Experimental Study on Partial Replacement of Pineapple Leaf Ash and Granite Powder In Concrete

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Abstract- *As a result of the rising cost of building materials, it has become necessary to search for the affordable and cheaply obtainable material which might be partially replaced cement in the production of concrete. However, this research work was aimed at determining the chemical and physical properties of PLA*, workability properties of fresh concrete, the specific gravity, bulk densities and compressive strength of the hardened concrete under different loadings. This project is an experimental study on the use of Pineapple Leaf Ash (PLA) as partial replacement for cement. More so, Pineapple leaves were dried, burnt and heated in a furnace to produce Ash, which was discovered to possess pozzolanic properties. The Ordinary Portland cement was replaced by PLA* at 5%, 10%, 15% and 20% by weight and the cubes were crushed to get the various compressive strength of the concrete at different curing days. The results revealed that, the workability and strength properties of the resulting concrete was dependent on the water cement ratio, total days of curing, and percentage of replacement of PLA* for OPC. In this study granite powder replaces fine aggregate by 25 % by the weight of fine aggregate*

Keywords- Compressive strength, PLA - Pineapple Leaf Ash, Workability, OPC-Ordinary Portland Cement

I. INTRODUCTION

Concrete is considerably the world's largely adaptable and well-liked material produced each year in the construction. Concrete is nothing but a combination of aggregates both fine and coarse, Cement and water. Comparing to all other ingredients in concrete, cement is considered to be the expensive material. This is because cement is manufactured using energy intensive process. Cement is one of the major producers of carbon dioxide, which is the main cause of global warming. During the manufacturing process of cement the formation of clinker can be achieved only by heating the cement at very high temperature. This leads to the release of enormous amounts of carbon in the atmosphere. This was one among the major problems identified for climatic changes. Various research works has been carried out for the cost reduction in construction with some of the locally available materials as the partial or full replacement material for cement. Over the last few decades supplementary materials like fly ash, rice husk, silica fume, egg shell, groundnut shell, etc. are used as a replacing material. These supplementary materials have proven to be successful in meeting the needs of the concrete in construction. Pineapple leaf ash is used as partial replacement of cement . waste of this leaf is several tons worldly . Granite powder is also used as partial replacement of M-Sand, which granite powder waste is 2000 tons regionally. In this research work, bio waste is utilized as a substitute of cement and granite powder is utilized as a substitute of M-Sand.

II.MATERIAL PROPERTIES:

CEMENT:

OPC (Ordinary Portland Cement) 53 Grade of ACC confronting to IS 269:1967, IS 4031:(I)1988 and IS 4031-(IV)-1988 adopted in this work. Test conducted on Cement are as follow,

CEMENT OPC 53 GRADE

Table I: Cement

PARTICULARS	PERMISSIBLE VALUES	TEST RESULTS	IS CODE
FINENESS TEST	≤10%	7%	IS 4031-(I)-1988
CONSISTENCY TEST	26-34%	32%	IS 4031-(IV)-1988
INITIAL SETTING TIME	30 mins	30 mins	IS 269 – 1967
FINAL SETTING TIME	600 mins	600 mins	IS 269 – 1967

COARSE AGGREGATE:

The aggregates used are locally available. The aggregate used are 20mm size. The coarse aggregate tested for their suitability for the experiment. The test conducted on aggregate are as in Table II.

Table II: Coarse aggregate

SL.NO	TEST	TEST RESULTS
1.	Size of aggregate	20mm
2.	Crushing value	20.55%
3.	Impact value	11.76%
4.	Abrasion value	18.4%
5.	Flakiness index	36.65%
6.	Elongation index	45.2%

FINE AGGREGATE:

Fine aggregate is natural sand which has been washed and sieved to remove particles larger than 5 mm. Sand consists of small angular grains of silica. Sand is commonly used as the fine aggregate in cement concrete.

Table III: Fine aggregate

SL.NO	TEST	RESULT	IS REQUIREMENT
1.	FINENESS MODULUS	4.7%	As per IS 383:1970 Max. 3.2
2.	MOISTURE CONTENT	7.5%	-

MANUFACTURED SAND (M-Sand):

Manufactured sand confirming to Zone – II as per IS: 383-1970 is used. It was tested as per Indian standard specification. The manufactured sand used, is brought from the nearby area.

Table IV: Test on Manufactured Sand

Physical Properties	Manufactured Sand result
Specific Gravity	2.6
Fineness modulus	2.95
Water Absorption	0.28%

Figure 1: M-Sand

PINEAPPLE LEAF ASH

Pineapple leaf ash was collected from a farms after cultivation. The collected samples are washed and cleaned with potable water to remove dirt and impurities. Then the samples were cut uniformly into a small pieces and dried for over a week. The dried sample is kept in an oven for 800oc for 6 hours to convert the organic matter into an inorganic substance. The samples were ground by an milling machine. The grounded sample was passed through a sieve of size 150 micron. The sample collected from the 150-micron sieve has been used as the replacement material for cement.

Figure 2: Pineapple leaf ash

GRANITE POWDER

Granite belongs to igneous rock family. The density of the granite is between 2.65 to 2.75 g/cm³ and compressive strength will be greater than 200MPa. Granite powder obtained from the polishing units and the properties were found. The granite powder was fine, hydrometer analysis was carried out on the powder to determine the particle size distribution. Concrete has been a leading construction material for over a century. Its annual global production is about 3.8 billion m³ - roughly 1.5 tonnes per capita according to data obtained from Portland Cement Association. Total waste produced by all industries in this region may be approximately

2000 tonnes per week. This waste is easily carried away by the air and hence causes problems to human health and environment.

CONCRETE MIX DESIGN:

In the present study, M25 grade with nominal mix as per IS 456-2000 was used. The concrete mix proportion (Cement: Sand: Coarse Aggregate) is 1: 1: 2by weight and a water cement ratio of 0.45.

III. RESULTS AND DISCUSSION:

Workability test results:

SLUMP TEST

Table VIII: SLUMP CONE VALUE

w/c ratio	Slump value in cm
0.38	0
0.4	2.5
0.42	3.2
0.44	5
0.46	7

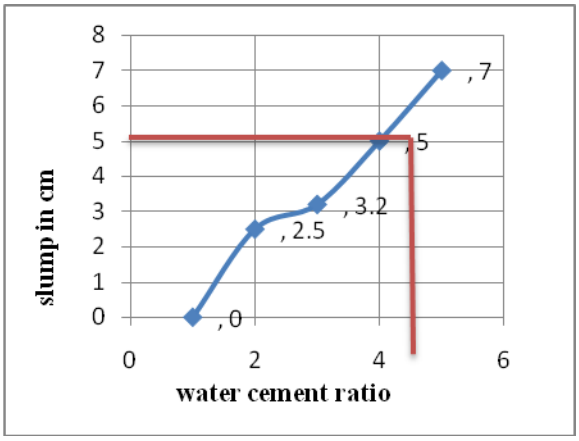

Figure 3: Slump cone test

CUBE

Table IX: Test results of compressive strength

Sl. no	Curing days	Average in compressive strength N/mm²			
		Control concrete	%Replacement of pineapple leaf ash (granite powder Constantly by 25%)		
			10%	15%	20%
1.	7	15.45	16.30	18.01	14.16
2.	28	22.56	23.29	24.25	21.52

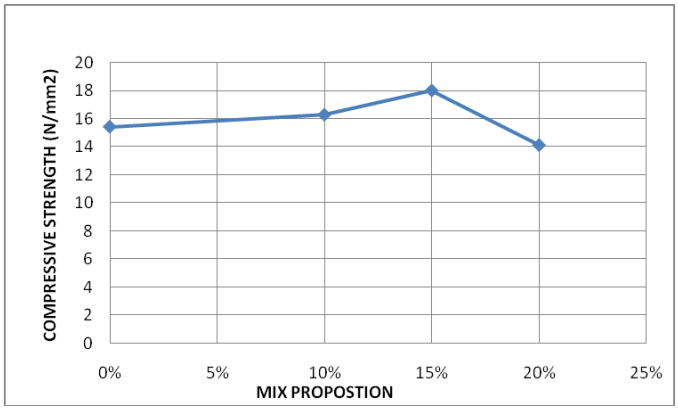

Figure 4: Result of 7 days

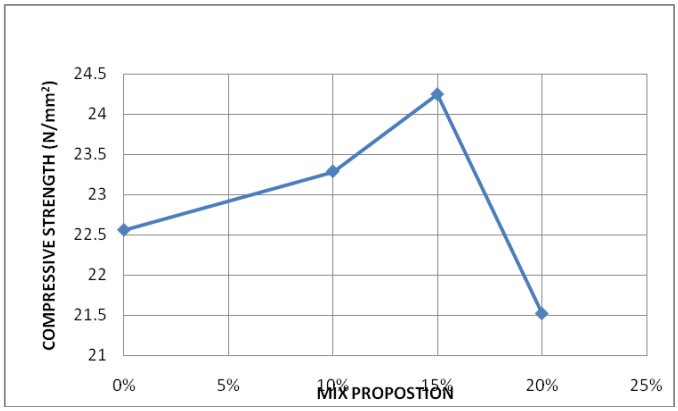

Figure 5: Result of 28 days

The value variation of compressive strength of cubes for the 15% Replacement of pineapple leaf ash (granite powder Constantly by 25%) gives maximum compressive strength of concrete after 7 and 28 days.

CYLINDER

Table X-Test results of spilt tensile strength

Sl. no	Curing days	Average in split tensile strength N/mm²			
		Control concrete	%Replacement of pineapple leaf ash (granite powder Constantly by 25%)		
			10%	15%	20%
1.	28	1.48	0.94	1.49	0.82

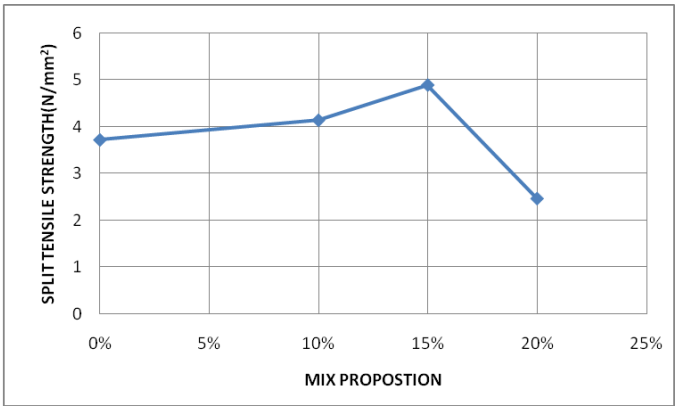

Figure 6: Result of 28 days

The value variation of spilt tensile strength of cylinder for the 15% Replacement of pineapple leaf ash (granite powder Constantly by 25%) gives maximum compressive strength of concrete after 28 days.

PRISM

Table XI- Test results of flexural strength

Sl. no	Curing days	Average in flexural strength N/mm²			
		Control concrete	%Replacement of pineapple leaf ash (granite powder Constantly by 25%)		
			10%	15%	20%
1.	28	3.71	4.13	4.88	2.46

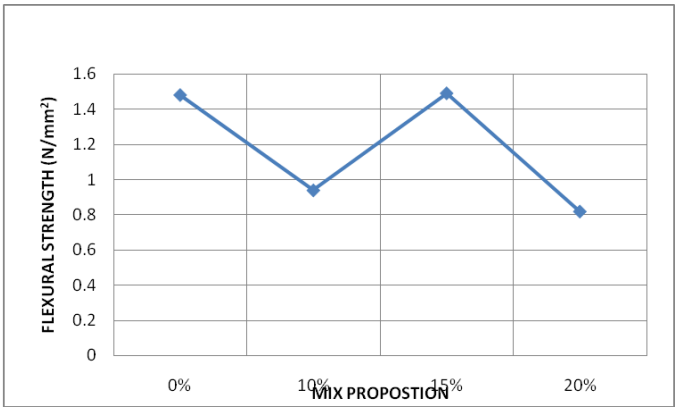

Figure 7: Result of 28 days

The value variation of flexural strength of cylinder for the the15% Replacement of pineapple leaf ash (granite powder Constantly by 25%) gives maximum compressive strength of concrete after 28 days.

IV. CONCLUSION

The concrete was prepared for the M25 grade concrete with partial Replacement of pineapple leaf ash (granite powder Constantly by 25%) of fine aggregate by GGBS with various percentages of 0%, 10%, 15% and 20%. The specimens were casted for 7days and 28 days then tested. The results are presented below.

From the above results following conclusion were made

1. Addition of pineapple leaf ash improves the workability of concrete. Addition of pineapple leaf ash at 10%, 15%, & 20% with cement gives the strength higher than the nominal strength of the concrete.
2. Thus cheaper concrete for a higher strength can be made with pineapple leaf ash. Addition of 15% results in greater strength than 10% & 20%.
3. High Volume pineapple leaf ash Concrete is more sustainable concrete compared to conventional concrete as it reduces the usage of cement . adequate curing are essential for strength gain

V. ACKNOWLEDGEMENT

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REFERENCES

[1] Devi .M & Kannan .K (2011) analysis of strength and corrosion resistance behavior of inhibitors in concrete containing quarry dust as fine aggregate in ARPN journal of engineering & applied sciences Vol.6,No .11,ISSN 1819-6608 ,pp.124-135.

[2] M . Shukla and A .K. Sachan (2000) "stone dust environmentally hazardous waste , its utilization in building construction " in materials and machines for construction , L. K. Mishra and Y. P. Gupta , Ed :New age international publishers ,pp.V77-V81.

[3] Linto Mathew, Dr.Mathews M Paul (2017), "Mechanical properties of Pineapple Fibre Reinforced Concrete subjected to high temperature", Global Research and development journal for Engineering, Vol.2, pg.200-205.

[4] A.Khalina et.al, A Review on Pineapple Leaves Fibre and Its Composites, International Journal of Polymer Science,2016

[5] E.Mello et.al, Improving Concrete Properties with Fibers Addition, International Journal of Civil and

Environmental Engineering, Vol. 8, pp. 249-254,2014

[6] G. Ramakrishna et.al , Studies on the durability of natural fibers and the effect of corroded fibers on the strength of mortar, Science Direct, journal of cement & concrete composite,Vol. 27, pp. 575-582,2005

[7] A non-technological evaluation and norms study in stone waste and granite industry. Report of Ministry of Science and Technology. GOI, 1993.