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ANALYSIS ON USE OF CELLULAR LIGHT WEIGHT CONCRETE IN BUILDING MATERIAL

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Abstract: ***Availability of raw material is very less due to higher use of concrete. Normal practice of concreting is batching of all raw materials, mixing (all raw materials), transporting, compaction at site, finishing and curing is followed by industry. In developed country like India use of concrete is higher quantity and availability of raw material is very less. Total replacement of concrete is not possible due to no material plays the role of concrete in terms of strength, durability, and workability. We have to partial replace all the material to achieve desire properties of concrete in terms of workability, strength and durability. This paper includes study of waste material as Egg Shell and palm kernel shell used in the concrete. The carbon dioxide produced by cement industries causes environmental pollution and global warming. In order to reduce the impact of cement production and coarse aggregate production on atmosphere, waste by products is used as admixture in this study, so that environmental pollution and natural resources consumption is reduced. Egg shell powders which are rich in calcium are thrown away as a waste and palm kernel shell has good impact value. In the present study, these two wastes are used as a partial replacement of cement and coarse aggregate, various properties like workability, compressive strength, homogeneity were determined. Egg shell powder is varied upto30% (10%, 20% & 30%) and palm kernel shell is varied upto 30% (10%,20% and 30%).***

Keywords: ***PPC Cement, Egg Shell Powder (ESP),Palm Kernel Shell (PKS), Compressive Strength, Workability, Homogeneity.***

1. OBJECTIVE OF RESEARCH

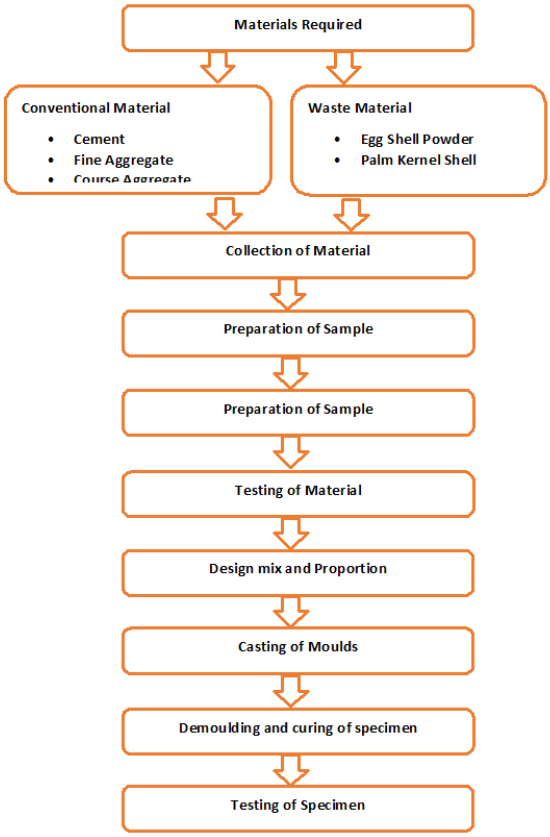
The primary objective of the research is to understand the possibilities of use of Egg Shell Powder and Palm Kernel Shell which partially replaced by cement and coarse aggregate: -

1) To study the workability of the concrete by adding egg shell powder and Palm Kernel Shell.
2) To study the Compressive strength of Concrete.
3) To verify the homogeneity of ESP and CS added concrete.
4) To determine the optimum percentage of Egg Shell Powder and Palm Kernel Shell in concrete by replacing 10%, 20%, and 30% of cement and coarse aggregate.

2. MEHODS OF EXPERIMENTAL INVESTIGATION

The whole experimental methodology is completed in various stages for the determining the compressive strength of Partially Replaced Concrete by Egg Shell Powder and Palm Kernel Shell in different proportions. So the entire methodology can be spited in following major categories for the execution of work which is corresponded to flow chart.

3. FLOW CHART OF METHODOLOGY



4. CONCRETE MIX PROPORTIONS

The mix proportioning for M25 grade concrete was done in this research work corresponding to the Indian Standard Recommended Method IS 10262 - 2009 and with regard to IS 456- 2000. During the whole research work water- cement ratio was taken 0.45. Mix proportions of different materials used in concrete are given Table 3.8 and Table 3.9.

Table Details and quantities of materials

Materials	Quantity	Proportion
Cement	375 Kg/ m^3	1
Sand	702.21 Kg/ m^3	1.87
Coarse Aggregate	1187.5 Kg/ m^3	3.16
Water	169 Kg/ m^3	0.45

SLUMP CONE TEST

Slump cone test were carried out to obtain the workability and consistency of fresh concrete. The efficiency of egg shell powder by replacing cement and Palm Kernel Shell by replacing coarse aggregate is depend upon obtained of a homogenous distribution in the concrete, their reciprocal with the cement matrix, and the ability of concrete successfully cast. Basically, egg shell powder should be properly chemically bonded with all the ingredients like cement as the property of cement should be followed and the Palm Kernel Shell be equally coated with cement to supply the benefit in concrete. The slump changed because of the partial replacement of the core material in concrete. The main reason of lower slump is the fact of adding two different materials to replace two different ingredients in different proportion can form a network structure in concrete. As results the replacement of cement are certain to absorb more concrete paste wrap around and the increase viscosity of combination of mix the slump reduction.

Slump cone method is most common method used for measuring the workability and consistency of concrete which can be conducted either in laboratory or site of work. This test is not suitable for very wet and very dry concrete.
Apparatus details as per IS: 1199 – 1959
(a) A standard hollow cone of size, bottom diameter 200 mm, top diameter 100 mm and 300 mm height is taken with the arrangement of lifting handle attached with cone.
(b) A tamping rod of length 600 mm and 16 mm diameter with rounded bottom edge.

PROCEDURE FOR TESTING

(a) The interior surface of the mould is thoroughly cleaned and a light layer of oil is applied.
(b) The mould is put on a smooth, flat, rigid and non-absorbent surface.
(c) Concrete is filled in the cone in four layers, each approximately one- quarter of the height of the mould and each layer is tamped 25 strokes.
(d) Immediately after filling is completed and the concrete is leveled, the cone is slowly and carefully raised vertically, when unsupported concrete will slump.
(e) The slump is measured by inserting the cone just besides the slump concrete and the temping rod is placed over the cone so that it should also come over the area of slump concrete.
(f) The decrease in height of concrete is measured with the scale i.e. slump value of fresh concrete.Workability of concrete shown in Table 3.11.and recommended slump of concrete shown in Table 3.12. also show the classification of concrete in Table 3.13

SLUMP CONE TEST RESULTS

The slump cone test results carried out on the various specimen of concrete of M25 grade are given in Table 4-1 and shown in Figure 4:1. Throughout the research work water – cement ratio kept 0.45, for the proper workability of the egg shell powder and Palm Kernel Shell added concrete. From the slump test results it was observed that as the amount of egg shell powder and Palm Kernel Shell increased as 10%, 20% and 30%, in the concrete mix, then the slump value decreased.

Table Slump Cone Test

Mix	Eggshell Powder (%)	Palm Kernel Shell (%)	Slump value (mm)
J0	0	0	89
J1	10	10	82
J2	20	20	77
J3	30	30	70

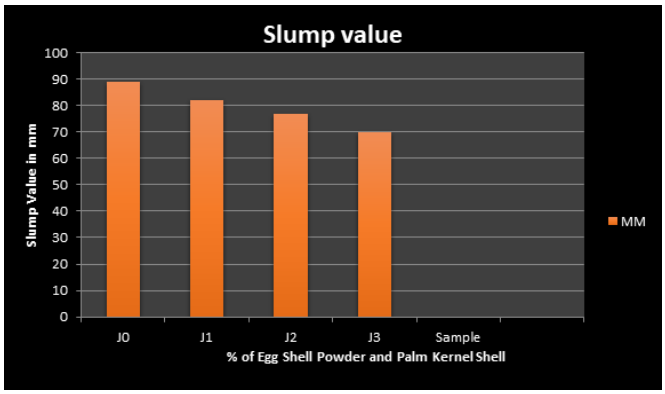


Figure Slump value

COMPRESSIVE STRENGTH TEST RESULTS

The compressive strength test performed on specimen made during the experimental work containing Egg Shell Powder and Palm Kernel Shell in different proportions after curing period of 7 and 28 days. There are three samples of each percentage of adding Egg Shell Powder and Palm Kernel Shell are tested and average of three is taken. From the test results it can be observed that the compressive strength of Egg Shell Powder and Palm Kernel Shell Concrete in different proportions of 10%, 20% and30%is less than the controlled mix. The Compressive strength of conventional concrete and Egg Shell Powder and Palm Kernel Shell Concrete was evaluated, the result was found that the compression value of conventional concrete is more than the concrete with different proportion of Egg Shell Powder and Palm Kernel Shell. But it was found that 10% of ESP and 10%of CS concrete Compressive Strength was nearly equal to the conventional concrete. It was found that after 7 days curing period, convention concrete was about 33.15 N/mm2

and 10% of ESP and 10% of CS concrete was 32.40 N/mm2. Therefore after 7 days curing period the values were approximately same. The same result was found after 28 days curing period as well. After 28 days curing conventional concrete compressive strength was 42 N/mm2 and 10% of ESP and 10% of CS compression value was 41.74 N/mm2.
Hence, as compared to 10% of ESP and 10% of CS concrete compression value with conventional concrete value, it was found that after 7 and 28 days curing the Compressive Strength Values were approximately similar with each other.The test results are given in Table 4-2, 4-3 and also graphically shown in Figure 4:2, 4:3 and comparison of compressive strength between 7 & 28 days after curing period shown in Figure 4:4.

Table Compressive Strength Test (7 Days)

Mix	Egg Shell Powder by weight of cement (%)	Palm Kernel Shell by weight of Coarse Aggregate (%)	Average Compressive strength (N/mm^2)
J0	0	0	33.15
J1	10	10	32.40
J2	20	20	28.90
J3	30	30	26.54

Table Compressive Strength Test (28 Days)

Mix	Egg Shell Powder by weight of cement (%)	Palm Kernel Shell by weight of Coarse Aggregate (%)	Average Compressive Strength (N/mm^2)
J0	0	0	42
J1	10	10	41.74
J2	20	20	37.12
J3	30	30	34.36

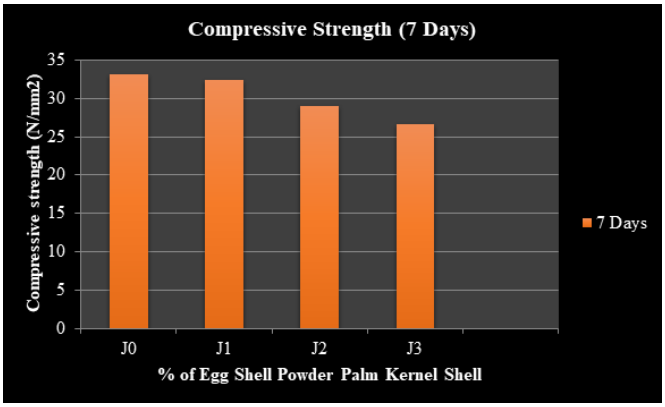


Figure Compressive strength of cube

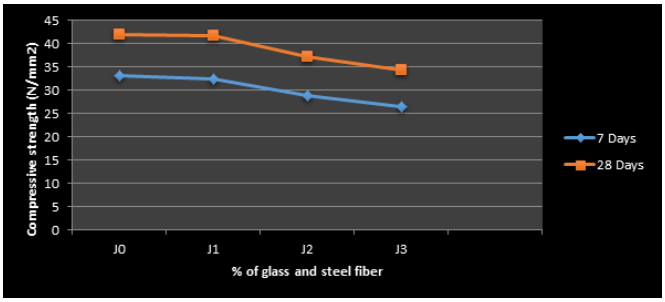


Figure comparison of compressive strength

ULTRASONIC PULSE VELOCITY TEST RESULT
Ultrasonic Pulse velocity test was conducted after 7 and 28 days of curing. The average value of three cubes of each samples of different proportions were overlooked. A result shows the homogeneity of concrete. Table no.4-4 and 4-5 shows the value of UPV results after 7 and 28 days and comparison of UPV test after 7 and 28 days curing shown in figure 4:5.

Table Ultrasonic Pulse Velocity Test (7 Days)

Sample	J0	J1	J2	J3
Average UPV Value After 7 Days (m/s)	2.711	2.709	2.650	2.529

Table Ultrasonic Pulse Velocity Test (28 Days)

Sample	J0	J1	J2	J3
Average UPV Value After 28 Days (m/s)	2.75	2.715	2.691	2.58

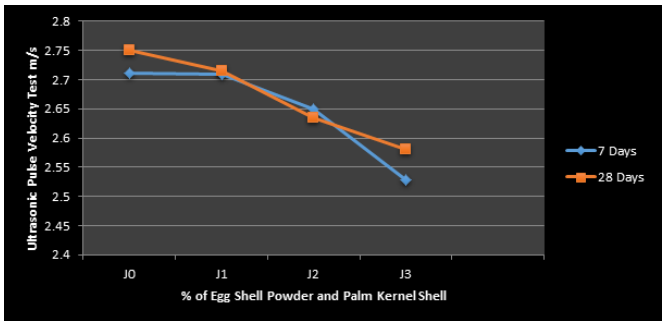


Figure Comparison of UPV result after 7 and 28 days of curing

5. CONCLUSION

According to the experimental investigation the results were analyzed. On the basis of result of partial replacement of cement with Egg Shell Powder and Coarse Aggregate with Palm Kernel Shell up to 10%, 20% and 30%, following conclusions were made:

- Slump value decreases with increase in replacement percentage of cement and coarse aggregate.
- By increasing the replacement of cement and coarse aggregate with egg shell powder and Palm Kernel Shell, concrete losing its workability.
- It was observed that the optimum percentage of cement and coarse aggregate by egg shell powder and Palm Kernel Shell in concrete up to 10% gives approximately similar value as compared to conventional concrete.
- Compressive strength of concrete comprises similar value at10 % replacement of cement with egg shell powder and coarse aggregate with Palm Kernel Shell as compared conventional concrete, but after 10 % i.e. at 20% and 30% replacement shows degradation in the compression value of concrete.
- It was found that after 7 days curing the compressive strength of 10% partial replacement of cement with egg shell powder and coarse aggregate with Palm Kernel Shell was 32.40 N/mm2 and compressive strength of conventional concrete was 33 N/mm2.
- The similar result was found after 28 days curing the

compressive strength of 10% partial replacement of cement with egg shell powder and coarse aggregate with Palm Kernel Shell was 41.74 N/mm2 and compressive strength of conventional concrete was 42 N/mm2.

• Hence, 10% partial replacement of cement with egg shell powder and coarse aggregate with Palm Kernel Shell can be replace.

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