# Experimental Study of Replacement of Cement With Rice Husk Ash And Proportionate Addition of Coconut Fibre on Concrete

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***Abstract-*** *This study summarizes the impact of partial replacement of cement with rice husk ash and proportionate addition of coir fibre with aggregates for Ordinary Portland cement concrete. Concrete is the most vital construction engineering material and to change the properties of concrete some addition or replacement in the cement has to be done to make the concrete more durable. Due to many research paper it is found that concrete is good in compression but weak in tension and flexural. The main purpose of uses coir fibre is resistance to hold cracks and strengthening of concrete. Usage of the waste materials will study is to determine the optimum mix level of replacement of RHA in cement and addition of coir fibre with aggregates and to investigate the effect on strength of the concrete by changing of cement with rice husk ash and proportionate addition of coconut fibre. Partial replacement level of (CC) 0%, 5%, 10% RHA with cement in additional cocount coir fibre by using M20 grade of concrete.*

***Keywords***- Rice husk ash, cement, fine aggregate, coarse aggregate, coir fibre, compressive strength.

## I. INTRODUCTION

In the construction industry the concrete is most commonly used material for the construction of Building, Roads and Bridges etc. From last many years the many materials are used as replacement or addition in cement to produce the concrete more durable and increased the strength of concrete research find new material to increases the strength of concrete continuous even today. From the studied research paper it is observed that the concrete is good in Compression strength and weak in tensile and flexural strength so reinforced bars are used as reinforcement material the use of reinforced steel bars is very costly to make the concrete more durable and strong so we introduced the fiber reinforced concrete material. Fiber reinforced concrete is defined as a complex material made up of Portland cement, aggregates, water and discrete fibers.

**1.1METHOLOGY-**The experimental was aimed at studied the compression strength and split tensile strength and experimental work involved casting and testing of conventionally concrete cubes and cylinders having different amount of RHA and coconut fibre. The quality as well as characteristics of the concrete depends upon the properties of the materials therefore the initial test were conduct on cement, course aggregates and fine aggregates before beginning of the experimental planned. The cubes specimen of 150*150*150mm3 were casted with different amount replacement of cement with RHA and the addition of coconut fibre.

### RICE HUSK ASH

RHA stands for rice husk ash stands, which are a large amount of silicon dioxide (SiO2), importance. Rice husk ash has been around 70 million tons per year. Where rice husk ash surrounded the area to put big risk. Rice is the waste product of rice hush industry. Rice to the burning of rice husk has been developed husk ash. Later, as a substitute for cement with or rice husk that is complementary content and cementanious burning material is used to know. Means using rice husk ash content of rice during construction filtrate.

The present time is increased to strengthen the solid waste materials to access updated with new material. To create low-cost new products are in different places with rice husk ash. Husk ash is used to make high performance concrete. Every 1000 kg of rice grain produced 220 kg of Rice husk. Means using rice husk ash content of rice during construction filtrate. To create low-cost new products are in different places with rice husk ash. Husk ash is used to make high performance concrete.

### COCONUT FIBREREINF ORCED CONCRETE

Coconut Fibres and used in the work of the branch of engineering as fiber material was used in one of the construction material in civil engineering. The coconut fibres

are also one of the best fibres. Coconut fibre is removed from the outer shell of coconut and it's a scientific name and plant family name of the coconut natural fibre is "coir Coconut fibre already being low in density so reduces the weight of the fibre reinforced concrete therefore it can be used as a structural light weight concrete and by reinforcing the concrete with coconut fibres which are freely available, we can reduce the environmental waste. Flexural strength increases in when added 3% of fibre in concrete mix. Thus, economy can be achieved in construction.

## II. SCOPE STUDY

a) The rice husk ash and coconut fiber, are the industrial and agricultural waste products -industrial a product of Agricultural waste to reduce environmental impact, The concrete grade M 20 is used for research work .

b) Cement is to be changed (by weight) by rice husk ash and addition of coconut fibre to concrete by 5%, 10%, respectively, to get optimal results.

1. The various concrete properties like compressive strength, split tensile strength and flexural strength for various mixes is to be examined at a changed proportion of Rice Husk Ash and coconut fiber.
2. The results carried out after replacement and addition of cement compared with the standard concrete mix and then best result is taken into considered for practical applications.

## III. LITERATURE REVIEW

**Ramakrishnan S et al.(2014)** Studying the pavement concrete performance on limited changed percentage mix of M20 grade concrete growth rice hush ash cement control weight. Change the cement with limited rice husk ash at 0%, 5%, 10%, 15%, with M20 grade concrete mix for concrete pavement.The most significant and useful properties of concrete is its compressive strength. In the structure applications concrete is mostly used to hold the compressive stress. The concrete specimen changed with RHA at 0%, 5%, 10%, 15%, for calculated compressive strength were determined.

**Makarand SureshKulkarni et al. (2014)** studies the mechanical properties of concrete by limited changed of rice husk ash with cement of 0%, 10%, 20 %, 30 %. In this study the optimal amount of replacement of RHA with cement is determined. With the rise of 10%, 20% and 30% RHA in normal concrete at 7 days the strength is slightly increased but after 28 days the addition of 20% RHA gives the similar strength to the normal concrete. The optimal replacement amount of RHA for M20 grade of concrete is found to be 20%.

**Godwin A. Akeke et al. (2012)** studied the improvement on Structural Properties of concrete by the partially changed of RHA with ordinary Portland cement (OPC). Rice husk ash has been used great scale and found to concrete tensile strength changed percentages of 10-25% in a mix of 1:1.5:3. The effects of compressive strength.

**Abhilash Shukla et al. (2011)** studied the mechanical properties of concrete with partial change of RHA. The aim of this work is to control the optimal percentage (0, 5, 10, 15 & 20%) of RHA as a partial change for M20 and
M60 grade of concrete.

## IV. MARTERIALS AND METHODS

### Materials

### Ordinary Portland cement (OPC)

Ordinary Portland cement will check the requirement of IS (8112:1989) OPC 43Grade cement is used for the experimental work.

| SINO | PROPERTIES | VALUE |
|---|---|---|
| 1 | Specific gravity | 3.5 |
| 2 | Water absorption | 3.5% |
| 3 | Setting time | 48min (Initial)<br>165min (final) |

### FINE AGGREGATES

Properties of fine aggregates were determined by conducting tests as per IS 2386 (part-1).the result obtained from sieve analysis are determined in table. The result indicates that the fine aggregate conforms to Zone I of IS: 383-1970.

| SI NO | PROPERTY | VALUE |
|---|---|---|
| 1 | Sieve Analysis | Zone I |
| 2 | Specific gravity | 1.53 |

### COARSE AGGREGATES

Crushed granite stones are Gnanamani College Technology. Two size of coarse aggregates are used 20mm and 10mm aggregates. The properties of course aggregates are determined by conducting test as per IS: 2386 part III

| SI NO. | PROPERTY | VALUE |
|---|---|---|
| 1 | Specific gravity | 2.65 |
| 2 | Water absorption | 1.3% |

**WATER**

Portable tap water available in laboratory with pH value of 7.0 ± 1 and confirming to the requirement of IS: 456-2000 was used for mixing concrete and curing the specimens as well. Combining water with a cementations material forms a cement paste by the process of hydration. Hydration involves many different reactions, often occurring at the same time. As the reactions proceed, the products of the cement hydration process gradually bond together the individual sand and gravel particles and other components of the concrete, to form a solid mass.

**COCONUT COIR FIBRE**

Coir fibre is the agricultural waste material obtained from mature coconut. In this project coconut coir is collected from furniture shop Amritsar and its diameter is 0.22mm having aspect ratio is 110. Coconut fibre having high water absorption property therefore coir fibre is placed in water before mixing in the concrete.

**THE PHYSICAL PROPERTIES OF COIR FIBRE**

| ASPECT RATIO | LENGTH | DIAMETER |
|---|---|---|
| 110 | 2.5cm | 0.022cm |

| SI NO. | PROPERTY | VALUE |
|---|---|---|
| 1 | Water absorption | 2.22% |

**THE CHEMICAL PROPERTIES OF COIR FIBRE**

| Composition | Fibre old nuts | Fibre young nuts |
|---|---|---|
| Cellulose | 43.44 | 32.86 |
| Hemicelluloses | 0.25 | 0.15 |
| Lignin | 45.84 | 41.54 |
| Ash content | 2.06 | 2.50 |

**Rice Husk Ash**

RHA is grayish-black in color due to unburned carbon. At burning temperatures of 550–800 °C, amorphous silica is formed, while crystalline silica is produced at higher temperatures. The specific gravity of RHA varies from 2.11 to 2.27; it is highly porous and light weight, with a very high specific surface area.

**The Physical Properties Of rice husk ash**

| Particulars | Properties |
|---|---|
| Color | Grey |
| Particle Size | <45 microns |
| Shape texture | Irregular |
| Odor | Odor less |
| Appearance | Very Fine |
| Specific Gravity | 2.3 |

**The Chemical Properties of Rice husk ash**

| Si.No | Particulars | Proportion |
|---|---|---|
| 1 | Silicon dioxide | 87% |
| 2 | Aluminum oxide | 0.2% |
| 3 | Iran oxide | 0.1% |
| 4 | Sodium oxide | 0.1-0.8% |
| 5 | Calcium oxide | 0.3-2.2% |

**DESIGN OF CONCRETE MIX**

The fundamental requirement of concrete mix that, it should be satisfactory with both in fresh as well as in the hardened concrete, processing certain minimum desirable properties like workability, strength and durability. M20 grade Mix design is the process of selecting suitable ingredients of concrete, determining their relative proportions with There are number of methods of concrete mix design. In this project work, the concrete mix design recommended by IS 10262-2009.

**MIX DESIGN**

**Design mix based on IS 10262-2009 method:**

**Design Stipulations:**

1. Grade of concrete = $M_{20}$
2. Characteristic compressive Strength at 7days = 20N/Sq m3
3. Maximum size of aggregate = (20 to10 mm)

**Test Data for Materials:**

4. Cement Used = OPC 43 Grade
5. Specific gravity of Cement = 3.15
6. Specific gravity of Fine aggregate = 2.33
7. Specific gravity of Coarse aggregate = 2.75 (20 mm)
8. Specific gravity of Coarse aggregates = 2.75 (10mm)
9. Water absorption of Fine aggregate = 1%
10. Water absorption of Coarse aggregate = 1.46%

**Sieve Analysis:**

11. Fine aggregate = Zone I
12. Coarse aggregate = (20 to10 mm)

**Target Mean Strength:**

Fck = Fck+1.65*Standard Deviation
Fck = 20+1.65*4
= 26.66 N/$mm^2$

**Water Cement ratio**

Exposurte – mild
Minimum water content /$m^3$
Of concrete =300kg
W/c = 0.55
For 20 mm aggregates
Maximum water content / $m^3$
Of concrete = 186kg
Degree of workability = medium.
Slump value =20KN/$mm^2$
Total water for 10mm
Slump =11.6kg
Total = 197.16 kg
Now w/c = 0.55
Cement = 394.32 kg

1. Water = 198 kg/$m^3$
2. Cement = 394.32 kg
3. W/c ratio = 0.55

**Aggregates:**

Course aggregates fraction = 0.62
Fine aggregates fraction = 0.38
Volume of concrete = 1$m^3$
Volume of Cement = 0.135$m^3$ Volume of water = 0.198$m^3$
Volume of aggregates = 0.667$m^3$
Course aggregates = 1154.285kg/$m^3$
Fine aggregates = 648.295kg/$m^3$

## V. EXPERIMENTAL WORK

**Casting of Specimen**

The experimental Studies consist of testing of 16 specimen (8 cubes 3 for each mix proportion) sample with 3 specimen of cement replaced with Rice husk ash. Composition of Rice husk ash and coconut fibre with different. All specimen cubes having same M20 grade of concrete. The concrete cubes having size of (150*150*150) mm

**Mixing of normal concrete.**

Firstly mix the cement, dry course aggregates and fine aggregates in the proportion properly before mixing the water. Add the required water in the concrete mixing it for 2 minute to achieve uniformity of the concrete then casted in the mould of cubes and cylinder. The cubes are washed and oiled properly so that can remove easily after hardened of concrete.

**Casting And Curing**

The mould is arranged properly and placed at smooth Surface. The side walls of the mould is oiled properly so prevent to absorbing water from concrete and easily remove after hardened of the concrete. While moulded to ensure that cement, sand and course aggregates are mixed uniformly then placed the concrete cubes on the vibrator machine for compacting of concrete. The specimen was remoulded after 24 hours of casting and placed the specimen in the water for curing of 7 days.

**WORKABILITYOF FRESH CONCRETE**

Workability is defined as the ease with which concrete can be compacted 100% having regard to mode of compaction, flexural test and place of deposition in this project the workability of concrete the slump test and compaction factor test.

| SL.NO | TYPE OF CONCRETE | COMPACTION FACTOR |
|---|---|---|
| 1 | Nominal Mix 0% | 0.92 |
| 2 | Used 05% | 0.86 |
| 3 | Used 10% | 0.79 |

**COMPREESIVE STRENGTH**

Cube moulds of size 150 x 150 x 150 mm were casted and allowed for curing in a curing tank for 28 days and they were tested at 7 and 28 days. These cubes were tested on compression testing machine as per I.S. 516-1959.

Cube compressive strength ($F_{ck}$) in MPa = PA

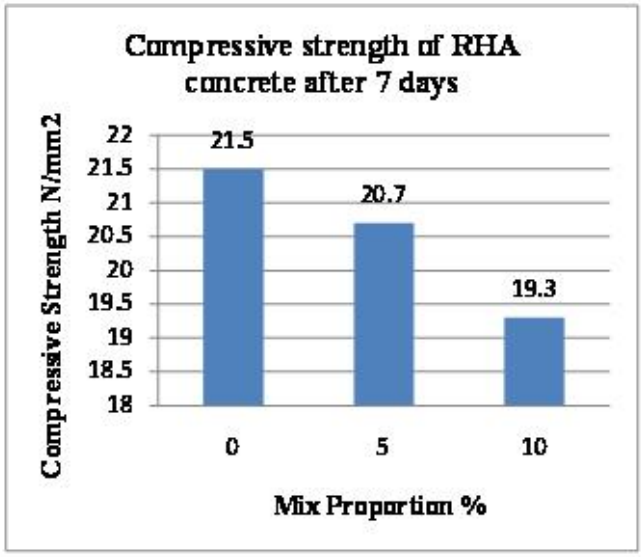
Where, P = Cube compression load
A= Area of the cube

## VI. RESULT AND DISCUSSIONS

**Compressive strength test**

Compressive strength of concrete with partial replacement of cement with RHA. Concrete construction applications are particularly resistant to the most the compressive stresses. If the plain concrete is under pressure, cube diagonal falls on the vertical plane. Due to the lateral tension strain cracks occurs.

| S.NO | MIX | RHA REPLACEMENT | STRENGTH ($N/mm^2$) 7 Days |
|---|---|---|---|
| 1 | M20 | 0% | 21.5 |
| 2 | | 5% | 20.7 |
| 3 | | 10% | 19.3 |




## VII. CONCLUSION

1. The density of coconut fiber is much lower, so that the total weight of the material can be reduced and used as lightweight construction materials.
2. RHA produce a large amount of silica gel when water is added in concrete which provide high strength concrete.
3. The maximum Split Tensile strength is achieved at 10% replacement of RHA with cement.
4. RHA and coconut fiber are waste material both reduce the material cost of construction.
5. Replacement of RHA is economical for 10% replacement after that the Compressive strength is

reduced due to high heat of hydration produced by RHA.

6. The purpose of fibre used in concrete is to hold the small hair cracks that developed in concrete due to applied loads but due to high water absorption property of the coconut fibre are placed in water before mixing in the concrete.

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