Use of sugarcane bagasse ash as brick Material

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Abstract— Sugarcane bagasse is a waste-product of the sugar cleansing industry. The bagasse is fibrous in nature. A very large amount of bagasse ash is obtained from these industries which requires its disposal and environmental problems. The bagasse ash can be used as partial replacement of fly ash in fly ash bricks with significant alteration in properties of bricks. In present study, the effect of bagasse ash is investigated when used as replacement in fly ash bricks. The bricks prepared with different amount of bagasse ash and fly ash are tested for strength and other properties. It is observed that compressive strength is decreased along with density as bagasse ash is used to replace fly ash in bricks. However, the density is also found to decrease by about 80%.

Key words: Cement Concrete; Bagasse Ash; Compressive Strength

I. INTRODUCTION

The productive efforts of industries are leading to a developed India, this growing industrial scenario tends to increase the production of waste. According to a survey approximately 250 to 300 million tons of wastes are being produced annually by chemical and agricultural industries in India [1]. Disposal of this waste without affecting the health of people, surrounding environment, land and water bodies etc. is crucial. The fibrous residue left after crushing of sugar cane leave a fibrous material which is a leading industrial waste product from the sugar industry [2].

Bagasse (the fiber of sugar cane) is that the by - product or residue of milling the cane, which might even be made by mastication the cane by local people. Concerning thirty third of the pulp made, provides the fuel for the generation of steam [3]. With present alternative sources of fuel, sugar factories have Associate in Nursing excess of pulp, that along with regionally generated pulp, cause serious environmental production drawback, that once indrawn in excess, causes disease called bagassiosis [4]. In Nigeria, the calculable land beneath sugar cane cultivation is twenty-three - 30, 0000ha, whereas giant scale cultivation is done at with Associate in Nursing calculable annual output of ninety-six [5]. It has shown use of phosphate waste and small-grained coal bottom ash, the utilization of pulp ash as pozzolana has received lit tle attention. In Nigeria, there's very little or no management over cement prices, especially as each bulk and bagged cements square measure largely foreign at terribly high foreign exchange rates [7]. Economic use of cement in concrete will so principally be achieved in Niger ia by thought of pa rtial replacement of the cement needs in concrete by cheaper native pozzolana reminiscent of pulp ash Using Sugarcane bagasse ash in brick making can save the disposal costs and can help in producing 'greener' bricks for construction [8].

II. EXPERIMENTAL MATERIAL

A. Sugarcane Bagasse Ash:

Incineration of fibrous material left after crushing of sugarcane produces bagasse ash [8]. Currently in sugar factories bagasse as a fuel is used so as to run their boilers and then dumped in large farms [3]. This causes environmental problems like land infertility, water pollution etc. Therefore, its reuse is essential, also it is found that bagasse ash is rich in siliceous compounds and to have pozollonic property so it can be used as auxiliary to construction material. Fly ash

Class F type fly ash is pozzolonic in nature, and consistsof less than 20% lime (CaO). Class F type fly ash act as cementing agent in the presence of binder material like cement, lime etc.

B. Acetylene Lime:

The fusion of pure calcium oxide with coke yields the highest amount of acetylene. Carbide lime produced by this process have a finer particle size resulting in better binding property and workability.

C. Quarry Dust:

The physical appearance of quarry dust resembles with sand. The density of Quarry dust is 1650 kg/m³.

D. Water:

Water is the most important constituent of brick manufacturing. It acts as a binder for the raw materials and give proper mix and adhesion.

Sr.No.	Chemical Compound	Class F
1	SiO_2	54.90
2	$A1_2O_3$	25.80
3	Fe2O5	6.90
4	CaO	8.70
5	MgO	1.80
6	SO_3	0.60
7	Na_2O & K_2O	0.60

Table 1: Chemical composition of fly ash

III. MIX DESIGN

The mix design is performed for bagasses and varied amount of fly ash and bagasse ash. The proportions of various mixes are given in Table 2.

Sample	Fly ash amount (kg)	Bagasse ash amount (kg)	Lime (Kg)	Quarry Dust (Kg)
Std.	60.00	0.00	20.00	20.00
S1	50.00	10.00	20.00	20.00
S2	40.00	20.00	20.00	20.00
S3	30.00	30.00	20.00	20.00
S4	20.00	40.00	20.00	20.00
S5	10.00	50.00	20.00	20.00
S6	0.00	60.00	20.00	20.00

Table 2: Mix proportions

IV. EXPERIMENTAL INVESTIGATION

In the present study brick contains fly ash, Lime, water, and Quarry dust. Certain amount of the fly ash is substituted with Bagasse ash (Table 3), this data from the Bagasse ash fly ash brick is than compared with that from a standard fly ash brick without bagasse ash. Five bricks samples of size 230 mm × 115 mm × 75 mm were cast. The industrialized manufacturing procedure of bricks generally involves of three steps:

- Mixing the ingredients.
- Pressing the mix in the machine.
- Curing the bricks for a stipulated period.

Machinery for brick pressing should be chosen carefully, it mainly depends on the constituents of brick mix. For the present study the suitable machinery is a Vibro - press machine, which is a conventional low cost machine and can be handled by ordinary semiskilled labor. It can produce around 1000 bricks per shift and can be easily operated in two shifts without any overhead operation/maintenance cost.

A. Compression Test:

After pressing is done and bricks are sundried they are immersed in water for 24 hours. 1:3 cement mortars is filled in the frog of the brick and the sample are put in storage in a moist jute bag for 24 hours and then again immersed in clean water for 24 hours for complete absorption of water. Compressive strength testing is carried out with 6 mm plywood on both the top and bottom faces of brick specimen to get uniform loading [6]. The load is wholly axial and applied at a constant rate of 14 N/mm^2. The failure load is noted. Mean value of three specimen for every mix is taken. The results are plotted below.

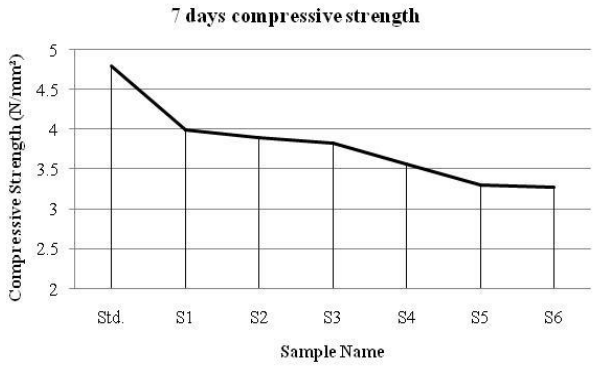

Fig. 1: 7 days Compressive strength of bagasse concrete

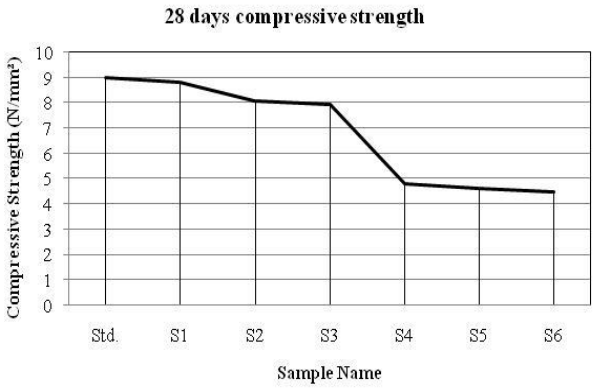

Fig. 2: 28 days compressive strength of bagasse concrete

Sr. No	Description	Clay Bricks	Bagasse Ash Fly ash Bricks
1	Size, mm	215x100x70	230x100x75
2	Volume, cm^3	1505	1725
3	Bricks in 1 Cum Masonry	664	500
4	Density, Kg /m^3	1600	1668
5	Cost in Rupees	4000/1000	2420/1000
6	Compressive Strength, Kg/cm^2	30-50	30-50
7	Water Absorption,%	20-25	8-12

Table 3: Comparison between clay bricks and bagasse fly ash bricks

V. CONCLUSION

Based on this limited experimental investigations regarding compressive strength of Brick, the following conclusioncan be made:

1) A decreasing trend is observed on increasing the percentage of bagasse ash in fly ash bricks.
2) Replacement of fly ash from bagasse ash in brick can solve the disposal problem, can reduce the cost and produce a 'greener' Ecofriendly bricks for construction.
3) Environmental effects of wastes and disposal problems of waste can be reduced through this research.
4) A better degreeof non-conventional Construction Material is designed through this study.
5) A more appreciable use of sugarcane bagasse ash is found through this research.
6) In this study, maximum compressive strength is obtained when 10 kg of fly ash is replaced by bagasse ash.
7) It reduces the density of bricks from 20 kg/m^3 to about 11 kg/m^3 which is about 45% decrement in weight hence, bagasse ash bricks reduce the seismic weight of building.
8) Along with reduction in cost per brick.

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