



Paper brick construction in laboratory using waste papers and comparison of properties with conventional bricks

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Abstract: New construction practices in India demands the use of innovative economical, durable & light weight material so that structure will able to resist forces due to earthquake & also act as heatproof material which keeps inside of the premises cool. It has been attempted to replace the soil used in manufacturing conventional bricks with paper pulp obtained from industry. Partial use of the paper waste for brick making will solve environmental degradation and also waste disposal problem. Also the paper bricks prepared are light weight and could be used to replace the gypsum partition walls, cladding work due to its thermal resistance.

Keywords: Light weight, Economic, Durable, paper brick, compressive strength

1. INTRODUCTION

- With new technology and quick demand for completion of construction projects, it is desirable to manufacture the required material in time at workshop so that project gets completed as per schedule.
- Multi-storey and skyscraper are the requirement of today which leads to vertical growth of the building and needs light weight material that reduces the load on structure to resist earthquake forces. Paper bricks prepared in laboratory are light weight than conventional bricks and concrete blocks which may be used as replacement to these material.
- Low cost housing is one more thrust area in all metro cities to clear slums. Paper bricks prepared are having cost lower than the traditional material used.

1.1 Objective of study

Making of paper brick will allivate the following issues.

- Utilization Of Waste Material (Paper)
- Environmental Friendly
- Less Weight
- Inflammable

2. LITERATURE REVIEW & STUDY

We have developed a way to create paper bricks from recycling waste.

Made from 90% recycled paper mill waste (RPMW) and 10% cement, the mixture is mechanically mixed and pressed into moulds and then cured in the sun.

The weight of this brick is 2/3rd to 3/5th lesser than conventional clay brick.

Using the paper bricks in a building, total cost will be reduced from 20% to 25%.

The observations during the tests show high energy absorption capacity even beyond the failure load.

2.1 Scope of study & making of paper brick

- Increase the strength by adding other materials
- Decrease the water absorption capacity.
- Increase fire resistance capacity
- Trying to reduce concrete required prepared with same strength.
- Ultimately reduced CO2 amount.
- Decreases in the carbon footprint of the house.
- Use the different materials at the place of cement.

2.2 Application of paper brick

- Establishing the industries

- Low cost
- Eco-friendly
- Production will become easy
- Will get good quantity of bricks

3. METHODOLOGY OF CONSTRUCTION OF PAPER BRICK

3.1 Following procedure is followed in laboratory to prepare bricks.

- Take cement, sand & paper pulp in required quantity



- **Decide the proportion**

According to the proportion calculate the amount of cement, sand & paper pulp

Cement = 400(GM)

Sand = 400(GM)

Paper pulp = 1200(GM)

Then mix the cement, sand, paper pulp & also add the proper amount of water .



- Cast the mould
- Then mix the material until it comes in proper form.
- After the material is ready fill it in to the mould in 3 to 4 layer by compacting each layer



3.2 Material

3.2.1 Sand:-

It is a granular material. which is composed of finely divided rock & mineral particles. It can also be defined by size, by being finer than gravel & coarser than silt. Sand is made from rock by artificial process usually for construction process in cement or concrete.

3.2.2 Cement:-

Cement is a very popular binding material, is important civil engineering material. Cement concerns the physical and chemical properties.

Cement is made up of lime stone, sand or clay, bauxite & iron ore & it may also includes shells, chalk, marl, shale, clay, blast furnace slag, slate.

3.2.3 Paper pulp

The paper pulp was prepared from the waste and used papers. Only 90 % of paper is being recycled out of 100% hence we can collect that 10 % for our use in making of paper brick. This reduces the disposal problem of paper waste.

3.2.4 Water

The potable water was used to prepare the mix.

4. RESULTS & COMPARISON

4.1 Compression test

The Compression test is performed in a compression testing machine. The load is applied on the top surface of the brick. The maximum load at which the brick breaks is noted. The below pictures are of the bricks on which we have performed the test. The Compressive test is calculate by

The compressive or crushing strength of brick = $\text{Maximum Load} / \text{Surface Area}$





Type of Brick	Compressive Strength (kN)
Conventional brick	17.1 kN
Paper brick	17.3 kN

4.2 Hardness test

Hardness Test is a simple test. A good brick is more resistance to abrasion. Sharp object scratches the surface of bricks and if there is no impression on brick by scratching then it's a Hard Brick.

The result of hardness test is as under. No scratch is being left on brick prepared using paper pulp.



4.3 Durability test

We perform the durability test by dropping the bricks from a height of one metre on a hard surface. The brick remains unaffected due to impact from 1 m fall.



4.4 Water absorption test

Water Absorption Test the brick is weighted before soaking it into water for twenty-four hours. The difference in weight indicates the amount of water absorbed by the brick. The percentage of water absorption is higher than conventional brick. Conventional brick shows 15.3 % of water absorption, whereas the paper brick shows water absorption of 42.8 %. This result shows that we need to apply surface coating for better performance.



5. CONCLUSION & SUGGESTIONS

Based on our laboratory tests it has been concluded to use paper pulp to replace natural soil. Raw material of paper pulp from industry which can't be recycled and creates environmental issues for disposal is alleviated with green building concept.

The possibility to use the paper wastes as an alternative raw material in the production of bricks leads to achieve economy in construction cost. It should also be noted that this material do not emit any kind of pollutants in environment.

Compressive strength obtained in laboratory clearly suggests the use of paper-pulp bricks because of required strength properties.

It is viewed that paper bricks are the best light weight material to be used for reducing the load on the structures and imparts earthquake resistance. This bricks have more heat resistance than conventional bricks. We suggest the use of these bricks for replacement of gypsum partition due to its thermal resistance.

6. REFERENCES

- [1] G.V.S. Siva Prasad, Padmanabha Reddy “Study And Behavior Of Some Properties Of Papercrete Brick With Modular Bricks.”International Journal of Engineering Research-Online A Peer Reviewed International Journal Vol.3., Issue.3, 2015 ISSN: 2321-7758
- [2] Rohit Kumar Arya 1, Rajeev Kansal “Utilization of Waste Papers to Produce Ecofriendly Bricks” International Journal of Science and Research (IJSR) Volume 5 Issue 8, August 2016,,ISSN (Online): 2319-7064
- [3] Indian standard: IS: 4031 (Part-1)- 1996 method of testing of fineness of cement.