COMPARATIVE STUDY ON THE EFFECT OF SUGARCANE BAGASSE ASH BRICKS

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ABSTRACT: Utilization of industrial and agricultural waste products has gained importance in research field, for economic, environmental and technical reasons. Sugarcane bagasse is a fibrous waste product of the sugar refining industries. Huge quantity of ash, which is a waste product , available in a very negligible rate and also in abundance. In this paper, a comparative study on various bricks prepared using clay, cement and sugarcane bagasses ash is made. Compressive strength and percentage of water-absorption of sugarcane bagasse ash bricks is compared with that of clay bricks and cement bricks.

INTRODUCTION

GENERAL

A brick is building material used to make walls, pavements and other elements in masonry construction. Traditionally, the term brick referred to a unit composed of clay, but it is now used to denote any rectangular units laid in mortar. A brick can be composed of clay-bearing soil, sand and lime, or concrete materials. Bricks are produced in numerous classes, types, materials, and sizes which vary with region and time period, and are produced in bulk quantities. Two basic categories of bricks are fired and non-fired bricks

Brick is one of the most common masonry units as a building material due to its properties. Many attempts have been made to incorporate wastes into the production of bricks, for examples, rubber, limestone dust, wood sawdust, processed waste tea, fly ash, polystyrene and sludge. Recycling such wastes by incorporating them into building materials is a practical solution for pollution problem. This paper reviews the recycling of different wastes into fired clay bricks. A wide range of successfully recycled materials and their effects on the physical and mechanical properties of bricks have been discussed. Most manufactured bricks with different types of waste have shown positive effects on the properties of fired clay bricks.

Application of bio-fuel by-product sugarcane bagasse ashes a principal raw material for the manufacturing of bricks was studied. The bricks were developed using the quarry dust as a replacement to Natural River sand and lime as a binder. The bricks also serve the purpose of solid waste management and innovative sustainable construction material.

The bricks can be used in local construction especially for non-load-bearing walls. The sugarcane ass brick thus obtained is used for making building bricks by mixing with cement and sand in different proportion.

Building with brick is good for your bottom line. Of all exterior finish products, brick has a greater market appeal. Studies by the National Association of Home Builders and other building organization continually find that 60% of the nation`s homebuyer prefer brick homes. Brick homes command higher selling prices. Brick homes also provide higher profit margins for the builder. To the consumer, a brick home means a sound investment and savings. It increases a home`s investment value, sells faster and brings a higher resale price. Brick is virtually maintenance-free. It never needs painting, caulking or staining. Brick won`t burn or not like other finish material, nor will it chip off at the whim of a woodpecker. Brick won`t burn and subsequently can reduce fire insurance premiums by up to 50%. Brick is energy efficient. Its inherent mass qualities help keep a home cooler in the summer and warmer in the winter. Brick`s mass also makes it a very efficient noise insulator as well. Brick can save thousands of dollars over the life of a mortgage.

SUGARCANE BAGASSE

Bagasse is the fibrous matter that remains after sugarcane are crushed to extract their juice. The dry pulpy residue left after the extraction of juice from sugar cane. It is used as a bio fuel and in the manufacture of pulp and building materials.

SUGARCANE BAGASSE ASH (SCBA)

Sugarcane bagasse ash (SCBA) is a residue resulting from the burning of bagasse in boilers in the sugarcane/alcohol industry. SCBA has a very high silica concentration and contains aluminium, iron, alkalis and alkaline earth oxides in smaller amounts. Moreover, bagasse is being sold for use as a fuel (replacing heavy fuel oil) in various industries, including citrus juice concentrate, vegetable oil, ceramics, and tyre recycling. Bagasse burning is environmentally friendly compared to other fuels like oil and coal.

PRODUCTION OF SUGARCANE IN INDIAN INDUSTRIES

Operational sugar mills – 526 operational (695 installed). Total sugarcane crushing capacity – 2.3 mlntca. Total sugar production capacity – over 30 mln tons per annum. Average crushing capacity - 4000 tons per day per unit

ADVANTAGES OF SUGARCANE BAGASSE BRICKS

The resulting CO_2 emissions from bagasse are equal to the amount of CO_2 that the sugarcane absorbs from the atmosphere during its growing phase, which makes the process of co-generation greenhouse gas neutral. The bricks thus manufactured using these wastes are energy-efficient due to zero emission of the principal raw materials. The brick can be manufactured in brick quarry itself (i.e.) No additional setup is needed to make sugarcane bagasse brick. Economically efficient. Reduce the usage of natural resources by using the waste materials. This kind of brick is eco-friendly. Time taken for making the brick is similar to that of standard brick. This brick has sufficient strength to build the walls, arches, small columns and sometimes for flooring, paving, small brick foundation etc.

MAKING OF SUGARCANE BAGASSE ASH BRICKS

The sugarcane bagasse was bought and it is burnt. Then the burnt sugarcane bagasse ash was mixed with cement and sand for the preparation of sugarcane bagasse bricks. The cement was replaced 15% by sugarcane bagasse ash. The mixing was done by hand and the mixture was placed in the mould which is of size 190mmX90mmX90mm. The mix is then stuffed inside the mould and blown for proper settlement of the mix.

MOULDING OF BRICK

Sugar cane ash has mixed with corresponding ratio of cement and sand. Then the mixture is placed in the brick mould and it is placed in compression machine. Many number of bricks are moulded by giving various moulding. The mixture is placed in brick mould and the mould is placed in compression machine and the load is applied.

TESTING ON BRICK

To know the quality of bricks following 7 tests can be performed. In these tests some are performed in laboratory and the rest are on field

- Compressive strength test
- Water Absorption test
- Efflorescence test

COMPRESSIVE STRENGTH TEST

This test is done to know the compressive strength of brick. It is also called crushing strength of brick. Generally 5 specimens of bricks are taken to laboratory for testing and tested one by one. In this test a brick specimen is put on crushing machine and applied pressure till it breaks. The ultimate pressure at which brick is crushed is taken into account. All five brick specimens are tested one by one and average result is

taken as brick's compressive/crushing strength. The specimen is then placed between plates of compression testing machine.

WATER ABSORPTION TEST

In this test bricks are weighed in dry condition and let them immersed in fresh water for 24 hours. After 24 hours of immersion those are taken out from water and wipe out with cloth. Then brick is weighed in wet condition. The difference between weight is the water absorbed by brick. The percentage of water absorption is then calculated. The less water absorbed by brick the greater its quality. Good quality brick doesn't absorb more than 20% water of its own weight

RESULTS

COMPRESSION TEST

For clay bricks

The compressive strength of clay brick is being given in the table

S.NO	SPECIMEN DETAIL	LOAD (KN)	AREA (mm^2)	COMPRESSIVE STRENGTH (N/mm^2)
1	Clay -1	12.6	$17.1x10^3$	0.15
2	Clay -2	12.5	$17.1x10^3$	0.12
3	Clay -3	11.2	$17.1x10^3$	0.13
4	Clay -4	9.3	$17.1x10^3$	0.11
5	Clay -5	10.8	$17.1x10^3$	0.13
6	Clay -6	11.5	$17.1x10^3$	0.13
Average compressive strength of clay bricks				**0.13**

For 15% of sugarcane bagasse ash bricks

The compressive strength of sugarcane bagasse brick is being given in the table

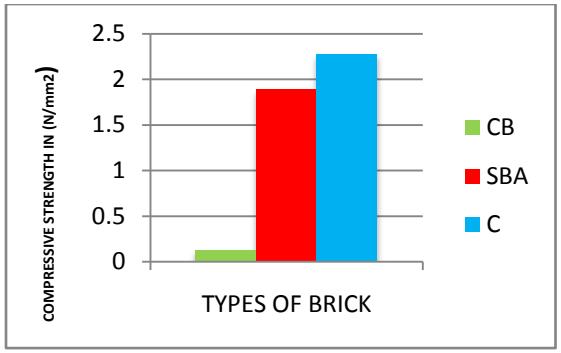
S.NO	SPECIMEN DETAIL	LOAD (KN)	AREA (mm^2)	COMPRESSIVE STRENGTH (N/mm^2)
1	SBA -1	32	$17.1x10^3$	1.5
2	SBA -2	44	$17.1x10^3$	2.06
3	SBA-3	48	$17.1x10^3$	2.25
4	SBA-4	40	$17.1x10^3$	1.87
5	SBA-5	36	$17.1x10^3$	1.68
6	SBA-6	42	$17.1x10^3$	1.97
Average compressive strength of sugarcane bagasse bricks				**1.89**

For cement bricks

The compressive strength of cement brick is being given in the table

S.	SPECIMEN DETAIL	LOAD (KN)	AREA (mm^2)	COMPRESSIVE STRENGTH

NO				(N/mm^2)
1	Cement-1	54	17.1x10^3	3.62
2	Cement-2	44	17.1x10^3	2.96
3	Cement-3	52	17.1x10^3	3.43
4	Cement-4	48	17.1x10^3	1.87
5	Cement-5	54	17.1x10^3	2.53
6	Cement-6	46	17.1x10^3	3.15
Average Compressive strength of cement bricks				**3.38**



6.2 WATER ABSORBTION TEST

The water absorption of the brick can be determine from the formula mention below

`Percentage of water absorption $= \frac{weight\ of\ wet\ bricks - weight\ of\ dry\ brick}{weight\ of\ dry\ brick}$ **x100**

For clay bricks :

S.NO	SPECIMEN DETAIL	WET WEIGHT	DRY WEIGHT	% OF WATER ABSORPTION
1	Clay -1	3.693	3.388	9
2	Clay -2	3.345	3.072	8.89
3	Clay -3	3.280	2.995	9.52
4	Clay -4	3.420	3.132	9.20
5	Clay -5	3.290	3.000	9.67
6	Clay -6	3.392	3.112	9.00
Average water absorption of clay bricks in %				9.21

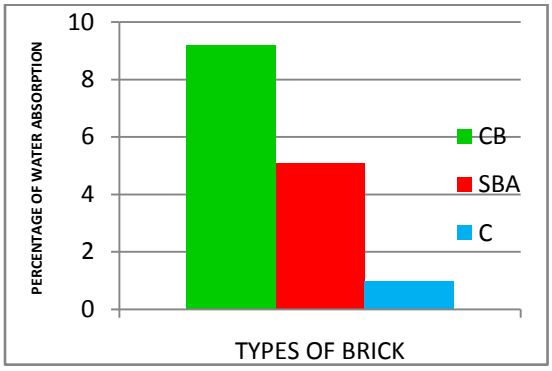
For 15% of sugarcane bagasse ash bricks:

water absorption of *sugarcane bagasse* bricks

S.NO	SPECIMEN DETAIL	WET WEIGHT	DRY WEIGHT	% OF WATER ABSORPTION
1	SBA-1	4.175	4.082	2.28
2	SBA -2	3.823	3.590	6.49
3	SBA -3	3.491	3.830	4.20
4	SBA -4	4.125	4.025	2.48
5	SBA -5	3.838	3.622	5.96
6	SBA -6	3.745	3.431	9.18
Average water absorption of sugarcane bagasse bricks in %				5.10

For cement brick

S.NO	SPECIMEN DETAIL	WET WEIGHT	DRY WEIGHT	% OF WATER ABSORPTION
1	Cement -1	4.787	4.740	0.99
2	Cement -2	4.582	4.540	0.93
3	Cement -3	4.697	4.655	0.90
4	Cement -4	4.506	4.459	1.03
5	Cement -5	4.600	4.555	0.99
6	Cement -6	4.488	4.438	1.13
Average water absorption of cement bricks in %				0.995



CONCLUSION

The various waste that are currently recycled in bricks manufacturing have been reviewed. The effect of those waste on the bricks properties are reviewed. Enhance performance in terms of making more environmental and an economical brick neither consumes energy resource nor emits pollutant gases gives an economical option to design the green building. Certain bricks are produced without firing which is an advantage over other manufacturing of bricks in term of low embodied energy material. The study is useful for various research involved using industrial or agricultural waste material to develop sustainable construction material.

From this project work the following points are concluded

- Sugarcane bagasse can be added in a higher percentage as compared to the other material used.
- The percentage of water absorbed is 44% which indicates that this brick comes under first class and second class brick and we can use less amount of water in cement mortar for construction of brick work.
- The compressive strength of a sugarcane bagasse brick is found to be above 60% strength increases, which implies this brick comes under second class brick. From the code IS:1077-1992, it is concluded that this brick comes under second class brick type.
- Thus the bricks can be said heavy duty bricks and internal walls.
- Hence the usage of these bricks in large construction company helps to achieve maximum profit potential and would result in sustainable development.

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