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An Experimental Investigation on Properties of Concrete by Partial Replacement of Cement with Dolomite Powder by using Abaca Fibre

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Abstract: *With the increased demand for cement around the world, there is a strong need to find alternatives to cement in concrete. The introduction of a new alternative reduces CO2, a key greenhouse gas. Scientists are conducting research all over the world in order to uncover various material possibilities. River sand is extracted from riverbeds and utilized to build homes and enormous infrastructure to suit population expansion needs. Globalization and modern technology, which are required to fulfill the needs of the global economy both domestically and globally, have become a major concern in the preservation of river sand, which is utilized as a fine aggregate in concrete production. A small trial is carried out in this study to adjust the characteristics of concrete by partially replacing cement with dolomite powder. In this study a small trial is done to modify the properties of concrete by partial replacement of cement with dolomite powder with different percentages 0%,6%,12%,18% and fine aggregate with abaca fiber is varied different percentages of 0%,0.25%,0.5%,1% Different tests are done to determine Compressive and split tensile strength of concrete. All the specimens are used for 28,56 &90 days and tested for compressive and split tensile strength.*

Keywords: Dolomite powder, Abaca fiber, compressive and split tensile strength

I. INTRODUCTION

The interest for concrete is next just to water with the progression of innovation and expanded field of utilization of cement and mortars, different properties of the common cement required alteration to make it progressively appropriate for different circumstances, prudent and eco-friendly. This has prompted the utilization of cementation materials. The utilization of dolomite and crushed sea shell in part supplanting the total concrete in solid out comes in decrease of cement utilized, decrease in the emission ofcarbon dioxide (Co2), and preservation of existing assets alongside the upgrade in the quality and strength properties of concrete. Dolomite is a calcium magnesium carbonate mineral with the formula CaMg (CO3)2. The phrase also refers to a sedimentary carbonate rock that is primarily formed of the mineral dolomite. Dolostone is another name for the dolomite rock type. Dolomite is used as a decorative stone, a concrete aggregate, a magnesium oxide source, and in the manufacturing of magnesium. Dolomiteis sometimes used as a flux for the smelting of iron and steel when calcite limestone is unavailable or too expensive. The manufacturing of float glass requires a large amount of processed dolomite. Abaca is a vegetable leaf fiber. The abaca fiber is extracted from the leaf stalks of the plant. Abaca is also known as Manila hemp. Its appearance is similar to the banana plant, but itis completely different in its properties and uses. Abaca fibers are extensively used to produce ropes, woven fabrics, tea bags, filter paper and banknotes.

II. OBJECTIVES

The objectives of this study are as follows

1. To optimize the usage of cement with dolomite powder.
2. To optimize the usage of Abaca Fiber
3. To evaluate the compressive and spilt tensile strength test.

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III. MATERIALS

The properties of cement are presented in Table 1.

Table 1: Physical properties of cement

S. No.	Property	Cement (53 grade)
1	Specific gravity	3.14
2	Fineness	10%
3.	Bulk density	1440 N/mm^2

3.1 Dolomite Powder

Dolomite is a hydrous carbonate mineral compose of calcium magnesium carbonate, ideally $CAMg(CO_3)_2$.The term is also used for a sedimentary carbonate rock composed mostly of the Mineral dolomite. The mineral dolomite crystallizes in the trigonal- rhombohedral system. It Forms white, tan, grey, or pink crystals. Dolomite is a double carbonate, having an alternating Structural arrangement of calcium and magnesium ions.Unless it is in fine powder form, It does not rapidly dissolve.

3.2 Abaca Fiber:

The challenge of Abaca fiber waste management involves utilizing Abaca fiber as construction materials in concrete. The abaca fiber was utilized as partial or total replacement of fine and coarse aggregates in concrete. This paper is a literature review of abaca fiber on aggregate in concrete. Abaca fiber has the potential to develop as alternative material based on chemical, physical and thermal properties. Abaca is one of natural fiber that has high mechanical properties because supported by the architecture of its cell walls. The mechanical properties of abaca fiber is very influenced by the cell walls structure, cellulose, hemi cellulose and lignin composition carbonate.

IV. EXPERIMENTAL INVESTIGATIONS

4.1 Compressive Strength Results

The compressive strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in table 2 to 4.

Table 2: Compressive strength of concrete with Dolomite as partial replacement of cement in concrete

Sl. No	Dolomite	28 days N/mm^2	56 days N/mm^2	90 days N/mm^2
1	0%	39.64	43.17	46.12
2	6%	41.86	45.61	48.93
3	12%	43.79	47.72	51.17
4	18%	42.67	46.84	49.87

Table 3: Compressive strength of concrete with addition of Abaca fibres

Sl. No	Abaca fibres	28 days N/mm^2	56 days N/mm^2	90 days N/mm^2
1	0%	39.64	43.17	46.12
2	0.25%	44.26	48.22	51.70
3	0.5%	46.82	51.27	55.03
4	1%	40.99	44.88	48.08

Table 4: Compressive strength of Concrete Dolomite and Abaca fibre

Sl. No	Dol + AF	28 days	56days	90 days
1	0%	39.64	43.17	46.12
2	12%Dol +0.5%AF	48.89	53.48	57.33

4.2 Split Tensile Strength Results

The split tensile strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in table 5 to 7.

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Table 5: Split tensile strength of concrete with Dolomite as partial replacement of cement in concrete.

Sl. No	Dolomite	28 days N/mm^2	56 days N/mm^2	90 days N/mm^2
1	0%	3.91	4.25	4.60
2	6%	4.09	4.44	4.75
3	12%	4.55	4.97	5.38
4	18%	4.15	4.49	4.84

Table 6: Split Tensile strength of concrete with addition of Abaca fibres: -

Sl. No	Abaca fibres	28 days N/mm^2	56 days N/mm^2	90 days N/mm^2
1	0%	3.91	4.25	4.60
2	0.25%	4.19	4.56	4.87
3	0.5%	5.33	5.77	6.34
4	1%	2.64	2.87	3.06

Table 7: Split tensile strength of Concrete Dolomite and Abaca fibre

Sl. No	Dol + AF	28 days	56days	90 days
1	0%	3.91	4.25	4.60
2	12%Dol +0.5%AF	5.64	6.15	6.67

V. CONCLUSION

In this study, the concrete ingredients like cement and fine aggregate are partially replaced by Dolomite powder and Abaca fibre respectively. Abaca fibre are varied different percentages of 0%,0.25%,0.5%,and 1% and dolomite powder is varied with different percentages like 0%,6%,12%,and 18%.

- At 12% replacement of cement by dolomite the achieved compressive strength of concrete at 28, 56 & 90 days is43.79N/mm^2,47.72N/mm^2,51.17 N/mm^2.
- At 12% replacement of cement by dolomite the achieved Split strength of concrete at 28, 56 & 90 days is4.55 N/mm^2,4.97N/mm^2,5.38N/mm^2.
- At 0.5% replacement of Abaca fibre the achieved compressive strength of concrete at 28, 56 & 90 days is 46.82 N/mm^2,51.27N/mm^2,55.03N/mm^2.
- At 0.5% replacement of Abaca fibre the achieved split tensile strength of concrete at 28, 56 & 90 days is 5.33N/mm^2,5.77N/mm^2,6.34N/mm^2.
- By the combination of 12% Dolomite +0.5%Abaca fiber the compressive strength of concrete at 28,56 and 90 days are 48.89N/mm^2,53.48N/mm^{2}and57.33 N/mm^2.
- By the combination of 12% Dolomite +0.5% Abaca fiber the Split tensile strength of concrete at 28,56 and 90 days are 5.64N/mm^2,6.15N/mm^{2}and6.67 N/mm^2.

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