International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 11 Issue 4 ǁ April 2023 ǁ PP. 596-600

A Review on Partial Replacement of Cement by Using Corn Husk Ash

Ms. Prajakta J. Ukey[1] Ms. Madhura P. Thodge[2]
Mr. Abhishek C. Gote[3] Mr. Nikhil R. Kaurati[4]
Guided By Ms. Rutuja Kakpure
(Assistant Prof)
B.E Student, Department of Civil Engineering, Bapurao Deshmukh College of Engineering, Sevagram, India[1]
B.E Student, Department of Civil Engineering, Bapurao Deshmukh College of Engineering, Sevagram, India[2]
B.E Student, Department of Civil Engineering, Bapurao Deshmukh College of Engineering, Sevagram, India[3]
B.E Student, Department of Civil Engineering, Bapurao Deshmukh College of Engineering, Sevagram, India[4]
Asst. Professor, Department of Civil Engineering, Bapurao Deshmukh College of Engineering, Sevagram, India[5]

***Abstract**: For any type of construction Cement make an important role in the concrete production; however, it is expensive and unaffordable for many low-income and rural communities in developing countries. For that objective we think that to control the cost of cement and make it economical for everyone. As per increasing demand for concrete for various infrastructure construction has led to significant production and usage of Portland cement which is the main binder used for concrete. To produce low-cost concrete by blending various ratios of cement with corn husk ash & to reduce disposal and pollution problems and it is most essential to develop profitable building materials from corn husk ash. The cement has been replaced by corn husk ash accordingly in the range of 0%, 5%, 10%, & 15% by weight. Concrete mixtures were produced, tested, and compared in terms of strength with the conventional concrete. These tests were carried out to evaluate the mechanical properties like compressive strength of concrete blocks up to 7, 14 and 28 days.*
***Keywords**: Corn Husk Ash, Compressive Strength, Flexural Strength.*

Date of Submission: 11-04-2023 Date of acceptance: 25-04-2023

I. INTRODUCTION

The construction industry is far and wide advanced from day to day. The need of construction materials are increasing in large amount; cement, sand, aggregates, and water are the three basic components of concrete and the most widely used construction material in the world. The most expensive and very essential material in the production of concrete is cement than all other concrete-making materials, and it is an environmentally unfriendly material. The main environmental challenge faced by the cement industry is release of air.

Concrete is the most versatile construction material and the most impetus of infrastructural development of any nation. Civil engineering practice and construction works around the world depend to a very large extent on concrete. To reduce the cost of concrete production there is a need to employ the use of agro waste scientifically known as pozzolana as a replacement of cement in concrete. Concrete made with Ordinary Portland cement is strong in compression but weak in tension and tends to be brittle. The weakness in tension can be overcome using materials that are good in tension such steel bars and enough certain fibres. The addition of fibres could change the performance of the fibre-matrix composite, resulting in the enhancement of the energy absorption capacity, of concrete.

Because we use the corn husk ash as a binding material it is use to enhance the sustainability of concrete. As a way of ensuring a sustainable use, this study focused on ways of utilizing corn husk ash in concrete production with the aim of improving the strength characteristics in the long term. The utilization of corn husk ash (CHA) as a cementitious material to supplement cement to improve the strength reinforced concrete was investigated in this research.

II. LITERATURE REVIEW

Some information has been published on uses for corn husk ash. There is a lack of information on the engineering properties of the material.

1. **Peter Paa Kofi Yalley & Augustine Sam (2021):** In this research as cementitious material corn husk is utilized to improve the strength of fibre reinforced. Corn husk ash was found to compensate the strength losses due to pores caused by the coconut fibre.

2. **Sunita Kumari, Dinesh Chande (2018):** The research founding indicated that corn cob is suitable for partial replacement of cement. It can be replaced up to 7.5% level with cement for load bearing structure and for non–bearing structures up to 12.5%. corn cob ash concrete or Corn cob- rice husk ash concrete are alternate cementitious material and use of these ashes can help in reducing emission of carbon dioxide in atmosphere, impacts on environment and reduce cost of cement.

3. **Shruthi H G, Madhushree M:** The maximum compression strength is obtained when 15% of RHA & CCA was replaced in cement. The compressive strength for 20%, 25% and 30% replacement of RHA & CCA is not increased. The variation in strength is decreasing with increasing in CCA and RHA when compared with the normal concrete.

4. **Mattey, Pedro E., Rafael A. Robayo:** The strength behaviour of Corn Husk Ash polymer concrete reinforced with coconut fibre was investigated in this study. The study assessed the suitability of using coconut fibre in concrete to improve its strength properties. The concrete was prepared and cured based on British Standard. Different proportions of the coconut fibre as well as the Corn Husk Ash (CHA) polymer were used in the concrete mix.

5. **Richard Ahumada , Holman Ospina –Mateus(2021)** Improvement in setting time & adhesive property & properties of the material is optimized with partial replacement in the mixture up 15 to 20%.

6. **Rainer R. Fisal, Kristoffer Bryan V. Dandan (2015):** The present environmental issue can resolve by using non-timber resources for making paper. This study aims to produce quality paper out of corn husks and snake plant fibres. It also seeks to determine the qualities of produced paper through laboratory experiment and sensory evaluation. Experimental design was utilized in developing paper. In line with this, increasing demand for paper was leading to rapid environment destruction.

7. **Priya et al (2017)** studied the partial replacement of cement with CCA and coarse aggregate with steel slag. The CCA was used to replace cement partially in 5 % and 10 % ratio while steel slag was used to replace aggregate partially in 40 % and 50% ratio. They carried out compressive strength test, split tensile strength test and flexural strength test at ages of 7, 14 and 28 days. The researcher concluded that concrete acquires maximum increase in strength of concrete at 5 % replacement of cement by CCA and 40 % coarse aggregate replacement by steel slag.

8. **Antonio et al (2014)** In this research they evaluated the benefits of replacing Ordinary Portland Cement (OPC) with CCA blended cements. They carried out an experiment to designate an appropriate percentage replacement of CCA that would comply with specific standards of cement production. The experimental plan was designed to analyze compressive strength, workability and thermal performance of various CCA blended cements. The researchers concluded that up to 10 % CCA replacement could be used in cement production without compromising the structural integrity of OPC and that the compressive strength and workability of the resulting concrete could be improved when CCA is added to the mixtures.

III. MATERIALS AND PROPERTIES

Materials

- Cement
- Aggregate
- Sand
- Water
- Corn Husk Ash

CEMENT

In ordinary Portland cement, the lime was used as a cementing material. Most of the cement concrete work in building construction is done with ordinary Portland cement at present. But other special varieties of cement such as rapid hardening cement and high alumina cement are used under certain circumstances. The cement should comply with all the standard requirements. Ordinary Portland cement (OPC) of 43 grade of wonder Brand was used and tests were conducted for Specific gravity, consistency, initial setting, and final setting time. All the values of the tests were compared with the permissible limits of IS code10262:2009. The initial and final setting time of cement was found to be 190 minutes and 345 minutes respectively. Specific gravity of cement is 3.18.

AGGREGATE

For a good concrete mix, aggregates need to be clean, hard, strong particles free of absorbed chemicals or coatings of clay and other fine materials that could cause the deterioration of concrete. Aggregates, which account for 60 to 75 percent of the total volume of concrete, are divided into two distinct categories--fine and coarse. Fine aggregates generally consist of natural sand or crushed stone with most particles passing through a 3/8-inch sieve. Coarse aggregates are any particles greater than 0.19 inch, but generally range between 3/8 and 1.5 inches in diameter. Gravels constitute most of the coarse aggregate used in concrete with crushed stone making up most of the remainder.

After harvesting, aggregate is processed: crushed, screened, and washed to obtain proper cleanliness and gradation. If necessary, a benefaction process such as jigging or heavy media separation can be used to upgrade the quality. Once processed, the aggregates are handled and stored to minimize segregation and degradation and prevent contamination.

SAND

This kind of sand is usually found near riverbanks and streams. It is a fine quality white-grey sand used in concrete and masonry work. It can also be used for plastering, brickworks, RCC etc. This sand has a better grain shape with a smooth texture and demands less moisture since water is already trapped within its particles. It consists of 5-20% of silt content and is also budget friendly.

Fine aggregate: The material below 4.75mm. Size is termed as fine aggregate. The sum of all types of deleterious material in fine aggregate should not exceed 5%. Natural sand or crushed stone dust is the fine aggregate chiefly used in concrete mix. Sand may be obtained from sea, river, lack or pit, but when used in a concrete mix, it should be properly washed and tested to ascertained total percentage of clay, silt, salt and other such organic matter does not exceed of specified limit" (Kumar, 1992). "Sand- A fine aggregate which is either natural sand crushed stone sand or crushed gravel sand. Natural Sand-A fine aggregate produced by the natural of rock.

WATER

Generally, quality of water for construction works are same as drinking water. This is to ensure that the water is reasonably free from such impurities as suspended solids, organic matter, and dissolved salts, which may adversely affect the properties of the concrete, especially the setting, hardening, strength, durability, pit value, etc. The water shall be clean and shall not contain sugar, molasses or gur or their derivatives, or sewage, oils, organic substances. If the quality of water to be used for mixing is in doubt, cubes of 75 mm in cement mortar 1:3 mix with distilled water and with the water in question shall be made separately. The latter type of cubes should attain 90% of the 7 days' strength obtained in cubes with same quantity of distilled water. Alternatively, the water shall be tested in an approved Laboratory for its use in preparing concrete / mortar.

CORN HUSK ASH

The corn husk that we used was sourced from near-by city areas and market areas. The corn husk for the purpose of this study refers to the dry outer covering of the corn kernel which is left behind after harvesting. The corn husks were gathered on the farm and subjected to uncontrolled combustion in the open amidst constant stirring the husks to ensure even combustion. In other words, the incineration conditions of the corn husk ash were not controlled in this study. It was then allowed to cool naturally before packing into sacks. Corn Husk were collected from the fields of nearby village. The Corns were removed, and husk were broken in small pieces to dry in the sun for one week. The dried corn was burnt in Open air furnace at controlled temperature of 900oC. Ash cooled down within two days. The ash was ground in millet and sieved through 90micron.

IV. METHODOLOGY

The present study is experimental In the first stage, in India there are higher availability of agricultural waste. The collection of sample is carried out, and the methods of preparing the samples for use as pozzolanic additions were established. The agro-industrial waste was subjected to a calcination process under controlled conditions and then to commination or reduction in size as recommended by previous studies. In the next stage, it was sought to characterize the ashes' physicochemical properties to evaluate their potential. The ash obtained was subjected to humidity tests, organic matter content, density, loss on ignition, and screening. In the next research stage, a mixture of ceramic adhesive mortar was made, making partial substitutions of cement for the ash obtained. In the experiment, the cement replacement percentages were varied to establish the recommended percentage to obtain the best performances. The mixed design were prepared in M20 grade of concrete and the replacement of the cement is according to the 0%, 5%,10% and 15% in concrete and casting in progress. Then next stage is curing of the 3,7,14,and 28 days for the strength of cube.

PROPERTIES

A) CEMENT

Content	Percentage
Lime	60-70
Silica	17-25
Alumina	3-8
Iron Oxide	0.5-6
Sulphur Trioxide	2-3.5
Magnesia	0.5-4
Calcium Sulphate	0.1-0.5
Alkaline	0-1

B) CORN HUSK ASH

Chemical components	Value
Silicon dioxide (SiO2)	64.56%
Calcium oxide (CaO)	12.0%
Iron oxide (Fe2O3)	5.12%
Aluminium oxide (Al2O3)	9.42%
Magnesium oxide (MgO)	3.01%

TEST

- Fineness Modulus
- Specific Gravity
- Water Absorption
- Compressive Strength
- Workability
- Specific Gravity of Cement, Coarse Aggregate and Fine Aggregate
- Water Absorption
- Free (Surface) Moisture
- Slump Cone
- Sieve Analysis
- Consistancy
- Compressive Strength

V. CONCLUSION

After Studying Number of papers, we are concluded that,

The corn husk samples collected from the disposal areas in small market and the nearby site of city is a better innovative sustainable cementitious construction material by converting the corn husk into the ash which is used in concrete. So, the corn husk ash is proving to be economical and sustainable, and it can save the environment by using wastes disposal costs and produce a “greener” concrete for construction.

REFERECES

[1]. Ashish Pandya. "Gainful utilization of hypo sludge in concrete", International Journal of Civil Engineering and Technology (IJCIET) Volume 8, Issue 2, February 2017, pp. 128–134 Article ID: IJCIET_08_02_013.

[2]. G.L. Abhishek, "Experimental study on behaviour of paper sludge concrete", IIOABJ, Vol. 8, Suppl 3, 73-78,

[3]. G. Navya et al. (2010) determined the compressive strength, water absorption and flexural strength of paver blocks by adding coconut fibres in the top 20 mm thickness.

[4]. In 2013, Jayraj et al done experimental investigation on strength of concrete and optimum percentage of the partial replacement by preparing a mixM20 grade.

[5]. In 2016 Er. Siddharth Talsania experimental study of hypo sludge s a partial replacement of cement.

[6]. Katru Sai Teja, "Hypo sludge as a partial replacement of cement in concrete", International Journal of Civil Engineering and Technology (IJCIET), Volume 8, Issue 4, April 2017, pp. 1645–1651, Article ID: IJCIET_08_04_185

[7]. Mattey, Pedro E., Rafael A. Robayo, Jherson E. Díaz, Silvio Delvasto, and José Monzó. (2015) "Application of rice husk ash obtained from agro-industrial process for the manufacture of nonstructural concrete blocks." Revista latino americana de metalurgia y materiales 35(2): pp. 285-294

[8]. Mr. R. balamuruga & Mr. R. karthickraja, an experimental investigation of partial replacement of cement by industrial waste (hypo sludge), 2014. International Journal of Engineering Research and Applications, (IJERA) ISSN: 2248- 9622.

[9]. P Antonio, Y Ryan, F Ellie and A Taher. Investigating Effects of Introduction of Corncob Ash into Portland Cements Concrete: Mechanical and Thermal Properties. American Journal of Engineering and Applied Sciences. 2014; 7 (1), 137-148.

[10]. Prof. Jayesh kumar Pitroda1, & Dr. L. B. Zala, Dr. F. & S. Umrigar, Innovative use of paper industry waste (hypo sludge) in design mix concrete, 2013. IJAET, Volume IV, Issue I, pp. 31-35.

[11]. Peter Paa Kofi Yalley & Augustine Sam | (2021)Strength behaviour of Corn Husk Ash polymer concrete reinforced with coconut fibre, Cogent Engineering, 8:1, 1993511, DOI: 10.1080/23311916.2021.1993511 Published online on 28 Oct 2021

[12]. Rainer R. Fiscal, Kristoffer Bryan V. Dandan (2015) "Development and Evaluation of Paper from Corn Husks (Zea mays L.) and Snake Plant Fibers "2319-7064 Volume 5 Issue 8, August 2016

[13]. Rakesh Kumar (2014) investigated suitability of concrete reinforced with synthetic fibre for the construction of pavements.

[14]. Richard Ahumada, Holman Ospima-Mateus, Katherinn SalasNavarro (2021)"Use of the rice and corn husk ashes as an innovative pozzolanic material in ceramic tile adhesive production" 1877-0509 10.1016/j.procs.2021.12.288

[15]. Rushabh a. shah & prof. jayesh kumar pitroda**, Effect of hypo sludge as partial replacement with cement in mortar 2013. International Journal of Engineering Research and Applications, (IJERA) ISSN: 2248-9622.

[16]. Sajad Ahmad, M. Iqbal Malik, Muzaffar Bashir Wani, Rafiq Ahmad, Study of Concrete Involving Use of Wastepaper Sludge Ash as Partial Replacement of Cement. IOSR journal of Mechanical & Civil Engineering.

[17]. Shruthi H G1, Madhushree M"(2019) Effect of Rice Husk Ash and Corn Cob. Ash in Concrete with Partial Replacement Cement" ISSN(Online): 2319-8753 ISSN (Print): 2347-6710 Vol. 8, Issue 6, June 2019

[18]. Sumit Santosh Sable (2020) Replacement level of hypo 10%, 20%, 30% and 40% with cement.

[19]. S Priya, R Dhanasekar, P Vijayalakshmi, A Siva and P Vignesh. Experimental Investigation on Partially Replacement of Cement, Coarse Aggregate by Corn Cob Ash and Steel Slag. International Journal for Innovative Research in Science & Technology. 2017; 3(10), 209-214.

[20]. Valeria Corinaldesi, Gabriele Fava (2010). Paper Mill Sludge Ash as Supplementary Cementitious Material. ISBN 978-1-4507-1490-7.