IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

AN EXPERIMENTAL INVESTIGATION ON PINEAPPLE LEAF FIBRE CONCRETE BY USING ZEOLITE POWDER AND DUNITE POWDER AS PARTIAL REPLACEMENT CEMENT

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ABSTRACT:

The most popular material used in construction is concrete. A cement paste that can flow holds together concrete, a composite material made of fine and coarse aggregate.In this work, a short trial is conducted to change the mechanical properties of Pine apple leaf fibre reinforced concrete using zeolite powder and dunite powder as a partial replacement cement. The cement is partially replaced with 3%, 6%, 9%, 12%,15% and 18% zeolite powder and 20%,40% and 60%, as well as addition of pine apple leaf fibre in concrete with percentages 0.1%, 0.2%,0.3%, 0.4% and 0.5%. When cement is replaced with zeolite powder the optimum strength increases 27.02% at 15% zeolite powder and 7.89% at 40% dunite powder, by addition of pine apple leaf in concrete at 0.3% the strength increases 13.84%. Combine replacement of 15%zeolite powder,40% dunite powder and 0.3% pineapple leaf fibre the strength increases 37.86%. Compressive strength , split tensile test results for concrete must be determined after 7 and 28days.

KEY WORDS: Zeolite powder, dunite powder and pine apple leaf fibre, Compressive strength and Split tensile strength .

1. INTRODUCTION

Civil engineering works that are incredibly challenging and intricate are being developed today. Concrete will support procedures like post & pre tensioning to get a higher strength at a time with the reduction of concrete. There are many approaches to achieve various required conditions, some of which may be of a higher strength than the conventional. Cement serves as the concrete's binding agent and is combined with water, coarse aggregate, and fine aggregate. An exothermic reaction occurs when cement gets into contact with water, hardening the concrete's components as a result.

Zeolite can also be used in powder form to partially replace cement in concrete. It is capable of absorbing atmospheric carbon dioxide and has strong pozzolanic reactivity. Long-term use of zeolite increases concrete's hardness. It stops the growth of cracks. For the creation of sulfate-resistant Portland cement, it serves as a replacement for ordinary Portland cement. It serves as an organic anti-corrosion agent. Zeolite allows for a reduction in cement admixture without sacrificing strength. It assists in lowering production costs and cutting CO2 emissions.

An intrusive igneous rock having an ultramafic composition and phaneritic (coarse-grained) texture is dunite, also known as olivinite. An igneous rock belonging to the peridotite group called dunite has an ultramafic composition and a coarse-grained or phaneritic texture. 90% of the dunite is made up of olivine, and the remaining 10% is made up of trace amounts of other minerals such pyroxene, chromite, magnetite, and pyrope.

An unwanted byproduct of pineapple plants is pineapple leaf fibre (PALF). PALF is widely available, inexpensive, has a high specific strength, and is rigid and abundant for industrial use. By using bio-composites as reinforcement material, PALF is promoting sustainable development. A natural fibre called pineapple leaf fibre (PALF) has the potential to take the place of synthetic fibres in concrete reinforcement. As a reinforcement fibre in concrete, PALF will fibrillate, absorb water, and alter the mechanical properties of freshly-poured concrete.

2. OBJECTIVES

a) To optimize the usage of zeolite powder and dunite powder in cement.

c) To absorb water and mechanical properties of concrete by adding Pineapple leaf fibre in concrete.

c) To assess the results of the compressive strength and split tensile strength tests.

3. MATERIALS:

a. Cement: The most widely used type of cement is ordinary Portland cement, which is used as a fundamental component in most non-specialty grout, concrete, mortar, and other construction materials. When making concrete, cement is the primary component. By altering the cement content, concrete's properties will be significantly impacted. Ordinary Portland Cement of Grade 53, in accordance with IS 12269-2013, was the material used in this project.
b. Fine aggregate: The most important aspect of concrete created with natural sand or crushed stone is fine aggregate. The density and quality of the fine aggregate significantly affect the properties of the cured concrete.
c. Coarse aggregate: In this experiment, coarse material that was readily available locally and had a maximum size of 20 mm and a minimum size of 12.5 mm was used. The aggregates were cleaned to get rid of dirt and dust, and they were then dried until they were surface dry. According to IS: 383-1970, the aggregates passed testing.
d. Water: Water is one of the most important elements in construction and is required for the preparation of mortar, mixing of cement concrete and for curing work etc. The quality of water used has a direct impact on the strength of the motor and cement concrete in the construction work.
e. Zeolite powder: A sedimentary ash-based mineral called zeolite naturally occurs. Zeolite is formed when volcanic ash and molten rock come in contact with seawater during an eruption.
f. Dunite powder: An igneous rock belonging to the peridotite group called dunite has an ultramafic composition and a coarse-grained or phaneritic texture.
g.Pine apple leaf fiber: The capacity of beams after cracking and the width and deflection of concrete fractures may both be reduced using bamboo fibre. In bio composites and material science, pineapple leaf fibre composite plays a significant role. PALF has been shown to be a good alternative to manufactured filaments because of its sensible and limitless character. The leaves' outermost layer is separated from the fibres in the leaves to produce the fibres, which are then dried.

4. RESULTS AND DISCUSSIONS

Compressive strength test: The measurement of concrete's compressive strength is crucial since it serves as a benchmark for the material's quality. Compressive strength is the standard unit of measurement for other strength. In N/mm2, the strength is measured.

Table 1: Compressive strength result on concrete by zeolite powder as partial replacement of cement.

S.No	Zeolite powder	Compressive strength results, N/mm^2	
		7 days	28 days
1	0%	34.22	49.67
2	3%	37.45	53.71
3	6%	38.34	54.94
4	9%	40.24	57.66
5	12%	41.11	59.49
6	15%	43.97	63.09
7	18%	42.83	61.28

Table 2: Compressive strength result on concrete by Dunite powder as partial replacement of cement.

S.No	Dunite powder	Compressive strength results, N/mm^2	
		7 days	28 days
1	0%	34.22	49.67
2	20%	35.74	51.21
3	40%	37.39	53.58
4	60%	35.78	51.13

Table 3: Compressive strength result by addition of Pine apple leaf fibre in concrete

S.No	Pine apple leaf fibre	Compressive strength results, N/mm^2	
		7 days	28 days
1	0%	34.22	49.67
2	0.1%	36.57	52.39
3	0.2%	37.65	53.94
4	0.3 %	39.48	56.57
5	0.4%	37.21	53.22
6	0.5%	36.16	51.73

Table 4: Compressive strength of concrete for combined partial replacement of cement by 40% Dunite powder+ 15% of Zeolite powder and addition of 0.3%pine apple leaf fibre.

S.No	ZP+DP+PALF	Compressive strength results, N/mm^2	
		7 days	28 days
1	0%	34.22	49.67
2	15%ZP+20%DP+0.3%PALF	47.29	68.52

b. Split tensile strength test: The cylindrical specimens (150mm diameter x 300mm height) were examined for assessing the split tensile strength at ages 7 and 28 days. A cylindrical sample is placed horizontally between a compression testing machine's loading surface, and a load is applied until the cylinder fails along its vertical diameter.

Table 5: Split tensile strength result on concrete by zeolite powder as partial replacement of cement .

S.No	Zeolite powder	Split tensile strength results, N/mm^2	
		7 days	28 days
1	0%	3.38	4.91
2	3%	3.72	5.33
3	6%	3.83	5.49
4	9%	3.99	5.75
5	12%	4.10	5.88
6	15%	4.35	6.23
7	18%	3.38	4.91

Table 6: Split tensile strength result on concrete by Dunite powder as partial replacement of cement

S.No	Dunite powder	Split tensile strength results, N/mm^2	
		7 days	28 days
1	0%	3.38	4.91
2	20%	3.46	5.06
3	40%	3.61	5.29
4	60%	3.42	5.05

Table 7: Split tensile strength result by addition of Pine apple leaf fibre in concrete

S.No	Pine apple leaf fibre	Split tensile strength results, N/mm^2	
		7 days	28 days
1	0%	3.38	4.91
2	0.1%	3.65	5.23
3	0.2%	3.72	5.38
4	0.3 %	3.91	5.59
5	0.4%	3.65	5.25
6	0.5%	3.46	5.09

Table 8: Split tensile strength of concrete for combined partial replacement of cement by 40% Dunite powder+ 15% of Zeolite powder and addition of 0.3%pine apple leaf fibre.

S.No	ZP+DP+PALF	Split tensile strength results, N/mm^2	
		7 days	28 days
1	0%	3.38	4.91
2	15%ZP+20%DP+0.3%PALF	4.71	6.75

5. CONCLUSION

1. The achieved Normal Concrete Compressive strength result for 7 and 28 days is 34.22 and 49.67 N/mm^2.

2. At 15% Zeolite powder the Compressive strength result for 7 and 28 days is 43.97 and 63.09 N/mm^2.

3. At 40% Dunite powder the Compressive strength result for 7 and 28 days is 37.39 and 53.58 N/mm^2.

4. Addition of 0.3% Pine apple leaf fibre then the Compressive strength result for 7 and 28 days is 39.48 and 56.57 N/mm^2.

5. By constant maintaining of 15% replacement of Zeolite powder in cement and 40% replacement of Dunite powder in cement and 0.3% added of pine apple leaf fibers the maximum compressive strength result for 7 and 28 days is 47.29 and 68.52 N/mm^2.

6. The achieved Normal Concrete Split tensile strength result for 7 and 28 days is 3.38 and 4.91 N/mm^2.

7. At 15% Zeolite powder the Split tensile strength result for 7 and 28 days is 4.35 and 6.23 N/mm^2.

8. At 40% Dunite powder the Split tensile strength result for 7 and 28 days is 3.61 and 5.29 N/mm^2.

9. Addition of 0.3% Pine apple leaf fibre then the Compressive strength result for 7 and 28 days is 3.91 and 5.59 N/mm^2.

10. By constant maintaining of 15% replacement of Zeolite powder in cement and 40% replacement of Dunite powder in cement 0.3% added of pine apple leaf fibers the maximum compressive strength result for 7 and 28 days is 4.71 and 6.75 N/mm^2.

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