

Utilization of Quarry Dust as a Partial Replacement of Fine Aggregate in Glass Fibre Reinforced Concrete introduction

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ABSTRACT

Concrete plays important role in the construction of structures. The need for concrete increases day by day. Material required for concrete are getting depleted, so there is a requirement to find alternatives. At the same time the alternative materials should possess the property of the actual materials used in concrete and also they must provide the required strength to the concrete. Normally Concrete is firm in compression but anemic in tension and shear. The purpose of this study is to find the behaviour of concrete reinforced with hybrid macro fibers. By adding Glass fibers in percentages like 0.2%, 0.4%, 0.6% & 0.8% to the concrete, the properties like compressive, flexural and split tensile strength are investigated. The optimum percentage of glass fiber was found to be 0.4%. Quarry dust has been widely used in structures since ancient times. The present study is aimed at utilizing waste Quarry dust (WQD) in construction industry itself as fine aggregate in concrete, replacing natural sand and also by adding the optimum percentage of glass fibers. The replacement is done partially and fully in the various proportions like 0%, 25%, 50%, 75% and 100% and its effect on properties of concrete were investigated. The optimum percentage of the concrete by adding 0.4% of glass fiber and the proportions was found to be 25%.

Keywords: Concrete, construction of structures, fibers.

INTRODUCTION

Concrete is a very strong and versatile moldable construction material. It consists of cement, sand and aggregate (e.g., gravel or crushed rock) mixed with water. The cement and water form a paste or gel which coats the sand and aggregate. When the cement has chemically reacted with the water (hydrated), it hardens and binds the whole mix together. The initial hardening reaction usually occurs within a few hours. It takes some weeks for concrete to reach full hardness and strength. Concrete can continue to harden and gain strength over many years. It is estimated that the present consumption of concrete in the world is of the order of 10-12 billion tones every year. Humans consume no material except water in such tremendous quantities. The ability of concrete to withstand the action of water without serious deterioration makes it an ideal material for building structures to control, store, and transport water. The ease with which structural concrete elements can be formed into a variety of shapes and sizes. This is because freshly made concrete is of a plastic consistency, which permits the material to flow into prefabricated formwork. After a number of hours, the formwork can be removed for reuse when

the concrete has solidified and hardened to a strong mass. It is usually the cheapest and most readily available material on the job.

LITERATURE SURVEY:

G.Balamurugan [7] et al., conducted the experimental study presents the variation in the strength of concrete when replacing sand by quarry dust from 0% to 100% in steps of 10%. From the test results it is found that the maximum compressive strength, tensile strength and flexural strength are obtained only at 50% replacement. This result gives clear picture that quarry dust can be utilized in concrete mixtures as a good substitute for natural river sand at 50% replacement with additional strength than control concrete.

Shrikant M. Harle [15]etal., conducted experimental study on behavior of steel and glass Fiber Reinforced Concrete Composites. The study conducted on Fiber Reinforced concrete with steel fibers of 0% and 0.5% volume fraction and alkali resistant glass fibers containing 0% and 25% by weight of cement of 12 mm cut length, compared the result.

M.IqbalMalik [13] et al., studied behavior of concrete beams reinforced with glass fiber reinforced polymer flats and observed that beams with silica coated Glass fiber reinforced polymer (GFRP) flats shear reinforcement have shown failure at higher loads. Further they observed that GFRP flats as shear reinforcement exhibit fairly good ductility. The strength of the composites, flats or bars depends upon the fiber orientation and fiber to matrix ratio while higher the fiber content higher the higher the tensile strength.

DeshmukhS.H [5] et al., conducted durability studies on glass fiber reinforced concrete. The alkali resistant glass fibers were used to find out workability, resistance of concrete due to acids, sulphate and rapid chloride permeability test of M30, M40 and M50 grade of glass fiber reinforced concrete and ordinary concrete. The durability of concrete was increased by adding alkali resistant glass fibers in the concrete. The experimental study showed that addition of glass fibers in concrete gives a reduction in bleeding. The addition of glass fibers had shown improvement in the resistance of concrete towards attack of acids.

Working Methodology

1. Literature collection
2. Procurement of materials
3. Material testing
4. Mix design
5. Conventional concrete casting
6. Casting of Curing
7. Testing
8. Comparison of results
9. Casting of beams
10. Curing
11. Testing of beams
12. Conclusion.

COMPRESSIVE STRENGTH TEST FOR CUBE

Description	No of Days	CC	% replacement of Quarry Dust with addition of 0.4% of glass fiber			
			25%	50%	75%	100%
Compressive Strength (N/ mm ²)	7	22.08	21.3	27.59	22.62	20.51
	28	32.54	34.82	40.55	36.08	28.14

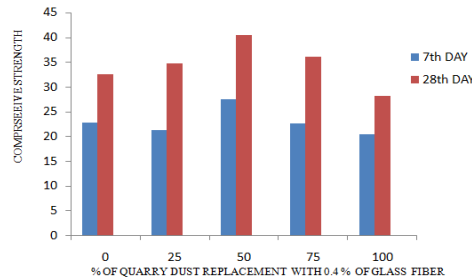


Fig1. Compressive strength of the concrete with addition of optimum percentage of glass fiber and replacement of quarry dust on 7th and 28th day.

Split Tensile Strength Test for Cylinder

Description	No of Days	CC	% of Glass Fiber			
			0.2%	0.4%	0.6%	0.8%
Split Tensile Strength (N/ mm ²)	7	2.12	1.69	3.53	3.09	3.11
	28	3.36	2.07	4.20	3.95	4.02

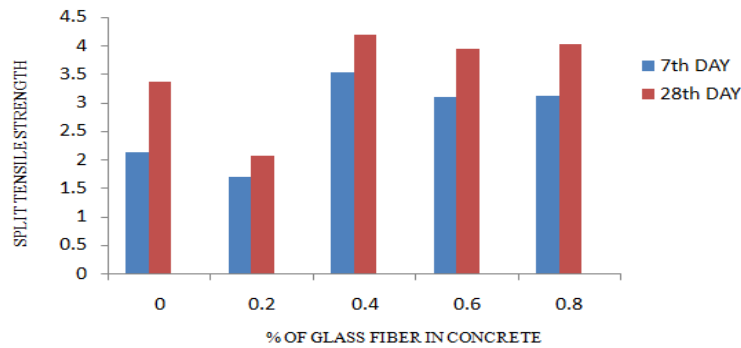


Fig. Split Tensile strength of the concrete with addition of optimum percentage of glass fiber on 7th and 28th day.

Flexural Strength Test for Prism

Description	No of Days	CC	% of Glass Fiber			
			0.2%	0.4%	0.6%	0.8%
Flexural Strength (N/ mm ²)	7	5.355	3.11	4.63	4.23	4.52
	28	6.07	4.2	4.9	4.5	4.86

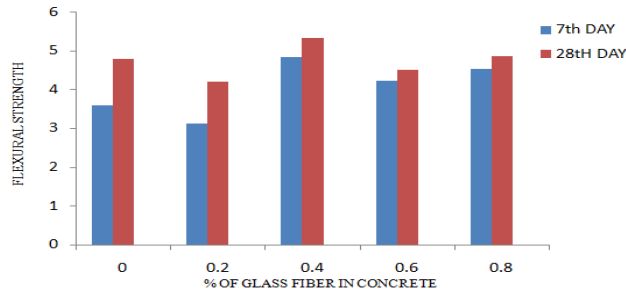


Fig. Flexural strength of the concrete with addition of optimum percentage of glass fiber on 7th and 28th day.

Comparison:

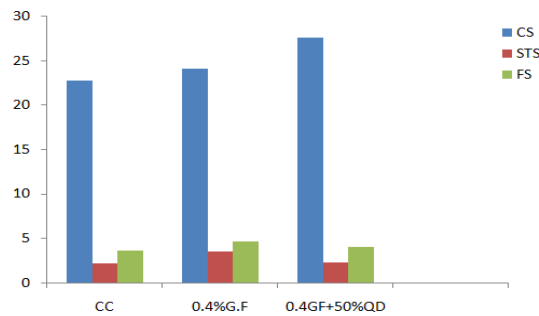


Fig. Comparison of optimum percentage of Glass fiber and Quarry dust with conventional concrete on 7th day

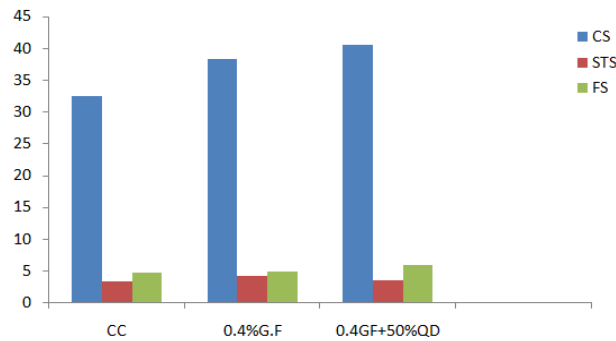


Fig. Comparison of optimum percentage of Glass fiber And Quarry dust with conventional concrete on 28th day

DISCUSSION OF THE RESULT

For Cubes, Cylinders and Prisms

1. The optimum percentage of replacement of fine aggregate in concrete with quarry dust was found to be 50% .
2. The optimum percentage of addition of glass fiber in concrete was found to be 0.4%.
3. While comparing the results, addition of the glass fiber has increased the split tensile strength than that in the conventional concrete. It increases about 30% with the addition of glass fiber.

CONCLUSIONS

CONCLUSION BASED ON TEST RESULTS

From the experimental studies the following conclusions are observed

1. The optimum percentage of replacement of fine aggregate in concrete with quarry dust was found to be 50% .
2. The optimum percentage of addition of glass fiber in concrete was found to be 0.4%.
3. While comparing the results, addition of the glass fiber has increased the split tensile strength than that in the conventional concrete. Split tensile strength increases by 40% with the addition of glass fiber.
4. The compressive strength was increased with the optimum percentage (50%) replacement of quarry dust in a glass fiber reinforced concrete. Compressive strength increases by 20% with the replacement of fine aggregate with quarry dust.
5. The flexural strength of concrete with replacement of fine aggregate was increasing, but decreased at certain percentage.
6. On use of quarry dust as replacement for fine aggregate the weight of concrete got reduced with increase in replacement.

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- [9] IS : 516 - 1959 (Reaffirmed 2004) (Methods of test for strength of concrete)

Conflict of Interest

None of the authors have any conflicts of interest to declare.

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