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COMPARATIVE STUDY OF FLY ASH BRICKS CONTAINING VERY FINE FLY ASH WITH STANDARD BRICKS

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ABSTRACT

The aim of present paper is fly ash is to suitable for bricks. Fly ash is a major by product of thermal power plant. It is a very fine material about 60-70% of which has a size below 0.075 mm. as it is formed by the burning of pulverized coal. The disposal of such fly ash is creating a serious problem as per its storage space and cost involved in its storage. At the same time there is a lot of pollution of the environment due to the fineness of the fly ash. The effects for its utilization for many gainful purposes have been made since late sixties of this century by various research institutions and public enterprises, but nothing spectacular has really been seen yet in commercial utilities. The present utilization of the fly ash is about 2% of the total generation. For the present development scenario of India, one of the thrust area is infrastructure where generation of power holds major share. It is estimated that at present about 125 million tonnes of fly ash is generated every year from 82 thermal power plants. This amount will reach 200 million tonnes very soon. The fly ash disposal is going to be a major problem in near future. Thus use of fly ash to Manufacturing bricks & the bricks are used for construction.

Keywords*: Fly ash, Lime, Gypsum, Sand,* **Set accelerator**

1 INTRODUCTION

Flyash can be used in combination with clay or with lime and sand to produce clay-flyash bricks and flyash-sand-lime bricks respectively. Production of clay flyash bricks was taken up by setting up a bricks kiln at Lehra Mohabat with the objective to produce 2 crore bricks. Machine moulded terracotta colour bricks cost Rs 2200 per 1000 no while hand moulded clay bricks place cost such bricks of first-class quality apart of the second-class and third-class bricks. The kiln has produced more than 1.8 core of first class clay-flyash bricks of which about 1.5 crore stand consumed by now. The cost of conventional to place. The variation is quite large and ranges from Rs 12000 to Rs 2200 per 1000 between Rs 1200 to Rs 1700 no bricks. at Lehra Mohabat or in Bathinda region, conventional clay bricks of first class quality are available at Rs 1300 per 1000 bricks. Taking into account the extra labour cost, power consumption, depreciation of machinery and interest charge on capital investment, the cost of clay flyash bricks being produced at Lehra Mohabat works out to be about Rs 1475 per 1000 no bricks. The cost of clay flyash bricks is thus higher by Rs 175 per 1000 no. The difference in cost of clay flyash bricks and conventional bricks will, however, vary from place to place. It has been noted that hand-mixing, hand-moulding of clay flaysh bricks is not possible. Proper mixing and blending of soil and flyash do not take place in hand mixing. However machine-mixing, hand-moulding is possible in these bricks. Clay-flyash bricks, when tested for various physical requirements laid in IS 13757-1993, give satisfactory results. These bricks need to be tested for compressive strength, water absorption and efflorescence. Actual results received on testing of these bricks show that compressive strength of these bricks is very high in comparison to the minimum strength requirement of 105 kg/sq cm prescribed for conventional burnt clay bricks. The water absorption and efflorescence results are also significantly better than those noted for the conventional bricks. Overall, the test results strongly plead for addition of flyash to clay for the manufacture of bricks. It has been observed that the buildings where clay flyash bricks have been used show lesser signs of dampness in comparison to those using conventional bricks. This is because of low porosity of these bricks. Comparison of machine-mixed, machine-moulding bricks with and without use of flyash was also made at the kiln site, keeping all other conditions same, to determine the effect of flyash on the strength of bricks. It was found

that that average compressive strength of clay flyash brick was 300 kg/cm while that of bricks without flyash was 190 kg/cm. This shows that addition of flyash to soil has a positive effect on the strength of bricks. A saving in fuel consumption has been noted while manufacturing clay flyash bricks. A flue consumption of 11 to 12 tonne of coal for production of one lakh clay-flyash bricks has been noted. This is 3 to 4 tonne lesser than the normal corresponding consumption of coal. This awing occurs due to presence of unburnt carbon in the fly ash. Percentage of un burnt carbon in fly ash may vary from place to place depending upon the efficiency of boilers of the thermal plant. In general, percentage of 6-12% unburnt carbon in flyash has been noted. The above saving, however, is for an unburnt carbon content of 3-6% only. The quality and calorific value of coal also determines its consumption. If good quality coal is used, the consumption may be further reduced.

2. PROPERTIES OF STD. BRICK & FLY ASH BRICK

The properties such as size, density. Crushing strength & water absorption capacity is given in the table below

IndIndex	Fly Ash Bricks	Red Burned Clay Bricks
Size (mm)	225 x 112.5x75	225 x 112.5x75
Dry Density (kg/Kgm³)	1570	1700
Cold Crushing	170	100
Strength (kg/cm)	300	190
Water Absrption (%)	13 to 15	20

Table no-1 Properties of std. brick & fly ash brick

3. PRODUCTION OF FLY ASH BRICKS: TECHNOLOGY OF MANUFACTURE

For production of good quality fly ash bricks, the quality of fly ash should be as under:

1) It should be either dry or moist {containing moisture not more than 5 %}

2) Visual appearance should be light steel grey or smoky grey in colour. The brownish or light yellowish grey colour fly ash is of inferior quality.

3) The fly ash should be very fine and can pass through 200 mesh sieve.

4) The unburnt carbon in fly ash with negligible fraction is tolerable for use

3.1 Manufacturing Method of fly ash

Raw Materials:

- Fly ash, Lime, Gypsum, Sand , Set accelerator mix of the ingredients is prepared by intimate mixing in suitable blender/mixer. Manual mixing will not give the desired results and hence hand mixing should be avoided. This mix ultimately gives comprehensive strength of 80 - 110 kg/cm^2 fly ash bricks. The water, bricks mix ratio be maintained between 6 to 7 %. This percentage changes with different mix raw material ratio. For moulding the bricks, many types of machine used. The stabilized bricks after moulding are further hardened by curing. The chemical changes occur in the bricks mix contents after moulding and heat of hydration is evolved. The rate of the effect of heat of hydration is mitigated and lowered with sufficient water in alkali solution is provided to accelerate pozzolanic reaction. There aredifferent process of curing Steam curing under high pressure {normally called autoclaved curing}, Steam curing under normal pressure, Hot water dip curing , Hot water air curing ,Water tank curing, Water curing in open air. The cost of curing in all the processes varies and minimum cost involvement is in "water curing in open air" and maximum cost involvement is in "autoclaved pressurised curing". Water is heated by low cost solar collector and further increase in temperature of water is made by covering the brick stack by black tarpaulin, after watering the stack by hot water from solar collector. Unpressurised hot water vapours are produced and the vapours are allowed to pass through the whole stacks between individual bricks. It accelerates the pozzolanic reaction & reduced final time.

types of machineries of indigenous make are available. They are :

1) Manual press (with power) 2) Vibro press (with power) 3) Hydraulic press, with or without vibration. 4) Screw press with or without wire cutting arrangement. 5) Tampering hand moulding machines

Selection of machinery depends on the bricks mix contents. For manufacturing fly ash lime stabilised bricks, the best suited machinery is virbo - press machine, which is an indigenous low cost machine and can be run by ordinary semiskilled worker. Its production capacity is 1000 bricks per shift and can be operated for two shifts without any operation/maintenance load. The maintenance cost is so low that it can be ignored. 15 lakh bricks can be produced for each machine in its life cycle

3.2 Curing

The stabilized bricks after moulding are further hardened by curing. The chemical changes occur in the bricks mix contents after moulding and heat of hydration is evolved. The rate of the effect of heat of hydration is mitigated and lowered with sufficient water in alkali solution is provided to accelerate pozzolanic reaction. There are different process of curing.

Steam curing under high pressure {normally called
autoclaved curing} Steam curing under normal pressure

Hot water air
curing Water
tank curing
Water curing
in open air.

The cost of curing in all the processes varies and minimum cost involvement is in "water curing in open air" and maximum cost involvement is in "autoclaved pressurised curing". Water is heated by low cost solar collector and further increase in temperature of water is made by covering the brick stack by black tarpaulin, after watering the stack by hot water from solar collector. Unpressurised hot water vapours are produced and the vapours are allowed to pass through the whole stacks between individual bricks. It accelerates the pozzolanic reaction and reduced final time water dip curing

3.3 Process of curing

Various raw materials of brick mix in desired proportion are blended intimately in dry or wet form. Water/brick-mix ratio is maintained as explained above. The wet brick-mix is fed into the machine mould. The vibration is given for a while and the mould is again fed. The striper head is pressed and vibration is given simultaneously for about 8 seconds. The mould is lifted and bricks produced pallet is removed and kept on the platform for air drying. Next day the bricks produced on the previous day are put in the stack. The stack is formed with care to see that curing water and air for drying reach to every brick. After 3 days the hot water from the solar collector in small quantity is poured on the fresh stack without any pressure. After 5 days the solar collector water is poured on the bricks stack for 2 times a day. The bricks in stack after each watering are immediately covered with black PVC tarpaulin, with a clear space of 250 mm form the layers of the bricks, inside the closed cover. The curing is continued for 15 days and the tarpaulin cover is removed. The bricks are then left in the stack for drying or heating the bricks stack. The bricks are ready for despatch after 22 days from the date of manufacture.

The comprehensive strength of the bricks produced from the brick-mix and the manufacturing process suggested here in, will be 80kg/cm^2 to100 kg/cm^2. It is observed that the fly ash bricks produced are found to be superior then that of conventional Red burnt clay bricks. The fly ash bricks confirm to the Indian standard IS : 3495 - 1966. The technical comparison of fly ash bricks verses red burnt clay bricks are given in Table More over they can also be used in the manufacture of mosaic tiles, plain tiles, prestressed roofing steps, thermal insulation bricks and road sub-grades. The fly ash can also be used as fertilizer to increase the production of crops particularly rice, wheat and cereals. But they cannot be used in any quantity for better production.

4. CONCLUSION

With the help of fly ash we can produce Compressed Bricks, Tiles, Blocks which are of accurate dimensions excellent surface finish. The fly ash bricks are eco-friendly, capable of using pollutant like hydrated lime, industrial waste materials, river silt and non-agricultural sandy soils etc. The fly ash bricks have excellent strength and can be stacked to the desired level. These are quick drying because of low moisture content. Fly ash bricks has Low power and coal consumption. These require less manpower. The heavy duty construction offers continuous working with low maintenance. Ultimate value addition with reduction in the cost of production is achieved

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