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Implementation and Utilization of Sugarcane Pressed Mud to manufacture of Bricks

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ABSTRACT

- In this paper, the effects of incorporation of sugarcane bagasse ash (SCBA) on the properties of fired clay bricks were investigated. Clay bricks fabricated with 0, 2.5, 5, 7.5 and 10% by weight SCBA were tested. The clay brick specimens were fired at 900, 1000 and 1100 °C to study for water absorption, density, porosity and compressive strength of the brick samples were investigated. The bulk density of the tested specimens varied upon the SCBA dosage level and the dosage level of up to 10 wt.% was found to be satisfactory in this work. This was accompanied by the increases in water absorption and porosity and reduction in compressive strength of samples. The compressive strengths of bricks with 2.5 % SCBA fired at 1000 °C and with 2.5, 5.0 and 7.5 % SCBA fired at 1100 °C were higher than the required strength values as per ASTM C62-13a with beneficial reduced density and increased porosity. The firing shrinkage values were slightly increased with increasing in the SCBA content but were still within limit of the standard requirement. The results thus showed that SCBA was a potential material for use as a pore former additive to raw clay-brick production. In this study and sugarcane press mud is used as a replacement for brick. This is aimed to reduce the sugarcane waste dumping in the earth to protect the environment from hazardous and also increment of low-cost brick towards the construction industry for the sustainable development. Bricks are the major building material used for constructional. In earlier days mud blocks were used and nowadays clay bricks are being used So the industrial waste materials and the by products are used in the manufacturing of bricks.

Keywords- SCBA, Sugarcane Pressed Mud, Manufacture Bricks, Waste Material, Water Absorption, Density.

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I. INTRODUCTION

1.1 General Introduction

Bricks have been used for more centuries. The present investigation, an attempt made with mixing sugarcane press mud with other constituents.

Population state of affairs comes in the direction of India by using increasing industries. As the industries will increase also the waste coming from them at the end of product will increase. India is the second largest sugar producing country in the world. It contributes 20 % at the total sugar industry in the world and accounts for about 15 % of the global production. Sugar factories produce large quantity of fly ash. This fly ash is a waste produced in the sugar factories and it causes air, water and soil pollution when it is exposed to environment. The ultimate disposal of incinerated "bagasse" ash can be accomplished by it an Engineering construction material. The fibrous residue of sugarcane after crushing and extraction of its juice, known as "bagasse" is one of the largest agricultural residue in the world. The bagasse however used as bio-mass fuel for boilers but after burning the by-product (SCBA, press mud) left is of no use generally. Therefore our aim is to use this bagasse ash and press mud for manufacturing of bricks. It also shows cementious properties and works as a binding.

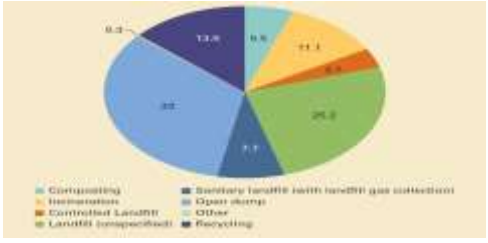


Fig 1. Percentage of Dumping Waste

II. DETAIL DESCRIPTION

2.1 Clay:

A fire brick is a special type of brick made using fire clay and has a good resistance against high temperatures which are used in kilns, lining furnaces, fireplaces and fireboxes. These bricks are manufactured in a way similar to that of normal bricks, except during the burning process- Fire bricks are exposed to very high temperatures.

Fire clay for Making Fire Bricks

Fire clay is used to make fire bricks and is generally found under the coal seams. Fire clay contains two major constituents- silica and alumina, of which, the silica percentage varies from 60 to 70% and alumina varies from 25 to 35%.
Some other constituents such as oxides of calcium, magnesium, iron, potassium and titanium are also present in fireclay. However, the percentage of constituents other than silica and alumina does not exceed 5% in the case of good fire clay.

2.2. Press mud:
Organic waste, such as press mud or filter cake, is generated as a by-product of sugarcane industries and characterized as a soft, spongy, amorphous, and dark brown to brownish material depicted in Fig.2. It is generated during the purification of sugar by carbonation or sulphonation process. Both the processes separated clear juice on top and mud at the bottom. In general, when100 t of sugarcane is crushed, about 3 t of press mud are produced as a by-product. It is considered as rejected waste material of sugarcane industries that cause problem of storage and pollution to surrounding of sugar mills on its accumulation. It contains sugar enhanced its decomposition in soil.
Press mud supplies a good amount of organic manure and can be an alternate source of plant nutrient and act as a soil ameliorates. The amount of sugar press mud (SPM) production depends upon the carbonation and sulphonation process; it is 7–9 and 3–5 % of the total weight of sugar cane from above the process, respectively. It contents 50–70 % moisture, which is most favorable for soil micro-organisms, especially earthworms. The composition of SPM is also affected by variety, fertility status of soil, and also there cover process of industries. It contains significant amounts of iron, manganese, calcium, magnesium, silicon, and phosphorus, and enhanced the suitability of SPM as a source of nutrient. Press mud, an end product of the sugar industry, is used as one of the substrates in bio-composting.

Fig.2. Sugarcane Bagasse and Press mud

III. DESIGN PROCESS

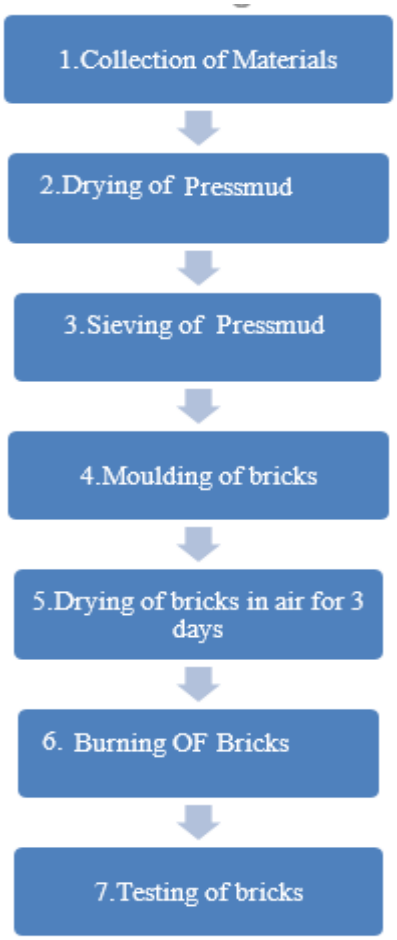


Fig 3. Process Steps

3.1 Material Used:

COLLECTION OF PRESSMUD

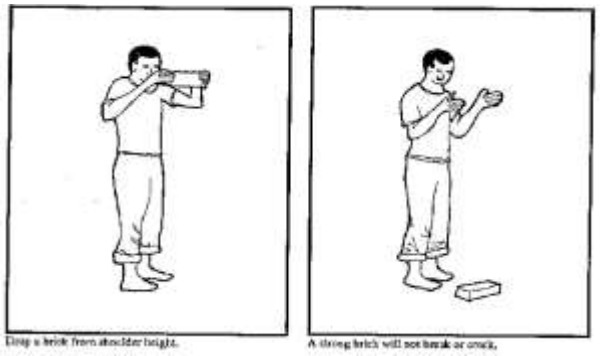
COLLECTION OF CLAY

MODELLING BRICKS DESIGN

DRYING OF BRICKS

BURNING OF BRICKS

TESTING BRICKS



IV. TEST ANALYSIS

1. Compressive strength test:

This test on bricks is found out by placing the brick in the compressive testing machine. The minimum compressive strength of bricks should be 3.50N/mm2.

To determine the compressive strength of bricks. The compressive strength of bricks are obtained by placing the brick on the compression testing machine with 6mm plywood an top and bottom of it to get uniform rate of 14N/mm2 . The axial load is applied at uniform rate until the bricks get failure. The compressive strength of the brick is obtained by using the formula,

Compressive strength = Maximum load at failure/Area of the surface.

(i)Taken two random bricks samples and immerse them in water for 24 hours at room temperature.
(ii) After 24 hours, take them out, allow them to drain and then clean the surplus water.
(iii) Now, fill their frogs (and any other voids) by a layer of standard 1:1 mortar (Store these bricks under damp sacks for 24 hours (to allow setting of mortar).
(iv) Place the bricks in water for seven days. (This is to allow the mortar to harden).
(v) Take the bricks out of the water, allow the water to drain and remove the surplus water.
When surface dry, each brick is tested for compressive strength individually.
(vi) Place the brick flat-wise, with frog end facing upward, between two plywood sheets.
(vii Brick so adjusted between the plywood sheets is placed on the bed of compressive strength of bricks testing machine and load is applied axially and at a uniform rate of 140 kg/cm2/minute. (This is very important).
(viii) Note the load at which the brick fails (gets broken). This load (P) is divided by cross sectional area A of the brick gives the compressive strength.

Co=P/A

(ix) The arithmetic mean of the compressive strength of bricks values of all the five bricks shall be taken as the compressive strength of that lot of bricks represented by the test samples, (and not for all the bricks of a kiln).

Compressive Strength of Bricks.

(I) Compressive Strength of first class brick is 105 kg/cm2.(10.5MPa)

(II) Compressive Strength of 2nd class brick is 70 kg/cm2. (7 MPa)

(III) Compressive Strength of common building brick is 35 kg/cm2. (3 MPa)

(IV) Compressive Strength of sun dried brick is 15 to 25 kg/cm2.

SIZES OF BRICKS:

1. Size of 1st sample of brick: 190mm*90*mm90mm (19cm*9cm*9cm)
2. Size of 2nd sample of brick: 190mm*90*mm90mm

The results showed that the compressive strengths of the samples varied from 10.53 to 24.47 MPa with corresponding 10 wt.% SCBA.

SAMPLE	Compressive strength (N/mm2)
L1	7.2
L2	8.3

Table 1. Compression test Readings

Fig 4: Compression Testing Machine

2. Water Absorption Test

A brick is dried is weighted. It is then immersed in water for a period of 24 hours. It is weighed again and the difference in weight indicates the amount of water absorbed by the brick. It should not, in any case, exceed 20% of the weight of dry brick for first class.

Water absorption (%) = [(W2-W1) / W1] x 100

Where,

W1 = Dry Brick Weight (oven Dry Condition after 24 hours at temperature 110 to 150 °C) W2 = Wet Brick Weight (After Immersion for 24 Hour)

- Note dry weight of brick.
- Immerse in water for 16 hours.
- Weighed again.
- Difference in weight indicates the water absorbed.
- In no case it should not be greater than 20% by

Dry weight of brick.

(i) Take five whole bricks randomly.
(ii) Dry these samples to a constant weight by placing them in a ventilated oven at 110° C +- 5°C. This may take 48 hours or more time.

The specimens are weighed individually after cooling.

(i) The dry, weighed samples are then immersed in water, at room temperature, for 24 hours. (v) After 24 hours the samples are taken out. Each sample is wiped dry and weighed individually within three minutes after it is taken out from the water.

Sample	Water Absorption (% by wt.)
L1	13%
L2	16.8%

Table No 2. Water Absorption test reading

3) Effloresce Test

For finding the presence of salt on brick it is immersed in water for 24hrs.Ot is then taken out and allowed to dry . If the white content on bricks is 10% then the effloresce is said to be light. If it is up to 50% it is said to be moderate. If the effloresce is said to be more than 50% then the brick is called as serious and then it is rejected.

(i) Take five bricks at randomly.

(ii) Place each brick on end in a separate shallow flat bottom dish containing distilled water.

Note that depth of immersion of bricks should not be less than 2.5 cm in each case.

(iii) Keep the above dishes (containing water and bricks) in a warm (18°C to 30°C) room which has adequate Ventilation.

(The water from the dishes will be lost due to absorption by bricks and subsequent evaporation).

(iv) Add fresh quantity of distilled water when the bricks appear having dried.

(v) At the end of the second drying, each brick is observed for efflorescence; that is an appearance of any white patch of salt on the surface of the brick.

EFFLORANCE ON BRICKS

4. Hardness Test

In this test scratch is made on the brick surface with the fingernail.

If no impression is left on the surface then the brick is said enough hard.

TRIALS	RESULT
1	NO
2	NO

Table 3. Hardness test result

V. RESULT AND DISCUSSION

Tests are carried out after 28 days of manufacturing the bricks. The better compressive strength of the brick is obtained at the first mix. The compressive strength of the brick is 7.75 N/mm2.The water absorption is less than 14.9% which should be less than 20%. On adding more amount of sludge and press mud it reduces the strength of the bricks it just occupies the space as filler. The following graph shows the compressive strength of bricks.

The following conclusion can be drawn from the result obtained from the experimental investigations.

i. The compressive strength test carried out at 21days the comparison made between the conventional fly ash brick with four proportion of sludge as per IS code 3495Part1:1992.
ii. It has been observed that in case of compression test, for 10 % press mud, compressive strength comes to maximum.
iii. Water absorption test carried out for 24 hours the comparison made between the conventional fired clay brick with two proportion of components as per IS code 3495 Part2:1992.
iv. Study shows that water absorption values for the bricks is 14.9 % so the brick required very ease amount of water for curing.
v. Environmental effects from wastes and disposal problems of waste can be reduced or controlled through this research.
vi. Environment is protected due to less emission of CO2(less clay-less coal-less CO2)
vii. A better measure by an innovative Construction Material is formed through this project.
viii. It utilizes waste material such as press mud .
ix. Pressed Bricks can be made just like Clay Bricks i.e. no additional technology is required. Hence Technically Feasible
x. As the cost of manufacturing of bricks is less than 8 Rs (less as compared to the convectional bricks). So this is profitable.

Final results:

- Compressive strength = 7.75 N/mm2
- Water absorption = 14.9 %
- Successfully passed the hardness and soundness test.
- Manufacturing Cost =Rs 8
- BCR = 1.18

VI. CONCLUSION

The following conclusion can be drawn from the result obtained from the experimental investigations.

i. The compressive strength test carried out at 21days the comparison made between the conventional fly ash brick with four proportion of sludge as per IS code 3495Part1:1992.
ii. It has been observed that in case of compression test, for 10% sludge, compressive strength comes to maximum.
iii. The max compressive strength on brick was 7.75 N/mm2 which are as compared to 2nd class bricks.
iv. Water absorption test carried out for 24hours the comparison made between the conventional fired clay brick with four proportion of sludge as per IS code3495Part2:1992.
v. Study shows that water absorption values for the bricks is less than 14.9% so the brick required very ease amount of water for curing.
vi. Environmental effects from wastes and disposal problems of waste can be reduced or controlled through this research.
vii. Environment is protected due to less emission of CO2.
viii. A better measure by an innovative Construction Material is formed through this project.

VII. FUTURE SCOPE

The scope of the current work can be summarized as follow:

1) Sugarcane Press mud is cheap, so low cost bricks and hence economical construction.
2) Conserve brick making earth and sustainable development.
3) Reduce energy used for normal bricks.
4) An innovative construction material is formed through this project

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