

EFFECT OF USING COCONUT FIBRE BY MANUFACTURING ECO FRIENDLY BRICKS (BLOCKS)

Submitted in partial fulfilment of the requirements for the award of
Bachelor of Engineering degree in Civil Engineering

by

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**DEPARTMENT OF CIVIL ENGINEERING
SCHOOL OF BUILDING AND ENVIRONMENT
SATHYABAMA**

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade "A" by NAAC
JEPPIAAR NAGAR, RAJIVGANDHI SALAI,
CHENNAI-600119**

APRIL 2022



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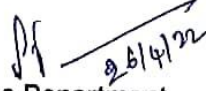
DEPARTMENT OF CIVIL ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **SP.PONGANESH (REG.NO.38200025) AND G.CHARLES (REG.NO.38200006)** who carried out the project entitled "**EFFECT OF USING COCONUT FIBRE BY MANUFACTURING ECO FRIENDLY BRICKS (BLOCKS)**" under my supervision from October 2021 to April 2022.


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ACKNOWLEDGEMENT

The satisfaction and elation that accompany the successful completion of any task would be incomplete without the mention of the people who have made it possible. It is our great privilege to express our gratitude and respect to Board of Management of **SATHYABAMA** who have guided us and inspired us during the course of our project work.

We convey our thanks to School of Building and Environment and **Dr. S.Packialakshmi, M.E., Ph.D., & Dr. R.Padma Priya, M.E., Ph.D., Head of the Department, Dept. of Civil Engineering** for providing me necessary support and details at the right time.

We would like to express our sincere and deep sense of gratitude to our Project Guide DR S. PACKIALAKSHMI for her valuable guidance, suggestions, constant encouragement of support which paved way for the successful completion of our project work.

We wish to express our thanks to all Teaching and Non-teaching staff members of the **Department of Civil Engineering**, who were helpful in many ways for the completion of the project.

ABSTRACT

The coconut fibres being wasted in India, thus we are utilizing this waste as building material. To reduce the cost of construction To reduce the dead load of the building as they are light weight. To produce the ecofriendly building material. While Coconut Fibre (CF) is very cheap material but has large deformation capacity. So we are going to use CF as a reinforcement in this study. CF is used with 5%, 10% and 15% with respect of total volume of brick. The tests on bricks will be performed to determine dimensions, compressive strength, water absorption and Efflorescence.

ADVANTAGE OF ECO FRIENDLY BRICKS

- Improves workability
- Better plastering finishes
- This flyash bricks are environmental friendly with improved cementitious binder economics.
- Being lighter weight than normal brick and the dead building load and transportation cost will be less.
- More resistance to salinity water.

TABLE OF CONTENT

CHAPTER NO.	TITLE	PAGE NO.
	ABSTRACT	v
	LIST OF TABLES	vii
	LIST OF FIGURES	viii
1.	INTRODUCTION	1
	1.1 GENERAL	1
	1.2 OBJECTIVE	1
	1.3 SCOPE	2
2.	REVIEW OF LITERATURE	3
	2.1 CONVERSION OF WASTE COCONUT FIBER INTO BRICKS	3
3.	MATERIALS AND METHODS	7
	3.1 METHODOLOGY	7
	3.2 M SAND	8
	3.2.1 CEMENT	8
	3.2.2 FLY ASH	9
	3.2.3 COCONUT FIBER	9
	3.3 CASTING OF BRICKS	10
4.	RESULT AND DISCUSSION	13
	4.1 COMPRESSIVE STRENGTH TEST	13
	4.2 WATER ABSORPTION TEST	19
	4.3 EFFLORESCENCE TEST	24
	4.4 HARDNESS TEST	26
5.	CONCLUSION	27
	REFERENCES	28

LIST OF TABLES

TABLE NO.	TITLE	PAGE NO.
4.1	Compressive Strength Test Mix 1	14
4.2	Compressive Strength Test Mix 2	15
4.3	Compressive Strength Test mix 3	15
4.4	Comparison on Proportion of Bricks	16
4.5	Water Absorption Mix 1	20
4.6	Water Absorption Mix 2	21
4.7	Water Absorption Mix 3	21
4.8	Comparison	22

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE NO.
3.1	Methodology of the study	7
3.2	Cement	8
3.3	Coconut fiber	9
3.4	Casting brick	10
3.5	Concrete mix	11
3.6	Mix proportion	12
4.1	Compressive strength	14
4.2	Comparison on proportion of bricks	16
4.3	Comparison on proportion of bricks	17
4.4	Water absorption	20
4.5	Average water absorption	22
4.6	Efflorescence test	24

CHAPTER-1

INTRODUCTION

1.1 GENERAL

Bricks have been a major construction and structure material for a long time. The worldwide periodic product of bricks is presently about 1391 billion units and the demand for bricks is anticipated to be continuously rising. Conventional bricks are produced from soil with high temperature kiln blasting. It is also noted that there is a deficit of in numerous corridor of the world. To cover the complexion resource soil and the environment, some countries similar as China have started to limit the use of bricks made from complexion. Coconut is a protean product and has multiple uses. nearly all the corridor of a lately grown coconut, comestible or else, are used in some or the other manner. India is one of the leading coconut directors in the world, producing 13 billion nuts per annum. Fired bricks are made by using soil beach mixes with different probabilities of rice cocoon ash. The blasting durations at 9000C were intependently 2, 4 and 6 hours. The goods of rice cocon content on workable mixing water content, Atterberg limits, direct loss , compressive strength and water absorption of the bricks were deived. The results indicated addition of rice cocoon, increased the compressive strength of bricks. The bricks made of soil – coconut filaments, shell mixes could be used for construction purpose.

1.2 OBJECTIVE

- To check the feasibility of coconut waste as a partial cover for to soil in the medication of bricks.
- To reduce the quantity of Soil for making bricks with natural waste accoutrements as well as artifical waste accoutrements.
- To use waste Material (coconut cocoon) in construction units.
- To study the geste of compressive strength and water absorption

1.3 SCOPE

The present study utilizes the coconut fibre in Ecofriendly waste material for manufacturing brick. CF is used with 5%, 10% and 15% with respect of total volume of brick. The tests on bricks will be performed to determine dimensions, compressive strength, water absorption and Efflorescence test and Hardness test.

CHAPTER 2

LITERATURE REVIEW

2.1 CONVERSION OF WASTE COCONUT FIBRE INTO BRICKS

This chapter elaborates the earlier exploration about the effect of using Coconut fibre for manufacturing Eco Friendly Bricks.

Majid Ali (1989) conducted a study on Coconut fibre are reported most ductile and energy spongy material. The coconut fibres have the evetutially to be used in mixes for different purposes. colourful aspects of numerous the coconut fibres corroborate mixes have fomely been deived and the provident better results are achieved as reported by numerous experimenters

Abdul Kadir,Siti NoorhajarMohd (1990) conducted a study on the percels of, coconut fibre. It is largely implict waste to be incorporated into fired complexion bricks as it can reduce air pollution from open burning conditioning and most of the pracles complied with the standard with 3% of coconut fibre incorporated. This also provides indispensable disposal system for coconut fibre and reduces the impact towards the terrian. Other than that, the application of coconut fibre into fired complexion brick could act as low-cost severance formers to produce featherlight brick.

Habibunnisa Syed (1995) conducted a study on the construction strength test. It yields the significant results. still the construction strength decreases while adding of other filaments. When the fiber content is increased, the tensile split strength increases at outside of 5%. Tensile pracles of CCFC crack pattern shows, it is especially useful in construction conditioning at seismic areas due to its high tensile

Achudhan (1997) conducted a study on the compressive strength and split tensile strength of coir fiber corroborate concrete. It has been tested and the tested results shown that the strength of coir fiber corroborate concrete is increased gradationlly when we increase the chance of fiber. It has been easily noted that adding fiber upto 3% slightly increases the strength. The flexural strength of coir fiber corroborate concrete increases for 1%, 2%, 3% of fiber used for M20 grade when compared with conventional concrete

Sahaya Ruben (1999) conducted a study on using coir fibre in civil construction which reduces environmental pollution factors and may also bring several advancement in concrete characteristics. Coir fibre used in cement improves with the resistance of concrete from sulphate attack. Compressive strength is also bettered up to certain chance. Addition of coir fibre also apprehensions the micro cracks present in the concrete

Adewumi John Babafem (2001) conducted a study on the addition of 0.5 and 1% CF in concrete which had no effect on its viscosity; that is, the viscosity of plain concrete, 0.5% CFRC and 1% CFRC were fairly the same. preface of CF in concrete slightly bettered its compressive strength (21.8%). 0.5% CF content bettered the strength of concrete more than 1% CF content. Richer blend proportion improves the effectiveness of CF in concrete, inferring that its bond strength with concrete matrix was bettered.

Kiruthika ,Niresh. B (2002) conducted a study on the compressive strength of cover ash bricks using coir fibre is 1.6% advance than the ordinary complexion bricks, so this bricks can be effectively used for all construction purposes. In this report optimum value of the brick sample4(S4) was observed at the proportion of 60% of Fly ash, 10% of Cement ,30% of Quarry dust and 1.6% of coir fibre and the cost of that brick was Rs. 3.36 only.

C. Mohanasundaram (2004) conducted a study on comparing the experimental results with the results of normal flyash bricks. It is concluded that, the compressive strength of flyash was not too dropped. variation in compressive, tensile and flexural strengths of coir bricks using fibre beachers and raw fibre meshes at varying fibre contents and to compare it with that of flyash bricks

NurilMahda Rangkuti (2007) conducted a study on in aggrement with the exploration itinerales that the composition of added constitudes using coconut fiber or coco fiber. This composition uses 4 (four) variations in which each variation gets 5 (five) samples with a aggregate of 20 (twenty) samples from all of the variations. After the variations were used in a chance blend of 0%, 1.5%, 1.8% and 2.1%, those variations were in the use of added consitutients by reducing the weight of the beach. The ensuing list shows the coconut fiber composition.

Coconut fiber being low in viscosity reduces the weight of the fiber corroborated concrete. The compressive strength and Split Tensile Strength of the concrete gets the maximum value at the mix1. Since by addition of filamates in the concrete the strengths of the samples get dwinding and it can be conclude that the fibre should not be used beyond 1% (Sai Uday, 2005).

Santhoshkumar (2004) conducted a study on the use of coconut shell and coir fibre as a partial relief of coarse total and fine total. It should be encouraged for sustainable and profitable construction. By the application of agricultural waste accouremments in concrete tends to low cost construction and waste operation. The results conclude that the concrete with coarse total and fine aggregate incompletely replaced with coconut shell and coir fibre shows the icrease in the strength of the concrete

Arul Surya (2006) anatomized the effect on coconut coir to the normal flyash bricks. It has shown a huge enrichment in compressive strength. The use of coconut coir in the brick up to 10% has shown good results, further addition of coconut coir is not still investigated. This says that the brick with coconut coir will have a gradational increase in its strength

Cinthia Maia Pederneiras (2007) conducted a study on Coir fiber addition which reduces the mortars' plasticity, anyhow of the type of binder used. As adding the fiber length and volume bit, a advanced mixing water content is needed to achieve the intended thickness when compared to the reference mortars. The mortars with coir filmates presented a more ductile gaste and lower vulnerability to cracking than that of the control mortars, since they presented lower modulus of plaitness and advance fracture toughness. Concerning the mechanical geste of the mortars, the

coir fiber addition bettered in the first periods of the mortars. Over time, the coir filaments did not significantly affect their compressive and flexural strengths.

Compressive strength of paver block mixes upto 30% relief of cover ash by weight of cement and 0.5% addition of coir fibre by weight of fine total is greater than conventional paver block. The issues demonstrate that the cover ash remains in high extent can be effortlessly utilized as a part of financially saving material and it is an efficient method for the disposal of coir mattress waste. From the below compliances, it was understood that the blend of 30% cover ash by weight of cement and 0.5% coir fibre by weight of fine aggregate is most suitable with respect to strength. (Rakesh, 2004)

CHAPTER 3

MATERIALS AND METHODS

3.1 METHODOLOGY

This chapter discusses the methodology adopted in the present study

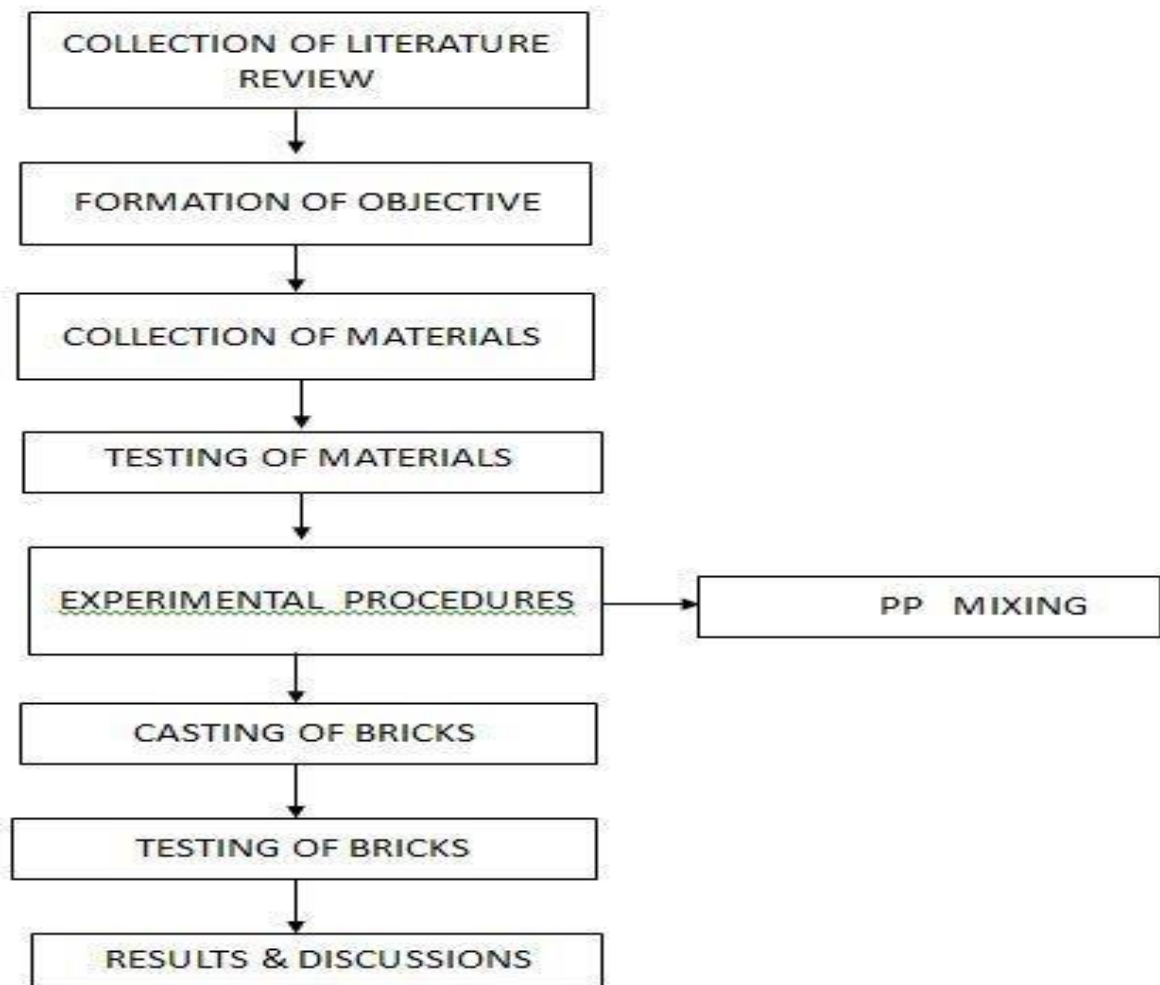


Fig: 3.1: Methodology flow chart for the study

3.2 MATERIALS USED

3.2.1 M Sand

M sand is a form of artificial sand by manufactured by crushing large hard stones, mainly rocks or granite and into fine particles, which is then washed and finely graded. It is widely used as a substitute for river sand for construction purposes, mostly in the production of concrete

3.2.2 Cement

A cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Cement is seldom used on its own, but rather to bind sand and gravel together. Cement mixed with fine aggregate produces mortar for masonry with sand and gravel, produces concrete hardens and adheres to other materials to bind them together. [Fig : 3.2]



Fig: 3.2: Cement

3.2.3 Fly Ash

Fly ash is a fine gray powder consisting mostly of spherical, glassy particles that are produced as a byproduct in coal-fired power stations. Fly ash has the

pozzolanic properties, meaning that it reacts with lime to form cementitious compounds. It is commonly known as with supplementary cementitious material.

3.2.4 Coconut Fiber

- Coconut fiber is one of the natural fibers they abundantly available in tropical regions, extracted from the husk of coconut fruit. [Fig 3.3]
- It is also called coir fiber. Coconut fiber is extracted from the outer area shell of a coconut.
- Length in inches...6-8
- Density (g/cc) 1.42
- Tenacity (g/Tax) 10.0
- Breaking elongation%... 30%
- Diameter in mm.....0.1 to 1.5
- Rigidity of Modulus.....1.8924 dyne/cm²
- Swelling in water (diameter)... 5%



Fig: 3.3: Coconut fiber

3.5 CASTING OF BRICKS

- The normal hand mould should be used to cast the bricks with the standard size of 230mm x 110mm x90mm.

- They are cast according to the standard procedure with a various mix proportions arrived. [Fig 3.4]
- The required quantity of Fly ash, m sand, cement and coconut fiber wastes is calculated previously, according to that the materials mixed properly. Then required quantity of water was added.
- Then they are mixed thoroughly. [Fig 3.5] [Fig 3.6]
- Then the prepared mix was poured in to the mould and it is compacted. After with compacting gets into over then the mould is removed.
- Then the wet brick was kept under air curing for 2 days and then bricks were water cured for some days.



Fig: 3.4: Casting brick



Fig: 3.5 : Process of casting

3.6 MIX PROPORTION

Test specimen 1

- Fly ash 45%
- M sand 40%
- Cement 10%
- CF 5%

Ratio: 4:5 4:1 0:5

Test specimen 2

- Fly ash 45%
- M sand 40%
- Cement 10%
- CF 10%

Ratio: 4:4 1:1

Test specimen 3

- Fly ash 45%
- M sand 40%
- Cement 10%
- CF 15%

Ratio: 3:5 4:1:1.5



Fig: 3.6: Mix Proportion

CHAPTER 4

RESULT AND DISCUSSION

4.1 COMPRESSIVE STRENGTH TEST

Compressive strength of bricks is the capacity of brick to resist or withstand under compression when tested on compressive testing machine (CTM). The Compressive strength of a material is determined by the ability of the material to resist failure in the form of (racks and fissure. Coconut Fibre is added in these bricks in a specifi proportions to impact the strength characteristics and also to utilize the waste materials that are dumped in the surroundings. The specimen is placed such a way that flat face horizontal and mortar filled face facing upwards between plates of the testing machine. Apply load axially at a uniform rate of 14 N/mm² (140 kg/cm²) per minute till failure occurs and note maximum load at failure. The load at failure is maximum load at which the specimen fails to produce any further increase in the indicator reading on the testing machine. Compressive test of brick N/sq.mm

$$= (\text{Maximum load failure in (N)} / \text{Average area of the bed faced in (Sq.mm)})$$

Mix 1 [6.1] N/ M² is termed as test specimen 1

Mix 2 [7.16] N/ M² is termed as test specimen 2

Mix 3 [8.45] N/ M² is termed as test specimen 3

Table 4.1 to 4.4 and fig 4.2 to 4.3

Show the compressive strength value for different proportion.

Table 4.1: Compressive Strength Test

Test specimen 1

L Mm	B mm	H mm	Load (KN)	Compressive strength (N/sq.mm)	Average Compressive strength (N/sq.mm)
230	110	90	99	4.913043	6.1
229	110	90	104	4.128622	
230	110	90	92	5.636364	
230	110	90	87	5.438735	
229	110	90	85	6.374355	

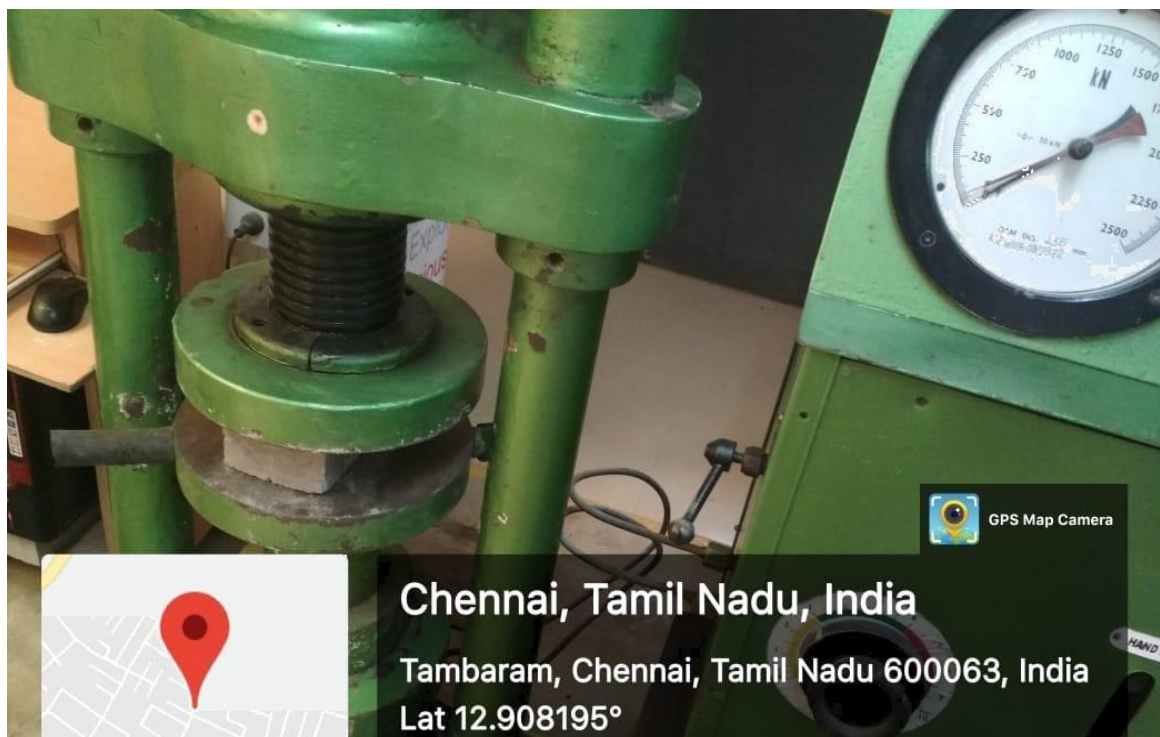


Fig: 4.1: Compressive Strength

Table 4.2 : Compressive Strength Test**Test specimen 2**

L mm	B mm	H mm	Load (KN)	Compressive strength (N/sq.mm)	Average Compressive strength (N/sq.mm)
230	110	90	160	6.324111	7.16
229	110	90	152	6.034141	
230	110	90	157	7.165534	
230	110	90	148	8.849802	
229	110	90	150	8.954744	

Table 4.3: Compressive strength test**Test specimen 3**

L mm	B mm	H mm	Load (KN)	Compressive strength (N/sq.mm)	Average Compressive strength (N/sq.mm)
230	110	90	99	6.913043	8.45
229	110	90	104	7.128622	
230	110	90	92	8.636364	
230	110	90	87	9.438735	
229	110	90	85	9.374355	

Table 4.4: Comparison different test specimen

Proportions of Coconut fibres (%)	Average compressive strength of bricks (N/mm²)
Test Specimen 1 (5%)	6.1
Test Specimen 2 (10%)	7.16
Test Specimen 3 (15%)	8.45

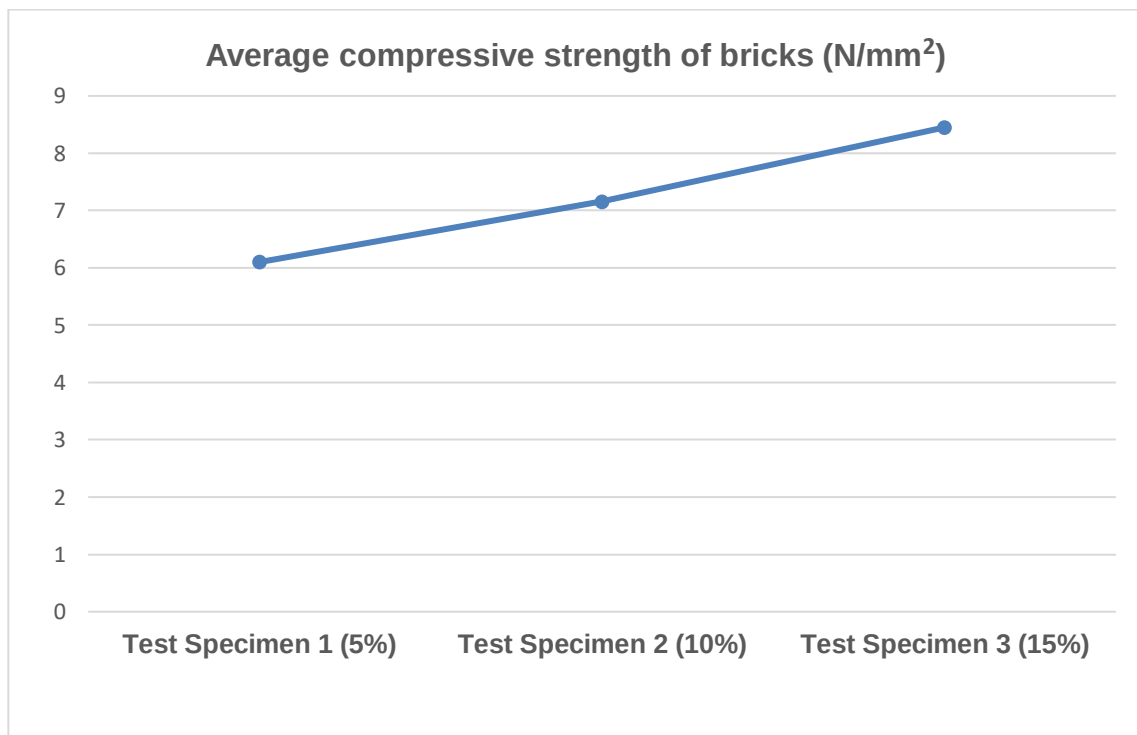


Fig: 4.2: Comparison on Proportions of Bricks

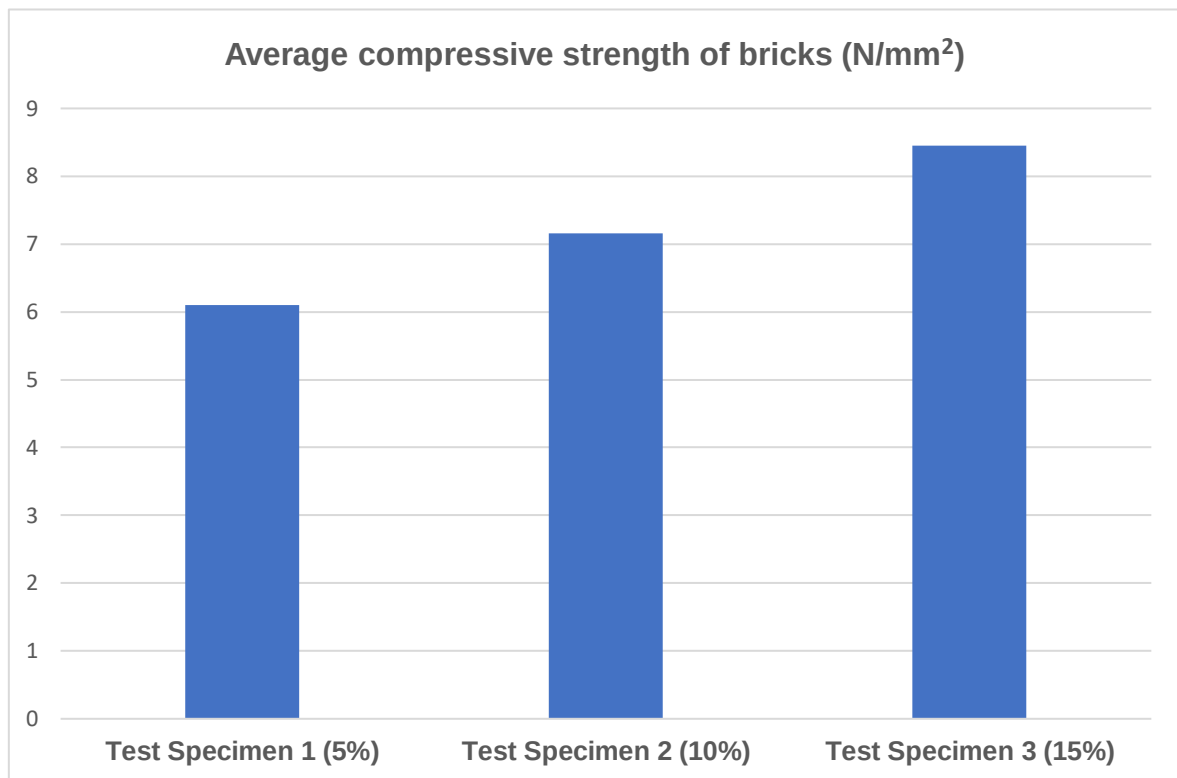


Fig: 4.3: Comparison on Proportions of Bricks

1. From the literature survey (rakesh 2005) it is inferred that addition coconut fibre adding more than 15% significantly affect the strength characteristic of test bricks
2. Table 4.1 to 4.3 and Fig. 4.1 to 4.3 shows the compression test value for the specified Test specimen 1 (6.1) Test specimen 2 (7.16) Test specimen 3 (8.45).
3. The average compressive strength value are 6.1 N/M^2 , 7.16 N/M^2 and 8.45 N/M^2 for Test specimen 1, Test specimen 2, Test specimen 3 respectively.
4. While comparing Test specimen 1, Test specimen 2, and Test specimen 3 values, Test specimen 3 (8.45) shows the significantly greater strength than other 1 and 2 values.

4.2 WATER ABSORPTION TEST OF BRICKS AS PER IS 3495 (PART 2) 1992

Bricks are dry and porous; therefore, it has the ability to release and absorb moisture inherently from the weather/mortar/concrete. If the brick dry, absorbs moisture from water when laid, the mortar will become weak and poor. It fails to make the bond between bricks and mortar due to insufficient water for the hydraulic reaction of cement in the mortar and overall reduces the strength of construction. Also, if the brick absorbs more water than the recommended result, it gives adverse effects on the strength of brick as well as the durability of the structure. The porous bricks will allow absorption of rainwater thereby giving rise to dampness in the wall. Even it cannot be grouted like concrete. So, water absorption of bricks is a significant and useful property of bricks.

Take five random bricks as specimens. Dry the specimen in a ventilated oven at a temperature of 105°C to 115°C till it achieves considerably constant mass. Cool the specimen to room temperature and take its weight (M1). When the specimen is completely dry, then immerse it in the clean water at the room temperature ($27 \pm 2^\circ\text{C}$) for 24 hours. Remove the specimen from the water after 24 hours and wipe out water with a damp cloth and weigh the specimen. Take the weight (M2) of the specimen after 3 minutes of removing from the water.

Mix 1 [13.77] is termed as test specimen 1

Mix 2 [11.22] is termed as test specimen 2

Mix 3 [8.39] is termed as test specimen 3

Table 4.5: Water absorption

Test specimen 1

S.no	W1 Kg	W2 Kg	$(W2 - W1)/W1 \times 100$ %	AVERAGE %
1	2.94	3.36	14.28571	13.77
2	2.91	3.34	14.77663	
3	3.01	3.43	13.95349	
4	2.98	3.34	12.08054	
5	2.92	3.35	14.72603	

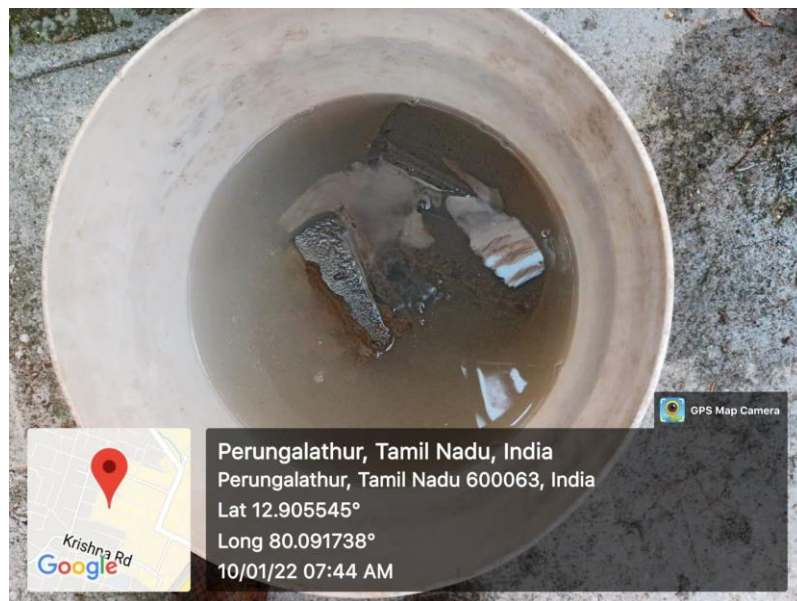


Fig: 4.4: Water Absorption

Table 4.6: Water absorption

Test specimen 2

S.no	W1 Kg	W2 Kg	(W2- W1)/W1X100 %	AVERAGE %
1	2.72	3.01	10.66176	11.22
2	2.75	3.08	12	
3	2.71	2.99	10.3321	
4	2.77	3.1	11.91336	
5	2.77	3.08	11.19134	

Table 4.7: Water absorption

Test specimen 3

S.no	W1 Kg	W2 Kg	(W2- W1)/W1X100 %	AVERAGE %
1	2.41	2.6	7.88	8.39
2	2.39	2.58	7.95	
3	2.41	2.62	8.71	
4	2.35	2.58	9.79	
5	2.37	2.55	7.59	

Table 4.8: Comparison

Proportions of Coconut fibres (%)	Average water absorption of bricks (%)
5%	13.77
10%	11.22
15%	8.39

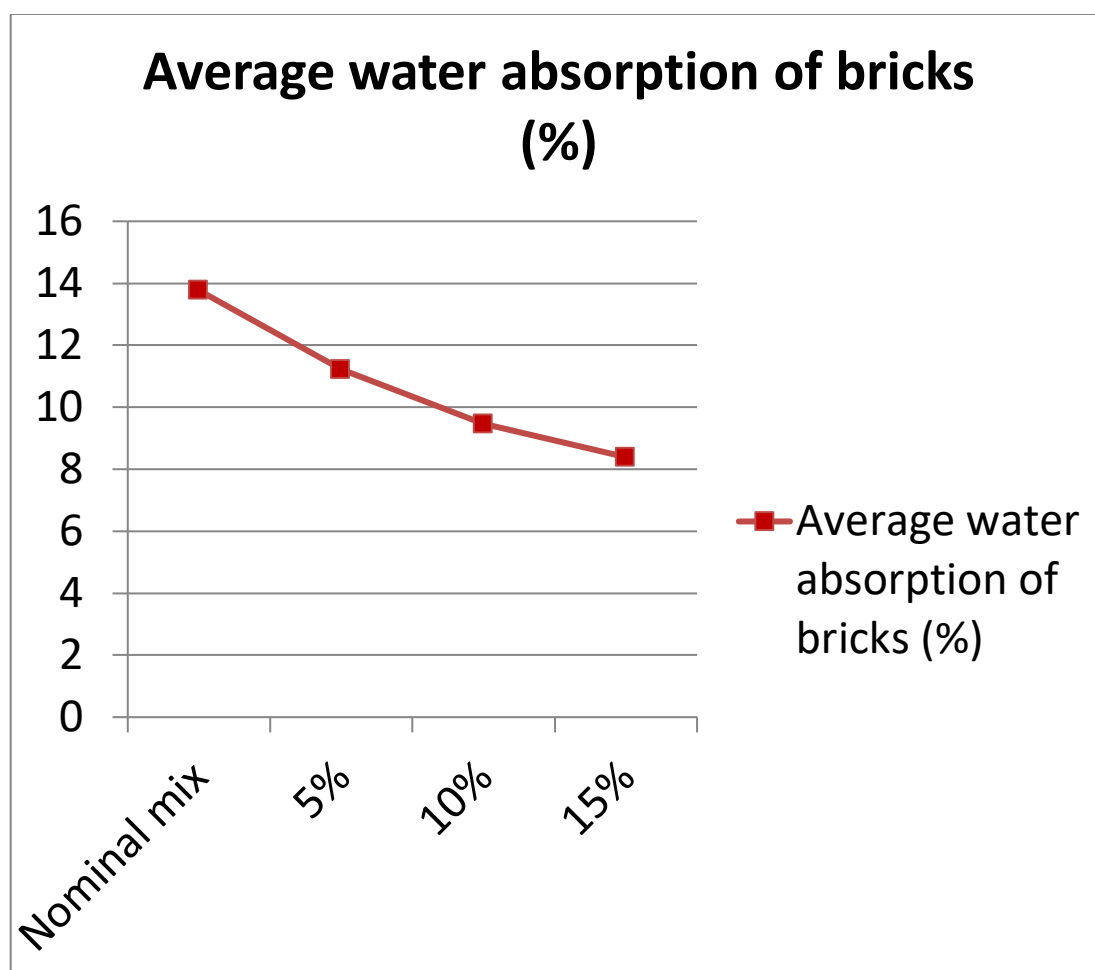


Fig: 4.5: Average water absorption of bricks

1. Table 4.4 to 4.7 and Fig. 4.4 to 4.5 shows the water absorption test value for the specified test specimen1 [13.77] test specimen 2 [11.22] test specimen 3 [8.39].
2. The water absorption test value are 13.77, 11.22 and 8.39 for test specimen 1, test specimen 2, test specimen 3 respectively.
3. While comparing test specimen 1, test specimen 2, and test specimen 3 values, test specimen 3 [8.39] shows the less weight test specimen1 and test specimen 2 values.

4.3 EFFLORESCENCE TEST (IS: 3495 (PART III))

The ends of the brick are kept in a 150 mm diameter porcelain or glass dish containing 25 mm depth of water at room temperature (20 o -30 o C) till the entire water is absorbed or evaporated. The water is again filled to 25 mm depth in the dish and allowed to be absorbed by the brick or evaporated. Presence. The efflorescence test showed an excellent performance on the plastic wastes bricks. There were no formation of grey or white layer on the brick surface. From this test we can conclude that no traces of alkalis were presented in this brick



Fig: 4.6: Efflorescence Test

By comparing efflorescence characteristics both Test specimen 2 and Test specimen 1 show the significant less white patches when compare to Test specimen 3.

4.4 Hardness test

A good brick should resist scratches against sharp things. So, for this test a sharp tool or finger nail is used to make scratch on brick. If there is no scratch impression on brick then it is said to be hard brick. In this hardness test, a scratch was made on brick surfaces. This test was carried out for all proportion of bricks. While the scratch was made with the help of a finger nail on the bricks, no impression was left on the any brick surface While conducting the hardness test none of the specimens shows the scratches (or) any impression significantly on the surface.

CHAPTER – 5

CONCLUSION

From this investigation the following conclusions are derived on the basis of laboratory tests are shown below:

- From compressive strength test it is noted that test specimen 1 [6.1] N/M², test specimen 2 [7.16] N/M² and test specimen 3 values, 3 [8.45] N/M² shows the significantly greater strength than other test specimen 1[6.1] N/M² and test specimen 2 [7.16] N/M² values.
- From water absorption test specimen 1, test specimen 2 test specimen and test specimen 3 values, 3 [8.39] shows the less weight than test specimen 1 and test specimen 2 values.
- By comparing efflorescence characteristics both test specimen 1 and test specimen 1 show the significant less white patches when compare to test specimen 3.
- While conducting the hardness test none of the specimens shows the scratches (or) any impression significantly on the surface.
- By comparing all the test values with all the specimens test specimen 3 shows optimum result when compared with test specimen 1 and test specimen 2. Further, the study recommends elaborated research in utilize Coconut fibre for manufacturing light weight Ecofriendly bricks.

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