COMPARATIVE STUDY ON STRENGTH OF SUGARCANE BAGASSE ASH AND MARBLE SLURRY DUST ADMIXED MASONRY MORTAR

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ABSTRACT. This paper deals with effective ultilization of industrial wastes such as Sugarcane Bagasse Ash (SCBA) and Marble Slurry Dust (MSD as a supplementary cementitous material in masonry mortar. Ordinary Portland cement (OPC) was partially replaced with finely sugarcane bagasse ash (SCBA) and Marble Slurry Dust (MSD) with 0%, 5%, 10%, 15% and 20% by weight of cement. Compressive strength of mortar was determined by casting cube specimen of size 70.6 mm x 70.6 mm x 70.6 mm with water to binder ratio 0.4. The cubes were tested at 7, 21 and 28 days of curing ages for compressive strength of mortar and comparing the test results of sugarcane bagasse ash (SCBA) and Marble Slurry Dust (MSD) with respect to the control specimen, this paper validated the positive effect of sugarcane bagasse ash and Marble Slurry Dust (MSD) in strength improvement of mortar at 7, 21 and 28 days. Results revealed that Sugarcane Bagasse Ash (SCBA) and Marble Slurry Dust (MSD) both can be used as a pozzolanic material in mortar up to 10%.

Keywords: Sugarcane Bagasse Ash (SCBA), Marble Slurry Dust (MSD), pozzolanic material, Compressive strength, Industrial waste

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INTRODUCTION

Cement concrete is the most extensively used construction material in the world. Ordinary Portland cement is recognized as the major construction material throughout the world. Portland cement is responsible for about 5 to 8% of global CO_2 emission this environmental problem will most likely to be increased due to exponential demand of Portland cement [6]. Industrial wastes, such as rice husk ash, fly ash and silica fume are being used as supplementary cement replacement materials [4, 5]. In addition to these, agricultural wastes such as rice husk ash, wheat straw ash, and sugarcane bagasse ash are also being used as pozzolanic materials and hazel nutshell used as cement replacement material [7]. India is the second largest producer of sugarcane and large quantity of bagasse ash (67,000 tonnes/day) and large quantity of sugarcane bagasse is available from sugar mills [9,10]. Sugarcane baggase ash is a byproduct of sugar factories and it is produced by burning sugarcane baggase. It was found that SCBA improves the properties of concrete and mortar such as compressive strength, water tightness in some percentage of replacement [11]. Initiatives are taken worldwide to control and to manage the agricultural waste by replacing it with cement to make green environment [6, 15]. There are various studies related to use of SCBA as supplementary cementitious material in concrete and mortar [8, 12, 13].

One of the major wastes produced in the stone industry during cutting, shaping, and polishing of marbles is the marble dust [14, 15]. Due to the availability of large quantity of waste produced, this paper deals with the possible use of sugarcane bagasse ash and marble slurry dust in mortar as partial replacement of cement.

MATERIALS PROPERTIES

In this work, cement, sand, water, sugarcane bagasse ash and marble slurry dust were used.

Cement

The cement used was Ordinary Portland cement (43 Grade) with a specific gravity of 3.15. Initial and final setting time of the cement was 20 min and 227 min, respectively. Ordinary Portland cement of 43 grade was used in this experimentation conforming to I.S-8112- 1989 [1].

Aggregates

Good quality river sand was used as a fine aggregate. The specific gravity was 2.45. Its density was 2.47 conforming to I.S. – 383-1970 [2].

Sugar Cane Baggashe Ash

Sugarcane bagasse ash used for this work was obtained from purti power plant, bela, Nagpur, Maharashtra, India. Sugarcane baggase ash is a byproduct of sugar factories and it is produced by burning sugarcane baggase. The bagasse ash passing from a 90μ sieve and retained on 45μ the retained bagasse ash is taken for the preparation of mortar.

Figure 1 Sugarcane Bagasse Ash

Marble Slurry Dust

Marble powder was collected from the dressing and processing unit in Nagpur, Maharashtra, India. The marble dust used is in powdered form, odourless, grey in colour with the moisture content of 1.59%. Marble is a metamorphic rock resulting from the transformation of a pure limestone.

Figure 2 Marble Slurry Dust

In order to be used as a mineral admixture in mortar, material must have appropriate chemical properties. The moisture content of baggase ash and marble slurry dust, weight and the amount of ash were measured first. The chemical composition of baggase ash and marble slurry dust were investigated and compared with ordinary portland cement based on limitation given by IS 1489 [3].
The results of chemical composition of sugar cane bagasse ash and marble slurry dust are shown in table 1.

Table 1 Chemical composition of Sugar Cane Bagasse Ash and Marble Slurry Dust

SR. NO	OXIDES	MASS (gm/100gm) SCBA	MASS (gm/100gm) MSD
1	Silicon Oxide (SiO_2)	53.44	5.97
2	Aluminium Oxide (Al_2O_3)	14.73	0.35
3	Ferrous Oxide (Fe_2O_3)	11.41	2.87
4	Calcium Oxide (CaO)	3.45	36.48
5	Magnesium Oxide (Mgo)	6.77	12.02
6	LOI	10.30	38.06

Table 1 show chemical compositions of sugar cane bagasse ash and marble slurry dust. It was found that silicon di-oxide is 54% in sugar cane bagasse ash as a main oxide. The other

oxides presents are aluminium oxide 14(g/100g), iron oxides of about 11(g/100g) and CaO of about 3(g/100g). MnO was found to be about 6.7(g/100g) and loss of ignition was found to be 10.30 composition. The similar oxide has been found with that of cement.
In case of marble slurry dust, it was found that calcium oxide content is major oxide which is nearly 37 percent by weight of marble dust powder. Also the lime content in marble dust is more than any other component.

EXPERIMENTAL RESULTS AND DISCUSSIONS

Compressive strength of mortar with different blends at 0%, 5%, 10%, 15% and 20% partial replacement by sugarcane bagasse ash and marble slurry dust were carried out in laboratory. The water to binder ratio was kept constant to 0.4 and aggregate to binder ratio fixed to 1:3 for all the blends.
Compressive strength of mortar results for blends containing 0%, 5%, 10%, 15% and 20% sugarcane bagasse ash and marble slurry dust replace with ordinary cement at various ages are shown in figure 3,4 and 5.

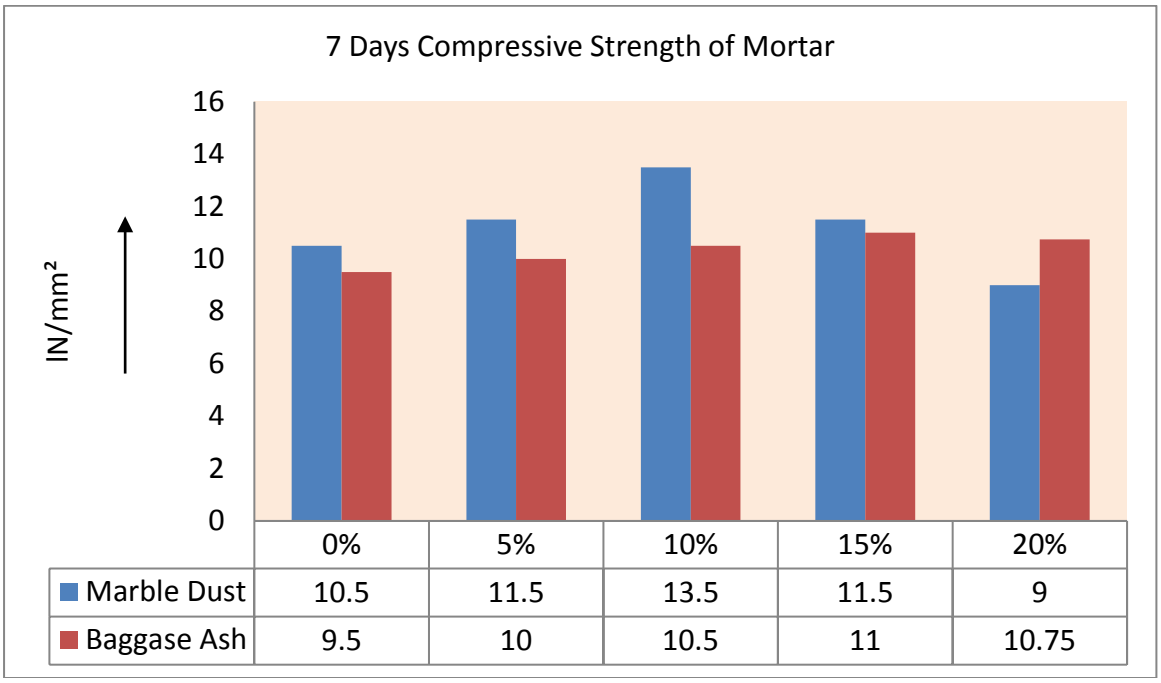

Figure 3 Compressive Strength of Mortar at 7 Days

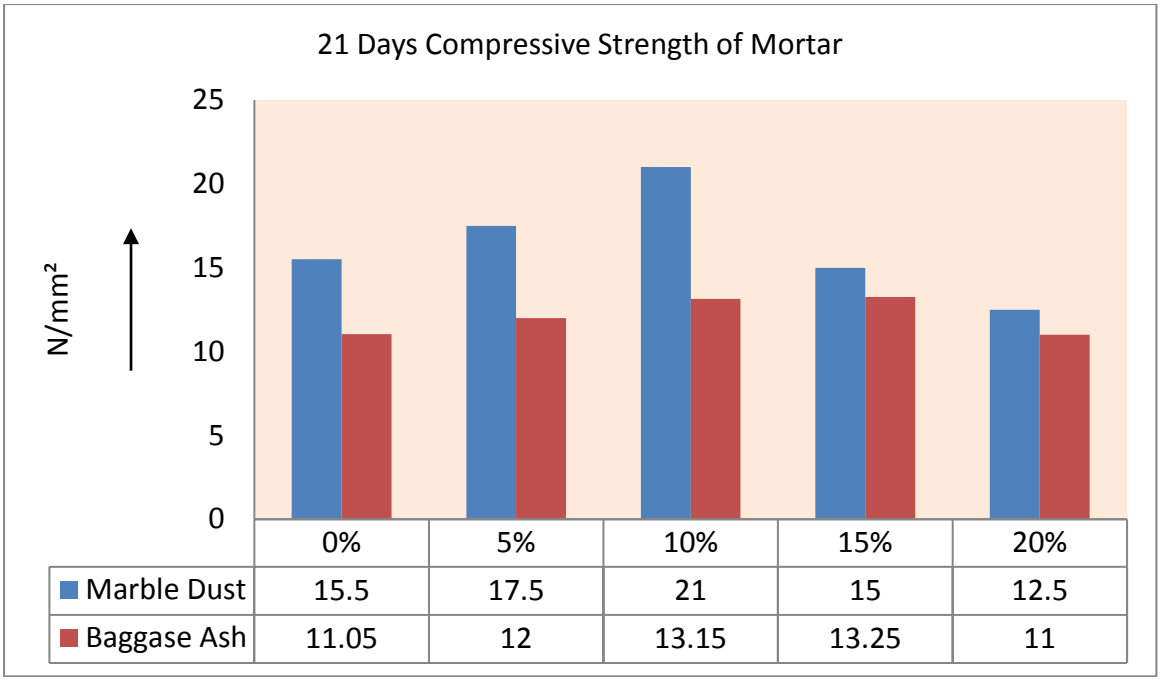

Figure 4 Compressive Strength of Mortar at 21 Days

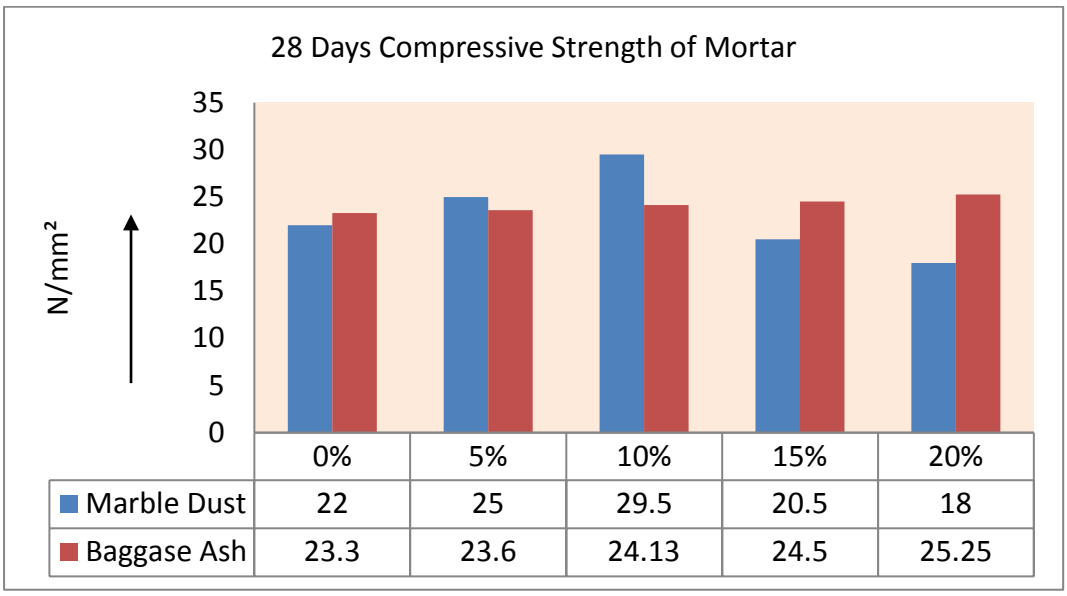

Figure 5 Compressive Strength of Mortar at 28 Days

Figure 3,4 & 5 shows the comparison and variation of results of compressive strength of mortar blended with 0%, 5%, 10%, 15% and 20% sugarcane bagasse ash and marble slurry dust replace with cement. It was observed that, optimum level of replacement was found to be 10% of for both the material. Further replacement of cement by SCBA and MSD shows decrease in strength of concrete.

It was observed that maximum compressive strength for mortar is found to be 25.25 N/mm^2 for 28 days replacement which is decrease at 28 days of curing. The compressive strength of 7 and 21 days was equal for 20% replacement of cement with SCBA. The strength of mortar was found significantly increase at 21 days of curing.

The mortar with SCBA has 22% higher compressive strength for 15% replacement of SCBA for 7 days of curing, 20% higher compressive strength for 15% replacement of

SCBA for 21 days of curing and 9.44% higher compressive strength for 20% replacement for 28 of curing days than conventional mortar.

CONCLUDING REMARKS

This paper focus on effective utilization of sugarcane bagasse ash (SCBA) and marble slurry dust as a pozzolanic material to produce green mortar. Both waste materials can be used to in mortar as there is always a need to overcome the problem of disposal of industrial waste and green house effect.

On the basis of experimental study, the following conclusions can be drawn.

1. SCBA can be a good replacement for cement in mortar compared to MSD. Therefore SCBA is more promising material than MSD.
2. The SCBA concrete gives higher compressive strength compared to MSD than that of control specimen.
3. Bagasse ash can prove to be a potential ingredient of concrete since it can be an effective replacement to cement.
4. It is cost effective too as it mitigates the cost by 12% for 1 m^3 of concrete.

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