Innovative Block a New Eco-Friendly Material for Construction

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Abstract— *Bricks remain one of the most important building materials in all construction industries. In recent years, with expanding urbanization and increasing demand for construction materials, brick manufacturing has to grow to meet the demand. It has directly or indirectly caused a series of environmental and health problems. Most of the construction techniques focus should be now more on seeking eco-friendly solutions for greener environment. Analysis of construction materials on availability, cost, energy consumption and carbon emission parameters helps in highlighting suitable alternatives for construction. Construction of alternative bricks by a new approach by using locally available soils and regenerating resources leads to a prospective solution for sustainable building construction. Such bricks construction is less energy intensive and very effective in different climatic conditions. Its manufacturing raw materials are easily available, cheap and the process requires a simple technology, hence it is efficient and economic. Making a construction material within low cost but with higher strength and durability will be of great achievement.*

Keywords— *Eco-Friendly, Carbon emission, Compressive Strength, Innovative Brick, Persea Macrantha, Cost Effective.*

I. INTRODUCTION

Brick is the most commonly used building material for construction. The emission of CO2 in the brick manufacturing process affects the green environment badly. Therefore, it is necessary to focus more on seeking eco – friendly solutions for greener environment. Analysis of materials based on cost, energy consumption and emission of carbon parameters helps in highlighting suitable options for better construction. Construction of alternative bricks by a new approach by using locally available soils and regenerating resources leads to a prospective solution for sustainable building construction. Such brick construction is less energy intensive and very effective in different climatic conditions. Its manufacturing raw materials are easily available, cheap and the process requires a simple technology, hence it is efficient and economic. This paper aim to implement an environment friendly brick manufacturing project, financial feasibility is a must. As this technology is capital intensive, this report aims to identify the parameters to achieve to implement a green brick technology. In this paper, attempt has been made to replace the conventional building bricks with an innovative brick manufacturing process using eco-friendly raw materials such as soil, clay and Persea macrantha tree leaf extract. This satisfies the characteristics like cost effective, environmental friendly, less weight, aesthetically pleasing, less water absorption, heat resistant and locally available. Construction using this environmental friendly brick will provide a better durable material with economy is a no doubt fact by the results obtained from our experimental investigation. Sustainability and economy with no pollution is a dream that persist in our society.

II. RAW MATERIAL USED

A. Soil

Soil is the basic ingredient of a brick. There are different types of soil depends upon the nature of the rock, its mineral contents and the climatic condition of the area where rocks seen. Here, we use red soil for the manufacturing processes of bricks.

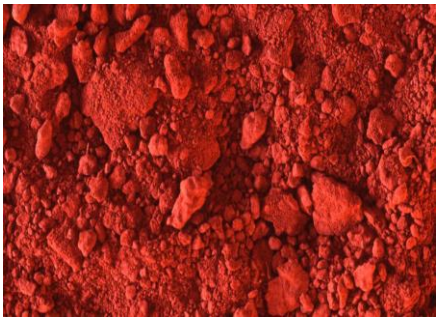


Fig 1: Red Soil

B. Clay

Clay is a fine powdered natural rock or soil material. It combines one or more clay minerals. Clays are plastic because of the presence of water content in it and become hard, brittle and non–plastic while drying or firing.

Fig 2: Clay

C. Persea Macrantha

Persea Macrantha is the large-flowered bay tree. It is a species of plant in the Lauraceae family. The plant grows to about 30 m (98 ft.). The jelly like extract, extracted from these leaves is used for making this innovative brick instead of using water. It provides a better bonding strength to the soil than by using water.

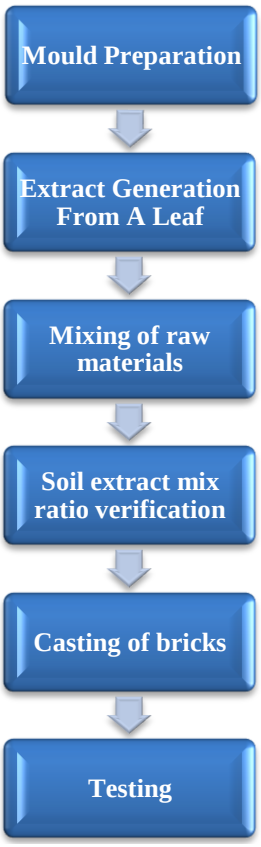
Fig 3: Persea Macrantha

D. Quarry Dust

Quarry dust is formed as a result of the crushing process. It is used as aggregates for concreting purpose, especially as fine aggregates. Quarry dust is a fine powder, used in brick manufacturing processes for achieving better consistency.

Fig 4: Quarry Dust

III. MANUFACTURING PROCESSES



IV. PROPERTIES OF MUD BLOCK CONSTRUCTION

A. Appearance

The appearance of mud bricks reflects the materials they are made from. They are thus earthy, with their color determined by the color of clays and sands in the mix. Finished walls can range from a strong

expression of the brick patterns to a smooth continuous surface.

B. Structural Capability

With thick enough walls, mud brick can create, load bearing structures up to several storeys high. Vaults and domes in mud brick prove that it can be used for many situations other than vertical walls. It may be employed as infill in a timber frame building or for load bearing walls, although its compressive strength is relatively low. Typically, Australian mud brick structures are single or double storey. In the Yemen buildings eight storeys high and more have stood for centuries.

C. Thermal Mass

Mud brick walls can provide moderate to high thermal mass. For most Australian climatic conditions, as a rule of thumb, walls should be a minimum of 300mm thick to provide effective thermal mass.

D. Insulation

Contrary to popular belief mud bricks are not good insulators. Since they are extremely dense they lack the ability to trap air within their structure, the attribute of bulk insulation that allows it to resist the transfer of heat.

To achieve the levels of insulation needed for sustainable house construction and it is almost always necessary to add insulation linings to external mud brick walls. In some milder climate zones, where thermal insulation is less critical to the overall building performance, mud brick walls may not need additional insulation.

One way of dealing with mud brick's lack of insulation is to construct some or all of the outer walls with framed construction, and use mud brick for partition walls and as an internal 'reverse brick veneer' on some external walls. This approach allows the building to reach 'lock-up' very quickly and provides a protected space to make and dry the bricks.

Traditional earth buildings often used walls up to a one meter thick; these would provide reasonable insulation and enormous mass to stabilize internal temperatures.

E. Sound Insulation

A well-built mud brick wall has very good sound insulation properties. In fact, it can be almost equivalent to a monolithic masonry structure in its capacity for sound attenuation. Some modern mud brick homes use mud brick for external walls and light partition walls internally; it is more effective for thermal and acoustic performance to use mud brick for the partition walls and lightweight, well-insulated external walls.

F. Fire And Vermin Resistance

Since earth does not burn, and earth walls do not readily provide habitat for vermin, mud brick walls generally have excellent fire and vermin resistance.

G. Durability And Moisture Resistance

Mud brick walls are capable of providing structural support for centuries but they need protection from extreme weather or continuous maintenance. Although some soils are very resistant to weathering, as a general rule mud brick needs protection from driving rain and should not be exposed to continuous high moisture.

H. Breathability And Toxicity

Mud bricks make 'breathable' walls but some mud brick recipes include bitumen, which potentially results in some out gassing of hydrocarbons. Ideally earth should be used in, or as near as possible to, its natural state.

I. Environmental Impacts

Mud bricks could have the lowest impact of all construction materials. Mud brick should not contain any organic matter, the bricks should be made from clays and sands and not include living soil. They require very little generated energy to manufacture, but large amounts of water. Their embodied energy content is potentially the lowest of all building materials but the use of additives such as cement, excessive transport and other mechanical energy use can increase the 'delivered' embodied energy of all earth construction.

V. TESTS CONDUCTED

A. Weight

Weight test is done to compare the weight between the ordinary conventional brick and the alternative brick. Weight test is done by using weighing balance apparatus.

Table I: Weight of Persea Macrantha Bricks

Sl. No	*Identification Mark*	*% of Extract*	*Dry Weight (kg.)*
1	P1	12	2.590
2	P2	13	2.730
3	P3	14	2.736
4	P4	15	2.746
5	P5	16	2.311

B. Water Absorption Test

The water absorption test is done to determine the water absorption capacity of a material under specified conditions.

Table II: Water absorption test of Persea Macrantha bricks

Trail	*Water absorption in % (24 hours)*				
Mix	12	13	14	15	16
	3.2	3.7	3.8	3.2	3.6

C. Compression Test

Compression test is done to determine the compressive force of a material and also to determine the ability of a material to recover after a specified compressive force is applied.

Table III: Compressive strength of Persea Macrantha bricks

Trial	*Best Compressive Strength in N/mm^2*				
Mix	12	13	14	15	16
	3.21	3.50	4.38	4.09	4.26

VI. RESULTS AND DISCUSSIONS

A. Weight

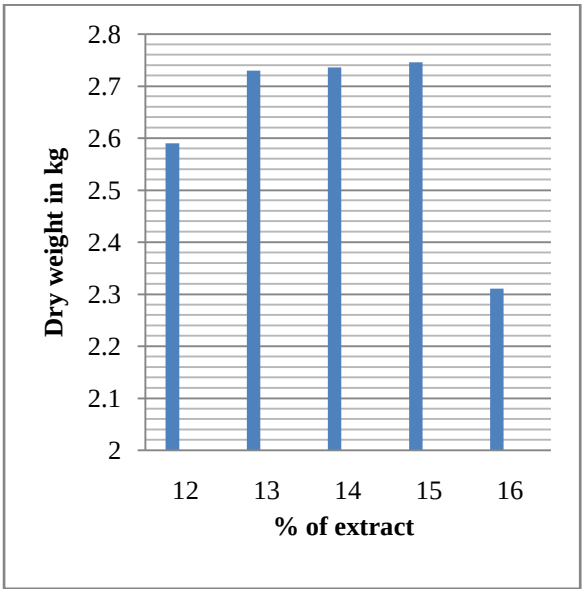


Fig 5: Variation of dry weight with percentage of extract

B. Water Absorption Test

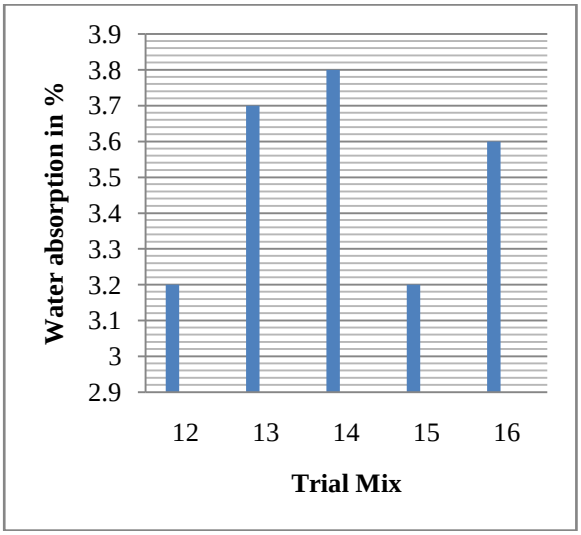


Fig 6: Variation of water absorption with varying trial mix

C. Compression Test

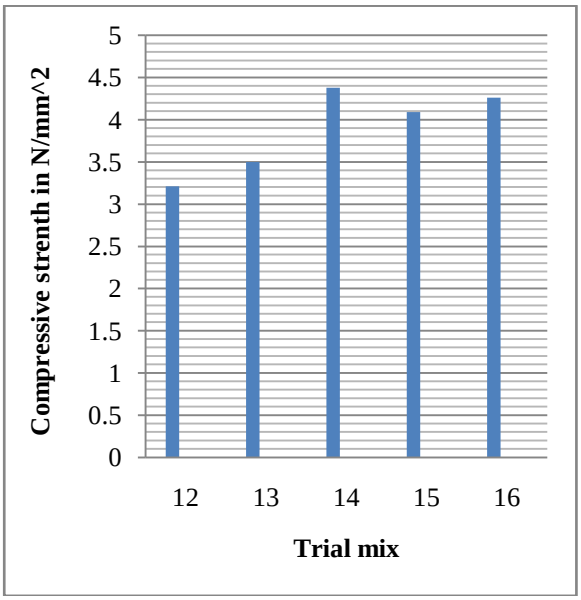


Fig 7: Variation of compressive strength with varying trial mix

VII. CONCLUSIONS

The construction using natural resources with the replenishment of them and the growth of the world will be an achievement to admire. Construction using this environmentally friendly brick will provide a better durable material with economy is a no doubt fact by the results obtained from our experimental investigation. Sustainability and economy with no pollution is a dream that persists in our society. This

type of construction brings us a step closer to this motto.From the above experimental studies we can conclude that:

- Such brick construction is less energy intensive and very effective in different climatic conditions.
- Construction using this environmental friendly brick will provide a better durable material.
- Its manufacturing raw materials are easily available, cheap and the process requires a simple technology, hence it is efficient and economic.

REFERENCES

[1] M. Scinduja, Innovative Brick Material, International Journal for Research in Applied Science & Engineering Technology., 1(10), 2, pp. 49-61, 2014.
[2] Niranjana Devi Kasirajan, Strength Behaviour of Brick Using Admixtures, International Journal of Civil Engineering, 1(3), pp. 49-56, 2017.
[3] Shweta O. Rathi, AAC Block - A New Eco-friendly Material for Construction, International Journal of Advance Engineering and Research Development , 2(4), pp. 410-414, 2015.
[4] Sanchay Patel and Ram Parvesh Prasad, Study of Behaviour of Stabilized Mud Block and Burnt Clay Brick Masonry and Stabilized Rammed Earth Walls , International Journal for Scientific Research and Development , 7(4), pp. 780-783, 2016.
[5] Raju Sathish Kumar, Janardhana Maganti and Marga Kumar Nandyala, Rice Husk Ash Stabilized Compressed Earth Block- A Sustainable Construction Building Material –A Review, International Journal of Civil Engineering And Technology, 3(1), pp. 3-14, 2012.