

# UTILIZATION OF SUGARMILL WASTE IN MANUFACTURING OF BRICKS

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**Abstract-** In India, bricks are usually made up of clay, and are generally produced in traditional, unorganized small-scale industries. Application of bio-fuel by-product sugarcane bagasse ash (SBA) as a principle raw material for manufacturing of brick was studied. Bricks were manufactured using the quarry dust (QD) as a replacement to sand and lime (L) as a binder. Recycling of such waste as raw material alternatives may contribute in the exhaustion of natural resources and reduction in waste disposal. The brick was manufactured of size 230mm×110mm×80mm. All the bricks are kept for drying for 3 days followed by 7 days wet curing and then 7 days sun drying. The tests to be performed are Compressive strength test, Water absorption test, Efflorescence test, Impact test, Soundness test, Hardness test.

**Key words:** Sugarcane bagasse ash (SBA), Quarry dust (QD), Lime(L), Water, Cost effective.

## I. INTRODUCTION

Due to limited availability of natural resources and rapid urbanization, there is a short fall of conventional building construction materials. The production of conventional building construction materials can cause environmental hazards and also affects the human health. Landfills are commonly used for disposal for sludge in India, rapid urbanization has made it increasingly difficult to find the suitable landfill sites. Therefore, incineration has become one of the few alternatives available for disposal of sludge. The ultimate disposal of incinerated bagasse ash can be accomplished by using it an engineering construction material. The waste from industries is very harmful for the environment as well as to our health, if not disposed in proper manner. The fibrous residue of sugarcane after crushing and extraction of its juice, known as “bagasse” is one of the largest agricultural residues in the world. The bagasse is however used as a bio mass fuel for boilers, but after burning the by-product left is of no use generally

disposed into the rivers which affects the health of human being, environment, fertile land, sources of water bodies etc., Uses of sugarcane bagasse ash waste in brick can save the sugarcane industry disposal costs and produce a ‘greener’ brick for construction.

## II. SCOPE

- To promote the solid waste from sugar mills as a useful product.
- To manage the disposal of waste product into construction raw material.
- To encourage the waste product as ecofriendly material.
- To dispose the waste safely.

## III. LITERATURE REVIEW

A. Bahurudeen, K. S Vaisakh, Manu Santhanam (July 2015), “Availability of sugarcane bagasse ash and potential for use as a supplementary cementitious material in concrete”. Rapid implementation of new cogeneration plants in sugar industries are further expected to increase bagasse ash generation significantly. Utilization of bagasse ash as supplementary cementitious material in concrete strive to achieve durable as well as sustainable concrete and can tackle the disposal problem significantly.

Madurwar V. Mangesh, Mandavgane A. Sachin and Ralegaonkar V Rahul have studied that Application of bio-fuel by-product sugarcane bagasse ash (SBA) as a principle raw material of manufacturing of bricks was studied. The bricks prepared in commercial plants using SBA, quarry dust and lime meet all the requirements as described in the Indian standards. Recycling of solid waste into sustainable, energy efficient construction material is the only viable solution to the environmental concerns and natural resource conservation for future generations.

#### IV. OBJECTIVES

- To utilize the waste materials available in the sugarcane industries.
- To study the Compressive strength of the brick by adding different percentage of bagasse ash and other materials.
- To make the bricks which are energy efficient which is the only viable solution to the environmental concerns and natural resource conservation for future generations.

#### V. MATERIALS TO BE USED

1. Bagasse ash.
2. Lime.
3. Quarry dust.
4. Water.

##### 1. BAGASSE ASH

The burning of bagasse, which is a waste of sugarcane which produces bagasse ash. India alone generates 90 million tons of bagasse as a waste material from sugarcane industries. For each 10 tons of sugarcane crushed, a sugar factory produces nearly 3.1 tons of wet bagasse which is a by-product of the sugarcane industry. This material contains amorphous silica which is indication of cementing properties.

##### 2.LIME

Calcium oxide, commonly known as quick lime or burnt lime, is a widely used chemical compound. It is a white, caustic, alkaline, crystalline solid at room temperature. It is used as a binding material as replacement for cement.

##### 3.QUARRY DUST

Quarry dust is a waste product produced during the crushing process which is used to extract stone. It is like sand but mostly grey in color. The density of quarry dust is 1650 kg/m<sup>3</sup>.

#### 4. WATER

Water is an important ingredient of brick as it actually used for manufacturing of brick. Since it helps to bind all the raw materials for giving proper mix.

#### VI. MATERIALS COLLECTION

The principle raw material, SBA sample, was collected from Perambalur sugar mills Ltd., Perambalur, India. Samples were collected during the cleaning operation of boilers in the factory. In the boiler, sugarcane bagasse is burnt at a temperature varying from 240°C to 600°C, depending on the moisture content and feed off the bagasse. Raw lime conforming to Bureau of Indian Standards (BIS), IS 712:1984 was used. Crushed quarry dust was obtained from local crusher plant.

#### VII. PROCEDURE

1. Required proportion of raw materials are taken separately.
2. Lime and water are mixed thoroughly.
3. In order to obtain a homogenous mix, SBA and Quarry dust are later added to lime slurry.
4. The freshly prepared mix is pressed into the mould.
5. As most of the local manufactures are producing brick of dimensions 230mm×110mm×80mm. The same dimension is adopted here for production of bricks.
6. All the brick samples are kept for drying for 3 days followed by 7 days wet curing and then 7 days sun drying.
7. Compressive strength test and water absorption test are to be conducted to fund the effective proportion of the raw material.

#### VIII. BRICK MAKING PROCESS



Fig.1 LIME MIXING



Fig. 2 SBA & QD MIXING



Fig. 3 FRESHLY PREPARED MIX



Fig. 4 WET BRICK



Fig. 5 CURING OF BRICK

## IX. TEST TO BE PERFORMED

### A. COMPRESSIVE STRENGTH TEST

The brick specimens are immersed in water for 24 hours. The specimen is placed in compression testing machine with 6 mm plywood on top and bottom of it to get uniform load on the specimen. The load is applied axially at a rate of 14 N/mm<sup>2</sup>. The crushing load is noted. Then the crushing strength is the ratio of crushing load to the area of brick loaded. Average of three specimens is taken as the

crushing strength. The crushing load is noted for bricks named 1,2,3,4,5,6 & 7 (different proportions).

### B. WATER ABSORPTION TEST

A brick is taken and it is weighted dry. It is then immersed in water for 24 hours. It is weighed again and the difference in weight indicates the amount of water absorbed by the brick. It should not exceed 20 percent of weight of dry brick.

### C. SHAPE AND SIZE TEST

In this test, a brick is closely inspected. It should be of standard size and its shape should be truly rectangular with sharp edges. For this purpose, 3 bricks are selected at random and they are stacked length wise, along the width and along the height.

### D. EFFLORESCENCE TEST

This test is carried out to obtain the presence of alkaline substances in bricks. First, bricks are fully submerged in fresh water for 24 hours. After 24 hours they are collected from water and let them to dry. After completely dried, the bricks are closely observed to find the presence of alkali. If a white or grey layer is formed on the brick surface, it means alkali is present in the brick.

### E. IMPACT TEST

In this test, few bricks are dropped from 1 m height. If bricks are broken it indicated low impact value and not acceptable for construction work. Good quality bricks do not break at all.

### F. SOUNDNESS TEST

In this test, two randomly selected bricks are hardly punched with each other. If they produce a clear metallic sound and remain unbroken then they are good quality bricks.

### G. HARDNESS TEST

In this test, scratches are made on the surface of the brick by a one-rupee coin. If it does not leave any impression the brick surface then it will be considered as good quality bricks.

## X. CONCLUSIONS

Based on the above experimental procedure and test, we conclude as;

1. Use of bagasse ash, quarry dust in brick can solve the disposal problem, reduce cost and produce a 'greener' Eco-friendly brick for constructions.
2. The crushing strength or compressive strength of bricks named as 1 is 6N/mm<sup>2</sup>, 2 is 4.1N/mm<sup>2</sup>, 3 is 3.3 N/mm<sup>2</sup>, 4 is 2.7N/mm<sup>2</sup>, 5 is 4.9N/mm<sup>2</sup>, 6 is 5.5N/mm<sup>2</sup>, and 7 is 5.25N/mm<sup>2</sup>.
3. Hence we strongly recommend brick 1 has a good compressive strength and suitable for construction.
4. Environmental effects of wastes and disposal problems of waste can be reduced through this brick manufacturing process.
5. This study helps in converting harmful bagasse ash in to bricks and make it valuable.
6. From this research, maximum compressive strength of correct proportion is obtained.
7. The expected cost of bricks can be reduced.

## REFERENCES

- [1] Cordeiro, G.C., R.D. Filho, L.M. Tavarise, and E.M. Fairbairn (2009) Ultrafine grinding of sugarcane bagasse ash for application of pozzolanic admixture in concrete. "Cement and Concrete Research", 39, 110-115.
- [2] Bahurudeen, A. and M.Santhanam (2013) Characterisation of sugarcane bagasse ash as supplementary cementitious material in concrete. Proceedings of UKIERI "Concrete Congress-Innovations in concrete construction", India, March, 181-185.
- [3] Tay, J.H., and show, K.Y. (1999). "constructive sludge disposal option converting sludge into innovative civil engineering material"
- [4] Indian Standard: IS 1077:1992, common burnt clay building bricks- specifications. BIS, New Delhi, 1997(5<sup>th</sup> revision).
- [5] Madurwar, M.V., Ralegaonkar, R.V. and Mandavgane, S.A., Application of agro waste for sustainable construction materials: A review. Construction Building Material, 2013, 38, 872-878.
- [6] Faria, K.C.P., Gurgel, R.F and Holanda, J.N.F. , Recycling of sugarcane bagasse ash waste in production of bricks. J.Environ. Manage. 2012,101,7-12.
- [7] Goyal, A., H. Kunio, O. Hidehiko, and A. Muhammad (2010) Processing of Sugarcane Bagasse ash and Reactivity of Ash-blended Cement Mortar. Transactions of The Japanese Society of Irrigation, Drainage and Rural Engineering, 77, 243-251.
- [8] Marcos, O. D. P., Ilda De Fatima, F. T., Conrado De, S. R. and Jairo Alexander, O. S., Sugarcane bagasse ash as a partial Portland cement replacement material. Medellin, 2010, 163, 47-54.