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EXPLORING THE PERFORMANCE OF DUNITE POWDER AS CEMENT REPLACEMENT AND ALKALI GLASS FIBER REINFORCEMENT IN CONCRETE: AN EXPERIMENTAL STUDY

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ABSTRACT
It is common knowledge that the world is growing rapidly and that building construction is necessary for this expansion. A thorough analysis of the use of concrete will reveal that it raises the demand for natural resources. To protect our natural resources, we thought about replacing some of the concrete's proportions with the following measurements. This essay explains the use of dunite as cement in various ratios.We are adding alkaline resistant glass fibers with a length of 12 mm to the volume of concrete in two different percentages—0.03% and 0%—in order to increase the material's tensile properties because we are aware that concrete is weak in tension and strong in compression. To assess compressive and split tensile strengths for 28,56 and 90 days.

Keywords:
Alkaline glass fiber, Dunite powder, compressive strength, split tensile.

1. INTRODUCTION

The quest for sustainable and durable construction materials has led to innovative approaches in concrete technology. Among these approaches, the incorporation of alternative materials as cement replacements and the integration of reinforcing fibers have gained significant attention. In this context, dunite powder and Alkali Resistant (AR) fibers emerge as promising components to enhance the performance and sustainability of concrete structures.
Dunite, a mineral rich in magnesium silicate, presents an opportunity as a supplementary cementitious material due to its pozzolanic properties. By replacing a portion of cement with dunite powder, not only can the environmental impact of concrete production be reduced, but also the long-term durability and strength properties of the resulting concrete can be improved.

2. OBJECTIVES

1. To evaluate cement's use of dunite powder.
2. To improve concrete's tensile qualities by adding AR fibers.
3. To ascertain the concrete's split tensile and compressive strengths.

3. MATERIALS

3.1 Cement: In construction, cement is a substance that acts as a binding agent to keep the other building materials together. The majority of the material in concrete is composed of coarse aggregate, with fine aggregate filling in the spaces left by the coarse aggregate. Mortar is only regular cement combined with water and fine aggregate, whereas concrete is just cement mixed with coarse material.
3.2 Fine Aggregate: Fine aggregates are natural sand particles that are extracted from the earth during mining. They can be any ¼" or smaller crushed stone particle size. Since the size, or grading, of this aggregate is what leads to the

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frequent description of this product as 1/4' minus. A 4.75 mm IS Sieve is considered to be the material that passes through as fine aggregate. Sand in River Grading Zone II.(Grain of medium size).

3.3 Coarse Aggregate: Aggregate preserved above IS Sieve 4.75 mm is referred to as coarse aggregate. Although self-compacting concrete has been found to use particle sizes of up to 40 mm or more, the usual maximum size is progressively 10–20 mm.

3.4 Dunite Powder: Dunite, also known as magnesium iron silicate, is a plutonic rock made up of several basic minerals that are regularly converted into secondary minerals by somewhat complicated geological processes. Olivine is the primary mineral present in dunite, a basic rock classified by chemical composition.

3.5 Alkali-Resistance Glass Fibres: Alkali resistant (AR) glass fiber is glass fiber that has had zirconium oxide added to it to help it resist alkalinity assault. Given the alkaline environment of concrete, this is an essential part of these fibers. The usual fiberglass (e-glass) in concrete deteriorates due to the alkaline aggregate environment. AR fiber has been widely used in the concrete industry since the 1970s. Glass fiber concrete has the potential to be thinner and lighter.

4. EXPERIMENTAL INVESTIGATIONS

4.1 **Compressive Strength Results:** The compressive strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in table 1 to 3.

Table 1: Compressive strength of concrete with dunite powder as partial replacement of cement.

S.No	% of Dunite powder	Compressive strength (N/mm^2)		
		28 Days	56 Days	90 Days
1	0%	49.33	53.75	57.26
2	20%	50.86	55.37	59.44
3	40%	53.22	58.05	62.29
4	60%	50.84	55.41	59.43

Table 2: : Compressive strength of concrete with AR Glass Fiber replacement of concrete.

S.No	% of AR Glass fiber	Compressive strength (N/mm^2)		
		28 Days	56 Days	90 Days
1	0%	49.33	53.75	57.26
2	0.03%	58.69	63.79	68.72

Table 3: Combined Compressive Strength of % of Dunite powder With Partial Replacement of cement +10 % of AR Glass fiber replacement of concrete.

S.No	% of DP+% of AR	Compressive strength (N/mm^2)		
		28 Days	56 Days	90 Days
1	0%	49.33	53.75	57.26
2	40% DP+ 0.03% AR	64.09	69.86	74.91

4.2 Split Tensile Strength Test

The results of the split tensile strength test that was performed on the cast and cured specimens of cylinders.

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Table 4: Split tensile strength of concrete with dunite powder as partial replacement of cement.

S.No	% of Dunite powder	Split tensile strength (N/mm^2)		
		28 Days	56 Days	90 Days
1	0%	4.87	5.32	5.71
2	20%	4.93	5.36	5.77
3	40%	5.15	5.64	6.03
4	60%	5.03	5.48	5.87

Table 5: Split tensile strength of concrete with AR Glass Fiber replacement of concrete.

S.No	% of AR Glass fiber	Split tensile strength (N/mm^2)		
		28 Days	56 Days	90 Days
1	0%	4.87	5.32	5.71
2	0.03%	6.16	6.71	7.25

Table 6: Combined Split tensile strength of % of Dunite powder With Partial Replacement of cement +10 % of AR Glass fiber replacement of concrete.

S.No	% of DP+% of AR	Split tensile strength (N/mm^2)		
		28 Days	56 Days	90 Days
1	0%	4.87	5.32	5.71
2	40% DP+ 0.03% AR	6.43	7.02	7.52

5. CONCLUSIONS

1. At 40% DP, the compressive strength of concrete is 53.22, 58.05 and 62.29 N/mm^2 at 28, 56 and 90 days.
2. For 0.03% AR glass fibers the compressive strength is 58.69, 63.79 and 68.72 N/mm^2 at 28, 56 and 90 days.
3. With 0.03% AR glass fiber + 40% DP the maximum compressive strength is 64.09, 69.86 and 74.91 N/mm^2 at 28, 56 and 90 days.
4. At 40% DP, the split tensile strength of concrete is 5.15, 5.64 and 6.03 N/mm^2 at 28, 56 and 90 days.
5. For 0.03% AR glass fibers the split tensile strength is 6.16, 6.71 and 7.25N/mm^2 at 28, 56 and 90 days.
6. With 0.03% AR glass fiber + 40% DP the maximum split tensile strength is 6.43, 7.02 and 7.52 N/mm^2 at 28, 56 and 90 days.

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