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STRENGTH STUDIES ON GRAPHENE OXIDE CONCRETE AS PARTIAL REPLACEMENT OF CEMENT WITH QUARTZ POWDER

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ABSTRACT

The GO-cement composites' hydration qualities have been observed to result in a higher hydration rate, which has an impact on the composites' workability and water need. The functions and impacts of GO, as well as how it affects cement-based composites' hydration, workability, transport characteristics, development of mechanical properties, and durability. Cement is substituted for graphene oxide in varied amounts, including 0%, 0.05%, 0.10%, and 0.15%. An additive used in construction to strengthen concrete is quartz powder. The substance is water mixed with powdered quartz rock that has been crushed. Quartz is the perfect building material because of these qualities because it may be used as insulation or as the main component of cement. One pound of this chemical expands to approximately one cubic foot when combined with wet cement, strengthening concrete by 10% on average. When used on roads and pavements, for example, it can withstand wear and tear substantially better than traditional concrete. At ages 7 and 28 days, The strength of concrete enhanced its compressive, split tensile, and ultrasonic pulse velocity properties.

***Key words*: Graphene oxide, Quartz Powder, Compressive strength, Split tensile strength.**

1. INTRODUCTION

A fluid cement that gradually grows harder is used to bind coarse aggregate to create the composite material known as concrete. Concrete made using hydraulic cements or lime-based concretes like Portland cement concrete are the most prevalent types. The most important construction materials now are those made of cement, and it is very likely that they will continue to be so in the future.

Graphene concrete and cement additives provide stronger, more durable concrete constructions, enabling creative and potentially more ecologically friendly design approaches for infrastructure and building projects. External testing shows an improvement in the tensile and compressive strength of cement mortar when measured

using globally recognised criteria. Graphene is one of the materials that has entered our lives and has the potential to alter the direction of human history. A solid chemical substance called graphene is formed entirely of carbon atoms and contains molecules arranged in a honeycomb-like pattern. Although it has only recently (15 years) been synthesised, we are confident that it will revolutionise a number of industries, including design and construction.

Quartz is primarily crystalline in its organisation, though there can be variations in the degree of crystallisation. When a single crystal can be seen with the unaided eye, the crystal is considered to be macro-crystalline. The other kind is micro-crystalline, also known as cryptocrystalline, in which crystal aggregates are only discernible when observed in close-up. The cryptocrystalline variants might be primarily opaque or translucent, with macrocrystalline transparency being more prevalent.In the concrete, paint, and glue industries, quartz sand is particularly helpful due to its unique properties. Paint and other products are more chemically resistant when made with quartz sand. The igneous rock known as quartz is composed of silicon and oxygen atoms arranged in a continuous pattern called a silicon-oxygen tetrahedron (SiO4). Each oxygen atom is shared solely by two tetrahedral

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2. OBJECTIVES:

1. To enhance the usage of Quarry powder in cement.
2. To assess the usage of Graphene oxide in cement.

3. MATERIALS

3.1 Cement:

Depending on their purity and composition, the materials are pulverised, blended in particular proportions, and then burned in clinker at temperatures between 1300 and 1500 °C. The materials partially fuse and sinter at this temperature to produce clinker with a nodular shape. The clinker is cooled and ground into a fine powder after being mixed with 3 to 5% gypsum. The byproduct of using the aforementioned method is cement.

3.2 Fine aggregate:

Any shattered stone bits that are 14" or smaller, like natural sand, are considered fine aggregates. Because it describes the size, or grading, of this particular aggregate, this product is frequently referred to as 1/4"' minus. In zone II, river sand.

3.3 Coarse aggregate:

Coarse aggregates are any particles larger than 0.19 inches; however they typically have a diameter of between 3/8 and 1.5 inches. The majority of the remaining coarse aggregate, which is mostly composed of gravel, is crushed stone.

3.3 Water:

One of the most important building supplies is water, which is needed for a variety of processes like creating mortar, mixing cement, curing work and more. The longevity of the mortar and cement concrete used in building directly depends on the quality of the water utilised.

3.4 Quarry Powder:

Quartz is virtually always inert when used as aggregate in concrete rather than as a fine powder to replace cement. It means that it is incapable of responding in typical situations. Less reaction and a real problem that is simpler to control. Along with its hardness, that makes concrete desirable.

3.5 Graphene oxide:

The graphene oxide carbon allotrope is a single layer of atoms arranged in a two-dimensional honeycomb lattice nanostructure. A substance entirely composed of carbon atoms, graphene has a solid molecular structure resembling a honeycomb.

4. EXPERIMENTAL RESULTS

4.1 Compressive strength

The 150mm x 150mm x 150mm cube specimens were cast, tested in a compression testing equipment for seven and twenty-eight days while curing the concrete, and then shown inTable.

Table 1 Compressive Strength result on concrete with quartz powder as partial replacement of cement

S.No.	% Quartz powder	Compressive Strength, N/mm^2	
		7 Days	28 Days
1	0	26.85	39.21
2	5	29.07	42.44
3	10	30.67	44.27
4	15	33.70	48.01
5	20	32.43	46.40

Graph 1: Compressive Strength on concrete with quartz powder as partial replacement for cement.

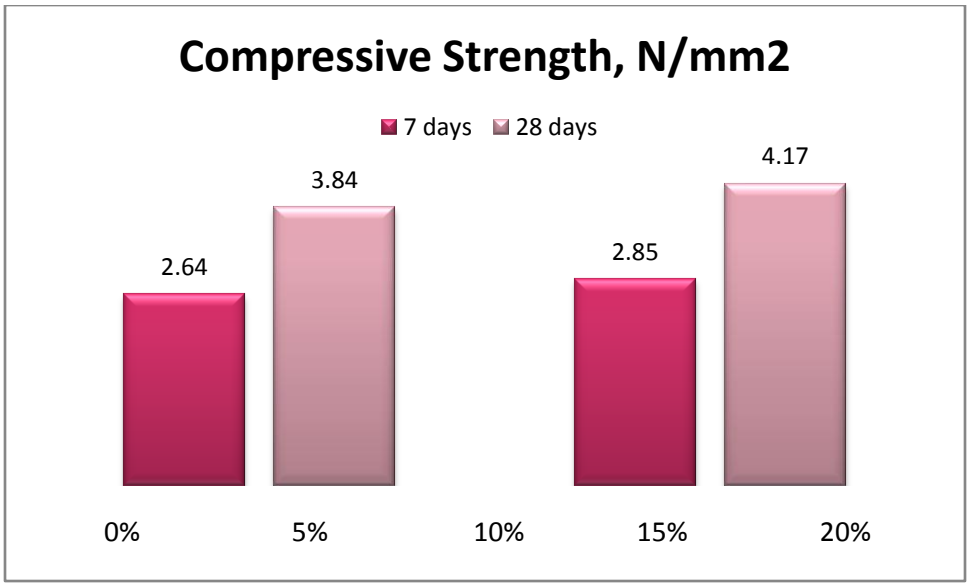
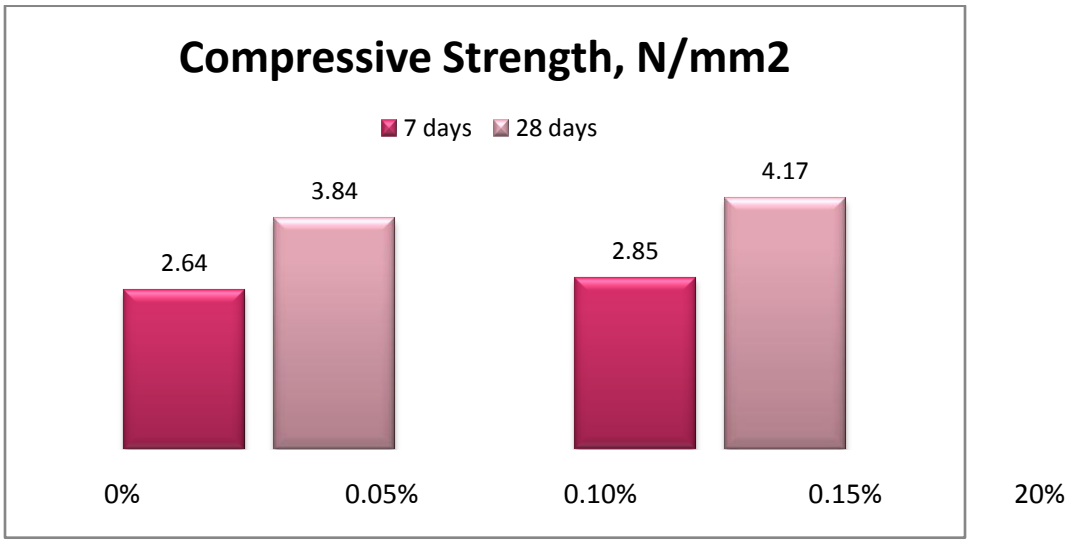


Table 2: Compressive Strength on concrete with graphene oxide as partial replacement of cement.

S.No.	% Graphene Oxide	Compressive Strength, N/mm^2	
		7 Days	28 Days
1	0	26.85	39.21
2	0.05	36.62	52.94
3	0.10	40.85	58.28
4	0.15	37.79	54.62

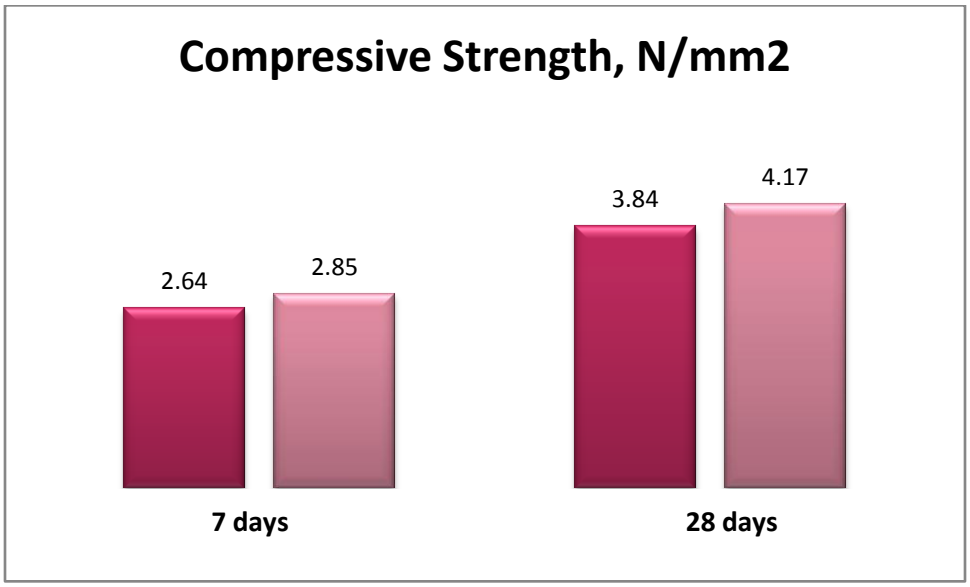


Graph 2: Compressive Strength result on concrete with graphene oxide as partial replacement of cement.

Table3 :Compressive strength of concrete for combined replacement of cement by 0.12% Graphene oxide and 30% of Quartz powder

S.No	Combined replacements(%)	Compressive strength, N/mm^2	
		7 days	28 days
1	0	26.85	39.21
2	30%QP+0.12%GO	43.86	62.68

Graph 3: Compressive strength of concrete for combined replacement of cement by 0.12% Graphene oxide and 30% of Quartz powder.



4.2 Split tensile strength results

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

Table 4:Split tensile strength of concrete Partial replacement of Cement with Quartz powder

S.No.	% Quartz powder	Split tensile Strength, N/mm^2	
		7 Days	28 Days
1	0	2.64	3.84
2	5	2.85	4.17
3	10	3.02	4.37
4	15	3.36	4.79
5	20	3.19	4.57

Graph 4 :split tensile strength result on concrete Partial replacement of Cement with Quartz powder.

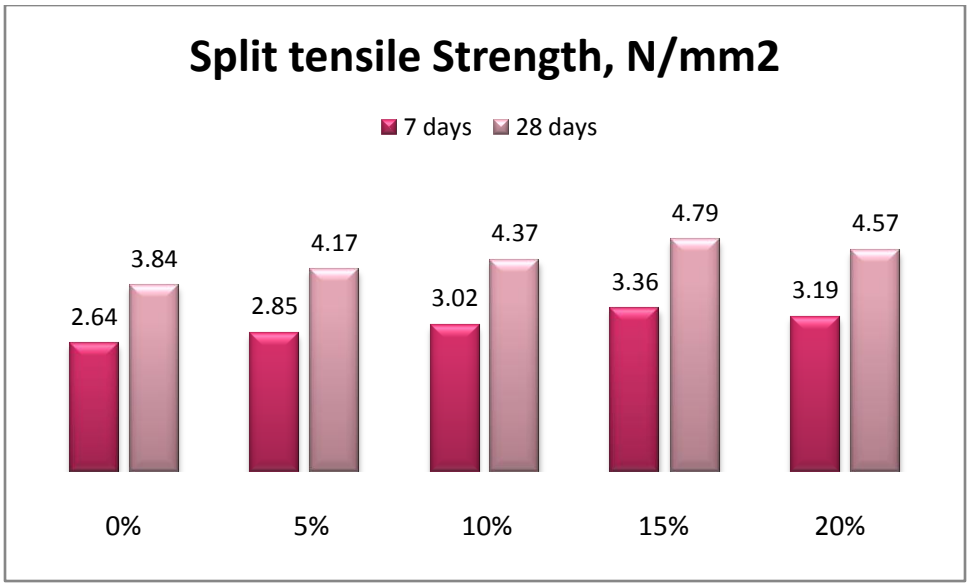


Table 5:Split tensile strength on concrete Partial replacement of Cement with graphene oxide.

S.No.	% graphene oxide.	Split tensile Strength, N/mm^2	
		7 Days	28 Days
1	0	2.64	3.84
2	0.05	3.62	5.19
3	0.10	4.31	6.11
4	0.15	3.78	5.45

Graph 5:Split tensile strength on concrete Partial replacement of Cement with graphene oxide.

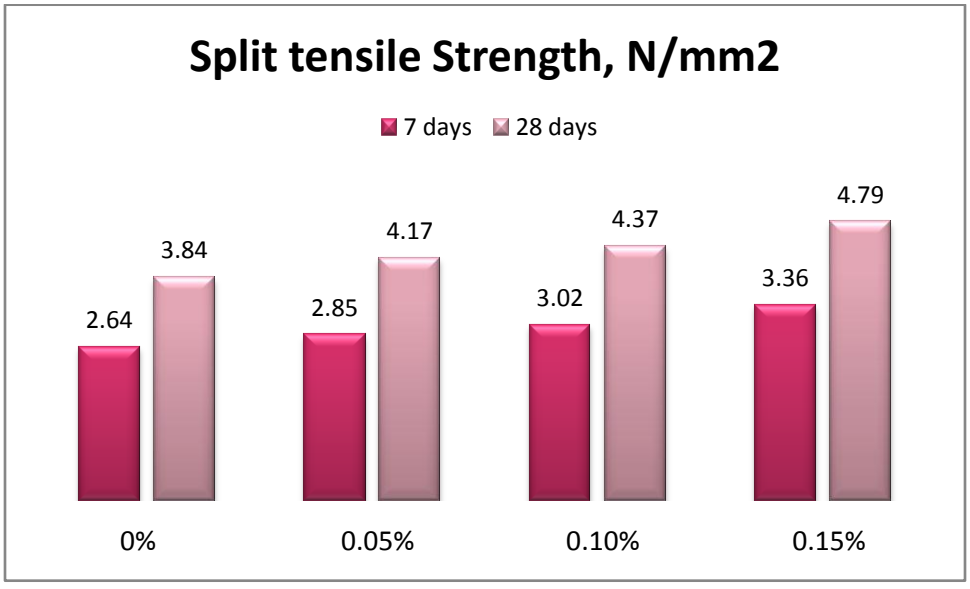
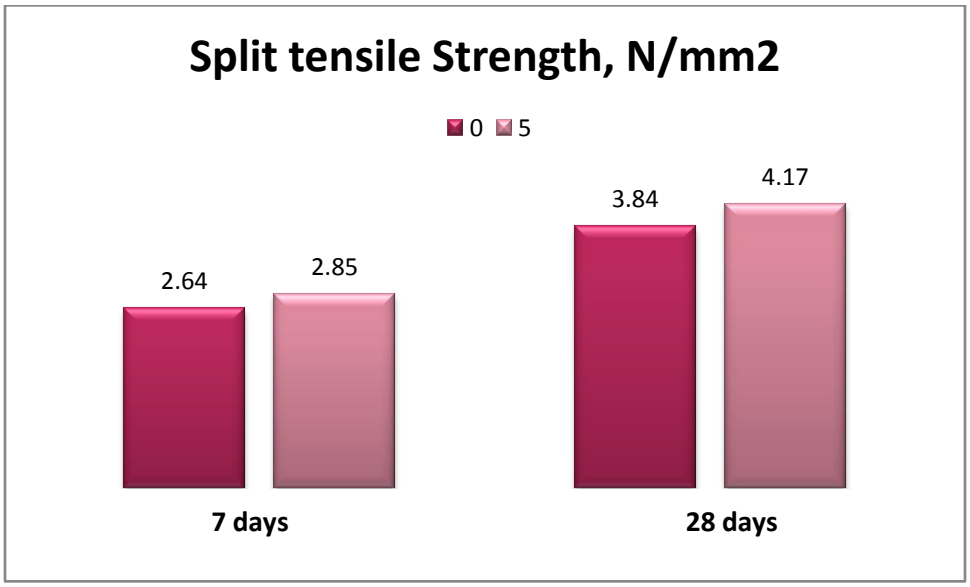


Table6: Split tensile strength of concrete for combined partial replacement of cement by 0.10% Graphene oxide and fine aggregate by 15% of Quartz powder

S.No	Combined replacements(%)	Split tensile strength, N/mm^2	
		7 days	28 days
1	0	2.64	3.84
2	15%QD+0.10%GO	4.61	6.58

Graph 6: Split tensile strength of concrete for combined partial replacement of cement by 0.10% Graphene oxide and fine aggregate by 15% of Quartz powder



5. CONCLUSION:

1. The normal concrete of compressive strength result of concrete for 7 and 28 days is 26.85 and 39.21N/mm^2.
2. At 15% replacement of cement by quartz powder is achieved compressive strength of concrete for 7 and 28 days is 26.85 and 39.21N/mm^2.
3. At 0.10% replacement of cement by quartz powder is achieved compressive strength of concrete for 7 and 28 days is 40.85 and 58.28N/mm^2.
4. The combined replacements 30%Quartz powder + 0.12% Grapheneoxide the compressive strength result of concrete for 7 and 28 days is 43.86 and 62.68N/mm^2.
5. The normal concrete of Split temsile strength result of concrete for 7 and 28 days is 2.64 and 3.84 N/mm^2.
6. At 15% replacement of cement by quartz powder is achieved Split temsile strength of concrete for 7 and 28 days is 3.36 and 4.79N/mm^2.

7. At 0.10% replacement of cement by quartz powder is achieved Split temsile strength of concrete for 7 and 28 days is 4.31 and 6.11 N/mm^2.
8. The combined replacements 30%Quartz powder + 0.12% Grapheneoxide the Split temsile strength result of concrete for 7 and 28 days is 4.61 and 6.58 N/mm^2.

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