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Comparison of Clay Brick and Fly Ash Brick Available in Market

Pushpraj, Akash Agarwal, Ashhad Imam, Shakti Suryavanshi

M.Tech Student, Dept. of Civil, SHUATS, Allahabad, India

Abstract: ***In fast growing today's world development of new building materials and Processing & utilization of industrial waste is being given the top priority in the program of building research at a very high rate. This is important for achieving maximum disposal of wastes and conservation of scarce resources and materials. The bricks produced were about 29% lighter than clay bricks. The compressive strength of bricks manufactured from fly ash possessed higher than 20 MPa. This generally exceeds the best of load carrying clay bricks available by more than 25% and is several times better than acceptable commercially available common clay bricks. Other important characteristics of the fly ash bricks have been evaluated. The values of these characteristics for fly ash bricks are excellent and have exceeded those pertaining to clay bricks. Moreover, fly ash bricks have been produced with a naturally occurring reddish colour similar to that of normal clay bricks. The new bricks and process have been patented. This dissertation presents the results of testing and the advantages gained by this type of fly ash bricks over conventional clay bricks. In the present study, the effects of fly ash on the properties of bricks are studied and the behaviour of fly ash bricks is compared with conventional burnt clay bricks.***

Keywords: Compression, test, Compressive strength, Fly ash, Brick, Clay Brick

1. Introduction

Milled firewood ash generally identified as fly ash is a useful by-product from thermal power stations using milled coal as gas and has considerable pozzolonic activity. This source has been usefully operate for construct of milled fuel ash-lime bricks as a complement to regular burnt clay buildings bricks foremost to conservation of minerals and improvement in environment quality.

Pulverized firewood ash-lime bricks are founded from material involving of milled fuel ash in chief amount lime and increased as a mechanism. milled firewood ash-lime bricks are usually affected by intergraded blending different raw materials are then mould into bricks and subjected to curative cycle at diverse temperatures and pressure. On incident as and when necessary crushed base firewood ash or sand is also utilized in the work of the raw material to control water absorption in the final product. Milled firewood ash reacts with Crushed base firewood ash or sandy is also utilized in the work as a coarsely lime in occurrence of dampness from a calcium hydrate which is a ring binder material. Thus milled firewood ash – lime in occurrence of dampness form calcium – silicate hydrate which is binder material.

Thus milled firewood ash – lime brick is a chemically wrecked bricks. These bricks are appropriate for use in masonry construction now like common burnt clay bricks. Making of milled firewood ash-lime bricks has previously ongoing in the country and it is expected that this normal would support construction and use on mass scale. This stand lays down the essential requirements of milled firewood ash bricks so as to attain consistency in the construction of such bricks.

In the near situation in the construction industry, use of economic and environmental friendly material is of a great concern. One of the main ingredients used is cement. It is experimented as of different reading that the temperature emitted from cement account to a larger percentage in universal warming. Cement industry report to a larger emission of CO2 and they also use lofty level of energy resources in the construction of cement.

In order to minimize these effects, substitution of cement with some pozzolanic material such like fly ash, can have an improving effect against these harmful factors. Use of fly ash like a raw matter for the construction of building bricks is not only workable different to clay but also a explanation to hard and costly ravage disposal difficulty Population situation comes toward India by means of growing industries. The rich efforts of industry guide to build up India.

Fly ash and with few other wastes The conventional method of bricks making has caused serious environmental contamination represented by the enormous emissions of green house gases (GHG) resulted in unusual climate changes as smog, acid rain and global warming. Furthermore, energy as fuel and electricity showed a drastic consumption during the traditional manufacturing of bricks led to highly economical expenditures. As a result, vast forests are in current deforestation in order to utilize their woods and trees as source of energy in the firing stage of bricks production. Hence, recycling the wastes in the bricks production appears to be viable solution not only to environmental pollution but also economical option to design of green building. However, the chronicle problem of (GHG) and energy consumption has not yet been tackled properly as most of the previous works were mainly focused on recycling the wastes traditionally in the bricks. Several researches addressed the amount of (GHG) emission and their impacts on the context as well as the energy consumption .Few researches took the initiative in developing eco- friendly bricks in an economical environmental concern .Energy requirement for the developing countries in particular area get energy from coal. The disposal of the increasing amount of thermal waste from coalfired thermal power plant, this disposal of the thermal waste is called as *fly ash,* which is

composed of the non combustible mineral portion of coal consumed in a coal fuelled power plant. Fly ash is a powdery substance obtained from the dust collectors in the electrical power plant that use coal as a fuel. Fly ash bricks are made of lime, fly ash gypsum and sand. These can be extensively used in all building constructional activities similar to that of common burnt clay bricks. The fly ash bricks are comparatively lighter in weight and stronger than common clay bricks. Since fly ash is being accumulated as waste material in large quantity near thermal power plants and creating serious environmental pollution problems, its utilization as main raw material in the manufacture of bricks will not only create sample opportunities for its proper and useful disposal but also help in environmental pollution control to a greater extent in the surrounding areas of power plants. In view of superior quality and ecofriendly nature and government support.

2. Materials and Methods

Fly ash Fly ash is finely divided residue resulting from the combustion of powdered coal and transported by the flue gases and collected by electrostatic precipitator. ASTM broadly classifies fly ash into two classes Class F: Fly ash normally produced by burning anthracite or bituminous coal, usually has less than 5% CaO. Class F fly ash has pozzolanic properties only. Class C: Fly ash normally produced by burning lignite or sub-bituminous coal. Some class C fly ash may have CaO content in excess of 10%. In addition to pozzolanic properties, class C fly ash also possesses cementious properties. Fly ash used is of type class C with a specific gravity of 2.19**.**

Lime Lime is an important binding material in building construction. It is basically Calcium oxide (CaO) in natural association with magnesium oxide (MgO).Lime reacts with fly ash at ordinary temperature and forms a compound possessing cementitious properties. After reactions between lime and fly ash, calcium silicate hydrates are produced which are responsible for the high strength of the compound.

Fly ash Bricks

Gypsum Gypsum is a non- hydraulic binder occurring naturally as a soft crystalline rock or sand. Gypsum have a valuable properties like small bulk density, incombustibility, good sound absorbing capacity, good fire resistance, rapid drying and hardening with negligible shrinkage, superior surface finish, etc. In addition it can strengthen material or increase viscosity. It has a specific gravity of 2.31 grams per cubic centimeter. The density of gypsum powder is 2.8 to 3 grams per cubic centimeter.

Quarry dust It is residue taken from granite quarry. Due to excessive cost of transportation from natural sources locally available river sand is expensive. Also creates environmental problems of large-scale depletion of these sources. Use of river sand in construction becomes less attractive, a substitute or replacement product for concrete industry needs to be found. Whose continued use has started posing serious problems with respect to its availability, cost and environmental impact. In such a case the Quarry rock dust can be an economic alternative to the river sand. Usually, Quarry Rock Dust is used in large scale in the highways as a surface finishing material and also used for manufacturing of hollow blocks and lightweight concrete prefabricated Elements. After processing fine particles of size less than 4.75 mm is used in this work.

Water-binder ratio Water- binder ratio is calculated based on weight of fly ash and weight of lime to total weight of the brick. It also plays the significant role on the compressive strength of the brick. Considering the water content or water to binder ratio is an indirect approach to sizing the volume, thus ensuring greater durability in the mixture proportions for bricks made. Then water-binder ratio used for various proportions is given.

Manufacturing of Flyash bricks Required raw material like Fly ash, Gypsum, alum and stone crushing dust have to be mixed as per the ratio. The mixed product can be placed into automatic locking machine. This to be kept in moulds for manufacturing of automatic locking fly ash bricks. After the processing the bricks have to be dried after applying required water on the bricks. After two days drying the bricks can be sold.

Clay Bricks Building bricks are usually made of a mixture of clay and sand, which are mixed and molded in various ways, after which they are dried and burnt. Clay for brick making must develop proper plasticity and be capable of drying rapidly without excessive shrinkage, warping or cracking and of being burnt to desired texture and strength utilized to make bricks and blocks in one of several ways: (a) As substitute for a portion of the cement and/or aggregates in making concrete bricks and blocks. This is a common use nowadays in many countries.

Manufacturing of Clay Brick The four distinct stages of manufacturing the hand mould clay bricks are, (i) preparing the brick earth, (ii) moulding clay in rectangular blocks of uniform size (iii) drying in sun and air and (iv) burning them in brick kilns. Burning of the brick during manufacture governs the quality and properties of brick. The manufacturing process has six general phases: 1) mining and storage of raw materials, 2) preparing raw materials, 3) forming the brick, 4) drying, 5) firing and cooling and 6) de-hacking and storing finished products.

Compression Test The brick specimens are immersed in water for 24 hours. The frog of the brick is filled flush with 1:3 cement mortars and the specimen are stored in damp jute bag for 24 hours and then immersed in clean water for 24 hours. The specimen is placed in compression testing machine with 6 mm plywood on top and bottom of it to get uniform load on the specimen. Then load is applied axially at a uniform rate of 14 N/mm2. The crushing load is noted. Then the crushing strength is the ratio of crushing load to the area of brick loaded. Average of five specimens is taken as the crushing strength.

Figure: Compression strength test for Brick

3. Results and Discussions

Tests are applied to bricks

Compressive Strength test
Water Absorption test
Efflorescence

Compressive strength test The compressive strength of clay brick is three times greater than the normal fly ash brick. The minimum compressive strength of clay brick is 10-12N/mm².So as the flyash brick has compressive strength of 5-8 N/mm². Bricks to be used for different works should not have compressive strength less than as mentioned above. The universal testing machine is used for testing the compressive strength of bricks After the curing period gets over bricks are kept for testing. To test the specimens the bricks are placed in the calibrated Compression testing machine of capacity 3000 kN applied a load uniform at the rate of 2.9 kN/min. The load at failure is the maximum load at which specimen fails to produce any further increase in the indicator reading on the testing machine. In that three numbers of bricks were tested for each mix proportion. Each brick may give different strength. Hence, average of three bricks was taken

Water absorption Fly ash Bricks should not absorb water more than 12%. The bricks to be tested should be dried in an oven at a temperature of 105 to 115o C till attains constant weight cool the bricks to room temperature and weight (W1). Immerse completely dried and weighed W1 brick in clean water for 24 hrs at a temperature of 27±20 Degree Celsius. Remove the bricks and wipe out any traces of water and weigh immediately (W2).
Water absorption in % by weight = (W2 – W1/W1) x 100

The average of three bricks should be taken. Our bricks absorb 09.114 % of water only; it has less water absorption property

Efflorescence For this test, brick was placed vertically in water with one end immersed. The depth of immersion in water being 2.5 cm, then this whole arrangement should be kept in a warm-well-ventilated room temperature of 20-30 0 C until all evaporates. When the water in the dish is absorbed by the brick and surplus water evaporates. When the water is completely absorbed and evaporated place similar quantity of water in dish and allows it to absorb and evaporate as before. Examine the brick after this and find out the percentage of white spots to the surface area of brick. If any difference is observed because of presence of any salt deposit then the rating is reported as 'effloresced'. If no difference is noted, the rating is reported as 'not effloresced'. Percentage of white spot in the brick = Nill

S.N	Flay ash brick failure load kn	Flay ash brick average compressive strength N/ mm²
1	**180**	**6.80**
2	**190**	**7.18**
3	**200**	**7.56**
4	**90**	**3.40**
5	**95**	**3.95**
6	**110**	**4.15**
7	**155**	**5.86**
8	**150**	**5.67**
9	**210**	**7.93**
10	**170**	**6.42**
11	**160**	**6.04**
		Total value 64.96

S.N	Clay brick load	Clay brick average
1	200	7.56
2	260	9.28
3	220	8.31
4	420	17.87
5	264	16.25
		Total value 59.27

4. Conclusion

- The Compressive strength of Flyash bricks comes out to be 5.90 which is very low as compared to traditional clay bricks
- The water absorption of flyash bricks is 12% which is quite low as compared to clay bricks.
- No signs of efflorescence are visible on flyash bricks.
- The results of Compressive strength test shows that the flyash bricks, available in the market, do not comply with the strength requirements of bricks.
- Weight of flyash bricks is less than that of clay bricks which helps in reduction of dead load.
- The main outcome of this study is that the flyash bricks available in the market are not suitable for brickwork due to its low compressive strength, although its market rate is quite less than that of traditional clay bricks.

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