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An Experimental Investigation on Sisal Fibre Concrete Using Quartz powder as Partial Replacement of Cement

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Abstract- Concrete is weak in tension yet strong in compression. We will therefore provide the concrete reinforcement. The primary use of steel is as reinforcing. A lot of research is being done to find a substitute for this drug. Synthetic fibres were recommended by several research. The purpose of this study is to examine the properties of sisal fibre, a naturally occurring fibre that can be utilised in place of reinforcing material. The material is composed of powdered crushed quartz rock combined with water. These qualities make quartz the perfect material for use in building projects, where it can be utilised as insulation or as a raw material for cement. The quartz powder strengthens the concrete when it is applied. Quartz powder is substituted with cement to variable degrees (5%–20%). Destructive tests for 28, 56 and 90 days should be determined.

Keywords: Sisal fibre, Quartz Powder, Compressive Strength and Split tenile Strength.

1. INTRODUCTION

Concrete is a composite material made of coarse aggregate and fluid cement that hardens gradually. The most often used types of concrete are those like Portland cement concrete that are created with hydraulic or lime-based cements. For the time being, cement-based materials are the most crucial ones for building, and it's highly likely that they will continue to be so.

Quartz sand is particularly useful in the glue, paint, and concrete industries because of its special qualities. Using quartz sand increases the product's resistance to chemicals, including paint. Silicon and oxygen atoms are organised in an uninterrupted structure known as silicon-oxygen tetrahedra (SiO4) to form the igneous rock known as quartz. Each pair of tetrahedra shares an oxygen atom independently.

Natural fibres are being investigated by a number of researchers as potential building materials for concrete, mortar, and cement paste. The current study evaluates the compressive and tensile strengths of concrete using sisal fibres as reinforcement. Investigated is the effect of varied aspect ratios and fibre percentages on the compressive strength of concrete cube specimens in various configurations.

2. OBJECTIVES

1. To make the most use of the quarry powder in cement

2. To examine the mechanical properties, such as split tensile strength and compressive strength, of both regular concrete and fiber-reinforced concrete with additions of 0.5%, 1%, and 1.5% sisal fibre.

3. To gauge the strengths of the cylinders and cubes at 7 and 28 days and contrast them with ordinary concrete.

3. MATERIALS

a. Cement: The materials undergo grinding, mixing with clinker at a temperature between 1300 and 1500 °C, and burning in a specified ratio determined by their composition and purity. A nodule-shaped clinker is formed at this temperature when the ingredients partially fuse and sinter. Clinker is allowed to cool and ground into a fine powder after adding three to five percent gypsum. Using the previously outlined method, cement is the byproduct produced.

b. Fine Aggregate: Granular material classified as fine aggregate has particles so tiny they can pass through a 4.75mm screen. Aggregate is the granular material that is used to make mortar and concrete. It's a cheap material that's frequently utilised in the building industry to boost concrete volume. However, the size, density, and grading of zone two river sand fine aggregate should be fairly familiar to construction.

C.Coarse Aggregate: Usually, coarse aggregates are any particles larger than 0.19 inches; their diameters range from 3/8 to 1.5 inches. The remainder coarse aggregate,

which is mainly composed of gravel, is mainly composed of crushed stone.

d.Water: Water is one of the most important components of construction since it is needed, among other things, for curing activities, mixing cement concrete, and preparing mortar. The quality of water used in the construction process has a direct impact on the strength of the motor and cement concrete.

e.Quartz Powder: Almost always, quartz is inert when used as aggregate in concrete instead than as a fine powder to replace cement. It means it is unable to respond in normal situations. less reaction and a more manageable real problem. That, together with its hardness, is what makes concrete desirable.

f. Sisal fibre: Scientifically named as Agave sisalana, sisal fibre is a leaf fibre that is derived from the leaves of this plant. One kind of perennial shrub found worldwide in tropical and subtropical areas is the sisal plant. It is among the hard fibres that are farmed the most globally. It thrives in extremely tough soils that may not support the growth of typical plants.

4. RESULTS AND DISCUSSIONS

a. Compressive strength test: A 150 mm by 150 mm by 150 mm cube-shaped cast specimen is used for the compression strength test. After the cast specimen had fully cured in a water tank 28, 56 and 90 days, its strength was assessed.

Table 1: Compressive Strength Results By Adding 1% Hooked Steel Fibre Reinforced Concrete by Partial Replacement of 1 % Of GGBS

S.No	1.5% Of SF and % Of QP	Compressive Strength Results, N/mm²		
		28 days	56 days	90 days
1	0%	39.05	42.46	45.63
2	1.5% SF+5%QP	61.43	66.92	71.08
3	1.5% SF+10%QP	63.02	69.25	73.76
4	1.5% SF+15%QP	66.97	73.01	78.48
5	1.5% SF+20%QP	64.68	70.49	75.66

b, Split tensile Strength test: The split tensile strength of the cylindrical specimens (150 mm in diameter x 300 mm in height) was measured at 28, 56 and 90 days.

Table 2: Split Tensile Strength Results By Adding 1% Hooked Steel Fibre Reinforced Concrete by Partial Replacement of 1 % Of GGBS

S.No	1.5% Of SF and % Of QP	Split Tensile Strength Results, N/mm²		
		28 days	56 days	90 days
1	0%	3.86	4.19	4.51
2	1.5% SF+5%QP	5.29	5.75	6.18
3	1.5% SF+10%QP	5.51	6.01	6.43
4	1.5% SF+15%QP	5.87	6.42	6.87
5	1.5% SF+20%QP	5.74	6.25	6.71

5. CONCLUSIONS

1. The Normal Concrete of Compressive Strength results for 28, 56 and 90 days is 39.05, 42.46 and 45.63 N/mm².
2. The Normal Concrete of Split tensile Strength result is for 28, 56 and 90 days is 39.05, 42.46 and 45.63 N/mm².
3. By 1%SF and 15%QP the Compressive Strength results for 28, 56 and 90 days is 66.97, 73.01 and 78.48 N/mm².
4. By 1%SF and 15%QP the Split tensile Strength results for 28, 56 and 90 days is 5.87, 6.42 and 6.87 N/mm².

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