International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 10 Issue: 12 | Dec 2023 www.irjet.net p-ISSN: 2395-0072

MECHANICAL PROPERTIES OF SISAL FIBRE CONCRETE USING QUARTZPOWDER AS PARTIAL REPLACEMENT OF CEMENT

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Abstract- In tension, concrete is weak, yet in compression, it is strong. Thus, we shall give the concrete reinforcement. Steel is mostly utilised as reinforcement. Numerous studies are being conducted to identify an alternative to this substance. Numerous studies suggested synthetic fibres. In this study, we want to investigate the qualities of sisal fibre, a naturally occurring fibre that can be used as a substitute for reinforcement material. The substance is made of crushed quartz rock that has been powdered and mixed with water. Due to these characteristics, quartz is also the ideal material for use in construction projects, where it may be used as a raw material for cement or as insulation. When applied, the quartz powder makes the concrete more durable. Cement is used in place of quartz powder to varying degrees, ranging from 5% to 20%. To determine destructive testing for 7 and 28 days.

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

1. INTRODUCTION

Concrete is a composite material composed of gradually hardening fluid cement and coarse aggregate. The most popular varieties of concrete are those made with lime-based or hydraulic cements, such as Portland cement concrete. At the moment, cement-based materials are the most important ones for construction, and it's very possible that they will stay that way in the future.

Due to its unique properties, quartz sand is very helpful in the glue, paint, and concrete industries. Paint and other products become more chemical-resistant when quartz sand is used. The igneous rock known as quartz is composed of silicon and oxygen atoms arranged in a continuous structure called silicon-oxygen tetrahedra (SiO4). Every oxygen atom is shared by two tetrahedra separately.

Various researchers are looking at using natural fibres as building materials for cement paste, mortar, and concrete. Using sisal fibres as reinforcement, the current study assesses the compressive and tensile strengths of concrete. The impact of varying fibre percentages and aspect ratios on the compressive strength of concrete cube specimens in different combinations is investigated.

2. OBJECTIVES

1.To maximise the use of cement's quarry powder

2. To investigate the mechanical characteristics of standard concrete and fiber-reinforced concrete by adding 0.5%, 1%, and 1.5% sisal fibre, such as split tensile strength and compressive strength.

3. To measure the cubes' and cylinders' strengths at 7 and 28 days and compare them to regular concrete.

3. MATERIALS

a. Cement: After being pulverised and combined in precise ratios according to their composition and purity, the materials are burned in clinker at temperatures ranging from 1300 to 1500 °C. The components partially fuse and sinter at this temperature to produce nodule-shaped clinker. The clinker is cooled and ground into a fine powder with the addition of 3–5% gypsum. The result of using the previously indicated method is cement.

b. Fine Aggregate: A granular substance known as fine aggregate has particles so tiny they can fit through a 4.75mm screen. Aggregate is the term for the granular material used to make mortar or concrete. It is an inexpensive ingredient that is frequently used in the construction sector to increase the volume of concrete. However, you should be well aware of the grading zone two river sand, density, and size of the fine aggregate.

C.Coarse Aggregate: Coarse aggregates are defined as any particle larger than 0.19 inches; these particles usually have a diameter of 3/8 to 1.5 inches. Most of the remaining coarse aggregate, which is mainly composed of gravel, is crushed stone.

d.Water: Water is one of the most important building materials since it's needed for curing processes, mixing cement concrete, and preparing mortar, among other things. The quality of the water used during construction directly affects the strength of the motor and cement concrete.

e. Quartz Powder: Quartz is nearly always inert when used as aggregate in concrete as opposed to a fine powder to replace cement. It implies that it is incapable of responding in normal situations. less reaction and a genuine problem that is simpler to control. That's why concrete is attractive in addition to its hardness.

f. Sisal fibre: Sisal fibre is a type of leaf fibre that is taken from the leaves of the plant known by its scientific name, Agave sisalana. One kind of perennial shrub that thrives in tropical and subtropical climates worldwide is the sisal plant. It is among the hard fibres that are grown on a large scale worldwide. It thrives in extremely hardy soil types that are unsuitable for typical plant growth.

4. RESULTS AND DISCUSSIONS

a. Compressive strength test: A cube-shaped cast specimen of 150 mm by 150 mm by 150 mm is used for the compression strength test. Seven and twenty-eight days after the cast specimen had finished curing in a water tank, its strength was assessed.

Table 1: Compressive Strength Results by Adding 1.5% Sisal Fibre Reinforced Concrete by Partial Replacement of different % of Quartz Powder

S.No	1.5% Of SF and % Of QP	Compressive Strength Results, N/mm²	
		7 days	28 days
1	0%	27.25	39.05
2	1.5% SF+5%QP	42.32	61.43
3	1.5% SF+10%QP	43.46	63.02
4	1.5% SF+15%QP	46.81	66.97
5	1.5% SF+20%QP	45.21	64.68

b, Split tensile Strength test: The cylindrical specimens (150 mm in diameter x 300 mm in height) were subjected to split tensile strength tests at 7 and 28 days of age.

Table 2: Split Tensile Strength Results By Adding 1.5% Sisal Fibre Reinforced Concrete by Partial Replacement of different % Of Quartz Powder

S.No	1.5% Of SF and % Of QP	Split Tensile Strength Results, N/mm²	
		7 days	28 days
1	0%	2.52	3.86
2	1.5% SF+5%QP	3.54	5.29
3	1.5% SF+10%QP	3.68	5.51
4	1.5% SF+15%QP	3.73	5.87
5	1.5% SF+20%QP	4.04	5.74

5. CONCLUSIONS

1. The Normal Concrete of Compressive Strength result for 7 and 28 days is 27.25 N/mm² and 39.05 N/mm².
2. The Normal Concrete of Split tensile Strength results is for 7 and 28 days is 2.52 N/mm² and 3.86 N/mm².
3. By 1%SF and 15%QP the Compressive Strength results for 7 and 28 days is 46.81 N/mm² and 66.97 N/mm².
4. By 1%SF and 15%QP the Split tensile Strength results for 7 and 28 days is 3.73 N/mm² and 5.87N/mm².

6. REFERENCES

[1] K. V. Sabarish.,Strength And Durability Evaluation Of Sisal Fibre Reinforced Concrete, International Journal of Civil Engineering and Technology,8(9),(2017),pp. 741–748.

[2] J. Sree Naga Chaitanya, Performance on Jute Fiber Reinforced Concrete with Admixtures and the Replacement of Fine Aggregate by Moorum Soil, International Journal for Multidisciplinary Research,4(4),(2022),590-595.

[3] Alaa M. Rashad Effect of quartz-powder on the properties of conventional cementitious materials and geopolymers 13 May 2018

[4] J. Sree Naga Chaitanya, Dr.K. Chandramouli, N.Pannirselvam, M.Priyanka Experimental Investigation on Jute Fibre Concrete with Partial Replacement of Cement with Alccofine and Metakaolin Using M30 Grade of Concrete 8(4)(2021),591-594.

[5] Romildo Dias Toledo Filho, Kuruvilla Joseph and Khosrow Ghavami (1999) The use of sisal fibre as reinforcement in cement based composities.

[6] Patrick Oguguo Nwankwo, Emmanuel Achuenu (2014), "Compressive Behaviour of Sisal Fibre Reinforced Ternary Concrete at Elevated Temperatures", International Journal of Advancements in Research & Technology, ISSN 2278-7763, Volume 3, Issue 8, pp 123 -131.

[7] Evgenii I.Klabunovskii Mineralogy and mineral chemistry of quartz SEPTEMBER 28 2021 Can Enantiomorphic Crystals Like Quartz Play a Role in the Origin of Homochirality on Earth 5 Jul 2004 (1of 2)

[8] Ganesh R Kalagi, Dr. Rajashekar Patil, Narayan Nayak, M. Ambarish, HN. Mayura, MK. Niranjan, Kishor Kumar Aroor, V. Karthik, Ananth Mohan Mallya and Sunil Kumar Shetty. Experimental Study on Damping Properties of Sisal/Flax Fibre Reinforced Composite Material. International Journal of Mechanical Engineering and Technology, 8(2), 2017, pp. 70–81.

[09] J. Sree Naga Chaitanya, Dr. K. Chandramouli, Sk. Sahera, Dr. D. Vijayakumar, Shaik. Siddaiah. Investigation On Hooked Steel Fiber Reinforced Concrete With Partial Replacement Of Cement With Dolomite, International Journal Of Progressive Research In Engineering Management And Science,3(5),92023),Pp : 766-771 .

[10] J.Sree Naga Chaitanya, Dr.K.Chandramouli, Sk.Sahera, G. Sai Teja Reddy. An Experimental Investigation On Pineapple Leaf Fibre Concrete By Using Zeolite Powder And Dunite Powder As Partial Replacement Cement, International Journal of Creative Research Thoughts, 11(6),(2023),pp:d186-d189.

[11] Benhassaine, A., 1999a. Grinding and pozzolanic reactivity of quartz powders. Powder Technol. 105, 167–171 .

[12] F. Silva and Dr. R. D. T. Filho (2004) Sisal fibre reinforcement of durable thin walled structures– A new perspective.

[13] Dr. K.Chandramouli, J. Sree Naga Chaitanya, Dr.N.Pannirselvam, G.Jayasurya. Experimental Study on Papercrete Concrete. Vol. 8, Issue 7, July 2021.