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Production of Eco-Friendly Bricks by Recycling the Waste Paper and Coconut Fiber

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ABSTRACT: The cost of the materials is a key factor in any building project. The construction sector consumes a considerable amount of non-renewable resources globally. One such resource is coco fibre and waste paper.. More waste paper and coco fibre are dumped at landfills and other disposal sites every day than are recycled. It was discovered that about fifteen trees are needed to produce a tonne of paper, which means that every year, 720 million trees are utilised only once before being buried as landfills. In order to determine whether waste paper (newspaper) and coco fibre are suitable for use as building construction materials, this effort attempts to create an alternative material and tests its compressive strength, weight, and brick cost.

The brick underwent a compressive test, and the result showed that the higher strength of gain was 2.916.

KEYWORDS: Compressive strength, Papercrete, Recycling, Lightweight.

1.INTRODUCTION

Recycling is the process of gathering and converting resources into new goods that would otherwise be thrown away as waste. Your community and the environment may both benefit from recycling. to use waste materials, such as paper and coconut fibre, in the creation of a new kind of environmentally friendly brick called paper bricks. The optimum applications for the bricks are non-load-bearing buildings.

Over 450 million tonnes of paper are generated annually worldwide, according to study. Paper mills are predicted to produce 500 million tonnes of paper and cardboard annually by the year 2020. There is no chance of a decrease in consumption, despite the fact that we definitely need it. The third-largest industrial polluter of air, water, and soil is the pulp and paper industry. Paper and cardboard now account for a larger share of the output of municipal solid garbage than they did a year ago in several countries.

Civil engineers have dared to convert industrial waste into useful building and construction materials due to the high demands placed on the construction industry, particularly in the last decade as a result of a significant increase in pollution, which causes a chronic shortage of construction resources. The use of recycled paper as a building material is one of the best recycling solutions. Construction consumes a lot of non-renewable resources, therefore using waste paper to make inexpensive, lightweight composite bricks for construction will not only increase the likelihood that waste paper will be recycled, but will also ease the demand on the world's natural resources.

Paper trash, Portland cement, water, and/or sand are all components of the complex compound known as paper concrete. Combining these materials could result in a method for offering affordable homes to a big population. As a less expensive alternative to traditional building materials, paper concrete emerged as a fire-resistant, light material with excellent thermal and sound insulation. Even though it was created 80 years ago, it has only lately come to light again, and there haven't been many studies done to evaluate its structural suitability.

Other names for papercrete include fibre concrete, Padobe, and Fidobe. Paper, portland cement, and water are combined to make fibre concrete. Paper concrete is made without using a lot of energy or producing any hazardous byproducts. Portland cement is not available at Adobe. Instead of Portland cement, clay is used as the binder here. It consists of a blend of clay-infused soil, water, and paper. Padobe and Fidobe are similar, however Fidobe may have more fibrous material.



1.1 OBJECTIVE OF THE STUDY

- To determine the method utilised to make paper products.
- To ascertain the characteristics of M-sand & cement.
- To learn about eco-friendly, light-weight bricks' features.
- To mix and match various proportions.
- To determine the eco-friendly, light-weight bricks' compressive strength.
- Research the strength properties of bricks made from moulded paper and coco fibre.
- A comparison of environmentally friendly light weight bricks with regular clay bricks and fly ash bricks

1.2 CHARACTERISTICS OF PAPER BRICKS

- COST EFFECTIVE
- ENVIRONMENTALLY FRIENDLY
- LIGHT WEIGHT
- EASILY ACCESSIBLE
- AFFORDABLE PRICE
- FRIENDLY TO THE ENVIRONMENT

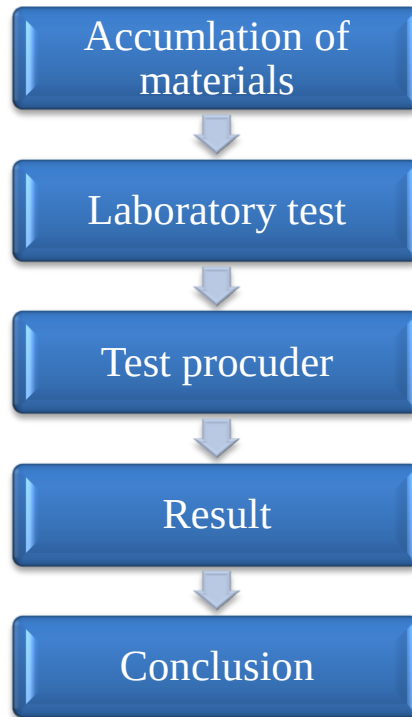
1.3 PURPOSES OF PAPER BRICKS

- Identify the process used in the creation of paper products.
- To find out the properties of cement and m-sand.
- Find out the characteristics of ecological lightweight bricks.
- Suggest a different ratio for mix.
- Determine the compressive strength of ecological lightweight bricks.
- Study the strength characteristics of pressed paper and coir bricks.
- Comparative study of ecological light weight with normal clay bricks and fly ash bricks.

1.4 SCOPE

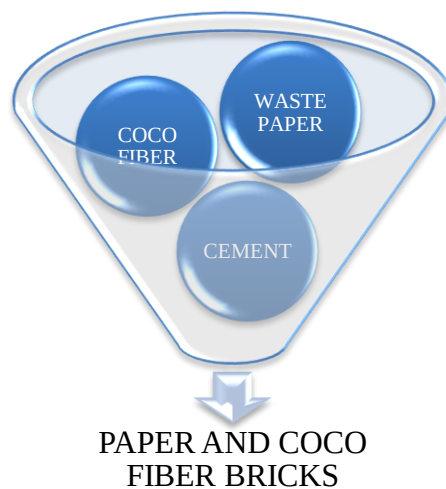
- Since paper pulp and coir are biodegradable materials, they can be converted into non-biodegradable material by adding chemicals for further studies to be done on it.
- Addition of very small amount of bitumen to the coir which helps to reduce water absorption and also helps to increase strength and durability.

II.METHODOLOGY CHART



2.1 ACCUMULATION OF MATERIALS

Materials collection is preliminary stage of any project also the materials used in the project should be eco - friendly , that should not be harmful to the environment.



2.1.1 COCONUT FIBER AND WASTE PAPER

"Paper and coconut coir are the key components, hence the qualities of papercrete rely on the type of paper used and its microstructure. Paper is anisotropic, therefore the strength and quality of its fibre vary based on a number of parameters. They are the type of wood, the amount of recycled paper and coconut coir, the method of pulping, and the amount of water in the pulp.



Fig.1 &2.Coco Fiber and Waste Paper in the form of Pulp

2.1.2 CEMENT

Since cement is a binding substance with cohesive and adhesive qualities, it can be used to bind all other construction materials.



Fig.3 Cement

2.1.3M-SAND

As we know that the M- sand is the substitute of the river sand for the construction material .It is obtained from crushing from hard grained granite stone.



Fig.4 M-Sand

2.2 LABORATORY TEST ON MATERIALS TEST ON CEMENT

FINENESS TEST ON CEMENT

As we know that the cement is a binding material having cohesive and adhesive properties which makes it capable to unite all the other construction materials.

M-SAND

As we know that the M- sand is the substitute of the river sand for the construction material. It is obtained from crushing of hard grained granite stone.

LABORATORY TEST ON MATERIALS TEST ON CEMENT

2.2.1 FINENESS TEST ON CEMENT

The degree of fineness of cement is a measure of the main size of grains in the cement. The rate of hydration and hydrolysis and consequent development of the strength depends upon the fineness of cement.

Properties	Result
Fineness	4.6

2.2.2 SPECIFIC GRAVITY TEST

Specific gravity is normally defined as the ratio between the mass of given volume of material and the mass of an equal volume of water.

Properties	Result
Specific gravity	3.142

2.2.3 SETTING TIME OF CEMENT

The initial setting time of cement is not too quick and after it has been laid, hardening should be rapid so that the structure can be made use of as early as possible.

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Properties	Result
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2.2.4 SPECIFIC GRAVITY TEST

Specific gravity is normally defined as the ratio between the mass of given volume of material and the mass of an equal volume of water.

Properties	Result
Specific gravity	3.142

2.2.5 SETTING TIME OF CEMENT

The initial setting time of cement is not too quick and after it has been laid, hardening should be rapid so that the structure can be made use of as early as possible. The initial set is a stage to be process of hardening after which may crack that may appear will not re-unit. The concrete is used to be finally set when it has obtained sufficient strength and hardness.

Properties	Result
Initial setting time(min)	30
Final setting time (min)	600

2.2.6 TEST ON M-SAND FINENESS TEST ON M-SAND

Test on sand particles. It is calculated by performing the sieve analysis test with standard IS sieves. The fineness modulus of sand ranges from 2.2 to 3.2.

Properties	Result
Fineness	2.9

SPECIFIC GRAVITY TEST

Specific gravity of sand is the ratio of the weight of given volume of aggregate to the weight of equal volume of water. The specific gravity of sand is considered around 2.65.

Properties	Result
Specific gravity	2.5

2.7 TEST ON WATER

pH TEST ON WATER

Water which is used in mixing of materials should be potable. The test on water is carried out to know the pH value. In general, a surface water with pH < 7 is considered as acidic and the > 7 is considered as basic. The normal range for pH in surface water system is 6.5 to 8.5.

Properties	Result
pH	7

III.RESULT

COMPRESSION TEST RESULT

Compression strength is the maximum compressive stress that, under a gradually applied load, a given solid material can sustain without fracture.

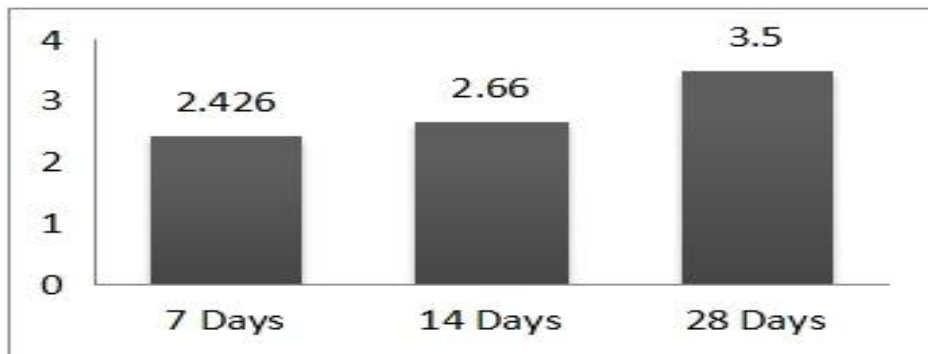


Fig-5&6 Paper Bricks

COMPRESSIVE STRENGTH OF BRICK 1:1:1.5		
Sample	Load in kN	Compressive strength (N/mm ²)
7 Days	40.18	2.259
14 Days	43.31	2.533
28 Days	48.63	2.869



COMPRESSIVE STRENGTH OF BRICKS 1:1:2		
Sample	Load in kN	Compressive strength in (N/mm ²)
7 Days	41.23	2.425
14 Days	45.58	2.66
28 Days	48.58	2.855

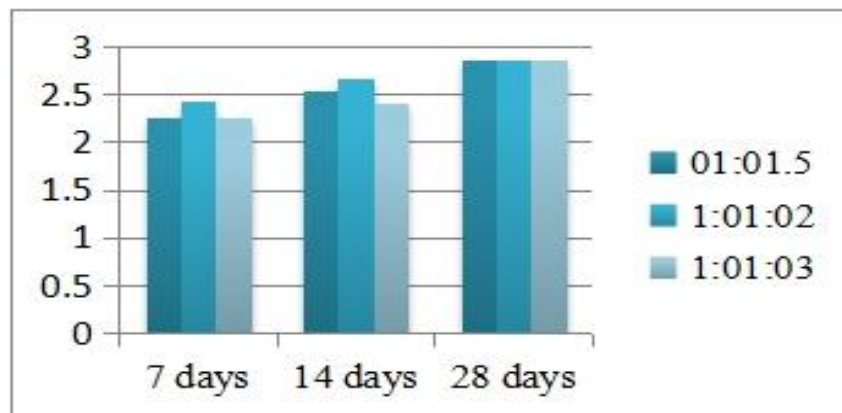


COMPRESSIVE STRENGTH OF BRICKS 1:1:3		
Sample	Load in kN	Compressive strength in (N/mm ²)
7Days	39.40	2.248
14 Days	41.79	2.408
28 Days	50.90	2.869



COMPARISON CHART

No of days	Ratio	1:1:1.5 Load in (N/mm ²)	1:1:2 Load in (N/mm ²)	1:1:3 Load in (N/mm ²)
7 days		2.259	2.425	2.248
14 days		2.533	2.66	2.408
28 days		2.869	2.85	2.869



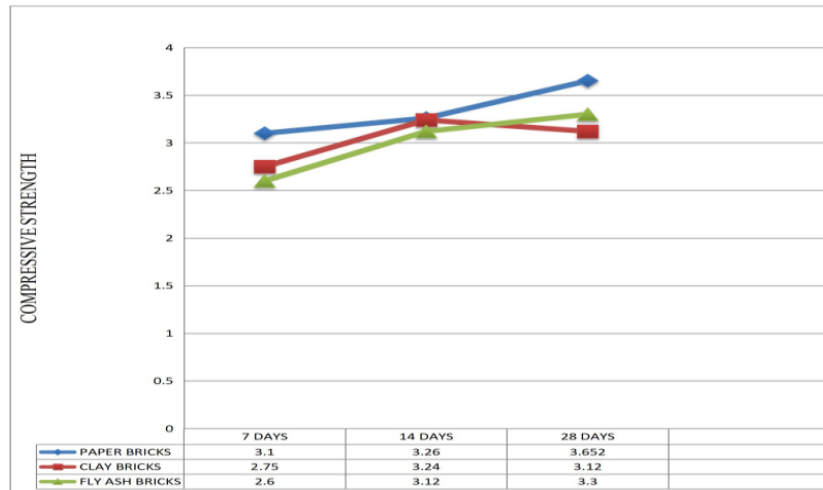


Fig-7 Graphical Representation

IV.CONCLUSION

- It was observed that as paper pulp increases the strength of the bricks decreases.
- Water absorption is less for 1:1:1.5 as compared to that of 1:1:2 and 1:1:3.
- By conducting soundness test, the brick were not broken and a clear ringing sound was produced.
- It was observed that the paper bricks are strong as that of conventional bricks can be construction site.
- The cost of paper bricks approximately 50% (3.5 to 4 rupees) lesser than the normal clay bricks (6 to 7 rupees).
- The paper bricks are best suitable for the non loading bearing structures.
- From the results obtained, the following conclusions were made: Considering the desirable compressive strength shown
- Lesser than the conventional clay brick. Due to less weight of papercrete bricks, the total deadload of the building will be reduced. Due to lesser weight and more flexibility, these brick are potentially ideal material for earthquake prone regions.
- Papercrete has a high fire resistance, good sound absorbent, good thermal resistance with an value between 2 to 3 per inch. In walls 12 to 16 inches thick, the long energy saving of papercrete will be a great advantage for the house owner and environmental.
- Because of this, glass sheets or glass blocks can be fastened inside and trimmed using papercrete. These bricks also do not expand or contract. Papercrete brick will lessen landfills and pollution because it is primarily made of waste materials. As a result, the overall cost is far lower than with traditional brick.
- It has been observed that employing papercrete bricks in a building's construction lowered the overall cost by 20 to 50 percent.

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