International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 06 | June - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Employment of Coffee Husk Ash as Proxy with Fine Total & Corn Cob Ash as Cover to Cement for M40 Specific

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Abstract - As In the recent decades the worldwide construction business has encountered hurdles owing of the Covid-19 epidemic, resulting to developing concerns. Material shortages throughout the supply chain have become a serious problem. Construction material contributes about 50% of overall project expenditures. Effective material management is vital to solve shortages and limit inventory costs. The continued demand for building services leads to increasing costs. Sustainable building materials serve a crucial role in resolving environmental issues and boosting resilience in civil engineering projects. The easiest technique to handle this problem is include the waste products towards elements in concrete. COFFEE HUSK ASH (CHA) is a byproduct obtained from the burning of coffee husks, which are produced in vast amounts owing to worldwide coffee bean trade. Researchers have examined the use of CHA in concrete, particularly as a partial cement substitute. However, our experimental work, the emphasis moved to replacing fine aggregate (not simply cement) with CHA. CORN COB ASH (CCA) is another agro-waste resource that may be utilized as a supplemental cementitious ingredient. It helps lessen the environmental effect of concrete manufacturing and may be partly replaced for cement.

This Paper speaks about preserve the consistent frequency to compose CCA with cement 4% & CHA with Fine total like 0%, 3%, 6%, 9%, 12% & 15% and additionally the comparison is conducted with proxy blends like 0%CCA+0%CHA, 4%CCA+3%CHA, 4%CCA+6%CHA, 4%CCA+9%CHA, 4%CCA+12%CHA & 4%CCA+15%CHA for M40 Specific. In summary, both coffee husk ash and corn cob ash provide viable solutions for strengthening concrete characteristics while resolving waste management problems. This study continues to seek creative methods to employ such materials in sustainable building processes.

Key Words: Coffee Husk Ash (CHA), Corn Cob Ash (CCA), Cement, Fine Total & M40 Specific

1. INTRODUCTION

1.1 Review

Coffee Husk Ash

At the moment, construction has become the most fundamental component in the development of a country, and it plays a significant role in the social, economic, and particularly in the making of employment opportunities. When we speak about construction, it is directly or indirectly related to concrete making and which leads to huge extraction of natural resources. Concrete, as the major and the world's oldest and most generally used construction resources, is relatively economical to turn out due to the plenty of its works, which include aggregate and sand, as well as cement and water as the binder. Due to the common abundance of its raw resources, cement fabrication is common. Even though concrete has a relatively high strength, excellent aesthetics, ability to resist severe weather conditions, and is easy to use, it will almost certainly remain the ideal construction material. In concrete production, the paste is made of cement and water, as well as other cementitious and chemical admixtures, whereas the aggregate is made of sand, gravel or crushed stone.

Corn Cob Ash

Corncob ash is a crop deposit and agricultural waste consequent from the maize crop. A study showed, that of the 750 Tg of biomass burnt across Asia, 250 Tg (33.4%) originated from open-field incineration. The main donors were India (84 Tg) and China (10 Tg).CCA is an agricultural deposit product derived from maize, the highly significant grain crop in Sub-Saharan Africa. The Food and Agriculture Organization estimated that 589 million tons of maize was prepared worldwide. The US was the crest maize maker, secretarial for 43% of global output. Africa accounted for 7% of global maize production. With 4.62 million tons, Nigeria was Africa's second-highest producer of maize. South Africa has the biggest output (8.04 million tons). Corncob is typically discarded as rubbish in disadvantaged nations. Therefore, it stops sewers, drains and pollutes the atmosphere via combustion, generating substantial socioeconomic and health losses.

1.2 Coffee Husk Ash

The chemical compositions of CHA depend on temperature and burning time, chloride and moisture substance, pasting on ignition, and silica substance. The main chemical compounds of CHA decreased as the blazing temperature of coffee husk enlarged. It is caused by the ash disintegrating into its constituent chemical fundamentals. Relative to other SCMs, CHA is composed of a small quantity of SiO_2, Al_2O_3, and Fe_2 O_3 and superior amount of CaO, with special other oxides from which alkali pleased of K_2O is substantial (45–65%). and the loss on ignition (LOI) value of CHA is significant (Up to 20%) because of the approved out incineration and dispensation.

The partial replacement of fine total in concrete has been a area of research in the field of civil engineering for many years. The goal is to find alternative materials that can partially replace fine total without compromising the durability and strength of concrete. Waste glass is one of the most common materials used in concrete as partial replacement for fine aggregate. In a study conducted on the use of crushed glass as a partial replacement for fine aggregate in concrete, the glass improved the concrete's compressive strength, flexural strength, and elasticity modulus. The study also revealed that the optimal replacement percentage of fine aggregate with crushed glass was 20%, giving increases in compressive and flexural strength by 4.33% and 10.99%, respectively.

Applications

Sure thing! Coffee husk ash (CHA) has found applications in building and geotechnical engineering here are some key uses:

- Concrete Production: Coffee husk ash can be used as a partial replacement for fine aggregate in concrete. Researchers have researched its impact on several performance indicators.
- For instance, replacing 4% of the fine aggregate with CHA (CHA04) resulted in enhanced compressive strength, flexural strength, and splitting tensile strength compared to conventional concrete mix:
- Additionally, CHA displayed greater durability under acid and alkaline environments and decreased chloride permeability.

1. **Pavement Mixtures:** CHA can substitute common fillers like basaltic stone dust and slag ash in hot-mix asphalt concrete, addressing the environmental dilemma of agricultural waste disposal.

2**. Soil Stabilization**: Researchers have studied utilizing CHA to enhance the shear strength of clay soil, producing an environmentally acceptable alternative composition.

3. In summary, coffee husk ash offers sustainable solutions in construction and soil engineering.

1.3 Corn Cob Ash

Pozzolanic, a chemical constituent combines chemically with calcium hydroxide, which is produced when Portland cement hydrates at regular room temperature, to construct compounds with cementitious properties when lightly divided and in the existence of moisture.

1. Pozzolanic materials are finished up of alumina (Al_2O_3), silica (SiO_2), and ferrite (Fe_2O_3) oxides in amounts the same to or greater than 70% by weight. Pozzolanic are added, which reduces porosity and pore diameters and increases power.
2. Pozzolanic reactions are silica reactions that result in the formation of calcium silicate hydrates when calcium hydroxide and water are current (C-S-H).
3. The cost of constructing stabilized roads has remained expensive because of an unwarranted reliance on soil-improving additives produced industrially, such as cement, lime, and others.
4. The outlay of building highways in developing countries has soared since most of them are inaccessible to rural people, who make up a substantial proportion of their population.
5. The potential use of agricultural wastes such as corn cob ash (CCA) will significantly reduces construction costs.

Applications

Of course! There are a number of intriguing uses for corn cob ash (CCA). Now we will examine a handful of them:

- The cementitious material used in concrete, known as corn cob ash (CCA), is an inorganic or heterogeneous byproduct of burning corn cobs at high temperatures. It can range in color from grey to brown.
- It may have pozzolanic properties due to its chemical make-up.
  Research on CCA as a cement substitute in concrete has been conducted.
- While it affects compressive strength, thermal conductivity, ultrasonic pulse velocity, and density of hardened concrete at normal temperatures, thermal treatment (calcinations) and longer curing boost compressive strength due to higher silica content and surface area Material for Asphalt Concrete Filler:
- Asphaltic concrete for heavily utilized roads can benefit from CCA's usage as filler.
- This application enhances the characteristics of asphalt concrete while also helping to address the disposal problem of agricultural waste.
- Corn cob, which can be processed into CCA, has great potential as a substitute for fine aggregate in concrete.

Given that countries like the United States create roughly 50 million tons of maize annually, utilizing corn cob debris as CCA could be environmentally advantageous.

1.4 Objectives

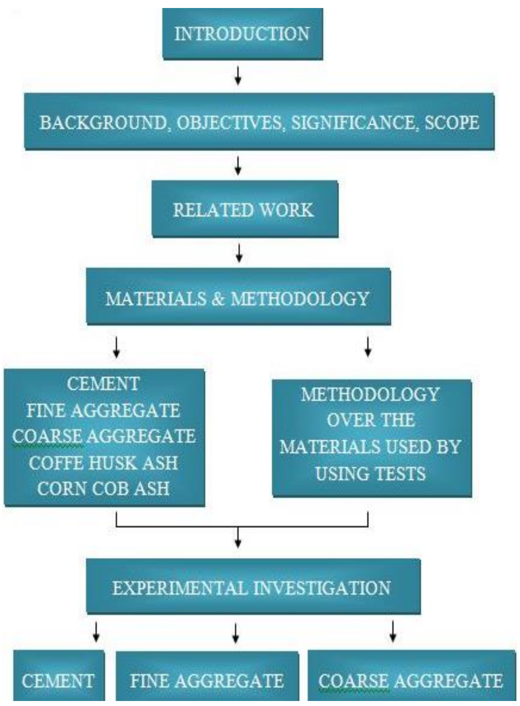
- To get better understanding of the CCA and CHA as a construction material.
- To know the properties of CCA and CHA.
- Study of compressive strength, flexural strength, split tensile strength of concrete by conducting different tests on cement, fine aggregate, coarse aggregate.
- To prepare the cubes, cylinders, beams of concrete by using
- To prove that corn cobs ash can be used as a stabilizer of cement and coffee husk ash in fine aggregate.
- To create an economical and environmental friendly block material in support of a sustainable society.
- Therefore, the main objective of the study under consideration is to determine the effects of engineering

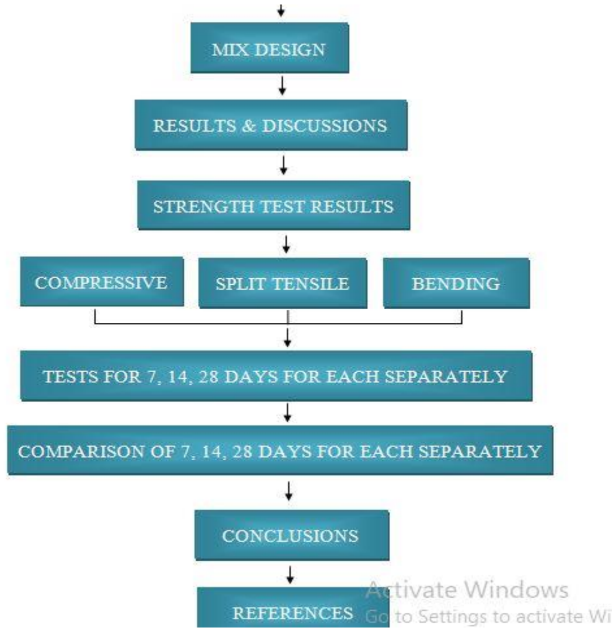
properties (consistency, setting time, slump for workability, compressive strength, sulphate resistance, water absorption and microstructure properties, and compressive strength relationships with that of sulphate resistance and water absorption) of concrete containing coffee husk ash as partial replacement of cement on the concrete properties.

1.5 Significance of the Study

- The rapid increase of population in the India means also a rapid growth in demand for buildings, houses, and many other infrastructures hence the increase in demand for raw materials and other sources of energy.
- The budget for construction is very big because you will need to hire engineers, laborers, and lastly materials such as bricks, cement, steel, timber, plastics, glass etc.
- Furthermore, the cost of transfer of those materials considering how far is the location plus factories producing steel and cement emit toxic substances that is harmful for the environment.
- It is a fact that there are also other sources of pollution but it also a fact that it can be reduced. A good way for this is to use corn cobs ash as an additive for the cement and coffee husk ash as fine aggregate.

1.6 Document Overview Flowchart





2. LITERATURE SURVEY

Related Work

Corn Cob Ash

In creating concrete with maize cob ash, the features and virtues of employing this pozzolan in concrete are determine Narmluk and Nawa, (2011). Expressing it another way, it may be argued that 7% of worlds carbondioxide (CO_2) emission is related to cement industry (Olutoge, 2010). Because of the Abstract: This study addresses the investigation of concrete made by partial replacement of cement with maize cob ash (CCA).

Compressive strength test was carried out on the cubes and the flexural strength on beam. The results showed that the concrete strength reduced with increasing replacement with the maize cob ash (CCA). The 28 days compressive strength for 5% replacement was 28.78 N/mm2, 10% replacement was 26.22 N/mm^2, 15% replacement was 22.33 N/mm^2, 20% replacement was 20.27 N/mm^2 and 25% replacement was 17.33 N/mm^2 respectively while its flexural strength for same age for 5% replacement was 9.98 N/mm^2, 10% replacement was 8.58 N/mm^2, 15% replacement was 7.82 N/mm^2, 20% replacement was 6.56 N/mm^2 and 25% replacement was 5.72 N/mm^2.

Ahangba Augustine. S-B.Engg (Civil Engineering) in Federal University of Agriculture Makurdi, Nigeria. has substantial contribution to the environmental pollution to the high consumption of natural resources like limestone and the high cost of cement, Raheem, (2010) presented an insight on the maize cob as agricultural waste product obtain from maize, which is the most significant cereal crop in sub-saharan Africa according to food and agriculture organization (FAO) data, 589 million tons of maizeare produce worldwide in the year 2000 (FAO record 2012).

Nigeria was the second greatest producer of maize in Africa in the year 2001 with 4.62 million tons. There had been various effort on the use of maize cob ash (MCA) and other pozzolannic as replacement for cement in concrete (Olutoge, 2010) presented a comparative study on fly ash and groundnut husk ash to replace cement in a wake to reduce carbondioxide emission associated with production of cement clinker, another study was presented by (Hassanbeigi, 2012) on the reduction on the partial replacement of cement with maize cob ash which by him is expected to yield a significant reduction in carbondioxide emission.

Coffee Husk Ash

Since Ethiopia has coffee beans production every year, around 450,000 tons is produced during 2013/2014 alone. Coffee production is high in Jimma zone. Therefore, it has a low cost to use as a stabilizer. Jimma Zone is one of coffee growing zones in the Oromia Regional State, which is produced in the eight woredas namely, Gomma, Manna, Gera, Limmu Kossa, Limmu Seka, Seka Chokorsa, Kersa and Dedo which has a total area of 1,093,268 hectares of land Currently, the total area of land covered by coffee in the zone is about 105,140 hectares,The processing of coffee generates significant amounts of agricultural waste, ranging from 30% to 50% the weight of the total coffee produced, depending on the type of processing. Coffee husks are the major solid residues from the processing of coffee, for which there are no current profitable uses, and their adequate disposal constitutes a major environmental problem.

Additionally, the durability of the concrete using CHA as partial replacement to fine aggregate is studied in acidic and alkaline environments. In recent years, scientists have become aware of the potential for the efficient and cost-effective application of plant-derived fibers and the likelihood of producing higher-quality fiber-reinforced polymeric materials for construction projects.

The task of turning agricultural waste into practical construction and building materials has been placed before civil engineers. Coffee husk is produced in vast amounts due to the global commerce of coffee beans, which are incinerated into ash when used as fuel, producing coffee husk ash (CHA). Even though many researchers have worked on the utilization of CHA in concrete, they have been used as partial cement replacement but not as a replacement of aggregates. The experimental study of the performance of concrete on fine aggregate replaced partially with CHA is represented in this paper. The fine aggregate is replaced by 0%, 2%, 4%, 6%, and 8% by weight of CHA.

3. MATERIALS AND METHODOLOGY

3.1 Cement:

A cement particle bonds firmly to the stone when it comes into touch with water. The compounds found in cement stay in the finished result, giving it the desired qualities and encouraging its inclusion into the concrete. The cement is ACC cement, more precisely Portland Pozzolona cement (PPC 43 Review**).**

3.2 Fine Aggregate:

Fine sums are tiny particles with a diameter of 4.75mm that are extensively used in the improvement business. They are used to fill the gaps between larger particles, which are mostly made of 77% calcium oxide. This improves the dimensional robustness of the concrete mix. The sand used is locally obtained and fits zone I specifications. It underwent strainer testing inside the investigation office in accordance with IS 383:1970 guidelines.

3.3 Coarse Aggregate:

The coarse particles of a certain size and irregular shape used in development activities make up the approximate amounts acquired by the mining approach. These sizes, which include ratings exceeding 40mm, 20mm, and 10mm, are offered in the showcase. This raises the concrete's quality considerably. According to IS 383-1970, the quantity utilized is roughly one and rated at 20 mm.

3.4 Water:

Due to its significant involvement in the chemical processes that occur between cement and water, water is a basic component of concrete. The screen handle is mixed and cured using tap water. H. P. 6.8.

3.5 Coffee Husk Ash (CHA):

Coffee Husk Ash (CHA) is a result of burning coffee leaves. These pods are widely found in coffee areas. Coffee Husk Ash (CHA) is a material made by burning coffee husks as a fuel source in different small businesses and farms. When burned, the organic molecules in the shells are oxidized, leaving behind artificial minerals and elements that form ash.

3.6 Corn Cob Ash (CCA):

A gray to brown colored inorganic or heterogeneous leftover substance produced by high-temperature incineration of maize cobs (CC) is known as corn cob ash (CCA). Because of its chemical makeup, CCA is a possible pozzolana even though biomass ash is usually problematic1. Being high in silica, it has characteristics with other supplemental cementitious materials (SCM) like rice husk ash (RHA) and fly ash (BA). CCA is therefore applicable as SCM in concrete and cement.

3.7 Methodology

The Methodology describes the fill-ins used & mechanical attributes done over this paper:

1. Understudy of Corn Cob Ash to Cement & Coffee Husk Ash to Sand with a fixed proportion of 4% in cement & a variable proportion of 3%-15% with frequency of 3% in Sand respectively.
2. Property check of Compressive Strength for cubes with a size of 150mm*150mm*150mm.
3. Property check of Tensile Strength for cylinder with dimensions of 150mm diameter & 300mm Height.
4. Property check of Bending Strength for Beam with a dimensions of 500mm*100mm*100mm.

3.8 MIX DESIGN

A) Stipulation for Proportioning Concrete Ingredients

a) Characteristic compressive quality required within the field at 28 days review - M 30

b) Sort of Cement - OPC 43 Review affirming to IS 8112 : 1989
c) Max size of CA - 20 mm
d) Shape of CA - Angular Aggregates with angularity Shape
e) Greatest water-cement proportion - 0.45 (IS 456)
f) Workability - 100mm (droop)
g) Degree of super vision - Good
h) Sort of total - Pulverized point total
i) Chemical admixture - Nil

B) Test information for materials:
a) Cement Specific Gravity - 3.15
b) Particular gravity of total coarse - 2.45
c) Particular gravity of total fine - 2.40
d) Particular gravity of Chemical admixture - Nil
e) Water retention coarse total - 4.65%
f) Water assimilation fine total - 1.58 %
g) Free (surface) dampness
1) Coarse total: Nil (retained dampness too nil)
2) Fine total: Nil (retained dampness too nil)
Aggregate are expected to be in immersed surface dry condition as a rule whereas planning plan mix.
h) Strainer Examination
Fine totals: Affirming to Zone I of Table 4 IS – 383

Estimation of Concrete Mix Calculations
The following are the blend calculations per unit volume of concrete:
1. Concrete volume (a) = 1 m^3
2. Cement volume (b) = (cement mass / cement specific gravity) x (1/1000)= (438/3.15) x (1/1000) = 0.139 m^3
3. Water volume (c) = (Mass of water / Particular gravity of water) x (1/1000) = (197/1) x (1/1000)= 0.197 m3
4. Add up the whole volume (d) =a-(b+c)
=1-(0.138+0.197)
= 0.665 m^3
5. Mass of coarse totals = d X Coarse Total Volume X Coarse Total Particular Gravity X 1000= 0.665 X 0.60 X 2.73 X 1000
= 1089.27 kg/m^3
6. Mass of fine totals = d X Fine Total Volume X Fine Total Particular Gravity X 1000= 0.665 X 0.40 X 2.46 X 1000
= 654.36 kg/m^3

Concrete Mix proportions for Trial Number 1

Table 1 : Mix proportion of M30

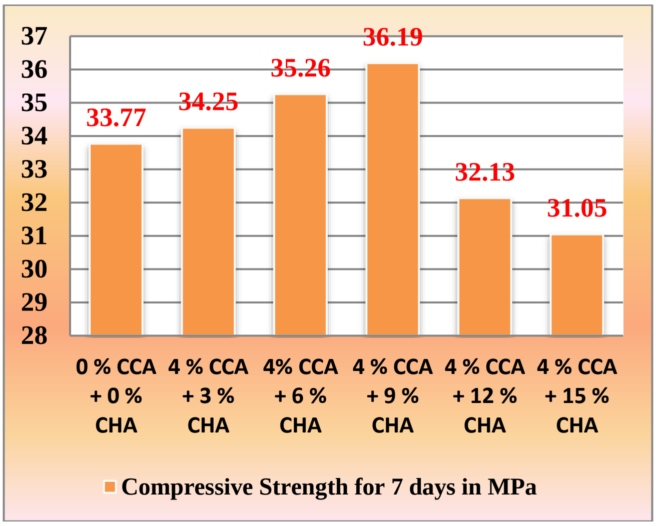
Grade	M30
Proportion	1:1.49:2.49
W/C ratio	0.45
Cement	438
Fine Aggegate	654
Coarse Aggregate	1089
Water	197

4. RESULTS AND ANALYSIS

4.1 Compressive Strength Test:

Table 1 Compressive Strength for 7 days

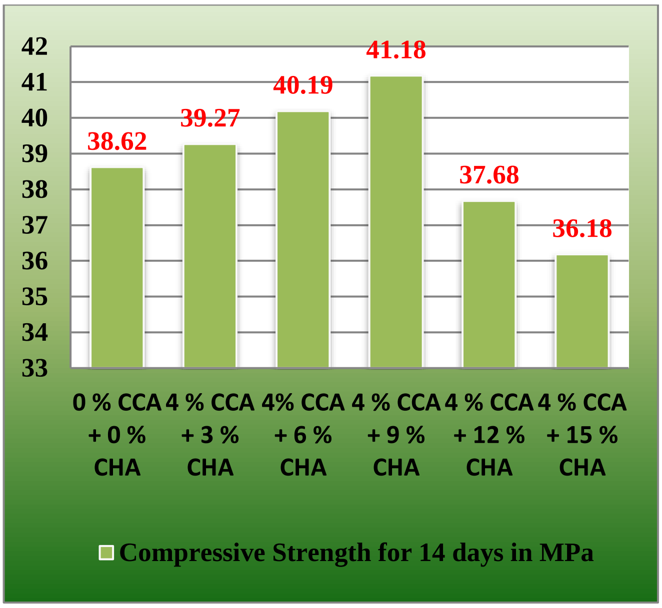
Mix % Replacement	Compressive Strength for 7 days in Mpa
0 % CCA + 0 % CHA	33.77
4 % CCA + 3 % CHA	34.25
4% CCA + 6 % CHA	35.26
4 % CCA + 9 % CHA	36.19
4 % CCA + 12 % CHA	32.13
4 % CCA + 15 % CHA	31.05



Graph Compressive Strength Test for 7 days

Table 2 Compressive Strength Test for 14 days

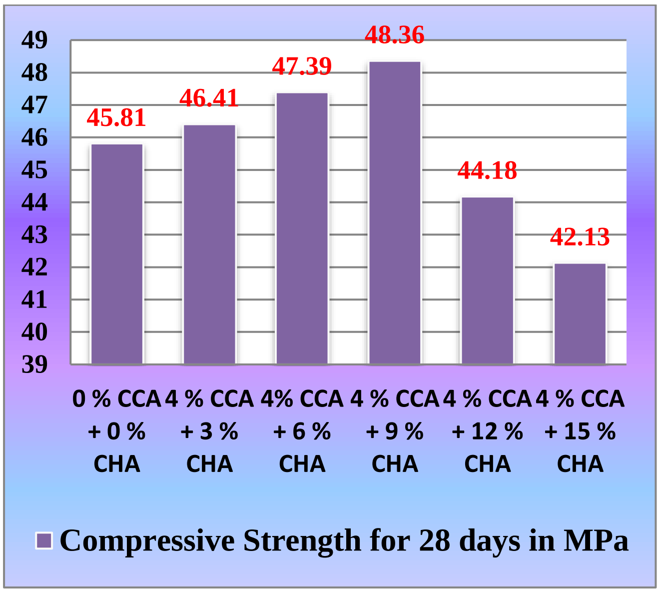
Mix % Replacement	Compressive Strength Test for 14 days in Mpa
0 % CCA + 0 % CHA	38.62
4 % CCA + 3 % CHA	39.27
4% CCA + 6 % CHA	40.19
4 % CCA + 9 % CHA	41.18
4 % CCA + 12 % CHA	37.68
4 % CCA + 15 % CHA	36.18



Graph Compressive Strength Test for 14 days

Table 3 Compressive Strength Test for 28 days

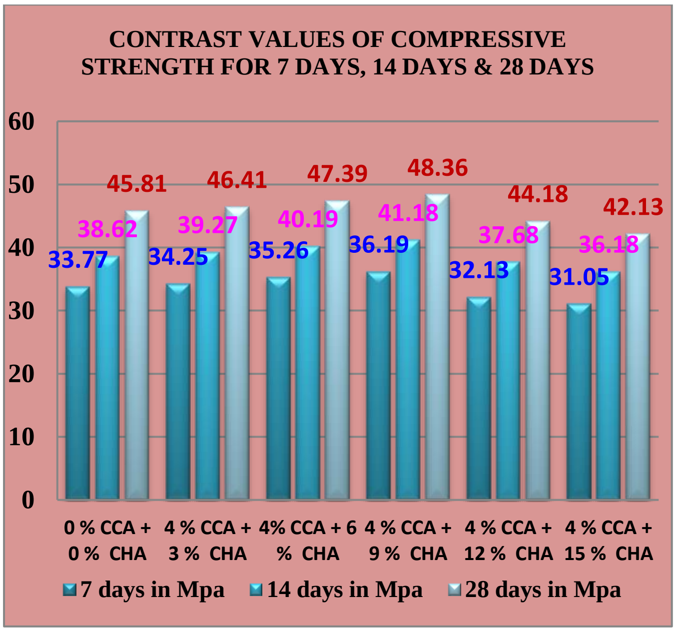
Mix % Replacement	Compressive Strength Test for 28 days in Mpa
0 % CCA + 0 % CHA	45.81
4 % CCA + 3 % CHA	46.41
4% CCA + 6 % CHA	47.39
4 % CCA + 9 % CHA	48.36
4 % CCA + 12 % CHA	44.18
4 % CCA + 15 % CHA	42.13



Graph Compressive Strength Test for 28 days

Table 4 compressive strength for 7,14,28 days

Mix % Replacement	7 days in Mpa	14 days in Mpa	28 days in Mpa
0 % CCA + 0 % CHA	33.77	38.62	45.81
4 % CCA + 3 % CHA	34.25	39.27	46.41
4% CCA + 6 % CHA	35.26	40.19	47.39
4 % CCA + 9 % CHA	36.19	41.18	48.36
4 % CCA + 12 % CHA	32.13	37.68	44.18
4 % CCA + 15 % CHA	31.05	36.18	42.13

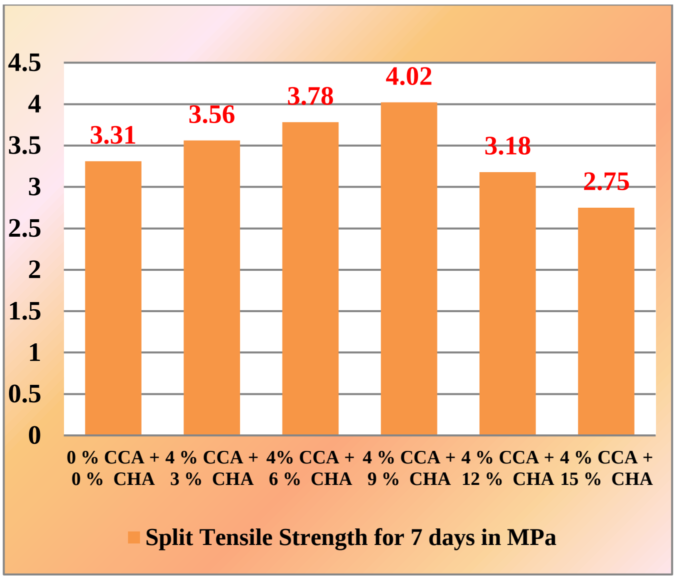


Graph Compressive strength for 7,14,28 days

4.2 Split Tensile Strength Test:

Table 5 Split Tensile strength for 7 days

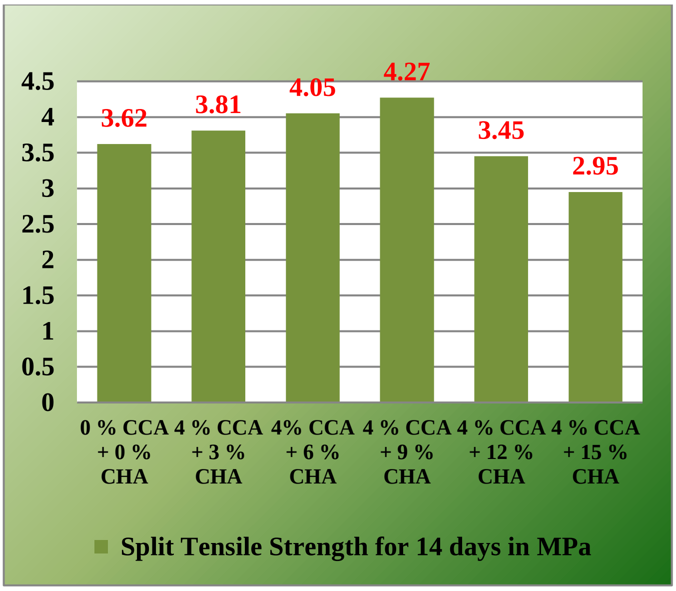
Mix % Replacement	Split Tensile Strength for 7 days in Mpa
0 % CCA + 0 % CHA	3.31
4 % CCA + 3 % CHA	3.56
4% CCA + 6 % CHA	3.78
4 % CCA + 9 % CHA	4.02
4 % CCA + 12 % CHA	3.18
4 % CCA + 15 % CHA	2.75



Graph **Split Tensile Strength For 7 Days**

Table 6 Split Tensile strength for 14 days

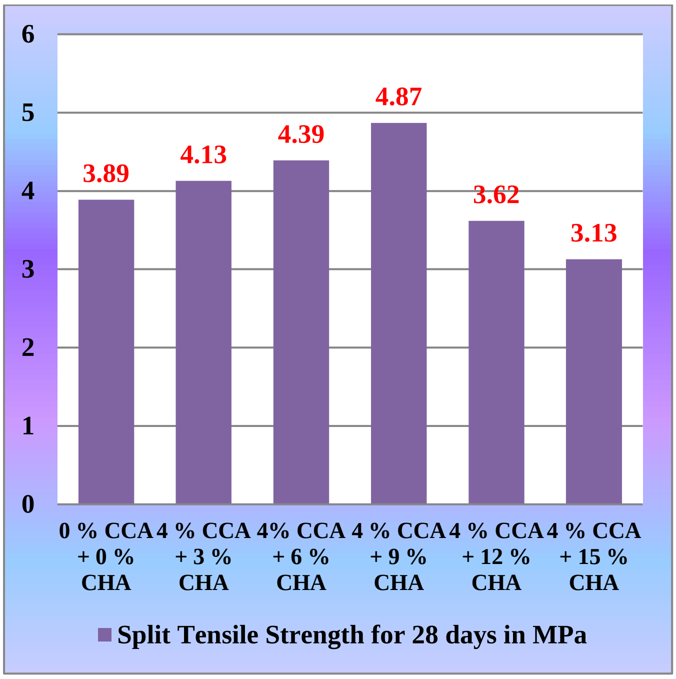
Mix % Replacement	Split Tensile Strength for 14 days in Mpa
0 % CCA + 0 % CHA	3.62
4 % CCA + 3 % CHA	3.81
4% CCA + 6 % CHA	4.05
4 % CCA + 9 % CHA	4.27
4 % CCA + 12 % CHA	3.45
4 % CCA + 15 % CHA	2.95



Graph **Split Tensile Strength For 14 Days**

Table 7 Split Tensile strength for 28 days

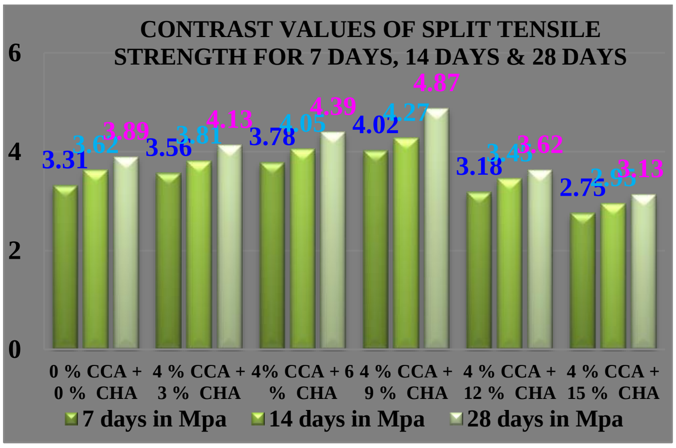
Mix % Replacement	Split Tensile Strength for 28 days in Mpa
0 % CCA + 0 % CHA	3.89
4 % CCA + 3 % CHA	4.13
4% CCA + 6 % CHA	4.39
4 % CCA + 9 % CHA	4.87
4 % CCA + 12 % CHA	3.62
4 % CCA + 15 % CHA	3.13



Graph **Split Tensile Strength For 28 Days**

Table 8 Split Tensile strength for 7,14,28 days

Mix % Replacement	7 days in Mpa	14 days in Mpa	28 days in Mpa
0 % CCA + 0 % CHA	3.31	3.62	3.89
4 % CCA + 3 % CHA	3.56	3.81	4.13
4% CCA + 6 % CHA	3.78	4.05	4.39
4 % CCA + 9 % CHA	4.02	4.27	4.87
4 % CCA + 12 % CHA	3.18	3.45	3.62
4 % CCA + 15 % CHA	2.75	2.95	3.13

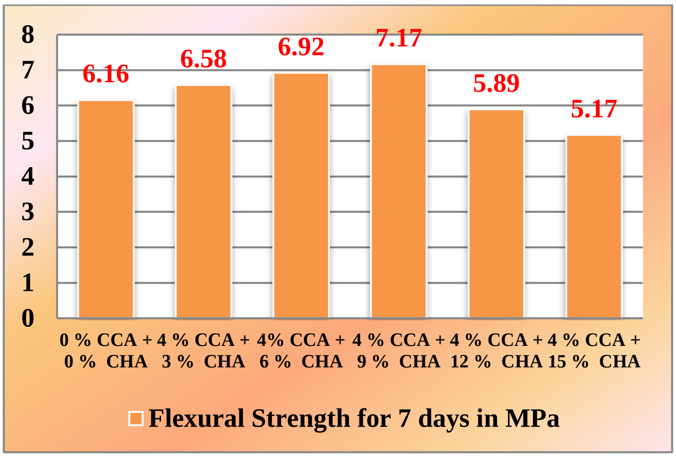


Graph 1 **Split Tensile Strength For 7, 14, 28 Days**

4.3 Flexural Strength Test:

Table 2 Flexural strength for 7 days

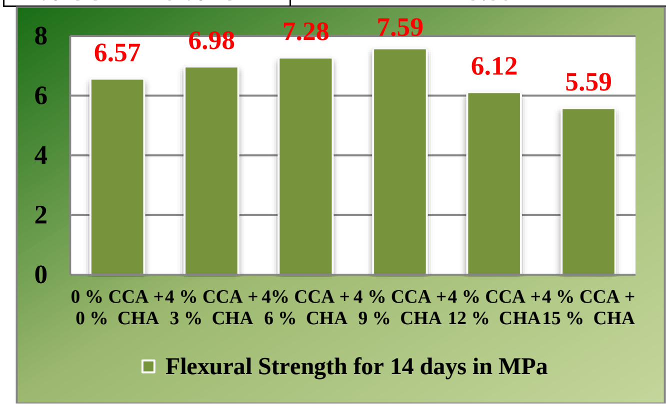
Mix % Replacement	Flexural Strength for 7 days in Mpa
0 % CCA + 0 % CHA	6.16
4 % CCA + 3 % CHA	6.58
4% CCA + 6 % CHA	6.92
4 % CCA + 9 % CHA	7.17
4 % CCA + 12 % CHA	5.89
4 % CCA + 15 % CHA	5.17



Graph **Flexural Strength For 7 Days**

Table 3 Flexural strength for 14 days

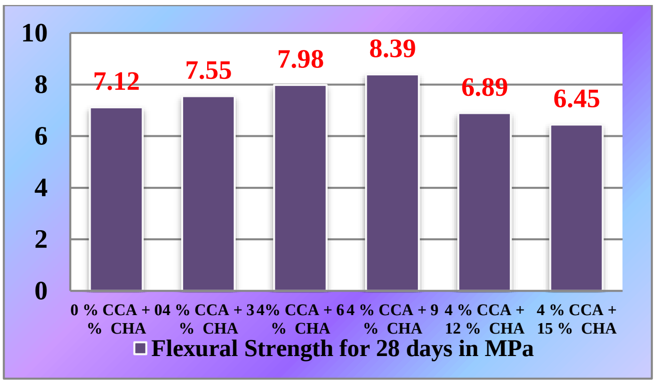
Mix % Replacement	Flexural Strength for 14 days in Mpa
0 % CCA + 0 % CHA	6.57
4 % CCA + 3 % CHA	6.98
4% CCA + 6 % CHA	7.28
4 % CCA + 9 % CHA	7.59
4 % CCA + 12 % CHA	6.12
4 % CCA + 15 % CHA	5.59



Graph **Flexural Strength For 14 Days**

Table 11 Flexural strength for 28 days

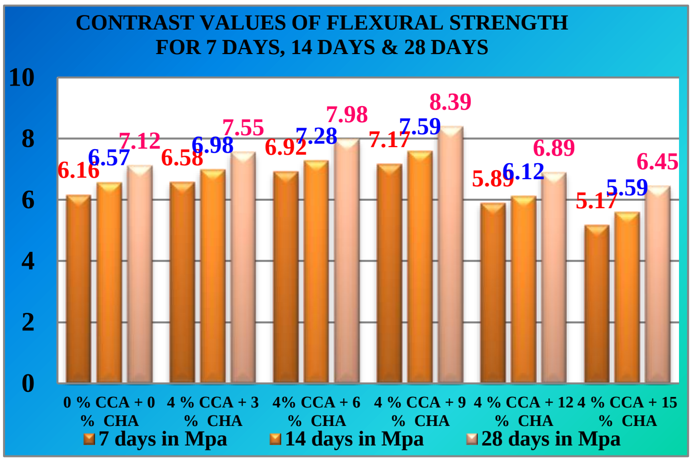
Mix % Replacement	Flexural Strength for 28 days in MPa
0 % CCA + 0 % CHA	7.12
4 % CCA + 3 % CHA	7.55
4% CCA + 6 % CHA	7.98
4 % CCA + 9 % CHA	8.39
4 % CCA + 12 % CHA	6.89
4 % CCA + 15 % CHA	6.45



Graph **Flexural Strength For 28 Days**

Table 12 Flexural strength for 7,14,28 days

Mix % Replacement	7 days in Mpa	14 days in Mpa	28 days in Mpa
0 % CCA + 0 % CHA	6.16	6.57	7.12
4 % CCA + 3 % CHA	6.58	6.98	7.55
4% CCA + 6 % CHA	6.92	7.28	7.98
4 % CCA + 9 % CHA	7.17	7.59	8.39
4 % CCA + 12 % CHA	5.89	6.12	6.89
4 % CCA + 15 % CHA	5.17	5.59	6.45



Graph **Flexural Strength For 7,14, 28 Days**

5. CONCLUSIONS

In this study, the applicability of producing and using coffee husk ash and corn cob ash from the Indian crops has been presented as a partial replacement for fine aggregate and cement in concrete production. This paper briefly described the production process of the coffee husk ash and corn cob ash as well as an intensive material characterization (physical and chemical). The produced coffee husk ash (CHA) and corn cob ash (CCA) has proven its applicability as a fine aggregate and cement replacement potential candidate because of its acceptable portion of total pozzolanic essential compounds. In this investigation, the produced ash has been used as CHA as fine aggregate with different replacement ratios (0%, 3%, 6%, 9%, 12% and 15 %) and cement replacement with CCA with constant 4% replacement. The different replacements ratios showed a increase in the compressive strength, split tensile strength, flexural strength at early ages of 28 days, however, the concrete mixes with corncob ash and coffee husk ash gained strength at 4% CCA and 9% CHA even surpassing the control mix. The mechanical properties of the CCA and CHA developed concrete can be summarized as follows:

- The 4% cement replacement and 9% fine aggregate showed the best performance in terms of compressive, flexural, and tensile splitting strength compared to the other tested replacement ratios and slump value of 89mm.
- Furthermore, the impact of using cement with higher grade had been assessed by changing the cement grade to the control mix and the 4% cement replaced mix and 9% Fine aggregate mix.
- Moreover, the cost and environmentally friendly of concrete using the cornstalk ash had been assessed throughout the two replacements in concrete and also more durability should be included including chemical resistance and the degradation of the developed concrete under thermal cycles..

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