# An Experimental Study on Recycled Aggregate Concrete by Partial Replacement for Cement by Arecanut Husk Ash

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***Abstract*- Urbanization growth rate in India is very high due to industrialization. For large construction, concrete is preferred as it has longer life, low maintenance cost and better performance.Ordinary Portland cement is the most common type of cement in general use around world because of its high compressive strength .The arecanut is the seed of the areca palm and extensively cultivated in India. According to an estimate India produces about 3000 million tons of husk waste annually.In this project the recycling of arecanut husk ash as supplementary cementitious material in respect of recycled aggregate concrete. The mixes are prepared with 5 percent intervals (0, 5, 10, 15 and 20) of arecanut husk ash as a partial replacement of Portland cement. Concrete cubes are tested for compressive strength upto the age of 28 days. Test results have shown that arecanut husk ash is an effective pozzolanic material which gives the better result at the optimal replacement ratio of 10%.**

***Index Terms*- AHA- Arecanut Husk Ash, RAC-Recycled Aggregate Concrete, ARC-Arecanut Husk Ash Recycled Aggregate Concrete.**

## I. INTRODUCTION

Ordinary Portland cement is the most common type of cement in general use around world because of its high compressive strength . The current production rate OPC cement of the world is nearly 3.4 billion metric ton per year. Although the raw material for making OPC are readily available in most countries , search for new and viable alternative is important for conservation of natural resources ,reduction in the manufacturing cost and environmental burden as OPC production is still responsible for 7-10% of global CO2 emission. These alternative materials are generally selected on the basis of additional functionality that they offer and their cost effectiveness. The arecanut is the seed of the areca palm and extensively cultivated in India. The nut is used mainly formasticator purpose with betel leaf and its husk has no conventional use. On an average, 5.5-6 tons of husk is produced /hectare/year will be available in arecanut garden. According to an estimate India produces about 3000 million tons of husk waste annually.

## II. MATERIALS

### *A. CEMENT*

When it comes to different grades of cement 53 Grade OPC is a higher strength cement to meet the needs of the consumer for higher strength concrete. As per BIS specification IS: 12269 -1987 requirements of the minimum 28days compressive strength should not be less than 53Mpa. Ordinary Portland Cement (OPC) was brought from Ujire, Charmadi road.

### *B. ARECANUT HUSK ASH (AHA)*

For replacement of AHA in cement, the mix design was done. Later the required quantity of AHA was calculated and the husk was collected from Gowramma's house ,Ujiri it was then burned in the Annapurna Aluminium Industry by using electrical muffle furnace at $700^{o}$C for 6 hours after this the husk is converted into ash.

*C. AGGREGATES*

Fine aggregate of sieve size which passes through 4.75 and retrained on 2.36 and Coarse aggregate of nominal size 20mm which passes through 25,20,16 and retrained on 12.5.Aggregates was collected near Raktheshwari temple ,Ujiri.

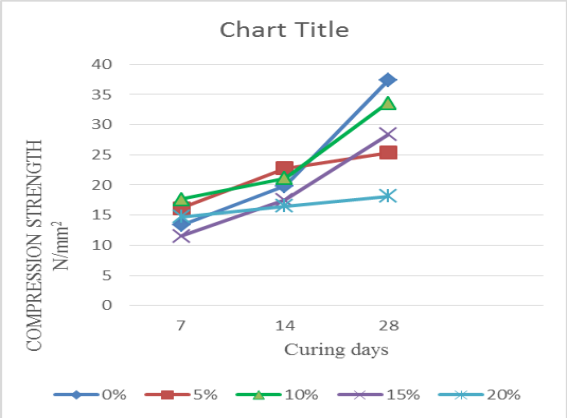
## III. METHODOLOGY

- Burning of arecanut husk at 600$^{o}$ C for 6 hrs to get good quality of Arecanut husk ash.
- Finding silica content in arecanut husk ash.
- Basic tests on Cement, Ash, Sand, & Recycled Aggregate.
- Preparations of recycled aggregate concrete using weigh batching.
- Preparing the concrete cubes for Recycled aggregate concrete and 5,10,15,20% replacing cement by arecanut husk ash.
- Testing the cubes for 7, 14 and 28 days of curing period.
- Calculation of Compressive strength & Density of concrete.

## IV. RESULTS & DISCUSSION

Table 1 .**Results of compressive strength of RAC.**

| Sl. No. | Mix Ratio | Days | Load (KN) | Compressive Strength (N/mm$^2$) |
|---|---|---|---|---|
| 1 | 0% | 7 | 300.5 | 13.350 |
| | | 14 | 446.5 | 19.840 |
| | | 28 | 841 | 37.377 |
| 2 | 5% | 7 | 363.5 | 16.155 |
| | | 14 | 512 | 22.755 |
| | | 28 | 547.5 | 25.33 |
| 3 | 10% | 7 | 397.5 | 17.66 |
| | | 14 | 475.5 | 21.13 |
| | | 28 | 759 | 33.6 |
| 4 | 15% | 7 | 259 | 11.5 |
| | | 14 | 393.5 | 17.48 |
| | | 28 | 638 | 28.35 |
| 5 | 20% | 7 | 331 | 14.71 |
| | | 14 | 367 | 16.5 |
| | | 28 | 408.5 | 18.15 |



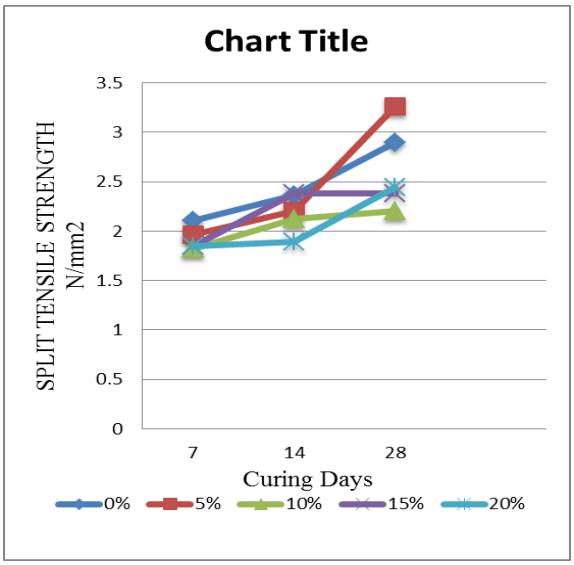

**Graph 1.Total Compressive Strength Results.**

Compressive strength of RAC without using AHA increased about 67% from 7 to 14 days and increased about 88% from 14 to 28 days.Compressive strength of RAC with 5% replacement of AHA increased about 41% from 7 to 14 days and increased about 11% from 14 to 28 days.Compressive strength of RAC with 10% replacement of AHA increased about 20% from 7 to 14 days and increased about 59% from 14 to 28 days.Compressive strength of RAC with 15% replacement of AHA increased about 52% from 7 to 14 days and increased about 62% from 14 to 28 days.Compressive strength of RAC with 20% replacement of AHA about 12% from 7 to 14 days and increased about 10% from 14 to 28 days.

**Table 2 .Results of Split Tensile strength of RAC.**

| Sl. No. | Mix Ratio | Days | Load (KN) | Split Tensile Strength (N/mm$^2$) |
|---|---|---|---|---|
| 1 | 0% | 7 | 149.5 | 2.11 |
| | | 14 | 167.5 | 2.36 |
| | | 28 | 205.5 | 2.9 |
| 2 | 5% | 7 | 139 | 1.96 |
| | | 14 | 156 | 2.2 |
| | | 28 | 231 | 3.26 |
| 3 | 10% | 7 | 129 | 1.82 |
| | | 14 | 150 | 2.12 |
| | | 28 | 155.5 | 2.2 |
| 4 | 15% | 7 | 130.5 | 1.85 |
| | | 14 | 168.5 | 2.38 |
| | | 28 | 168.5 | 2.38 |
| 5 | 20% | 7 | 130.5 | 1.85 |
| | | 14 | 134 | 1.89 |
| | | 28 | 172.5 | 2.44 |

**Graph 2.Total Split Tensile Strength Results.**




Split Tensile strength of RAC without using AHA increased about 12% from 7 to 14 days and increased about 23% from 14 to 28 days.Split tensile strength of RAC with 5% replacement of AHA about 12% from 7 to 14 days and increased about 48% from 14 to 28 days. Split tensile strength of RAC with 10% replacement of AHA about 16% from 7 to 14 days and increased about 4% from 14 to 28 days.Split tensile strength of RAC with 15% replacement of AHA by 15% increased about 28% from 7 to 14 days and increased about 0% from 14 to 28 days.Split tensile strength of RAC with 20%replacement of AHA about 55% from 7 to 14 days and increased about 29% from 14 to 28 days.

## V. CONCLUSION

1. Compressive strength of recycled aggregate concrete without replacing Arecanut husk ash at the age of 28 days is 37.37 N/mm$^2$ which is more than target mean strength (32.6 N/mm$^2$).
2. Compressive strength of recycled aggregate concrete with 10% replacement Arecanut husk ash at the age of 28 days is 33.6N/mm$^2$ which is more than target mean strength.
3. By observing the cost comparison of ARC with conventional concrete, found economical.

## VI. SCOPE FOR FUTURE WORK

1. Replacement of Arecant husk ash for conventional/normal concrete.
2. Study on flexural strength of ARC.
3. Study on density of concrete.
4. RAC with AHA in addition of admixtures.
5. X-Ray diffraction test.

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