UTILIZATION OF BAGASSE ASH AS A BRICK MATERIAL, A REVIEW

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Abstract - *As we all know that the waste from the 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 agriculture residues in the world. The bagasse is however used as a biomass fuel for boilers, but after burning the by-product left is of no use and generally disposed into the rivers which affects the health of human being, environment, fertile land, sources of water bodies etc. Depending on the incinerating conditions, the resulting sugarcane bagasse ash (SCBA) may contain high levels of SiO_2 and Al_2O_3. Uses of Sugarcane bagasse ash waste in brick can save the sugarcane industry disposal costs and produce a 'greener' bricks for construction. In this research the bagasse ash, lime, quarry dust and scrap can be used as the replacement of clay and sand in the burnt clay bricks. The different proportions of the bagasse ash, lime, quarry dust and scrap are taken and bricks can be manufactured. After the full manufacturing process the bricks are to be tested in the laboratory and results are analyzed regarding the water absorption and compressive strength. The aim of this research was to make economical and green bricks to maintain environmental balance and avoid problem of ash disposal. It was also expected that bricks must be lighter in weight, energy efficient and meet compressive strength requirements of IS 1077:199*

***Key Words*: Bricks, Quarry dust, Lime, Sugarcane bagasse ash, Scrap.**

1.INTRODUCTION

There is a strong demand for environmentally safe reuse and effective disposal method for bagasse ash due to the increasing amount of sludge generated by the various industries or plant in India. Landfills are commonly used for disposal of sludge in India, rapid urbanization has made it increasingly difficult to find 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 materials. One possible solution for the management of this sludge is to re-use it as a building material, namely, to incorporate this bagasse ash into bricks. The fired clay brick is one of the most common and abundant masonry building materials and remain popular for its many characteristic properties. As such, the recycling of waste materials by incorporating them into bricks has been a popular topic of investigation over the last century, with varying degrees of success across a wide range of waste material. This popularity is likely due to flexibility on the type of wastes which can be mixed into the brick making material, but more importantly, the high temperature involved in firing the bricks allows for the volatilization of dangerous component, as well as the fixation of wastes into the vitreous phase of the brick. The current study investigates the potential for reusing sugarcane sludge or bagasse ash by using it as a partial replacement material in clay bricks. Due to limited availability of natural resources and rapid urbanization, there is a shortfall of conventional building construction materials. On the other hand, energy consumed for the production of conventional building construction materials pollutes the air, water and land. Accumulation of unmanaged agro-waste, especially from the developing countries, has an increased environmental concern. Therefore, development of new technologies to recycle and convert waste materials into reusable materials is important for the protection of the environment and sustainable development of the society.

1.1 LITERATURE REVIEW

Kulkarni Apurva , Raje Samruddha , Rajgor Mamta(1) studied that Utilization of industrial and agricultural waste products in the industry has been the focus of research for economic, environmental, and technical reasons. Bagasse ash can be utilized by replacing it with fly ash and lime in fly ash bricks. Trial bricks of size (230x100x75) mm were tested with different proportions of 0%, 10%, 20%, 30%, 40%, 50% and

60% with replacement of fly ash and 0%,5%, 10%, 15% and 20% with replacement of lime.

Madurwar V. Mangesh, Mandavgane A. Sachin and Ralegaonkar V Rahul(2) have studied that Application of bio-fuel by-product sugarcane bagasse ash (SBA) as a principal raw material for the manufacturing of bricks was studied. The bricks were developed using the quarry dust (QD) as a replacement to natural river sand and lime (L) as a binder. The bricks with 20% addition of lime to SBA and quarry dust exhibited a compressive strength of up to 6.59 MPa, which is almost double that of the conventional clay bricks (3.5 MPa). The optimum composition of SBA–QD–L brick is 15% and 25% lighter than the commercially available burnt clay and fly ash– cement bricks respectively. It was also observed that masonry bonding of SBA–QD–L bricks is stronger compared to commercially available fly ash and burnt clay bricks. Manufacturing process of SBA–QD–L bricks results in 50% and 6% reduction in energy consumption over the commercially available burnt clay and fly ash– cement building bricks. The results showed significant potential and scope for utilizing the agricultural solid waste for manufacturing of building materials that are energy-efficient, lightweight and sustainable.

Deng Fong Lin and Chin Huang Weng(3) has used sewage sludge ash as brick material. The result of the compressive strength test on the bricks made from both clay and sludge ash mixtures. The optimum amount of sludge ash that could be mixed with clay to produce mix bonding bricks was 20% by weight. As shown with up to 40% sludge ash added to the bricks, the strength achieved at all temperature can be as high as that of normal clay bricks. With up to 50% ash in the bricks, the strength is even higher than that of normal clay bricks. The compressive strength of the bricks made from ash-clay mixture all meet the standards (CNS 1999b) for the bricks requirement: 100 kg/cm^2 for a first class bricks and 75 kg/cm^2 for second class bricks. It is concluded that sludge ash can be blended with clay in different proportions to produce a good quality of brick under a certain firing temperature.

Kevin Hii, Abbas Mohajerani, Paul Slatter and Nicky Eshtiaghi(4) has used Desalination Sludge for brick making in partial and full replacement of clay. Theoretically, if the bricks were made using industrial size equipment, a higher density and strength should be achievable. The OMC% for 30% bricks was 20.5 and maximum dry density was 1660 kg/m3 .Theoretically, if the bricks were made using industrial size equipment, a higher density and strength should be achievable. So the compressive strength values scaled up to match a 15 MPa pure clay brick and shows that at 20% sludge addition , a compressive strength of 4 MPa may still be achievable.

Table -1. Chemical composition of bagasse ash

Minerals	percentage
SiO_2	73
Al_2O_3	6.7
Fe_2O_3	6.3
CaO	2.8
MgO	3.2
P_2O_5	4.0
Na_2O	1.1
K_2O	2.4
Loss of ignition	0.9

1.2 OBJECTIVE OF THE WORK

1. To study the compressive strength of the brick by adding different percentage of bagasse ash and other material
2. To study the cost of the brick.
3. To check the density of the bricks.
4. To utilize the waste materials available in the agro-industries.
5. To make the bricks which are energy efficient which is the only viable solution to the environmental concerns and natural resources conservation for future generations.

2. METHODOLOGY TO BE ADOPTED

First of all literature survey is being carried out to study the availability of the sludge in India. It has been observed that mass quantity of the sludge is available in our country. So we can carry forward our research in this field. Then the materials which we have to used is selected and the properties of those materials are studied. Then after selection the binding property of these materials are tested whether the materials are forming a bond or not. After testing binding property the required proportions of the materials are selected and then it is mixed together to mould a brick in definite shape. The kneading process is very carefully done. After moulding the brick is removed from the mould and it is remained at the same stage for drying. The drying must be done carefully at room temperature firstly and then sun drying is done for five days so that the required strength can be attained.

Firstly the water absorption test is performed, After which the most important test i.e compressive strength test is performed using a compression testing machine A loading is applied to the bricks. until they failed and the maximum loading rate is recorded. The compressive strength is taken as the average result from a set of five test for each respective brick type.

2.1 MATERIALS TO BE USED

1. Bagasse ash.
2. Lime.
3. Quarry dust.
4. Metal Scrap.
5. Water

Bagasse ash

The burning of bagasse which a waste of sugarcane produces bagasse ash. Presently in sugar factories bagasse is burnt as a fuel so as to run their boilers. This bagasse ash is generally spread over farms and dump in ash pond which causes environmental problems also research states that Workplace exposure to dusts from the processing of bagasse can cause the chronic lung condition pulmonary fibrosis, more specifically referred to as bagassosis. So there is great need for its reuse, also it is found that bagasse ash is high in silica and is found to have pozollinic property so it can be used as substitute to construction material.

Fig – 1 : Bagasse Ash

Lime

Pure calcium oxide is fused with coke in order to render the highest yield in the manufacture of acetylene. The quality of the resultant carbide lime is a direct result of the excellent quality raw materials. Carbide lime is finer in particle size, and physically, having a very finely divided particle size makes carbide lime better. A finer particle size means faster and more reactivity.

Fig – 2: Lime

Quarry dust

Quarry dust is a waste product produced during the crushing process which is used to extract stone. It is rock particles. When huge rocks brake in too small parts for the construction in quarries. It is like sand but mostly grey in colour.

Fig – 3: Quarry dust

Scrap

For harnessing the large quantity of steel the lathe machine is used and due to their usage a large amount of scrap is produced.

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. Water used for making brick should be free from impurities.

2.2 TESTS TO BE PERFORMED

A. Compression Test

The brick specimens are immersed in water for 24 hours. The frog of the brick is filled flush with 1:3 cement mortars and the specimen are stored in damp jute bag for 24 hours and then immersed in clean 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. Then load is applied axially at a uniform rate of 14 N/mm2. The crushing load is noted. Then the crushing strength is the ratio of crushing load to the area of brick loaded. Average of five specimens is taken as the crushing strength.

B. Water absorption test

The bricks specimen are dried completely in an oven at 100+-5ºC and then Weigh it as W_1 .Then immersed the brick in water for 24 hrs and wipe out the water from the bricks and again weigh it as W_2.

Water absorption=$W_1 - W_2 / W_1$

3. CONCLUSIONS

Based on the study concerning the literature , the following observations are made regarding the resistance of Bagasse ash bricks:-

1. Use of bagasse ash in brick can solve the disposal problem; reduce cost and produce a 'greener' Eco-friendly bricks for construction.
2. Environmental effects of wastes and disposal problems of waste can be reduced through this research.
3. This study helps in converting the non-valuable bagasse ash into bricks and makes it valuable.
4. In this research maximum compressive strength can be attained.
5. Bagasse ash bricks can reduce the seismic weight of building.
6. The expected cost of the bricks can be reduced.

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