

Experimental Investigation on Concrete by Using Partial Replacement of Ground shell ash With Fine Aggregate and Zeolite Powder with Cement

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Abstract- Aggregate is a hard, chemically inert particle material used in building that forms bonding with structural materials through the use of cement and water. Typically, aggregate consists of sand and gravel. The effects of partially substituting cement in concrete with zeolite powder on its characteristics were investigated through experimental research. Zeolite powder can be used to replace cement in different percentages 5%, 10%, 15%, 20%, 25%, and 30%. The viability of using groundnut shell ash partially replace of fine aggregate was assessed in this experimental investigation. Instead of using 2.5%, 5%, 7.5%, or 12.5% fine aggregate for M40 concrete with distinct concrete compositions with powder and ash were used. In both fresh and hardened concrete settings, the characteristics of these concrete combinations were examined. In order to ascertain the cube samples' compressive strength, they were moulded, cured, and evaluated after 7 and 28 days.

Index Terms- Zeolite powder, Groundnut shell ash, Compressive strength and Split tensile strength.

I. INTRODUCTION

Concrete is a composite material that dries over time and is made of fine and coarse aggregate mixed with cement paste. The majority of the concrete uses hydraulic cement-based concrete or concrete with a lime base. e. Waste products like peanut shell ash are produced by the peanut industry. Typically, it is disposed of outside without considering the financial advantages or environmental effects. Preparing for the effective use of resources that are readily available locally is the goal. This study investigated the appropriateness of crushed nut shell ash as a building material by testing its compressive strength, split tensile strength, water absorption rate, and partial substitution of fine particles. One metal oxide that has a considerable solid acidity is zeolite. Additionally, zeolite is available as a powder for use in concrete as a partial cement alternative. It can absorb carbon dioxide from the air and has a high pozzolanic reactivity.

II. OBJECTIVES

- To maximize the use of ground nut shell ash with fine aggregate.
- To make the best use of zeolite powder in concrete.

- To assess the concrete's split tensile and compressive strengths.

III. MATERIALS

Cement: Cement is mostly utilised as a binder material in concrete, which is used for building and hardens and sets to link other materials. Ordinary Portland cement, or OPC, is used in construction. Grade 53.

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

Coarse Aggregate: Aggregate that remains above the IS Sieve 4.75 mm is referred to as coarse aggregate. A progressive increase in size of 10–20 mm is the average maximum, as stated in IS383:1970.

Water: The drinkable water that was utilised to make concrete.

Groundnut Shell Ash: This nutrient-dense leguminous crop is primarily grown for oil and seed production globally. The by-product of removing the groundnut seed from its pod is groundnut shells. This is a common agricultural and industrial waste product that breaks down very slowly in the environment.

Zeolite powder: Zeolite has been employed as an antibacterial agent, a fluidizing agent for carriers, a strengthening agent, a humidity-regulating agent, a concrete preventive agent, and an agent to boost concrete strength.

IV. EXPERIMENTAL RESULTS

Compressive strength: Compressive strength of concrete must be evaluated since it serves as a standard to determine the material's quality

Table 1 : Compressive strength of concrete with Groundnut shell ash as partial replacement of fine aggregate in concrete.

% Of GSA	Compressive strength Results (N/mm ²)	
	7 days	28 days
0%	33.98	49.12
2.5%	35.12	50.93
5%	36.01	51.48
7.5%	36.24	51.82
10%	37.51	52.98
12.5%	36.67	52.43

Table 2: Compressive strength of concrete with Zeolite powder as partial replacement of cement in concrete.

% of ZP	Compressive strength Results (N/mm ²)	
	7 days	28 days
0%	33.98	49.12
5%	37.81	54.09
10%	40.19	58.34
15%	44.25	62.76
20%	40.56	60.81
25%	39.61	57.06
30%	38.94	55.71

Table 3: Combined compressive strength of concrete with 15% Zeolite powder and 10% Ground nut shell ash.

GSA+ZP	Compressive strength Results (N/mm ²)	
	7 days	28 days
0%	33.98	49.12
10% GSA+15%ZP	45.06	64.54

Split tensile strength results: The split tensile strength conducted in compressive strength machine for the cast and cured specimens and the results are furnished in Table.

Table 4: Split tensile strength of concrete with Groundnut shell ash as partial replacement of fine aggregate in concrete

% of GSA	Split tensile strength Results, (N/mm ²)	
	7 days	28 days
0%	3.41	4.93
2.5%	3.52	5.04
5%	3.59	5.11
7.5%	3.71	5.23
10%	4.03	5.66
12.5%	3.82	5.27

Table 5: Split tensile strength of concrete with Zeolite powder as partial replacement of cement in concrete.

% of ZP	Split tensile strength Results, (N/mm ²)	
	7 days	28 days
0%	3.41	4.93
5%	3.67	5.31
10%	4.05	5.77
15%	4.39	6.25
20%	4.08	6.03
25%	3.92	5.68
30%	3.67	5.29

Table 6: Combined Split tensile strength of concrete with 15% Zeolite powder and 10% Ground nut shell ash.

GSA+ZP	Split tensile strength Results, (N/mm ²)	
	7 days	28 days
0%	3.41	4.93
10% GSA+15%ZP	4.59	6.61

V. CONCLUSION

- The Normal Concrete Compressive strength result for 7 and 28 days is 33.98 N/mm² and 49.12 N/mm².
- At 15% replacement of cement by zeolite powder the compressive strength of concrete is for 7 and 28 days 44.25 N/mm² and 62.76 N/mm².
- At 10% partial replacement of Gsa with fine aggregate the compressive strength of concrete for 7 and 28 days are 37.51 N/mm² and 52.98 N/mm² .

- Combined replacement of compressive strength of concrete with 15% of zeolite powder and 10 % of GSA for 7 and 28 days are 45.06 N/mm² and 64.54 N/mm² .
- The Normal Concrete Split tensile strength result for 7 and 28days are 3.41 N/mm² and 4.93 N/mm² .
- At 15% replacement of cement by zeolite powder the Split tensile strength of concrete is for 7 and 28 days 4.39 N/mm² and 6.25 N/mm².
- At 10% partial replacement of Gsa with fine aggregate the Split tensile strength of concrete for 7 and 28 days are 4.03 N/mm² and 5.66 N/mm² .
- Combined replacement of Split tensile strength of concrete with 15% of zeolite powder and 10 % of GSA for 7 and 28 days are 4.59 N/mm² and 6.61 N/mm² .

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