash:*

Sugarcane Bagasse Ash in this experiment was obtained from New India Sugar Mill hata, Kushinagar, U.P.

1) Physical Properties Bagasses Ash

S. NO.	Physical properties	Test Values
1.	Specific gravity	1.3
2.	Initial setting time (min)	125
3.	Final setting time (min)	300
4	Optimum moisture content (%)	16.6
5.	Maximum dry density (g/cc)	1.220

Table: Physical properties Bagasses Ash

B. *Cement:*

Cement used in the experiment was obtained from Shree Tech Cementing Company with name BANGUR Cement.

1) Physical Properties of Cement

S. NO.	Physical properties	Test Values
1.	Specific gravity	1.3
2.	Initial setting time (min)	125
3.	Final setting time (min)	300
4	Optimum moisture content (%)	16.6
5.	Maximum dry density (g/cc)	1.220

Table: Physical properties of cement

C. *Fine Aggregates:*

Fine aggregate was purchased which satisfied the required properties of fine aggregate required for experimental work and the sand conforms to zone II as per the specifications of IS 383:1970.

a) Specific gravity = 2.62
b) Fineness modulus = 2.81

1) Water:

Water is an important ingredient of concrete as it actively participates in the chemical reaction with cement. Since it helps to form the strength giving cement gel, the quantity and quality of water is required to be looked into very carefully. Mixing water should not contain undesirable organic substances or inorganic constituents in excessive proportions. In this project clean potable water is used

2) Sample – 1: 10 % replacement of cement with SCBA

S. No.	Weight Of Mould (gm)	Weight of mould + wet sample (gm)	Weight of crucible + wet sample (gm)(A)	Weight of crucible + dry sample (gm)(B)	Weight of crucible (gm) (C)	Weight of wet sample (gm)	Volume of mould (cc)	Density (gm/cc)	Water Content (A-B)/(B-C)*100	Dry density
1.	5690	7630	41.498	40.335	18.615	1940	1000	1.940	0.05349	1.8414
2.	5690	7745	43.561	41.559	16.944	2055	1000	2.055	0.08133	1.9004
3.	5690	7890	40.460	38.232	16.739	2200	1000	2.200	0.1036	1.9934
4.	5690	7940	52.716	48.628	15.845	2250	1000	2.250	0.1247	2.0005
5.	5690	7930	59.684	54.718	18.897	2240	1000	2.240	0.1380	1.9683

Table 1: OMC Data for 10% replacement

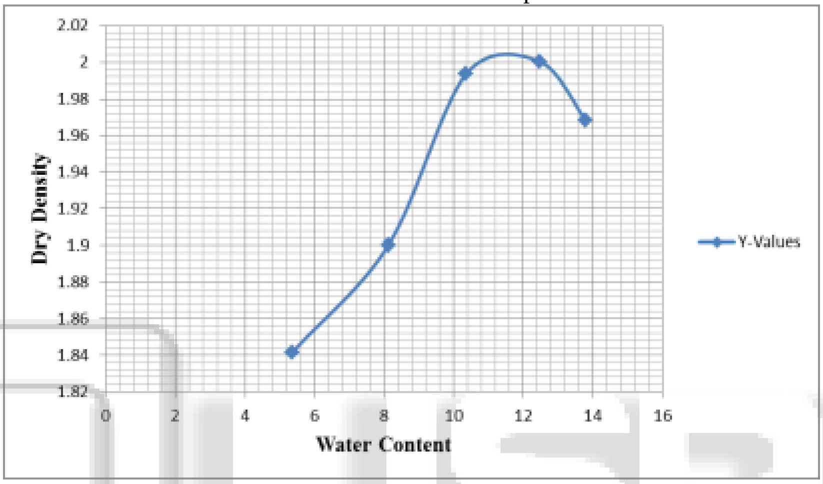

Fig. 1: OMC and dry density graph

3) *Sample-2: 20 % Replacement of Cement with SCBA*

S. No.	Weight of mould (gm)	Weight of mould + wet sample (gm)	Weight of crucible + wet sample (gm) (A)	Weight of Crucible + dry sample (gm) (B)	Weight of crucible (gm) (C)	Weight of wet sample (gm)	Volume of mould (cc)	Density of sample (gm/cc)	Water Content (A-B)/(B-C)*100	Dry Density
1.	5690	7585	30.098	29.286	17.151	1860	1000	1.895	0.0669	1.7761
2.	5690	7735	33.840	32195	17.220	2040	1000	2.045	0.1098	1.8426
3.	5690	7845	30.177	28.672	16.792	2135	1000	2.155	0.1266	1.9126
4.	5690	7980	31.741	29.786	18.609	2270	1000	2.290	0.1749	1.9491
5.	5690	8135	33.999	31.258	18.629	2300	1000	2.445	0.2166	2.0096
6.	5690	7977	33.273	29.993	16.867	2267	1000	2.287	0.2498	1.8298

Table 2: OMC Data for 20% replacement

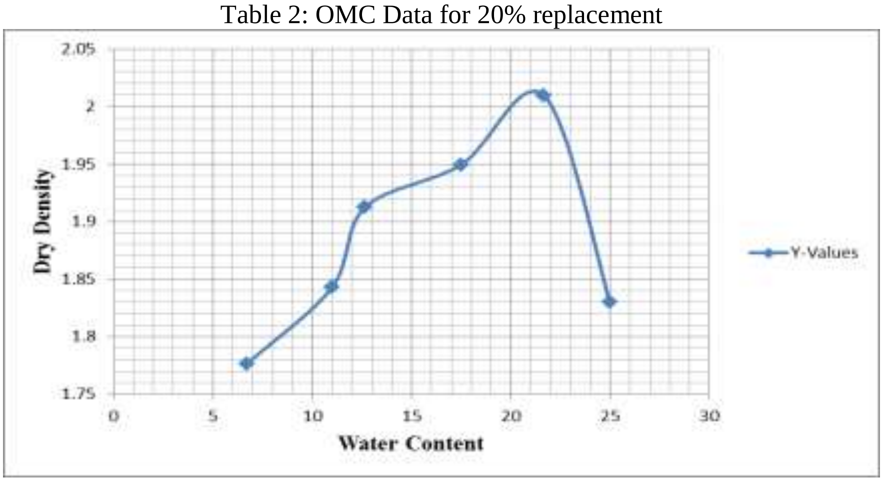

Fig. 2: OMC and dry density graph

4) Sample-3: 25 % Replacement of Cement with SCBA

S. No.	Weight Of Mould (gm)	Weight Of mould + wet sample (gm)	Weight of crucible + wet sample (gm)(A)	Weight of crucible + dry sample (gm)(B)	Weight of crucible (gm) (C)	Weight of wet sample (gm)	Volume of mould (cc)	Density (gm/cc)	Water content (A-B)/(B-C)*100	Dry density
1.	5690	7510	30.351	29.286	17.151	1820	1000	1.820	0.0877	1.6730
2.	5690	7690	32.453	31.095	17.220	2000	1000	2.000	0.0978	1.8217
3.	5690	7788	31.245	29.853	16.792	2098	1000	2.098	0.1065	1.8959
4.	5690	7945	31.887	29.832	18.609	2255	1000	2.255	0.1831	1.9060
5.	5690	8035	33.454	31.053	18.629	2345	1000	2.345	0.1932	1.9652
6.	5690	8020	32.845	30.257	17.867	2330	1000	2.287	0.2088	1.8918

Table 3: OMC Data for 25% replacement

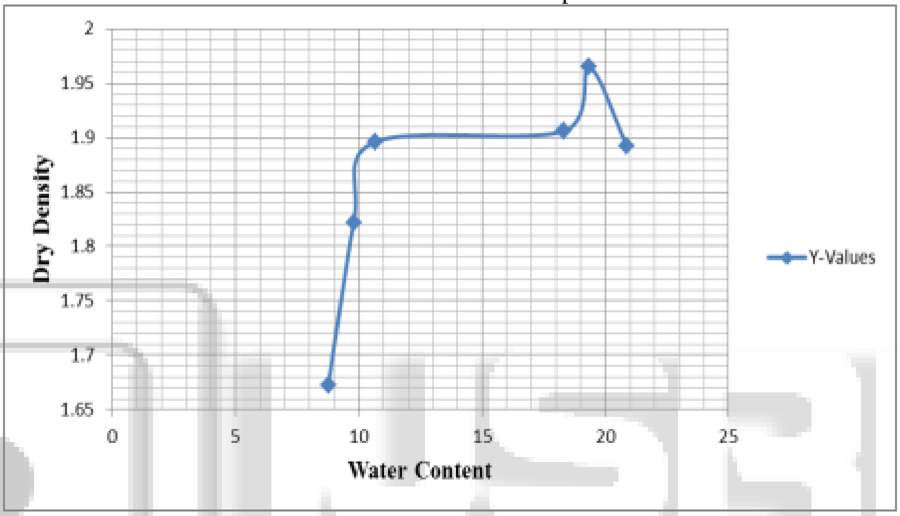

Fig. 3: OMC and dry density graph

III. Conclusions

Based on the study carried out on the strength behavior of Sugarcane Bagasse Ash ash the following conclusions are drawn:

- At the initial ages, as replacement level of Sugarcane Bagasse Ash increases the moisture content also increases.
- The optimum moisture is obtained at the level of 15 % of OPC replaced by Sugarcane Bagasse Ash.
- Using Sugarcane Bagasse Ash as replacement of OPC in concrete, the emission of greenhouse gases can be reduced up to a greater extent.
- OPC replacement by Sugarcane Bagasse Ash is environmental friendly due to utilization of waste (SCBA is basically a waste obtained from Sugar Mill) and replacement of cement (Production of 1.5 MT cement emerges 1.5 MT Carbon-di-Oxide).

Reference

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