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Mechanical Properties on Pineapple Leaf Fibre Concrete by Using Dunite Powder and Zeolite Powder As Partial Replacement Cement

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ABSTRACT: *Aggregate is a term used in construction to describe a hard, chemically inert particle material (usually sand and gravel) that binds to structural materials by binding them with cement and water. The effects of using zeolite powder instead of some of the cement in a concrete mix were investigated experimentally. Zeolite powder can replace cement in various amounts, including 0%, 3%, 6%, 9%, 12%, and 15%. When dunite is used as a cement substitute in place of traditional cement, such as 0%, 20%, 40%, and 60%, concrete is found to become up to 40% stronger.The dunite powder is generally less expensive than cement, according to studies based on periodic cement rate records. In the near future, dunite powder will prevail in the usage of cement. In the concrete industry, the utilisation of plant fibres occupies a leading position. It helps to incorporate natural resources as a replacement for artificial resources in order to lessen the negative effects caused by synthetic fibres. One of these is pineapple leaf fibre (PALF). In tropical regions, particularly in Kerala, PALF is widely accessible and reasonably priced. When compared to other types of natural fibres, it has a high tensile strength. Additionally, it lessens concrete shrinkage and fissures. This study emphasises the behaviour of concrete containing 0.1%, 0.2%, 0.3%, and 0.4% of pineapple leaf fibres. Tests might last between 28, 56 and 90 days.*

Keywords: *Zeolite powder, Dunite powder, PALF (Pineapple Leaf Fibre), Compressive Strength, Split tensile Strength.*

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I. INTRODUCTION:

One of the most popular composite materials in use today, concrete is mostly employed in building. It is constructed of binding elements like cement that are adhered to filler materials like aggregate. Due to its excellent compressive strength, high moldability, plasticity when fresh, durability, impermeability, and fire resistance when hardened, it is frequently employed.

Dunite is an igneous rock belonging to the peridotite group with a coarse-grained or phaneritic texture and an ultramafic composition. 10% of the dunite is made up mostly of trace amounts of pyroxene, chromite, magnetite, and pyrope, while the remaining 90% is made up of olivine.

One metal oxide that has a sizable amount of solid acidity is zeolite.Zeolite is also sold as a powder that can be used to partially replace cement in concrete. It is very pozzolanic reactive and may absorb carbon dioxide from the atmosphere.

By adding fibre material to the composite, concrete's strength can be increased. Because it is readily available and has a high strength, pineapple leaf fibre is an excellent choice. Better than synthetic materials or other chemically active materials are natural plant fibres like that found in pineapple leaves. Fibres aid in minimising shrinkage and cracks in concrete and also aid in enhancing the composite's strength and toughness.

II. OBJECTIVES:

1. To evaluate concrete's use of dunite powder.
2. To make the best use of zeolite powder in concrete.
3. The purpose of this study is to compare the impact on concrete's compressive strength of a set fraction of PALF at various lengths.

III. MATERIALS:

3.1 Cement: Cement is generally utilised as a binder material in concrete, which is used for construction and sets and hardens to link other materials. OPC (ordinary Portland cement) grade 53 is used in construction.

3.2 Fine Aggregate: Fine aggregate, which is made of natural sand or crushed stone, is a crucial part of concrete. The fine aggregate density quality has a considerable impact on the concrete's hardened qualities.

3.3 Coarse Aggregate: The material that is kept over the IS Sieve 4.75 mm is referred to as coarse aggregate. The typical maximum size is gradually 10–20 mm, according to IS383:1970.

3.4 Water: the drinkable water used in the production of concrete.

3.5 Zeolite powder: Zeolite has been employed as an antimicrobial agent, fluidizing agent for carriers, agent to strengthen concrete, agent to control humidity, and agent to increase concrete strength.

3.6 Dunite Powder: The fundamental minerals that make up dunite (Magnesium Iron Silicate), a plutonic rock, regularly go through more or less intricate geological processes that transform them into secondary minerals. Dunite, which is classified chemically as a basic rock, has olivine as its main component.

3.7 PALF- To increase the strength of the fibres recovered from pineapple leaves, a 5% NaOH solution was used. The obtained fibre was lengthened to 15mm and 5mm. The PALF has a density of 1.32 to 1.543 g/cm3 and an average diameter of 80 metres.

IV. EXPREMENTAL RESULT:

4.1 COMPRESSIVE STRENGTH:

The resistance to failure when subjected to compressive forces is known as compressive strength. Samples measuring 150mmX150mmX150mm are utilised for cube tests. These samples are put through compression testing after 28, 56, and 90 days.

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

Sl.no	% of Zeolite powder	28 Days (N/mm^2)	56 Days (N/mm^2)	90 Days (N/mm^2)
1	0	49.67	53.98	58.09
2	3	53.71	58.43	62.76
3	6	54.94	59.26	64.21
4	9	57.66	62.78	67.39
5	12	59.49	64.73	69.54
6	15	63.09	68.76	73.82
7	18	61.28	66.25	71.69

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

Sl.no	% of Dunite powder	28 Days (N/mm^2)	56 Days (N/mm^2)	90 Days (N/mm^2)
1	0	49.67	53.98	58.09
2	20	51.21	55.81	59.94
3	40	53.58	58.43	62.68
4	60	51.13	55.67	59.77

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

Sl.no	% of Pine apple leaf fibre	28 Days (N/mm^2)	56 Days (N/mm^2)	90 Days (N/mm^2)
1	0	49.67	53.98	58.09
2	0.1	52.39	57.06	61.23
3	0.2	53.94	58.79	63.17
4	0.3	56.57	61.68	66.21
5	0.4	53.22	57.95	62.36
6	0.5	51.73	56.27	60.41

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		
		28 Days	56 Days	90 Days
1	0%	49.67	54.09	58.21
2	15%ZP+20%DP+0.3%PALF	68.52	74.68	80.16

4.2 SPLI TENSILE STRENGTH:

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

Sl.no	% of Zeolite powder	28 Days (N/mm^2)	56 Days (N/mm^2)	90 Days (N/mm^2)
1	0	4.91	5.46	5.73
2	3	5.33	5.89	6.29
3	6	5.49	5.96	6.41
4	9	5.75	6.27	6..75
5	12	5.88	6.41	6.87
6	15	6.23	6.79	7.28
7	18	4.91	5.34	5.79

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

Sl.no	% of Dunite powder	28 Days (N/mm^2)	56 Days (N/mm^2)	90 Days (N/mm^2)
1	0	4.91	5.37	5.73
2	20	5.06	5.54	5.91
3	40	5.29	5.76	6.18
4	60	5.05	5.49	5.82

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

Sl.no	% of Pine apple leaf fibre	28 Days (N/mm^2)	56 Days (N/mm^2)	90 Days (N/mm^2)
1	0	4.91	5.34	5.73
2	0.1	5.23	5.69	6.09
3	0.2	5.38	5.82	6.29
4	0.3	5.59	5.76	6.54
5	0.4	5.25	5.71	6.12
6	0.5	5.09	5.53	5.94

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		
		28 Days	56 Days	90 Days
1	0%	4.91	5.38	5.72
2	15%ZP+20%DP+0.3%PALF	6.75	7.35	7.89

4.3 ULTRASONIC PULSE VELOCITY (UPV) TEST RESULTS:

Pulse of Ultrasonic Wave Concrete's density and elastic modulus are the key determinants of its velocity. This in turn is dependent on the components and mixture ratios used to make concrete, as well as the techniques employed for placement, compaction, and curing. Utilising the guidelines listed in table 2 of IS 13311 (Part 1):1992, the concrete's quality was evaluated. the concrete sample 28-day UPV results.

Table 9: Ultra pulse velocity on concrete by zeolite powder as partial replacement of cement

S.No	Zeolite powder	UPV (m/s)	Quality of concrete
		28 days	
1	0%	4128	Good
2	3%	4214	Good
3	6%	4338	Good
4	9%	4461	Good
5	12%	4522	Excellent
6	15%	4678	Excellent
7	18%	4487	Good

Table 10: Ultra pulse velocity on concrete by Dunite powder as partial replacement of cement

S.No	Dunite powder	UPV (m/s)	Quality of concrete
		28 days	
1	0%	4128	Good

2	20%	4293	Good
3	40%	4507	Excellent
4	60%	4376	Good

Table 11: Ultra pulse velocity result by addition of Pine apple leaf fibre in concrete

S.No	Pine apple leaf fibre	UPV (m/s)	Quality of concrete
		28 days	
1	0%	4128	Good
2	0.1%	4475	Good
3	0.2%	4503	Excellent
4	0.3 %	4521	Excellent
5	0.4%	4355	Good
6	0.5%	4306	Good

Table 12 : Combined Ultra pulse velocity on concrete

S.No	ZP+DP+PALF	UPV (m/s)	Quality of concrete
		28 days	
1	0%	4128	Good
2	15%ZP+20%DP+0.3%PALF	4892	Excellent

V. CONCLUSION:

1. The Normal Concrete Compressive strength result is 49.67, 53.98 and 58.09 N/mm2 for 28, 56 and 90 days.
2. At 15% Zeolite powder the Compressive strength result for 28 ,56 and 90 Days is 63.09,68.76 and 73.82 N/mm^2.
3. At 40% Dunite powder the Compressive strength result for 28 ,56 and 90 Days is 53.58 ,58.43 and 62.68 N/mm^2.
4. Addition of 0.3% Pine apple leaf fibre then the Compressive strength result for 28 ,56 and 90 Days is 56.57, 61.68 and 66.21 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 28 ,56 and 90 Days is 68.52 , 74.68 and 80.16 N/mm^2.
6. The achieved Normal Concrete Split tensile strength result for 28 ,56 and 90 Days is 4.91, 5.46 and 5.73 N/mm^2.
7. At 15% Zeolite powder the Split tensile strength result for 28, 56 and 90 Days 6.23, 6.67 and 7.28 N/mm^2.
8. At 40% Dunite powder the Split tensile strength result for 28, 56 and 90 Days is 5.29, 5.76 and 6.18 N/mm^2.
9. Addition of 0.3% Pine apple leaf fibre then the Compressive strength result 28 ,56 and 90 Days is 5.59, 5.76 and 6.54 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 28 ,56 and 90 Days is 6.75, 7.35 and 7.89 N/mm^2.
11. The Ultrasonic Pulse Velocity test for Normal concrete the observed value is 4128 m/s.
12. The Ultrasonic Pulse Velocity test value of 15%Zeolite powder by partial replacement of cement the observed value is 4678 m/s.
13. The Ultrasonic Pulse Velocity test value of 40%Dunite powder by partial replacement of cement the observed value is 4507 m/s.
14. The Ultrasonic Pulse Velocity test value of 0.3 % Pine apple leaf fibre added to concrete then the observed value is 4521m/s.
15. The Ultrasonic Pulse Velocity test value of % of zeolite powder by partial replacement of cement + % of Dunite powder by partial replacement of cement + by adding % of pine apple leaf fibre in concrete the observed value is 4892 m/s.

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