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Utilization of Sugar Mill Waste in Manufacturing of Bricks

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Abstract— In India we know that the bricks are made from soil clay. Now a running days the demand of bricks increases day by day for construction. It is generally produced in traditional, unorganized small scale industries. Brick making consumes large amount of clay which leads to top soil removal and land degradations. India produces around 170 billion bricks per year, in the process consuming around 442 million tons of soil. Considering that the majority of the bricks produced will be burnt clay bricks, this volume of production will require about 230-240 million m^3 of agricultural soil. This is equivalent to 25,500 hectares of fertile agricultural land, with the exploitive depth being 1 m. Such exploitation will have a tremendous impact on national food security. To overcome this problem, the application of bio-fuel by products sugarcane bagasse ash (SCBA) as a principal raw material for manufacturing of bricks was studied. SCBA is partially replaced of 10%, 20%, 30% by weight of brick. After process of moulding and drying, bricks are burnt in kiln at temperature of 700°-1000° to imparts hardness, strength and to increase the density of bricks. The size of brick is (190×90×90) mm. The test to be performed are compressive strength test, water absorption test, shape and size test, efflorescence test, etc. In accordance with Bureau of Indian standards (BIS) specifications, by also considering the costs.

KEYWORDS— Sugarcane bagasse ash, bricks, soil clay, compressive strength.

1. INTRODUCTION

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 material and makes it light weight. The use of SCBA & press mud in bricks making also reduces the land degradation by replacing someamount of soil clay in it.

SCOPE

- To manage the disposal of waste product into construction raw materials.
- To make the bricks which are energy efficient it is the only viable solution to the environmental concern and natural resources conservation for future generation.
- To dispose the waste safely.
- To make the bricks which are having low thermal conductivity so as the building remainscool in summer.

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LITERATURE REVIEW

S. Manoprakash, J Muthu Prasad , R. Naresh Raj (March 2019) have studied that the application of bio- fuel by-product sugarcane bagasse ash (SBA) as a principle raw material of manufacturing of bricks was studied . Utilization of industrial and agricultural waste product in the industry has been the focus of research for economical, environmental and technical reasons. SBA is a largest agricultural waste in the world. Therefore our aim behind this research paper, effectively use of this agricultural waste (SBA, press mud) for manufacturing of bricks. In this paper, Bagasse ash has been chemically and physically characterized. SCBA-clay-lime combination brickswere designed and developed in different mix proportions. The properties of developed bricks were studied according to recommended standards. The result of the SCBA-C-L bricks were compared with physico-mechanical properties of commerciallyavailable burnt clay and fly ash bricks. It was observedthat it the SCBA-C-L bricks were lighter in weight, energy efficient and meet the compressive strength requirement of IS-1077:1992. The bricks also served the purpose of solid waste management and innovative sustainable construction materials. The bricks can be used in local construction especially for non-load- bearing walls.

OBJECTIVES

- To study the compressive strength of the brick by adding different percentage of bagasse ash and other materials.
- To utilize the waste materials available in agro-industry.
- The thermal conductivity of bricks should be low as it desirable that the building built with them should be cool in summer and warm in winter.
- Bricks should be non-inflammable and incombustible.
- Bricks should be sound proof.

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MATERIALS TO BE USED

1. Bagasse ash.
2. Press mud.
3. Lime.
4. Clay.
5. Water.

1. BAGASSE ASH

Bagasse ash is a residue obtained from the burning of bagasse in sugar producing factory. Bagasse is currently used as burning product for boilers of sugar mill which is produces bagasse ash. Sugarcane production in India is over 300 million tons per per year leaving about 10 million tons as unutilized. Therefore it is big issue of waste management. For each 10 tons of sugarcane crushed, a sugar factory produces nearly 3.1 tons of wet bagasse called it as press mud which is by- product of the sugarcane industry. After its burning it converted into ash which is having amorphous silica, indicating cementious properties . It provides good bonding in case of weak soil.

- PHYSICAL PROPERTIES OF CEMENTAND BAGASSE ASH

Materia l	Density (kg/cu. m)	Specifi c Gravity	Fineness passing 45µm	Specifi c surfacearea	Mean grainsize
Cement	1.15	3.00	85	300	2.15
Bagasseash	0.40	1.80	95	800	4.89

2. PRESS MUD

In sugar mills, sugar is produced through many processes and produces so much solid waste in the production. Press mud is a byproduct obtained from the clarification process of sugarcane juice, raw juice has non-sugar contaminants are removed using a mixture of chemical reactant such as sulphur and lime. For every 100 tons of crushed sugarcane 3.3 tons of filter cake remains as a byproduct. The mainchemical component of press mud is CaO. It is combustible and also used in brick kiln for brick manufacturing.

3. LIME

Lime is produced when limestone is subjected to extreme heat, changing calcium carbonate to calcium oxide. Limestone is a sedimentary rock that formed millions of years ago as the result of the accumulation of shell, coral, algal and other ocean debris. High calcium lime is almost pure calcium carbonate. At about 1100°c, lime acts as a catalyst to elevate the furnace temperature to 1650°c at which silica fuses. This slightly fused silica works as a strong cementing material. Excess lime in brick clay will cause vitrification of bricks. It causes bricks to melt, as more than the required amount of silica will fuse.

4. CLAY

Clay is one of the abundant natural minerals on earth. Clay must possess some specific properties and characteristics. Such clays must have plasticity, which permits them to be shaped or molded when mix with water. The best suited clay for the manufacturing of bricks will be silted clay or weathered clay as this soil has sufficient cohesion and little silt content will aid in the strength. Weathered soil has an adequate amount of moisture. It provides proper texture and plasticity to clay to ensure the softening of clay.

5. WATER

Water is a crucial element of brick as it surely used for production of raw materials for giving proper mix. Water used for making bricks should be free from impurities.

DESIGN MIX

S. NO	CLAY	SCBA	PRESSMUD	LIME
1.	80% (2.8 kg)	5% (0.175 kg)	5% (0.175kg)	10% (0.350 kg)
2.	70% (2.45 kg)	10% (0.350 kg)	10% (0.350 kg)	10% (0.350 kg)
3.	60% (2.10 kg)	15% (0.525 kg)	15% (0.525 kg)	10% (0.350 kg)

2. MATERIALS COLLECTION

The principal raw material, SCBA sample and press mud (byproduct) was collected from Deccan Sugar private Ltd. Mangrul, Yavatmal, India. Samples were collected during the cleaning operation of the boilers in the factory. In the boiler, sugarcane bagasse is burnt at a temperature varying from 350°C to 600°C, depending on the moisture content and feed of the bagasse. Raw lime conforming to Bureau of Indian Standards (BIS), IS 712:1984 was used. Lime is used from local hardware store.

PROCEDURE

1. Required proportion of all raw materials such as SCBA, press mud, clay, lime and water are taken separately.
2. In order to obtain homogenous mix, SCBA and press mud are later added to lime slurry.
3. The freshly prepared mix is pressed into themould.
4. Place it for sun drying until it becomes hard it takes nearly 4 to 5 days for removal of moisture and become hard for attaining good strength.
5. After sun drying place it in clamp for burning at a temperature of 700°C to 1000°C for 28 days.
6. Kept it for Cooling near about 7 to 8 days.
7. Compressive strength test and water absorption test are to be conducted for to find the effective proportion of the raw material.

BRICK MAKING PROCESS

A. MIXING OF MATERIALS IN DEFINITEPROPORTION

B. MAKING SLURRY

C. PREPARE MOULDING

MOULDING

WET BRICKS

E. BURNING IN CLAMP

F. DRIED BRICKS

TEST TO BE PERFORMED

A. COMPRESSIVE STRENGTH TEST /CRUSHING STRENGTH

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. Then load is applied axially at a uniform rate of 14 N/mm2. The crushing load is noted for the bricks named 1, 2, and 3. If its strength is less than 3.50 N/mm^2 then it is not useful in construction purpose.

B. WATER ABSORPTION TEST

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

B. SHAPE & 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.

3. CONCLUSION

After the completion of the experimental work for compressive strength and water absorption test, the following conclusion can be drawn regarding the maximum utilization of waste material like bagasse ash and stone dust for construction brick.

1. Environmental effect of waste and disposal problems of waste can be reduced though this research.
2. This study helps in converting non–valuable bagasse ash into bricks and make it valuable.
3. In this research maximum compressive strength can be attained by changing mix proportion.
4. Bagasse ash brick can reduce the seismicweight of the building.
5. A higher degree through an innovativeconstruction material is fashioned though this study.
6. From the test conducted in laboratory, in all test it is observed that upto 20% bagasse ash all the characteristics of bricks are adequate and desirable for use in building construction.
7. As addition of bagasse ash more than 20% cause more water absorption, reduction incompressive strength, less hardness, under burnt.
8. So we concluded that 20% to 25% clay can be replaced by SCBA and press mud.

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