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Strength Positives Between Gravel And Palm Kernel Shell In Concrete Formation.

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----------ABSTRACT----------
This work compares the strength of palm kernel shell concrete and natural aggregate (bush gravel) with equal weight of concrete of similar mix. Concrete cubes were cast using mix ratio 1:2:4 for natural aggregate, palm kernel and their strength compared with relative normal concrete. Palm kernel was used as replacement for coarse aggregate with varying percentages to ascertain the effect on overall strength. The more the quantity of palm kernel shell, the more the loss in the strength of the concrete. However, a low percentage of palm kernel shell in the volume of concrete serves as perfect alternative coarse aggregate for volume even as it helps in reducing the challenges of environmental pollution.
KEYWORDS;-*Palm Kernel Shell, Gravel, Concrete, Strength and Structure.*

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I. INTRODUCTION

The rate of development over the years from Stone Age to the modern age has necessitated the importance of housing to humans, as population increases, the need for a bigger and better shelter becomes paramount. Moreover, there are evolving needs for building constructions, reservoirs, roads, bridges and so on. Concrete has been a major component in the construction industry and it is almost impossible to erect cheap, but effective, structure without concrete either in little quantity or high volume. However, this daily depletion in the quantity of available concrete will create an eventual scarcity if its regular use is not reduced. The performance of the aggregates and other constituents are very important to avoid structural failure which has become rampant in the regular collapse of building structures.

The high cost of concrete ingredients has been alarming over the years (Barry, 2010), and there is the need for alternatives so that shelter can be available for the ever growing masses This is evident in the daily report of shortages in housing needs across the world. About 60 to 70 percent of the total volume of concrete used in structures is occupied by aggregate; it is expected for aggregate to have profound influence on the concrete properties and its general performance (Muhit, et al 2015). Furthermore, in developed countries, the construction industries have identified the use of waste natural materials as the potential alternative to conventional aggregates by reducing the size of structural members to achieve cheaper construction. However, it is important that regardless of the different components that could be used as coarse aggregates, there is the need to ensure aggregates are of good quality and able to perform effectively and efficiently. There have been several cases of failed structures associated with poor mix ratio as well as low quality materials used, poor soil investigation, unsuitable foundation and poor workmanship. It will be wrong to trade durability and strength for supposed economic gain.

Palm fruits are evergreen seeds from straight grained and non-flowering softwood trees with needle-like leaves. The fruits have fleshy covers which produce the palm oil used in baking, cooking and the likes. A whitish edible substance is encased by a brown coloured shell which is also covered by a spongy throw-out shaft produces the oil. However, this shaft is usually a dispensed waste dotting the landscape and equally causing environmental pollutions. And, as postulated by Fakuyi (2016), waste were previously seen as enormous but worthless and people were unaware that these can serve as raw materials for wealth creation in form of replacement and or addition for building materials. Apart from the fact that the use of these 'wastes' will serve as an environmental management system, it will also contribute positively to the economic growth of the society (Osuntuyi et al, 2016).

The palm tree produce oil palm fruits. Palm kernel shell is one of the wastes produced during palm oil processing (Payam, et al 2011). The palm tree grows in regions where the temperature is very hot and it rains a

lot, such as applicable in Nigeria, Ghana and Malaysia to produce palm fruits. Oil palm fruit consists of two major parts; the pulp that is a yellowish fruit and when crushed produces palm oil and palm kernel which is bounded in the shell of the seed when kernel is crushed, it produces palm kernel oil while Local Gravel (Bush gravel) is a natural occurring coarse aggregate found in Akure Metropolis. Bush gravel contains 7.4% impurities, 45.6% fine aggregate, 14.8 % coarse aggregate and 32.2% boulders. The compressive strength of concrete made from natural aggregates (Bush gravel) in Oda Town (Akure) is compared with concrete from Palm Kernel Shell so as to evaluate the feasibility of using the palm kernel shell as an effective alternative in general construction industry.

II. MATERIALS AND METHODOLOGY:

The materials used for this research includes: Cement, Fine Aggregate, Coarse Aggregate (Palm Kernel Shell and Gravel) and Water

CEMENT- This is a powdery substance that serves as binder, it is a material with both cohesive and adhesive properties that binds aggregates together. Cement is an additive that equally adds to the strength of the constituents when thoroughly mixed together at the right consistency and plasticity.

AGGREGATES - These are the inert materials which combine with cement paste by developing a mechanical bond to form a hard mass. It may be fine grained (particles passing through a 4.75mm sieve) or coarse grained which are particles greater than 4.75mm but not more than 37.5mm (Chen, 2003). Fine aggregates are sand, silt and sand-dust etc while the coarse aggregates are gravels, granite, stones (washed and unwashed) and so on. For this research, the coarse aggregate used are Palm Kernel Shell and Natural Aggregate (Bush gravel).

WATER - This is a solvent which helps in the chemical reaction known as hydration when added to sand, and cement to produce a paste-like mortar. It facilitates mixing, placing and compacting of fresh concrete. Water is used in washing dirty aggregate and also used in curing concrete, therefore, portable water is used in concreting because the impurities from non-potable water will effectively reduce the potency, binding abilities and cohesiveness of the mixed mortal or concrete at whatever ratio.

METHODOLOGY

The Natural aggregates were used in two forms (washed and unwashed state). The high amount of impurities necessitated its washing in order to determine its most potent state. The palm Kernel Shell used was crushed and size ranging from 4.75 to 20mm were used for the concrete.

A total of 24 cubes were casted with the following conditions:

i. 4 Cubes with Granite as coarse aggregate. This mixture will serve as the control.
ii. 4 cubes with natural gravel (unwashed state).
iii. 4 cubes with Natural gravel (washed state).
iv. 4 cubes with palm kernel shell as the only coarse aggregate
v. 4 cubes with palm kernel shell in 80% and 20% granite
vi. 4 cubes with palm kernel shell in 60% and 40% granite.

The slump test was carried out in accordance with BS EN 12350-2 for accessing the consistency of all the samples while water cement ratio of 0.6 was adopted. Each sample of cubes was crushed in 7, 14, 21 and 28 days respectively to determine their compressive strength. The fine aggregates, cement and water used for all the mix types were from the same pool having the same quality. Since any deviation from this aforementioned could negatively or positively impact on any of the mix types.

III. RESULTS AND DISCUSSIONS

From Table 1.0, it shows that the soil is depleted of the element having no zinc and Sodium.

Table 1.0:Chemical Composition of Natural Aggregate Location

Chemical Analysis	Oda (Akure)	Chemical Analysis	Oda (Akure)
Ks	38	pH	5.8
Na	0	Alkanity *100	2.15
Zn	0	Acidity *100	1.6
Mg	36	Conductvity *100	8.3
Fe	78	% Organic Matter	0.45
Cu	0	Tw	24
Pb	140	Tur (NTU)	22
Mn	0	Colour (pcu)	50
NO_3	780		
SO_4	105		
Cl-	180		

From Table 1.1 below, the high amount of fine aggregate in its components, coupled with impurities increases the quantity of cement needed to obtain a higher strength.

Table 1.1: Physical Composition of Coarse Aggregate (Bush Gravel)

CONSTITUENTS	%
Specific Gravity	2.67
Bulk Density (Kg/m^3)	2480
Absorption (%)	0.37
Impurities (%)	7.4
Fine Aggregates (%)	45.6
Coarse Aggregate (%)	14.8
Boulders (%)	32.2

From Figure 1.2 below, the control has a compressive strength of 13.3N/mm^2 while the Washed Natural aggregate has a closer strength of 12.3N/mm^2.

It was observed that the palm kernel shell has reduced strength as the quantity of palm kernel shell in the concrete increases. Its flaky shape which reduced the bonding between fine aggregates and cement matrix (Mirza, 2019). This is an indication that the higher the palm kernel shell in the concrete, the lower the compressive strength. There is need to reduce the quantity of palm kernel shell in concrete to achieve higher strength as observed since the strength reduces with higher composition of palm kernel shell.

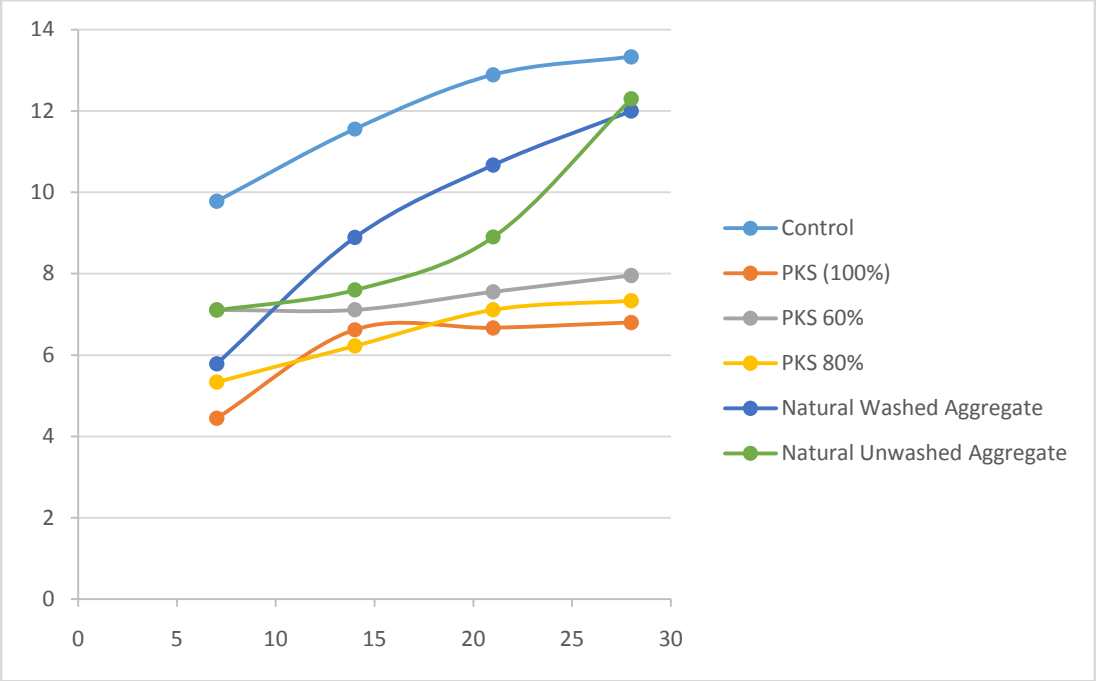

Figure 1.2: Compressive strength of palm kernel shell and natural aggregates in washed and unwashed form.

The washed natural aggregate shows high compressive strength at the 28th day, which makes it feasible replacement for normal concrete where granite is used as coarse aggregate.
There is rapid increase in strength from 7days to 28days when natural aggregate is used.

IV. CONCLUSION AND RECOMMENDATION

There is an increase in the strength of concrete with respect to reduction in percentage of palm kernel shell. Though, there is no much change in the weight of the mould as compared to the individual strength at the end of 28 days. The effect of washing on the local aggregate is more glaring in the early period. The unwashed aggregate tends to attain considerable strength at 28 days upward. The local aggregate is a better replacement compared to the palm kernel shell aggregate that has strength less than 8N/mm^2. There is the need for improvement and further study on palm kernel shell in order to serve as a replacement for coarse aggregate.

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