RESEARCH ARTICLE OPEN ACCESS

Low Cost Roofing Tiles Using Agricultural Waste

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Abstract:

The scenario of living in huts in slum areas is becoming very difficult day by day due to vast change in climate. Replacing the ordinary huts and conventional poor class roofs with much efficient alternate roof cover is being the most required. On the other side, proper and efficient disposal of agricultural wastes is being the key factor in solid waste management in most of the Indian States. Having both the problems in a single line, in this project we have prepared and evaluated the performance of low cost roofing tiles using agricultural wastes as raw material. Based on the results, it is suggested that we can efficiently replace significant quantity of river sand in making roofing tiles with the corn cob powder and rice husk powder in appropriate propositions which gave compressive strength as similar as before replacement. By replacing the river sand in making roofing tiles would reduce its manufacturing cost as well as selling price and makes it more affordable. Thus preparation of such sand replaced roof tiles will significantly reflect healthy environmental and economic benefits.

Keywords — Low cost tile, Economical tile, Agri-tile, Low cost roofing tile.

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I. INTRODUCTION

Building materials have undergone a lot of modification from ancient times till this present technology era. With everyone seeking for affordable and comfortable houses to live in, every scientist and engineer is working hard to develop and optimize new building materials that would be durable and cost effective. Building materials range from roofing sheet, block, concrete, gravel, sand, clay, stone, cement, roofing tiles, steel, fine aggregate, coarse aggregate, laterite among others. The tiles are usually hung in parallel rows, with each row overlapping the row below it to exclude rain water and to cover the nails that hold the row below. There are also roof tiles for special positions, particularly where the planes of the several pitches meet. They include ridge, hip and valley tiles. Slate roof tiles were traditional in some areas near sources of supply, and give thin and light tiles when the slate was split in to its natural layers. It is no longer a cheap material, however and is now less common.

1. **AIM**:

To produce that type of construction materials, which is useful as well as Economical and environment friendly by using agricultural waste.

2. **OBJECTIVE**:

To determine various useful properties of Rice Husk Ash (RHA)

To ensure actual quality and costing of roofing tiles.

To find out the various uses of agricultural wastage produced day by day in agricultural field

To make construction more aesthetically pleasant in the eye of environment.

3**. GENERAL ROOFING TILES:**

Numerous shapes (or "profiles") of roof tiles have evolved. These include:

Flat tiles –

the simplest type, which are laid in regular overlapping rows. An example of this is the clay-made "beaver-tail" tile (German Biberschwanz [de]), common in Southern Germany. Flat roof tiles are usually made of clay but also may be made of stone, wood, plastic, concrete, or solar cells.

Plain clay tiles –

The size of the plain clay tile 10+1⁄2 by 6+1⁄2 inches (270 mm × 170 mm) was originally defined by statute in 1477 during the reign of Edward IV. These are double-lap tiles made originally from clay but more recently in concrete. They are specified generally for their aesthetic properties. The colour were generated through the control of the kiln atmosphere to generate either red, brown or blue tiles depending on the degree of reduction in the kiln. Some tiles are still manufactured in this traditional way.

lmbrex and tegula –

an ancient Roman pattern of curved and flat tiles that make rain channels on a roof.

Roman tiles –

flat in the middle, with a concave curve at one end and a convex curve at the other, to allow interlocking.

Pantiles –

with an S-shaped profile, allowing adjacent tiles to interlock. These result in a ridged pattern resembling a ploughed field. An example of this is the "double Roman" tile, dating from the late 19th century in England and US.

Monk and nun tiles, also called mission or barrel tiles –

semi-cylindrical tiles laid in alternating columns of convex and concave tiles. Originally they were made by forming clay around a curved surface, often a log or the maker's thigh. Today barrel tiles are mass-produced from clay, metal, concrete or plastic.

Interlocking roof tiles – similar to pantiles with side and top locking to improve protection from water and wind.

Antefixes – vertical blocks which terminate the covering tiles of a tiled roof

4. **METHODOLOGY**

4.1 Requirements – The first when you start the preparation of any project you have require sufficient information about project topic to carry out work in proper manner as we need, we collect information about generation of agricultural waste and its disposal as well as recycling of it , by reading newspapers and all that information from internet with respect to project topic. Below are some byproducts from recycled agricultural waste.

4.2 Analysis - It is the one of the most important step in our micro-project, we analyzed market and other places; where production of roofing tiles is possible, the concept "low cost" is directly related to market analysis, from the ancient era to till date we improved our day to day life and living standards with it costs of market also reaching the sky.

4.3 Design - We include the design of roofing tiles as a comparison to normal design of roofing tiles, for the first step to production of roofing tiles use to design roofing tile simple; below are the design of roofing tile we used in our project. In that we referred a one type to design is Bangalore roof tiles.

5. DESIGNING OF ROOFING TILES

LENGTH = 19.2 cm
WIDTH = 9 cm
THICKNESS. = 4.1 cm
VOLUME. = 708.48
(Therefore, the total weight of roofing tile is 0.900 Kg. with volume is 708.48 cm3)

6. MATERILS USED IN ROOFING TILES

Rice Husk Ash (RHA) It is byproduct of rice husk which is considered as waste in agricultural sites of farms. RHA is grayish-black in color due to unburned carbon. At burning temperatures of 550–800 °C.

Chemical composition (%)

Chemical Component	Rice husk ash	Rice straw ash	Bagasse ash	Trass	Fly ash
SiO2	79.5	82.0	75.0	50.0	66.8
Al2O3	0.09	0.3	6.7	17.8	7.2
Fe2O3	0.06	0.3	6.3	6.8	5.1
CaO	0.64	1.5	2.8	4.5	2.7
Mgo	0.83	1.8	3.2	1.0	2.7
Na2O	0.07	5.3	1.1	3.9	0.9
K2O	3.75	4.9	2.4	2.6	4.5
P2O5					
Loss of ignition	14.3	-	0.9	2.5	9.8

Table 1. Chemical composition of RHA

Red soil
Red soil is a type of soil that typically develops in warm, temperate, and humid climates and comprises approximately 13% of Earth's soil.

M-Sand
It is basically M sand is a form of artificial sand, manufactured by crushing large hard stones, mainly rocks or granite, into fine particles, which is then washed and finely graded.

7. MIXING OF MATERIAL
We used Manual mixing process, for good mixtures of Materials; below showing chart is a part and description of materials with their various proportion,

SR.NO	NAMEOFMATERIALS	PERCENTAGE	WEIGHTINKG
1	RICEHUSKASH(RHA)	10	0.180
2	M-SAND	30	0.240
3	CLAY	30	0.240
4	REDSOIL	30	0.240

Table 2. Proportion of materials

8. **Tests performed**
- Compression test / Load bearing test
- Bending stress test
- Water absorption test
- Drop test

8.1. Compression test

Sr.No	Length of tile (CM)	Breadth of tile (CM)	Thickness of tile (CM)	Weight of tile (KG)	Comprehensive strength(N/mm 2)
1	18	9	4.3	0.948	5.5
2	19	8	4.1	1.030	4.8
3	18	9	3.9	0.800	5.2
Average	18.3	8.6	4.1	0.926	5.1

Table 3. Comprehensive strength test
Load is equal for all samples is 150 Kg
"The average compressive strength of brick is 5.7 Mpa"

8.2. Bending stree test
8.3. Water absorption test

Sr.No	Length of tile (CM)	Breadth of tile (CM)	Thickness of tile (CM)	Weight of tile (KG) at dry condition	Weight of tile (KG) at wet condition	Weight of water absorped (Litre)
1	19.2	8.7	4.3	0.980	1.2	0.220
2	19.2	8.2	4.1	0.800	1.1	0.300
3	19.2	7.9	3.7	0.915	1.4	0.433
Average	19.2	8.26	4.03	0.967	1.23	0.317

Table 4. Water absorption test

"The total percent of water absorption of tile is 34.64% of total weight of average tile".

8.4. Drop test

Sr.No	Length of tile (CM)	Breadth of tile (CM)	Thickness of tile (CM)	Weight of tile (KG)	Condition of tile (Good/damaged)
1	19.2	8.7	6.4	0.984	Damaged at the height of 6 feet
2	19.2	8.3	5.2	1.032	Good at the height of 5.5 feet
3	19.2	7.9	6.3	0.864	Good at the height of 5 feet
Average	19.2	8.26	5.96	0.960	Therefore the tile will break ; when it's drop from and above of 6 feet

Table 5.Drop test

9. CONCLUSIONS
After project completion we conclude that:

1) Rice Husk Ash (RHA) has several types of construction properties and could be used for a good strength in construction materials.

2) By replacing any other artificial material and chemicals that are manufactures in laboratories into Rice Husk Ash, it would make it economical as well as environment friendly

3) Reduced cost of manufacturing of roofing tiles with RHA, Red soil and M-sand without using the materials which is hard to recycle, reduce and recover.

10. REFERENCES

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