

# INFLUENCE OF RISE HUSK ASH AS AN INGREDIENT OF CONCRETE: A REVIEW

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**Abstract:** *This paper gives the idea about researches carried out and on going on concrete by use of rise husk ash. Basically it summarise the influence in the properties of concrete like compressive strength, initial and final setting time, workability, and durability by replacing the cement amount partially in percentage. Replacement leads to economy in concrete cost with environment friendly use of rice husk ash. Here the optimum percentage of replacement of rise husk ash is concluded.*

**Keywords:** *Rice husk ash (RHA); compressive strength; workability; durability.*

## I. INTRODUCTION

Concrete is the world's most used material. It ranked second in its usage. The composition of the concrete (cement, sand and aggregates) comes from earth's crust. Cement its one of the composition librates green house gas CO<sub>2</sub> in its production in huge quantity which is not considerable from environment point of view and also the cost of cement is increasing day by day. Various research work is going on to replace the cement partially by agricultural industrial wastes such as fly ash, rice husk and blast furnace slag which are cheaply and easily available so that properties of concrete is least affected. Rice husk is an agricultural waste which accounts for 20%-30% of the rice produced annually all over the world [1]. Rice husk has been proven as good pozzolonic material by the various researchers

## II. LITERATURE REVIEW

### 1. Study on Strength Characteristics Of High Strength Rice Husk Ash Concrete [2]

- As the replacement of cement by RHA in concrete increases, the workability of concrete decreases by 27% slump and 9% compaction factor.
- Replacement of cement with Rice Husk Ash leads to decrease in the compressive strength improved the workability and achieved the target strength at 10% replacement for both the grades of concrete.
- The rate of increase with age of concrete was good for the replacement levels and was on par with the conventional cases at early ages.
- The optimum replacement level of Rice Husk Ash is found to be to10% for both M40 and M50 grades of concrete.

### 2. Rice Husk Ash Blended Cement: Assessment of Optimal Level of Replacement For Strength And Permeability Properties Of Concrete [3]

- Rice husk ash obtained from Indian paddy when reburnt at 650C for a period of 1 h transforms itself into an efficient pozzolanic material rich in amorphous silica content (87%) with a relatively low loss on ignition value (2.1%).
- As high as 30% by weight of OPC can be replaced with reburnt rice husk ash without any adverse effect on strength and permeability properties.
- Replacement with 30% of reburnt rice hush ash leads to substantial improvement in the permeability properties of blended concrete when compared to that of unblended OPC concrete, namely
  - About 35% reductions in water permeability.
  - About 28% reductions in chloride diffusion.
  - About 75% reductions in chloride permeation.
- A linear relationship is found to exist among three measured transport properties, namely sorptivity, chloride penetration in term of total charge passed in coulombs and chloride diffusion coefficient.
- In the case of compressive strength and chloride permeation properties, standard practice of curing for 28 days is found to be adequate. Prolonged curing up to 90 days is found to be beneficial only from the point of view of improving the resistance to water absorption.
- When rice husk ash which has a lower loss on ignition value compared to OPC is used to partially replace OPC, resistance to chloride permeation is substantially improved. This may be probably due to a decrease in electrical conductivity of concrete due to lowering of unburnt carbon content in RHA, in addition to pore structure refinement and conductivity of pore solution.

### 3. Rice Husk Ash – Pozzolanic Material for Sustainability [4]

- Increased in the amount of RHA in the mix resulted in a dry and unworkable mixtures unless Sp is added. The inclusion of Sp in RHA concrete while maintaining the w/b ratio increased the slump and improved the cohesiveness of the concrete.
- The optimum replacement of OPC with RHA taken at 28 days strength for Grade 30 and Grade 40 was 30%, while for Grade 50 was 20%.
- Replacement of OPC with RHA reduced the water permeability of the concrete. Thus, suggested that the presence of RHA in the mix and with concrete of higher grade, the coefficient of permeability reduces, thus improves the durability of concrete. This is due to pore refinement attributed to RHA fineness or a transformation of large permeable pores to a small impermeable pore. The effect is more pronounced with the addition of Sp.

- d. The water absorption values of RHA concrete are lower than the OPC control concrete. These results emphasize the beneficial effect of incorporating RHA to increase the durability of concrete, irrespective of their concrete grade. The percentage of water absorption obtained for all the grades are between 3% - 5% which can be considered as average absorption.
- e. The resistance to chloride ion penetration of concrete as measured by the charge coulomb was significantly increased with incorporation of RHA. Thus, suggested that the presence of RHA resulted in lower coefficient of permeability, thus improves the durability of concrete.
- f. From the study conducted, it was clearly shown that RHA is a pozzolanic material that has the potential to be used as partial cement replacement material and can contribute to the sustainability of the construction material.

#### 4. Benefits of Use Of Rice Husk Ash In Concrete [5]

- a. Strength and cost savings (as shown above) of Rice Husk Ash concrete proves it to be a better material than various other supplementary materials which involve higher transport cost.
- b. By using this Rice husk ash in concrete as replacement the emission of green house gases can be decreased to a greater extent. As a result there is greater possibility to gain more number of carbon credits.
- c. The technical and economic advantages of incorporating Rice Husk Ash in concrete should be exploited by the construction and rice industries, more so for the rice growing nations of Asia.
- d. This study is relevant in the global scenario towards attaining sustainable development.

#### 5. Reduction in Environmental Problems Using Rice-Husk Ash in Concrete [6]

- a. The rice-husk yielded 22% of the ash by weight of its total quantity burnt. It would, therefore, seem logical to make arrangement for incineration in rural areas near the core source of husk to reduce the transportation cost.
- b. SEM shows that the RHA sample is multi-dispersed with micro porous surface and irregular shaped particles.
- c. Water demand was high for concrete mixtures containing RHA which decreased the compressive strength. To achieve more workable and higher strength SP should, therefore be added to the concrete mixtures incorporating RHA.
- d. Rate in strength gain at early ages is lower in RHAC concrete as compared to OPC concrete. It may be due to slow reaction rate of RHA.
- e. Concrete mixture containing 25% RHA as a replacement of OPC produced the same strength as the concrete containing 100% OPC. Therefore, this concrete could be used to reduce environmental problems associated with OPC production and RHA dumping.
- f. Higher proportions (40%) of RHA could be used for non-structural works where strength is not critical.
- g. The RHAC mortar containing RHA has more resistance to chemical attacks than OPC concrete without RHA. The RHAC mortars placed in different salt solutions for 70 days showed satisfactory results compared to OPC mortars. However, in acidic solution, both the OPC and RHAC mortars were deformed and disintegrated.

#### 6. Mechanical Properties of Rice Husk Ash (RHA) – High Strength Concrete [7]

From this experimental study it is inferred that the incorporation of RHA in concretes results in improved compressive strength and flexural strength. A slight increase in bond strength was also reported. RHA- High strength concrete showed a reduction in density compared with conventional concrete. Hence this study promotes the use of RHA in high strength concrete as a sustainable cement replacement material.

#### 7. Properties of Concrete Block Containing Rice Husk Ash Subjected TO GIRHA [8]

- a. It was observed the increase of replacement level of RHA significantly decreases the initial suction of rates. The possible reason arises for this fact is that the porous characteristic of the block resulted in capillary action from the aggregates. This is also probably because of the presence of RHA in the block that absorbed any available water for the hydration process to take place. Calcium silicates hydrate is a by-product from pozzolanic reaction which fills the pores and leads to higher strength development. In the case of water absorption, higher percentage gained at early age tends to decrease at later age except for controlled block. The existence of pozzolanic material in concrete block tends to finer the pore radius in accordance of C-S-H (gel) during the hydration process.
- b. The high performance of concrete blocks can be produced using rice husk ash (RHA) as cement replacement material. It was found that optimum RHA replacement level is 15%. It shows the RHA replacement level exceeds 15% also indicates comparable results and reached minimum requirements 2.8 N/mm<sup>2</sup> with no individual block result lower than 80% of that value. Nevertheless, the strength of the block was expected to increase in later ages. The strength gained contributes from the high silica content available in RHA. It was identified from XRF analysis that 90% of SiO<sub>2</sub> is present in the ash. Burning temperature of 700°C confirmed that the ash is in the form of amorphous form.
- c. There is influence of elastic modulus for concrete block when RHA was used as a partial cement replacement material from 0 to 20% to the cement. RHA20 block unit shows the lowest elastic modulus among the block i.e. RHA10, RHA15 and OPC. Block unit shows significant increase in elastic modulus.

#### 8. Structural Properties of Rice Husk Ash Concrete [9]

RHA is a super pozzolan and its use in Civil Construction, besides reducing environmental polluters factors, will bring several improvements to concrete Characteristics. The compressive strength and workability tests suggests that RHA could be substituted for OPC up to 25% in the production of concrete with no loss in workability or strength. Based on the results of split Tensile Strength test, it is convenient to state that there is no Substantial increase in Tensile Strength due to the addition of RHA. The Flexural strength studies indicate that there is a marginal improvement with 10 to 25% RHA replacement levels. Rice Husk Ash concrete possess a number of good qualities that make a durable and good structural concrete for both short term and long term considerations. It is good for structural concrete at 10% replacement level.

#### 9. Review Research Paper on Influence of Rice Husk Ash on The Properties Of Concrete [10]

RHA concrete possess a number of good qualities that make a structurally and environmentally good. It helps in reduction of green house gases as well as cost of concrete. After reading a number of research papers I hereby concluded that 5-20% replacement of cement

with RHA helps the concrete in possessing desirable workability, durability, compressive strength, flexural strength and initial and final setting time.

#### 10. Rice Husk Ash as Admixture in Concrete [11]

- a. The workability of concrete increases with increase in addition of RHA, and was within the design limit.
- b. The compressive strength of grade 20 and 30 concrete cured in water, increased with addition of 5% and 10% RHA. It however increases with 5% addition more than with 10% addition, but reduces with further increase in percentage addition of RHA.

### III. CONCLUSION

Followings are the predominant conclusions obtained from the studied literature reviews:

RHA concrete possess a number of good qualities that make a structurally and environmentally good. It helps in reduction of green house gases as well as cost of concrete. After reading a number of research papers I hereby concluded that 5-20% replacement of cement with RHA helps the concrete in possessing desirable workability, durability, compressive strength, flexural strength and initial and final setting time.

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