

UTILIZATION OF COIR FIBRE AS A COMPONENT MATERIAL IN MANGALORE TILES

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ABSTRACT

This study was conducted to utilize coco coir fiber as a component material in Mangalore tiles. As technology innovation, the Breaking load tests of the Mangalore tiles was conducted to determine the fracture or to cause the sample to fail of using a Breaking load Testing machine. Coco coir fibers were air-dried and shredded, segregated and cut into a maximum length of 15 millimeters to prevent these from bending during the mixing process. Statistical results showed that the use of coco coir fiber as a component material significantly affected the tensile strength of Mangalore tiles. Brown coir and white coir should be mixed with clay by selecting a different proportion. Then tiles are made with machine. These tiles were dried and burnt for 20 days. Then breaking load test and water absorption test must be done. As a result, white coir reinforced tile gives more strength and it is more durable when compared with brown coir reinforced tile.

Keywords-: Coconut Fibers, Water Absorption, Breaking Load, Permeability test.

I. INTRODUCTION

General

In almost all developing countries, there is a great shortage of roofing material. Local materials are often used, like soil, stone, grass and palm leaves. These roofs require a lot of maintenance and are not always resistant to heavy rain. Materials like Corrugated Iron Sheets (CIS) and asbestos cement sheets have replaced traditional material. Roofing materials tend to be the biggest expense for individual home builders.

Asbestos cement sheets should not even be considered, because of the health Hazard associated with making them. Ceramic tile roofs are good. However, if the Kiln does not allow adequate temperature control during firing, the quality of the finished tiles can be very much uneven. Concrete tiles have partially replaced ceramic tiles for purely economic reasons but what limits the use of concrete tiles is their weight on the roof, which requires a strong load bearing structure.

Coir fibre is one of the natural fibres abundantly available in tropical regions, and is extracted from the husk of coconut fruit. Coir is stiff coarse fibre and is being found between the husk and the outer shell of a coconut. It is a fibre abundantly Available in India the second highest in the world after Philippines. The individual fibre cells are narrow and hollow, with thick wall made of cellulose. There are two Varieties of coir; (i) Brown coir- extracted from a varieties ripe coconut which contains more lignin and less cellulose and are stronger but less flexible.

(ii) White coir- The immature husks are suspended in a river or water-filled pit for up to ten months. During this time micro-organisms break down the plant tissues surrounding the fibres to loosen them – a process known as retting. Segments of the husk are then beaten by hand to separate out the long fibres, which are subsequently dried and cleaned. This fibres are extracted from coconut before they are ripe, which are white or light brown in Colour and are smoother and finer. There are many general Advantages of coconut fibres e.g. they are mooth-proof, resistant to fungi and rot, Provide excellent insulation against temperature and sound, not easily combustible, flame-retardant, unaffected by moisture and dampness, tough and durable, resilient, springs back to shape even after constant use, totally static free and easy to clean.

II. OBJECTIVES

- To achieve an eco-friendly product using locally available material.
- To decrease the self-weight and cost.
- To improve the breaking load and ductility with the addition of fibres.
- To improve the strength as well as durability of the tile.

III. METHODOLOGY

Brown coir reinforced Mangalore tile:

The fibrous husks are soaked in pits or in nets in a slow moving body of water to swell and soften the fibres. The long bristle fibres are separated from the shorter mattress fibres underneath the skin of the nut, a process known as wet-milling. Some mattress fibre is allowed to retain more moisture so that it retains its elasticity for 'twisted' fibre production.

The obtained brown coir fibrous husk are then cut into small pieces of 15mm length and blended it with soil and dried for 15 days and burnt for 24 hours taken it for the conduction of various tests like (i) Breaking load test- in this the fibre is

mixed by blending it with the clay. In the breaking load test we have tested the prepared dried and burnt tile specimen in the breaking load test machine to know its strength.

(ii) Water absorption test: in this the oven dried brown coir blended tile specimen is soaked entirely in a water bath condition for 24 hours to know the water absorption ability of the blended coir fibre.

White coir reinforced Mangalore tile:

After selecting suitable materials like sand and coir fibres, material properties were determined. In order to replace clay with white coir fibre, initial studies were conducted to finalise the percentage replacement of clay with fibres. After finalising the same, tile specimens were prepared using white coir blended with sand. The prepared tile will be dried for 15 days and burnt for 24 hours in kiln.

The prepared white coir blended tile specimen is then subjected to various tests to know its physical properties those tests are: (i) Breaking load test- where the coir fibre is cut into a small pieces of 15mm length and is mixed with the tile specimen and after drying and burning the same is brought for the breaking load test to know the strength.

(ii) Water absorption test- the prepared oven dried white coir blended tile specimen is wholly immersed in water bath condition for 24 hours to know the water absorption ability of the blended coir fibre.

IV. RESULTS

A. Test Results On Normal Mangalore Tile Specimen:

a) Breaking load test

Three tile specimens have been taken as the samples for the test to be carried out, the tile is placed in such a way that, it is supported evenly flat-wise on the bearers, setting a span of 25 cm and resting on

bottom surface. After the conduction of the test we are tabulated the obtained results:

Table No: 1 Breaking load test

Trial no.	Initial weight (Kg)	Strength (KN)
1.	2.272	7.36
2.	2.278	7.38
3.	2.272	7.35

Average Breaking Load = 7.363 N/mm^2

b) Water absorption test

After taking the initial weight of the oven dried specimen then we have immersed the tile wholly inside the water bath for 24 hours, after that we have taken the final weight of the specimen, then the test results were tabulated below

Table No: 2 Water absorption test

Trial no.	Dry weight of the specimen, (W1) Kgs	Weight of the tile specimen after immersion in cold water (W2) Kgs	Percentage of water absorption by weight $= (W2 - W1) / W1 * 100 \%$
1.	1.246	1.436	15.24
2.	0.568	0.658	16.00
3.	1.380	1.600	15.80

Average percentage of water absorption = 15.68%

B. Test Results On Brown Coir Reinforced Mangalore Tile Specimen

a) Breaking load test

Five brown coir reinforced tiles have to be tested, the coir reinforced tile is supported evenly flat-wise on the bearers, setting a span of 25 cm and resting on bottom surface. Load is applied with the direction of load being perpendicular to span. After the conduction of break load test we were tabulated the obtained results below

Table No: 3 Breaking load test

Tile No.	Proportion (%)	Initial weight (Kg)	Strength (KN)
1.	0.1	2.080	5.576
2.	0.2	1.994	9.464
3.	0.3	1.954	8.346
4.	0.4	1.956	7.688
5.	0.5	1.930	7.574

Maximum breaking load obtained, in which the different proportions of brown coir reinforced Mangalore tiles are taken = 9.464 N/mm^2

b) Water absorption test

After taking the initial weight of the oven dried specimen then we have immersed the brown coir reinforced Mangalore tile wholly inside the water bath for 24 hours, after that we have taken the final weight of the specimen, then the test results were tabulated below

Table No: 4 Water absorption test

Tile no.	Dry weight of the specimen, (W1) Kgs	Weight of the tile specimen after immersion in cold water for 24 hrs (W2) Kgs	Percentage of water absorption by weight = $(W2 - W1)/W1 * 100\%$
1.	0.992	1.174	18.35
2.	1.000	1.190	19.00
3.	0.902	1.064	17.96
4.	0.984	1.170	18.90
5.	0.894	1.060	18.57

These are the results obtained after the conduction of water absorption test for brown coir reinforced Mangalore tiles and results are tabulated above for different five proportions of coir reinforcement. Minimum water absorption obtained, in which the different proportions of brown coir reinforced Mangalore tiles are taken = 17.96 %

C. Test Results On White Coir Reinforced Mangalore Tile Specimen**a) Breaking load test**

Five white coir reinforced tiles have to be tested, the coir reinforced tile is supported evenly flat-wise on the bearers, setting a span of 25 cm and resting on bottom surface. Load is applied with the direction of load being perpendicular to span. After the conduction of break load test we were tabulated the obtained results below

Table No: 5 Breaking load test

Tile no.	Proportion (%)	Initial weight (Kg)	Strength (KN)
1.	0.2	1.976	10.77
2.	0.4	2.124	11.26
3.	0.6	1.894	9.00
4.	0.8	1.966	8.78
5.	1.0	1.902	6.96

Maximum breaking load obtained, in which the different proportions of white coir reinforced Mangalore tiles are taken = 11.26 N/mm^2

b) Water absorption test

After the conduction of water absorption test for the white coir reinforced Mangalore tile we were tabulated the obtained results below

Table No: 6 Water absorption test

Tile no.	Dry weight of the specimen, (W1) Kgs	Weight of the tile specimen after immersion in cold water for 24 hrs (W2) Kgs	Percentage of water absorption by weight $= (W2 - W1) / W1 * 100 \%$
1.	0.962	1.130	17.46
2.	1.306	1.512	15.77
3.	0.846	1.000	18.20
4.	1.006	1.200	19.20
5.	0.882	1.044	18.37

Minimum water absorption obtained, in which the different proportions of white coir reinforced Mangalore tiles are taken = 15.77%

V. CONCLUSION

On the basis of literature and tests which are conducted to know their various physical properties, the following conclusion can be made:

- It is possible to replace coir reinforced Mangalore tiles in place of normal Mangalore tiles, which has more strength, less self-weight, more stable and durable and eco-friendly one.
- Using white coir reinforced Mangalore tile is more advantageous when compare to Brown coir reinforced Mangalore tiles. As its strength and water absorption ability is preferably good as per the requirements.
- Currently, now a day's all are using normal Mangalore tiles as a roofing material. But now by the conduction of above tests we come to know that white coir reinforced Mangalore tile has more strength when compared to brown coir reinforced one.
- Hence we can replace the white coir reinforced Mangalore tile as a roofing material in place of normal Mangalore tile.

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