

# REUSE OF NATURAL WASTE MATERIAL (COCONUT WASTE) FOR MAKING LIGHT WEIGHT BRICKS

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**Abstract:** Brick are widely used construction and building material around the world. Bricks are prepared from natural waste material (coconut waste). 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. 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. These 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 with varying composition of soil reduced the quantity of soil (10%-25%) respectively. The prepared bricks are tested in compression strength machine for getting compressive strength of bricks.

**Keywords:** Bricks, Coconut Fiber and Shell, Soil, Environmental friendly, Compressive Strength.

## 1. INTRODUCTION:

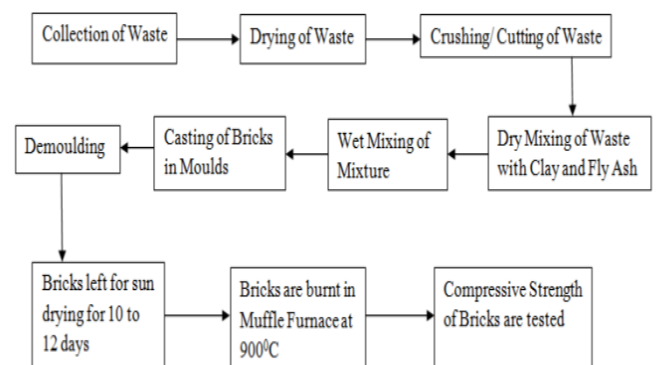
Bricks have been a major construction and building material for a long time. The worldwide annual production of bricks is currently about 1391 billion units and the demand for bricks is expected to be continuously rising. Conventional bricks are produced from soil with high temperature kiln firing. It 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 900°C 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, shell mixes could be used for construction purpose.

## Objectives

- 1) Check the feasibility of coconut 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
- 3) To use waste Material (coconut shell & fiber) in construction units.
- 4) Study the behavior of compressive strength and water absorption
- 5) Compare the result with conventional brick.

## 2. EXPERIMENTAL WORK



In our experimental process, we are using soil as binding material for coconut waste bricks. Starting with the collection of material required as brick making soil is collected from Dasturi-khed and coconut waste collected from local vendors and various temples of khed. We are preparing the bricks of size 20cm x 10cm x10cm which is nominal size of brick and for that mould of same size is fabricated. The soil is sun dried for 15 days for various test. Coconut waste is utilized for preparing bricks in the manner where it was previously go through the process of removing the husk and cut into the pieces of size 6 cm to 7cm and shell was crushed to size of pieces of 2cm to 3cm

in machine. After that rice husk and water mixed in to soil and treated coconut waste is mixed with that mixture and required water is added. The bricks are prepared with varying compositions and left sun drying for 10 to 12 days and further it was burnt at kiln.

### 3. MATERIALS

#### 3.1 Soil:

Laterite soils are red in colour due to little clay and more gravel of red sand-stones. Laterite soils have a high clay content, which mean they have higher Cation 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.



**Fig-1: Soil**

#### 3.2 Coconut fiber

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  $\mu\text{m}$  (0.0004 to 0.0008 in) in diameter. Fibers are typically 10 to 30 centimeters (4 to 12 in) long.



**Fig-2: Coconut Fibers**

#### 3.3 COCONUT SHELL

Coconut Shell is the strongest part covered in coconut fruit. Coconut shell is located in between the coconut flesh and coconut husk.



**Fig-3: Coconut Shell**

#### 3.4 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.



**Fig-4 : Rice Husk**

#### 3.5 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.



**Fig-5: Wood Sawdust**

### 4. TEST ON SOIL

#### 4.1. Moisture Content

Moisture content is defined as the ratio of the mass/weight of water to the mass/weight of water to the mass/weight of soil solids.

The three soil samples having moisture content 25%, 50%, 25 % due to presence of water content. The average value of moisture content in soil sample is 34%.

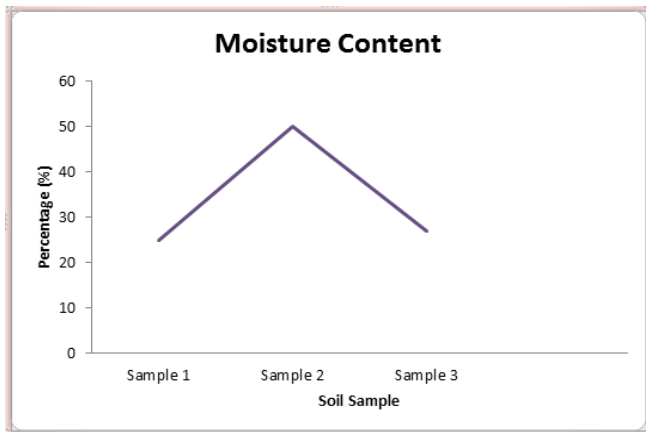


Chart-1: Moisture Content

#### 4.2. Liquid Limit

A liquid limit is the moisture content expressed as a percentage of the weight of over-dried soil, at which soil changes from a plastic to a liquid state. As per conducted experimental test results are 33.33%, 42.85%, 50%, 50% and average result is found that the liquid limit of soil sample is 44%.

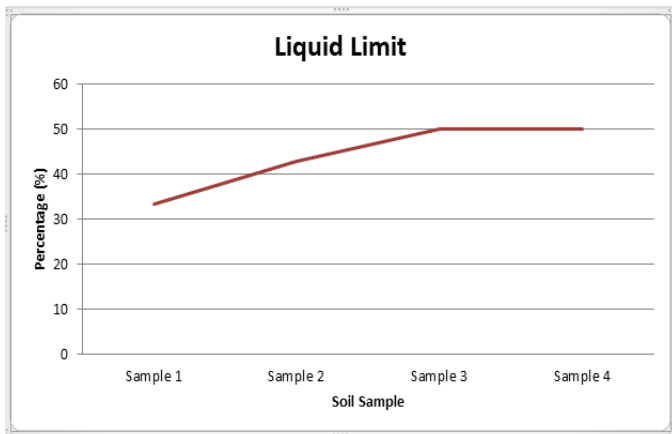


Chart-2: Liquid Limit

#### 4.3. Plastic Limit

The plastic limit of soil is the water content of the soil below which it ceases to be plastic. It begins to crumble when rolled into threads of 3mm diameter. From the experimental test result is found that the water content in soil sample is 36.20%.

#### 4.4. Plasticity Index

Plasticity Index (Ip) is the difference between liquid limit and plastic limit. According to the calculation the value of plasticity index is 7.8

Table No-1: Geotechnical properties of soil

Sr. No.	Name of Tests	Results	IS Code
1.	Moisture Content	34%	IS 2720 (Part VIII), 1983
2.	Liquid Limit	44%	IS 2720 (Part V)
3.	Plastic Limit	36.20%	IS 2720 (Part V)
4.	Plasticity Index	7.8	IS 2720 (Part V)

### 5. TEST ON BRICK

#### 5.1. Compressive Strength



Fig-6: Compressive strength machine

The compressive strength 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%.

Table No-2: Comparative Result of Compressive Strength

Sr No.	Soil (%)	Waste (%)	Avg. value of comp. strength without waste (N/mm <sup>2</sup> )	Avg. value of comp. strength with waste (N/mm <sup>2</sup> )
1	100	0	5	5
2	90	10	5	4.33
3	85	15	5	4.17
4	80	20	5	3.83
5	75	25	5	2.7



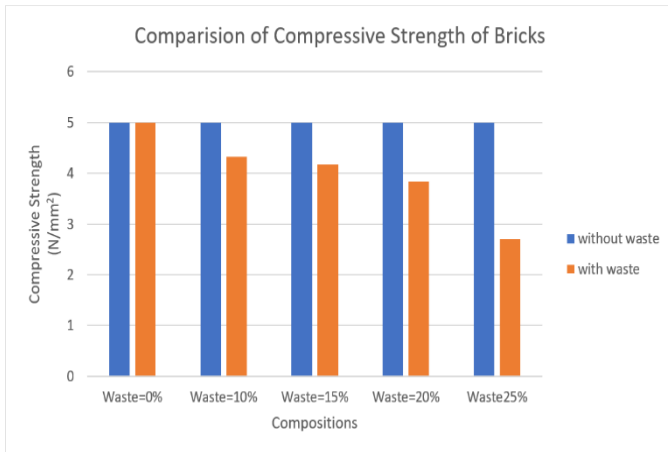


Chart 3: Compressive strength test

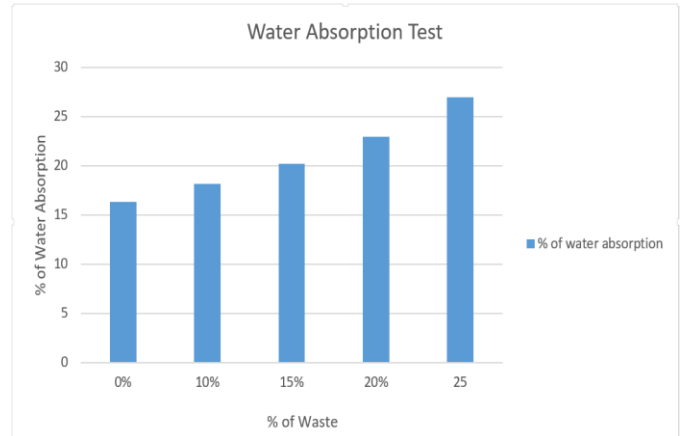


Chart-2: Water absorption test

### 5.2. Water Absorption Test

The weight of a quantity of water absorbed to the weight of brick expressed as a percentage is the water absorption capacity of brick. The strength of brick depends upon its water absorption capacity. 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%. The results obtained are



Fig-7: Water absorption test

Table No-3: Water absorption results

Sr. No.	% of waste	Avg. Wt. of brick before absorption (kg) $W_1$	Avg. Wt. of brick after absorption (kg) $W_2$	% of water absorption
1	0	2.18	2.53	16.35
2	10	2.05	2.42	18.17
3	15	1.92	1.31	20.21
4	20	1.82	1.23	22.91
5	25	1.69	2.15	26.96

Table no 4: Result: Light weight Brick

Sr. No.	Wt. of Soil in (%)	Wt. of Waste (%)	Avg. value of wt. of Brick	
			Unburnt Brick (kg)	Burnt Brick (kg)
1.	100	0	2.54	2.18
2.	90	10	2.42	2.05
3.	85	15	2.26	1.92
4.	80	20	2.17	1.82
5.	75	25	2.02	1.69

### CONCLUSION:

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

1. It is observed that if the percentage of soil reduces then the compressive strength of bricks decreases.
2. It is noted that as a soil content is reduced brick becomes lighter in weight.
3. Maximum strength is achieved after replacing 10% and 15% of soil by coconut waste.
4. At 25% of waste the water absorption of brick is 26.96% and compressive strength of brick is 2.7 N/mm<sup>2</sup> so it is not suitable for construction purpose.
5. Coconut waste can be easily handled and utilized for making light weight brick.

### Future scope:

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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## BIOGRAPHIES



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