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Experimental Study on Chemically Synthesized Bricks

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ABSTRACT

All over the world billions of bricks are produced annually and the total bricks count will be massive, if we consider them based on numbers up to today. It has been estimated that nearly 65% of the bricks were used for residential purposes and remaining 35% were subjected to commercial, industrial and institutional constructions. The extensive application of these bricks in various sectors attracted technologists toward development of advanced and modified bricks. The manufacture of conventional bricks, they are generally heated to very high temperatures in kiln. Thus there arises a need for bricks that are manufactured at lower temperatures, which can be attained with help of Chemicals. This Research paper presents a novel experimental investigation, comprising material proportions, laboratory tests, focusing on the effects of chemicals. The compressive strength, water absorption test, Efflorescence, Hardness and soundness test were conducted to design low heated chemically synthesized bricks and the maximum strength is obtained after adding 100 grams of Zinc oxide and the value is found to be 9.59 N/mm^2.

KEY WORDS: Chemicals, Bricks, Mean Compressive strength, Zinc Oxide.

1. INTRODUCTION

Bricks are being used extensively in the construction of buildings over the century and they still remain to dominate among the commonly used constructional materials. The wide-ranging application in constructions and industrial assemblies are contributed by Clay bricks. Bricks are prepared by molding clay into required shapes and then by subsequently drying and burning operations. With the invention of extrusion and pressing machines, the quality of bricks has improved remarkably. But in countries like India molding by hand still remains the most prevalent way of manufacturing bricks because of their light weight and convenient size and shape bricks are preferred to stores at least where clay is found in large quantity than stone. In general, the word clay infers a usual earthly well grained substantial and it is capable of developing plasticity when certain boundless quantity of water is added and mixed. Compound investigation of clays exhibits them to be in essence silica, alumina and water, commonly with noticeable measures of iron, alkalis and high pH earth. The Vandal sand is a soft sandy clay stone with a porous or cellular structure. Admixture of red and yellow residual soils or surface products that have originated in situ from the atmosphere weathering of rocks, impregnated with iron, streaked red and yellow brown to black in color. It is easy to work and can be quarried with the aid of pick axe.

Review of Literature: Mbumbia (2000), studied that the laterite topsoil from the Etoug-Ebe zone is exceedingly soft and the soil sample comprises of fineness about 70% in total. These soil trial comprehends constituent part of various proportions from gravel down to mud and might be labelled as “sandy silt clay”. The stabilization process was carried out using heat and this technique was adopted in this research. Based on this procedure, it has been found that it is conceivable to have the products of resilient bricks even at very truncated temperatures of firing deprived of tallying any additives. The high compressive strength obtained from the lateritic soil bricks, are appropriate for the load level supported by usual unit floor lodgings. The outcomes publicized that the compressive strength of fired up laterite bricks are higher than the normal bricks even out with lime, cement or betonies. The key benefits are low-cost and the happenstance of ‘ethnic choice and practice’ of public of the study region.

Muntohar (2011), presented there is potential for the user of lime and RHA accumulating soil to that of material so mixed in the clay so even out will give rise to more enhancement in the water retaining capability of bricks and the compressed-stabilized soil encounters the necessity of Indonesian customary SNI 15-2074-2000 for bricks manufacturing. The accumulation of lime and RHA mixture will shrink the capacity of compacted alleviated soil to captivate the water. It furthermore achieved maximum strength at the proportion of 1:1.

Liu and Vipulanandan (2004), analyzed that, the recital of two epoxy- grounded coverings on drain graded earthen bricks was assessed using a grouping of attachment strength and acid resilient tests over the tenure of 3 years. The assessment outcomes exhibited that the closeness strength of the epoxy coverings hinge on the parched and damp apparent surroundings of the bricks during the phase of glaze. The bonding strength wide-ranging one which has the value from 0.2 MPa to 3 MPa. The covering layers excellently reduce water intake of bricks and the weight gain of the furnished clayey bricks were subjective by pinholes. The attachment strength and acid resilient weight increase of the confirmed layers has no relationship. An archetypal was established to envisage the weightiness variation in clay bricks so coated. A research laboratory analysis suite was established for appraising layers for naturalizing engineering and drain amenities. Two epoxy coverings having very analogous majority possessions were designated for this study and the bonding strength and element confrontation of coated clay bricks were considered and the bricks so made up of clay are coated and then subjected to testing in water and 3% of solution made up of sulfuric acid.

2. MATERIALS

Various materials used in the execution of the chemically synthesized bricks are Clayey Soil, Pond vandal sand, Zinc oxide (10%-20%), Benzene, sodium salicylate, Calcium Hypochlorite. Clayey Soil is a normal soil which is existing in red, black, brown, grey and other variety range of colors respectively. Locally available clayey soils are collected in the regions like Madurai, Tirunelveli and are tested in the laboratory for suitability. Vandal Sand or river sand, locally available passing through 2.36 mm sieve and having specific gravity of 2.65 is suitable for the manufacture of bricks.

Casting: Firstly, appropriate quantities of various materials according to the mix were weighed accurately in the weighing pan and transferred to the mixing tray. It was then mixed thoroughly with slow addition of water by hands and trowel to achieve a homogenous mixture. Subsequently, it was filled inside the bricks moulds, compaction and compression is accomplished by hand.

Fig.1. Mixing of brick materials

The brick mold is dismantled immediately after the casting and the brick is kept under direct sunlight for sun drying. Thereby, there is no need of water for curing. Sun dry curing is done until the surface is completely dry which may take a maximum of 5 days in total. The casted brick was then taken to the oven and is heated to a temperature of around 75°C for 6 hours.

Fig.2. Finished brick

3. RESULT AND DISCUSSION

The results are obtained from the tests carried out on the trial specimens casted, mixed with various proportions of Chemicals.

Compressive strength test: The brick sample is located in compression testing machine with even surfaces are straight. The load is pragmatic in the path towards the direction along the bricks depth. The brick specimen is kept at center before loading steel plate is used at the top of the specimen to apply the load at a rate of 14KN/min till the brick fails uniformly.

Fig.3. Compression testing of the specimen

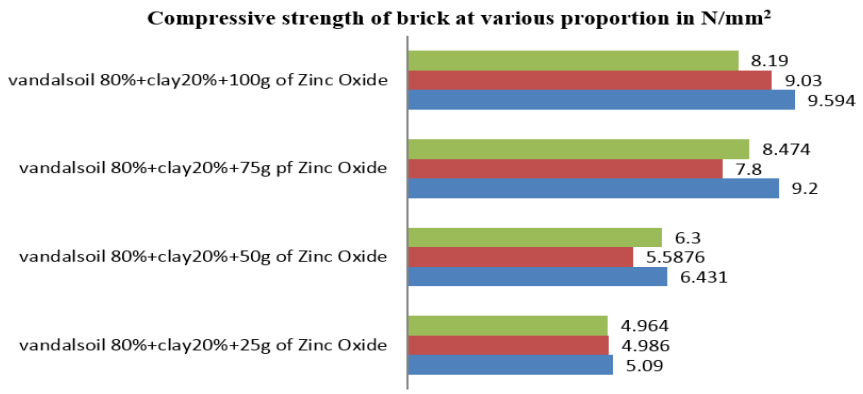

Fig.4. Compressive strength of bricks

The above graph shows that the compressive strength values of the bricks gets keep on increasing when the amount of Zinc Oxide is added to the proportion of the bricks. Thus it is found that along with the increase in the concentration of Zinc Oxide, the strength increases, however to make it economical, it is preferable to use the 3rd proportion, which uses 75 grams of Zinc Oxide.

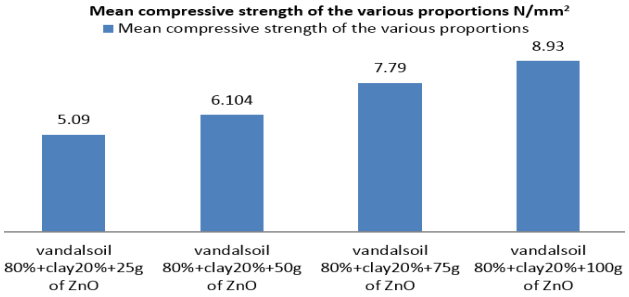

Fig.5. Mean compressive strength of bricks

The above charts represent the mean compressive strength of bricks at various proportions. In the chart first 25 g of Zinc Oxide added to the brick 3 cubes are prepared likewise 50 g, 75 g, and 100 g of Zinc Oxide added to the brick for every proportion 3 cubes are casted to find the accurate compressive strength of the brick

Water absorption test: The permissible water absorption percentage of normal brick should not be greater than 20%. In case of binder mixed brick, we have found the percentage of absorption to be 19.445% without applying any coat over it. So we can conclude that the chemically synthesised brick is well within the limit of water absorption. Fig.6, depicts the values of the water absorption test based on the various addition level of Zinc oxide at different proportions.

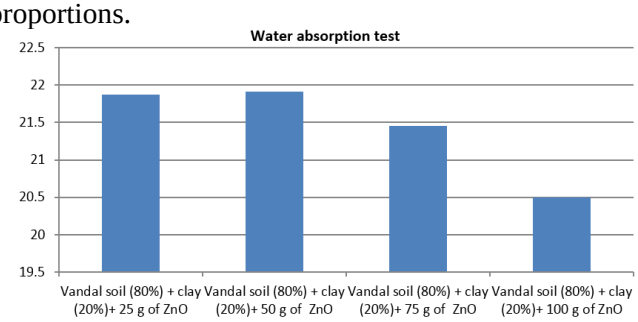

Fig.6. Water absorption results of brick

Figure.7. Water absorption test

Efflorescence test: All the bricks are subjected to efflorescence test and test results shows that the bricks have not shown any efflorescence on the surface. From the table.1, it is inferred that the efflorescence results were nil depicts the bricks are good enough with adequate strength based on the various addition level of Zinc oxide at different proportions.

Table.1. Effect of efflorescence

S.no	Proportion	Efflorescence
1	Vandal soil(80%) + clay (20%)+ 25 g of Zinc Oxide	Nil
2	Vandal soil (80%) + clay (20%) + 50 g of Zinc Oxide	Nil
3	Vandal soil (80%) + clay (20%)+ 75 g of Zinc Oxide	Nil
4	Vandal soil (80%) + clay (20%)+ 100 g of Zinc Oxide	Nil

Cost analysis: The cost of brick plays a major role in the manufacturing of bricks of tentative overview of the cost analysis is presented. It should be appreciated that the cost details adopted in the analysis are based on laboratory investigations. The cost structure at scaled –up factory level operations of conversion is expected to be at variance with the cost structure worked out.

Table.2. Cost Analysis for Chemical bricks (dap mixed bricks)

Description	Cost and quantity of raw materials
Weight of sand required per brick	=3.5kg
Cost of sand per brick (3.kg)	=Rs 1.33
Labor charges per brick	=Rs 0.5
Electricity charges and other expenditures	=Rs 0.25
Amount of Zinc Oxide required per brick	=75 gm grams/3.5kg
Rate of Zinc Oxide per ton	= Rs 9450
Cost of Zinc Oxide per brick	= Rs 0.75
Total cost per brick with Zinc Oxide	**= Rs 2.83**

Table.3 Cost Analysis for Normal Bricks

Description	Cost and quantity of raw materials
Weight of sand required per brick	= 3.5kg
Cost of sand per brick (3.kg)	= Rs 1.33
Labour charges per brick	= Rs 0.5
Electricity charges and other expenditures	= Rs 0.25
Rate of heating per brick	= Rs 1.50
Total cost per brick	**= Rs 3.58**

4. CONCLUSION

Composition of clay, sand and Zinc Oxide has sufficed adequate amount of strength required for more than one storey building. Chemically Synthesized bricks does not result in any environmental and social impacts whereas there may be a chance in conventional and Cement based bricks. Chemically synthesized bricks are also free from heat of hydration and thus prevents the Earth from Global warming. This Eco-friendly and naturally available renewable material usage promotes Sustainable development. As, it involves only with locally and easily avaliable materials, it can help in Low cost housing for rural people. Having inherited all the above features, it is obviously that the chemically synthesized bricks are eco-friendly. Since, no extraordinary skills are required for process such as Mixing and preparation, there will be a considerable employment oppoturnities to rural people. The Maximum strength achieved is 9.59 N/mm^2 on addition of 100 gms of Zinc Oxide. Mere addition of 75 gms of Zinc Oxide will not cause harmess to the evnironment. A Single coat of paint or finish can reduce the water absorption further. Cost effective when soil is readily available.

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