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Incorporation of Rice Husk Ash as Partial Replacement of Cement in M40 Grade Concrete

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Abstract: ***In this developing era concrete and cement mortar are widely used by the construction industry, with this development. Large number of industrial wastes are generated and if these wastes are not properly used it will create severe problems, keeping the environment in mind, concrete engineers are trying to find some alternative materials which will not only replaces the cement content but also improves strength of concrete.***

As we also know that during the manufacturing of cement large amount of Co_2 is released into the environment, but if we use such material that will replace the quantity of cement content therefore indirectly, we are contributing towards the prevention of our planet from global warming and other pollutions. Also, in this research work the Rice Husk Ash is used. the rice husk ash obtained from the rice processing units, by adding this product with concrete, not only replaces the cement content but also increases the strength of concrete like compressive strength etc. The Rice husk ash was incorporated with concrete with varying percentages of 2.5% ,5% ,7.5%, & 10%. the proper codal precautions were followed during the manufacture of concrete cubes of 150x150x150mm. it was concluded that the strength of concrete increased by incorporated the rice husk ash.

Keywords: Concrete, RHA, Compressive strength, Industrial wastes, Cement etc

I. INTRODUCTION

Rice husk ash (RHA) is a by-product from the burning of rice husk. Rice husk is extremely prevalent in East and South-East Asia because of the rice production in this rea. The rich land and tropical climate make for perfect conditions to cultivate rice and is taken advantage by these Asian countries. The husk of the rice is removed in the farming process before it is sold and consumed. It has been found beneficial to burn this rice husk in kilns to make various things. The rice husk ash is then used as a substitute or admixture in cement. Therefore, the entire rice product is used in an efficient and environmentally friendly approach. Rice husk ash is produced in large quantities globally every year and due to the difficulty involved in its disposal, can lead to RHA becoming an environmental hazard in rice producing countries, potentially adding to air and water pollution. Rice husk ash is a natural pozzolan, which is a material that when used in conjunction with lime, has cementitious properties. Several studies have shown that due to its high content of amorphous silica, rice husk ash can be successfully used as a supplementary cementitious material in combination with cement to make concrete products. RHA can be carbon neutral, have little or no crystalline $Si0_2$, or no toxic materials, as in the case of off-white rice husk ash. According to the Food and Agricultural Organization of the United Nations, global production of rice, the majority of which is grown in Asia, totaled 746.4 million tons in 2013. This means that the volume of unused rice husks amounted to 150 million tons. Due to their abrasive character, poor nutritive value, very low bulk density, and high ash content only a portion of the husks can be used as chicken litter, juice pressing aid, animal roughage and pesticide carrier. The remaining husks are transported back to field for disposal, usually by open field burning. RHA is obtained by burning of rice husk. When RH is properly brunt, it has high silica content and can be used as an admixture in mortar and concrete. India produces about 122 million tons of Paddy every year. About 20-22% rice husk is generated from paddy and 20-25% of the total husk becomes a Rice Husk ash after burning. The rice husk ash is used as Pozzolanic material for making concrete.

II. OBJECTIVES

The main objectives of the present work are:

1) To study the behavior of concrete for various proportion of Rice husk ash with the strength parameters and workability parameters.
2) To examine the feasibility of using unprocessed rice husk ash to reduce the amount of cement

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III. MATERIALS AND METHODS

A. *Materials Used*

Following materials are used for preparing concrete

1) *Cement:* Cement is a binder, a substance that sets and hardens independently, and can bind other materials together. The ordinary Portland cement of grade 43 will be used in the study.
2) *Sand:* Fine sand is to be used after proper sieving. Sand is mainly used as an inert material to give volume in concrete for the economy.
3) *Coarse Aggregate:* Well-graded gravel which passes 20 mm sieve and is retained 4.75 mm, naturally occurring crushed stone used in the work
4) *Water:* The binding property of cement activates in the presence of water and thus mortar is prepared. The portable water was used here for making a concrete mix.

B. *Rice Husk Ash*

The utilization of rice husk for use as a cementations material in cement and concrete depends on the pozzolanic property of its ash. The pozzolanic reactivity of the ash is closely related to the form of silica present and the carbon content. Since the physical and chemical properties of silica in RHA are strongly influenced by the temperature and the duration of thermal treatment, the yield of a highly reactive ash requires a burning method that can remain a low firing temperature and a short retention period in order to give ash with low carbon content and a high surface area.

Fig Rice Husk ash

IV. METHODOLOGY

A. Source of Rice husk Ambika traders Gujrat)
B. Cement used: OPC 43 GRADE (TCI MAX)
C. Tested the material properties as per Indian standards code (IS 383 – 1996) procedures.
D. Mix design for concrete proportion has been developed as per IS 10262 – 1982.
E. Casted and cured the concrete specimens as per Indian standards procedures.
F. The characteristic strength of hardened concrete specimen was tested as per IS 456 – 2000

V. RESULTS

DETAIL	COARSE AGGREGATE
SPECIFIC GRAVITY	2.70
IMPACT VALUE	20.5%
CRUSHING VALUE	29.8%
BULK DENSITY	1.47kg/m^3
WATER ABSORBTION	0.52
DETAIL	FINE AGGREGATE(SAND)
ZONE	ZONE 2
BULK DENSITY	1.634

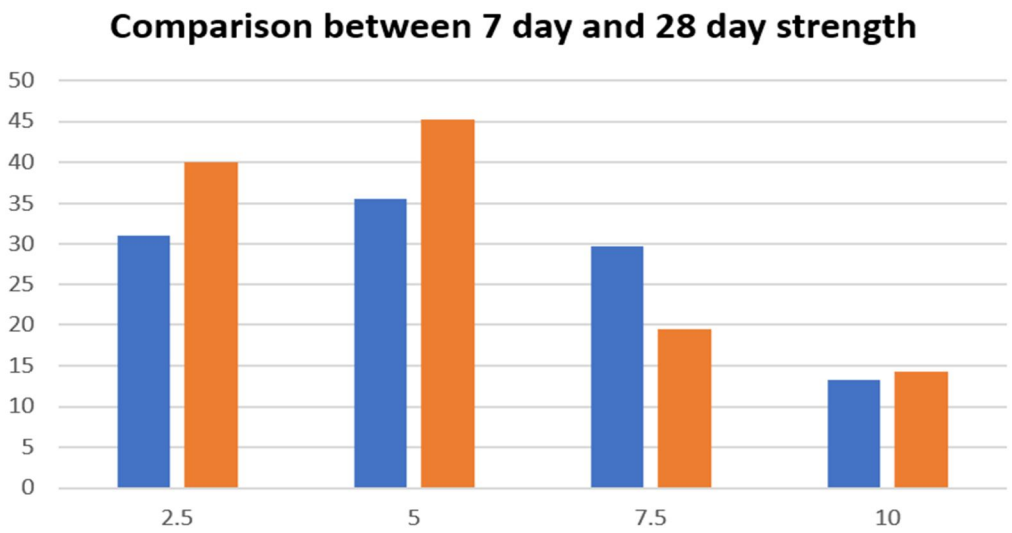
DETAIL	CEMENT
CONSISTENCY LIMIT	28%
INITIAL SETTING TIME	90 MINUTES
FINAL SETTING TIME	252 MINUTES

A. For Mix Design M40(1:1.1:2.67)

Water Cement Ratio	0.35
7 Days Strength	29.78 N/mm^2

B. Compressive Strength test After Incorporation of Rice husk

RICE HUSK ASH	7 DAYS TEST	28 DAYS TEST
2.5%	31.11 N/mm^2	40 N/mm^2
5%	35.55 N/mm^2	45.33 N/mm^2
7.5%	29.77 N/mm^2	19.55 N/mm^2
10%	13.33 N/mm^2	14.22 N/mm^2



VI. CONCLUSION

1) It was seen that up to 5% there was increase in compressive strength afterwards there was a sharp decrease in compressive strength Moreover at 5% our concrete specimen moved to M45 Grade.

2) 4-6% of the cost of the cement will be saved

VII. FUTURE SCOPE OF WORK

Study has shown that rice husk ash and waste paper sludge ash can be used in concrete. There are several areas in which further work can be extended:

1) Some tests relating to durability aspects such as water permeability, resistance to penetration of chloride ions, corrosion of steel reinforcement, resistance to sulphate attack durability in marine environment etc. with Rice husk ash and need investigation.

2) Work can be done on the microscopic structure of Rice Husk Ash so that chemical properties can be known.

3) Further research is needed to establish the long-term durability of concrete containing mineral admixtures. The microstructure properties of concrete are needed to be further researched.

4) Research can be done to find out the characteristics strength of concrete using properly grinded and controlled temperature burnt RHA

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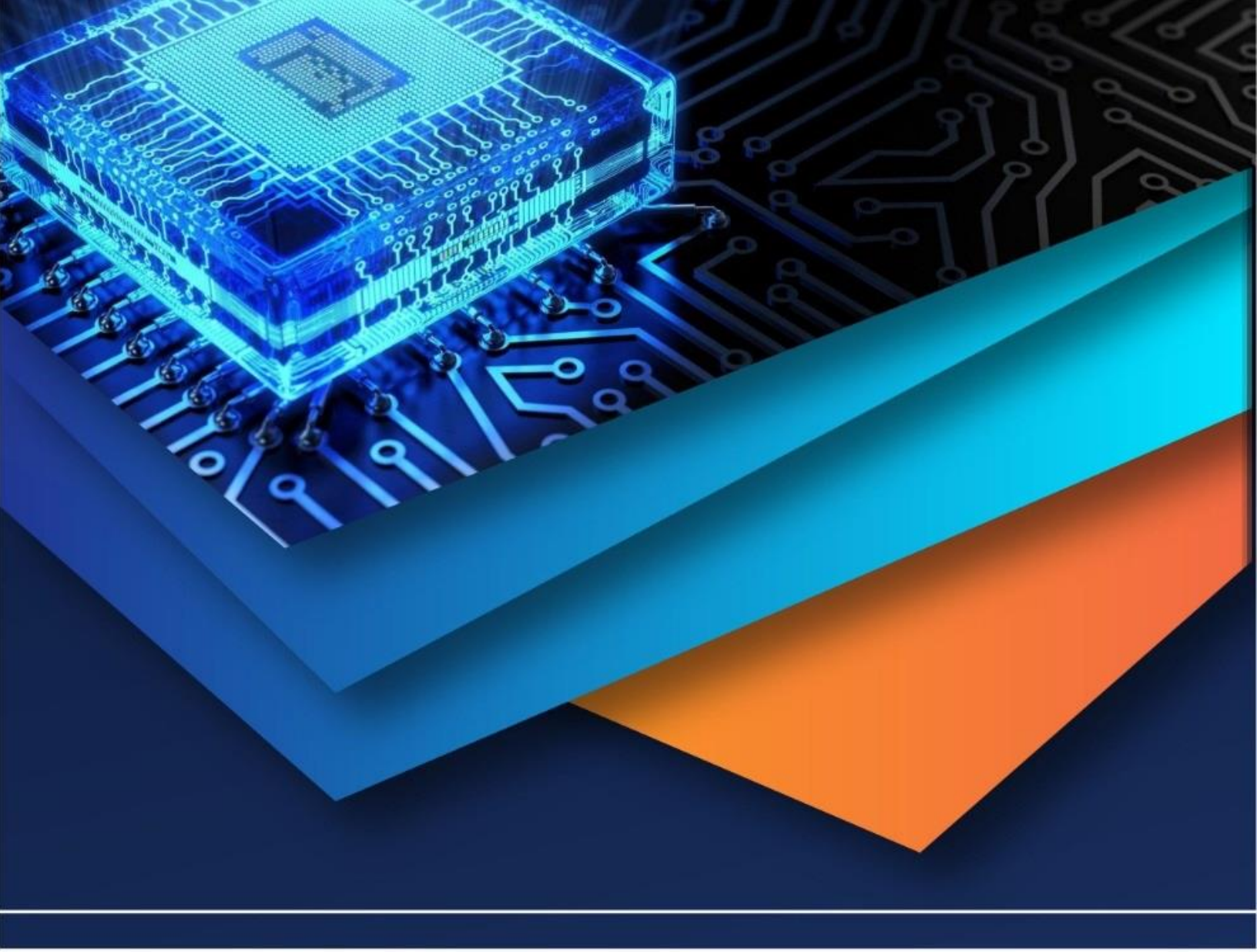

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