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Composite Bricks using Waste Materials

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Abstract - *Brick is most ancient and most recognized building materials. It is known as an ideal building material because they are relatively cheap to make, very durable and require little maintenance. A brick which is made by mixing two or more different types of construction materials is known as Composite bricks. The aim of this paper is to provide an alternative solution for conventional bricks in economical way. Cement, Crusher Sand and other waste materials are mixed in proper proportions to cast the composite brick. Here to reduce the environmental effects, we have reduced the percentage of cement and we have replaced it with some composite materials. And to reduce the wastes which are not properly disposed in the environment, so we have decided to use the wastes released from the saw industry. By reusing the wastes in the effective manner, we have decided to cast the brick. In addition to these materials coco- peat powder and hydroton powder was added to reduce the curing rate and to reduce the weight of the brick respectively. With a proper proportion composite brick have been casted. The casted bricks were dried, cured and tested. We have studied and analyzed the properties of the composite bricks. The strength, water absorption and other parameters was comparatively equal to the conventional bricks. This bricks from wastes will be useful and provide sustainable solution.*

Key Words: *Composite bricks, Wastes, Saw dust, Sustainable, Cement, Crusher Sand.*

1. INTRODUCTION

A brick is a type of block used to build walls, pavements and other elements in masonry construction. Properly, the term brick denotes a block composed of dried clay, but is now also used informally to denote other chemically cured construction blocks. Bricks can be joined together using mortar, adhesives or by interlocking them. Bricks are produced in numerous classes, types, materials, and sizes which vary with region and time period, and are produced in bulk quantities. Block is a similar term referring to a rectangular building unit composed of similar materials, but is usually larger than a brick. Bricks are laid in courses and numerous patterns known as bonds, collectively known as brickwork, and may be laid in various kinds of mortar to hold the bricks together to make a durable structure. The conventional methods of bricks production have brought undeniable shortcomings. The consumption of earth-based material clay, shale and sand in brick production resulted in resources depletion, environmental degradation and energy consumption. Most of the researchers went through enhancing the clay brick quality and properties by mixing the clay with various recycled wastes such as Granite waste, Foundry sand, Clay wastes, Waste glasses etc.

2. MATERIALS USED

The new materials used in our project to produce an alternative material for composite bricks are

- Crusher sand
- Cement
- Saw dust
- Hydrotons
- Coco-peat

2.1 CRUSHER SAND

Crusher sand is a substitute of river sand for concrete construction. The crushed sand is of cubical shape with grounded edges, washed and graded to as a construction material. The size of crusher sand is less than 4.75mm and the color of crusher sand is grey.

FIG - 1: Crusher Sand

2.2 CEMENT

Cement is a binder substance used in construction that sets, hardness and can bind other materials together. Cement used in construction can be characterized as being either hydraulic or non-hydraulic depending upon the ability of the cement to set in the presence of water.

Portland Pozzolana Cement (PPC) is used in this project. PPC is manufactured by inter-grinding well-burnt OPC clinker with gypsum and pozzolanic materials like power station fly ash or siliceous earths. The standard IS code referred for the Portland Pozzolana Cement IS: 1489-1991 and the cement tests should confirm to the values prescribed in it.

FIG - 2: Cement

2.3 SAW DUST

Saw dust is the waste product from wood industry. Saw dust is used as pore former to attain insulating properties of bricks. The incorporation of saw dust into the mixture has been proven as a key factor in altering quality. The use of saw dust as replacement of aggregate in bricks will improve the durability of brick with addition of PPC cement.

FIG - 3: Saw Dust

2.4 HYDROTONS

Hydrotons are the clay balls which are made by heating day to over 900^0F. Also known as light weight expanded clay aggregate. Usually the size will be of 0.1mm to 25mm, commonly 0-4mm, 4-10mm, 10-25mm. Then densities are 250, 280, 330 and 510 kg/m^3. Here, it is crushed, made it as powder and then added to the bricks.

FIG - 4: Hydrotons

2.5 COCO PEAT

Coco peat is also known as coir pith or coir peat. It is extracted from the tissues surrounding the seed of coconut palm (coco nucifera). Raw coconut is washed, heated and graded before being processed into coco peat. The least fiber obtained from coconut fiber industry is called coco peat.

Coco peat has very high-water capacity, it can hold water by more than 7 times of its weight which helps in reduction of curing time and amount of water required for curing. It is an organic waste material and hence it is an ecofriendly material compared to sand.

FIG – 5: Coco Peat

3. MIX PROPORTION

To make the composite bricks following mix proportion is arrived by trial and error method. The proportion table is mentioned in table 1.

TABLE – 1: Mix Proportion of Bricks

MATERIALS	IN PERCENTAGE (%)	IN g
Crusher sand	40	1000
Cement	40	1000
Saw dust	10	250
Hydrotons powder	05	125
Coco peat	05	125

4. MANUFACTURING OF BRICKS

For manufacturing of bricks, variety of bricks has been developed during the past years, differing in shape and size, depending on the required strengths and uses. We have used the mold size as 19cm x 9cm x 9cm.

5. QUANTITY OF MATERIALS USED

The quantity of materials required to cast a single brick is arrived by taking a brick weight of 2.5 kg is given in the table. The process of the material proportion is explained below:

- 40% of crusher sand, 40% of cement, 10% of saw dust, 5% of hydrotons powder and 5% of Coco peat where taken to cast the bricks.
- All the raw materials where mixed and thoroughly blended.
- The required water was added to mix the raw materials and convert it into wet condition.
- The slurry was poured into the mold.
- The mold was removed and dries for 2days.
- Then the mold was placed inside the curing tank for curing process.
- After curing process 7, 14 days strength test were tested.

All bricks were made using wooden mold, to produce brick of 190mm x 90mm x 90mm in size under a manual compaction preparation of bricks.

FIG – 6: Mold

6. TESTING OF BRICKS

There are several tests which are commonly used to obtain various properties of the brick. However, in this study, only two bricks test were required. The two brick tests were the determination of compressive strength of the bricks and the water absorption of bricks. The procedure of the testing was based on Indian Standards (IS) codes. Here, the following tests were done on the composite bricks.

- Compressive Strength Test
- Water Absorption Test
- Impact Test
- Hardness Test
- Dimension Tolerance Test
- Efflorescence Test
- Soundness Test
- Color Test
- Structure Test

For the tests that had been done on the bricks, several statements could be made based on the results obtained and observation done during the tests.

6.1 COMPRESSIVE STRENGTH TEST

In this project since we can do only one mix, the test results of the following mix are tabulated below. Here, the values of compressive strength test ranges between 6 – 6.9. By seeing the results, we can conclude that the brick samples fall under first class bricks.

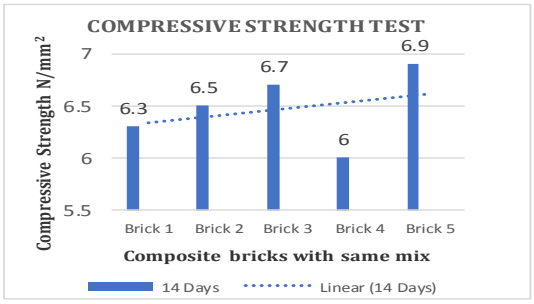
TABLE – 2: Compression Strength Test

Sample	Weight of brick before immersed in cold water (W_1) kg	Weight of brick after immersed in cold water (W_2) kg	Water Absorption (W_2-W_1 / W_1) x 100 %
Brick 1	2.440	2.765	13.3
Brick 2	2.175	2.655	22
Brick 3	2.315	2.780	20

COMPRESSIVE STRENGTH = (Load in N / Surface Area in mm²)

The overall dimension of each brick was measured and the area of the bed face of the specimens was calculated. The corresponding load at which the brick fails to the surface area of the brick gives the compression strength of the bricks.

Chart – 1: Compression Strength Test



6.2 WATER ABSORPTON TEST

From observing the water absorption limit for the composite brick made with saw dust is tested in accordance with the procedure laid down in IS 3495 Part-II – 1976.

TABLE – 3: Water Absorption Test

Sample	Compressive Strength (14 Days) (N/mm²)
Brick 1	6.3
Brick 2	6.5
Brick 3	6.7
Brick 4	6
Brick 5	6.9

WATER ABSOPRTION = ($W_2 - W_1 / W_1$) x 100

The water absorption test is conducted for same mix proportion. The values obtained from the three brick samples ranges between 13 – 23%. The water absorption is maximum for Brick 2 is 22%.

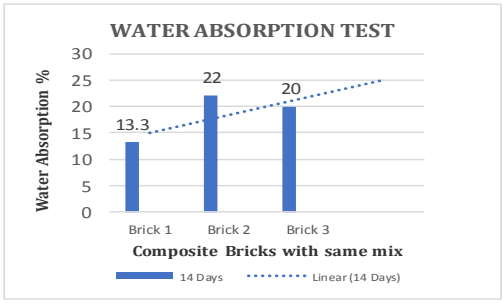


Chart – 2: Water Absorption test

6.3 IMPACT TEST

In this test, bricks are dropped from a height of 1metre. If the bricks break then it has low impact value and it is not suitable for construction purposes. The brick did not break when dropped from the mentioned distance. Hence, it is a good quality brick.

6.4 HARDNESS TEST

This test is conducted to see whether the brick is sufficiently hard or not. It is done by scratching on the bricks surface with the help of the finger nail. With the help of our nail or any other sharp object, scratches are made on the surface of the brick. There were no impressions on the surface of the test sample.

6.5 DIMENSION TOLERANCE TEST

The tolerances on the sizes of bricks are fixed by giving maximum and minimum dimensions. In order to perform this test, 20 bricks are randomly from a stacked and the values are measured and noted. Bricks are closely viewed if its edges are sharp and straight and uniform in shape. The brick sample is in perfect dimensions.

TABLE – 4: Dimension Tolerance Test

Dimensions	Values
Length	3695
Breadth	1750
Depth	1750

6.6 EFFLORESCENCE TEST

Efflorescence test on bricks is to know the presence of soluble salts in a brick, placed in water bath for 24 hours and dry it in shade. After drying, observe the brick surface thoroughly.

TABLE – 4: Efflorescence Test

Sample	Efflorescence
1	Nil
2	Nil
3	Nil

(Nil: When there is no perceptible deposit of efflorescence)

6.7 SOUNDNESS TEST

If two bricks are struck with each other they produce clear ringing sound. The sound should not be dull. In this test, two bricks were randomly chosen and struck again one another. They produced a clear bell ringing sound and they did not break. Hence the sample is said to be a good brick.

6.8 COLOR TEST

A good quality of brick should have bright and uniform color throughout. In this test, the brick sample are perfect in color.

6.9 STRUCTURE TEST

A brick is broken and its structure is examined. It should be homogenous, compact and free from lumps, holes etc. Here, the sample is free from cracks and holes. Hence these are good quality of bricks.

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REFERENCES

[1] Sorfa P. (1984): **"Properties of wood cement composites"** - Journal of Applied Science, 40;207-216.
[2] A.Zziwa, S. Kizito, A.Y.Banana, J. R. S. Kaboggoza1, R.K. Kambugu and O. E. Sseremba: **"Production of composite bricks from sawdust using Portland cement as a binder" -** Uganda Journal of Agricultural Sciences, Vol. 12 - No.01 June -2006.
[3] B. Berge: **"The ecology of building materials"** Routledge, Abingdon, 2009.
[4] S. Deboucha and R. Hashim: **"Effect of OPC and PFA cement on stabilized peatbricks"** - IJPS, Vol.5(11), Sept-2010.
[6] Adrian Bustamante, Romel Sia, Greg Mark Dablo, Renato Arazo: **"Physical and mechanical properties of composite brick from cement mortar, fly ash, and rubber crumbs" -** IJRET, Vol. 04 - No.10, Oct-2015.
[5] Kota Sai Krishna,Gujja Swathi:**"Experimental Investigation on Bricks by Replacing of Clay and Sand with Various Supplementary Materials"** - IJAR 5(12), 797-804, Dec- 2017.
[6] K. Sasikumar, G. Minnalkodi, Dr. G. Dhanalakshmi: **"Strength characteristics of bricks using composite materials"**- IRJET Vol. 05 - Issue.03, Mar-2018.
[7] V.M.Sathianarayanan, R.Arivazhagan, V.Balakumar : **"Project on innovation and implementation of composite brick in construction"**-International Journal of Pure and Applied Mathematics, Vol. 119 - No. 7, 2018.
[8] K. Dhanasekar, V. Murugesh, V. Hari Haran, T. Amudhan, R. Hemachandran, N. Selva Aravind: **"Comparison of conventional bricks with composite bricks"**–IJESC, Vol.9 Issue.3, March-2019.
[9] U.Kayalvizhi, M.Kathiresan, A.Ayyappan, K.Priya: **"Development of Bio-Weeds Composite Bricks with Granite Powder"** – IJSDR Vol. 4 Issue. 3, March 2019.
[10] M. Zami and A. Lee: **"Using earth as a building material for sustainable low-costhousing in Zimbabwe"** – IJRTE, Vol.8 Issue-1S, May-2019.
[11] Jason Maximino C. Ongpeng, Edward Inciong, Vince Sendo, Crizia Soliman and Adrian Siggaoat: **"Using Waste in Producing Bio-Composite Mycelium Bricks"**- Applied Sciences,31 July 2020.