

USE OF RICE HUSK ASH AS PARTIAL REPLACEMENT WITH CEMENT IN CONCRETE

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Abstract: In concrete, the rice husk used in the form of partially replacing material. The rice husk partially replaces cement in the concrete, because of having a pozzolanic property. Production of rice husk is economical and having technical advantages so that it can use in a concrete for constructional work. Rice plants and paddy industries gives rice husk in the form of by-product. We can use it in concrete as supplementary cementing material for improving the property. Use of by-product in concrete is a good idea for disposal of waste material and also good for environment, if waste are not dispose properly they pollute the environment i.e. pollute the fresh air, land areas and sea water etc. The experiment done based upon the properly use of waste pozzolanic rice husk ash by partially replacing to Ordinary Portland cement in concrete without affecting the concrete property. In this experiment cement is partially replace by weight, like 5%, 10%, 15% and 20%, find out the excess strength of concrete and also compare with the strength of the normal concrete at the days of 7days, 14days and 28days. In this research study the properties and strength of the concrete prepared by rice husk ash and partially replaced cement done.

Keywords: Rice husk ash; Concrete; Workability; Compressive strength; Slump test

1 INTRODUCTION

In construction field, concrete is main important material. According to the characteristic of paste/mix, we can determine the quality of concrete. Concrete is a heterogeneous mix of cement, water and aggregates. Various materials such as fly ash, rice husk and admixtures are added to concrete to obtain the desired property. The demand for rising concrete day by day for infrastructure development. The concrete has good strength, durability, versatility and its great affordability. In market different kinds of concrete has been available like, self-compacting concrete that enhance the durability of the concrete. High strength concrete provides an ultra-high strength. But that concrete have high cost and rarely available. For reducing the high cost of the ordinary Portland cement with the desired characteristics, some materials have modified. Locally available by-product such as rice husk ash used for making concrete it is effectively fulfilling the requirement.

In the field of, agriculture, rice husk found in the form of waste material. Rice husk is a very useful material it improves the physical and chemical properties of concrete in the construction field. Comparatively supplement cement with the sufficient water-cement ratio helpful to improve the suitability, durability and workability, also strength. Fine rice husk ash reduce the temperature but temperature of the ordinary Portland cement not reduced. According to the research observation that proper proportionate ration rice husk ash can reduce the initial setting time and also obtains maximum strength for a few days. Silica solidification state, silica composition, rice husk ash fineness and its exterior acreage is affected the rice husk ash.

Rice husk ash used in concrete due to the following reasons:

- 1) In the coastal states of India Large-scale production of rice than the other countries of Asia.
- 2) Mostly countries grow rice in large amount yearly because it is a staple food.
- 3) It pollutes the environment because the agricultural industries are save rice grains and thrown husk openly in the environment.
- 4) We can utilise the rice husk waste to giving a domestic or pet animals as an eating material.
- 5) It serves as good manure to the plants when its little part mix in cow excreta.
- 6) It is helpful in reducing the construction cost it is build an economical buildings.
- 7) Rice husk ash is serves as an environment-friendly construction material

2 MATERIAL USED

Various material used in this research work are cement, fine aggregate, coarse aggregate, water, and rice husk ash (RHA).

Concrete Materials: The concrete is made by cement, sand, aggregate and water in our experiment we are used rice husk ash as a partially supplementary material in place of cement. Concrete is construction material it consisting a binding material and also mineral fillers. Concrete is made on construction site.

Cement: cement have adhesive and cohesive properties, cement is bonding the concrete materials and giving a strength of concrete by the method of curing. Cement made of magnesium, silica and lime; now a day usually used ordinary Portland cement for constructional process or studies.

Table 1 Composition of Ordinary Portland cement

Sl. No.	Composition of OPC	Possible range, Percent
1	Silica	20-25
2	Lime	65-70
3	Iron oxide	0.52-7
4	Magnesia	0.15-3
5	Soda and potash	0.45-1.4
6	Alumina	4-8
7	Sulphur trioxide	2-4

RHA: rice husk ash having a pozzolanic characteristics because it having an amorphous silica. Rice husk is obtain from paddy industries and agricultural industries. we use rice husk in a concrete as the partial cement replacement material it help for increasing the cement chemical properties and also increase strength. Rice husk ash is obtain by burning of rice husk in a controlled temperature. Use the rice husk in concrete is economical and good for environment.

Table 2 chemical composition of rice husk ash

Sl. No.	Composition of rice husk ash	Possible range, Percent
1	K ₂ O	0.11-2.64
2	Fe ₂ O ₃	0.57- 0.60
3	CaO	0.11-1.35
4	SiO ₂	65.5-96.6
5	Na ₂ O	0.03-1.59
6	MgO	0.02-1.98
7	SiO ₃	0.2-1.25
8	P ₂ O ₅	0.05-2.70
9	C	2.75-6.45

Fine aggregates: Fine aggregates used for research works. Obtained locally available aggregate that fulfils the requirement provided by Indian Standard 383 1970. The purity of the aggregate was analysed glancing the code provided by Indian Standard.

Coarse Aggregates: The aggregates that used for this research work taken from the locally available natural rocks. Aggregates retained on 4.75micron sieve after being crushed in a laboratory used.

Water:-In the present work locally available purified drinking water used. We use that water which is free from turbidity, salt, pesticide free, chemical free. Water used for mixing the concrete materials and use for providing the strength of building members by the process of curing buildings members throughout the investigation.

3 METHODOLOGY

Aim of the project is to replace the cement with rice husk ash which having a pozzolanic property and make a concrete cube and study there strength and property and suitability in concrete member. By using the rice husk ash, we can improve the strength of a concrete member of a building. This experiment done for increasing the use of the rice husk as a partially replacing material it is economical, rice husk ash increases the characteristics of concrete members example-it increase the compressive strength, split tensile strength, tensile strength, flexural strength. The outcome of the project is that when we use rice husk ash as a replacing material it reduce the construction cost, increase the property of building members and it is a good way of waste material use of rice husk ash is only give benefits when we use in a constructional work. Some of the variables are affected the behaviour of concrete.

Some of the variables are kept stable like: size of the rice husk ash constant, the chemical substitute are kept constant for rice husk, rice husk ash replaces the replacement percentage value of cement, the water-cement ratio, and also the methods of curing of concrete members. The different types of a literature review about the rice husk ash give the different characteristics properties of different materials. Some variables are kept unchangeable for this experimental work.

- In this research paper comparing the property and strength of the concrete which is made by the partially replacing cement by rice husk as thus obtained with conventional concrete for construction work.
- Concrete cube mix design using a varying percentage of gradation.
- Evaluation and comparing the strength characteristics such as compressive strength, flexure strength, and doing slump cone test of concrete and comparison of the same with conventional concrete.

4 EXPERIMENTAL RESULTS

Various types of test, such as slump test, compacting factor test, compression test and split tensile strength tests are conducted on fresh or strong concrete to find the mechanical characteristics of concrete member. Below table shows the physical properties of material, test result of slump and compaction factor for 0 % rice husk ash, test result of slump and compaction factor for 5 % rice husk ash for different percentage of water cement ratio for the fresh concrete.

Table 3 Physical properties of material

Sl. No.	Physical Properties	Result
1	Specific gravity of cement	3.10
2	Specific gravity of fine aggregate	2.61
3	Specific gravity of coarse aggregate	2.60

Table 4 Test results of slump and compaction factor for 0% rice husk ash

Sl. No.	W/C ratio	Slump(mm)	Compaction factor
1	0.40	0	0.82
2	0.45	0	0.73
3	0.50	6	0.72
4	0.55	21	0.71
5	0.60	36	0.69

Table 5 Test results of slump and compaction factor for 5% rice husk

Sl. No.	W/C ratio	Slump	Compaction factor
1	0.40	0	0.85
2	0.45	0	0.75
3	0.50	0	0.73
4	0.55	11	0.72
5	0.60	22	0.69

Results for hardened concrete: - The compressive strength test was done for concrete cubes, after the curing period of cubes of 7 days and 28 days. The cubes tested for each curing period. The compressive strength of all cubes shown in the table:-

Table 6 Result of compressive strength of hardened concrete

Sl. No.	Rice husk (%)	Compressive strength of concrete at 7days (MPa)	Compressive strength of concrete at 28days (MPa)
1	0	11.75	19.88
2	5	12.68	22.16
3	10	12.89	23.47
4	15	14.03	25.88
5	20	11.01	17.58

5 CONCLUSIONS

Various conclusions found in this research work after testing the fresh and hardened concrete by replacing cement with various percentage of rice husk ash are:

- When increasing the percentage of the rice husk ash then decrease the workability of rice husk ash concrete and also decrease the compacting facer of rice husk ash concrete.
- The flexure strength is increase when increasing the percentage of rice husk ash.
- Rice husk ash can be added to cement concrete at the 10% or 20% without any reduction of the property of concrete. This will give a good result and also reduce the cost of concrete to some extent.
- Compressive strength increase of the rice husk ash when increasing the percentage of the rice husk ash in concrete to some extent.
- The by-product Rice husk ash is polluting environmental material and is best supplementary material for cement replacement as it is easily available in rice producing areas or paddy industries.
- The rice husk concrete is economical than conventional concrete for construction works. It decreases the cost of concrete by percentage replacement cement by rice husk ash.

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