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An Experimental Result Analysis on Partial Replacement of Cement with Wheat Husk Ash in Design Mix Concrete: A Review

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Abstract: ***Rapid development of construction in India has resulted in shortage of conventional construction material. The high cost of building material has important role to increase price of housing. Wheat husk is an agricultural waste product which is burn to form powder .It acts as a Pozzolanic property that would potentially be used as a partial replacement material in cement concrete. The replacement material wheat husk ash is used in design mix cement concrete with desired proportion such as 0%,6%,12%,18%,24% and 30% in Ordinary Portland Cement of grade 53.To investigate the strength parameter of concrete is workability, Consistency, compressive strength and flexural strength. The main objective is therefore to utilization of agricultural waste product in the construction material, which is locally available material and help to low cost housing. In the present investigation, an experimental study is made to use of Wheat husk as a replacement material in cement concrete.***
Keywords: Agricultural waste, Compressive strength, Consistency, Cement concrete, Wheat husk ash, Ordinary Portland Cement

I. INTRODUCTION

Concrete is the most important building material for various type of structure due to its structural stability and strength. Human activities on the earth produces solid waste in considerable quantities of over 3500/MT per year, including industrial wastes, agricultural waste and wastes from rural and urban societies. Recent technological development has shown that these materials are valuable as inorganic and organic resources. Wheat milling generates a byproduct known as husk. This surrounds the wheat grains. During the milling of paddy about 78% of weight is received as wheat. The rest 22% of the weight of wheat is received as husk. This husk is used as fuel. This Wheat husk contains about 75% organic matter which burns it and the remains 25% of weight of this husk is converted into ash during the firing process, which is known as wheat husk ash. Dry wheat husk was burnt approximately 36hours under uncontrolled combustion process. The burning temperature was within the range of 600 to 800 degree. The ash obtained was ground in a ball mill for 30 minutes and its colour was seen as grey.

In India, wheat has producing large amount in country and the wheat husk generated during milling from wheat grains. Then it is mostly used as fuel in the boilers for processing.

In this experiment, cement was replaced by wheat husk ash at different percentages to comparative study for compressive and flexural strength.

In construction, Cement is a unique binding material which has fly ash. The waste has generally no commercial value and is locally available at a low transportation cost. The use of Waste has traditional material in construction and hence provides practical and economic advantages. The proper utilization of these wastes conserves the natural resources and protects the environment.

The Wheat husk ash can also is used in concrete due to the following point:

A. Large production of wheat in India and in the other country of world.
B. It is the staple food in majority of the country of the world and thus generates the husk in huge tones per year.
C. After the wheat grain is collected, the husk and ash is thrown and causing environmental pollution.
D. Some percentage of husk serves as eatable for the domestic animals while excess are wasted.
E. Organic wastes serves as good manure to the plants.
F. Helpful in cost effective material and low rising building.
G. It is an environmental eco-friendly construction material.
H.

II. LITERATURE REVIEW

A. Sumit A Balwaik, S P Raut et al (2011).

Based on the results presented the following conclusion can be drawn: In this experiment slump increased up to 5% replacement of Cement, then more 5% the slump decrease as the paper pulp content increase in the concrete mixtures. Generally The results of compressive strength, splitting tensile strength and flexural strength increase up to 10% addition of waste paper pulp otherwise reduces the strength gradually.

B. Dhanaraj Mohan Patil, Dr. Keshav K. Sangle et al(2013).

In this experimental result ,The waste glass powder used as replacement to some percentage of cement in the concrete ingredient.The compressive strength are measured. The cement is replaced at 10%,20% and 30% .It is found that initial strength is very less due to addition of waste glass powder on 7^{th} day but it increase on the 28^{th} days. It is found that 20% addition of waste glass powder gives higher strength.

C. Mr. R. Balamurugan, Mr. R. Karthick raja et al (2014).

This project based on the casting of concrete cube added with industrial waste (fly ash).It has been observed that 10% of hypo-sludge concrete gives result that compression strength has been increased, up to 10% cement has been replaced by hypo-sludge .the hypo-sludge minimized the cost of construction. The utilization of waste product also reduces the environmental effects.

D. T. Omoniyi, S. Duna, A Mohammed et al (2014).

This work reports on an investigation in to the use of Cow dung ash as supplementary cementations Materials in concrete. Cement was replaced with Cow dung ash up to 30 % and get the experimental results such as setting time, slump test and compressive strength .The workability decrease as the cow dung ash increase. Cement is replacing as 15% can be consider for the production of strong and quality concret.

E. P. Padma Rao, A. Pradhan Kumar, B. Bhaskar 014).

Based on this study carried out on the strength behavior of rice husk ash. The replacement levels of Rice husk ash, there is 5%,7.5%, 10%,12.5% and 15%.There is gradually increase in compressive strength from 7 day to 28 days followed by gradually increase. The flexural strength of rice husk ash concrete is decrease gradually till 7.5% replacement of cement.

F. Jitender Kumar Dhaka, Surendra Roy et al (2015).

This experiment show that the study of the utilization of waste materials in concrete production will not only save the cement used in concrete industry but will also protect the environment by controlling the emission of CO_2 from the cement industries.
In this study, the replacement material is fly ash and cow dung ash, the cube of M20 grade of concrete has different proportion of cement, fly ash and cow dung ash. Then cubes were cured for the period of 3 day, 7 day, 14 days, 21 days and 28 days. The compressive strength of all the cubes was determined using a Universal Testing Machine.

G. Inderveer singh Gurjar, Gautam Bhadoriya et al 2015.

In this paper present the experimental study of Cow dung ash and rice husk ash as partial replacement of ordinary Portland cement in M15 mix concrete. Cement was replaced with Cow dung ash and rice husk ash by weight of 5%, 10%, 15%, 20% and 25 % respectively in concrete. Compressive strength test was carried out on concrete cube after 7, 14 and 28 days curing. This experimental results has maximum compressive strength is achieved when cement is replaced with 5 % Cow dung ash and Rice husk ash.

H. D.Gowrisankar, S.Aslam, R.Satish Kumar et al (2016).

This experimental study present the variation in the strength of concrete when replacing sand by quarry dust and cement by lime powder also replacement by from 0% to 30% in M20 grade of concrete. The slump results are 60 mm and the compressive strength of cubes at age 7 and 28 days also increase.it also help to increase in the tensile strength of concrete. These results gives that quarry dust can be partial utilized in concrete mixtures as a good substitute of natural river sand.

I. SandeepDalal ,Parveen Berwal et al (2016).

In this research paper the compressive strength of M20 design mix concrete cube increased as the time of curing period increase. It has observed that the percentage of rice husk and cow dung ash increased the strength decrease even after increase in curing period. The compressive strength of cube prepared only by the cement was the highest at 28 day. There is significant difference in the

strength of concrete which is prepared by 10% of rice husk ash and 10% of cow dung ash.Then the cubes were cured for the period of 3days, 7day ,21days and 28days.

J. Sruthy B, Anisha G Krishnan ,Gibi Miriyam Mathew and Sruthi G Raj et al (2017).

This paper presents the result on the study for the use of Cow Dung ash as partial replacement of cement in the production of concrete. This replacement was designed to study the effect of adding Cow dung ash in various percentage by weight (6%,8%,10%,12% and 14%) of cement. The strengthen the Cow dung ash concrete and making it more durable 0.5% glass fibre is being added. It is an economically strong material, have excellent flexural strength, crack resistance and can also use as an alternate material for concrete construction.

III. MATERIAL USED

The materials used in this study include ordinary Portland cement, fine aggregate (sand), coarse aggregate, water and wheat husk ash.

A. Cement

The most common cement material is ordinary Portland cement is 53 grade used in construction. The standard consistency, setting time and specific gravity were tested in the laboratory. All the tests were carried out in accordance with procedure laid down as follow.

Fineness of Cement IS:4031(Part 1)-1996.
Specific Gravity IS:4031 (Part 11)-1988
Consistency IS:4031 (Part 4)-1988
Initial setting time & Final setting time IS:4031 (Part 5)-1988
Compressive strength IS:4031 (Part 6)-1988

Properties of Cement:

S.no	Properties	Value
i	Fineness	1.12%
ii	Specific Gravity	3.15
iii	Consistency	30%
iv	Initial setting time (minute)	30
v	Final setting time (minute)	210
vi	Compressive strength (28 days in (N/mm^2	53

B. Fine Aggregate

Fine aggregates are basically sand it also available locally present. Fine aggregates are the material that passes through 4.75 mm IS sieve. Manufactured sand is a substitute of river for construction purpose sand produce from hard granite stone by crushing. The test such as specific gravity and gradation were carried out to determine the physical properties of fine aggregate.

Fineness modulus-IS:383-1970
Specific gravity-IS:2386 (Part 3)-1988
Bulk density-IS: 2386 (Part 3)-1988
Water absorption-IS:2386 (Part 3)-1963

Properties of Fine Aggregate:

S.no	Physical properties	value
I	Fines modulus	3.25
II	Specific gravity	2.25
III	Bulk density	1.657
IV	Water absorption	0.80%

C. Course Aggregate

Coarse aggregates of 20 mm maximum size has been used which is present locally with high strength. The sieve analysis of combined aggregates confirms to the specification of IS 383:1970 for graded aggregates.

Fineness modulus-IS:383-1970

Specific gravity-IS: 2386 (Part 3)-1988

Bulk Density- IS: 2386 (Part 3)-1988

Impact test- IS: 2386(Part 4)-1963

Properties of Coarse Aggregate:

S.no	Physical properties	value
I	Fines modulus	6.25
II	Specific gravity	2.40
III	Bulk density	1.564
IV	Impact test	8.0%

D. Water

The water used for the study was taken as portable water. It should be clean and free from impurities. Water is least expensive but most important ingredients of concrete. The water used in the experiment which PH is less than 7.

E. Wheat Husk Ash

Wheat husk ash in the present experimental study was obtained from village. Specific gravity test perform by Pycnometer apparatus.

Physical properties of Wheat husk ash are given:

Physical state	Solid non toxic
Appearance	fine
Particle size	<45 micron
Colour	gray
Odour	odorless
Specific gravity	2.4

Chemical composition of Wheat husk ash:

Oxides	Percentage
CaO	10.64
SiO_2	50.71
Al_2O_3	0.49
MgO	2.23
K_2O	0.08
Na_2O	5.58
SO_3	6.18

IV. OBJECTIVE OF THE STUDY

A. To investigates the compressive strength of design mix concrete with Wheat husk ash to that of normal concrete.

B. To prepares high strength concrete, eco-friendly and cost effective to the construction.

C. The material is locally available and also reduces the cost of casting of design mix concrete.

D. To form idea of significance and importance of consumption of agricultural waste material for the casting of sustainable design mix concrete for the construction.

V. CONCLUSION

Based on above literature survey we have concluded that material like Fly ash, Rice husk ash, Ceramic waste, industrial waste, Waste paper pulp, waste glass powder, marble dust, quarry dust, lime powder, and cow dung ash from different industries used in

varying proportion for partially replacement of concrete ingredient. For better utilization of this type waste material required detail investigation for effective results because of different proportion of waste material used in concrete .In this paper many type of replacement material has been used by comparing their 7, 14 and 28 day compressive strength, flexural strength and split tensile strength. All such type of ingredient material gives high strength, durability and workability when added in desired proportion of concrete.

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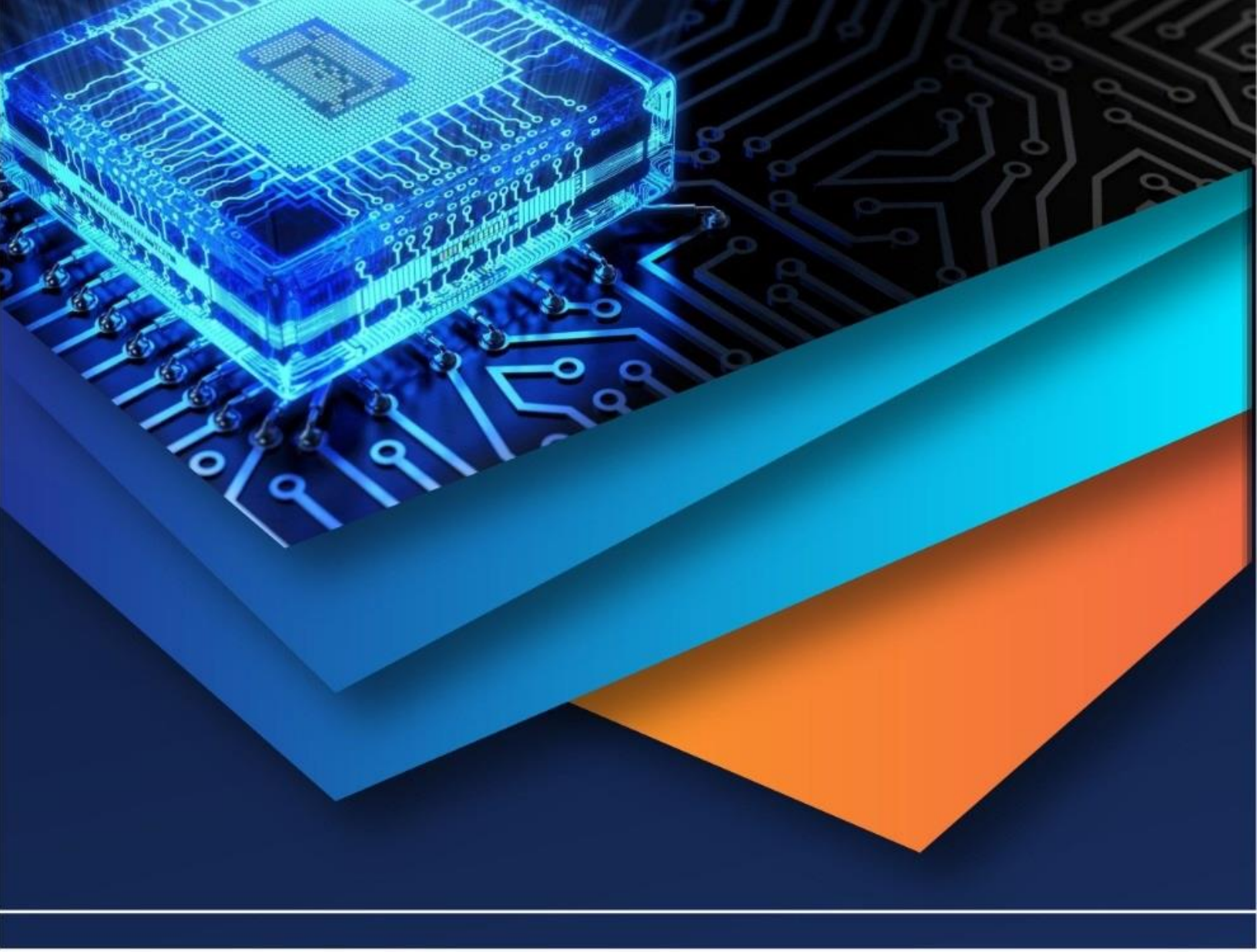

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