

Fabrication of Envisioning Bricks

Ramprashanth.A¹, Hari Priya.M², Juliet Asha.A³, Kannan.B⁴, Dharun Prakash.P.G⁵

Department of Civil Engineering, SNS College of Engineering, Coimbatore

ABSTRACT:

The construction industry consumes large amount of non-renewable resources. To keep up with sustainable development movements and increasing competitive pressure in the industry, building materials in future have to be of lighter weight, more energy efficient and lower cost. Paper bricks are key construction materials for building in general and low cost housing in particular. The objective of this study is to develop light weight paper brick from waste paper with minimum cost. The waste paper was collected, hydrated and spun to obtain paper pulp slurry mixing with cement and cast into shape. The tests were conducted on bricks after drying and curing. Therefore these bricks will reduce the dead weight of the structure to the considerable amount. So it changes our design and building cost as in economical point of view.

KEY WORDS: light weight paper brick, compression test, efflorescence test, water absorption test

INTRODUCTION:

According to research, more than 450 million tons of papers are produced every year. It is estimated that by 2020, paper mills will be producing 500 million tons of paper each year. Pulp and paper is the 3rd largest industrial polluted of air, water and soil. Since a large demand placed on the building industry, especially in the last decade, due to the increasing population which causes a chronic shortage of building materials, the civil engineers have been challenged to convert industrial wastes to useful building and construction materials. This experimental study which investigates the potential use of

waste papers for producing a low-cost and light weight composite brick as building material. These alternative bricks were made with papercrete. Physical and chemical properties of paper and cement vary significantly depending on many factors such as geographical location and industrial processes. The main aim of this project is to compare the compressive strength of the bricks. So for this purpose, different percentage of paper 35%, 40%, 45% and cement of 25%, 20%, 15% (i.e. increase in paper sludge with decrease in cement content) and then compressive strength of bricks as established. Then with the help of graph, a comparison between compressive strength, water absorption of ordinary bricks and paper bricks was determined. Before manufacturing the bricks, different properties of materials (cement and paper) were verified. After that, bricks were made and sun dried and some bricks were oven dried and then with the help of a compression testing machine (CTM), their compressive strength was calculated. The purpose of this study was to use waste paper to produce light weight masonry bricks.

EXPERIMENTAL PROCEDURE:

Raw materials: The raw materials used are as follows.

Cement: Cement is one of the binding materials in this project. Cement acts as a good binder with paper sludge to produce paper bricks. It hardens quickly when mixed with paper sludge and water. Ordinary Portland cement (OPC) conforming to IS 8112-1989 cement is used.



Description of test	Requirements of IS 8112:1989
Initial setting time	30mins
Final setting time	Less than 600minutes
Specific gravity	3.12

Paper: Paper is the natural polymer which consists of wood cellulose. The cellulose chain bristles with polar –OH group on adjacent chains, bundling, and the chain together. The chains also pack regularly in places to form hard, stable crystalline region that gives the bundle chains even more stability and strength.

Water: Water is the essential material to mix all the above mentioned components. The quantity of water used is according to the workability of the mix. The pH of water used should be from a range of 6.0 to 8.5. Water is required for preparation of cement mix and curing work during casting of blocks. The quality and quantity of has much effect on the strength of cement in construction blocks.



Quarry dust: Quarry dust is a waste obtained during quarrying process. It has very recently gained good attention to be used as an effective filler material instead of fine aggregate. In the present study, the hardened and durable properties of concrete using quarry dust were investigated. And also physical and chemical properties of Quarry dust are obtained by testing the samples as per Indian standards.

EXPERIMENTAL PROCEDURE:

In this study, six proportions were made for with silica and without silica and it was shown in table. The quarry dust was kept constant and the cement and paper sludge ratio was changed. For each ratio ten samples were prepared. The standard block size is 190x90x90 mm. In this project the block size is 230x100x90 mm. The waste papers were soaked in 24 hours. The hand mixing was done for mixing the samples. Then the mixed sample was casted in brick mould of 3 layers. Each layer is compacted uniformly. Subsequently the formed brick samples were removed from the mould as early as 1 min and dried for at least 5 days at room temperature. No damage was observed on the bricks while demoulding. Then it is cured and tested in compression testing machine (CTM). The testing was taken for 7 days, 14 days and 28 days and comparison graph is drawn.

Property	Quarry dust
Specific gravity	2.17
Fineness modulus	2.22%
Unit weight	1.27 gm/cc

MIX PROPORTIONS:

specimen	% of paper sludge	% of cement	% of quarry dust
A	45	20	35
B	50	15	35
C	55	10	35

7-day compressive strength for different % replacement of paper sludge and cement

Specimen	% of paper sludge	% of cement	Compressive strength (N/mm ²)
A	45	20	5.86
B	50	15	4.76
C	55	10	4.12

RESULTS AND DISCUSSION:

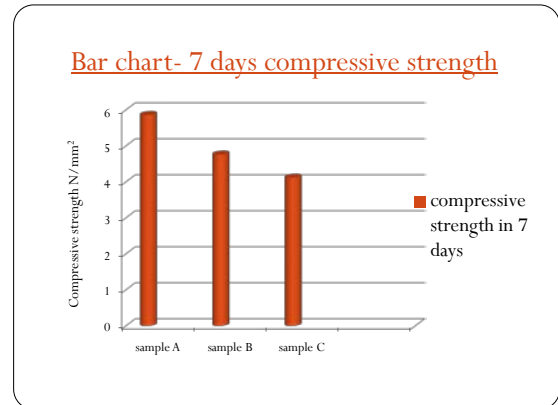
After casting, drying and curing the various tests were conducted on bricks. Following are the tests conducted on bricks.

1. Compressive strength test.
2. Water absorption test
3. Efflorescence test
4. Thermal resistance test

Compressive strength test:

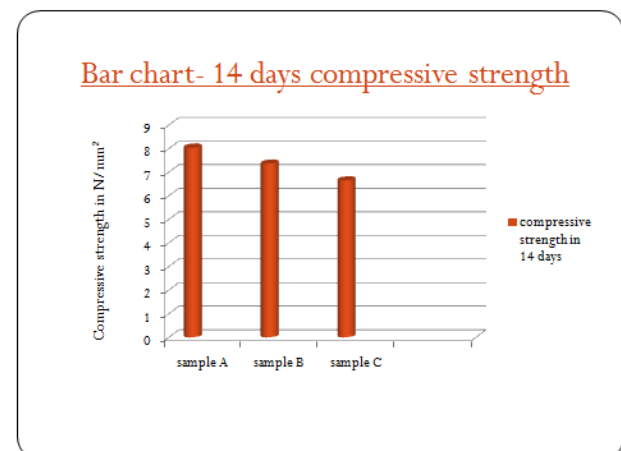
The bricks were prepared and compressive strength was tested for all the ratios. For each ratio 3 samples were tested and average or mean value is taken for 7th day, 14th day and 28th days.

The paper bricks have elastic behaviour and less brittleness, due to this structure was not fully collapsed, when the papercrete brick fails at higher load only the outer faces cracked and peeled out.



14-day compressive strength for different % replacement of paper sludge and cement

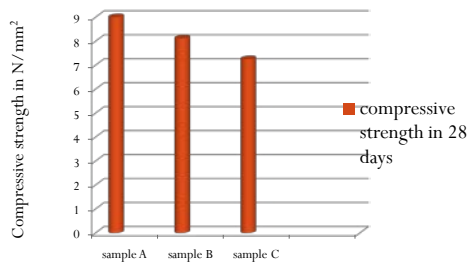
specimen	% of paper sludge	% of cement	Compressive strength (N/mm ²)
A	45	20	8.04
B	50	15	7.36
C	55	10	6.65



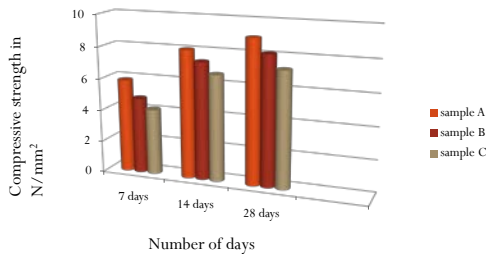
28-day compressive strength for different % replacement of paper sludge and cement

specimen	% of paper sludge	% of cement	Compressive strength (N/mm ²)
A	45	20	9.00
B	50	15	8.12
C	55	10	7.25

Bar chart- 28 days compressive strength



COMPRESSIVE STRENGTH OF BRICK WITH NUMBER OF DAYS

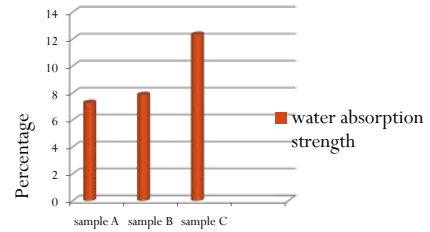


Water absorption test:

The blocks were soaked in water for a period of 24 hours and then their change in weights was measured using electronic weighing scale. The percentage of water absorption was found out by the difference in their initial and final weights.

specimen	Dry weight	Wet weight	% of water absorption
A	2.670	2.880	7.86
B	2.820	3.025	7.27
C	2.295	2.678	12.33

Bar chart- water absorption test results



Efflorescence test:

The soluble salts, if presents in bricks will cause efflorescence on the surface of bricks. For finding out the presence of soluble salts in a brick, this test was carried out. In this test, the brick were immersed in water for 24 hours and then they were taken out and allowed to dry. There was no any grey or white deposit on the brick surface hence it is free from soluble salts.

Thermal Resistance Test:

This test is conducted to test the samples for the effect of flame or high temperature. The initial weight of samples was measured. Then the samples were kept at 100°C in a muffle furnace and then they were taken out and examined for burns and ashes. Then they were weighted again using an electronic weighing scale.

Cost Analysis:

- Cost of one paper brick = Rs.9.00
- 60 bricks- paper brick = Rs.540.00
- 60 bricks- conventional clay bricks = Rs.420.00
- 60 bricks- fly ash brick = Rs.360.00
- 60 bricks- solid cement brick = Rs.780.00

Conclusion:

Based on the experimental investigation, the following results have been found:

The weight of paper bricks were found to be 40% to 45% lesser than the conventional bricks, hence it making weightless. The durability of paper bricks was found to be far more than conventional bricks. Strength aspects of Sample A and Sample B has similar strength as paper blocks which is higher of conventional blocks.

The cost of this project was found to be feasible for larger projects. The percentage of water absorption decreases as the cement content increases.

References:

1. Agilan.V(2012)“Energy saving light weight bricks using waste newspaper” quest for advancement in Civil Engineering March 15, 2012
2. Akinwumi, Olasunkanmi(2014)“Structural Evaluation of Lightweight Concrete Produced Using Waste Newspaper and Office Paper “ISSN- 2224-5790 (PAPER), ISSN 225-0514 (ONLINE), Civil and environmental Research Volume No 6, No 7-2014.
3. B J Fuller, AFafitis and J L Santamaria. (2006) “The Paper Alternative”, ASCE Civil Engineering Vol. 75 No.5 pp. 72-77.
4. Obada Kayali. High performance bricks from flyash. *World of Coal Ash (WOCA)*. April 2005; 11–15p.
5. Venkata Sairam Kumar N, Panduranga Rao B, Krishna Sai MLN. *Experimental Study on Partial Replacement of Cement with Quarry Dust*. E-ISSN2249–8974.
6. Kruy Sothea, Hamdi M. Development of bricks from paper. *Composite Wood and Plastic Waste Material, Melaka*. 7–10 December 2010.
7. Mohammad Ismail C, Ismail MA, Lau SK, et al. *Fabrication of Bricks from Paper Sludge and Palm Oil Fuel Ash*. June 2010; 1(2).