AN EXPERIMENTAL STUDY ON CONCRETE WITH PARTIAL REPLACEMENT OF COARSE AGGREGATE BY COCONUT SHELL AND CEMENT WITH FLYASH

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Abstract

In this project we will discuss about the replacing of coarse aggregate and cement by coconut shells and fly ash In this project we know that the strength of both coarse aggregate and cement mix now we will check the concrete and then we add coconut shells and fly ash 15% and we prepare the concrete We will use this mixture in making of cubes, columns, beams we will check the concrete strength for 7days, 14 days, 28days then we use it in preparation of concrete blocks and etc By using these elements we get the similar results and the cost will also reduce the detail report will be discussed in next pages

Keywords - Compressive strength, Flexural Strength, Tensile Strength, M25 grade of concrete.

1 Introduction

Concreteistheworld'smostconsumedman-mademate rial.Toproduce1ton of Portland cement,1.5tons of raw materials are needed. These materials include good quality limestone and clay. Therefore, to manufacture 1.5 billion tons of cement annually, at least 2.3 billion tons of raw materials are needed. Over 5-million BTU of energy is needed to produce one tone of cement. In the year 1914, India Cement Company Ltd started cement production in Porbandar with an output of 10,000 tons and a production of 1000 installed capacity. At the timeofindependence1947,the installed capacity of cement plants in India was approximately 4.5 million tons and actual production around 3.2million tons per year. The partial deep control in 1982 prompted various industrial houses to set a setup new cement plants in the country, capacity was nearly 30 million tons, which has now, increase to nearly 120 million tons during a period of 20years. The full de control on cement industry in 1988 further provided momentum for the growth. India is the second largest producer of cement on the globe after China. In total, India manufactures251.2MillionTonsofcementperyear.ThecementindustryinIndiahasreceived a great impetus from a number of infrastructure projects taken up by the Government of India like road networks and housing facilities. While the Indian cement industry enjoys a phenomenal phase of growth, expert sreveal that it is poised towards a highly prosperous future over the very recent years. The annual demand for cement in India is consistently growing at8-10%. National Counsel for Applied Economic Research (NCAER) has estimated after an extensive study that the demand for cement in the country is expected to increase to 244.82 million tons by 2012. At the same time, the demand will be at 311.37 million tones if the projections of the road and housing segments are met in reality

1.2 Fly Ash

Fly ash is a fine gray powder consisting mostly of spherical, glassy particles that are produced as a byproduct in coal-fired power stations. Fly ash has pozzolanic properties, meaning that it reacts with lime to form cementitious compounds. It is commonly known as a supplementary cementitious material.
Fly ash is suitable for a wide variety of applications and uses, including:

- Concrete
- Dams
- Flowable fill
- Mines
- Landfills
- Geopolymer concrete

Fly ash is also known as flue-ash or simply ash.

1.3 Coconut Shell

The concrete obtained using Coconut Shell aggregates satisfies the minimum requirements of concrete. Concrete using Coconut Shell aggregates resulted in acceptable strength required for structural concrete. Coconut Shell may offer itself as a coarse aggregate as well as a potential construction material in the field of construction industries and this would solve the environmental problem of reducing the generation of solid wastes simultaneously. The Coconut Shell-cement composite is compatible and no pre-treatment is required. Coconut Shell concrete has better workability because of the smooth surface on one side of the shells. The impact resistance of Coconut Shell concrete is high when compared with conventional concrete. Moisture retaining and water absorbing capacity of Coconut Shell are more compared to conventional aggregate. The amount of cement content may be more when Coconut Shell are used as an aggregate in the production of concrete compared to conventional aggregate concrete. The presence of sugar in the CS as long as it is not in a free sugar form, will not affect the setting and strength of concrete. It is found that wood based materials, being hard and of organic origin, will not contaminate or leach to produce toxic substances once they are bound in concrete matrix. The coconut shells are obtained from a local coconut field. They are sun dried for 1 month before being crushed manually. The crushed materials are later transported to the laboratory where they were washed and allowed to dry under ambient temperature for another 1 month [4]. Coconuts show a wide diversity in size,weight, shape and color, depending on genetic variety and maturity of the nut at harvest [3] The particle sizes of the coconut shell range from 5 to 20 mm. The surface texture of the shell was fairly smooth on concave and rough on convex faces. The absorption of water in the concrete will not affect its strength since lesser voids can be formed [4]

2.MATERIAL PROPERTIES

2.1 Cement

Ordinary Portland Cement (OPC) is the cement best suited to general concreting purposes. OPC 53 grade confirming with IS: 8112-2007 is used. The cement is kept in an airtight container and stored in the humidity controlled room to prevent cement from being exposed to moisture. The specific gravity of cement is 3.10

2.2 Aggregates:

Aggregates are the important constituents in concrete. They give body to the concrete, reduce shrinkage and effect economy. Aggregates occupy 70 to 80 percent of volume of concrete. Aggregates are obtained either naturally or artificially. Aggregates can be classified on the basis of size as fine aggregate and coarse aggregate.

2.2.1 Fine Aggregates (Sand)

For fine aggregate canal sand was used, comparable to IS383 -1970. To remove imported material, to use air dried sand, sieved, and earlier to mixing. The experiment was conducted as per IS: 2386-1963and the specific gravity value is2.60

2.2.2 Coarse aggregate:

The material whose particles are of size are retained on IS sieve of size4.75mm is termed as coarse aggregate and containing only so much finer material as is permitted for the various types described in IS:383-1970 is considered as coarse aggregate. Aggregates should be of uniform quality with respect to shape and grading. The size of coarse aggregated depends up on the nature of the work. The coarse aggregate used in this experimental investigation is 20mm and 10mm

size, crushed and angular in shape. The aggregates are free from dust before used in the concrete. The specific gravity of the coarse aggregate is 2.76

2.2.3Water

Water used for mixing and curing shall be clean and free from injurious amounts of oils, acid, alkalis, salts, organic materials or other substances they may be deleterious to concrete portable water is used for mixing as well as curing of concrete as prescribed in IS: 456 – 2000.

2.2.4Fly Ash

Flyash, which is a by-product of the combustion coal in the thermal plants. It is removed by the dust collection system as fine particle dregs from the incineration gases before they are quitted into the atmosphere. Fly ash accounts for about 9% of the cement mix in concrete. Water absorption, the coefficient of water and chloride diffusion coefficient was less in fly ash concrete. Fly ash can be used in a significant amount as replacement material of cement in concrete. It can be added to a quantity of 10% to about 35% by weight of cement. It will be very beneficial in reducing CO2 emission during production of cement, preventing the global warming.

2.2.5 Coconut Shell

Coconut plays a significant role in the agricultural economy of India. The coconut is known to be a rich source of raw material for various products. The nut is the most active material with its nut oil being widely used for eatable and manufacturing. The coconut shell is the raw material for the coir production. Coconut fibres attained from coconut husk, belongs to the family of palm fibres, and are available in large quantities in the tropical regions of the world, most especially in Africa, Asia and southern America. In Ghana, they are available in large quantities in the southern part of the country.

3.EXPERIMENTAL PROGRAM

3.1USINGCOCONUT SHELLASPARTREPLACEMENTOFCOARSE AGGREGATE

Mixproportionsfortrail-1:

(Cement+sand+100%gravel)

Cement. =481.8kg /$m^{3.}$

Water.=197kg/$m^{3.}$

Fine aggregate = 632.32 kg / $m^{3.}$

Coarse aggregate=1072.69kg/$m^{3.}$

Mixproportionsfortrail-2

(Cement+sand+(15%C.S+85% gravel)

Cement.=481.8kg/$m^{3.}$

Water. =197kg/$m^{3.}$

Fine aggregate. = 632.32 kg / $m^{3.}$

Coarse aggregate.=911.79kg/$m^{3.}$

Coconut shell. =68.38kg/$m^{3.}$(by volume)

Mixproportionsfortrail-3:

(Cement + sand+(30%C. S+70%gravel)

Cement. =481.8kg /$m^{3.}$

Water. =197 kg/ $m^{3.}$

Fine aggregate. = 632.32 kg / $m^{3.}$

Coarse aggregate = 750.83kg/$m^{3.}$

Coconut shell. =136.76kg/$m^{3.}$ (By volume)

3.2 USINGFLYASHASPARTREPLACEMENTOFOPC AND USING COCONUT SHELL AS REPLACEMENT OF COARSE AGGREGATE

Mixproportionsfortrail-4:

((20%F.A&80%cement)+sand+(15%C.S+85%gravel))

Cement. = 385.44 kg / $m^{3.}$

Fly ash.= 96.36 kg /$m^{3.}$

Water.=197kg/$m^{3.}$

Fine aggregate = 628.36 kg / $m^{3.}$

Coarse aggregate=894.92kg/$m^{3.}$

Coconut shell=67.11kg /$m^{3.}$(by volume)

Mixproportionsfortrail-5:

((20%F.A&80%cement)+sand+(30%C.S +70% gravel))

Cement = 385.44 kg / $m^{3.}$

Fly ash = 96.36 kg / $m^{3.}$

Water=197kg/$m^{3.}$

Fine aggregate = 628.36 kg / $m^{3.}$

Coarse aggregate=736.99kg/m^{3}

Coconut shell=134.23kg/$m^{3.}$(by volume)

3.3 MIXPROPORTION:

1. Cement +sand+100%gravel
2. Cement +sand+(15%CSand85%gravel)
3. Cement +sand+(30%CSand70%gravel)
4. (20%flyash &80%cement)+sand+(15% CSand85%gravel)
5. (20%flyash &80%cement)+sand+(30%CSand70%gravel)

3.3 Compressive Strength

Compressive strength or crushing strength is the main property observed in testing the cubes. The cubes of size 150 x 150 x 150mm were casted. After 24 hours, the specimens are removed from the moulds and subjected to curing for 28 days in portable water. After curing, the specimens are tested for compressive strength using compression testing machine of 2000 KN capacity (IS: 516 – 1959). Cubes are tested to calculate Compressive strength by applying gradual loading in Compression Testing Machine. The maximum load at failure occurs on the top of the machine. For M30 grade concrete, A total of 54 cubes were cast for the five mixes .i.e., for each mix 9 cubes were prepared. Testing of the specimens was done at 7 days, 28 days and 90 days, at the rate of three cubes for each mix on that particular day. The average value of the 3 specimens is reported as the strength at that particular age

Compressive strength = ultimate compressive load/cross sectional area

= P/A

= load/area N/mm2

3.4 Flexural strength test:

In the flexural strength test theoretical maximum tensile stress reached at the bottom fibres of the test beam is known as the modulus of rupture. When concrete is subjected bending stress, compressive as well as tensile stresses are developed at top and bottom fibres respectively. The strength shown by the concrete against bending is known as flexural strength. The standard size of specimen is 100mm×100mm×500m with a span of 600mm. The flexural strength of the specimen is expressed as the modulus of rupture '**fb**' which, if 'a' equals the distance between the line of fracture and the nearest support measure don the centre line of the tensile side of the specimen, in cm, is calculated to the nearest 0.05Mpa as follows

$$f_b = \frac{PL}{bd^2}$$

4.RESULTS

4.1 Compressive strength

The compressive strength test was performed on the cubes of size 15 cm x 15 cm x 15 cm to check the compressive strength of rubberized concrete and the results obtained are given inTable4.1

Table4.1:CompressivestrengthforM25grade(N/mm^2)

Days	0%CS	15%CS	30%CS	15% CS& 20%F.A	30% CS& 20%F.A
7	25	19.22	14.78	15.77	10.34

28	32.44	28.88	23.98	26.67	21.22

4.2 Flexural Strength Test

The Flexural test was performed on the beams of size 50 x 10 x 10 cm to check the flexural strength of the rubberized concrete and the results obtained while performing the flexural test on UTM are given in Table4.3&4.4.

Table4.3:FlexuralstrengthforM25grade

Days	28days	
	LOAD(Kn)	Strength (N/mm^2)
0%C.S	24.35	9.74
15%C.S	21.8	8.72
30%C.S	16.8	6.72
15%C.S&20%F.A	18.2	7.29
30%C.S&20%F.A	14.4	5.76

Table 4.4 FLEXURALSTRENGTHOFCONCRETE BEAMS

Sl.no	Percentage Replacement	Ultimate Load(KN)	Deflection(mm)	FLEXURLSTRENGTH (N/mm^2)
1	0%	82.15	7.6	17.03
2	15%CS	72.40	8.2	15.01
3	15% CSalongwith20% FA	64.24	8.1	13.32

4.3 SPLIT TENSILE STRENGTH

Table4.5:Split Tensile strengthforM25grade(N/mm^2)

days	**0%CS**	**15%CS**	**30%CS**	**15%CS & 20 %F.A**	**30%CS & 20 %F.A**
7	2.35	2.15	1.86	1.98	1.62
28	3.56	3.32	2.69	2.93	2.26

6. Conclusions

7.1. CONCLUSION:

a) Utilizing more Replacement of coconut shells, It decreases the compressive, tensile and Flexural nature of concrete.

b) Increase in rate of C.S, decreases the densities of concrete.

c) Increase in rate substitution by coconut shell builds workability of concrete .

d) Light weight concrete can be set up by utilizing coconut shells, as coarse aggregate.

e) When the different Percentage of CS as 15% and 30% is replaced in concrete with coarse aggregate. the compressive strength, split tensile strength, are more as compared to concrete replaced by coconut shell as 15% and30% along with cement replaced by 20% fly ash.

f) water absorption increases with increase in CS replacement.

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