Study of Effect of Rice Husk Ash Replacement for Fine Aggregates Concrete Block

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Abstract— RHA has been identified as an alternative to sand to reduce its impact and create properties like resistance. Rice husk ash (RHA) is a waste product produced in millions of tons of agricultural products. Over the years, waste managers have struggled to get rid of this agricultural waste. In today's world, protecting the environment is increasingly important. Parboil ash (RHA) from parboiling plants represents a serious threat to the ecosystem and disposal options are being considered. Furthermore, this material is super pozzolanic because it is rich in silica and has a silica content of approximately 85% to 90%. A good way to use this material is to obtain "high performance concrete" ensures that the concrete is well worked and durable. Concrete production consumes significant amounts of natural resources. This increased pressure to reduce sand consumption by using additional materials. Various parts of the rice husk ash were added to the sand and analyzed. The 2000 kN pressure testing machine is used for the pressure resistance test. A cube size of 150 x 150 x 150 mm was used. The maximum increase in compressive strength of RHA concrete, for example. H. 5.0% occurred after 28 days with a 5% replacement, while the compressive strength of RHA concrete decreased by 63.40% after 3 days with a 15% RHA replacement. It is clear that at the age of 28 days, the compressive strength of RHA concrete gradually increases for all replacement levels compared to concrete control. Strength development rate is highest up to 28 days of age at all RHA replacement levels. With 5% RHA in the sample, the concrete mix exhibits high flexural strength after 28 days, e.g. H. 5.14 N / mm². The divided tensile strength test of control concrete in class M25 provides 3.35 MPa. The tensile strength of concrete increases with the proportions of RHA. Concrete has a higher tensile strength, e.g. Eg H. 4.12 MPa relative to all other proportions and with a further increase in RHA content, the tensile strength at shear decreases. Using RHA in concrete increases costs by up to 1.78% compared to conventional concrete. The working capacity and strength of the concrete were determined by carrying out a pressure cube (150 mm × 150 mm × 150 mm), divided tensile test (cylinder with a diameter of 150 mm and a length of 300 mm) and an element of flexural strength (100mm × 100mm × 500mm) certainly. There is a good chance of obtaining good strength from concrete at a relatively higher cost, even if AF is replaced by RHA.

Keywords: Rice Husk Ash, Fine Aggregates, Precast, Improvement, Stabilization, Subgrade, Waste Product, Paddy, Silica

I. INTRODUCTION

There is an increasing importance to preserve the environment within the present day world. Rice Husk Ash (RHA) from the parboiling plants is posing a significant environmental threat and ways are being thought of to dispose them. This material is really a super-pozzolanic since it's rich in Silica and has about 85% to 90% Silica content. A decent way of utilizing this material is to use it for creating "High Performance Concrete" which suggests high workability and long-term durability of the concrete.

Rice husk is one of the main agriculture residual obtained from the outer covering of rice grains during the milling process Rice husk ash is obtained from burning of Rice husk which is the by-product of rice milling. It sis estimated that 1000kg of rice grains produced 200kg of Rice husk after burn. The rice husk ash had no useful application and had usually been dumped in to water streams and caused pollution until it was known to be a useful minerals admixture for concrete Rice husk ash is an agricultural waste which is produced in many tons. Waste managers have found it difficult over the years to dispose this agro-waste. Rice husk ash (RHA) is obtained by the combustion of rice husk and has been found to be super pozzolanic. RHA may be a highly reactive pozzolanic material suitable to be used in lime-pozzolanic mixes and for Portland cement replacement. RHA is extremely reached in silica which makes it very reactive with lime because of its non-crystalline silica content and its specific surface.

A. Rice Husk Ash as a Soil Stabilizer

Soils are the principal broadly utilized materials in building works, especially in asphalts. Be that as it may, the properties of neighbourhood soils aren't appropriate for the needs of specific structures. In these cases, improving soil properties is a delightful other option. There are basically two sorts of progress: alteration and adjustment. At the point when physical properties of soil, similar to versatility, surface, volumetric solidness, water driven conductivity and usefulness are improved, it's named alteration and adjustment when a major degree of long haul quality addition and toughness are created. Change can create significant quality improvement.

The impact of the expansion of RHA alone on the versatility, unconfined pressure quality (UCS) and California Bearing Ratio (CBR) of a lateritic soil with 45% passing the #200 strainer (75 μm), was examined by Rahman. Results indicated increments of UCS and CBR in 1 day with increment in RHA up to twenty and 18%, individually, after which they started to diminish. Likewise, Alhassan watched expanding of CBR with 6-day and 1-day drenching and without dousing when a clayey soil was balanced out with RHA up to six and 12%, separately.

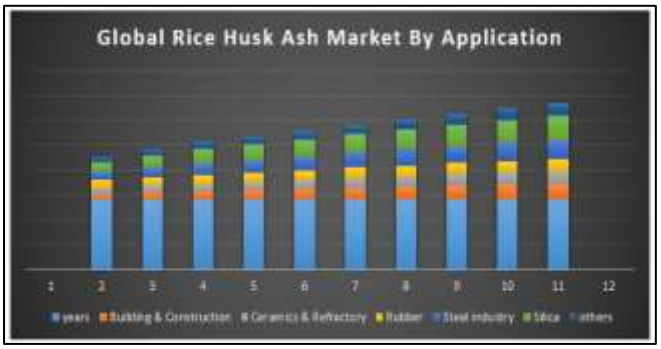

Fig. 1: Use of rice husk ash

The improvement of soils through expansion of rice husk debris (RHA) and lime was considered in a few inquires about. RHA created in research center with controlled temperature and time (RHAC) was likewise explored

B. Applications of Rice Husk Ash

The rice husk ash is a green supplementary material that has applications in small to large scale. It can be used for waterproofing. It is also used as the admixture to make the concrete resistant against chemical penetration.

The main applications of rice husk ash in the construction are:

- High-performance Concrete
- Insulator
- Green concrete
- Bathroom floors
- Industrial factory floorings
- Concreting the foundation
- Swimming pools
- Waterproofing and rehabilitation

II. LITERATURE REVIEW

M. C. Nataraja and Lelin Das (2010) evaluate different properties like compressive strength, split lastingness, bending strength and water absorption of paver blocks. Paver blocks consisting of nonconventional materials like kadapa for various percentage replacements of coarse aggregate are studied as per IS 15658:2006.

Vaz Aaron et al. (2012) found that concrete cement is currently one among the most utilized crude materials inside the world, since concrete is answerable for the creation of an outsized measure of CO2 and is also subject for the nursery impact. Presently a Dyas Geopolymer solid that is utilized as a possibility for OPC in precast solid items. Geopolymer concrete is an ecologically well disposed choice for squander adjustment. Geopolymer solid asphalt squares have points of interest on OPC inside the kind of high compressive quality. They even have a high untimely restoring time of 24 hours at 60 ° C and OPC fixes 28 days in water, so geopolymer concrete utilized Benefitly inside the generation asphalt.

Thakur et al. (2013) Discovered that Fibers of nylon likewise can be won't to expand the quality in pressure of the Paver Block. Expansion of optimum nylon fiber and debris inside the development of paver obstruct its compressive quality to13.55% when contrasted with plain blend.

Navya et al. (2014) inferred that Property of PB with the immediate incorporation of nature accessible fiber like coconut fiber in top 20mm layer included diverse rate and in this manner the outcome's a 0.3 % coconut Fiber goes to greatest pressure quality.

Raja et al. (2014) broke down that the development of silica sand is that the acceptable substitute for fine totals for the solid square. By utilizing the production sand, the compressive quality is typically accomplished inside the scope of 43.80 N/mm 2 during a clearing type M30 machine 200 mm x 200 mm x 50 mm. Assembling sand might be a decent option in contrast to waterway sand and along these lines the expenses likewise are efficient.

Neekhra et al. (2015) presumed that strands of Nylon are kept to guage hardness of PB. Nylon fiber, is high ductile filaments, nylon strands are commonly used in assembling and Nylon fiber is also thermoplastic polymer. In the wake of performing diverse level of nylon fiber inside the CPB it's seen that expansion of nylon fiber 0.3% with the portion of concrete in concrete by and large produces a greatest durability of seven, 14, and 21 days matured.

Santhosh et al. (2015) drilled to frame paver hinder with debris and glass powder results state that Higher quality inside the pressure and Bending quality was accomplished when 20% concrete was supplanted by equivalent extents of debris and glass powder and supplant up to 30% so scraped area opposition are is by all accounts good and water retention inside in reasonable level.

Nivetha C et al (2016) examined the plausibility of utilizing plastic waste as a coupling material rather than concrete in the manufacturing of paver squares. The investigation bears on plastics with a Polyethylene terephthalate premise. Plastic waste is carried to liquefy and blended in with a shifting extent of strong waste fly debris and quarry dust (PET 25-35 % fly debris 25 % and quarry dust 40-half in weight). The estimations of physical and mechanical properties show that plastic waste paver squares and this extent in plastic give's preferred outcomes over cement paver squares.

Atul Thakur et al (2017) examined fractional substitution (by weight) of concrete with RHA in asphalt squares to decide the change in compressive quality, water assimilation and scraped area obstruction of clearing squares. Fractional substitution of concrete in various rates, for example, 0%, 15%, 20%, 25%, 30%, 35% and 45% has been finished. The compressive quality is resolved toward the finish of 7, 28 and 56 days, the water assimilation test and scraped spot opposition is tried at 28 days.

III. PROBLEM STATEMENT

In current days, the construction of buildings is increasing rapidly in our country. Due to these constructions, more consumption of course aggregate and fine aggregate takes place, but for manufacturing of these requires the natural resources. So due to this large amount of natural resources are utilized which causes environmental imbalance, so need of alternative materials essentially require to partially replacement of these ingredients, effective utilization of RHA could be best alternative for cement in the manufacturing of concrete blocks.

Based on the literature review research workers have used various alternate materials for partial replacement of cement for making concrete. With varying properties silica fume and various fibres have also been used but they are costly. In this context RHA is useas partial replacement of fine aggregate.

IV. OBJECTIVE OF STUDY

The objective of this work is given below-

- To utilize the waste material such as rice husk ash as a partial replacement of fine aggregate.
- To study the effect of the partial replacement of fine aggregatewith different replacement ratio i.e. %, 10% and 15% of RHA.
- To develop RHA based concrete using standard code of reference.
- To compare it with the strength of normal concrete.
- How rice husk differ with other ordinary concrete mix as fine aggregate interms of water adsorption, compressive strength, tensile strength.
- To help contribute to the industry in saving the environment, to encourage the government to find solutions regarding the disposal to landfills of waste materials and save the environment, to provide new knowledge to the contractors and developers on how to improve the construction industry methods and services by using rice husk, and to sustain good product performance and meet recycling goals.

V. MATERIAL USED

The materials used in this investigation are

1) Cement
2) Fine aggregate
3) Coarse aggregate
4) Water
5) Rice Husk Ash

Chemical content	Amount (%)
Calcium Oxide (CaO)	60-67
Silicon dioxide (SiO_2)	17-25
Aluminium oxide (Al_2O_3)	3.0-8.0
Iron oxide (Fe_2O_3)	0.5-6.0
Magnesium oxide (MgO)	0.1-4.0
Sodium oxide (Na_2O) Potassium oxide(K_2O)	0.4-1.3.0
Sulfur Trioxide (SO_3)	1.3-3.0

Table 1: Chemical Properties of Portland cement

Material	Proportion by weight	Weight in kg
Cement	1	5
F.A.+RHA	1.5	7.5
C.A.(20mm)	3	15
W/C ratio	0.45	27

Table 2: Quantities of materials per cubic meter of concrete

VI. EXPERIMENTAL PLAN

The experimental program was designed for the properties i.e. workability, water absorption test, compressive strength, split tensile strength and flexural strength of concrete with M20 grade of concrete.

The program consists of casting and testing of total 90 cubes, 30 beams and 30 cylinders specimens. The specimen of standard cube of 150 mm x 150 mm x 150 mm, standard beam of 150 mm x 150 mm x 600 mm and standard cylinder of 150 mm diameter and 300 mm height were cast with and without manufacturing sand. Compressive testing machine (CTM) was used to test all the specimens.

- Proportioning
- Mixing
- Casting of specimens
- Curing of the specimens
- Compressive strength test
- Slump test
- Flexural strength tests
- Water absorption test
- Split tensile strength

VII. RESULTS & DISCUSSION

A. Compressive Strength Test on Hardened Concrete

Compression Testing Machine of 2000kN is used for Compressive strength test. Cube size of 150x150x150mmwas used.

Grade of Concrete	3 days	7days	28 days
M20	14.51	20.58	30.3

Table 3: Compressive strength of Control concrete in N/mm^2

The strength achieved at different ages namely 3, 7, and 28 days for Control concrete are also presented in bar chart in figure. From the figure, it is clear that as the age advances, the strength of Control concrete increases. The rate of increase of strength is higher at curing period up to 28 days. However the strength gain continues at a slower rate after 28 days.

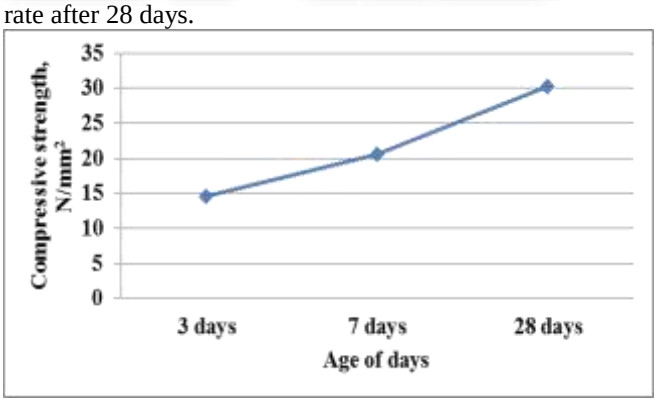

Fig. 2: Compressive strength of control concrete

Age in days	0%	5% RHA	10% RHA	15% RHA
3	14.51	12.96	12.7	8.88
7	20.58	19.3	18.96	16.22
28	30.3	31.5	30	21

Table 4: Highest Compressive strength obtained at different ages

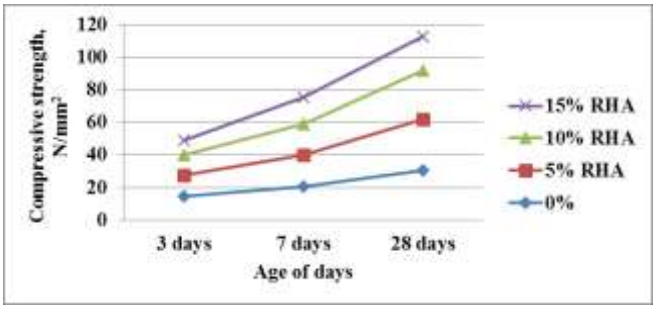

Fig. 3: Compressive strength vs age at different percentage of RHA

B. Flexural Strength

It is seen that strength of concrete in compression and tension (both tension and flexural tension) are closely related, but the relationship is not of the type of direct proportionality. The ratio of the two strengths depends on general level of strength of concrete. In other words, for higher compressive strength, concrete shows higher tensile strength, but the rate of increase of tensile strength is of decreasing order. The use of pozzolanic material increases the tensile strength of concrete.

Curing period	3 days	7days	28 days
M20	1.01	1.17	4.21

Table 5: Flexural strength of control concrete in N/mm^2

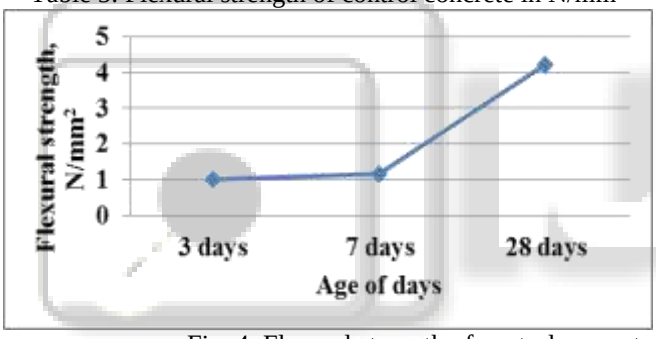

Fig. 4: Flexural strength of control concrete

Age in days	0%	5% RHA	10% RHA	15% RHA
3	1.01	3.12	3.09	2.82
7	1.17	4.23	3.10	3.02
28	4.21	5.14	3.21	3.18

Table 6: Highest flexural strength obtained at different ages

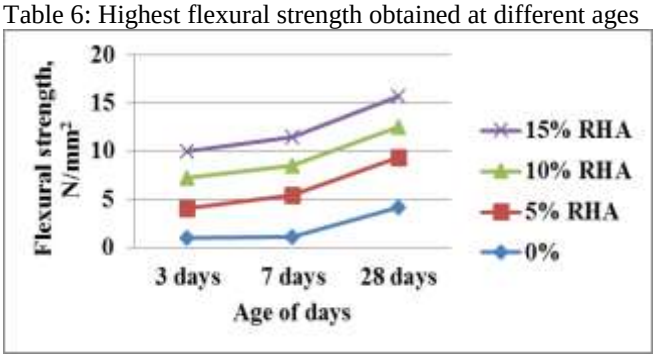

Fig. 5: Flexural strength vs age at different percentage of RHA

VIII. Conclusion

The following observations or what can be concluded after performing experiments and various tests have been discussed below.

1) The 28 days strength obtained for M20 grade Control concrete is 30.3 MPa. It is clear that as the age advances, the strength of Control concrete increases. The rate of increase of strength is higher at curing period up to 28 days. However the strength gain continues at a slower rate after 28 days.
2) Along with the variations shown for each replacement, for comparison similar variations is also shown for control concrete i.e., for 0% replacement. In each of these variations, it can be clearly seen that, as the age advances, the compressive strength also increases. The highest strength obtained at a 28 age for 5% RHA is 31.5 N/mm^2.
3) The maximum increase in the compressive strength of RHA concrete i.e., 5.0% has occurred at 28 days with 5% replacement, whereas the compressive strength of RHA concrete is found to be decreased by 63.40% at 3 days with 15% RHA replacement. It can be clearly observed that at the age of 28 days, there is gradual increase in the compressive strength of RHA concrete for all the replacement levels with respect to control concrete.
4) The strength is higher for control concrete (i.e. 0% replacement) for initial period up to between 3-7 days up to 10% replacement with Rice husk ash, and for 15% replacement with RHA, the strength is very much higher when compared to that of control concrete. The rate of strength development between 7-28 days is maximum when sand is replaced with 5% RHA. It is clear that the rate of strength development is maximum up to the age of 28 days at all the replacement levels with RHA.
5) It is seen that strength of concrete in compression and tension (both tension and flexural tension) are closely related, but the relationship is not of the type of direct proportionality. The ratio of the two strengths depends on general level of strength of concrete. In other words, for higher compressive strength, concrete shows higher tensile strength, but the rate of increase of tensile strength is of decreasing order. The use of pozzolanic material increases the tensile strength of concrete.
6) It can be clearly seen that, the strength is higher for control concrete (i.e. 0% replacement) for initial period up to between 3-7 days up to 10% replacement with Rice husk ash, and for 15% replacement with RHA, the strength is very much higher when compared to that of control concrete. The rate of strength development between 7-28 days is maximum when sand is replaced with 5% RHA. Thus from the above table it is clear that the rate of strength development is maximum up to the age of 28 days at all the replacement levels with RHA. At 5 % RHA in sample shows high flexural strength of concrete mix at 28 days i.e. 5.14 N/mm^2.

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