

Effect of Recycled Aggregate and Rice Husk Ash in Concrete

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ABSTRACT: Concrete composed of cement, sand and coarse aggregate. In this present era there is a lot of scarcity of aggregate in the construction industry. Therefore, there is a need of some alternative materials which can be used as aggregate in concrete. Recycled aggregate may be the best solution to be used as aggregate in concrete. Recycled aggregate is the waste material which is obtained from construction debris which can be reused as building material. Therefore, in this present study an attempt was made to use recycled aggregate in concrete as construction material and concluded that using RCA about 25% replacement to the Normal coarse aggregate will give good strength.

KEYWORDS: Recycled Coarse aggregate (RCA), Rice husk Ash (RHA), Compression strength, Tensile and Flexural Strength.

I. INTRODUCTION

Concrete is the most commonly used building materials. Concrete is made up of cement, sand and coarse aggregate. Aggregates makes about 60 to 75% of the total volume of concrete. In the present era scarcity of aggregate is one of the construction problems. In many regions there will be less availability of aggregated for construction. So there will be need of an alternative material which may be used as aggregate in the concrete for the construction, which may provide same property as an aggregate. Here in this present study an attempt was made to use recycled coarse aggregate collected from construction debris as coarse aggregate in the concrete for construction.

Recycled coarse aggregate is an aggregate which is obtained from the construction debris which will be left as waste may be reused as aggregate in concrete. Recycled aggregates are same as aggregates but the surface of the aggregate is adhered with the concrete. Which may absorb water and may affect the workability of the concrete. In this present study Rice husk ash is used as replacement for cement to avoid loss of workability due to recycled aggregate in the concrete. Rice husk ash is the waste product which is obtained from the combustion of rice husk which is obtained from the rice mill during the rice production.

II. NEED FOR THE STUDY

There is a lot of scarcity of aggregate which is a part of concrete in the construction industry due to unregulated mining, growing global population, urban development etc., but in the growing construction industry there is an urgent need of aggregates. So an alternative material which may have the properties same as that of normal aggregates can be a solution. Here in this study an attempt was made to use recycled aggregate as a partial replacement for normal aggregate.

III. OBJECTIVE OF THE STUDY

- To determine the basic properties of materials used for the preparation of concrete are to be determined as per IS specifications.
- To carry out the different tests on recycled coarse aggregate to verify the suitability as natural coarse aggregate.
- To carry out different tests on concrete made up of RCA, NCA and Rice husk ash such as slump cone, compressive strength, split tensile and flexural strength tests.

IV. MATERIALS USED

A. Cement

OPC of 43 grades (ACC) collected from RMC Hassan is used in this study having specific gravity of about 3.15. The various properties of cement are tested and tabulated in Table 1.

Table 1: Properties of Cement

SL No.	Properties	Result	IS code
1	Specific gravity	3.1	----
2	Normal consistency	32%	----
3	Initial setting time of cement	34	>30(minimum)
4	Final setting time of cement	300	<600(maximum)
5	Fineness of cement (%)	5	<10%
6	Compressive strength (N/mm ²)	7 Days	32.38
		14 Days	37.70
		28 Days	43.22

B. Rice Husk Ash

The husk is generated in rice mill as a waste material of rice and these husks is used as a fuel in rice mill. During burning of husk a large amount of ash produces which is called as Rise Husk ash, which will give same property as cement. That can be used as a partial replacement for cement. Rice husk ash was collected from Hassan.



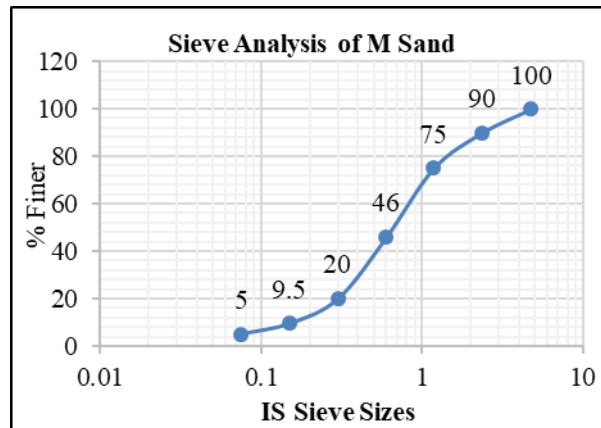
Fig 1: Production of Rice Husk Ash

C. M – Sand

M sand is used as a partial replacement for the river sand formed by crushing the hard granite stones. Physical properties of M sand are specified in the Table 2. Graph 1 shows the gradation curve of the M sand.

Table 2: Physical properties of M sand

Sl. No.	Tests	Value	IS code
1	Specific gravity	2.63	IS 2386 (part-111)-1963
2	Water absorption	2.8	



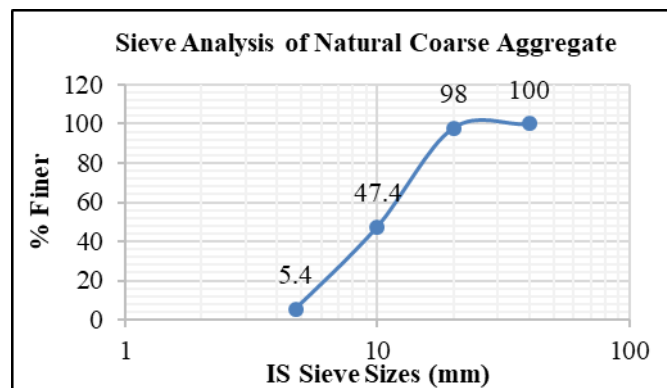
Graph 1: Gradation curve of the M sand

D. Coarse Aggregate

Natural aggregate of 20mm downsize aggregate is used which is collected from the quarry near Hassan. Characteristics of natural coarse aggregates is shown in Table 3. Graph 2 shows Gradation curve of the Natural Coarse Aggregate

Table 3: Characteristics of Natural Coarse aggregates

Sl No	Test	Result	IS Code
1	Specific gravity	2.6	IS 2386 (part-III)-1963
2	Water absorption, %	0.8	
3	Aggregate crushing value, %	23.50	IS 2386 (part-IV)-1963
4	Aggregate impact value, %	30	



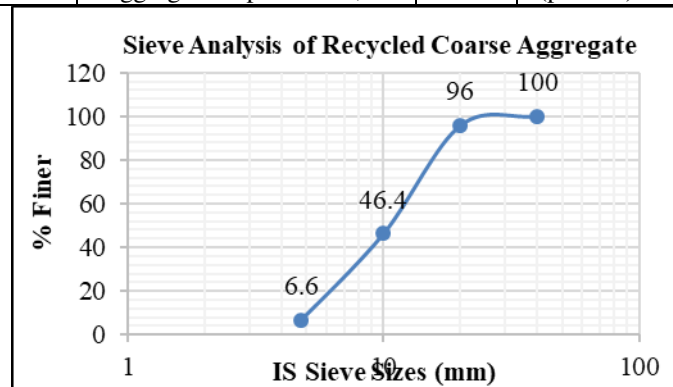
Graph 2: Gradation curve of the Natural Coarse Aggregate

E. Recycled Coarse Aggregate

Recycled Coarse aggregate of 20mm downsize aggregate is used as partial replacement for natural coarse aggregates which is collected from the quarry near Hassan. Characteristics of natural coarse aggregates is shown in Table 4. Graph 3 shows Gradation curve of the Natural Coarse Aggregate.

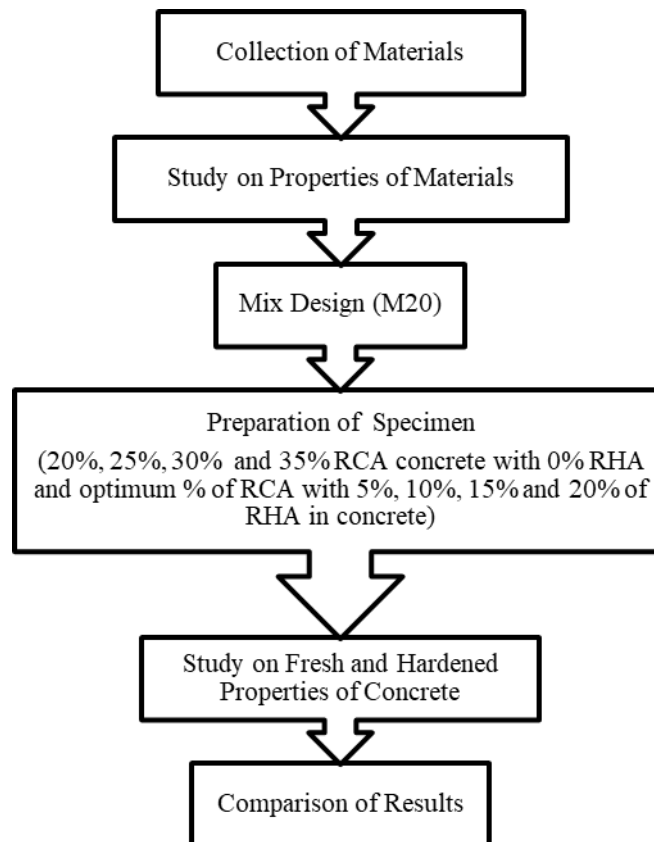
Table 3: Characteristics of Recycled Coarse aggregates

Sl No	Test	Result	IS Code
1	Specific gravity	2.38	IS 2386
2	Water absorption, %	2	(part-III)-1963
3	Aggregate crushing value, %	27	IS 2386
4	Aggregate impact value, %	32.5	(part-IV)-1963



Graph 3: Gradation curve of the Recycled Coarse Aggregate

V. METHODOLOGY



VI. RESULTS AND DISCUSSIONS

A. Slump Test

Water absorption capacity of RCA is more so the workability is less. To increase the workability of the RCA concrete RHA is used. Result of slump test shows that there is a variation in the workability with and without RHA.

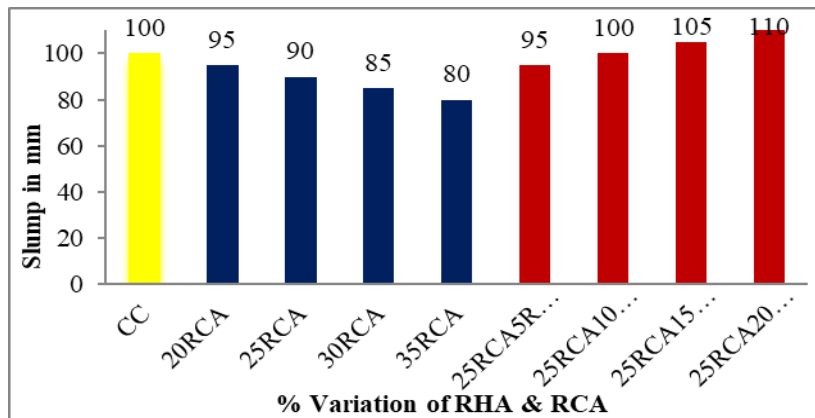


Fig 2: Variation in Workability using RCA & RHA

If only RCA replaced with NCA in concrete, then workability goes on decreases with the increase in RCA in concrete. if RHA is added to the same concrete with increase in RCA and RHA content workability goes on increases. Fig 2 shows variation in slump values by using RCA & RHA.

B. Compression Strength Test

Compression strength of the concrete is the resistance towards the load. Compression strength test was carried out for M20 concrete by using RCA and RHA and the results were noted. Fig 3 shows variation in compressive strength of the concrete using RCA and RHA.

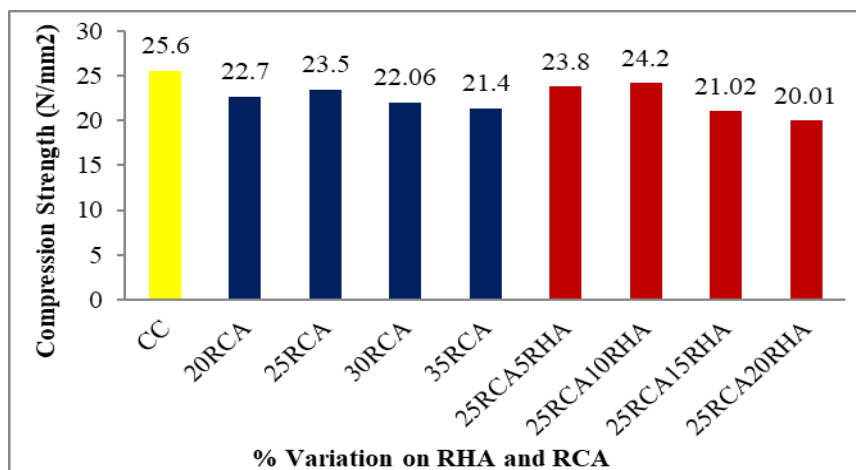


Fig 3: Variation in Compressive Strength using RCA & RHA

There is a decrease in the compression strength on replacing 20% of RCA with NCA but compression strength increases with increasing replacement of 25% of RCA with NCA. If about 10% of RHA is replaced with cement and 25% of RCA is replaced with NCA, Compression strength goes on increases but not more than Conventional concrete. As here using M20 concrete minimum strength as per IS codal provision is 20N/mm² but here in this present study replacement of RCA about 20%, 25%, 30% and 35% and also replacement of RHA about 5%, 10%, 15% and 20% will provide no much effect on flexural strength but the design strength as per IS codal provision was achieved.

C. Slit Tensile Strength Test

Split Tensile test was carried out for M20 concrete by using RCA and RHA and the results were noted. Fig 4 shows variation in Split Tensile strength of the concrete using RCA and RHA.

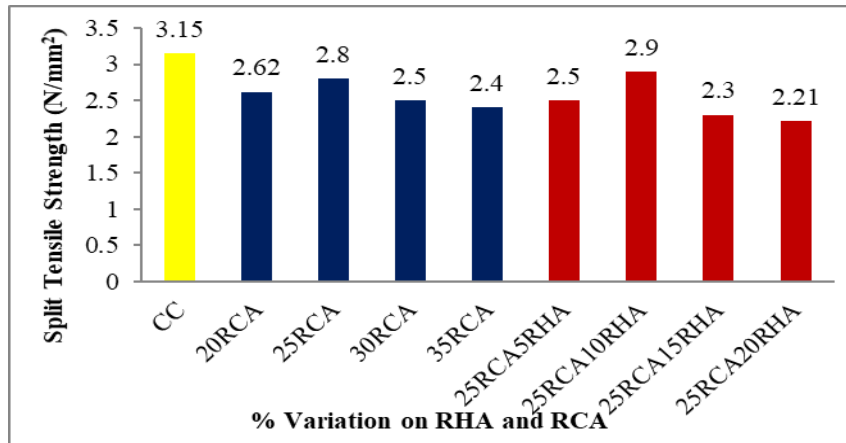
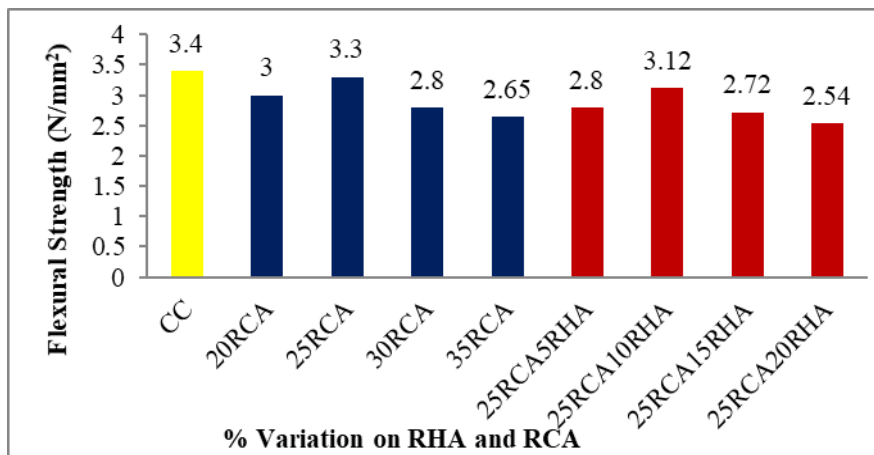


Fig 4: Variation in Slit Tensile Strength using RCA & RHA

There is a decrease in the Split Tensile strength on replacing 20% of RCA with NCA but compression strength increases with increasing replacement of 25% of RCA with NCA. If about 10% of RHA is replaced with cement and 25% of RCA is replaced with NCA, Split Tensile strength goes on increases but not more than Conventional concrete. Here in this present study replacement of RCA about 20%, 25%, 30% and 35% and also replacement of RHA about 5%, 10%, 15% and 20% will provide no much effect on Tensile strength but the design strength as per IS codal provision was achieved.

D. Flexural Strength Test

Flexural Strength test was carried out for M20 concrete by using RCA and RHA and the results were noted. Fig 5 shows variation in Flexural Strength of the concrete using RCA and RHA.



There is a decrease in the Flexural Strength on replacing 20% of RCA with NCA but Flexural Strength increases with increasing replacement of 25% of RCA with NCA. If about 10% of RHA is replaced with cement and 25% of RCA is replaced with NCA, Flexural Strength goes on increases but not more than Conventional concrete. Here in this present study replacement of RCA about 20%, 25%, 30% and 35% and also replacement of RHA about 5%, 10%, 15% and 20% will provide no much effect on flexural strength but the design strength as per IS codal provision was achieved.

VII. CONCLUSION

- Due to the adhere of concrete on the surface of the Recycled coarse aggregate, it absorbs more water compared to NCA so the workability will be seriously affected. To enhance the workability in the concrete rice husk ash was used as replacement for cement in the concrete.
- When compare to NCA used in controlled concrete usage of RCA will provide no much effect on compressive strength, Split Tensile Strength and Flexural Strength but the design strength as per IS codal provision was achieved.
- From the present investigation it can be concluded that, 25% RCA can be replaced to NCA and 10% RHA can be replaced to cement for M20 grade concrete.

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