EXPERIMENTAL STUDY 0N PALM KERNAL SHELL PARTIALLY REPLACEMENT IN COURSE AGGREGATE

N.Nirosha[1], K.Arulkumar[2]

[1]Assistant Professor, Civil department, Gnanamani College of Engineering, Namakkal, Tamil nadu, India,

[2]PG Scholar, Civil department, Gnanamani College of Engineering, Namakkal, Tamil nadu, India.

Abstract

This papers reviews previous paper carried out on the use of oil palm kernel shell (PKS) as light weight aggregate (LWA). OPKS is a waste material obtained during the extraction of plam oil by crushing of the plam nut in the palm oil mills. It is one of the most abundantly produced waste materials in South East Asia and Africa. PKS has been experimented in research as light weight aggregates (LWAs) to produce light weight concrete (LWC) since 1984 and today there are many researchers working in this area. In this paper the physical and mechanical properties of PKS are summarized along with mechanical, durability and functional properties and structural behavior of PKS concrete (PKSC). Recent papers on foamed and but reinforced PKSC are also included. It is seen from the results that PKSC has comparable mechanical properties and structural behavior to normal weight concrete (NWC). Recent investigation on the use of crushed PKS shows that PKSC can be produced to medium and high strength concrete. Sustainability issues combined with higher ductility and aggregate interlock characteristics of PKSC compared to NWC has resulted in many researchers conducted further investigation on the use of OPKS as LWA.

Key Words: Course aggregate, Palm kernel shell, High strength concrete, Light weight aggregate, Conventional concrete.

1.INTRODUCTION

Concrete is a construction material which consists of cement, sand, gravel and water. The concrete industry today is the largest consumer of limited natural resource caused by the high concrete demand and natural resources such as for gravel has reduced due to this tremendous demand. It is crucial to find surrogate materials which have sustainable features. As a result, it motivates researches to focus their investigation on the use of waste and by product materials into possible construction material. Recently, the waste material such as fly ash, clinker and expended slag cinder have led for sustainable materials because it provides the purpose of both the structural stability and economic viability. Hence, the best alternative to achieve sustainable development of the concrete industry is the use of waste and by product materials instead of natural resources in the concrete mixture. In this study, a by-product named palm oil kernel shell (PKS) was used as the replacement of coarse aggregate. It is irregularly shaped like an oval, circular, polygonal or flaky shaped with 0.15-8mm thickness. The previous study showed that the PKS is suitable for light and dense concrete production and also as a road building material. In addition, PKS concrete can achieve an acceptable compressive strength value which is among the design strength of 21 to 5 MPa with the density of 800 to 2240 kg/m^3.

PKS concrete containing with their workability, water absorption and strength well as performance of material. When subject to compressive strength test. In a nut shell, four series of concrete mix consists of 0%, 10%, 15%, 20%, of PKS is replaced by volume according to coarse aggregate content.

2. MATERIAL TEST RESULTS

Table 2.1 Physical Properties of the Palm Kernal Shell

PROPERTY	VALUE
Bulk density Mg/m3	0.74
Dry density Mg/m3	0.65
Void ratio	0.4
Porosity (%)	28
Water content (%)	9
Water absorption (%)	14
Specific gravity	1.62
Impact value (%)	4.5

Table 2.2 Properties of Materials

S. no	NAME OF THE TEST	TEST RESULTS
1	Specific gravity of cement	3.13
2	Specific gravity of fine aggregate	2.73
3	Specific gravity of course aggregate	2.76
4	Consistency of cement	36%
5	Initial setting time	30 min
6	Final setting time	540 min
7	Impact strength of course aggregate	20%

3. TESTING OF SPECIMENS

Testing of harden cement mortar plays an important role in controlling and conforming the quality of cement mortar work. Systematic testing of raw materials, fresh cement mortar and harden cement mortar are inseparable part of any quality program for cement mortar, which helps to achieve higher efficiency of the material used and greater assurance of the performance of the cement mortar with regard to both strength and durability.

The following test are conducted,

I. Compressive Strength Test
II. Split Tensile Strength Test
III. Flexural Strength Test

3.1 Compressive Strength Test

Fig.1 Testing of specimens

Table 3.1 Compressive strength for conventional concrete

Specimen no	Compressive strength (N/mm2)		
	7days	14 days	28days
1	13.47	15.50	20.00

Table 3.2 Compressive strength for replaced concrete

Specimen no	% of PKS replaced	Compressive strength (N/mm2)		
		7 days	14 days	28days
1	5	16.46	18.53	24.08
2	10	15.96	17.30	23.28
3	15	14.43	16.43	21.87
4	20	13.53	15.87	19.95

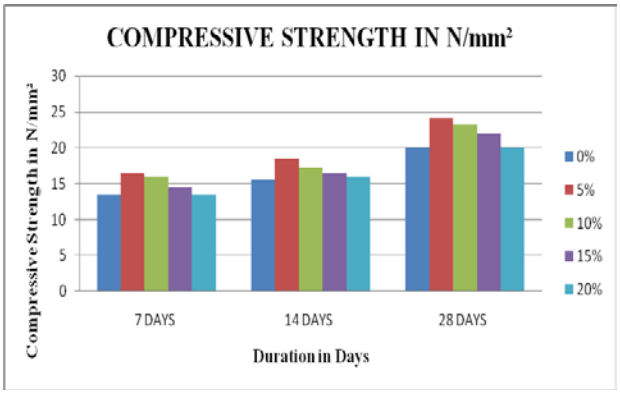

Chart - 1 Compressive Strength

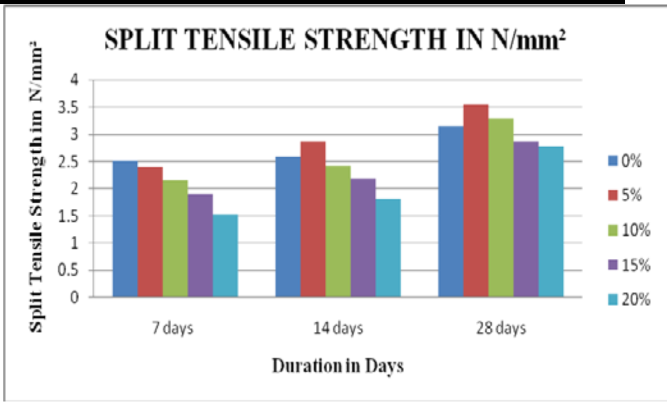

Chart - 2Split Tensile Strength

3.2 Split Tensile Strength Test

Fig2 Testing of specimens

Table 3.3 Split strength for conventional concrete

Specimen no	Split tensile strength (N/mm2)		
	7days	14 days	28days
1	2.10	4.43	4.48

Table 3.4 Split Tensile strength for replaced concrete

Specimen no	% of PKS replaced	Split strength (N/mm2)		
		7 days	14 days	28days
1	5	2.40	2.87	3.55
2	10	2.15	2.42	3.29
3	15	1.90	2.19	2.86
4	20	1.53	1.82	2.78

3.3 Flexural Strength Test

Fig 3 Testing of specimens

Table 3.5 Flexural strength for conventional concrete

Specimen no	Flexural strength (N/mm2)		
	7days	14 days	28days
1	3.65	4.73	5.36

Table3.6 Flexural strength for replaced concrete

Specimen no	% of PKS replaced	Flexural strength (N/mm2)		
		7 days	14 days	28days
1	5	2.92	3.42	5.85
2	10	3.12	3.69	5.89
3	15	2.57	3.07	4.50
4	20	2.17	2.77	3.40

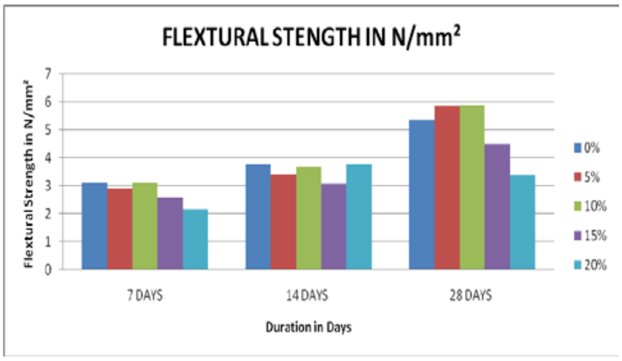

Chart – 3 Flextural Strength

4. CONCLUSIONS

The utilization of OPKS as LWA to produce OPKSC was reviewed through 74 recent and past literatures. The physical, mechanical, durability, functional and structural behaviors of OPKSC were discussed. The behavior of OPKSC was compared with NWC and conventional LWC. Based on the review, several conclusions can be drawn and these are listed below:

- Oil palm kernel shell (OPKS) is irregular shaped i.e. oval, circular, polygonal shaped with 0.15–8 mm thickness. The surfaces of both convex and concave portions of OPKS are quite smooth with rough surfaces along the cracked edges. OPKS can be termed as LWA as it has low specific gravity in the range of 1.17–1.6.
- Loose and compacted bulk densities of OPKS falls in the range of 500–600 kg/m3 and 600–620 kg/m^3 , respectively. Thus, the saturated surface density (SSD) of OPKSC falls in the range of 1600–1960 kg/m3 .
- The existence of numerous pores in the OPKS is responsible for high water absorption in the range of 14–33%. The free surface moisture content is reported to be in the range of 8–15%.
- OPKS has very low abrasion of about 3–8% compared to 20–25% of natural crushed granite aggregate and thus shows higher resistance to abrasion.
- It was reported that OPKS can also be used in asphalt concrete in pavement construction. It was shown that, in urban areas where traffic load is heavy, a replacement up to 10%bcan be allowed whereas the replacement can be up to100% in rural areas.
- OPKS concrete with a saturated density and compressive strength in the range of 1600–1700 kg/m^3 , and 16–24 MPa, respectively can be considered as structural grade concrete.

REFERENCES

- Alengaram U J, Muhit B A and bin Jumaat M Z 2013 A compariso n of the thermal conductivity of palm shell foamed concrete with conventional materials Construction and Building Materials 38 161–172
- Hashim H 2008 The effect of palm oil fibre on concrete properties
- Itam Z, Beddu S, Kamal N L M, Alam M A and Ayash U I 20 16 The feasibility of palm kernel shell as a replacement for coarse aggregate in lightweight concrete IOP Conference Series: Earth and Environmental Science vol 32 (Londo n: IOP Publishing) 01 2040
- Khan M, Deepak T and N air S 2016 Use of palm shell as replacement of coarse aggregate for investigating properties of concrete International Journal of Applied Engineering Research 11 2379–2383
- Olanipekun E, Olusola K and Ata O 2006 A comparative study of concrete properties using coconut shell and palm kernel shell as coarse aggregates Building and Environment 41 297–301
- Raut A N and Gomez C P 2016 Thermal and mechanical performance of oil pal m fiber reinforced mortar utilizing palm oil fly ash as a complementary binder Construction and Building Materials 126 476–483