Experimental Study On Investigationof Partial Replacement Of Cement Byrice Husk Ash

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Abstract- *Over 5% of global CO_2 emissions can be attributed to Portland cement production. Demand for cement continues to grow. The emissions caused by annual increases in production exceed gains to reduce emissions through manufacturing efficiencies and cleaner fuels. And also increase in the cost of conventional building materials and to provide a sustainable growth. The construction field has prompted the designers and developers to look for 'alternative materials' for the possible use in civil engineering constructions. For this objective, the use of industrial waste products and agricultural byproducts are very constructive. These industrial wastes and agricultural byproducts such as Fly Ash, Rice Husk Ash, Silica Fume, and Slag etc., can be used as cementing materials because of their pozzolanic behavior, which otherwise require large tracts of lands for dumping. Large amounts of wastes obtained as byproducts from many of the industries can be the main sources of such alternate materials.*

The world rice harvest is estimated at 588 million tonnes per year and India is second largest producer of rice in the world with annual production of 132 million tonnes per year. Thus the concrete industry offers an ideal method to integrate and utilize a number of waste materials, which are socially acceptable, easily available, and economically within the buying powers of an ordinary man. Presence of such materials in cement concrete not only reduces the carbon dioxide emission, but also imparts significant improvement in workability and durability.

I. INTRODUCTION

Rice is a primary source of food especially in the Asian region. It covers 1% of the earth's surface and ranks second to wheat in term of area and production. Globally, approximately 600 million tonnes of rice paddy are produced each year. Rice husks are by-products of rice paddy milling industries and each ton of dried rice paddy produces about 20% husks, giving an annual total production of 120 million tonnes. Assuming an ash to husk ratio of 18%, therefore the total ash production could be as high as 22 million tones per year.

Currently, based on the Eighth Malaysia Plan (2001-2005) report, the production of paddy in the country is increasing, with an increase of 4% from 1995 to 2000 and an increase of up to 20% from 2000 to 2005, i.e 2.235 million tonnes to 2.813 million tonnes. Out of this figure, it is expected that the husk production will be approximately 562,600 tonnes and the ash production could be as high as 102,000 tonnes. Rice husk is abundantly available in Malaysia especially in the state of Kedah, Kelantan, Perlis and Selangor. It composes of organic constituents such as cellulose, lignin, fiber, and small amounts of protein and fat and certain range of minerals that include silica, alumina and iron oxides. It is considered as an agriculture waste in the rice milling industry. Disposal of the husks is a big problem and open piles burning is not acceptable on environmental grounds, and so the majority of husk is currently going into landfill. Substantial research internationally has been carried out on the use of rice husk ash as partial substitute for cement due to its high reactivity. The properties of rice husks after burning are similar to silica fume in that SiO2 content is about 90% to 95%. Investigations on their chemical, mechanical properties and durability are worth looked into. A variety of institutions and individuals had undertaken the basic research and development works into RHA cement technology, and several attempts to commercialize and disseminate the technology principally had being made. A substantial amount of research conducted on RHA was for high strength and durable concrete applications. However, this paper reports on the study conducted on the performance of RHA concrete with target strength of 30 N/mm2, with and without super plasticizer, in terms of the absorptive characteristics such as water absorption and initial surface absorption.

The world at the end of the 20th Century that has just been left behind was very different to the world that its people inherited at the beginning of that Century.

II. LEITURE REVIEW

First of all various books and journals were collected for reference and study before starting the project work for having ideas about how the project should be.

Some of the literature reviews are

1. **Pham Duy Huu**, **Nguyen Ngoc Lan** "**Effect Of Rice Husk Ash On Properties Of High Strength Concrete"** The paper presents several key properties of high strength concrete using rice husk ashes (RHAs). RHAs obtained from two sources: India and Vietnam were used with various contents to partially replace for cement binder in high strength concrete. Key properties of concrete, including: slump, density, compressive strength, water and chloride permeability resistances, were investigated in comparison between samples without using RHA and samples using two types of RHAs.

2. **P.Chandan Kumar, P.Malleswara Rao, M.Potharaju, I.Patnaikuni** "**PERFORMANCE OF RICE HUSK ASH CONCRETE Exposed To Sea Water"** As concrete is produced and placed at construction sites, under conditions far from ideal, we do often end up with construction problems and a host of workmanship related problems. he studies on Rice Husk Ash concretes exposed to marine atmosphere for various ages showed that RHA replacement range of 5% to 7.5 % showed better compressive strength and 12.5% replacement showed less water absorption than other replacements at all ages and for all three grades of concretes.

3. **Sumrerng Rukzon, Prinya Chindaprasirt, and Rattana Mahachai (April 2009) "Effect of grinding on chemical and physical properties of rice husk ash"** The effect of grinding on the chemical and physical properties of rice husk ash was studied. Four rice husk ashes with different finenesses, *i.e.* coarse original rice husk ash (RHA0), RHA1, RHA2, and RHA3 were used for the study. Ordinary Portland cement (OPC) was partially replaced with rice husk ash at 20% by weight of binder.
4. **Jayasankar.R, Mahindran.N, Ilangovan.R (November 2010) "Studies on Concrete using Fly Ash, Rice Husk Ash and Egg Shell Powder"** Through out the world, concrete is being widely used for the construction of most of the buildings, bridges etc. Hence, it has been properly labeled as the backbone to the infrastructure development of a nation. Currently, our country is taking major initiatives to improve and develop its infrastructure by constructing express highways, power projects and industrial structures to emerge as a major economic power and it has been estimated that the infrastructure segment in our country is expected to see investments to the tune of Rs.4356 billion by the year 2009.

III. MATERIALS USED

RICE HUSK ASH

- properties of rice husks after burning are similar to silica fume in that SiO2 content is about 90% to 95%.
- This can be used to replace Cement.

B.Cement

Cement used to prepare the specimen was 53 grade Ordinary Portland cement, conforming to IS 12269:2013 with a fineness of 1%, standard consistency of 34% and Initial setting time 80min.

C. Courseaggregates

Course aggregates of 4.75mm to 12.5mm size aggregates wereused

D. Fineaggregates

Fine aggregates are taken for concrete preparation which pass through 2.36mm sieve size.

E.Water

Portable water was used for mixing and curing of concrete specimens.

IV. MIXDESIGN

As per ISCODEBOOK design mix for M 20 grade of concrete was prepared byr e placing fineaggregates by 50%, 75% and 100% by weight.

V. MATERIALS TESTRESULT

Fineness Modulus	Normal consistency	Initial Setting time	Final Setting time
1.0	34%	80min	260 min

Table-2 Physical properties of fineaggregates

Fineness Modulus	Specific gravity	Water absorption
2.85	3.1	1.92

Table-3 Physical properties of Coarseaggregates

Fineness Modulus	Specific gravity	Water absorption
7.73	2.7	1.5

VI. TEST RESULTS

A. CompressiveStrength

Compressive strength was tested in compressive testingmachine.Cubespecimensofsize150mmx150mmx150mm were adopted for the test. Compressive strength was tested after 7,21 and 28 days of curing. The results of the tests are tabulated below.

Table 6.1 Properties of Aggregates.

S.N	TITLE	Results	
		Course Aggregate	Fine Aggregate
1	Fineness Modulus of Fine Aggregate	2.63	8.65
2	Specific gravity of Aggregate	2.60	2.83
3	Bulk density of	1.825	1.655

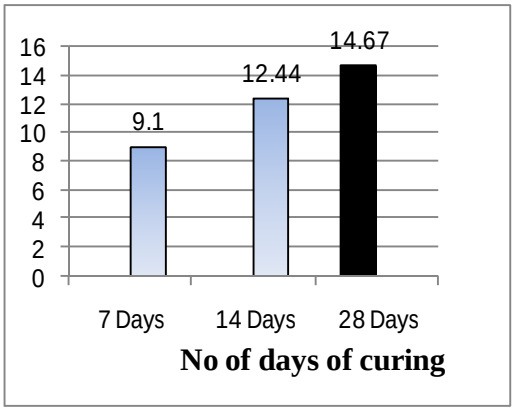
Table 6.2 Properties of cement

S.N	TITLE	Results	
		Course Aggregate	Fine Aggregate
1	Fineness Modulus of Fine Aggregate	2.63	8.65
2	Specific gravity of Aggregate	2.60	2.83
3	Bulk density of aggregate	1.825	1.655
4	Percentage of absorption of aggregates	0.943	0.54

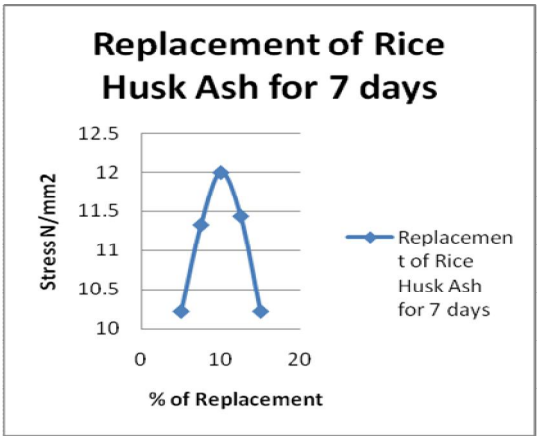
Table 6.3 Properties of Rice Husk Ash

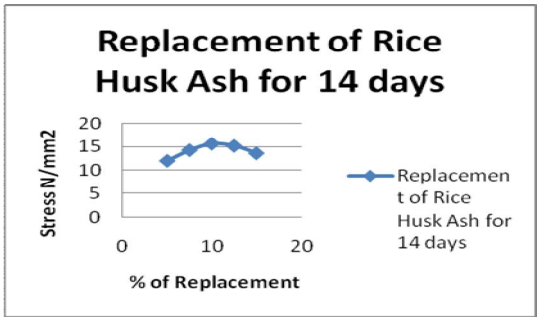
Sl.No	Description	Value
1	Physical state	Solid-non hazardous
2	Appearance	Very fine powder
3	Particle size	25 microns-mean
4	Color	Grey
5	Odour	Odourless
6	Specific Gravity	2.3

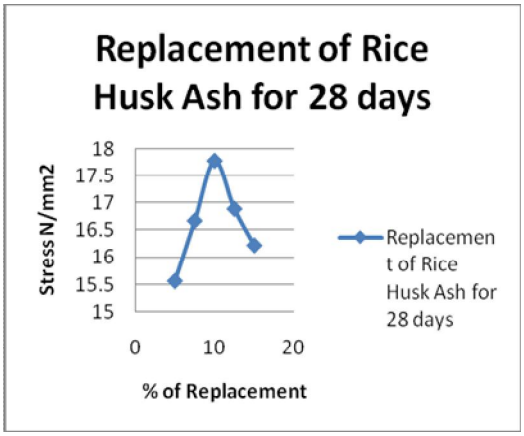
Table 6.4 Compressive strength of normal concrete



COMPRESSION STRENGTH OF REPLACEMENT OF RICE HUSK CONCRETE 7, 14, 21 DAYS







VII. CONCLUSION

Based on the limited study carried out on the strength behavior of Rice Husk Ash, the following conclusions are drawn:

(i) At all the cement replacement levels of Rice Husk Ash, there is a gradual increase in compressive strength from 3 days to 7 days. However, there is a significant increase in compressive strength from 7 days to 28 days followed by gradual increase from 7 days to 28 days.

(ii) At the initial ages, with the increase in the percentage replacement of both Rice Husk Ash, the flexural strength of Rice Husk Ash concrete is found to decrease gradually till 7.5% replacement. However, as the age advances, there is a significant decrease in the flexural strength of Rice Husk Ash concrete.

(iii) 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.

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