"COCONUT WASTE & GLASS WASTE USED FOR MAKING BRICKS"

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ABSTRACT

Space allotments for various kind of waste have been a major problem in all countries of the world. There are wastes like E-waste, Hazardous waste, Agricultural waste, Industrial waste, Municipal waste, Commercial waste, Chemical waste, etc. Brick are widely used construction and building material around the world. Bricks are prepared from natural waste material (coconut waste) & industrial waste (glass powder). Soil is used as a binding material for natural waste material. The main objective of the present study is to reduce the quantity of soil with natural waste material as well as industrial waste material. The coconut fibers are used to make light weight bricks. The coconut fiber which otherwise is land filled has been utilized to make construction bricks that serves a purpose of solid waste management. Also for environmental protection and sustainable development, extensive research has been conducted on production of bricks from waste material. This waste is used to reduce the quantity of soil as there is a greater storage of soil in many parts of world. The bricks are prepared by coconut fibers & glass powder with varying composition of soil reduced the quantity of soil (10%-30%) respectively. The prepared bricks are tested in compression strength machine for getting compressive strength of bricks.

Keyword: - *Bricks, Coconut Fiber and Shell, Glass Powder, Soil, Environmental Friendly, Compressive Strength.*

1. INTRODUCTION

Bricks have been a major construction and building material for a long time. The worldwide annual production of bricks is currently about 1391 billion units and the demand for bricks is expected to be continuously rising. Conventional bricks are produced from soil with high temperature kiln firing. It is also noted that there is a shortage of in many parts of the world. To protect the clay resource soil and the environment, some countries such as China have started to limit the use of bricks made from clay. Coconut is a versatile product and has multiple uses. Almost all the parts of a freshly grown coconut, eatable or otherwise, are used in some or the other manner. India is one of the leading coconut producers in the world, producing 13 billion nuts per annum. Fired bricks are made by using soil –sand mixes with different percentages of rice husk ash. The firing durations at 9000C were respectively 2, 4 and 6 hours. The effects of rice husk content on workable mixing water content, Atterberg limits, linear shrinkage, density, compressive strength and water absorption of the bricks were investigated. The results indicated that the inclusion of rice husk, increased the compressive strength of bricks. The bricks made of soil –coconut fibers–rice husk-glass powder, shell mixes could be used for construction purpose**.**

1.1 Objectives

1. Check the feasibility of coconut & glass powder waste as a partial replacement for soil in the preparation of bricks.
2. To reduce the quantity of Soil for making bricks with natural waste materials as well as industrial waste materials.
3. To use waste Material (coconut husk & glass powder) in construction units.
4. Study the behavior of compressive strength and water absorption
5. Compare the result with conventional brick.

1.2 Different types of Waste Materials

1. Coconut Waste

Coconut fiber is a natural fiber extracted from the husk of coconut. It is the fibrous material found coconut. Coconut fiber cells are narrow and hollow, between the hard, internal shell and outer coat of a with thick walls made of cellulose. Each cell is about 1 mm (0.04 in) long and 10 to 20 μm (0.0004to 0.0008 in) in diameter. Fibers are typically 10 to 30 centimeters (4 to 12 in) long. Coconut Shell is the strongest part covered in coconut fruit. Coconut shell is located in between the coconut flesh and coconut husk.

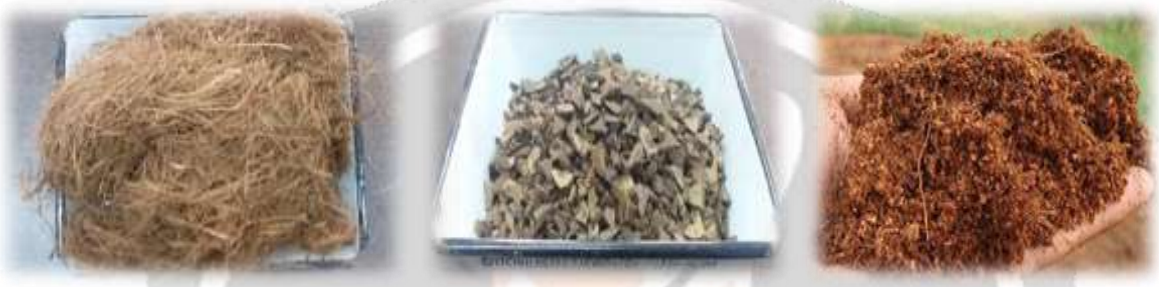


Figure No-1: Coconut Fibers, Coconut Shell, Coconut Husk

2. Rice Husk

Rice husks are the hard protecting coverings of grains of rice. In addition to protecting rice during the growing season, rice husk can be put to use as building material, fertilizer, fuel.

3. Wood Sawdust

Sawdust used is generated from the mechanical processing of raw wood in the sawing process. Sawdust is used in its original form and taken from its disposed area near the timber manufactures in the local region.

4. Glass Powder

The Boron Glass Powder and Soda Lime Glass Powder are collected from the Industries Boron glass powder are the classification of window panels and glass containers etc., and Soda Lime glass powders are under the classification of Reagent bottles, Medical devices and optical etc., Glass powders passing less than 75μm is used in the production of brick.

1.3 Literature Survey

(A). Feasibility of Using Waste Glass Powder in Fly Ash Bricks By N.Sudharsan1, T. Palainsamy

ABSTRACT: Fly ash is one of the major residues generated during combustion of coal in thermal power plants. Fly ash brick technology is the process of converting industrial waste material into quality building material. Glass waste is the problematic threat to environment and also to the developing countries. Fly ash, Lime, Gypsum and Crusher dust are used to manufacture the fly ash brick. In this study glass powder is used as a replacement material for fly ash. The fly ash was replaced by the glass powder in the various proportions. Two types of Fly ash bricks were casted. In first type Boron glass replaced in Fly ash bricks and another type Soda lime glass lime replaced in Fly ash bricks. The prepared bricks are cured for 7days and 28days dried in regular temperature. The tests results

shows the compressive strength of the brick with 20% replacement of boron and soda Lime glass powder revealed 6.723N/mm2, 6.150 N/mm2 provokes the excellent performance in compare to the Indian Standards. The water absorption, bulk density, hardness, efflorescence, initial rate of absorption and sorptivity of the brick are experimented as per IS code. The study was aimed to reduce the waste glass 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.

(B). Experimental Investigations on Bricks with the replacement of Coconut Fiber By G.Vinoth Kanna

ABSTRACT: We are using the waste, Coconut fiber in this project for building material and to protect environment and natural resource like clay and sand. The basic waste used in this project is coconut fiber in addition with polymer as used to attain the strength of the brick. At first we have to shredded coconut fiber into the small pieces, mix them at the right proportion to make this brick, bricks are allowed to laid on the ground with the help of the mold, wet bricks are dried for seven days and the bricks are fired for another seven days after this process, the bricks have to be burnt for 15 to 20 days to attain the good strength.

2. MATERIALS / TOOLS REQUIRED

In this chapter different materials and tools has been use for brick.

(A). USE OF MATERIALS

1. Coconut Waste
2. Glass Powder
3. Clay
4. Water

2.1 Coconut Waste

Basic information are already given in Ch.1-1.2

Physical and Mechanical Properties

The physical and mechanical properties of coconut fibers are presented. The conditions specifically mentioned by the researchers are given at the end of table. Coconut fibers were investigated by many researchers for different purposes. There is a huge difference in some properties, e.g. diameter of coconut fibers is approximately same and magnitudes of tensile strength are quite different.

There are variations in properties of coconut fibers, and this makes it difficult for their frequent use as construction material. The purpose of compilation of data for the properties of fibers is to get a guideline, but after compilation, a huge variation is seen. There should be some standards for such variations, just like we have standards for sand and aggregates.

Chemical Properties

Coconut husk contain cellulose, hemi-cellulose and lignin as major composition. These compositions affect the different properties of coconut husk. The pre-treatment of husk changes the composition and ultimately changes not only its properties but also the properties of composites. Some-times it improves the behavior of husk but sometimes its effect is not favorable.

Coconut fiber are agricultural waste products obtained in the processing of coconut oil and are available in large quantities in the tropical regions of the world, most especially in Africa, Asia and America. Coconut fiber are not commonly used in the construction industry but are often dumped as agricultural wastes. However, with the quest for affordable housing system for both the rural and urban population in the developing countries, various schemes focusing on cutting down conventional building material costs have been put forward.

2.2 Glass Powder

Basic information are already given in Ch.1-1.2

2.2 Soil

Laterite soils are red in colour due to little clay and more gravel of red sand-stones. Laterite soils have high clay content, which mean they have higher Caption Exchange Capacity and water-holding capacity than sandy soils. They are formed under condition of high temperature and heavy rainfall with alternate wet and dry periods.

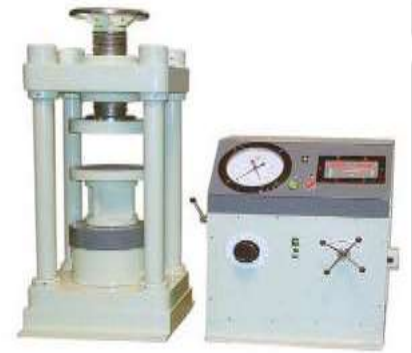
2.3 Water

Mixing water should not contain undesirable organic substances or inorganic constituents in excessive proportions. In this project clean potable water is used. Water in three states: liquid, solid (ice), and gas (invisible water vapor in the air). Clouds are accumulations of water droplets, condensed from vapor saturated air.

Water on Earth moves continually through the water cycle of evaporation and transpiration (evapotranspiration), condensation, precipitation, and runoff, usually reaching the sea. Evaporation and transpiration contribute to the precipitation over land. Water used in the production of a good or service is known as virtual water.

(B) TOOLS REQUIRED

Table No-1: Tools Required

 1. Compression Testing Machine	 2. Brick Mould  3. Weighting machine	 4. Hand Float.

3. TEST SET UP

To know the quality of bricks following 6 tests can be performed. In these tests some are performed in laboratory and the rest are on field.

1. Colour Test
2. Soundness Test
3. Hardness Test
4. Efflorescence Test
5. Water Absorption Test
6. Compressive strength Test

3.1 Colour Test

A good quality brick should have bright and uniform color throughout.

3.2 Soundness Test

In this test two bricks are held by both hands and struck with one another. If the bricks give clear metallic ringing sound and don't break then those are good quality bricks.

3.3 Hardness Test

In this test a scratch is made on brick surface with a hard thing. If that doesn't left any impression on brick then that is good quality brick.

3.4 Efflorescence Test

A good quality brick should not contain any soluble salts in it. If soluble salts are there, then it will cause efflorescence on brick surfaces. To know the presence of soluble salts in a brick, placed it in a water bath for 24 hours and dry it in shade. After drying, observe the brick surface thoroughly. If there is any white or grey color deposits, then it contains soluble salts and not useful for construction. The presence of alkalies in bricks is harmful and they form grey or white layer on brick surface by absorbing the moisture. This test is conducted to find out the presence of alkalies in bricks.

3.5 Water Absorption Test (IS 3495 – PART 2)

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 weights is the water absorbed by brick. The percentage of water absorption is then calculated. The less water absorbed by brick the greater its quality. The water absorption of a brick is done by preparing the specimen adding suitable waste of coconut fiber, coconut shell and rice husk in various proportions such as 10%, 15%, 20% and 25%. Good quality brick doesn't absorb more than 20% water of its own weight.

Calculation of %of Water Absorption:

Water absorption, percent by mass, after 24-hour immersion in cold water is given by the following formula:

$$\% \text{ water absorption} = ((M2-M1) / M1) \times 100$$

3.6 Compressive Strength Test (IS 3495-PART-1:1992)

The compressive strength of a brick is done by preparing the specimen adding suitable waste of coconut husk & glass powder in various proportions such as 10%, 20% and 30%.CTM (Compressive testing machine) is used for testing of brick; Capacity of compressive testing machine is 3000 KN. Compressive strength test is done for Conventional Brick, Coconut Husk Brick, Glass Powder Brick. Purpose of the experiment is to compare Compressive strength of above different types of bricks made with various proportion of waste to conventional brick. Specimens size of 21 cm x 9.5 cm x 9.5 cm for Brick. Figure shows set-up for compressive strength test.

$$\text{Compressive strength in N/mm}^2 = \frac{\text{Maximum load at failure in N}}{\text{Average area of the bed faces in mm}^2}$$

Figure No-2: Set-up of Compressive Strength Test

4. RESULTS AND DISCUSSION

4.1. Colour Test

(A). Coconut Husk Brick

Up to 20% proportion for coconut husk, bricks has good red uniform colour. But after 20% proportion, bricks have dark taupe (dark brown between brown & gray) color under burnt bricks.

(B). Glass Powder Brick

Up to 10% proportion for glass powder, bricks has good red uniform colour. But after 10% proportion, bricks have some white spot on surface but colour wise is red upto 30% glass powder may be used under burnt bricks.

4.2. Soundness Test for Bricks

(A). Coconut Husk Brick
When two bricks are struck with one another, up to 20% proportion, they give metallic sound. But 30% proportion gives dull sound.

(B). Glass Powder Brick
When two bricks are struck with one another, up to 30% proportion, they give metallic sound.

4.3. Hardness Test
Up to 20% proportion, bricks are hard. When scratch is made, it doesn't left mark for both coconut husk & glass powder brick. But after 30% proportions, there was scratch left on brick surface.

4.4. Efflorescence Test

(A). Coconut Husk Brick
Up to 20% proportion, no colour deposited on bricks surface. But after 30% proportions, there was a some small grey colour deposited on brick surface.

(B). Glass Powder Brick
Up to 10% proportion for glass powder, no colour deposited on bricks surface. But after 10% proportions, bricks have some white spot on surface.

4.5. Water Absorption Test

Table No-2: Water Absorption Test

Sr. No	SPECIMEN	WEIGHT BEFORE ABSORPTION OF WATER(W1)gm.	WEIGHT AFTER ABSORPTION OF WATER(W2)gm.	% OF ABSORPTION OF WATER
1	CONVENTIONAL BRICKS	2920 gm.	3276gm.	12.19 %
2	BRICKS WITH 10% OF COCONUT HUSK	2890gm.	3240gm.	12.11 %
3	BRICKS WITH 20% OF COCONUT HUSK	2860gm.	3135 gm.	9.61%
4	BRICKS WITH 30% OF COCONUT HUSK	2845gm.	3223gm.	13.28 %
5	BRICKS WITH 10% OF GLASS POWDER	2874 gm.	3220 gm.	12.03 %
6	BRICKS WITH 20% OF GLASS POWDER	2890 gm.	3246 gm.	12.31 %
7	BRICKS WITH 30% OF GLASS POWDER	2872 gm.	3283 gm.	14.31 %

4.6 Compressive Strength Test

Table No-3: Compressive Strength Test

Sr. No	SPECIMEN	SAMPLE	C/S AREA mm²	LOAD KN	COMPRESSIVE STRENGTH N/mm²	AVERAGE COMPRESSIVS TRENGTH N/mm²
1	CONVENTIONAL BRICKS	SAMPLE 1	210 × 95	70	3.50	**3.62**
		SAMPLE 2		65	3.65	
		SAMPLE 3		73	3.71	
2	BRICKS WITH 10% OF COCONUT HUSK	SAMPLE 1	210 × 95	120	5.01	**5.26**
		SAMPLE 2		110	5.51	
		SAMPLE 3		105	5.26	
3	BRICKS WITH 20% OF COCONUT HUSK	SAMPLE 1	210 × 95	115	5.76	**5.76**
		SAMPLE 2		120	6.01	
		SAMPLE 3		110	5.51	
4	BRICKS WITH 30% OF COCONUT HUSK	SAMPLE 1	210 × 95	65	3.25	**3.0**
		SAMPLE 2		55	2.75	
		SAMPLE 3		60	3.00	
5	BRICKS WITH 10% OF GLASS POWDER	SAMPLE 1	210 × 95	65	3.25	**3.33**
		SAMPLE 2		70	3.50	
		SAMPLE 3		65	3.25	
6	BRICKS WITH 20% OF GLASS POWDER	SAMPLE 1	210 × 95	85	3.50	**3.51**
		SAMPLE 2		75	3.45	
		SAMPLE 3		80	3.58	
7	BRICKS WITH 30% OF GLASS POWDER	SAMPLE 1	210 × 95	50	2.50	**2.5**
		SAMPLE 2		55	2.75	
		SAMPLE 3		45	2.25	

5. CONCLUSIONS

During different industrial, mining, agricultural and domestic activities, huge quantity of solid wastes are being generated as by-products, which pose major environmental problems as well as occupy a large area of lands for their storage/disposal. There is a tremendous scope for setting up secondary industries for recycling and using such huge quantity of solid wastes as minerals or resources in the production of construction materials. Environment-friendly, energy-efficient, and cost-effective alternative materials produced from solid wastes will show a good market potential to fulfill people's needs in rural and urban areas.

On the basis of experimental investigation the following observation are made:

1. It is observed that if the percentage of soil reduces more than 20% then the compressive strength of bricks decreases.
2. It is noted that as a soil content is reduces brick become lighter in weight
3. Maximum strength is achieved after replacing 20% of soil by coconut husk.
4. At 30% of waste the water absorption of brick is more and compressive strength of brick is less so it is not suitable for construction purpose.
5. Coconut waste can be easily handled and utilized for making light weight brick

6. SCOPE FOR FURTHER STUDY

Partial replacement of the bricks with coconut husk and glass powder in addition with clay it is a performance study, by this project the usage of the clay can be reduced and it lead to the safety of the environment. For the further study of the project using bricks others can use, take our project as a reference for their project for building materials.

1. Light weight bricks are easy to handle and transport.
2. High compressive strength, better workability, light weight etc. all these qualities of bricks will increase its future scope of construction work.
3. The effective way of utilizing waste material leads to clean environment.
4. Since the bricks have not been used on large scale for the construction work. But it has good scope in future, because these bricks is being manufactured from the waste material like rice husk, coconut waste.

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Part 1: determination of compressive strength
Part 2: determination of water absorption
Part 3: determination of efflorescence
Part 4: determination of war page