CONCRETE ARCHITECTURE FOR THE STRENGTH AND WORKABILITY TO EXAMINE THE COMPRESSIONS

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ABSTRACT
The study examined the compressive strength and workability of concrete using palm nut shell and palm nut fibre as a partial replacement for coarse mixture. Light-weight mixture obtained using, palm nut Shell (PKS) and palm nut fiber (PKF) severally as partial replacement for coarse mixture. Batching was done by volume using a water cement quantitative relation of one. 11 /2:3 and 1:2:4.

Index Terms— Compressive Strength, Palm Kernel Shell, and Palm Kernel Fiber, Workability, Light Weight Concrete,
INTRODUCTION

The concrete obtained of size 150 x 150 x 150mm³ was crushed using manual compression testing machine at 7, 14, 21, and 28 days respectively. The consequence of the specific gravity test using the water displacement method and the sieve analysis for the palm kernel shell is 2.59 & it has a curve with S-shape; whereas 4.70 and 0.265 are obtained for the coefficient of uniformity (Cu) and coefficient of curvature (Cc) respectively indicate that the aggregate is uniformly graded and can be utilized for the production of lightweight concrete. The values of the slump obtained for mix 1:1½:3 and Mix 1:2:4 for concrete produced with (PKS) and (PKF) is the 30mm and 38mm that indicates slump in a true manner. The concrete mix ratio PKS: PKF of 50:50 for 1:1½:3 and 1:2:4 has the compressive 12.29N/mm² and 10.38N/mm² strength after 28 days, which confirms lightweight concrete. The result obtained in the research, from both palm kernel shell and fiber could be used as a replacement for coarse aggregate in lightweight concrete.

The high demand for concrete in construction using normal weight aggregates such as; gravel and granite drastically reduces the natural stone deposits and this has damaged the environment thereby ecological imbalance (Short and Kinniburgh, 1978), (Alengaram, Jumaat, Mahmud, 2008). Hence, there is need to explore and to find out suitable replacement material to replace the coarse aggregate which could be utilized in the production of lightweight concrete. Palm kernel shell which is found cheap in large quantities as a byproduct in the yield of palm oil in some parts of the country Nigeria is investigated. This is the reason why the engineering properties of cracked palm kernel shell and fiber were chosen to be studied so as to ascertain its suitability as a substitute for gravel/granite in production of concrete for construction. Palm kernel shell and fiber shown in plate 1.0 are not common materials in the Nigeria Construction Industry but it has found its usefulness in countries such as Malaysia which is the second largest palm oil producing Country in the World and it produces more than half of World’s Palm Oil (Alangaram, Jumaat, Mahmud, 2008). The requirement of vegetable oil is constantly increasing and more cultivation of palm oil is forecast in the near future (Ramli, 2003). Simultaneously, the production of palm oil results on by-products such as Empty Fruits Bunches (EFB), Palm Kernel Shells, (PKS) or Oil Palm Shells (OPS), pericope, Palm Oil Mill Effluent (POME) and Palm Kernel Fiber (PKF). These are waste materials and stockpiling such wastes have caused storage problems in the
vicinity of the factories as large quantities of these wastes are created daily. Besides, these wastes are stockpiled in open areas, therefore it has a negative impact on the environment. One of the ways of disposing waste materials would be, by using them as a replacement for coarse aggregate in Building and Civil Engineering Construction Works. This will help to reduce cost of natural gravel/granite and also help to prevent the depletion of natural resources and to maintain ecological balance. Palm kernel fibers are derived from oil palm tree (Elaeis guineensis), (Akpe 1997, Ayanbadeto 1990) and economically valuable tree, and native to West African and widespread throughout the tropics. In Nigeria, the oil palm tree, and palm fiber are used largely as a source of fuel for domestic cooking in most areas where they occur. Palm kernel shell PKS is the hard endocarp of palm kernel that surrounds the palm seed. This is obtained as crushed pieces after threshing or crushing to remove the seed which is utilized in the production of palm kernel oil (Olutoge, 1995). PKS is light and therefore ideal for substitution as aggregate in the production of lightweight concrete. Olutoge (1995) in his investigations into the physical properties of palm kernel shell found that its density be 740kg/m3. He reasoned that these materials possess properties which resembled those of lightweight concrete materials. Olanipekun (2006) investigated the properties of palm kernel shells (PKS) as coarse aggregate to concrete. The CCS were crushed and substituted for conventional coarse aggregates in gradation of 0%, 25%, 50%, 75% and 100%. Two mix ratio (1:1:2) and (1:2:4) were used respectively. He noted that the compressive strength of concrete decreased as the percentage of the shells increased in the two proportions. His results also indicated a 30% and 42% cost reduction in concrete produced from coconut shells and palm kernel shells when used as a substitute for the coconut shell were more suitable than palm kernel shells when used as a substitute for conventional aggregates in concrete production. Also attempts by Abdullah (2003), Okafor (1988), and Okpala (1990) to use PKS as coarse aggregates replacing normal granite aggregate traditionally used for concrete production. Ata et al, (2006) compared to the mechanical properties of palm kernel shell concrete with that of coconut shell concrete and reported the economy of using PKS as light weight aggregate. Generally, PKS consists of 60 – 90% particles in the range of 5 – 12.7mm (Okafor, 1988, Okala, 1990). The specific gravity of PKS between 1.17 and 1.37, while the maximum thickness of the casing was about 4mm. The density of PKSC varies in the range of 1,700 to 2050kg/m3 that depends on factors such as type of sand and PKS contents. Generally when the density of concrete is lower than 2000kg/dm3, it is categorized as LWC. The 28 day days cube compressive
strength of about 15 – 25Mpa has been reported by them. The present study aims to investigate the suitability of palm kernel shell PKS and palm kernel fibre PKS as replacement for coarse aggregates in the production reinforced concrete. Having gone through a brief examination of the background to this study it will be restated that this investigation will adopt a “waste to wealth” policy as the study materials presently have little or no economic value with disposal problem but will also ensure their suitability as a replacement for coarse aggregate in production of concrete and thus enhance their economic value. Plate 1. Palm Kernel Fibers Plate 2. Palm Kernel Shells

MATERIALS AND METHODS

The materials used include the following Sharp Sand: The sharp was source from market where they are supply in Auchi Edo State, Nigeria. The Sharp sand was sun dried to control the moisture content during usage to fit the requirements of BS 882 (1982). Palm Kernel Shells and Palm Kernel Fiber: These were obtained from the South Ibie community in Etsako West Local Government Edo State, Nigeria. The shell and fiber were put in a basket in batches and thoroughly flushed with water to remove impurities that could be a contaminant in concrete. They were sun dried and kept in waterproof paper bags. Granite: The granite (coarse aggregate) used for the study was of range 2mm to 19mm graded, it was sourced from a quarry on Iyuku Auchi suburb community Nigeria, Edo State. Cement: The cement used was the ordinary Portland Cement (Dangote) it was sourced from Auchi, Edo State Nigeria and met the demands of the British Standard Code (BS 12 of 1996).
There exists a high potential for the use of palm kernel shells as aggregates in the manufacture of Lightly reinforced concrete. PKSC batched by volume replacement or weight replacement of coarse aggregate with palm kernel shells show similar trends in the variation of density, workability and strength with increase in percentage replacement. Loss of strength, workability and density per increase in percentage replacement by PKS is higher for weight-batched concrete than for volume batched concrete. There are potential cost reductions in concrete production using palm kernel shells as partial replacement for crushed granite. Based on the results obtained, replacement of 8% crushed granite by palm kernel shell in volume-batched concrete can be used in reinforced concrete construction whereas replacement of 13% if crushed granite in weight batched concrete can be used in reinforced concrete construction. Palm kernel shell concrete batched by volume performed better than that batched by weight.

EFFECT OF BROWN COAL BY-PRODUCTS IN PLASTIC SHRINKAGE PROPERTY OF CONCRETE

The reduction in wetness of recent concrete leads to plastic shrinkage owing to tensile stress induced by capillary pressure. When the enduringness signs on the far side the capability of concrete, it cracks and this result in early stage of concrete is termed as plastic shrinkage of concrete. This becomes a heavy issue for big expanse members like slabs. The shrinkage of concrete under restrained conditions during the first stages can be characterized by
experiments. This study was aimed at examining the plastic shrinkage property of fly ash aggregate concrete incorporated with bottom ash as fine residue. Concrete mix with combination of fly ash aggregate with two hundredth and four-hundredth replacement of fine aggregate with bottom ash has been studied. The 2 hundredth replacement of bottom ash provides higher outcomes and better percentages like 400th of bottom ash at the side of ash combination create a stronger combination to avoid plastic shrinkage of concrete. Higher share incorporation of bottom ash shows delicate surface cracks in concrete attributable to plastic shrinkage.

PLASTIC shrinkage cracks are due to the rapid loss of water when they are still in the plastic state. The gap appears when the evaporation rate exceeds the rate of water bleeding to compensate it. The gap occurs when the high evaporation rate causes the concrete surface to dry out before it set. These cracks rarely affect the strength and durability of concrete and can be avoided by proper measures before placing the concrete. Any factor that delays setting of concrete will increase the chances of plastic shrinkage cracking. Other factors are high cementitious materials, high fines content, reduced water content, high concrete temperature and thinner sections. Here in this study, the fine and coarse aggregate concrete is replaced with bottom ash and fly ash aggregates. The bottom ash and fly ash are residues of power plant, which are dumped as waste and contributes to major environmental issues [1]. The government has imposed laws for compulsory use of power plant wastes as construction materials now a day. Works has been done using these materials as a possible substitute for concrete materials [2], [3], [4], [5]. Though many works has been performed to examine the strength and durability factors, the plastic shrinkage property has not been examined in detail so far [6], [7], [8], [9], [10]. The fly ash residue has found a major role as a replacement material in pre-cast units of bricks and blocks. Hence, it needs to be studied for plastic shrinkage property of concrete. When considered for structural replacement material or as a reinforced cement concrete, the crack study is an important one to avoid corrosion in rebar.

MATERIALS AND EXPERIMENTAL METHODS

Cement

Ordinary Portland 53 grade cement with specific gravity 3.15 was used as the binder. The initial and final setting was 110 minutes and 260 minutes respectively.
Fine Aggregates

River sand of specific gravity 2.6 and lignite based bottom ash of specific gravity 2.4 were introduced as fine residue. A stereo microscopic image of bottom ash taken at 20X zooming is shown in Fig. Black particles are illustrated as the carbon content in bottom ash. Bottom ash with less than 4% carbon content is taken for this study.

Fig: Bottom ash under microscope

Benefits

1. Plastic shrinkage is reduced by the addition of fly ash aggregates as a coarse aggregate replacement material in concrete.
2. The bottom ash to the concrete as fine aggregate up to 20% performs better plastic shrinkage property beyond which it develops cracks in the surface.
3. The 40% replacement of bottom ash as fine aggregate in concrete results in plastic shrinkage crack in minor level with maximum of 0.088 mm width of the crack and maximum length of 62 mm.
4. When fly ash aggregate coarse aggregate and 40% replacement of bottom ash as fine aggregate were used, no crack was discovered. This proves that fly ash aggregate helps arresting plastic shrinkage crack to some extent.
EFFEVT OF PARARTIAL REPLACEMENT OF CEMEVT BY ASH, RICE HUSK ASH
WITH USING STEEL FIBER IN CONCRETE

In the ancient period, construction employment was mostly carried out with the help of mudstone from industry. Fly ash is a byproduct of burned coal from power stations and rice husk ash is the byproduct of burned rice husk at higher temperature for paper plant artificial fibers are commonly used nowadays in order to improve the mechanical properties of concrete. Especially artificial (Polypropylene, polyester etc.,) nylon, glass, asbestos, carbon and steel fibers utilized in concrete caused good results to improve various concrete properties. Wide efforts are being conducted worldwide to utilize natural waste and byproduct as supplementary cementing materials to improve the properties of cement concrete. Rice husk ash (RHA) and fly ash (FA) with using Steel fiber is such materials. RHA is a byproduct of paddy industry. The Rice husk ash is a highly reactive pozzolanic material produced by controlled combustion of rice straw. The solfa syllable are finely divided produced by coal-fired powerhouse. Fly ash possesses pozzolonic properties almost like naturally occurring pozzolanic material. The careful experimental investigation is creating bent on study the result of partial replacement of cement by the fa, RHA with exploitation Steel fiber in concrete. in this paper started proportion from half-hour fa and 0.33 RHA mix along in concrete by replacement of cement , last proportion taken 15 August 1945 fa and 15 August 1945 RHA, with gradual increase of RHA by two.5% and simultaneously gradual decrease of fa by two.5% and to boost the strength of concrete steel fibers were value-added and fiber volume fraction was 0.33, 0.25%, 0.5%, 0.75% and 1.0% in volume basis in the proportion of 100% RHA and 200th fa. The aim of this research is to examine the effects of

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<th>SiO2</th>
<th>Al2O3</th>
<th>Fe2O3</th>
<th>CaO</th>
<th>MgO</th>
<th>LOI</th>
<th>SO3</th>
<th>K2O</th>
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<td>19.71</td>
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<td>62.91</td>
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<td>2.72</td>
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<tr>
<td>Fly ash</td>
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<td>25</td>
<td>6</td>
<td>20</td>
<td>3.71</td>
<td>3.0</td>
<td>1.71</td>
<td>0.80</td>
<td>0.96</td>
</tr>
<tr>
<td>Rice husk ash</td>
<td>78.21</td>
<td>(-SiO2+ Al2O3+ Fe2O3)</td>
<td>0.99</td>
<td>4.69</td>
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steel fibers on the workability, compressive strength, flexural enduringness, ripping tensile strengths, Acid resistant take a look at , sturdiness study of ash and rice husk ash in concrete.

Benefits

1. Compressive strength increases with the increase in the percentage of Fly ash and Rice Husk Ash up to replacement (22.5%FA and 7.5% RHA) of Cement in Concrete for different mix ratios.
2. The maximum 28 days split tensile strength was obtained with 22.5% fly ash 7.5% rice husk ash mix.
3. The maximum 28 days flexural strength was obtained again with 22.5% fly ash and 7.5% rice husk ash mix.
4. The percentage of water cement ratio is reliant on quantity of RHA used in concrete. Because RHA is an extremely porous material
5. The workability of concrete had been found to be decreased with increase RHA in concrete.
6. As the rice straw is burned out at 600º to 800º c. It is observed that the 80 % silica was produced due to this it gives an excellent thermal insulation.
7. Through Rice husk ash is harmful to human being and the cost of rice husk ash is zero and so we preferred RHA use in concrete as compare to silica fumes and it is likewise economical.
8. The workability of RHA concrete was found to lessen but the FA increase the workability of concrete.
9. Rice Husk Ash can be used with admixtures, plasticizers, and super plasticizers, for increasing the workability and durability of concrete with partial replacement of cement.
10. The mechanical properties in terms of flexural and tensile strength have been significantly improved with the addition of RHA.
11. The unit weight of concrete increased uniformly with the increase in fiber content and decreased with the growth of rice husk ash content.
12. The inclusion of steel fiber reduces the workability with increasing fiber content.
13. It is found that the addition of steel fibers into the concrete the small increase in compressive strength with increase in fiber content after 7 days, 14 days,28 days,56 days and 90 days of curing.
14. It is observed that the addition of steel fibers did not improve the compressive strength in concrete. Steel fibers have showed more significant effects on flexural and tensile strength at 0.75% by volume fractions.

15. Durability studies carried out in the investigation through acid attack test and chloride test with 1% H2SO4 and 3% NaCl revealed that 22.5%FA+7.5%RHA concrete is more durable in terms of durability factors than control concrete.

16. It is observed that the rice husk ash concrete will have higher life compared to control concrete.

EFFECT OF blast furnace dross POWDER ON COMPRESSIVE STRENGTH OF CONCRETE

The Ordinary portland cement (OPC) is one among the most ingredients used for the production of concrete. Unfortunately, production of cement involves emission of huge amounts of carbon-dioxide gas into the atmosphere, a significant contributor for green house impact and also the heating, thus it is inevitable either to look for an additional material or partially replace it by another material. The hunt for any such material, which can be used as another or as a supplement for cement should lead to global property development and lowest potential environmental impact. Concrete property are often maintained with advanced mineral admixtures such as blast furnace slag powder as partial replacement of cement five to half-hour. Compressive strength of furnace slag concrete with totally different dosage of slag was studied as a partial replacement of cement. From the experimental investigations, have been determined, the optimum replacement of Ground coarse furnace scum Powder to cement without ever-changing abundant the compressive strength is V-J Day.
This study was carried out to obtain the results, tests conducted on blast furnace slag powder modified cement concrete mix, in order to ascertain the influence of blast furnace slag powder on the characteristics strength of concrete. The variation of compressive strength of concrete mix with different proportion of blast furnace slag powder as partial replacement of cement is shown in fig.1 and fig.2. It was observed that 7 days, 14 days and 28 days compressive strength on 30% replacement of cement reduces about 30% that is from 21.03 N/mm² to 15.40 N/mm², 23.70 N/mm² to 16.74 N/mm² and 26.9 N/mm² to 18.81 N/mm² respectively. From study it can be concluded that as the % of BFSP increase, the strength tends to decrease.
The results obtained from compressive strength tests conducted on concrete containing OPC and various percentage of blast furnace slag powder is comparable to that of concrete mix without slag powder. On replacement of OPC with 15% blast furnace slag powder the depreciation in 28day compressive strength is being near about 5%.

CONCLUSION

Reference


