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EXPERIMENTAL INVESTIGATIONON CONCRETE WITH DOLOMITE POWDER AND COIR FIBER

[1]J.SREE NAGA CHAITANYA, [2] DR.K.CHANDRAMOULI, [3]SK.SAHERA ,[4]P GOPI

[1,3] Assistant Professor,[2]Professor & HOD,[4]B. Tech Student
[1,2,3,4] Department of Civil Engineering, NRI Institute of Technology, Visadala (V), Medikonduru (M), Guntur, Andhra Pradesh, INDIA.
Email: koduru_mouli@yahoo.com jarugumillichaitanya1989@gmail.com

ABSTRACT

A crucial component of building, concrete is a composite made mostly of cement, particles, and water.Because of its strength and adaptability, it is essential for infrastructure.For the intended workability and durability, mix design is essential.Modern construction methods are based on the extensive use of concrete worldwide.This study examines adding coir fibers to concrete and partially substituting dolomite powder for cement.A readily accessible mineral, dolomite has the potential to be a sustainable supplemental cementitious material that lowers cement usage and the related environmental impact. Concrete's innate brittleness is addressed by adding coir fiber, a natural and renewable resource, to increase the material's tensile strength and resistance to cracking.In order to maximize mechanical qualities, the study investigates different percentages of coir fiber (by total concrete weight) and dolomite (by cement weight).Compressive strength and split tensile strength are among the parameters that are assessed.Compressive and split tensile strengths should be tested after 28, 56, and 90 days.

***KEYWORDS:**Dolomite, Coir Fiber,sustainable,Compressive strength and Split tensile strength*

1. INTRODUCTION

Concrete, a synthetic material that resembles rock, is the most widely used building material in the world in terms of volume.Its composition is primarily composed of cement, water, and fine and coarse aggregates; admixtures are commonly used to alter its properties.Concrete's allure stems from the hydration process, in which cement and water react chemically to form a solid, binding paste that envelops the particles.This paste hardens and strengthens with time, producing a composite that is durable and versatile.Its widespread use can be attributed to its exceptional compressive strength, fresh moldability, and affordable price.The foundation of modern infrastructure is concrete, which has an impact on the built environment all over the world through everything from enormous bridges and tall skyscrapers to ordinary pavements and house foundations.

Dolomite powder is a naturally occurring mineral that is made by crushing and grinding dolomite rock.CaMg(CO3)2, a double carbonate of calcium and magnesium, is its ideal formula.It typically appears as a fine, white powder with a light color.Because of its unique chemical and physical properties, it is widely employed in a wide range of sectors, including steel, glass, construction, and agriculture.As a helpful source of essential nutrients including calcium and magnesium, it is widely known for its ability to regulate pH levels in acidic soils.

The purpose of adding coir fiber to concrete is to improve its mechanical qualities, specifically its resistance to cracking and tensile strength.By adding ductile coir fibers, a fiber-reinforced composite is produced, overcoming the intrinsic weakness of concrete in tension and susceptibility to brittle failure.The toughness and flexural strength of the concrete are increased by these fibers' ability to bridge microcracks and stop them from spreading.This environmentally friendly method makes use of a plentiful natural resource and provides a more pliable and less brittle concrete framework for a range of building uses.

2. OBJECTIVES

1. To improve the compressive and tensile strength of concrete, find the ideal percentage of dolomite powder to use in place of some of the cement.

2. Examine the effects of different coir fiber doses and lengths on the mechanical characteristics of concrete, particularly its toughness and flexural strength.

3. Examine how adding coir fiber and using dolomite powder in place of cement affects the longevity of concrete, particularly its capacity to withstand abrasion and water absorption.

3. MATERIALS

3.1. Cement: Cement is a finely ground binding substance that is mostly used to make concrete and mortar.It solidifies when mixed with water, bringing together aggregates like sand and gravel to form strong, long-lasting constructions.Cement, which is made of limestone, clay, and other minerals, is essential to the stability and durability of buildings and infrastructure.

3.2 Fine aggregate: Fine aggregate is a construction material made up of tiny particles that can fit through a 4.75 mm sieve. It is generally sand or crushed stone.

3.3 Coarse aggregate: Larger particles like broken stone or gravel that are trapped on a 4.75 mm screen make up coarse aggregate, a crucial building material.It contributes bulk, strength, and long-term durability by establishing the structural foundation of concrete mixtures.The overall strength and load-bearing capacity of a structure are greatly enhanced by this component.

3.4 Water: In a number of construction processes, such as mixing cement, making mortar, and curing, water is an essential ingredient.The total performance of the construction is impacted by the water quality since it directly affects the strength and longevity of mortar and cement concrete.

3.5Dolomite Powder: It is typically found as an off-white or white powder. Due to its unique composition and properties, this adaptive material finds widespread use in a variety of industries, including steel manufacturing, glass production, agriculture (using it as a soil conditioner to alter pH levels and supply nutrients), and construction (using it as an aggregate or filler).

3.6 Coir Fibre: Coir fiber is used as a natural reinforcement in concrete to improve its mechanical qualities, particularly its resistance to cracking and tensile strength.

4. EXPERIMENTAL RESULTS

4.1 Compressive strength

The minimum compressive strength of a cubes is represented as the cube of compressive strength (15 cm x 15 cm x 15 cm). The concrete specimens are typically evaluated between the ages of seven and twenty-eight days. The cubes are usually assessed after 28,56 and 90days.

Table 1: Compressive strength results of concrete with Dolomite powder used as a partial replacement for cement.

Sl.no	% of Dolomite Powder	Compressive Strength Results, N/mm^2		
		28 days	56 days	90 days
1	0%	39.74	42.91	46.08
2	3%	41.19	44.49	47.75
3	6%	42.37	45.76	49.14
4	12%	43.89	47.42	50.92
5	15%	45.08	48.69	52.29
6	18%	41.62	44.94	48.31

Table 2: Compressive strength results of Coir fiber added by weight of concrete.

Sl.no	% of Coir Fiber	Compressive Strength Results, N/mm^2		
		28 days	56 days	90 days
1	0%	39.74	42.91	46.08
2	1%	40.53	43.77	47.12
3	2%	40.98	44.25	47.53
4	3%	42.89	46.32	49.84
5	4%	42.11	45.46	48.73

Table3: Combined Compressive strength of Coir fiber concrete with Dolomite Powder.

Sl.no	Combined Replacement(s)	Compressive Strength Results, N/mm^2

		28 days	56 days	90 days
1	0%	39.74	42.91	46.08
2	15 % of Dolomite+ 3 % of coir fibers	46.68	50.43	54.25

4.2 Split tensile strength

A load is applied along a horizontal cylindrical specimen until failure occurs to estimate the material's split tensile strength, which is a measurement of its resistance to tension. Because it replicates the tensile stresses that exist in structural parts, this test is essential for assessing the tensile characteristics of concrete. Better durability and resistance to cracking in concrete constructions for 28,56 and 90 days.

Table 4: Split tensile strength results of concrete with Dolomite powder used as a partial replacement for cement.

Sl.no	% of Dolomite Powder	Split tensile Strength Results, N/mm^2		
		28 days	56 days	90 days
1	0%	3.87	4.19	4.48
2	3%	4.07	4.35	4.72
3	6%	4.21	4.54	4.89
4	12%	4.38	4.73	5.08
5	15%	5.04	5.46	5.84
6	18%	4.16	4.49	4.83

Table 5: Split tensile strength results of Coir fiber added by weight of concrete.

Sl.no	% of Coir Fiber	Split tensileStrength Results, N/mm^2		
		28 days	56 days	90 days
1	0%	3.87	4.19	4.48
2	1%	4.05	4.38	4.71
3	2%	4.18	4.52	4.84
4	3%	4.63	5.01	5.37
5	4%	4.21	4.54	4.89

Table6: Ccombined Split tensile strength of Coir fiber concrete with Dolomite Powder.

Sl.no	Combined Replacement(s)	Split tensile Strength Results, N/mm^2		
		28 days	56 days	90 days
1	0%	3.87	4.19	4.48
2	15 % of Dolomite+ 3 % of coir fibers	5.41	5.84	6.27

5. CONCLUSION

1. The normal concrete compressive strength results for 28, 56 and 90 days is 39.74, 42.91 and 46.08 N/mm^2.
2. At 15% partial replacement of cement with dolomite powder which gives compressive strength result for 28, 56 and 90 days is45.08, 48.69 and 52.29N/mm^2.

3. At 3% addition of coir Fibre to concrete then the compressive strength result for 28, 56 and 90 is 42.89, 46.32 and 49.84 N/mm^2.
4. Compressive strength result for combined replacement of 15% dolomite powderfor cement and 3% coir fiber is addition to concrete for 28, 56 and 90 days is 46.68, 50.43 and 54.25 N/mm^2.
5. The normal concrete split tensile strength result for 28, 56 and 90 days is 3.87, 4.19 and 4.48 N/mm^2.
6. At 15% partial replacement of cement with dolomite powder which gives split tensile strength result for 28, 56 and 90 days is 5.04, 5.46 and 5.84N/mm^2.
7. At 3% addition of coir fiber to concrete then the split tensile strength result for 28, 56 and 90 days is 4.63, 5.01 and 5.37 N/mm^2.
8. Split tensile strength result for combined replacement of 15% dolomite powder for cement and 3% coir fiber is addition to concrete for 28, 56 and 90 days is 5.41, 5.84 and 6.27 N/mm^2.

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