

Compressive Strength of Sandcrete Interlocking Stone Using Dates Seed (Ds) As Partial Replacement for Quarry Dust

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Abstract

The research investigated the use of date's seed as partial replacement in sandcrete interlocking stone. Due to high cost of conventional construction materials in the country, the research reduced the cost of those conventional materials. Dates seed as an agricultural waste that are readily available. Some numbers of interlocking stones were produced by partial replacement in percentages from 5%, 10%, 15% and 20%. The interlocking stones without date's seed as aggregate was made as a control. The interlocking stones were produced by batching and the mix design was ratio 100:0, 95:5, 90:10, 85:15 and 80:20 the mould was I shape mould. The compressive strength was determined and workability was determined. The ratio of the interlocking stone were 1: 4. Total of sixty (60) interlocking stones were produced. The curing days was 7, 14, 21 and 28 days respectively and the compressive strength of the interlocking stone was determined. The compressive strength test shows that at 5% ratio at 28 days the strength of 17.60N/mm² was achieved at 1:4 (95:5) concrete mix ratio. The value of the compressive strength at 28 days for partial replacement in DS in concrete at 5% interlocking stone as partial replacement in aggregate can be used for walkway and compound landscaping.

Keywords: *Compressive Strength, Date Seed, Partial Replacement and Sandcrete*

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I. INTRODUCTION

In many countries sandcrete interlocking stones are used as walkways, construction of roads and car parks. Infrastructures which normally beautifies the surroundings. The use of sandcrete interlocking stones can last longer than expected and it can be easily replaced in case there are damages in any of the members of the interlocking stones.

Olufasiyo (2013) in Banikole and Olatunji (2018) stated that sandcrete interlocking stones has a higher initial cost than asphalt but lasts longer and has lower maintenance. Interlocking stones are usually used in a water logged area, it used where the soil of the roads is not firmed enough to withstand the pressure on the road. Interlocking. Interlocking are produced from both fine and coarse aggregates with ratio 1:4. In this research dates seed was used as partial replacement for quarry dust which can reduced cost of the aggregate and to add strength to the interlocking stone. The availability of the date seeds to be used, was source from in Nigeria.

Interlocking stone allow all run- off to pass through surface rather than running off it as would be the case of asphalt (Ojuri 2012).

The method of interlocking stone pavement dated back to the roads of the Roman Empire. They were constructed with tightly – fitted stone paving units set on a compacted aggregate base (ICPI 2006). Vila et. al (2017), mentioned that in In Nigeria, sandcrete interlocking stones are part of the conventional material used in construction. The use of date seeds as partial replacement for fine aggregate is imperative because it will reduce the cost of production of interlocking stone, without loss of strength. The date seeds remain as waste in environment and can be used as materials for construction of building when used as fine aggregate. Interlocking stones are precast units that conforms to the surface layer of articulated pavement.

II. LITERATURE REVIEW

Research has gone into replacement of both fine and coarse aggregate in production of concrete and mortar, due to non-availability of the aggregate in some parts of the country in Nigeria. This research will focus in quarry aggregate replacement. Mortar is one the most important conventional materials that builders and civil

engineers depend on. Quarry aggregates are from rock that gives quality to the mortar and concrete in producing sandcrete interlocking stones.

In line with the method of construction of paving stone there are three types of paving to be achieved vertical, rotational and horizontal interlock (ICPC 2006).

Design consideration

There are some factors to be considered before a paving stone can be done, the thickness and materials to be used, which are as follows: environment, traffic, subgrade soil strength and pavement materials.

Traffic: When a lot of traffic is on a pavement, it receives wear or damage. The amount of damage depends on the weight of the vehicles and the number of expected passes over a given period of time. The period of time, or design life span of a paving stone is usually 20 years before replacement.

Soil Subgrade: the strength of the soil subgrade has greatest effect on determining the total thickness of the paving stones concrete pavement. Where feasible, resilient modulus (M_1), R- value or soaked califormia bearing Ratio, (CBR) laboratory tests should be conducted on the typical subgrade soil to evaluate its strength.

III. METHOD AND MATERIALS

3.1 METHOD

This research was done by batching in volume. The mixes was 1: 4 (cement; fine sand; date seed). Water cement ratio of 0.60 was adopted for 1:4 mixes. The mixes were properly prepared in a concrete mixing machine for a period of 8 to 10 minutes and the mortar was placed into paving stone of plastic I shape mould. The paving stones were produced using date seed as partial replacement at 5 – 20% respectively. The river sand to use was from Ogun River from Ogun State and Portland cement was Dangote cement. The compressive strength was investigated after curing for 7, 14, 21 and 28days. Total of sixty (60) interlocking stones were produced, the mix design mix ratio. Compressive strength of paving stones were tested in accordance to BS 1881 (1996) with the use of matest digital compression machine.

3.2 MATERIALS

The following materials were used for the experiment.

1. **Dates seed (SD):** were collected from consumer from locations in both Lagos State and Ogun State Nigeria it is seed that people eat.
2. **Cement:** Ordinary Portland Cement (OPC) the cement was locally available in Nigeria (Dangote cement Brand) in 50kg was used for the experiment which was from obtained from Ilaro Ogun Sate Nigeria.
3. **Water:** Portable water from Civil Engineering Laboratory of the Federal Polytechnic, Ilaro Ogun State Nigeria was used for the experiment as it was clean and free from impurities.
4. **Coarse Aggregate (Granite):** Crushed granite stone was obtained crushed Quarry along Lagos/Ibadan express way Ogun State Nigeria.



Fig 1 Dates seed



Fig 2 Cement on weigh scale

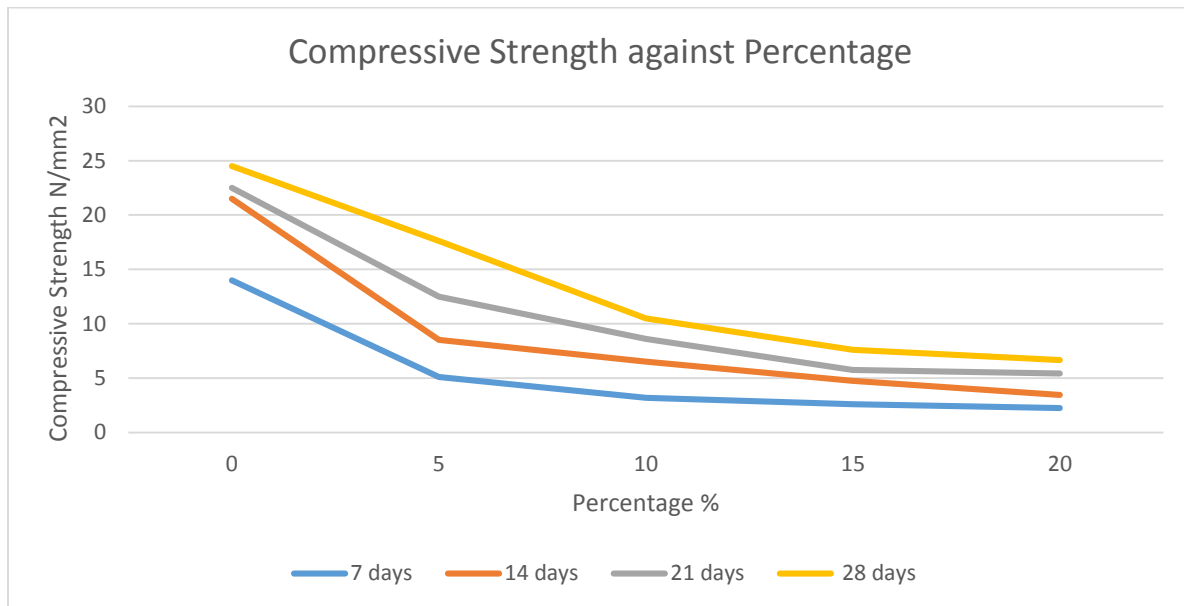
IV. RESULTS AND DISCUSSION

Table 1: Compressive Strength of Dates Seed

Dates Seed (SD) %	7 days N/mm ²	14 days N/mm ²	21 days N/mm ²	28 days N/mm ²
0	14.00	21.50	22.50	24.50
5	5.10	8.50	12.50	17.60
10	3.20	6.50	8.60	10.5
15	2.60	4.75	5.75	7.60
20	2.25	3.45	5.43	6.65

Source: Experiment 2024

Compressive strength: The results presented in Table 1 shows that the compressive strength of date’s seeds as partial replacement in interlocking paving stones reduces as the percentage of DS increases in replacement. The low strength of the performance of interlocking paving stone containing DS in due to reduction in bonding strength between the crush stone as a result of inadequate cement paste to bonded the larger specific surface area of the DS that was low in density. Therefore this research discover the proportion and determined the strength of dates seeds DS as partial replacement in interlocking paving stone influence the workability and the strength performance of the stone. From table 1 the observation of the strength of DS was achieved at 5% on 28 days with compressive strength of 17.60 N/mm².



Graph of Compressive Strength against percentage of Date seed in interlocking stone

Table 2: Percentages of Dates Seed in concrete slump test

Dates Seed % (DS)	Water / cement ratio	Slump mm
0	0.5	35
5	0.55	40
10	0.59	42.5
15	0.6	33.5
20	0.65	32.5

Source: Experiment 2024

Workability: The workability of concrete batched at different percentages of DS using slump test shows in table2. The mix samples with water/ cement ratio at different percentage were low in at control of the interlocking stone and high at 10% of replacement. It wasw observed that the workability of interlocking stone increased as the percentage of DS increases up to a maximum value of 42.5mm at 10% replacement. At a point where the workability reduced at 15% replacement.

V. CONCLUSIONS AND RECOMMENDATION

The result presented in this research shows that dates seeds DS as partial replacement of crush stone in interlocking stone can be used. The replacement of the date seed DS which attained its compressive strength at 17.60N/mm² at 28 days can be used for walkway and compound landscaping at 5%. However, to increase the strength of date's seed, it is recommended that the future investigation can focus on chemical and physical properties of the material used as partial replacement in concrete production.

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