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A Review on Experimental Investigation of Mechanical Properties of Coffee Husk Ash Concrete

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ABSTRACT:

Aggregates and binders are the two main components of concrete. Cement is an ecologically unsociable process since it releases CO2 gas into the air and causes ecological deterioration; it is also the most expensive and environmentally unfriendly component of concrete. To help promote environmentally friendly building methods, this research looks at the possibility of using coffee husk ash (CHA) in place of certain traditional Portland cement in concrete mixes. Because of its possible environmental advantages and resource saving, the use of agricultural waste, such coffee husk ash, as an additional cementitious ingredient has attracted interest. This study makes use of controlled laboratory trials to determine how different concentrations of CHA affect the mechanical, durability, and workability characteristics of concrete. The concrete's structural performance is evaluated by testing its compressive strength, flexural strength, and split tensile strength. Initial findings suggest that CHA, when used in part as a cement substitute, might enhance workability and maybe even certain mechanical qualities. The trade-offs between improving sustainability and preserving structural integrity must be carefully considered. By investigating the feasibility of using coffee husk ash as an additive in concrete, this study adds important new information to the continuing efforts towards sustainable building practices. In an effort to create infrastructure that is less harmful to the environment, the results should guide practices in the concrete sector and encourage greener options.

Keywords: Coffee Husk Ash, Mechanical properties, Compressive strength, Flexure and Tensile Strength.

INTRODUCTION

One of the most often used materials in construction is concrete, which is a composite substance made of cement, water, fine (sand), coarse (stone or gravel), and air. To enhance or alter its fundamental qualities, it might also include additions (pozzolans, active silica, etc.) and chemical additives. International researchers are currently focused on figuring out how to use industrial or agricultural waste as a source of raw materials for the construction industry. By doing this, the quantity of CO2 released during the manufacture of cement is reduced. [2,4]. One of the agricultural waste products that is found in substantial numbers is coffee husk ash. The addition of coffee husk ash to cement results in a pozzolanic reaction due to the inclusion of silica (SiO2) and aluminate. These compounds react with the free lime produced during cement hydration, leading to the formation of extra calcium silicate hydrate as a new product of hydration. The mechanical strength of the cement concrete is strengthened by this extra calcium silicate hydrate [1]. Demissew asserts that this research has demonstrated the significant potential of utilizing coffee husk ash as a sustainable cementitious material in concrete production. This approach not only reduces pollution but also provides a practical answer for coffee waste management. This research seeks to characterize the mechanical properties of CHA-replaced concrete. The material's split tensile, flexural, and compressive strengths were determined, and the outcomes of durability evaluations were acquired. On the other hand, processing produces a significant amount of agricultural waste, which could potentially affect the environment. In order to address the issue, coffee husk ash (CHA) has been examined in a few different nations for its pozzolanic qualities. It has been discovered that CHA can develop some of the paste's, mortar's, and concrete's qualities, such as compressive strength, split and flexure strength [3,20].

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MATERIALS

CHA:

The acquired sample was burned for three hours at 550 degrees Celsius to alter the ash, and it was exposed to the sun to remove any surface moisture. To ascertain the physicochemical characteristics of CHA, the cooled and ground material was passed through a 75 μm sieve. Filler is the term for the mineral material that gets through a No. 200 sieve. Coffee husk ash was the filler used in this investigation refer table-(1,2) [7,6,16,17]. Coffee husk, which comes from the solid waste generated by the coffee industry, was gathered from the Indian city of Chikkamagaluru [D]. The husk ought to be subjected to the sun to evaporate any moisture before being burned. [5,19,20]. This collected husk was burned. It was then burned at a temperature between 500 and 600 degrees Celsius.[7]

Table 1 – Components of coffee husk ash [7,10,15]

Components	Weight of coffee husk ash (%)
Aluminium Oxide (Al_2O_3)	11.85
Silicon dioxide (SiO_2)	14.15
Pottasium Oxide (K_2O)	47.13
Iron Oxide (Fe_2O_3)	4
Phosphorus Pentoxide (P_2O_5)	3.25
Sodium Oxide (Na_2O)	0.50
Calcium Oxide (CaO)	13.25

Components	Cement by weight (%)	Coffee husk ash by weight (%)
Aluminum Oxide (Al_2O_3)	5.5	11.85
Calcium Oxide (CaO)	64.68	13.25
Silicon dioxide (SiO_2)	21.3	14.15
Iron Oxide (Fe_2O_3)	3.33	4
Nitrous Oxide (N_2O)	0.05	0.50
Magnesium Oxide (MgO)	2	-
Sulphur tri-oxide	2.14	-

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Table 2 – Characteristics of CHA [7]

Attributes of CHA	Values
Specific gravity of CHA	2.42
Moisture Content	13.33%

CEMENT: Pozzolana cement Portland Grade 43 cement, as per IS:269-1976, was used during the examination. All-new, lump-free cement is utilized. Multiple tests were performed on the cement to ensure it complied with the IS criteria, for every test combination. A specific gravity of 2.62 is found for fine aggregate. One percent of the water was found to be absorbed. A smaller quantity of the same type of cement was used [11,18]. Concrete is made of dense components, including cement, but in the specific sense that the binding ingredients give the concrete strength and workability. In order to learn more about the qualities of the OPC43 grade cement. some basic experiments are conducted in this experiment refer table-3 [7].

Table 3 – Attributes of Cement [7]

Properties of Cement	Values
Specific gravity of cement	3.15
Fineness of cement	8%
Initial and Final Setting time	29 Min and 300 Min
Consistency test	31%

Fine Aggregates:

We use river sand for our experimental investigation, and some of the fundamental tests that are carried out are refer table-4 [7]. For the experimental program, local river sand that passes through a 4.75mm screen was utilized, in compliance with the IS [11]. Sand with a size range of 2.36 mm to 1.16 mm makes up most of the fine aggregate employed in this study. The fine aggregate guarantees that the intended performance of the concrete was attained. The sand that was used had a fineness modulus of 3.61 and a specific gravity of 2.59[9]. It is a naturally occurring substance made up of mineral particles.,

Table 4 – Attributes of F.A [7]

Attributes of Fine Aggregate	Values
Specific gravity of F.A	2.5
Sieve analysis	Confining to zone-II

Coarse Aggregate:

The nominal size of the aggregate employed in this experiment is 12 mm down, and some of the fundamental tests carried out are refer with table-(5,6) [7], Up to 70%–80% of the material used to make concrete is made up of coarse aggregate. Laboratory tests were conducted to establish the physical properties of the coarse aggregate, including its gradation, specific gravity, absorption capacity, moisture content, and unit weight. The coarse aggregates must be made of crushed rock and must be free of dust, friable material, organic material, and other harmful things. They must also be clean, hard, and durable. In addition to having strong compressive and shear strengths, aggregates also have adequate permeability and a good interlocking capability. 26.5mm to 2.36mm

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coarse aggregate [11]. The coarse aggregate used in this project was crushed basaltic stone that was carefully graded and washed to remove any dust or harmful substances. This ensures that it meets the specifications outlined in the ASTM standards. The aggregates employed in the block's construction process should be inaudible and honeycombed in order to ensure the structure's longevity.

Table 5 – Attributes of C.A [7]

Attributes of C.A	Values
Specific gravity of Aggregate	2.85
Sieve analysis	Zone-II

Table 6 – Physical Properties of Aggregate [3]

Description of Aggregates	Fine Aggregate	Coarse Aggregate
Maximum Size of Aggregates	4.75 [mm]	37.5 [mm]
Moisture Content of Aggregates	0.47	0.98%
Unit weight of aggregates	-	1572.2 [kg/m^3]
Absorption capacity	0.36%	1.04%
Specific Gravity of Aggregates	2.5	2.85
Fineness modulus	2.65	3.26

Water:

Water is a vital component in the production of concrete. Water is essential in concrete mixes for two primary purposes: firstly, it undergoes a chemical reaction with the cement to facilitate the setting and solidification of the concrete; secondly, it works as a lubricant for the other components, making the concrete easier to work with. [10].

LITERATURE REVIEWS:

Anshuman, Pratish Kannaujiya, Abdul Hameed, Afzal Mansuri, Aakash Vishwakarma (2023): To evaluate the impact of adding coffee husk ash (CHA) to M25 concrete in different proportions 0%, 5%, 10%, 15%, and 20%—the study measured the concrete's compressive strength after 7, 14, and 28 days of curing. As compared to the control mix without CHA, the results showed that the highest compressive strength was observed at 15% CHA replacement level, reaching 22.09N/mm2 at 14 and 28 days. This represents an increase of about 11 to 12%. Longer curing times enhanced the concrete's compressive strength, demonstrating its increasing strength over time. It was observed, meanwhile, that the compressive strength tended to decline with an increase in CHA content. Higher proportions of CHA were noted in conjunction with this decrease in strength. The addition of CHA to the concrete mixture led to a significant reduction in workability and slump. This alteration implies that CHA had a negative impact on the concrete's handling qualities. The lower specific gravity of CHA in comparison to cement also resulted in a lower density for the CHA concrete, which decreased the mix's overall density. In conclusion, the study found that increasing CHA concentration resulted in lower strength, even though the best increase in compressive strength was seen at 15% CHA substitution in M25 concrete. Additionally, the workability, slump, and general density of the concrete mix were all adversely affected by the addition of CHA.

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Firew B. Asfaw, Werku K. Hareru, Tewodros Ghebrab (2022): An investigation was undertaken at 7, 14, and 28 days of curing in order to assess the performance of M25 concrete when various proportions (0%, 5%, 10%, 15%, 20%, and 25%) of coffee husk ash (CHA) were substituted. Up to a 10% replacement level, consistent satisfactory performance was noted, and the results showed notable improvements in mechanical qualities up to a 5% replacement. Upon 28 days of healing, When the replacement percentage was at its maximum, the compressive strength observed was 38.57 N/mm². Achieved 3.308 MPa in split tensile strength, indicating enhancement up to 5% substitution. Recorded at 4.413 MPa, the flexural strength significantly improved up to 5% replacement and showed a similar increasing pattern to the split tensile strength. In M25 concrete, the mechanical parameters (compressive, split tensile, and flexural strength) showed a significant increase up to a 5% replacement of CHA. Up to a 10% replacement level, the strength of the concrete showed good performance. Since this was not made clear in the information given, the concrete's mechanical qualities may be negatively impacted after 10% replacement. In conclusion, adding coffee husk ash to up to 5–10% of M25 concrete showed notable improvements in the material's mechanical qualities, as seen by better split tensile, flexural, and compressive strengths than the conventional concrete mix.

Muliye Tarekegn, Kabtamu Getachew, and Goshu Kenea (2022): The goal of the project was to create M25 concrete using different proportions of sugarcane bagasse ash (SBA) and coffee husk ash (CHA), with an emphasis on replacing 0%, 5%, 10%, and 15% of the original material. Tests were conducted after 7, 14, and 28 days of curing. Optimal results were observed with a 10% increase in the use of CHA. Upon completion of the 28-day healing period, the most favourable outcomes were: This mixture demonstrated the highest compressive strength among all the studied mixtures, measuring at 24.84 N/mm². Split Tensile Strength of 3.308 MPa was attained. Flexural strength 4.413 MPa is the measurement. The M25 concrete mix exhibited peak performance concerning compressive, split tensile, and flexural strengths when 10% of the original CHA content was replaced. The article that was provided did not really discuss the effects of mixing sugarcane bagasse ash (SBA) into the concrete mixture. The combination of 10% CHA substitution in the M25 concrete formulation produced the best ideal mechanical qualities out of all the evaluated variations, according to the results. In conclusion, compared to the other replacement percentages (0%, 5%, and 15%) examined in the study, the use of a 10% replacement of coffee husk ash in the M25 concrete mix produced superior compressive, split tensile, and flexural strengths.

Abebe Demissew, Fekadu Fufa, Sintayehu Assefa (2019): To test the design of M25 concrete, several percentages (0%, 2%, 3%, 5%, 10%, and 15%) of a mixture of coffee husk ash (CHA) and sugarcane bagasse ash (SBA) were substituted for Ordinary Portland Cement (OPC). Compressive strength tests were conducted utilizing specialized equipment to assess the strength of the material after 7, 14, and 28 days of curing. Compressive strength consistently increased as the substitution rate of CHA for OPC reached up to 10% in all tested time periods (7, 14, and 28 days). With a value of 25.15 N/mm², the most advantageous outcome for compressive strength at 28 days was attained. Compressive strength increased when OPC was gradually replaced with the CHA and SBA mixture; the most improvement was seen at the 10% replacement threshold. It was not made clear what specific effects each of SBA and CHA had on the characteristics of the concrete. In conclusion, replacing OPC in the M25 concrete mix with up to 10% of a mixture of bagasse ash from sugar cane and coffee husk ash resulted in a considerable improvement in the compressive strength at all test ages. At 28 days, the highest compressive strength ever recorded was 25.15 N/mm².

Vikas S, Preethi V, Preethi M, Sagar B M (2022): To create M40 concrete, a mixture of coffee husk ash (CHA) in variable percentages (ranging from 5% to 25%) was used in place of Ordinary Portland Cement (OPC). Using a compressive test machine, the concrete specimens were evaluated at three distinct curing times: seven, twenty-eight, and fifty-six days. For all test ages (7, 28, and 56 days), enhanced compressive strength was consistently attained at a 5% replacement level of OPC by CHA. The maximum compressive strength values ever measured were during 7 days of curing, or 27.38 N/mm², 28 days after curing, 45.24 N/mm², 56 days after curing, 50.14 N/mm². The compressive strength increased steadily from 7 to 56 days over the curing period. After 56 days of curing, the concrete reached its maximum compressive strength, demonstrating that it kept getting stronger. In summary, the addition of a coffee husk ash mixture to M40 concrete instead of 5% of OPC resulted in appreciable increases in compressive strength at all test ages. Furthermore, the compressive strength increased steadily and significantly throughout the curing time, peaking at 50.14 N/mm² after 56 days of curing.

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Wahyuni, K.C.S. Zein, Munawir, and P.N. Ariadi (2019): Testing was performed on concrete samples that had aged for 7 and 28 days. M20 concrete was created using varying proportions of coffee husk ash as a replacement for the original mixture, ranging from 0% to 15%. The analysis revealed that the concrete's compressive strengths at 7 days were as follows: 0% - 12.27 MPa, 5% - 10.52 MPa, 10% - 9.99 MPa, and 15% - 9.09 MPa. The compressive strength at 28 days of age was as follows: 0% - 21.47 MPa, 5% - 13.16 MPa, 10% - 10.74 MPa, and 15% - 5.13 MPa. The compressive strength of the specified concrete after 28 days is 20 MPa, with a failure rate of 0% at 21.47 MPa. Studies indicate that when fly ash and coffee husk ash percentages in the combination rise, the concrete's compressive strength often decreases. The high silica (SiO_2) concentration of coffee husk ash is thought to be the cause of this strength loss because it prevents the cement from reacting with lime. This obstruction could lead to inadequate water availability, which would impair the ability of the concrete mixture to accomplish the best bonding.

Asmamaw Gedefaw, Begashaw Worku Yifru, Solomon Asrat Endale,Betelhem Tilahun Habtegebreal, and Mitiku Damtie Yehualaw (2022): Using varying amounts of coffee husk ash (CHA), the project's objective was to produce M25 concrete, with a focus on substituting 0%, 5%, 10%, 15%, and 20% of the initial material. Tests were conducted 3, 7, 28, 56, and 91 days after the cure. 10% extra CHA was utilized to get the greatest results. On samples of concrete, tests for uniformity, setting time, workability, strength at compression, absorption of water, sulphate attack, Fourier transformation infrared (FTIR), and thermo gravimetric (TGA) were done. After 28 days of curing, the best results were seen. The test results showed that the mixtures became harder to work with as the amount of CHA content went up. The slump values ranged from 15 to 35 mm. But as the amount of CHA in concrete mixes went up, so did the time it took for them to set. The first setting time (67–126 minutes) and the last setting time (310–524 minutes) were both within the acceptable range. The sample from after 28 days showed that the concrete's compression strength went down as the CHA percentage went up. It went from 35.1 MPa at 5% CHA to 22.7 MPa at 20% CHA. But because the CHA is porous, it grows as the curing days increase, while the concrete's water absorption increases as the CHA increases but reduces as the curing days increase.

Yomiyu Reta, Shivakumar Mahto (2019): They designed M25 concrete with replacement of (0%, 5%, 10%, 15%, 20%,25%) coffee husk ash and tested at 7,14 & 28 days of curing. Compressive strength during 28 days was 21.32 KN/m2 for 5% replacement, 20.67 KN/m2 for 10% replacement, 11.48 KN/m2 for 15% replacement, 8.81 KN/m2 for 20% replacement, and 7.17 N/mm2 for 25% replacement, respectively. It takes only 5% CHA substitution to get the full-strength gain benefits. Using 10%CHA, the maximum 28-day compressive strength was attained. In a similar vein, concrete's compressive strength has increased by 5%. It was determined that CHA may be used to partially replace cement in the production of concrete, as well as for creating unit walls and other light construction projects. Up to 10% of cement can be replaced while producing concrete.

Radhika P. Bhandary , Asha U. Rao, Prathibha P. Shetty, S. Blesson, and Blessen Skariah Thomas (2023): Although CHA has been the subject of extensive research, it has only been utilized in concrete as a partial substitute for cement rather than as a substitute for aggregates. This report presents the results of an experimental investigation into the behaviour of concrete when fine aggregate is partially substituted with CHA. In place of the fine aggregate, different amounts of CHA (2%, 4%, 6%, and 8% by weight) are used. To assess how well the CHA-replaced fine aggregate performed, we measure its effects on the following: fresh concrete's workability and compressive strength; hardened concrete's splitting tensile and flexural strengths; durability in acidic and alkaline media; thermal conductivity; and the rapid chloride permeability test. The findings show that all the chosen performance metrics are positively impacted when concrete's fine aggregate is partially replaced with 4% CHA (CHA04). The CHA04 mix outperformed the standard concrete mix (CHA00) in terms of splitting tensile, flexural strength, and compressive strength, measuring 3.7 MPa, 2.44 MPa, and 43.4 MPa, respectively. These differences were 19.35%, 1.66%, and 28.4% higher, respectively.

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TABLE 7 : An overview of the numerous studies that have been published on CHA replaced concrete

Author	Year	Quantities of Replacement	Grade of Concrete	Mechanical Properties
Abebe Demissew, Fekadu Fufa, Sintayehu Assefa	2019	0%, 2%, 3%, 5%, 10%, and 15%	M25	Optimum at 10% of CHA.
Yomiyu Reta, Shivakumar Mahto	2019	0%, 5%, 10%, 15%, 20%,25%	M25	When producing concrete, cement can create strengths of up to 10%.
Wahyuni, K.C.S. Zein, Munawir, P.N.Ariadi	2019	0%, 5%, 10%, and 15%	M20	. Optimum at 8% of CHA
Firew B. Asfaw, Werku K. Hareru, Tewodros Ghebrab	2022	0%, 5%, 10%, 15%, 20%, and 25%	M25	Adding coffee husk ash to up to 5–10% of M25 concrete showed notable improvements.
Muliye Tarekegn, Kabtamu Getachew, Goshu Kenea	2022	0%, 5%, 10%, and 15%	M25	Superior compressive, split tensile, and flexural strengths were obtained by replacing 10% of the coffee husk ash in the M25 concrete mix.
Vikas S, Preethi V, Preethi M, Sagar B M	2022	5% to 25%	M40	Optimum at 5% of CHA
Asmamaw Gedefaw, Begashaw Worku Yifru, Solomon Asrat Endale, Betelhem Tilahun Habtegebreal, Miiku Damtieyehualaw	2022	0%, 5%, 10%, 15%, and 20%	M25	10% extra CHA was utilized to get the greatest results.
Anshuman,Pratish Kannaujiya, Abdul Hameed, Afzal Mansuri, Aakash Vishwakarma	2023	0%, 5%, 10%, 15%, and 20%	M25	Optimum desired results are obtained at 15% of CHA
Radhika P. Bhandary, Asha U. Rao, Prathibha P.				Positively impacted when concrete's fine aggregate is

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Shetty, S.Blesson, And Blessen Skariah Thomas	2023	0%, 2%, 4%, 6%, and 8%.	M40	partially replaced with 4% CHA

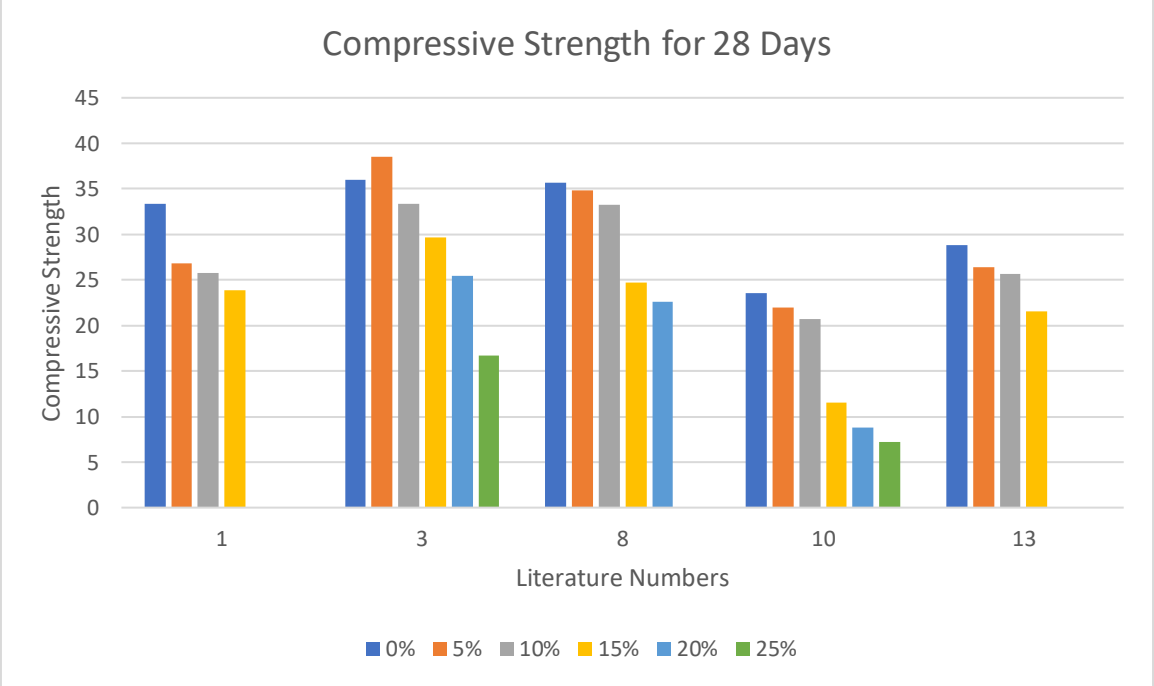


Figure:1 Compressive Strength for 28 days

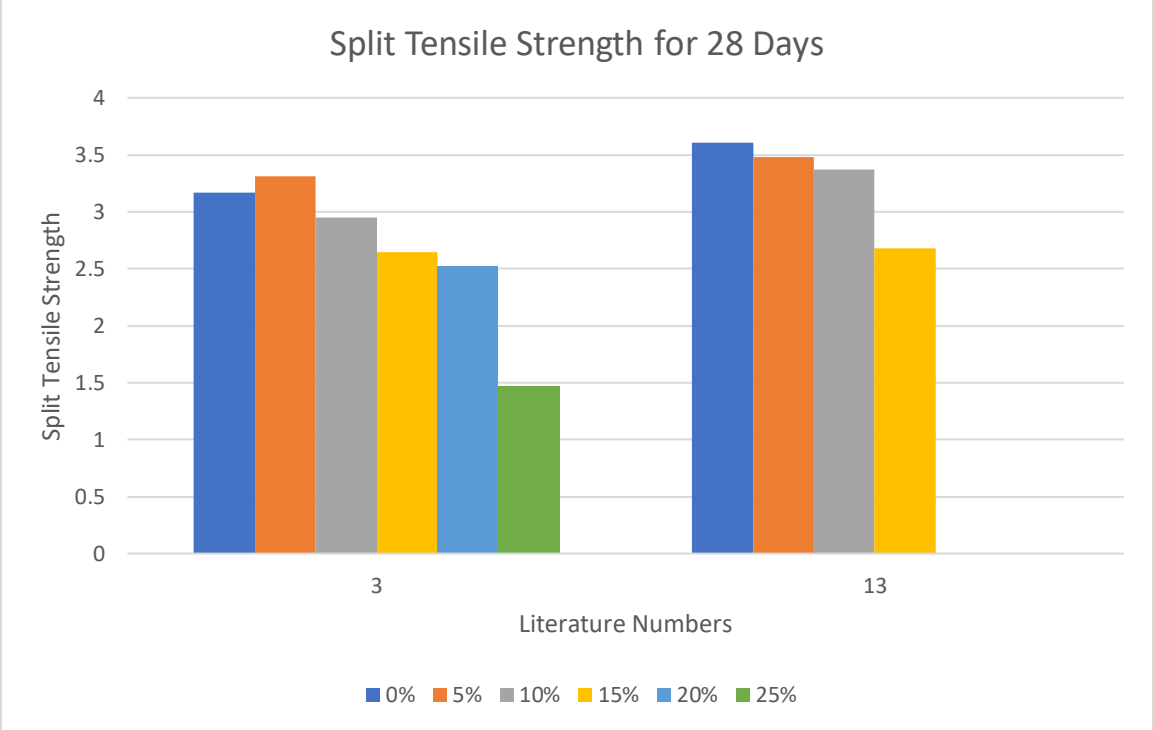


Figure:2 Split Tensile Strength for 28 days

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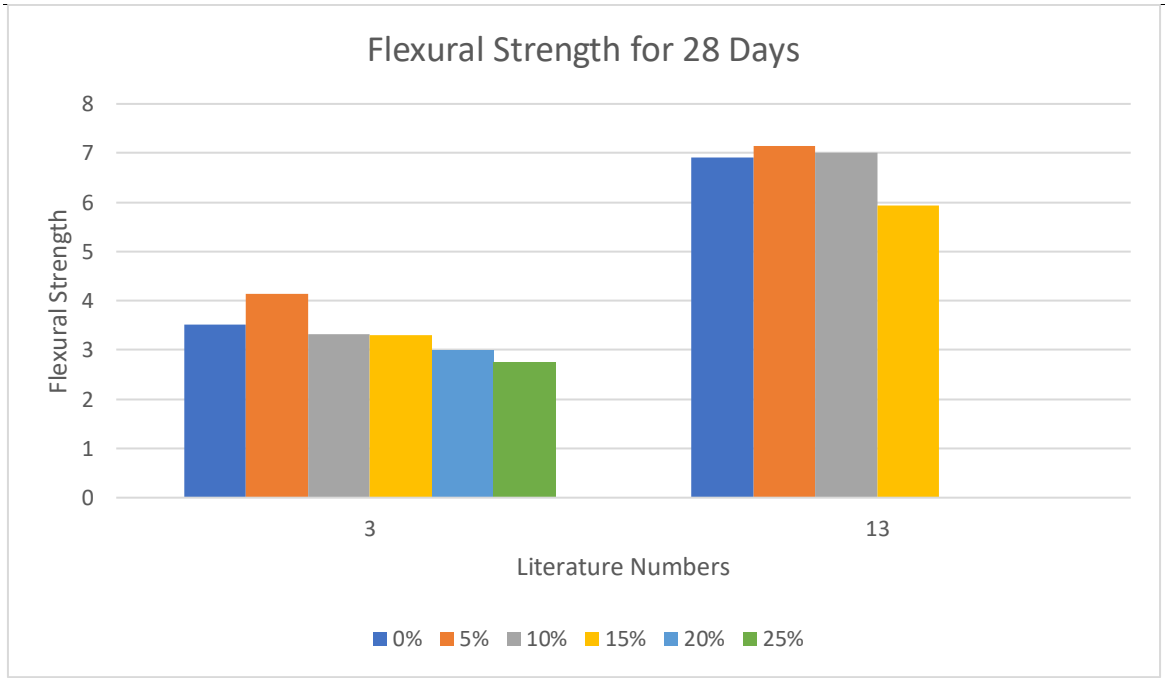
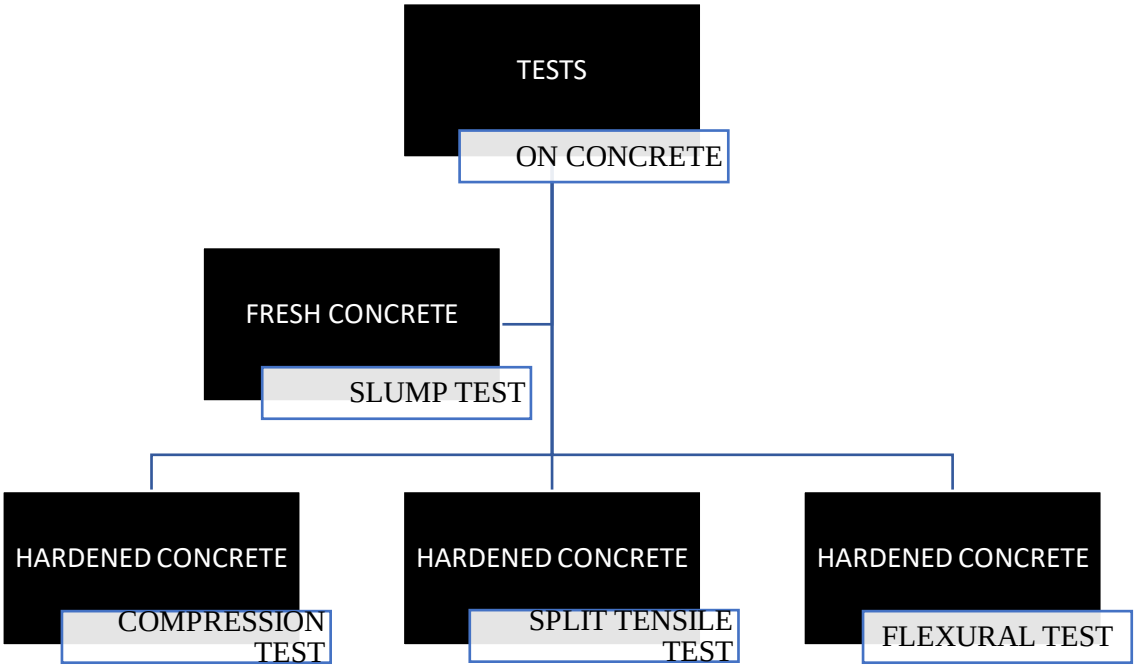


Figure:3 Flexural Strength for 28 days

Flow Charts Regarding Tests Conducted on Fresh Concrete and Hardened Concrete [14]:



Research Gap:

A comprehensive report was produced by compiling a broad range of research publications. After conducting an extensive literature review, it was discovered that a great deal of research has been done on the fundamental characteristics of concrete by substituting coffee husk ash for some of the cement. While extensive research has been conducted on the mechanical characteristics of concrete containing coffee husk ash as a replacement material, there is a lack of studies examining the long-term performance of such concrete in terms of durability. Specifically, there is a dearth of research on the durability of concrete and reinforced structures, including beams, columns, and slabs. In order to replace concrete with coffee husk ash, it is important to examine how the concrete behaves in terms of strength and ability to support loads in reinforced concrete structures. This area hasn't been looked into yet.

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Scope for Future Research:

Despite this, a thorough evaluation of concrete's fundamental qualities has been completed. Future investigations are necessary to fully understand the improvements in concrete's durability as well as to examine the many characteristics of reinforced concrete constructions.

CONCLUSION:

• Based on the literature review mentioned above, the following findings are made: Coffee husk and bagasse ash are Agricultural waste materials that have pozzolanic properties and can replace cement to some extent in normal concrete production (10–15%); a 10% replacement rate is ideal. Furthermore, the compressive strength of the material decreases as its percentage value rises.

• All of the researchers examined simply the pozzolanic properties and how they affected the percentage of replacement and compressive strength; they did not look at the durability issue. Thus, future research would concentrate on the robustness and ease of use of materials.

• From the figure-1, We conclude that, after 28 days, 5% of the cement in the concrete is changed with coffee husk ash to get the desired result in terms of compressive strength.

• From the figure-2, We conclude that, after 28 days, 5% of the cement in the concrete substituted with coffee husk ash achieved the intended result in terms of split tensile strength.

• From the figure-3, We conclude that after 28 days, 5% of the cement is replaced with coffee husk ash to get the required result in terms of flexural strength.

• Considering the mentioned literature evaluations, concrete that has some of its cement replaced with coffee husk ash will gradually gain strength over time as the curing duration grows.

REFERENCES

1. Demissew, A., Fufa, F., & Assefa, S. (2019). PARTIAL REPLACEMENT OF CEMENT BY COFFEE HUSK ASH FOR C-25 CONCRETE PRODUCTION. Journal of Civil Engineering, Science and Technology, 10(1), 12–21. https://doi.org/10.33736/jcest.1433.2019.
2. Alan Carlos de Almeida, Matheus Alves Lima da Silva, Queren Cabral de Abreu, Adriana Lau da Silva Martins, Sandro Pereira Ribeiro, & Cristiane de Souza Siqueira Pereira. (2019). Evaluation of Partial Sand Replacement by Coffee Husks in Concrete Production. Journal of Environmental Science and Engineering B, 8(4). https://doi.org/10.17265/2162-5263/2019.04.001.
3. Asfaw, F. B., Hareru, W. K., & Ghebrab, T. (2022). Physical and Chemical Characterization of Coffee Husk Ash Effect on Partial Replacement of Cement in Concrete Production. International Journal of Sustainable Construction Engineering and Technology, 13(1), 167–184. https://doi.org/10.30880/ijscet.2022.13.01.016.
4. Jaramillo, H. Y., Vasco-Echeverri, O., & Camperos, J. A. G. (2023). Characterization of the Coffee Husk: A Potential Alternative for Sustainable Construction. Civil Engineering and Architecture, 11(4), 1902–1908. https://doi.org/10.13189/cea.2023.110418.
5. Markos Makebo, G. (2019). Partial Replacement of Cement Material in Ethiopia: A Review. International Research Journal of Engineering and Technology. www.irjet.net.
6. M, S. B. (n.d.). Experimental Study on Partial Replacement of Cement with Coffee Husk Ash for Manufacturing Concrete Pavers. www.ijert.org.
7. Tessema, A. T., Wolelaw, N. M., & Alene, G. A. (2022). Experimental Evaluation of Coffee Husk Ash as a Filler in Hot Mix Asphalt Concrete Productions. Advances in Civil Engineering, 2022. https://doi.org/10.1155/2022/6726700.
8. Gedefaw, A., Worku Yifru, B., Endale, S. A., Habtegebreal, B. T., & Yehualaw, M. D. (2022). Experimental Investigation on the Effects of Coffee Husk Ash as Partial Replacement of Cement on

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Concrete Properties. Advances in Materials Science and Engineering, 2022. https://doi.org/10.1155/2022/4175460.

9. Bhandary, A. U., Shetty, P. P., Blesson, S., & Thomas, B. S. (2023). Application of Coffee Husk Ash as Partial Replacement of Fine Aggregate in Concrete. Sustainability (Switzerland), 15(18). https://doi.org/10.3390/su151813328.
10. Y. R., & Mahto, S. (n.d.). Experimental Investigation on Coffee Husk Ash as a Partial Replacement of Cement for C-25 concrete. http://cikitusi.com/.
11. R. P., Rao Experimental Investigation on the Effects of Coffee Husk Ash as Partial Replacement of Cement on Concrete Properties. (2023). www.jetir.orgl719.
12. Wahyuni, Zein, K. C. S., Munawir, & Ariadi, P. N. (2023). Effect of Mixing Coffee Husk Ash and as a Cement Replacement on the Strength of Concrete. IOP Conference Series: Earth and Environmental Science, 1140(1). https://doi.org/10.1088/1755-1315/1140/1/012019.
13. Tarekegn, M., Getachew, K., & Kenea, G. (2022). Experimental Investigation of Concrete Characteristics Strength with Partial Replacement of Cement by Hybrid Coffee Husk and Sugarcane Bagasse Ash. Advances in Materials Science and Engineering, 2022. https://doi.org/10.1155/2022/5363766.
14. Marar, K., & Eren, Ö. (2011). Effect of cement content and water/cement ratio on fresh concrete properties without admixtures. International Journal of the Physical Sciences, 6(24), 5752–5765. https://doi.org/10.5897/IJPS11.188.
15. Abebe Demissew Gashahun, Assessment on Cement Production Practice and Potential Cement Replacing Materials in Ethiopia. (2020). Civil and Environmental Research. https://doi.org/10.7176/cer/12-1-03.
16. R. P., Sundary, D., Munirwansyah, & Bunyamin. (2021). Study of coffee husk ash addition for clay soil stabilization. IOP Conference Series: Materials Science and Engineering, 1087(1), 012016. https://doi.org/10.1088/1757-899x/1087/1/012016.
17. Lin, L. K., Kuo, T. M., & Hsu, Y. S. (2016). The application and evaluation research of coffee residue ash into mortar. Journal of Material Cycles and Waste Management, 18(3), 541–551. https://doi.org/10.1007/s10163-015-0351-5.
18. Djamaluddin, A. R., Caronge, M. A., Tjaronge, M. W., Lando, A. T., & Irmawaty, R. (2020). Evaluation of sustainable concrete paving blocks incorporating processed waste tea ash. Case Studies in Construction Materials, 12. https://doi.org/10.1016/j.cscm.2019.e00325.
19. Bekalo, S. A., & Reinhardt, H. W. (2010). Fibers of coffee husk and hulls for the production of particleboard. Materials and Structures/Materiaux et Constructions, 43(8), 1049–1060. https://doi.org/10.1617/s11527-009-9565-0.
20. Ricciardi, P., Torchia, F., Belloni, E., Lascaro, E., & Buratti, C. (2017). Environmental characterisation of coffee chaff, a new recycled material for building applications. Construction and Building Materials, 147, 185–193. https://doi.org/10.1016/j.conbuildmat.2017.04.114.