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Experimental Investigation on Manufacture of Brick by Partially Replacing of Soil by Coconut Shell ASH

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Abstract- This study analyzed the influence of coconut shell ash (CSA) on the properties of burnt clay bricks. 2 to 10 % CSA was blended with the clay. The optimum amount of CSA to be added for the production of bricks was found to be 2%. Utilization of Coconut Shell will not only be cost effective and Eco friendly, but also resolve the issues related to shortage of conventional material and problem of disposal of waste material. The main purpose of this, rectifying the cost of materials by utilization of CSA at the same time attaining the properties of bricks and its strength.

Index Terms- coconut shell ash, Strength, production, conventional, Utilization rectifying

1.INTRODUCTION:

There is a wide range of material available for the construction industries. The choice and sustainability of a particular material depends largely on its availability, nature of project, individual preference, durability, proximity and economic consideration. Coconut is grown in more than 93 countries. India is the third largest, having cultivation in an area of about 1.78 million hectares for coconut production. Yearly output is close to 7562 million nuts with an average of 4248 nuts per hectare.

Coconut shell being a difficult and not easily degrade material if crushed to the size of sand can be a likely material to substitute sand. At present, coconut shell has also been burnt to produce charcoal and activated carbon for food and carbonated drinks and filtering mineral water use. The chemical composition of the coconut shell is similar to wood.

A healthy coconut tree will produce approximately 120 watermelon-sized husks and shells per year, each with a coconut imbedded inside. Thus, the coconut tree is a very abundant, renewable resource of energy. It contains 33.61% cellulose, 36.51% lignin, 29.27% and ash at 0.61%. In developing countries, where abundant coconut shell waste is discharged, these wastes can be used as potential material or replacement material in the construction industry. This will receive the dual advantage of reduction in the monetary value of construction material and also as a means of disposal of wastes.

1.1Availability of coconut shell:

S.No	Country	Coconut Production 2012 (metric Tonnes)	% of World Total
1.	Indonesia	18,000,000 t	30.0%
2.	Philippines	15,862,386 t	26.4%
3.	India	10,560,000 t	17.0%
4.	Brazil	2,888,532 t	4.8%
5.	Sri Lanka	2,000,000 t	3.3%

Source: FAOSTAT data, 2014 (last accessed by Top 5 of Anything: January 2014)

2. EXPERIMENTAL DETAILS:

2.1MATERIALS:

Red soil is a type of soil that develops in a warm, temperate, moist climate under deciduous or mixed forests and that have thin organic and organic-mineral layers overlying a yellowish-brown leached layer resting on an illuvial (see illuviation) red layer. Red soils generally derived from crystalline rock

Clay is a fine-grained natural rock or soil material that combines one or more clay minerals with traces of metal oxides and organic matter. ... Silts, which are fine-grained soils that do not include clay minerals, tend to have larger particle sizes than clays.

Coconut shell ash is agricultural waste. The waste is produced in abundance globally and poses risk to health. as well as environment. ... groups as reinforcement like fly ash, rice husk ash, bagasse ash that have been in Metal Matrix Composites.

2.2 Basic Characterization of Soil:

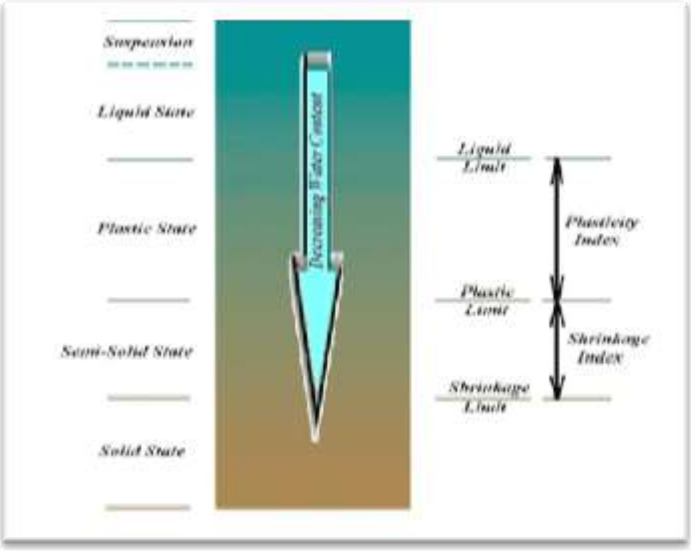
Soil Properties	Values
Natural moisture	12.2%
Liquid limit(LL)	39.3%
Plastic limit(PL)	19.2%
Plasticity index(PI)	20.1%
Linear shrinkage LS	10%
Specific gravity(G.S)	2.75
MDD	1.62MN/m3
OMC	18.2%
Particle size distribution	
Sand	36%
Clay	40.4%
Silt	21.6%
AASHTO classification	A-6 2

2.3Oxides Composition of CSA:

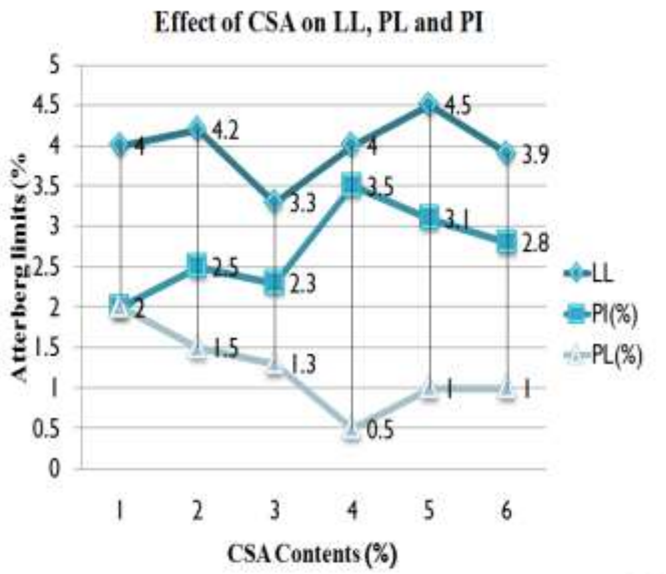
Oxides	Compositions
SiO_2	44.05
Al_2O_3	14.60
Fe_2O_3	12.40
CaO	4.57
MgO	14.20
MnO	0.22
Na_2O	0.45
K_2O	0.52
ZnO	0.3
LOI	8.69

3. EXPERIMENTAL PROCEDURE:

3.1ATTERBERG'S LIMIT TESTS:



3.2.Effect of CSA on Liquid Limit, Plastic Limit and Plasticity Index:



4. BRICKS PRODUCTION

The Different percentages of CSA (0, 2, 4, 6, 8 and 10 of dry weight of soil) were thoroughly mixed dry according to their proportion by weight. The required amount of water approximately the optimum moisture content for each determined previously was added gradually and mixed thoroughly with shovel until a uniform homogenous mix was obtained.

The mould inner surface was oiled or lubricated and the soil put into 230mmX115mmX70mm mould in three layers, each layer compacted by receiving 27 blows from a rod, the surface leveled and smoothened with straight edge and trowel.

4.1. AVERAGE DENSITY OF BRICKS (MG/M3)

Density tests were conducted on the bricks produced after adding 0, 2, 4, 6, 8and 10% CSA in the soil samples respectively. Density of the bricks was measured by weighing the bricks dry and dividing by the volume of each brick. The volume of each brick was calculated approximately by taking the reduced lengths of the sides after firing. Three 230mmX115mmX70mm sized bricks were tested at each % of CSA and average is taking as the density of the brick at that level.

4.2. WATER ABSORPTION OF BRICKS (%).

Water absorption tests were conducted on bricks produced after adding 0, 2, 4, 6, 8 and 10% CSA in the samples. The water absorption of a brick is a measure of its porosity. Some degree of porosity is desirable but highly porous bricks may absorb and transmit too much water and thus may swell and shrink or may lack durability. Water absorption was measured by immersion of the bricks in cold water for 24 hours and expressing the water absorbed as a percentage of its dry weight. The water absorbed is given by the relation;

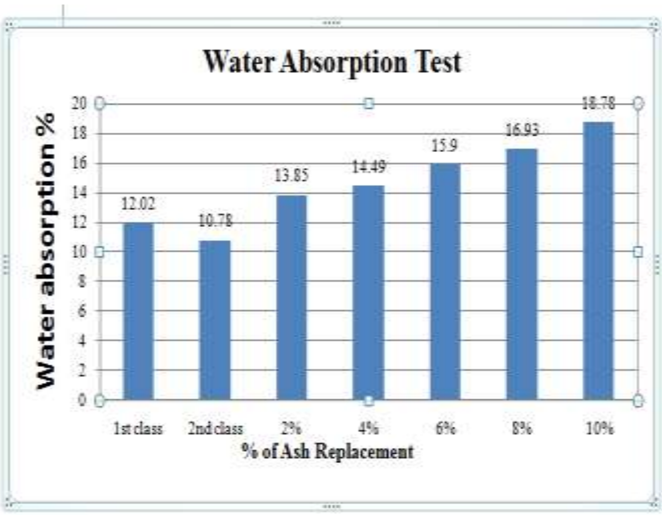
Water absorption capacity= $\frac{W_2 - W_1}{W_1} \times 100$

Take average value of the water absorption capacity of the three bricks.

For first class brick, the water absorption capacity should not be more than 20% by weight.

4.2.1. Effect of CSA on Water Absorption of Bricks

From the experiment conducted, water absorption decreases at 2%CSA after which it continue to increase with increase in %CSA. All the results conform to the BS specification of water absorption not to exceed 20% except for the 10% CSA which is 20.2%. Water absorption of as low as14.7% is obtained at 2%CSA addition adding.

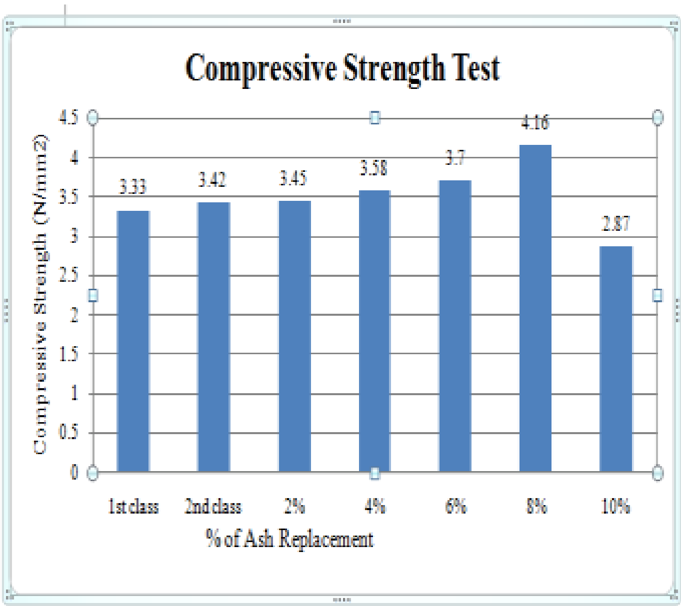


4.3. AVERAGE COMPRESSIVE STRENGTH OF BRICKS:

The compressive strength tests of the bricks were carried out after testing for water absorption and allowing drying at 500c for 24 hours.

4.3.1 Effect of CSA on Compressive Strength of Bricks.

The result showed increase in the compressive strength at 2%CSA after which the compressive strength continue to decrease with increase in %CSA content. The compressive strength is maximum at 10% CSA with a value of 4.16N/mm^2



5. CONCLUSION

Now we have investigated bricks experimentally and introduced a new composite brick with cheep and waste materials obtained variously in all places easily.

The compressive strength of bricks increases coconut shell ash proportion.

The bricks made under pressure have increased compressive strength according as the pressure was applied.

As long as the percentage coconut shell ash is unchanged, the change in soil percentages does not affect compressive strength significantly.

And according to cost also it is cheaper than normal 2nd class brick which is efficient to use and eco friendly material

Bricks are easy to transport.

By providing these bricks in field of construction can reduce the cost of construction and can been easily finishing the works also.

And no extra production layer should be laid because it is already to protect the bricks.

And finally we civil engineers taught more about the investigation projects and experimental works with a effective team work and data of material collections also which helps us to improve knowledge in field works and material properties.

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