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Compressive Strength Of Sandcrete Containing Rice Husk Ash Obtained From Different Calcinations Methods

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ABSTRACT: *This study investigates the compressive strength of sandcrete containing rice husk, ash(RHA) obtained from different calcinations methods namely local store, furnace and open burning.120 sandcrete cubes of dimension150x150x150 were produced using a constant mix ratio of 1:6with 0%5%, 10%and 15% RHA obtained from the different calcinations methods. The compressive strength on the cubes carried out on the 14, 21,28,50and90dayscuring period shows a decrease in strength with increasing RHA percentage in the mix. The maximum compressive strength of theRHAsandcretewasobtainedusing5%replacement value. The highest compressive strength of 3.62N/mm^2 obtained from the RHA sandcrete was a t90days using furnace calcinations and 5% replacement value. The compressive strength value at 90days for the various ashes using 5% replacement are (3.62,3.56,2.56)N/mm^2 with furnace, local store and open air calcinations respectively. At 28days, the compressive strength value using 5%RHA replacement are (3.58,2.22,2.11) N/mm^2 with furnace, local stove and open air calcinations respectively. Density result shows a eduction in density with increasing RHA% in the mix. RHA can be used satisfactorily as partial cement replacement in and crete with 5% replacement and furnacere commended forcommercials and crete production.*

KEYWORDS: *Pozzolan, sandcrete, block, ricehuskash, cement, compressive strength.*

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I. INTRODUCTION

The cost of erecting houses has become a thing of great concern mostly to the poor masses that still live Below the poverty line. This has directly rendered majority of the populace homeless, while others have taken to make shift homes. The cost of erecting houses ought to be in harmony with nature and using the concept of sustainable development involving the use of high performance economic friendly produced at reasonable cost without any environment hazard.

Sandcrete blocks comprise of naturals and, water and cement as binder. The cement as binder is one of the most expensive input in the production of sandcrete blocks. This has led to the production of sandcrete with low ordinary Portland Cement(OPC) content, which in variably will be affordable to people and with much profit.

The use of alternative echeap local material using the principle of sustainable development will greatly Enhance the production of sandcrete with the desired properties at low cost. It will also drastically reduce the cost of production and consequently the cost of construction work. These materials are termed pozzollans.

Pozzolans according ASTM (1) 618 are siliceous and aluminous materials which in itself posses little or cementitous properties but which will finely divided form in the presence of moisture react chemically with in a calcium hydroxide at ordinary room temperature to form compounds possessing cementitous properties.

The pozzolans provide a good substitute for ordinary Portland Cement (OPC) at a much lower cost with direct influence on the cost of housing. Example of pozzolans include rice huskash, palmoil bunch ash and cassava was teash etc.

In Nigeria, local milling of rice is accomplished with firewood ashe at source and assuch100%of the rice husk from the mill as a waste, it occupies 20–24percent of the rice produced although theratio differs by variety.

Rice husk ash a product of rice husk which burnt under controlled temperature has been found to be Rich in silica, the use of Rice Husk Ash as partial replacement of cement will provide an economic use of the by product and consequently produce cheap sandcrete blocks which will owerthe cost of building construction.

The compressive strength of sandcrete could be as high as 4.6N/mm^2 which is low as compared to concrete averaging 40N/mm^2.It is hence not used for load bearing columns but for wall sand foundations. When No suitable foundation material is available. Most sancrete blocks produced in Nigeria is way below the Recommended strength, this is because the ordinary Portland Cement(OPC) content in their production which is

The main cost factor. Thus the need for a research in to the suitability of organic waste as partial cement replacement.

II. METHODOLOGY

Rice husk ash were obtained locally in Nigeria. The source was Afikpo Local Government Area of Ebonyi State in South Eastern Nigeria. The rice husk were air dried and the Pozzolani cashes were obtained by burning rice husk with different calcinations method. The rice husk were burnt in the local store, by means of furnaceandopenburningtoobtainthedifferentricehuskash.Theresultantricehuskash(RHA)wassieved and large particles retained on the 600µmsieve were discovered while those passing the sieve were used for this work. No grinding or any special treatment to improve the quality at ash and enhance its pozzolanity was applied so that the simple processes could be easily replicated by the local community. The RHA had a bulk density of400kg/m^3 from local stove, 380kg/m^3 from open burning and 420kg/m^3 from furnace method calcinations. The gravity of the RHAwas2.10, from open burning, 2.32 from locals toveand2.22 from furnace. The fineness modulus of 3.541 from Local store, 3.35 from the furnace method and 3.283from the open burning method. Other materials used for the work include Dangote brand of ordinary Portland Cement(OPC) with a bulk densityof1650kg/m^3 and specificgravityof3.14.thefineaggregatewasfreefromdebrisandorganic materials with a bulk densityof1636kg/m^3, specific gravity of 2.62and fine modulusof3.438.

A simple form of pozzolani city test was carried out for the ash, it consists of mixing a given mass of the RHA with a given volume of Calcium Hydroxide solution ($Ca(OH_2)$ of known concentration and titrating samples of mixture against hydrochlo ricacid solution of known concentration at time intervals of 30,6090 and 120minutes for the various weight samples. The titre value was observed to reduce with time for the local stove method, open burning method and furnace method confirming the ash as a pozzolan that fixed more and more of The calcium hydroxide there by reducing the alkalinity of the mixture.

One Hundred and Twenty (120)concrete cubes of 150mmx150mm x150mm were produced with OPCandRHAusingaconstantmixratio1:6andwatercementratioof0.50ordinary Portland Cement was partially replaced with Rice Husk ash obtained from the three different calcinations methods local so the method, open burning method and furnace method.

The cement was partially replaced with Rice Husk Ash in percentages of 0%(control) 5%,10% and 15% from the different samples. Curing was done by sprinkling water on the cubes every morning and evening of the curing days.

III.RESULTSANDDISCUSSION

Pozzolanic Reactivity of RHA

The graph of concentration of $Ca(OH)_2$ against times how that the concentration of $Ca(OH)_2$ that reacted varies as the time increases with RHA from furnace calcinations method giving the highest while the open-air calcinations method gave the least result at time120minutes.

There sults shows that furnace calcinations method yielded a better pozzolana (RHA) than Pozzolana (RHA) produced from local store method, while RHA from open burning method shows least pozzani city.

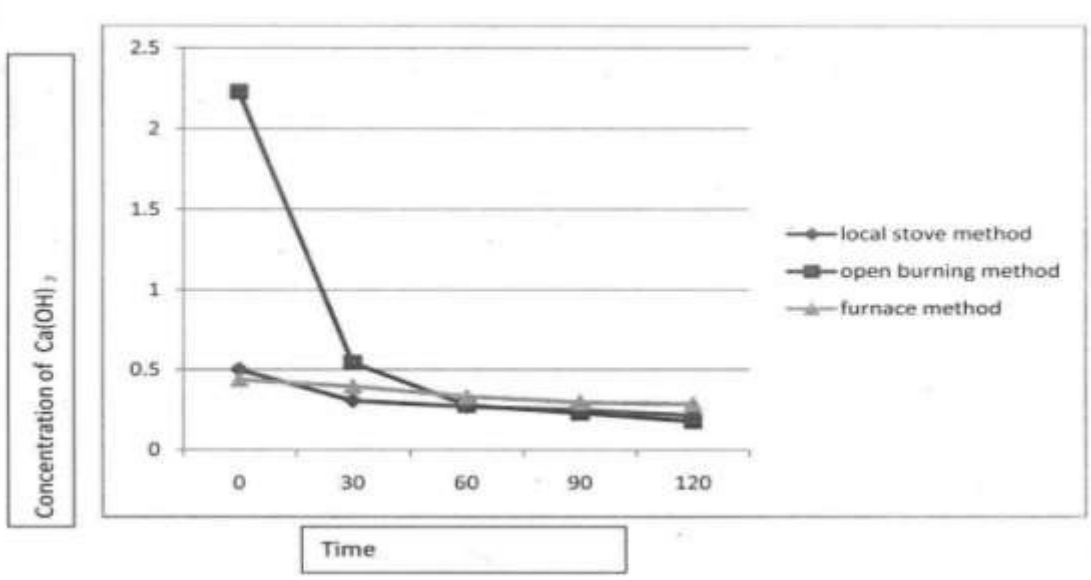

Fig.1 Titration graph showing concentration of Ca $(OH)_2$ against time in minutes.

Specific Gravity

The specific gravity of Otamiri River bed sand was found to be 2.62, the value obtained was within the limit for natural fine aggregates with value of specific gravity between 2.6and 2.7.Thespecific gravity of RHA from local store, furnace and open-air calcinations methodswerefoundtobe2.32,2.22and2.10.thevaluesof specific gravity of RHA obtained were less than the specific gravity of cement.

Compressive Strength

The variations of compressive strength with age and percentage replacement are presented inTable1-3

Table1 Compressive strength result of sandcrete cube containing Rice Husk Ash obtained from Open-air calcinations method at different curing ages.

Curing Age(DAYS)	**Compressive Strength**			
	0%	5%	10%	15%
14	2.56	1.13	0.56	0.44
21	2.89	1.49	0.62	0.67
28	3.73	2.11	1.40	0.96
50	4.09	2.13	1.58	1.18
90	4.11	2.56	1.67	1.60

Table2 CompressivestrengthofsandcretecubescontainingRiceHuskAshobtainedfromlocalstore calcinations method at different curing ages.

Curing Age(DAYS)	**Compressive Strength**			
	0%	5%	10%	15%
14	2.56	1.11	0.89	0.78
21	2.89	1.56	1.22	1.11
28	3.73	2.22	1.60	1.33
50	4.09	2.78	1.84	1.33
90	4.11	3.56	1.96	1.67

Table3 Compressive strength of sandcrete cubes containing Rice Husk Ash obtained from furnace calcinations method at different ages.

Curing Age(DAYS)	**Compressive Strength**			
	0%	5%	10%	15%
14	2.56	0.67	0.89	0.56
21	2.89	1.44	1.22	1.0
28	3.73	3.58	1.44	1.24
50	4.09	3.58	2.07	1.44
90	4.11	3.62	3.11	3.56

The compressive strength increases with age of curing. At 28 day hydration period, cubes made with 0% RHA/OPC gave 3.73N/mm^2,5%RHA/OPC from furnace calcinations method gave3.58N/mm^{2}which met the minimum required standard for sandcrete blocks (3.5N/mm^2). It was at 90days hydration period that the Compressive strength of sandcrete from furnace and local stove calcinations methods met the minimum standard of3.5N/mm^2 withcompressivestrength3.62N/mm^{2}and3.5N/mm^{2}for5%respectivelywhilesandcretefrom open burning still fell below the minimum standard.

IV.CONCLUSION

i) Compressive strength of sandcrete cubes decreases as the percentage replacement of Risk Husk Ash as the percentage replacement of Rice Husk Ash (RHA) increase.

ii) The highest compressive strength of 3.62N/mm^2 occurred at 90days curing period using 5% replacement of furnace ash and at 28days the highest strength was 3.58N/mm^{2}from5%replacement using furnace ash.

iii) Increase in RHA % in the mix produced sandcreteo flow density.

iv) Quality of RHA is greatly influenced by its method of production.

v) Rice Husk Ash (RHA) can be used as partial replacement to cement.

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