IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Experimental Investigation On Brick With The Partial Replacement Of Coconut Fibre

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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. We are using the waste, Coconut fiber in this project for building material and to protect environment and natural resource like. The basic waste used in this project is coconut fiber 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 mould, wet bricks are dried for seven days, the bricks have to be burnt for 15 to 20 days to attain the good strength. After these process bricks carried to the testing process as per Indian Standard codes 3495 part 1&2, 1077. The tests are Compression Test and Water Absorption Test.

I. INTRODUCTION

Agricultural materials have played a major role in human life. Globally,350 million tones of agricultural waste are produced per year and in India. Waste material from agricultural activities would cause environmental pollution and this waste must be managed properly to eliminate the effect towards the environment. Due to high demand and mass production, alternative ways had been used to reduce these huge amounts of agricultural waste as currently, landfill is still the ultimate disposal method for the waste and an inevitable consequence of solid waste in landfill that will cause ground water pollution.

Coconut fibre is one of the agricultural wastes that have been produced extensively. Coconut fibre is used in the development of ecological products, probably due to its characteristics as an organic solid waste. Coconut fibre also has shown potential in the production of various products in the world for several years. Furthermore, about billions of coconuts are harvested annually in the world and only 15% of the waste fibres are use as materials in manufacturing purpose. Therefore, most of the waste will be disposed in the landfill or will be burned as an easy way to reduce the waste. Open burning will release the smoke and dust that eventually will be carried by the winds thus causing air pollution and affect human health.Generally, farmer in this world make easy decision with burn the coconut fibre. Open burning is being practiced and the ash were produced will release gas emission into the atmosphere. Uncontrolled burning of that coconut fibre on farm became illegal and will cause sicknesses, illnesses and disease which might spread in communities. Therefore, those will increase the global warming phenomenon.

The alternative method must be produced to control these problems. One of the ways of disposing them would be utilization of coconut fibre into building materials. Thus, the use of agriculture waste materials such as coconut fibre will considerably reduce the cost of constructional and hazards they caused. Moreover, coconut fibres are also one of the substances that can be commercialized, recycled, can be used in the fired clay brick making process in order to reduce the rate of solid waste and improve the quality of the environment.

Recently, many researchers are interested to carry out an investigation of potential solid waste material that could be recycled in clay bricks. Many researchers have been done by using different types of agricultural waste such as sawdust, rice husk, palm oil waste, vegetable matter, rice husk and bio gas and pineapple leaves into building material.These materials are found to be a sustainable and environment-friendly raw material in construction. Therefore, due to this successful utilization this study investigated the potential of incorporating the coconut fibre into brick.

Meanwhile, utilization of coconut fibre in brick can be said is an essential ingredient in a building material. Coconut fibre are commonly use in material production because of the advantages has be found such as the resistant to fungi and rot, provide excellent insulation against temperature and sound, tough and durable, not easy to combustible and resilient. Moreover, coconut fibres are also one of the substances that can be commercialized, recycled, can be used in the fired clay brick making process in order to reduce the rate of solid waste and improve the quality of the environment.

II. OBJECTIVES

1) To check the feasibility of the brick by partial replacement of coconut fibre.

2) To check the strength of bricks by replacing coconut fibre.

III. LITERATURE SURVEY

1) Mohd Mustafa Al Bakri Abdullah, (2016): "Coconut fibre is highly potential waste to be incorporated into fired clay bricks as it can reduce air pollution from open burning activities and most of the properties complied with the standard with 3% of coconut fibre incorporated". This also provides alternative disposal method for coconut fibre and reduces the impact towards the environment.

2) T. Subramani, (2016): "Coir Fibre is a waste material which could be utilized in a stabilization of clay soil". The strength of soil-coir mix increases with increasing the percentage of coir Fibre. It is concluded that proportion of 0.5% coir Fibre in a soil is optimum percentage of materials having maximum soaked CBR value. Hence, this proportion may be economically used in stabilization of clay soil.

3) G. Vinoth kanna, (2018): "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". coconut fiber as an alternative raw material in brick production will induce a relief on waste disposal concerns. Further, the incorporation of coconut fiber in brick production leads to a new method of wastes disposal and found to be an environmental eco-friendly recycling process in brick industries and also preserve the 50% clay material.

4) Shahrukh T Munshi, (2019): "It is observed that if the percentage of soil reduces more than 20% then the compressive strength of bricks decreases, It is noted that as a soil content is reduces brick become lighter in weight". Maximum strength is achieved after replacing 20% of soil by coconut husk. 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) Kiruthika.N, (2020): The above results concludes that the compressive strength of fly ash bricks using coir fibre is 1.6% higher than the ordinary clay bricks, so these bricks can be effectively used for all construction purposes

IV. MATERIALS REQUIRED

1) Soil
2) Coconut Fibre
3) Water

A. *Soil*

Soil is the raw material that was used in this study. The soil collected are stored and dried in the oven at the laboratory. Subsequently, the soils were crushed and sieve to ensure the soil must not contain any impurities. Preliminary test was conducted which is covers the determination on plastic limit, liquid limit and plasticity index of the soil by carrying out the Atterberg Limit Test in accordance Method of Test for Soil or Civil Engineering Purposes. Atterberg Limit is the limit of water content used to define the soil behavior. This water content needs to be identified because it significantly affects the properties of soils. Strength may decrease as the water content increased. Soils also may swell-up upon the increasing of water content.

Fig 1 Soil

B. *Coconut Fibre*

Coconut fibre shown is used as replacement materials to clay by incorporating different percentages of coconut fibre into brick. Coconut fibre was collected from coconut fibre factory in **Kadaba, Tumkur** (D). Coconut fibre was dried in the oven before being used in the brick.

The bricks are made from ground coir and compressed into a brick form for easier transport and shipping. The process for maximizing this growing medium is extensive. Husks are removed from the coconuts and then soaked in order to loosen and soften the fibers.

Coconut fiber is available by dehiscing between skin and shell. These are multi-cellular, lignocelluloses, hard, a very coarse and rigid variety of natural fruit fiber. Its advantages are agro-renewability, biodegradability and a good blend of strength, length, extensibility, moisture regain, and high durability or resistance against sunlight, saline water, microbes, etc. The unfavorable attributes of coconut fiber are its coarse nature, variable length and fineness, somewhat stiff and harsh nature. Physical and mechanical properties of coconut fiber are compared with two allied popular lignocelluloses fibers viz., jute and sisal. Moreover, fine structure and chemical properties have also been described.

Fig 2 Coconut Fibre

V. METHODOLOGY

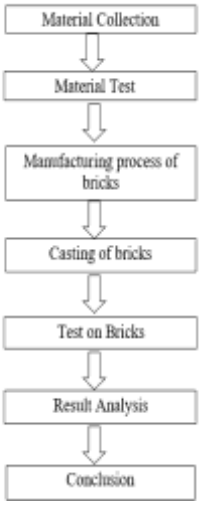

Fig 3 Flow Chart for Design Methodology

VI. EXPERIMENTAL WORK DONE

A. Tests On Soil

1) Specific Gravity: "the ratio of the unit weight of soil solids to the unit weight of water at the standard temperature of 4°C".

2) Plastic Limit Test: "the water content at which the soil changes from plastic state to semi-solid state".

3) Liquid Limit Test: the water content at which soil passes from zero strength to an infinitesimal strength, hence the true value of liquid limit cannot be determined.

4) Standard Proctor Compaction Test: "The soil particles are artificially rearranged and packed together into a closer state of contact by mechanical means in order to decrease the porosity of the soil and thus increases its dry density". The standard proctor test was developed by "R.R. Proctor" for the construction of earth fill dams.

5) Modified Proctor Compaction Test: "The soil particles are artificially rearranged and packed together into a closer state of contact by mechanical means in order to decrease the porosity of the soiland thus increases its dry density". Modified proctor test was developed to achieve greater state of compaction. In case of heavier transport and airfield pavements relatively higher compaction is required.

B. Laboratory Tests on Brick

1) Water Absorption Test.

2) Compressive Strength Test.

VII. MANUFACTURING PROCESS OF BRICKS

This study manufactured two types of brick, namely the conventional brick and coconut fibre brick. As for conventional brick, only clay soil was mixed with water to produce the brick. While mixing, the water was added gradually until attained the optimum moisture content of the mixture. After the soil was completely mixed, the mixture was pressed into moulds Meanwhile, similar sample preparation for coconut fibre brick was carried with refers to the method for conventional brick. In this stage, coconut fibre was added with 0.5%, 1%, and 1.5% by weight. summarizes the ratio of coconut fibre, clay soil and water added.

Table 1 Ratio of Coconut Fibre, Soil and Water

Specimen	Percentage of coconut fibre (%)	Weight of coconut fibre (g)	Weight of soil (g)	Percentage of moisture content (%)	Amount of water (ml)
Conventional brick	0	0	3000	16	480
Coconut fibre bricks 0.5%	0.5	15	2985	16	480
Coconut fibre bricks 1%	1	30	2970	16	480
Coconut fibre bricks 1.5%	1.5	45	2955	16	480

VIII. RESULTS AND DISCUSSIONS

A. Compression Strength of Bricks

Table 2 Compressive Strength

Sl No	Spicemen	Area mm²	Max Load At Failure kN	Compressive Strength N/mm²	Avg. Compressive Strength N/mm²
1	Coaventional Bricks	17100	130 120 110	7.60 7.01 6.43	7.01
2	0.5% of Coconut Fibre	17100	150 140 130	8.77 8.18 7.06	8
3	1% of Coconut Fibre	17100	190 180 190	11.11 10.53 11.11	10.92
4	1.5% of Coconut Fibre	17100	90 100 90	5.26 5.84 5.26	5.45

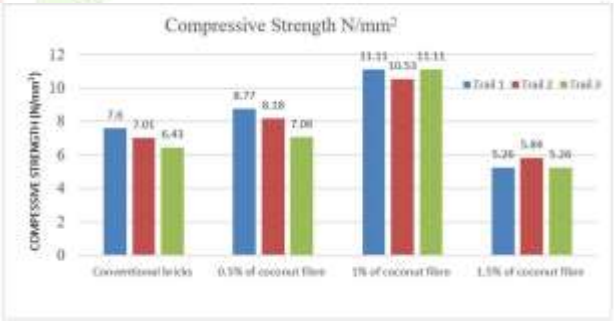

Fig 4 Comparison Between Conventional Brick and Coconut Fibre Bricks

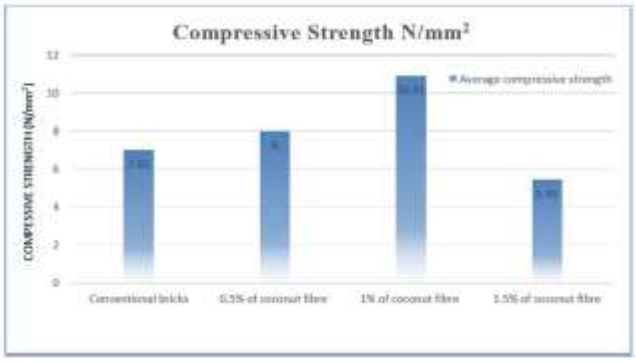

Fig 5 Average Compressive Strength of bricks

B. Water Absorption Test

Table 3 Water Absorption Test for Coconut Fibre Bricks

Percentage of coconut Fibre (%)	0.5	1	1.5
Dry weight of brick (W_1) in g.	2450	2390	2190
Weight of brick after immersing in water for 24 hrs. (W_2) in g.	2830	2700	2610
Water absorption(W_2-W_1)/W_1 x 100 in %	15.51	12.90	19.17

Table 4 Water Absorption Test for Conventional Bricks

Dry weight of brick (W_1) in g.	2854	2890	3172
Weight of brick after immersing in water for 24 hrs. (W_2) in g.	3184	3162	3350
Water absorption(W_2-W_1)/W_1 x 100 in %	11.56	9.41	5.61
Average water absorption in %	8.86		

IX. CONCLUSION

1) Coconut fibre wastes are produced abundantly in Malaysia and India. Regarding to the advantages of properties, coconut fibre is highly potential waste to be incorporated into fired clay bricks as it can reduce air pollution from open burning activities and most of the properties complied with the standard with 1% of coconut fibre incorporated.

2) This also provides alternative disposal method for coconut fibre and reduces the impact towards the environment. Other than that, the utilization of coconut fibre into fired clay brick could act as low-cost pore formers to produce lightweight brick.

3) Even though some of the properties decreased by incorporating the coconut fibre but it is still producing adequate fired clay brick that comply with the standard for non-load bearing purposes.

4) Coconut fibre is highly potential waste to be incorporated into bricks as a low-cost effective material.

5) The strength of coconut fibre has achieved good compressive strength when compared to conventional brick at modular percentages the water absorption capacity of these bricks during the conduction of experiment had resulted good and these are within the permissible limits of IS standards.

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