A Study on Unfired Clay Bricks with Enhanced Properties

Naveen Singhal[1]
Student,Civil Engineeering
Arya Institute Of Engineering
Technology &Management
Jaipur , Rajasthan, India
Naveensinghal71299@gmail.com

Cheenu Singhal[2]
Student,Civil Engineering
Arya Institute Of Engineering
Technology & Management
Jaipur,Rajasthan,India
cheenusinghal34@gmail.com

Mr.sanwar mal mitharwal
professor,Civil Engineering
Arya Institute of Engineering
Technology & Management
Jaipur,Rajasthan,India
2017pcs5395@mnit.ac.in

ABSTRACT:

Construction industry has always been a flourishing industry in the whole world. Today, with the global development especially in technology, real estate construction is growing more than ever and is continuously using new techniques and methods. However, cost remains a big challenge especially to developing and under developed countries where people in urban as in rural areas can't afford expensive materials and construction methods to build their own houses with. As a result, companies in the construction industry are highly competing, and several researches are being held in this field in order to find the best and most cost efficient building materials andtechniques. After siting the theoretical information needed, we will move to explaining the experimental procedure we followed to make 7 unfired clay bricks samples mixed with 3 additives: Palm fronds, dates pits and limestone. Then, results got from testing compressive strength of those bricks will be shown in order to be able to give a final decision about which additive is better in enhancing bricks' properties.

Keywords- claybrick , palmfronds, dates Pite,limestone

1. INTRODUCTION

Construction industry is a global industry that highly affects national economies. Companies and researchers all over the world are working on the development of effective building materials and methods to make good quality, cost efficient and environment-friendly constructions. In fact, although there exists today high quality engineering materials, but their cost and effect on the environment is still a big challenge to overcome. The environmental effect is a point that needs to be seriously taken into consideration when thinking about building constructions especially nowadays as people are getting more and more aware about the horrible consequences of harming nature, and about the need of preserving what the environment has to offer to us.

Bricks that are commonly used, such engineering bricks, are expensive and harmful to our environment; from here, the need of unexpansive alternatives that can be used to build sustainable and strong constructions emerges especially for people who seek to build their own houses with an affordable price. One of the materials that has been used for centuries and that is very interesting when it comes to its properties is clay which can be used to make building bricks

Clay bricks, also called masonry earth bricks, are a fundamental constructionmaterial thatpeople have been using for decades. In fact, clay, compared to other construction materials, is neither expensive nor difficult to work with. However, it is important to note that clay bricks that are used for the majority of buildings are fired to very high temperatures (around 1200°c), which adds a lot in the price of their manufacturing . Therefore, we have to find ways to make strong clay bricks but without firing. Also, buildings that are constructed with unfired clay bricks are thermally insulated compared to other materials; hence, they keep the inside warm during cold seasons.

2.LITERATURE REVIEW

Mike Lawrence, Andrew Heath, Pete Walker, and Tom Morton(2006) showed the different materials and amounts they experimented in order to get the best unfired clay bricks, and then tested them after leaving them to dry in open air.

Dr. Ali Arasteh (2009) The project explainedthe designing unfired clay bricks samples and testing them in order to see their properties.
Jonathan E.Oti ,John Kinuthia, and Jiping Bai'sThis research shows us that unfired clay bricks can be used in construction as their strength is within regulations; knowing that they are much less expensive than fired clay bricks and that cost-efficiency is an extremely important parameter in the construction industry.

O.S. Oladeji and A.F. Akinrindethe (2013)researchers recommended the use of soda ash in making fired and unfired clay bricks for it enhances their properties and makes them good and cost-efficient for buildings construction.

Mike Lawrence, Pete Walker, and Andrew Heathhave(2009) shown that this addition brought about "12% reduction in dry density, but had almost no effect on strength or the strength–moisture relationship for the material".

Abdul Hai Alami(2013) explained dates pits make clay-frond bricks stronger which makes it better to use in constructions or in insulation by making sheets or packed between construction buildings layers

3.MATERIALS USED

1. Clay was collected from the road cuts in Rajasthanlocated in the region of India. After that, it was granulated and then filtered using a sieve to eliminate rocks.

2. Palm fronds were collectedfrom a plant nursery in the region of India, cut into small rectangles of 3*7mm on average, and then put in the blast furnace for 5hours with a temperature of 50°.

3. Date pits were crushed into powder then filtered to eliminate the remaining big grains.

4. Limestone is in form of a sedimentary rocks.it is also known as a calcium carbonate.

4.METHODOLOGY

After having all the materials ready, it was to make bricks samples. 7 bricks were made with different percentages of each material as shows in the table below:

Sample number	Clay %	Dates Pits %	Palm fronds %	Lime stone %
1	100%	0%	0%	0%
2	95%	4%	1%	0%
3	85%	14%	1%	0%
4	90%	10%	0%	0%
5	95%	0%	0%	5%
6	90%	0%	0%	10%
7	85%	10%	0%	5%

When making each sample, the minimum amount of water that made the mixture homogeneous was added in order to decrease moisture content as much as possible, therefore make the samples' stabilization and drying faster. It is important to note that the first sample contained only clay and water in order to serve as a reference.

Test on bricks

After making the mixtures in molds, all bricks samples were left to dry for 13 days under sunlight. The machine used is a Control Group flexural and compressive strength testing machine shown in the figure bellow.

Fig. 1 Flexural and Compressive Strength Testing Machine

Flexural strength testing is designed for concrete beams to give the maximum rigidity for their working range by applying a load on the beam as the piston moves down, but it is also used for this research in order to compare the samples and decide which one is more rigid. For compressive strength testing, it gives us an idea about the maximum amount of compressive load the bricks can bear before fracturing. In fact, as shown in the figure below, the brick is placed between platens and compressed as a load is applied gradually. As shown in the figure below, the machine gives the compressive strength that the sample can bear in MPa, equivalent to N/mm². This value is simply the load that the brick can withstand divided by the surface area which is 4*4cm in the machine used.

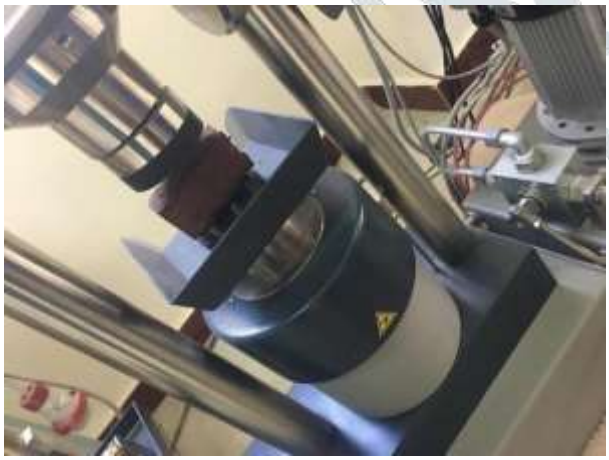

Fig 2 Compressive Strength Testing

Fig 3 Example of Compressive Strength Testing Result

Testing the bricks samples showed us that brick 4, which contains 10% dates pits and 90% clay, is the strongest one with a compressive strength equal to 2.91N/mm². This means that it even exceeds the minimum allowable compressive strength of fired clay bricks that is equal to 2.73N/mm². We can also notice that samples that contain limestone, which we refer to us brick 5,6,7, have higher compressive strengths than the sample that contains only clay, but still lower than all the other samples that contain dates pits and palm fronds.

To sum up, according to this test we can say that dates pits are the most preferable additives to be used with clay in order to make strong unfired bricks

5.CONCLUSION

Construction Industry is a huge industry that keeps growing every day and opening the door to creative and innovative ideas able to improves existing building materials and techniques.

This, however, comes with many side effects that badly influence our environment and human health in several ways. More than that, construction industry faces the challenge of increasing costs which makes it hard, especially for low-income families, to construct their houses. As a result, finding or enhancing relatively cheap and simple construction materials becomes extremely essential.

Several bricks types are used in masonry constructions depending on the kind of buildings and applications they are used for. In order to see the difference between al the existing bricks, they can be classified in many

categories. For example, we can classify them by shape as they can be solid, perforated and frogged, by the material used such as clay, sand lime, concrete or fly ash, or by quality as we find good and bad quality bricks depending on many criteria namely color, shape of edges and structure.

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