

Comparison between simple clay bricks and clay bricks with different additives

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Abstract

The objective was to observe the changes in the various properties of bricks when additives like fly ash, rice husk, orange peel, coconut waste and bagasse added to it. It was helped the disposal of waste material in a better manner in order to act it as an additive. These additives were collected from the near areas of Chandigarh. The mechanical property i.e. absorption test, crushing strength test, hardness test, shape and size, color test, soundness test, structure of brick, efflorescence test were evaluated. To search for new construction materials as well as a method to dispose the waste material and provide additional strengthening properties, therefore, it can be concluded that the addition of additives in clay brick is eco-friendly for the environment.

1. Introduction

Clay bricks are building material used to make walls, pavements and other elements in masonry construction. Traditionally, the term brick referred to a unit composed of clay, but it is now used to denote any rectangular units laid in mortar. A brick can be composed of clay-bearing soil, sand and lime or concrete materials. Bricks are produced in numerous classes, types, materials, and sizes which vary with region and time period, and are produced in bulk quantities for the purpose of construction. Bricks have many advantages when bricks are used as part of the construction. The bricks give the aesthetic, strength, porosity, fire protection, Sound Attenuation and durability. Additive are also added to something in small quantities to improve or preserve it for e.g. Polymer additive, Biodegradable additives etc. Additives exist that can replace all or part of the ball clay/betonies component in clay body formulas. This means that we could choose less-plastic clays in the clay body formula while also decreasing the amount of total water needed to make the clay body plastic.

These additives absorb onto the clay platelet, causing a negative charge that allows the clay platelets to slide past each other in the clay/water structure. In the clay mixing process, conditioners act as a lubricant in the clay mix, offering less resistance to pug mill and mixer parts. The decreased resistance in mixing lowers energy costs and extends the life of the clay mixer and pug mill. Lowering moist clay resistance and lubrication are critical factors in tile extrusion clay body formulas. Besides, using a smaller amount of water to achieve plasticity means there is less chance of shrinkage, warping, or cracking in the drying and firing stages.

2. Materials

Clay was taken from a kiln. Similarly, Fly ash, Orange peel, Coconut waste, RHA and SBA were obtained from a industrial area, juice bars, rice mill and sugar mill. Each additive was added and mixed separately with clay in different ratios then water was mixed with clay and mixture was kept for 3 to 4 hours for achieving uniformity. Mixture was filled in mold. After that Bricks were dried in the sunlight for 10 days and then burnt in a kiln for 3 days at 900o C to 1000o C. Brick were removed after 45 days from the kiln when the kiln cools down. Mechanical and durability properties absorption test, crushing strength test, hardness test, shape and size, color test, soundness test, structure of brick, efflorescence test were determined.

Table 1. Additives with different proportions

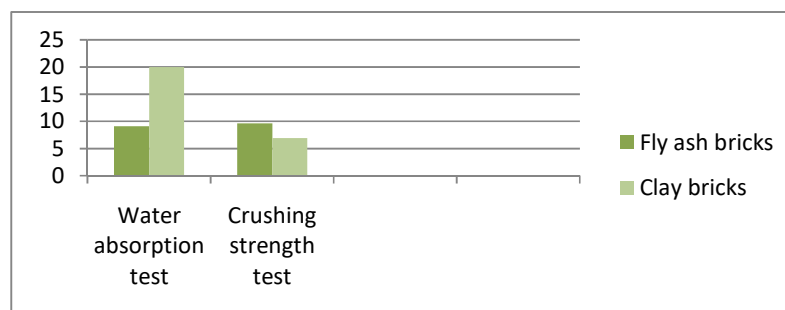
SAMPLE	CLAY (%)	FLY ASH (%)	ORANGE PEEL (%)	COCONUT WASTE (%)	RHA (%)	SBA (%)
1 ST	100	-	-	-	-	-
2 ND	98	2	-	-	-	-
3 RD	78	-	20	-	-	-
4 TH	78	-	-	20	-	-
5 TH	98	-	-	-	2	-
6 TH	98	-	-	-	-	2

3. Mechanical and durability properties

Table 2. Various properties of materials

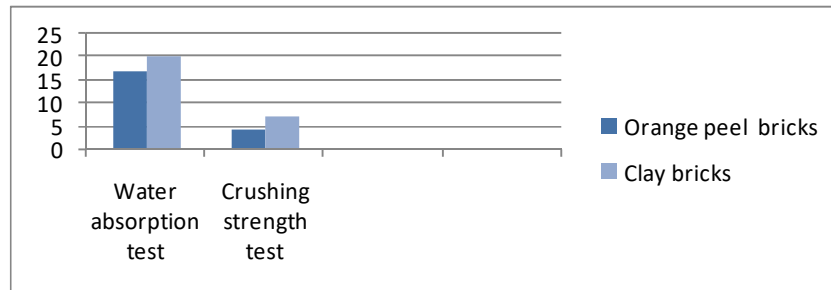
Material Used	Specific Gravity	Density	Fineness Modulus
Orange peel powder	1.02-1.05	1.36g/cc	-
Fly ash	2.1-3.0	0.54-0.86g/cc	2.67
Rice husk	2.4	0.781g/cc	6.8
Sugarcane Bagasse	2.83	1.5g/cc	3.1
Coconut waste	2.6	0.5-0.6g/cc	6.94

Figure 1. fly ash bricks v/s clay bricks



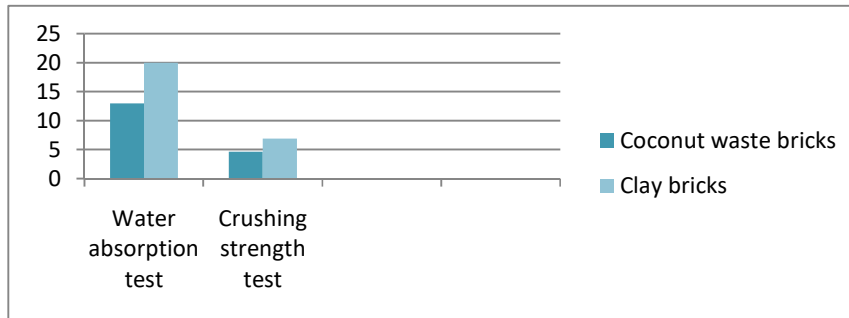
In (fig. 1) Adding fly ash results compressive strength is more. The porosity was moderate when fly ash was added. By adding 2% of fly ash by weight is the best of bricks properties which 9.61N/mm² of compressive strength and 9.11% of water absorption giving copper red color.

Figure 2. Orange peel bricks v/s Clay bricks



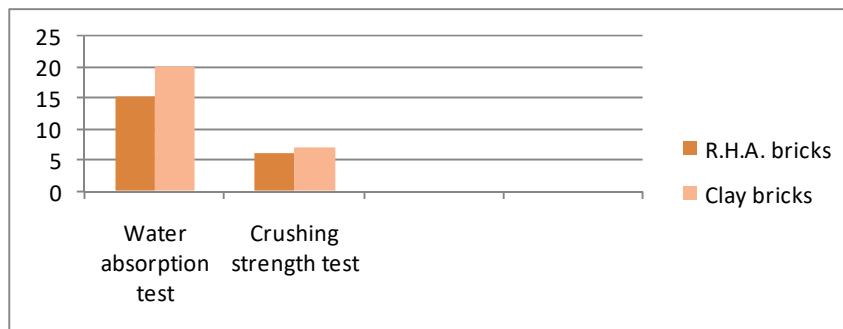
In (fig. 2) adding orange peel, results less compressive strength. The porosity was moderate when orange peel powder was added. By adding 20% of orange peel powder by weight is the best of bricks properties which 4.25/mm² of compressive strength and 17% of water absorption giving chocolate brown red color.

Figure 3. Coconut waste bricks v/s Clay bricks

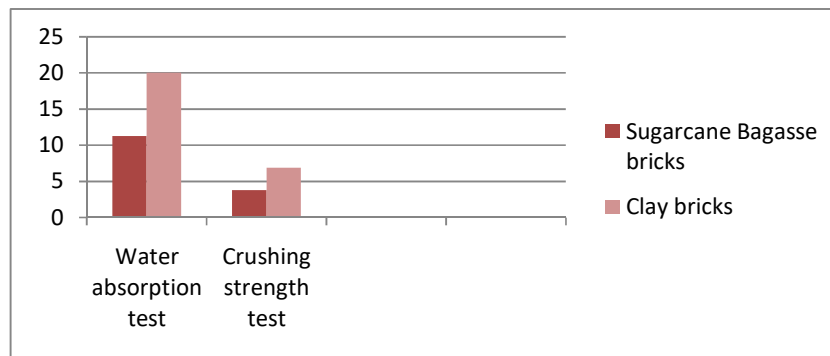


In (fig. 3) adding coconut waste, results less compressive strength. The porosity was moderate when coconut waste was added. By adding 20% of coconut waste by weight is the best of bricks properties which 4.65N/mm² of compressive strength, and 13% of water absorption giving brownish red color.

Figure 4. R.H.A. bricks v/s clay bricks



In (fig. 4) adding rice husk, results less compressive strength. Otherwise the porosity was moderate when rice husk was added. By adding 2% of rice husk ash by weight is the best of bricks properties which 6.20 N/mm² of compressive strength and 15.27% of water absorption giving grayish red color.

Figure 5. S.B.A. bricks v/s clay brick

In (fig.5) adding sugarcane baggage, results less compressive strength. The porosity was moderate when sugarcane baggage was added. By adding 2% of sugarcane baggage by weight is the best of bricks properties which 3.79N/mm² of compressive strength, and 11.24% of water absorption giving deep red color.

4. Results and discussion

Table no. 3 shows the comparison of all the observed value after testing the simple clay bricks and bricks with additives.

Table 3. Comparison between properties of all bricks

Test	fly ash bricks	Orange peel bricks	Coconut waste bricks	R.H.A. Bricks	S.B.A. bricks	Simple clay bricks
Absorption Test	9.11%	17%	13%	15.27%	11.24%	20%
Crushing strength test.	9.61 N/mm ²	4.25 N/mm ²	4.65 N/mm ²	6.2 N/mm ²	3.79 N/mm ²	6.9 N/mm ²
Hardness test.	No Appearance	No Appearance	No Appearance	No Appearance	No Appearance	No Appearance
Shape and size.	Rectangular with sharp edges (230x110x70)mm	Rectangular with sharp edges (224x120x76)mm	Rectangular with sharp edges (220x120x70)mm	Rectangular with sharp edges 228x114x76 mm	Rectangular with sharp edges (230x115x75)mm	Rectangular with sharp edges (215x100x70)mm
Color test.	Copper reddish	Chocolate brown red	Brownish red	Grayish red	Deep red	Bright red
Soundness test.	Clear metallic sound and brick did not break	Heavy sound and brick did not break	Clear metallic sound and brick did not break	Clear metallic sound and brick did not break	Dull sound and brick did not break	Clear metallic sound and brick did not break
Structure of brick.	Homogeneous	Homogeneous	Homogeneous	Homogeneous	Homogeneous	Homogeneous
Efflorescence Test	No	No	No	No	No	No

5. Conclusion

Different additives are used in the clay bricks for a disposal of waste material in a better manner and the outcomes are given, the clay bricks with additives are light in weight and dimensions are more than the simple clay bricks. Lighter bricks are friendly in attain economy during construction. All bricks have metallic sound except bricks with additive of S.B.A. and orange peel. The compressive strength of fly ash is increases with respect to simple clay bricks but in case of other bricks (additive) compressive strength is low. But minimum crushing strength of bricks is 3.5 N/mm^2 . if bricks are less than 3.5 N/mm^2 then it is not use in construction work but crushing strength of all bricks are more than 3.5 N/mm^2 .

On the other parameter of bricks, water absorption ratio is decrease in all cases and its mean on the behalf of classification; these types of bricks are included in the classification of first class bricks. Therefore by additives the properties may vary accordingly and also changes in physical attributes are visible. Based on study, it can be conclude that fly ash bricks are good to conserving an ecological balance and bricks with (R.H.A. and coconut waste) additive good for the unimportant structure due to less compressive strength.

6. References

- [1].S.J. Malik, S.A. AnwarAgriculture in Pakistan and the Doha Development Agenda International Trade Centre (UNCTAD/WTO) (2006) Publication No. BAS/TS/PAK/E/06/01
- [2].Z. Nawaz, N. Ramzan, S. Nawaz, S. Naveed, M.B. KhanGreen processing of coal to liquid fuels: Pakistan's perspective Proc. Pak. Acad. Sci., 49 (2012), pp. 165-172
- [3].M.A.F. Choudry, Y. Nurgis, M. Sharif, A.A. Mahmood, H.N. Abbasi, CompositionTrace element contents and major ash constituents of thar coal, Pakistan Am. J. Sci. Res. (2010), pp. 92-102
- [4].A Report: Pakistan Coal Power Generation Potential Private Power and Infrastructure Board (2004)
- [5].X. Lingling, G. Wei, W. Tao, Y. Nanru Study on fired bricks with replacing clay by fly ash in high volume ratio Constr. Build. Mater., 19 (2005), pp. 243-247
- [6].I. Demir, M.S. Baspınar, M. OrhanUtilization of kraft pulp production residues in clay brick production Build. Environ., 40 (2005), pp. 1533-1537
- [7].A. Pappu, M. Saxena, S.R. AsolekarSolid wastes generation in India and their recycling potential in building materials Build. Environ., 42 (2007), pp. 2311-2320
- [8].E. Rimpel Industrial production of high-porosity brick materials Ziegelindust. Int. Ann., 48 (1996), pp. 174-207
- [9].I. DemirEffect of organic residues addition on the technological properties of clay bricks Waste Manage., 28 (2008), pp. 622-627
- [10].V. Bánhid, L. Gömze Improvement of insulation properties of conventional brick products Mater. Sci. Forum., 589 (2008), pp. 1-6