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EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF CEMENT USING EUCALYPTUS DIE LEAVES ASH AND AGAVE DIE LEAVES ASH IN M25 CONCRETE

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ABSTRACT: In this research, Cement composites have become an inevitable part of construction industry. Concrete is the most utilized material on earth next to the water. With the advent of urbanization and increase in infrastructure activities, consumption of cement concrete has escalated. The production process of one ton of cement emits about 0.7 tons of carbon dioxide into atmosphere. The emitted carbon dioxide will lead to the greenhouse effect causing global warming. This turns affect the rainfall pattern, melting ice caps, and rise in sea levels. Hence there is a need to mitigate the use of cement and make development sustainable. The entire construction world is in search of a suitable and effective the waste product that would considerably minimize the use of cement and ultimately reduces the construction cost. Few of such products have been identified like eucalyptus ash and agave ash etc. Thereby, the mechanical properties such as compressive strength, split-tensile strength were determined for M25 grade concrete and by varying percentage of ash content from 10%, 15% and 20% by Cement is replaced by EUCALYPTUS ASH AND AGAVE ASH. Here the 10% of cement is replaced with 7.5% of eucalyptus ash and 2.5% agave ash. Similarly, in the next 15% and 30% of sement was replaced. The mechanical properties such as compressive strength with % ashes were compared with conventional concrete properties of M25 grade. From the results it is observed that increasing % of ash in concrete increases the compressive strength of concrete.

Keywords: Cement, Sand, Water, Eucalyptus ash, Agave ash, Compressive Strength.

INTRODUCTION:

Throughout the word, concrete is being widely used for the construction of the most of the buildings, bridges etc. Hence, it has been properly labelled as the back bone to the infrastructure development of a nation. It is generally known that, the fundamental requirement for making concrete structures is produced by carefully mixing cement, water and fine and coarse aggregate and combining admixture as needed to obtain the optimum product in quality and economy for any use. To meet out this rapid infrastructure development a huge quantity of concrete is required. Unfortunately, India is not self-sufficient in the production of cement; the main ingredient of concrete and the demand for exceeds the supply and makes construction activities very costlier.

Hence, currently. The entire construction industry is in search of a suitable and effective the waste product that would considerably minimize the use of cement and ultimately reduces the construction cost. Few of such products have been identified like eucalyptus ash and agave ash etc. Among these eucalyptus trees were grown across the Nilgiris district in India. However, it is recently proved that eucalyptus trees would supress the groundwater table as it needs about 90 liters of water per day. Thus its cultivation was restricted by law and the same is being used for firewood and burning of bricks. Still, these are available in abundance and hence it has become an economical fuel sources at the countryside. It acts as a source of bio-mass and curtails the use of non-renewable sources of energy. The ash produced by the burning activity is either dumped in landfills which creates soil and air pollution in the neighborhood. This ash contains cementitious property and it can be used along with cement. Confining its movement in the concrete would reduce the usage of cement, air pollution, and exploitation of natural resources. Agave species(sisal) were grown across the Nilgiris district in India. Here it has sharp marginal teeth, an extremely sharp terminal spine, and are very fibrous inside. These species are widely used in beverages, pulque, dwellings, thread, and to prepare some nutritious foods. But here we proved that agave is also used for constructions purposes also. These species is also harm to our human skin, so that we have considered the die leaves of these species and burnt it to make a ash of it. This ash contains cementitious property and it

can be used along with cement. Confining its movement in the concrete would reduce the usage of cement, increases ductility, compression strength.

LITERATURE REVIEW:

Abdul Rahuman and Saikumar Yeshika conducted a research work to check the workability and strength properties of sisal ashes reinforced concrete with different mix proportions and different percentage of ashes addition. Ashess were brushed, lined up and cut to obtain 4cm length. Degree of workability of concrete mix with 0.2% super plasticizer and water cement ratio 0.45 had good workability with slump value 53mm and compaction factor 0.88, which is effective, was obtained. Materials were hand mixed with 0.5%, 1%, 1.5% addition of ashes in M20 and M25 mix design and casted in cubes and cylinders. The obtained specimens were subjected to tests aimed to check the compressive, tensile and flexural strength. An increase in compressive strength by 50.53% and tensile strength by 3.416% was observed for 1.5% addition of ashes in M20 mix design respectively. An increase in compressive strength by 52.51% and tensile strength by 3.904% was observed for 1.5% addition of ashes in M25 mix design respectively.

Sathish and v. Murugesh focused on studying the compressive strength, split tensile strength, flexural strength performance of the blended concrete containing sisal ashes and different percentage of slag as a partial replacement of OPC. The cement in Concrete was replaced accordingly with the percentage of 10%, 20% and 30% by weight of slag and 1% of sisal ashes was added by weight of cement. Concrete cubes were tested at the ages of 7, 14 and 28 days of curing. Finally, the strength performance of slag blended ashes reinforced concrete is compared with GGBS mixed concrete

SACHIN K C a concrete mix of M20 grade was designed according to IS: 10262-2000 for moderate exposure conditions. 53 grade ordinary Portland cement (OPC), river sand, and 20mm down size crushed stone coarse aggregates were used to prepare the concrete. 1:1.71:2.78 mix proportion was finalized for the workability of 75-100mm slump with 0.5 water-cement ratios. To make the concrete eco-friendly, cement was partially replaced by eucalyptus ash at 20, 40, 60, and 80%. The fresh concrete property was determined by the slump cone test, which depicts that workability reduces with an increase in replacement levels of eucalyptus ash. Mechanical properties of concrete were determined by compression, split tensile, and flexural strength tests at 3, 7, 28, and 56 days. Mechanical properties proved that eucalyptus ash can be used as a supplement to cement up to 20%. At 20% replacement, concrete exhibited maximum compressive strength of 31.39 MPa on 28th day. After 20% replacement, the strength of concrete decreased gradually and it didn't reach the target mean strength. Split tensile strength and flexural strength were almost proportional to compressive strength

ALISSON FRANCO DO COUTO, GEOVANA SOUZA FERREIRA NOGRERIA, GERSSON SANDOL, NICEOLE SCHWANTES CEZARIO, GILSON MORAIES This study evaluated the possibility of using in natura Eucalyptus Wood Ash (EWA) from aviary furnaces as a mineral admixture in concrete. The ash was 100 mesh-sieved and added to the mix in 5, 10, 15 and 20% of the cement bulk. Physical analysis unveiled that EWA has a specific gravity higher than other organic originated residues, whereas its BET specific surface area is not enough to enhance its filler and/or pozzolanic effects. Chemically, the residue presented a low organic matter rate and a SAI below the minimum required by the Brazilian standards. EWA interfered in the times of cement set, increasing them, while FTIR unveiled mainly the presence of calcium carbonate bonds. The admixture compromised the concretes mechanical performance, leading to the conclusion that the sieving procedure of EWA alone is not enough do admit its usage as a mineral admixture.

PROPERTIES OF MATERIAL:

Cement, fine aggregate, coarse aggregate, Eucalyptus ash, Agave ash, water are the various material used in this project. Before casting the specimen various materials has been conducted and a study on them is presented in this journal.

MATERIALS:

CEMENT:

The cement used was OPC 53 grade cement. The different tests were conducted as per Indian Standards to determine the properties of this cement. For initial & final setting time IS: 8112-1989 is used and for standard consistency of cement IS: 4031(part-4) 1988. For specific gravity of cement (IS: 2720- part 3) is used.

Table 1: Physical Properties of Cement

S.No	Characteristics Experimental Valve	Experimental Valve
1.	Specific Gravity	3.15
2.	Standard consistency	30%
3	(i) Initial setting time	35 minutes
	(ii) Final setting time	7 hrs

FINE AGGREGATE:

Fine aggregate should be properly graded to give minimum void ratio and be free from deleterious materials like clay, silt content and chloride contamination etc., Hence it is desirable to use the coarser variety of fine aggregate having a high fineness modulus for making workable and strong concrete.

Locally available free of debris and nearly riverbed sand is used as fine aggregate. The sand particles should also pack to give minimum void ratio, higher voids content leads to requirement of more mixing water. In the present study the sand conforms to Zone II as per the Indian standards. Those fractions from 4.75mm to 150µ are termed as fine aggregate.

Table 2: Test on Fine Aggregate

S.NO	CHARACTERISTICS EXPERIMENTAL VALVE	EXPERIMENTAL VALVE
1.	Specific gravity	2.60
2.	Percentage of voids	24.5%
3.	Fineness modulus	4.0

4.	Bulk density	1.780 kg/m^3
5.	Water absorption	1%

COARSE AGGREGATE:

Coarse aggregate consists of larger than fine aggregate larger than dine aggregate and their size vary from 20 to 4.75mm. There tend to improve quality and bond characteristic and generally result in a higher flexural strength of concrete. It also helps in reducing shrinkage. These aggregates occupy 70-80% of volume of the concrete.

Table 3: Test on Coarse Aggregate

1.	Specific gravity	2.74
2.	Fineness modulus	4.63
3.	Bulk density	1.780 kg/m^3
4.	Water absorption	0.8%

EUCALYPTUS ASH:

Concrete is a material with high compressive strength, but predisposed to shrinkage cracking, rapid cracks propagation, and brittle failures. The incorporation of ash is an acceptable solution to reduce these limitations. However, high cost and energy consumption related to man-made ashes have placed natural ashes as an attractive sustainable alternative, especially considering that different natural ashes are industrial waste. Still, natural ashes can produce an important reduction of concrete strength, being this property fundamental for the massive use of concrete. Hence, an essential step to define potential applications of concrete with a natural ash is to evaluate the effects of that ash in traditional concrete mechanical properties as compressive and flexural strength. In this way, that evaluation is the first objective of the present book chapter, and, based on those results and ash properties, to define potential applications of concrete with Eucalyptus globulus bark ash. In effect, an experimental program was developed in such a way that reduces the results uncertainties and increases the power of decision regarding the percentage and ash conditions of the samples. In addition, a comparison of mechanical properties of natural ashes, and their concrete applications, is included as well. The results indicate that, unlike other natural ashes, the traditional mechanical properties have a slight reduction and acceptable workability. This fact is more evident in the samples with 0.50% ash with respect to the weight of cement. Bases on these results, and the use of other ashes in concrete, is possible to conclude that incorporating Eucalyptus globulus bark ashes emerges as an ecofriendly building alternative for micro cracking control and improving concrete ductility.

AGAVE ASH:

This paper presents physical, chemical, thermal and tensile properties of Mexican cooked blue agave bagasse ashes extracted from this plant. The ashes are 10–12 cm long and 592.341 m in diameter. The elliptical cells in the ashes are regularly arranged with varying lumen size. The cellulose and lignin contents of the ashes are 73.60% and 21.10% respectively. Ashes showed decreasing average values of ultimate tensile strength and constant values of Young's modulus and average % strain values with increasing mean gauge length 19 and decreasing mean diameter. Above results are discussed in the light of various factors that affect the properties. These ashes are found to be thermally stable due to their higher values of crystallinity and lignin. Main aim of this work is to characterize these partially degraded ashes with a view to find possible uses for such ashes such as compostable and biodegradable composites of corn starch/cooked blue agave residues.

MIX DESIGN OF CONCRETE:

Design of concrete mixes involves determination of the proportions of the given constituents namely cement, water, coarse aggregates and fine aggregates and marble powder and it should produce concrete possessing specified properties both in fresh and hardened states with the economy.

Design mix of concrete for 25 grade are made as per IS 10262:2000 (table 5). Size of nominal maximum of aggregate is 20mm is used .minimum water content as per IS 10262:2000 proportion of mix design is given below.

Table 4: Mix design proposition of M25

SAND	COARSE AGGREGATE	FINE AGGREGATE	WATER
1	1.4	2.3	0.5

RESULT:

As per design mix of concrete M25 and according to IS 10262:2009, compressive strength is measured for partial replacement of fine aggregate with eucalyptus ash and agave ash in cement ate various percentage such as 10%, 15% and 20% after 14 days and 28 days curing and found that the optimum compressive strength is gained at 10% partial replacement.

FUTURE SCOPE:

1.It will slightly reduce the dependency on cement.

2.High strength gives in tension as compare to conventional concrete.

3.To equal the conventional concrete strength.

4.EA and AA possess major problems for municipalities' particularly intensely populated are and this problem can be greatly eliminated by re-using EA and AA as cement replacement in concrete.

5.We have stepped into a realm of saving the environmental pollution by cement production.

CONCLUSION:

Replacement of cement with eucalyptus ash and agave ash is found to improve the strength of concrete.

- The Compressive strength of Cubes are increased with addition of eucalyptus ash and agave ash up to 20% replace by weight of cement and further any addition of both ashes the compressive strength decreases.

- Thus we found out the optimum percentage for replacement of eucalyptus ash and agave ash with cement and it is almost 20% of the total cement for cubes.

- The concrete specimens cast with both ashes as cement at various percentages like 10%, 15%, 20%. Among the above six 20% eucalyptus ash and agave ash replaced concrete produced better result than others, based on the compressive strength values.

- Concrete containing 20% eucalyptus ash and agave ash as cement the values shows maximum improvement in the compressive strength, split tensile strength, flexural strength and when compared to the control specimen.

- To minimize the costs for construction with usage of eucalyptus ash and agave ash which is freely or cheaply available and more importantly. • To saving the environmental pollution by cement production; being our main objective as Civil Engineers.

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