International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 05 | May - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

EXPLORING THE POTENTIAL OF RICE HUSK ASH AS CEMENT AND COCONUT SHELL AS COARSE AGGREGATE WITH LIMITED REPLACEMENTS IN M30 GC

V. Sandya Rani[1], P. Subhasri[2]

[1]PG Scholar, [2]Assistant Professor
[1,2]Department of Civil Engineering & Dr. K. V. Subba Reddy Institute of Technology

---***---

Abstract - As we know that so many wastes which can be used in traditional concrete like E- wastes, biomedical wastes, Agricultural wastes etc. Coconut casing and rice husk ash are also the key waste which is easily and plenty available in home needs and that can be used in usual concrete. This coconut shell can be trampled and used as a coarse aggregate in production of concrete. Coconut shell material could be used in rural areas and places where coconut is plentiful and may also be used where the usual aggregate is costly. Rice husk ash is a waste from rice manufacturing factories and it is a good combination of replacement of cement which has same properties. The elevated cost of usual construction material affects the financial system of structure. It is becoming more difficult to find natural resources. Use of waste material not only helps in getting them utilized in cement, concrete and construction materials but also has several indirect benefits such as diminution in landfill cost savings in energy and defending the environment from feasible pollution effects.

The Coconut Shells(CS) were taken on constant 5% with replacement of coarse aggregate and Rice Husk Ash(RHA) were taken on 0%, 4%, 8%, 12%, 16%, 20% & 24% with limited replacement of cement on M30 Grade of Concrete(GC). It is used to compare the results of compressive strength, split tensile strength, flexural strength of concrete. Its utilization is cost effective and eco-friendly.

***Key Words*:** Coconut shells (CS), Rice husk ash (RHA), Coarse aggregate, Fine aggregate, Cement, M30 GC.

1. INTRODUCTION

1.1 Overview of the project

In modern years, replacement for materials consummated for concrete fabrication is widely used and the proposal of using different materials helps in material management concrete. Coconut shell (CS) is one of the aggregate and a number of research works have been completed on coconut shell concrete. It is establish that in all these studies, CS was used in the place of usual coarse aggregate and gave good results for making strengthen concrete. In order to reduce the use of ordinary Portland cement and to aids for the reduction CO_2 emission, Rice Husk ash(RHA) be used so that land fill of RHA can be reduced and environment can be safe guarded.

1.2 Terminologies

In these terminologies it is divided into 2 types they are coconut shells (CS) and rice husk ash (RHA) which are the waste byproducts of agricultural wastes and are easily available in any place and can easily transport.

1.2.1 Coconut shell (CS)

Coconut shell was sun dried for 2 months before being crushed by the quarry. But In general I have collected the coconut shell in the home itself and dried up for 15- 20 days. This is to ensure that the moisture content is reduced to the minimum. The crushed coconut shell was shortly transported to the lab where they were thoroughly cleaned and washed, then permitted to dry below ambient temperature.

The coconut shells will be in the shapes of flaky, elongated, curved, roughly parabolic and other irregular shapes. In order to ascertain the properties of coconut shell aggregate the following tests are made they are specific gravity, bulk density, particle size distribution, aggregate impact value, aggregate crushing value, water absorption value. The chemical compositions of the Coconut shell are about lignin of 36.51%, cellulose of 33.61%, pentosans of 29.27% and powder of 0.61%.

1.2.2 Rice Husk Ash (RHA)

Rice husk is obtained from the rice milling industry because it is a byproduct. Research has confirmed that heating rice husk at a high temperature of 700°C makes a dust that has a plenty structure for pozzolanic materials. Research has also indicated that, because of RHA's high exterior area, the Rice Husk Ash can be use in concrete as a mineral admixture.

RHA decreases the permeability of concrete when uses as a mineral admixture. Rice Husk Powder utilized in the current study was gray, had a pH of 7.4, and contained silica of 62.3%. In general I have bought it from the market and used it for my project at the required percentages and tested various laboratory tests for the rice husk ash.

Figure 1 Coconut shell & Rice husk ash

1.3 Background of study

In the recent revision of IS: 456-2000, one of the major points discussed is the durability aspects of concrete. So the use of concrete is unavoidable. At the same time the scarcity of aggregates are also greatly increased nowadays.

Among that 7.0% in India, 57.7% in China, 9.4% in Developed Countries, 25.9% in other emerging countries. The composition of Coconut fabrication in India in the year 2009 is 10,894,000 tonnes.

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 05 | May - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Table 1 Coconut shell cultivation in percentages

S.No	States	Overall Coconut Cultivation in percentage
1	Kerala	45.22
2	Tamil nadu	26.56
3	Karnataka	10.85
4	Andhra Pradesh	8.93

1.4 Objectives

- ★ To get better understanding of the coconut shell and rice husk ash as a construction material.
- ★ To know the properties of coconut shell and rice husk powder.
- ★ Study of compressive strength, flexural strength, split tensile strength of concrete by conducting different tests on cement, fine aggregate, coarse aggregate.
- ★ To prepare the cubes, cylinders, beams of concrete by using coconut shell and rice husk ash.

1.5 Future Scope

- ❖ In future, first suitable mix design for the project is prepared &then the coconut shell is crushed either by mechanical or manual (by using hammer) means.
- ❖ The mix proportions of natural coarse aggregates and the coconut shells coarse aggregates are also kept ready as 1% to 10% coconut shells with natural coarse aggregates by weight.
- ❖ The Rice Husk Ash can be used up to 20% in the place of cement.
- ❖ Physical properties of the coconut shell aggregate are examined.
- ❖ Tests namely compressive strength, tensile strength, flexural strength, durability test is carried.

1.6 Limitations

- ➢ Study was carried out on M30 grade of concrete.
- ➢ Proportion of coconut shell was kept 5% Constant.
- ➢ Rice Husk ash proportion was kept as 0%, 4%, 8%, 12%, 16%, 20% and 24%**.**

2. LITERATURE SURVEY

Sukarton (2011) reported the incorporation of coconut shell in Bio char as a way of overcoming soil fertility problems. They described Bio char as carbon rich products obtained when organic biomass is heated under limited or without oxygen condition. Bio char produced from coconut shell had higher carbon with typically less ash and it contains mineral nutrients compound compare with Bio char produced from cattle dung.

Gimba (2008) worked on the “optimum conditions for carbonization of coconut shell”. The process is generally accomplished by heating the source material usually in the absence or limited amount of air to a temperature sufficiently enough to dry and volatilize substances in the carbonaceous material (Hassher, 1963).

It was reported by Gimba (2001) that coconut shell contains about 65 – 75% volatile matter and moisture which are removed largely during the carbonization process. This study addressed determination of yield, rate of weight loss, optimum temperature as well as determination of ash and moisture contents of the carbonized carbon and suitable resident time for carbonization. The result shows a maximum yield of 27% of carbonized product. The characteristic particle size of 500µ mm, carbonization temperatures of 500 – 600 °C at resident time of 5 minutes were the optimum production conditions.

Imoisilli (2012) investigated the “Effect of concentration of coconut shell ash on the tensile properties of Epoxy composites”. Having experimented with five filler concentrations (5 – 25% by weight) the test reports show that tensile strength, elastic modulus and micro hardness of the composite increase with increase in filler concentration, while percentage elongation and load at break decreases with increase in filler concentration. He concluded that coconut shell ash can be used as reinforcing filler in epoxy composites.

Rathanak and Ranat (2005) reported the great potential of coconut shell powder as a filler in producing biodegradable plastic composite in future. They studied the mechanical properties and bio degradability study of coconut shell powder filled low density polyethylene filler. The parameters tested include mechanical testing, tensile, and burst test. While the biodegradable test was carried out using microbes, Pseudomonas and E. Coli. It was concluded that the integration of coconut shell powder resulted in increment in modulus of elasticity burst strength and biodegradability, but reduction of tear strength, tensile strength and elongation at break

Sapuan and Hurimi (2003) also reported their findings on mechanical properties of epoxy/coconut shell filler particle composites. The parameters tested were the tensile and flexural properties of composites made from coconut shell filler particles and epoxy resin. The tensile and flexural tests composites base on coconut shell protective material particles at three different filler inside viz 5%, 10% and 15% were carried out using universal tensile testing machine according to ASTM D 3039/D, 3039 M – 95a and ASTM D 790 – 90 respectively.

Agunsoye (2012) studied the mechanical behavior of coconut shell reinforced polymer matrix composite. The focal point of the learning was the evaluation of the morphology and also the mechanical properties of coconut shell reinforced polyethylene composite to establish the possibility of using it as a new material for engineering applications. Coconut shell reinforced composite was prepared by compacting low density polyethylene matrix with 5% - 25% volume fraction coconut shell particles and the effect of the particles on the mechanical properties of the composite produced was investigated. The result shows that the hardness of the composite increased with increase in coconut shell content though the tensile strength, modulus of elasticity impact energy and ductility of the composite decreased with increase in the particle content, while the Scanning Electron Microscopy (SEM) of the composites (with 0% - 25% particles) surfaces indicates poor interfacial interaction between the coconut shell particles and the low density polyethylene matrix. The experimental results show that tensile and flexural properties of the composites increased with the increase of the filler particle contents.

3. MATERIALS USED AND METHODOLOGY

3.1 Materials

3.1.1 Cement:

Cement must build up the proper strength. It must signify the proper rheological behavior. Generally equal types

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 05 | May - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

of cements have relatively different rheological and strength characteristics, mainly when used in combination with admixtures and supplementary cementing materials.
Specific gravity of cement is 3.15. Ordinary Portland cement grade 43 of IS 8112-1976 was used for this project. Portland cement used in this investigation. The tests on the cement were done in my college civil labs. I have used the Ultra Tech cement in this project. The Portland cement conformed to the standards.

3.1.2 Fine aggregate:

Sand with particle size less than 4.75 mm, Specific gravity 2.4, Fine aggregate usually consists of natural, crushed, or manufactured sand. Natural sand is the common component for regular weight concrete. In various cases, manufactured light weight particles used for lightweight concrete and mortar. The maximum grain size and size distribution of the fine aggregate depends on the type of product being made.

Fine modulus - 2.4 used and
Density - 1417kg/m^3.

3.1.3 Coarse Aggregate:

Use 20 mm crushed stone with a specific gravity of 2.45 & a density of 1389 kg/m^3 as coarse aggregate. Smaller sized aggregates make higher concrete strength. Regularly an aggregate with specific gravity more than 2.55 and absorption less than 1.5% (except for light weight aggregates) can be regarded as being of excellent quality. Where aggregates strength is higher, concrete strength is also higher.

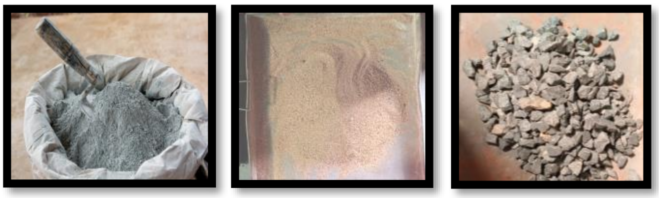


Figure 2 Cement & Fine Aggregate & Coarse Aggregate

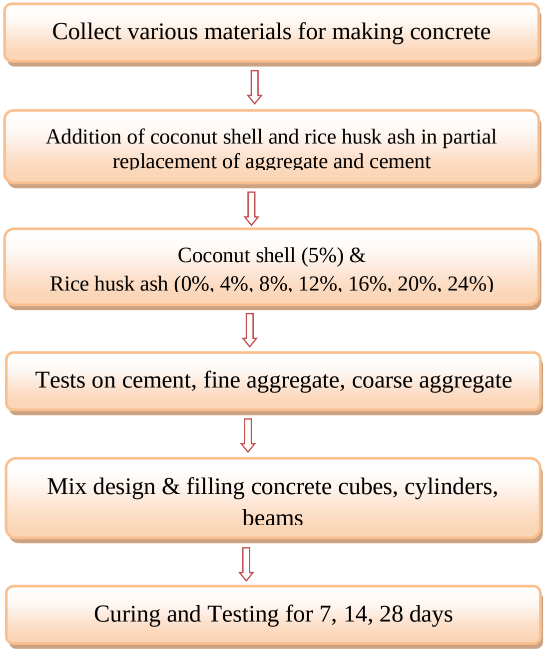
3.1.4 Coconut Shell:

Coconut shell pieces is a waste product from coconut shell and dried up for some time and then crushed it into pieces, piece crushed into 20mm same as coarse aggregate size and specific gravity of 1.47. The coconut shells are obtained from a local coconut field or from home itself. It should be sun dried before being crushed manually. Coconuts show a wide diversity in size, weight, shape and color, depending on genetic variety and maturity of the nut at harvest. 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.

3.5 Rice Husk Ash:

Rice husk ash is a waste product from the rice grain industry by burning this husk grains, rice husk has a mass of 95µ and spe cific gravity of 2.14. It is a fine powder resulting from the combustion of rice grain industry and collected in the Electrostatic Precipitators. Conversion of waste into a resource material is an age-old practice of civilization.

3.2 Methodology



4. EXPERIMENTAL INVESTIGATION

4.1 Specific Gravity of Cement

Aim:

To determine the specific gravity of cement once you have completed the steps above, apply the formula that is provided below.

$S_g = (W_2-W_1)/ ((W_2-W_1)-(W_3-W_4) \times 0.79)$

Apparatus:

1. Le–Chatelier flask
2. Kerosene
3. Cement

Procedure:

The following apparatus is used in specific gravity tests of cement

- Clean the Lechatlier flask before use. It should be free from moisture.
- Now, take the weight of the empty flask as W_1.
- Take around 50 gm of cement and fill in the flask.
- Fix the stopper on the flask and weigh the flask with cement as W_2.
- Now fill the kerosene in the flask up to the neck of the bottle.
- Thoroughly mix cement and kerosene in the flask taking with care no air bubble is left in it. Record this weight as W_3.
- Empty the flask and clean it. Now fill the kerosene in it up to the neck of the bottle and record the weight as W_4.

Observations and Calculations:

Table 2 Description of specific gravity of cement

Description of item	Trial
Weight of empty bottle(W1 g)	25
Weight of bottle + Cement (W2 g)	49
Weight of bottle + Cement + Kerosene(W3 g)	80
Weight of bottle + Full Kerosene(W4 g)	63.6
Specific Gravity of cement	3.15

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 05 | May - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Result

The specific gravity of a sample of cement = 3.15

4.2 Specific Gravity of Coarse Aggregate

Aim:

The objective of the effort is to evaluate the Particular gravity & Water Assimilation of Fine Total by using Pycnometer.

Apparatus:

1. A adjust of capacity about 3kg, to weigh precise 0.5g, and of such a form and shape as to encourage weighing of the test holder however hung in water.
2. A thermostatically regulated broiler to maintain temperature at 100-110° C.
3. A wire bushel of not more than 6.3 mm work or a perforated holder of fitting measure with lean wire holders for suspending it from the balance.
4. A holder for filling water and suspending the basket
5. An discuss tight holder with capacity similar to that of the basket
6. A shallow plate and two porous pieces of clothes, each not less than 75x45cm.

Theory:

Specific gravity test of totals is done to look at the quality or quality of the fabric while water assimilation test assesses the water retaining capacity of the coarse and fine totals.

The key purpose of this test is to

1. To degree the quality or quality of the material.
2. To determine the water assimilation of aggregates.

Specific Gravity is the proportion of the weight of a specific volume of total to the weight of an indistinguishable quantity of water. It is the degree of quality or quality of the provided material. Totals with lower particular gravity are generally weaker than those with higher specific gravity values.

Procedure:

1. Approximately 750 gms of entire test is washed fully to expel particles, depleted and placed in wire bushel and immersed in refined water at a temperature between 22- 32º C and a cover of at least 5cm of water over the beat of basket.
2. Instantly after inundation the caught talk is emptied from the test by lifting the wicker container carrying it 25 mm above the base of the tank and letting it to slide at the rate of roughly one drop per minute. The bushel and whole need to be entirely immersed in water for a duration of 24 hour after.
3. The bushel and the test are weighed when suspended in water at a temperature of 22° – 32°C.
4. The bushel and totals are taken back from water and cleared out to deplete for a couple of minutes, taking after which the totals are swapped to the dry retentive apparel. The purging bushel is at that point returned to the tank of water jolted 25 times.
5. The totals placed on the permeable garments are surface dried till no further dampness may be evacuated by this texture. At that point the totals are transferred to the moment dry texture supplied in single layer and cleared out to dry for at smallest 10 minutes till the totals are entirely surface dry.
6. The total is set in a shallow container and warmed in a stove kept up at a temperature of 110° C for 24 hours. It is at that point withdrawn from the burner, refrigerated in an extremely tight holder.
7. Quality of the material should be good and dry. The bush and whole need to be entirely immersed in water for duration of 24 hour.

Observations & Calculations:

1. Weight of empty container= W_1**g**
2. Weight of container with material = W_2 **g**
3. Weight of container + material + Water = W_3g
4. Weight of container + Water = W_4 **g**

Specific gravity = $(W_2 - W_1)/((W_2 - W_1) - (W_3 - W_4))$

Table 3 Calculation of Specific gravity of coarse aggregate

S.NO	DESCRIPTION	TRAIL-1	TRAIL-2	TRAIL-3
1	Weight of empty container W_1g	650	650	650
2	Weight of container with material W_2 g	1150	1166	1170
3	Weight of container + material + Water W_3g	1780	1786	1790
4	Weight of container + Water W_4 g	1461	1461	1461
5	Specific Gravity of Coarse Aggregate	2.76	2.70	2.72
6	Average		**2.73**	

Observations & Calculations of Water Absorption:

1. Weight of Saturated Surface dried material = **A gms**
2. Weight of oven dried material = **B gms**

Water absorption% = (A-B/A)*100

Table 4 : Calculation of Water absorption of coarse aggregate

S.NO	DESCRIPTION	I	II	III
1	Weight of Saturated Surface dried material A gms	673	665	670
2	Weight of oven dried material B gms	662	651	657
3	Water absorption (A-B)/A*100	1.78	2.10	1.94
4	Average Value		1.94%	

Result:

The Value of Specific gravity of coarse aggregate is **2.73 &** Water absorption is **1.94 %.**

4.3 Determination of Bulking of Fine Aggregate

Aim:

To explore the bulking of fine total (IS: 2386 (Part3) 1963).

Apparatus:

- Weighing adjust
- weight box
- mixing container
- measurement barrel
- pole for compaction.

Procedure:

1. Taken 500 gm(W1) of sand passing through 1.18 mm sieve.
2. Kept the test in a stove on a plate at a temperature of 100oC-110oC for 24±0.5 hours.3. 3. Cool the sand in a tight container and weight it(W2), water substance of the test is (W1- W2) ×100/W1 .
4. Taken out roughly 200 grams of sand and put it into a pan.
5. Included 2% of water (by weight) and blended well.
6. Poured the sand test into a measuring cylinder.
7. Leveled the surface and assessed the volume in ml (h1).
8. Poured water into the measuring barrel and entirely swamped the sand and shook it.
9. Leveled the surface and composed down the level in ml (h2).
10. Taken out the whole sum of sand and resumed the test by adding 2% water more each time and composed down the comparison volume of sand until the dump sand volume begins lowering.

11. At that moment (h1+h2) illustrates the bulking of the test sand under scrutiny. Rate of bulking = (h1- h2/h2) ×100 %.

Observations & Calculations:

Table 5 Calculation of Bulking of sand

Description	Trail 1	Trail 2	Trail 3
Vol. of loose sand, ml h1	200	200	200
Vol. of Saturated sand, ml h2	151	153	155
BulkingPercent=(h1-h2)/ h2*100	32.45	30.71	29.03
Average Value	**30.73 %**		

Result:

The Value of bulking of sand is **30.73%.**

4.4 New Concrete Is Determined by the Slump Test

Aim:

To determine the consistency of new concrete by measuring the coefficient of shrinkage

Apparatus:

i. The slump cone equipment used to perform the slump test generally consists of a cone-shaped metal mold with the following dimensions: bottom diameter: 20 cm, side top diameter: 10 cm, height: 30 cm, metal mold plate thickness of less than 1.6 mm weight and weight device,

ii. Compactor (diameter 16mm, length 600mm), pipes, mixing tools and boxes or concrete mixers etc.

iii. Compression factor equipment: trowel, shovel length of 150 mm, counterweight up to 25 kg with accuracy of 10 grams. Heavy and heavy equipment, compactors (diameter 16 mm, length 600 mm), rulers, mixing tools and vessels or concrete mixers, etc.

Theory:

Slump test:

Slump test is the most commonly used method to measure the consistency of concrete and can measure the consistency of concrete. Work in a lab or office. This method is not suitable for wet or very dry concrete.It does not measure all the factors affecting the work and does not always represent the plasticity of concrete. For slip collapse, the collapse value is measured as the difference between the mold height and the average slump height.

Compression ratio test:

The compression ratio test is mainly used in laboratories, but can also be used in the field. It is more accurate and sensitive than the slump test, it is especially useful for concrete mixes with very low workability and is generally used when the concrete is vibrated. This method applies to free and wind-entrained concrete made of lightweight aggregate, normal-weight aggregate, or heavy aggregate with a nominal maximum size of 40 mm or less, but not air-entrained rock or fine-grained rock.

Process:

I. Slump test:

(1) Using a weight mix: 1:1.5:3; using three different water-cement ratios = -0.4, 0.5, 0.6 to prepare three mixtures.

(2) Carefully wash the inside of the mold to remove excess water.

(3) Carefully place the mold on a smooth, flat, hard and non-absorbent metal sheet, etc., and fix it.

(4) Fill the mold with freshly prepared stone in four layers, and temper and tighten each layer with twenty-five tempering rods. After the top layer is secured with sticks, the excess stones are dug out and leveled with a trowel or firewood.

(5) Carefully lift the formwork vertically so as not to damage the concrete blocks.

(6) Determine the difference between the formwork height and the maximum concrete height. It varies in height up to 7 mm and has deflection for all concrete tests and table settling.

Check the compression ratio

(1) Prepare for mixing and cleaning the loading area, and remove the compression ratio and the inside of the cylinder mold.

(2) Pay attention to the dimensions of the top, bottom and cylindrical shape, and write the size in sa quality way in the report.

(3) The weight of the roller is used as W_1.

(4) Put the mixing stone into the upper chamber until it reaches the edge.

(5) Open the cover of the upper chamber to let the stones fall into the lower chamber.

(6) Then open the lower chamber lid to let the stones fall in a cylindrical shape

(7) In the case of dry mixing, the stones are rubbed lightly with a stick.

(8) Level the concrete over the rink. Use the weight of the roller and a portion of the concrete mixture and weight W_2.

(9) Empty the roller and pour it into the same layer of concrete structure to a depth of about 50mm.

(10) Compress each layer (preferably by vibration) to achieve sufficient compression.

(11) Then gently lift the water jet from above to the top of the cylinder.

(12) Weigh the finished concrete, called W_3, using the mold.

Result:

1. Concrete Settlement is 100mm Low/Medium/High Exploitation Indication
2. Compression Ratio Special 0.4.

5. MIX DESIGN

A) Stipulation for Proportioning Concrete Ingredients

a) Characteristic compressive quality required within the field at 28 days review - M 30
b) Sort of Cement - OPC 43 Review affirming to IS 8112 : 1989
c) Max size of CA - 20 mm
d) Shape of CA - Angular Aggregates with angularity Shape
e) Greatest water-cement proportion - 0.45 (IS 456)
f) Workability - 100mm (droop)
g) Degree of super vision - Good
h) Sort of total - Pulverized point total
i) Chemical admixture - Nil

B) Test information for materials:

a) Cement Specific Gravity - 3.15
b) Particular gravity of total coarse - 2.45
c) Particular gravity of total fine - 2.40
d) Particular gravity of Chemical admixture - Nil
e) Water retention coarse total - 4.65%
f) Water assimilation fine total - 1.58 %
g) Free (surface) dampness
1) Coarse total: Nil (retained dampness too nil)
2) Fine total: Nil (retained dampness too nil)

Aggregate are expected to be in immersed surface dry condition as a rule whereas planning plan mix.

h) Strainer Examination

Fine totals: Affirming to Zone I of Table 4 IS – 383

Mix Design of M25 Grade Concrete

Step 1: Determining the Target Strength for Mix Proportioning

f'ck = fck+1.65 S or f'ck = fck + X

Whichever is greater.

Where f'ck is the desired normal compressive quality at 28 days,

fck is the typical compressive quality at 28 days,

S is the standard deviation, and

X is the calculated value based on a review of the concrete.

Standard deviation, S = 4 N/mm2, from Table 2.

X = 5.5 in Table 1.

As a result, goal quality using both criteria is

a) f'_{ck} = f_{ck}+1.65 S
= 30 + (1.65*4)
= 38.25 N/mm^2.

b) f'_{ck} = f_{ck} + 6.5
= 30+ 6.5
= 36.5 N/mm^2

The higher value is considered.

As a result, the goal quality will be 38.25 N/mm^2 since 38.25 N/mm^2 > 36.5 N/mm^2.

Step 2: Approximate air content

From Table 3, the inexact sum of entangled discuss to be predicted in normal (non-air-entrained) concrete is 1.0 percent for 16 mm apparent maximum measure of total.

Step 3: Selection of water-cement ratio

From Fig. 1, the free water-cement percentage necessary for the goal quality of 38.25 N/mm^2 is 0.45 for OPC 43 review bend. This may be lower than the most extreme esteem of 0.45 approved for 'Severe' presentation for reinforced concrete as per Table 5 of IS 456. 0.45 ≤ 0.45, accordingly it is considered.

Step 4: Strength of water content:

Table 2 of IS 10262-2009

Maximum water substance = 186 lit (often for droop extend of 25 to 50 mm)

Within the above-mentioned IS regulation, the above-estimated water is suggested for a slump range of 25 to 50 mm. Water may be extended by 3% for every 25 mm increase in droop, according to IS 10262: 2009.

By using Interpolation method we got the extended percent to 6 %

Estimated water content for 100mm slump = 186 + 6% of w.c (IS 10262-2009)

= 186 + 6% (186= 197 lit

STEP 5: Calculation of Cement Content

Water-Cement Ratio = 0.45

Water content from Step – 4 i.e. 197 liters

Cement Content = Water content / "w-c ratio" = (197/0.46)

= 437.77 kg/m^3

= 438 kg/m^3

From Table 5 of IS 456,

Minimum cement Content for Moderate exposure condition = 320 kg/m^3

438 kg/m^3 > 320 kg/m^3, hence, it is considered.

As per clause 8.2.4.2 of IS: 456

Maximum cement content = 450 kg/m3, hence ok too.

STEP 6: Proportion of Volume of Coarse Aggregate and Fine aggregate Content

According to IS 10262-2009 Table 3, the volume of coarse total compared to 20 mm measure and fine total (Zone I) = 0.60. Fine Total Volume = 1 - 0.6 = 0.4

STEP 7: Estimation of Concrete Mix Calculations

The following are the blend calculations per unit volume of concrete:

1. Concrete volume (a) = 1 m^3
2. Cement volume (b) = (cement mass / cement specific gravity) x (1/1000)
   = (438/3.15) x (1/1000) = 0.139 m^3
3. Water volume (c) = (Mass of water / Particular gravity of water) x (1/1000)
   = (197/1) x (1/1000)= 0.197 m3
4. Add up the whole volume (d) =a-(b+c)
   =1-(0.138+0.197)
   = 0.665 m^3
5. Mass of coarse totals
   = d X Coarse Total Volume X Coarse Total Particular Gravity X 1000
   = 0.665 X 0.60 X 2.73 X 1000
   = 1089.27 kg/m^3
6. Mass of fine totals
   = d X Fine Total Volume X Fine Total Particular Gravity X 1000
   = 0.665 X 0.40 X 2.46 X 1000
   = 654.36 kg/m^3

STEP-8: Concrete Mix proportions for Trial Number 1

Table 6 : Mix proportion of M30

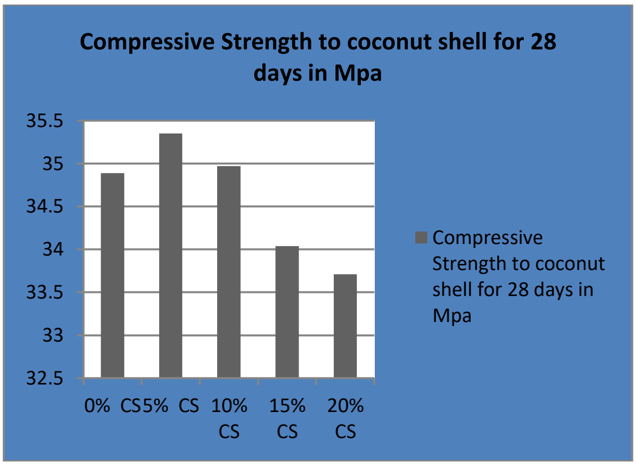
Grade	M30
Proportion	1:1.49:2.49
W/C ratio	0.45
Cement	438
Fine Aggegate	654
Coarse Aggregate	1089
Water	197

6. RESULTS AND ANALYSIS

6.1 Compressive Strength To Coconut Shell For 28 Days At Different Percentages

Table 7 compressive strength to coconut shells for 28 days

Mix % Replacement	Compressive Strength for 28 days in Mpa
0% CS	34.81
5% CS	35.35
10% CS	34.97
15% CS	34.04
20% CS	33.71

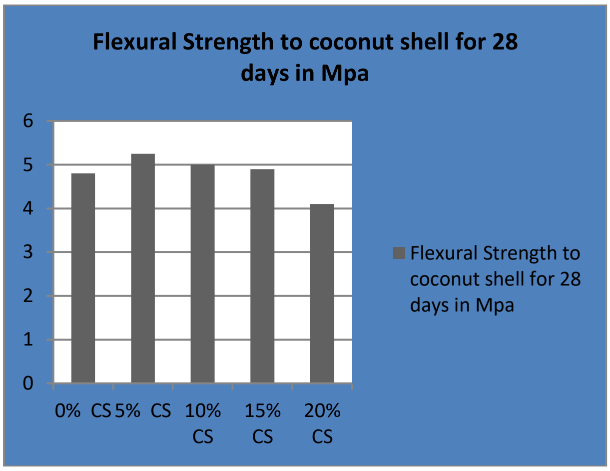


Graph 1 compressive strength to coconut shell for 28 days

6.2 Flexural Strength To Coconut Shell For 28 Days At Different Percentages

Table 8 Flexural strength to coconut shell for 28 days

Mix % Replacement	Flexural Strength to coconut shell for 28 days in Mpa
0% CS	4.8
5% CS	5.25
10% CS	5.0
15% CS	4.9
20% CS	4.1

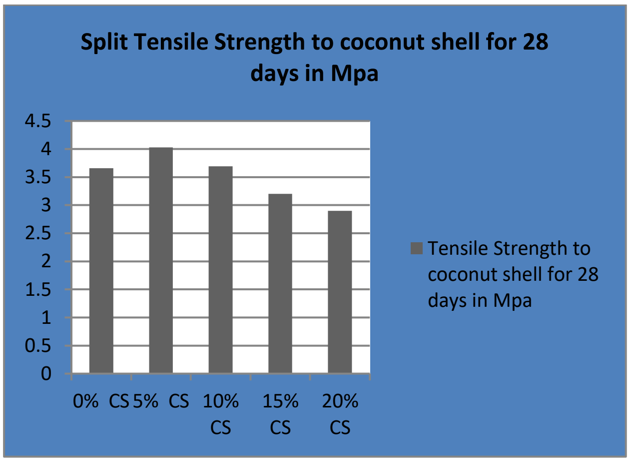


Graph 2 Flexural strength to coconut shell for 28 days

6.3 Split Tensile Strength To Coconut Shell For 28 Days At Different Percentages

Table 9 Split tensile strength to coconut shell for 28days

Mix % Replacement	Split Tensile Strength to coconut shell for 28 days in Mpa
0% CS	3.66
5% CS	4.03
10% CS	3.69
15% CS	3.2
20% CS	2.9



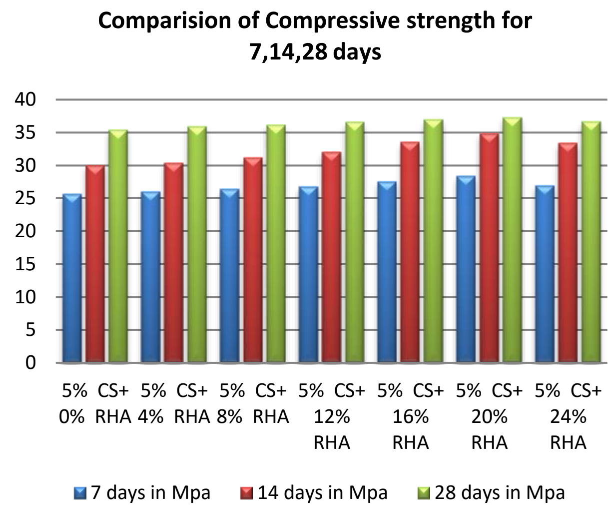
Graph 3 Split tensile strength to coconut shell for 28 days

As per the above study of Compressive strength, Flexural strength, Split Tensile strength properties I have taken 5% constant coconut shell as replacement of coarse aggregate because the Split tensile strength is increased at 5% of coconut shell in coarse aggregate so I have taken the highest compressive strength gained value in the project.

6.4 Comparison Of Compressive Strength For 7,14,28 Days

Table 10 compressive strength for 7,14,28 days

Mix % Replacement	7 days in Mpa	14 days in Mpa	28 days in Mpa
5% CS+ 0% RHA	25.58	29.97	35.35
5% CS+ 4% RHA	25.97	30.35	35.87
5% CS+ 8% RHA	26.34	31.12	36.11
5% CS+ 12% RHA	26.73	32	36.92
5% CS+ 16% RHA	27.52	33.5	37.03
5% CS+ 20% RHA	28.34	34.85	37.27
5% CS+ 24% RHA	26.94	33.36	36.63

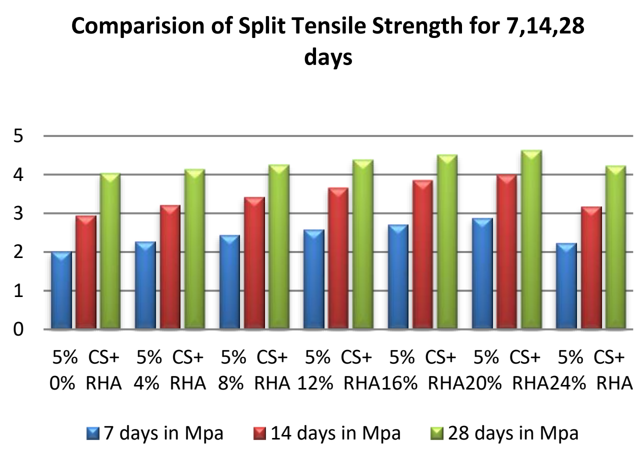


Graph 4 Compressive strength for 7,14,28 days

6.5 Comparison Of Split Tensile Strength For 28 Days

Table 11 Comparison of split tensile strength for 7,14,28 days

Mix % Replacement	7 days in Mpa	14 days in Mpa	28 days in Mpa
5% CS+ 0% RHA	2.01	2.95	4.03
5% CS+ 4% RHA	2.27	3.21	4.14
5% CS+ 8% RHA	2.44	3.43	4.25
5% CS+ 12% RHA	2.58	3.66	4.38
5% CS+ 16% RHA	2.71	3.85	4.51
5% CS+ 20% RHA	2.87	3.99	4.62
5% CS+ 24% RHA	2.23	3.18	4.22



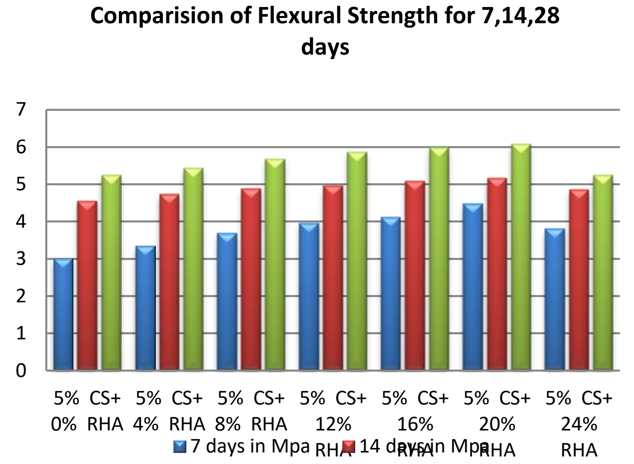
Graph 5 comparision of split tensile strength for 7,14,28 days

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 05 | May - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

6.6 Comparison Of Flexural Strength For 7,14,28 Days

Table 12 Comparison of Flexural strength for 7,14,28 days

Mix % Replacement	7 days in Mpa	14 days in Mpa	28 days in Mpa
5% CS+ 0% RHA	3.02	4.55	5.25
5% CS+ 4% RHA	3.35	4.73	5.43
5% CS+ 8% RHA	3.68	4.88	5.67
5% CS+ 12% RHA	3.95	4.96	5.86
5% CS+ 16% RHA	4.12	5.08	5.99
5% CS+ 20% RHA	4.47	5.17	6.08
5% CS+ 24% RHA	3.8	4.85	5.25



Graph 6 Comparison of Flexural strength for 7,14,28 days

7. CONCLUSIONS

The main aim of this research is to compare and to know the strength properties of concrete like compressive strength, split tensile strength, flexural strength for M30 grade of concrete with water-cement ratio of 0.45 and As I observed from the analysis of data from discussion in this study, it can be concluded that overall strength of concrete is increased. Rice husk ash concrete show better workability of concrete compared with the workability of coconut shell concrete. Based on the tests conducted on concrete on different percentages of coconut shell was taken to know the constant value and at 5% of coconut shell is increased the strength properties as reference from the above study I have taken constant 5% coconut shell and 0% with 4% increase of rice husk ash up to 24% then the compressive shows that the on 5% coconut shell and significantly compared with the 20% rice husk ash the concrete gets maximum strength. The compressive strength of a concrete at 7 days, 14 days and 28 days are 28.34Mpa, 34.85Mpa and 37.27Mpa respectively. However, the large addition value of replacement percentage can also reduce the strength of concrete.

Same as compressive strength ,the split tensile strength, flexural strength also increased with constant 5% CS and 20% RHA then gradually decreased was observed based on the data and discussion, So the partial replacement with coconut shell as coarse aggregate and rice husk powder with cement if suitable for concrete grade of M30 at 5% CS and 20% RHA.

As per the results coconut shell and rice husk ash confirm that the it has light weight concrete property and also using of both waste materials can reduce the cost of construction, reduces the depletion of natural sources of conventional concrete and also helpful to make eco-friendly environment. It can be used in partition walls, floors, tiles, concrete brick blocks etc.

REFERENCES

1. Alengaram, U. J., Mahmud, H. B., & Jumaat, M. Z. (2013). Utilization of coconut shell as coarse aggregate in concrete: A review. Construction and Building Materials, 38, 161-172.
2. ASTM International. (2016). Standard test methods for compressive strength of cylindrical concrete specimens (ASTM C39/C39M-16a). West Conshohocken, PA: ASTM International.
3. Rashid, M. E., Rahman, M. M., & Islam, M. S. (2019). Effect of rice husk ash and coconut shell ash on the properties of concrete. International Journal of Civil Engineering and Technology, 10(4), 291-301.
4. Siddique, R., & Naik, T. R. (2012). Properties of concrete containing rice husk ash: A review. Construction and Building Materials, 28(1), 536-541.
5. Suresh, S., & Prakash, K. (2014). Use of rice husk ash as a partial replacement with cement in concrete mixes: A review. International Journal of Engineering Research and Applications, 4(9), 81-84.
6. S. U. Azunna, et al., “Characterization of Lightweight Cement Concrete with Partial Replacement of Coconut Shell Fine Aggregate”. SN Applied Sciences, vol.1, No.649, 2019, Doi:10.1007/s42452-019-0629-7
7. J. T. Utsev and J. K. Taku, “Coconut Shell Ash as Partial Replacement of Ordinary Portland Cement in Concrete Production”. International Journal Of Scientific & Technology Research, vol.1, No. 8, 2012.