Performance Of Concrete Using Coconut Shell

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Abstract : In this present experimental investigation an attempt is made to use low cost building material like a coconut shell. In the present thing the natural aggregate is replaced by 10%, 20%, 30% of coconut shell for different grades of concrete such as M_{20}, M_{25}. A comparative study is made on compressive strength between the conventional concrete and coconut shell concrete.

***Keywords*-- cement concrete (CC), Coconut Shell (CS), Cement Mortar (CM), Consistency (P).**

GENERAL

In the recent years, the depletion and rising cost of natural aggregates and the change in the environment due to the production of concrete is raised up extensively. Many works are carried out on concrete to replace the materials with the wastes formed by industries and various sources.

Coconut Shell

Coconut shell can be used to produce lightweight aggregate by lowering the density of concrete. In light of this, we should study about the properties of coconut shell in concrete in terms of strength.

S.no	Properties	Coconut Shell
1.	Moisture content (%)	4.20
2.	Water absorption (24 h) (%)	20
3.	Specific gravity	1.05-1.20

Sequence of operation

The tests are conducted on cement to see the suitability of sample in concrete and the investigations were carried on the M_{20}, M_{25} grade concrete. Required quantity of materials is calculated for different grades of concrete and in different percentages of CS. The required uniform mix is obtained by mixing of materials. The tests are held on fresh concrete and hardened concrete.

TESTING PROGRAM

Fineness of cement

Fineness or particle size of cement affects the hydration rate of cement and thus the rate of strength gain. The smaller the particle size, the greater the surface area to volume ratio and thus the more area available for water-cement interaction per unit volume. The test is conducted by IS-90µ sieve conforming to IS:460-1965, standard balance.

Specific gravity of cement

Specific Gravity is just a comparison between the weight of a volume of a particular material to the weight of the same volume of water at a specified temperature. Every material has solid particles and pores which may contain water on it. If the cement has exposed to

extreme moisture content, then it influences the water-cement ratio. W/C ratio is a crucial factor as it is directly proportional to workability and strength of bonding. Test is conducted by specific gravity bottle. Cement, water and kerosene is used to determine specific gravity.

Normal consistency of cement

The main purpose of the test is to determine the percentage of water to the weight of cement to complete hydration process or to produce a cement paste of standard consistency. Vicats apparatus with plunger 10mm dia is used in this test. It plays an important role in determining the required water percentage of initial and final setting time, soundness of cement and compressive strength of cement.

Initial and final setting time of cement

Initial setting time is the time when the cement paste starts losing its plasticity. It is important mixing, transportation, placing and compaction of CC. t is required to delay the process of hydration or hardening. Final setting time is the time when the cement paste completely loses its plasticity. It is the time where the concrete gains its strength and original shape. It also facilitates the removal of scaffolding or formwork. 0.85%P is the required water percentage for this test. According to IS: 456 -2000, the initial setting time should not be less than 30 min.

Soundness of cement

Lechatlier method confirming to IS 5514-1969 is used to determine the soundness of cement. It is very important that the cement after setting shall not undergo any appreciable change of volume. Certain cements have been found to undergo a large expansion after setting, causing disruption of the set and hardened mass. This will cause serious difficulties for the durability of structures when such cement is used. The testing of the soundness of cement, to ensure that the cement does not show any appreciable subsequent expansion is of prime importance.

Compressive strength of cement

It is used to determine the strength of mortar used in concrete. It depends on the quality of cement, gradation of sand and quality of water. A cube of volume 7.06 cm^3 and a vibrating machine is used to cast the cubes of CM (1:6) and strength test is made on strength testing machine. As IS code saying minimum compressive strength of PPC for 7 days is 24 N/mm^2.

Slump cone test

Slump is a measurement of concrete fluidity/workability. It is an indirect measurement of concrete consistency or stiffness in a fresh state. By this test we come to know about the placing conditions of concrete.

Compressive strength of concrete

A mix proportion is designed as per IS 10262-1982. The following are the mix proportions is used for M_{20}, M_{25} is **0.55:1:1.6:3.08** and **0.5:1:1.2:2.3.** The specimens of standard cubes of 150mm*150mm*150mm were cast and stored in place, free from vibration and at a room temperature for 24 hours. After 24 hours, the specimen is denuded and immediately immersed in clean, fresh water tank for 28 days. On the date of testing, i.e., after 28 days casting of the cube specimens was removed from the water tank and placed on flat surface for 10 minutes to wipe off the surface water and grit, and also removes the projecting fineness on the surface of the specimens. Before placing the specimen in testing machine, the bearing surfaces of the testing machine were wiped clean, and the cube specimen also cleaned. The cube specimen was placed in the machine of 3000KN capacity. The load was applied approximately 140kg/sq.cm/min until the resistance of the specimen to the increasing load to be sustained, was shown in plate. The compressive strength of the specimen was calculated by dividing the maximum load applied to the specimen during the test by the cross-sectional area of the specimen for which average of three values of three cubes and the individual variation is more than 15% of the average was observed. Compressive strength results are primarily used to determine that the concrete mixture as delivered on site meets the requirements of the specified strength.

DISCUSSION OF TEST RESULTS

The following are the results obtained by the various tests

TEST	RESULT
Fineness of cement	8%
Specific gravity of cement	3
Normal consistency of cement	34%
Initial and Final setting time of cement	More than 35 minutes and around 10 hours
Soundness of cement	2mm
Compressive strength of cement	23N/mm^2

Slump cone test

Slump value for different percentage replacements in M_{20} grade concrete

Replacement in %	Slump in mm
0%	75
10%	60
20%	30
305	10

Slump value for different percentage replacements in M_{25} grade concrete

Replacement in%	Slump Value in mm
0%	70
10%	50
20%	35
30%	20

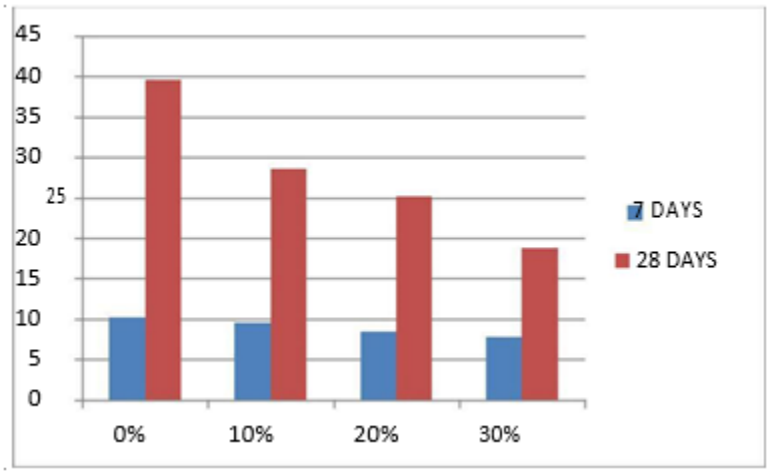
Compressive strength of M_{20} grade concrete cubes after 7 days

S. no	Coconut Shell (%)	Grade	Load Crushing in (KN)	Compressive Strength (N / mm^2)
1	0 %	M20	300	13.2
2	10 %	M20	240	10.56
3	20 %	M20	220	9.68
4	30 %	M20	190	9.24

Compressive strength of M_{20} grade concrete cubes after 28 days

S. no	Coconut Shell (%)	Grade	Load Crushing in (KN)	Compressive Strength (N / mm^2)
1	0 %	M20	700	30.8
2	10 %	M20	520	22.88
3	20 %	M20	470	20.68
4	30 %	M20	350	15.4

Comparison of strength for M_{20} grade concrete



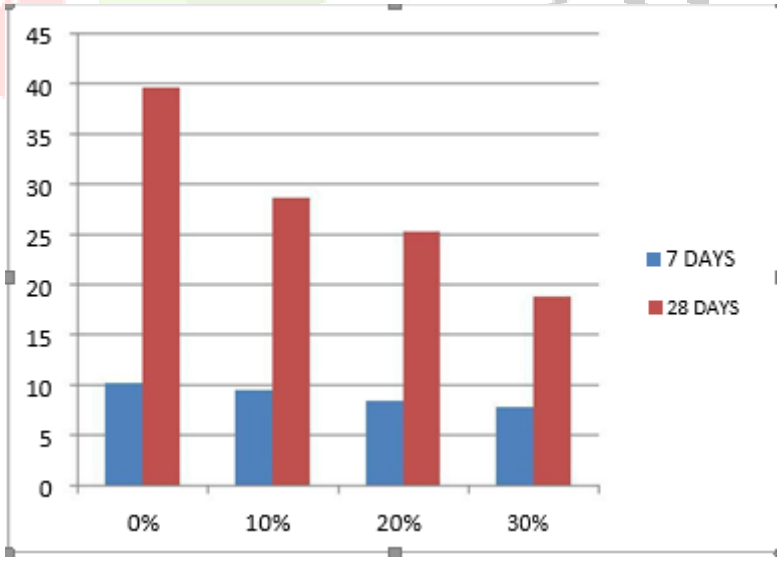
Compressive strength of M_{25} grade concrete cubes after 7 days

S. no	Coconut Shell (%)	Grade	Load Crushing in (KN)	Compressive Strength (N / mm^2)
1	0 %	M25	232	10.2
2	10 %	M25	216	9.5
3	20 %	M25	192	8.45
4	30 %	M25	176	7.75

Compressive strength of M_{25} grade concrete cubes after 28 days

S. no	Coconut Shell (%)	Grade	Load Crushing in (KN)	Compressive Strength (N / mm^2)
1	0 %	M25	950	39.6
2	10 %	M25	650	28.6
3	20 %	M25	573	25.21
4	30 %	M25	427	18.78

Comparision of strength for M_{25} grade concrete



CONCLUSIONS

It was concluded that the coconut shells were more suitable as low strength-giving lightweight aggregate when used to replace common coarse aggregate in concrete production.

The present project work gives the following:

1) Results of experiments on compressive strength and workability for different coconut shell replaced concretes have been presented with those of control concrete. The data show that coconut shell aggregate can be used in place of normal aggregate, as it reduces the density of concrete which falls under light weight concrete.

2) However, the overall strength decreased with coconut shell replacement when compared to control concrete.

3) Increase in coconut shell replacement permeable voids also increased.

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