Abhay Singh Chahal Journal of Engineering Research and Application *www.ijera.com*
ISSN: 2248-9622 Vol. 10, Issue 03 (Series -I) March 2020, pp 50-56

RESEARCH ARTICLE OPEN ACCESS

Investigation on properties of fly ash bricks

Er. Abhay Singh Chahal, Er. Neetu Balhara

First author: Er. Abhay Singh Chahal
Co-author: Er. Neetu Balhara
Department of civil engineering, Matu Ram Institute of Engineering and Management, Rohtak

ABSTRACT- In modern era, geo-polymer fly ash based bricks are abundantly utilized in numerous constructional projects instead of normal clay bricks from last few years. The main objective is to illustrate the silent feature regarding fly ash chemical property and use of this in construction similar to burnt clay bricks. Numerous laboratory tests along with field experiments are toted out on such waste material bricks like compressive strength testing, water absorption by bricks, hardness test, efflorescence test, soundness test, physical structure test, crushing strength test to compare properties with common clay burnt bricks. Bricks are always counted in the basic requirement before any construction starts. By the idea of future estimation with the help of previous data, Soil for manufacturing of these bricks would not be so sufficient in quantity because, need for land is shot up nowadays. In this particular condition, geo-polymer fly ash bricks will contribute to tackle this major issue because such bricks are prepared using raw material from industrial waste such as paper mills. Furthermore, nowadays the constructional structures are counted heavier, the utilization of fly ash and other waste material from industries in production of bricks are considered in a more productive way as they found light in weight and high strength if compared with clay bricks.
Keywords: Fly ash, bricks, fertile soil

Date of Submission: 25-02-2020 Date Of Acceptance: 05-03-2020

I. INTRODUCTION

Fly Ash is the residue left after coal combustion mostly composed from the mechanical or ESP just before fuel reaches in huge volume in the chimneys in thermal power plants. Mainly such ash consists of chemicals such as silica, Al_2O_3, ferric oxide, quick lime, magnesium oxide. However, composition may vary in different plants that depend upon numerous types of burner employed. Fly ash is one of numerous substances that contribute to polluting soil, air along with water. It also contains different numerous detect elements known as Hg, As, Sb, Cr, Se, Pb, Ni and Zn that results in disturbing ecological cycles and even it has contribution of toxic elements which may have negative effects on living beings and also help in creation of numerous environmental hazards too[1].

The merits of fly ash usage are:

- Reduction in space utilized in decomposition of such waste materials.
- Help to prevent natural resources.
- Prevent the environment from numerous pollution.

Manufacturing of burnt clay bricks required fuel such as coal, which resulted in lead greenhouse gas emissions. Soil is the primary raw material utilized in manufacturing of natural burnt clay bricks. For the production, soil is consumed from agriculture land, which further results as land degradation and even results in economic reduction to farmers due to unfertile agriculture land. In India, nowadays near about 200 billion burnt normal clay bricks are produced annually having huge impact on soil erosion. In the very same time period, thermal power plants established in the country India produced a lot of quantity of fly ash, disposal of this huge amount might be a significant challenge for them [2]. Utilization of this residue in construction material with lime and gypsum results in higher strength for manufacturing material such as fly ash bricks, hollow bricks and even structural concrete[3-6].

II. MATERIALS USED IN BRICK PRODUCTION.

Experimental work is performed for production of geopolymer bricks based on fly ash. In this experiment fly ash contains low calcium, sand , lime and a special type of plasticizer.

- **Fly ash:** Class F of low calcium is used in this process. This low calcium fly ash can be collected from paper mills.
- **Lime:** Calcium and magnesium oxide used be less than 15% and 60% respectively of total

volume. In white plastering coat fat lime (class C lime) is used.

- **Sand:** Materials such as sand, clay and silt are screened to 1.18mm mesh size and should be less than 5%.
- **Plasticizer:** The super plasticizer used in this is named as polycarboxylic ether.

III. EXPERIMENTAL RESULTS AND ANALYSIS

In this paper, numerous tests on fly ash bricks are carried out to check out its suitability in building work:

a) Absorption Test

It is carried out to find out the quantity of moisture absorbed by the bricks. Bricks are sunk in H_2O for a time period for 1day, after this time period weight should not exceed 20% of the weight of dry brick [8,9]. Table1& table 2 represents the data related to test performed whereas, figure1& figure2 illustrates about average percentage of water absorption by normal clay bricks and fly ash bricks respectively.

Table1: Show the data related to absorption test on normal clay bricks

Normal clay bricks			
Sample no.	Dry Weight of clay brick (in kg)	Wet Weight of clay brick (in Kg)	% of Water Absorption
A	3.15	3.50	11.11
B	3.18	3.68	15.72
C	3.21	3.65	13.70
D	3.30	3.70	12.12
Average percentage water absorption			13.16

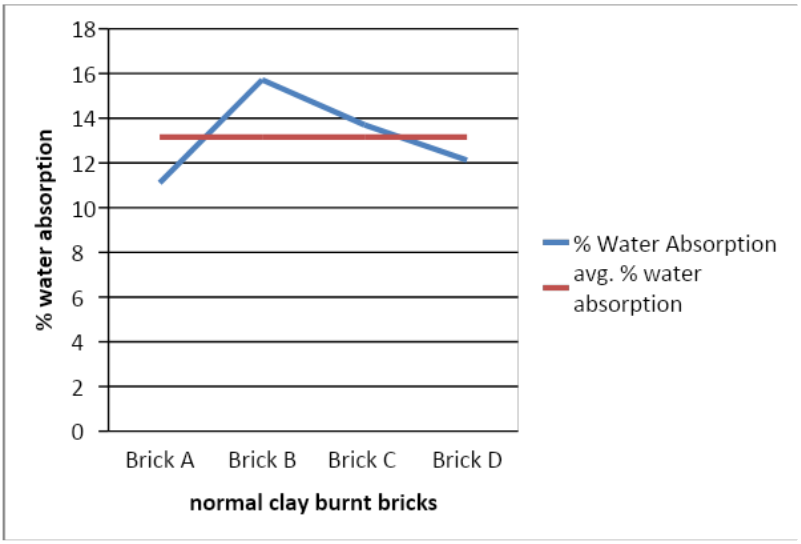


Figure 1: Absorption test on CLAY BRICKS

Table 2: Represent the data that relates to absorption test on fly ash bricks.

Fly ash bricks			
S.No.	Dry Weight of fly ash brick (kg)	Wet Weight of fly ash (kg)	% of Water Absorption by fly ash bricks
1	2.98	3.30	10.73
2	3.00	3.37	12.33
3	3.17	3.47	9.46
4	3.27	3.57	9.17
Average percentage water absorption			10.42

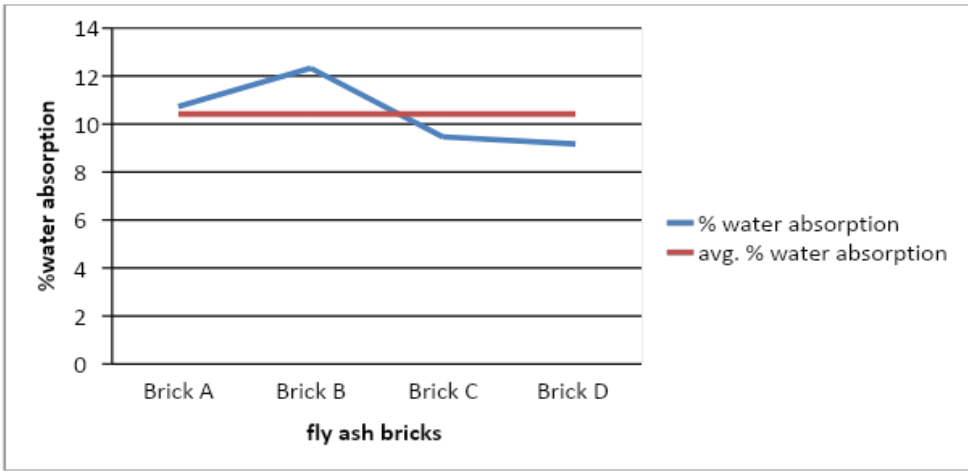


Figure 2: Represent % of water absorption by FLY ASH BRICKS

b) Hardness Test

It is performed to check that bricks are sufficient harder or not harder. To check the hardness of brick impressions are built manually on the top surface with a fingernail. On both type of bricks test is performed and results are mentioned in table3.

Table3. Hardness test for clay bricks as well as fly ash bricks

NORMAL CLAY BURNT BRICK	FLY ASH BRICK
Impressions are not noticed just after scratching on the header side of the brick.	Impressions are not witnessed after a scratchy process that is carried out manually on the surface of bricks.

c) Efflorescence Test

It is performed to check out the existence of salts in the brick after immersing bricks in water for a period of 1 day and then let it dry. Table4 illustrates the result for normal clay bricks along with fly ash bricks.

Existence of white and grey retainers on top layer of bricks announced the existence of soluble salts. Moreover, by chance white color retainers found on nearly ten percent of brick surface, then efflorescence will be known as slight and if cover 50% of area than known as moderate. Moreover, grey color & white color retainers noticed additionally to 50% of brick area, then efflorescence are counted as heavier [11].

Table4. Existence of salts in both bricks

Normal clay Burnt Bricks	Fly Ash Bricks
Efflorescence noticed is Slight to moderate.	In fly ash bricks, the grey color deposit is observed below 10%.

d) Soundness Test

It is done to notice a ringing sound and results are mention in brief for different bricks in table5. In this, two bricks are struck without any breaking. If brick are not found any crack of failure after striking and a clear ringing sound is observed, it indicates the bricks soundness [12].

Table5. Indicate the result for clay and fly ash bricks of soundness test

Normal clay burnt Brick	Fly Ash Brick
For common clay burnt brick the soundness noticed is Good	A clear ringing sound is observed in the case of Fly ash bricks.

e) Structural Test

It is performed to determine structural properties of bricks. In this first brick is broken and

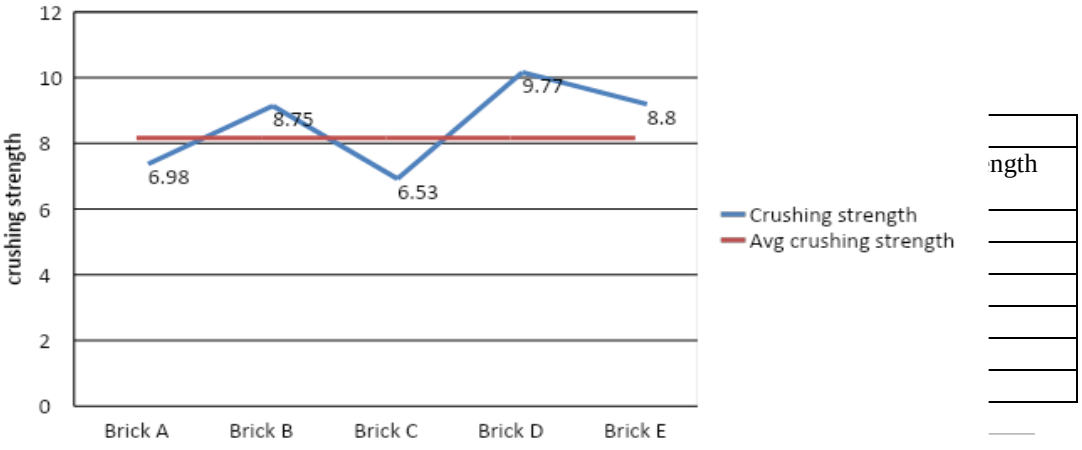
then clearly noticed that the appearance of broken brick is found homogeneous and also free from defects like holes, lumps etc. or not [7].
After the test performed it is clearly noticed that fly ash bricks are more homogenous and free from all defects.

f) Crushing Strength Test

It is the main test which is performed to check the suitability of brick in construction. It is performed using a compression testing apparatus [10] in the lab and result is noted done as shown in table6 & table7for both normal clay along with fly ash bricks correspondingly. A comparison with average crushing strength is shown in figure3 & figure4 for both bricks. Firstly, Brick is set in testing apparatus and after that load is applied till the cracks are not noticed. Finally, the compressive strength is noticed manually. Result of this test is represented with the help of tabular and line charts.

Table 6: Shows the result of crushing strength tests performed for normal clay burnt bricks

Normal clay burnt bricks					
S.No.	Length of brick	Breadth of brick	Height of brick	Load applied	Crushing strength
1	220	106	68	160	6.98
2	227	110	72	220	8.75
3	222	110	70	160	6.53
4	215	104	74	220	9.77
5	225	105	75	200	8.80
Average crushing strength					8.166



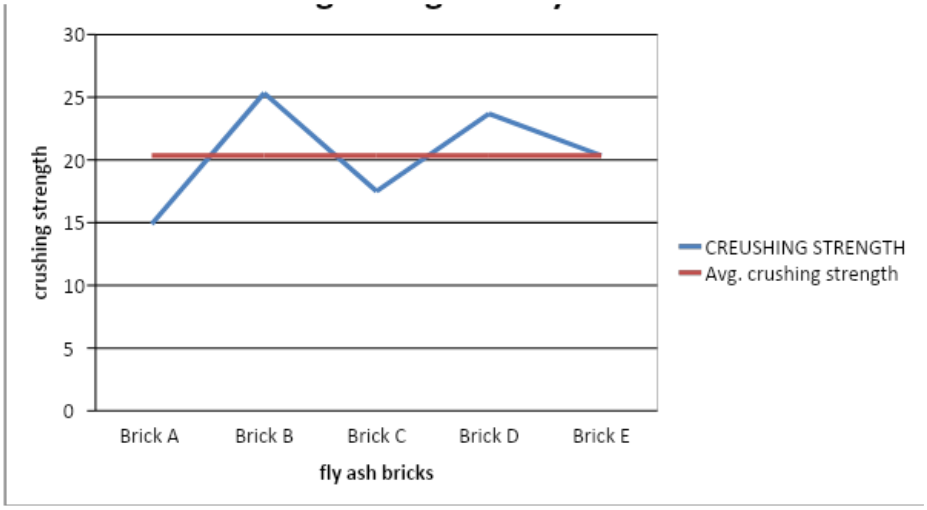


Figure 4: crushing strength test for fly ash bricks

2.1 Analysis of result

Analysis of above performed tests are as follows:

a) Moisture Absorption test

From the performed absorption test it is clearly noticed from figure 5that % of moisture absorption of fly ash brick is less than common clay burnt brick. Average percentage of moisture absorption for fly ash brick and common clay bricks are 10.14% and 13.16 % respectively.

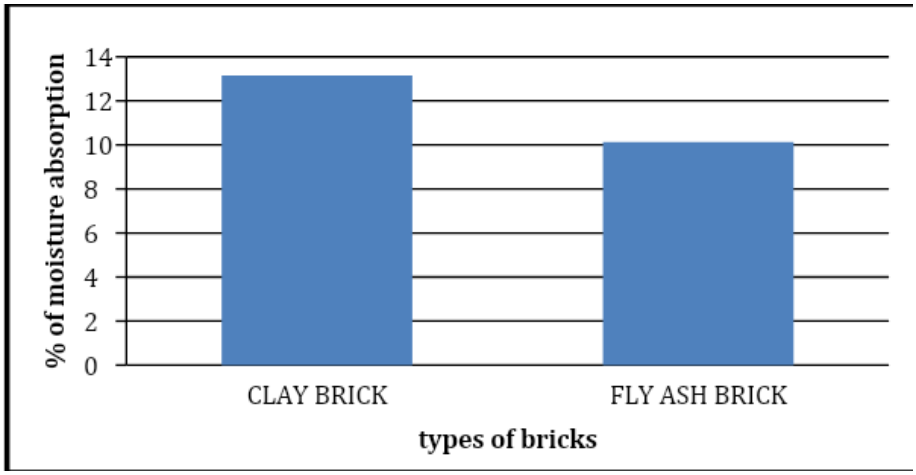


Figure 5: Bar chart shows the comparison of % of moisture absorption by clay and fly ash bricks.

b) Hardness Test

This test was carried out for both bricks and checked that no impression was noticed after scratching on the header side of the brick.

c) Efflorescence Test

This test is carried out for common burnt clay bricks and fly ash bricks and the results were analyzed in which Grey color and white color retainers are noticed slight to moderate in clay bricks and even below 10% of the surface area noticed in case of fly ash bricks.

d) Soundness Test

For both common burnt clay bricks and fly ash bricks, this test was performed and the results were compared in which bricks were struck and was noticed that a normal burnt brick shows good results when struck but in case of fly ash bricks it shows very clear ringing sound.

e) Structural Test

The structural test is performed for common clay bricks and fly ash bricks to check the structure of the brick. When bricks are broken, it was seen that no defects were found in both types of bricks. Moreover, it found that fly ash bricks are homogeneous.

f) Crushing Strength Test

The figure6 illustrates the crushing strength of common burnt clay brick and fly ash brick. It is easily noticed that the crushing strength of bricks manufactured using ash is almost twice as much as normal clay bricks.

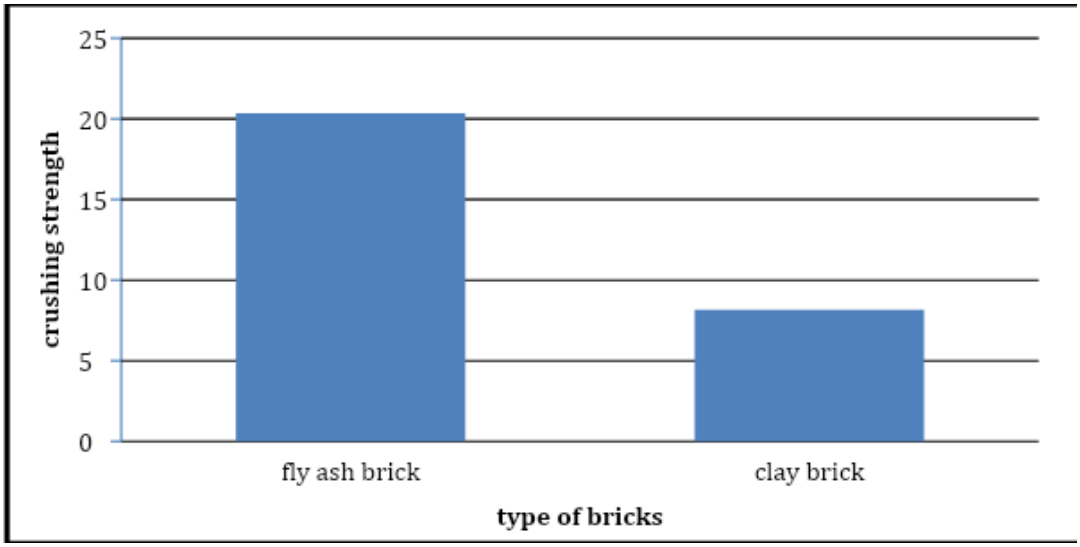


Figure 6: crushing strength comparison between fly ash and normal clay bricks

IV. CONCLUSION AND FUTURE WORK

Above results conclude that Geo-polymer fly ash bricks were found more hard, after performing a scratchy process manually if compared with clay bricks. A very clear ringing sound was witnessed in case of fly ash brick and even noticed much far better if comparison is done with normal bricks. Defects in the structure of bricks were not found if they were manufactured using fly ash. Absorbed moisture percentage in case of fly ash is less than clay bricks. The average % of moisture absorbed for fly ash and clay brick were 10.42 & 13.16 respectively. In case of crushing strength, crushing strength was more than twice for fly ash bricks if comparison is done with burnt clay brick. Proper utilization of fly ash helps to tackle the environmental issue and many health hazards also.

In future work, more investigation should be performed using industrial residue materials like waste products of woodworking known as saw dust, lime sludge and even husk from rice mills. Moreover, the rate of heat passes should also be checked for structural material formed using such type of industrial wastes. Waste material can be utilized partially with clay, that can help to tackle the decompose issue of such waste economically. If it is utilized with husk from rice mills, bonding of brick with mortar will be stronger. All waste from various industries should be put under some test to check their properties and should be utilized in construction purposes which can also result in positive and help in cleaning society and balancing the environment.

REFERENCES

[1]. Bhanumathidas N and Kalidas N, Fly Ash: the resource for construction industry, April 2003.
[2]. Reddi S.A. and Gurumurthy D.M., The Indian concrete journal, pg. 997-1004,2009.
[3]. IS:12894-1990, Techo economic Feasibility on fly ash bricks.
[4]. Rinku Kumar, Prof. Naveen Hooda, properties of fly ash bricks, in international journal of research in aeronautical and mechanical engineering.
[5]. Nutan C. Patel, Prof. Jayesh kumar Pitroda, Fly Ash Bricks: glass fibre the innovative concept for getting higher strength bricks, in Journal of innovative research in science, Engineering and technology.
[6]. IS: 1077-1992 Specification for common Burnt Clay Building Bricks (Fifth revision).
[7]. Ashik Kumar Parashar, Rinko Parashar, Bricks with Total Replacement of clay by fly ash mixed with different materials, International Journal of scientific and research, july 2012.
[8]. IS: 1905-1987 Code of Practice for Structural use of Unreinforced Masonry (Third revision)
[9]. IS: 2117-1975 Guide for Manufacture of Hand- Made Common Burnt Clay Building Bricks (Second Revision).
[10]. Reddi S.A. and Gurumurthy D.M., The Indian Concrete Journal, Pg. 997-1004, 2009.
[11]. Sharda Dhadse, Pramila Kumari and L.J. Bhagia, Fly ash characterization, Utilization and Government initiatives in india- A review, Journal of Scientific and Industrial Research, Vol. 67, Pg. 11-18, jan 2008.

[12]. Tutunlu and U. Atalay, Utilization of fly ash of manufacturing of building bricks, in International Ash Utilization Symposium, centre for applied Energy research,2010.

Abhay Singh Chahal, "Investigation on properties of fly ash bricks " *International Journal of Engineering Research and Applications (IJERA*), vol.10 (03), 2020, pp 50-56.