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# Experimental Investigation on Aramid Fiber Reinforced Concrete with Partial Replacement of Cement by Dolomite Powder

Muhammed Mannan[1], Ramya B V[2]

[1]*PG. Student, Department of Civil Engineering, Bapuji institute of Engineering and Technologydavanagere, Karnataka, India*

[2]*Assistant professor, Department of Civil Engineering, Bapuji institute of Engineering and Technologydavanagere, Karnataka, India*

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**ABSTRACT**:Cement, fine aggregate and coarse aggregate are the main constituent of the concrete. The properties of concrete depend on the properties of constituents. The use of ingredients may increase the cost of concrete. The industries produced the waste which cause pollution. Sometime production of cement cause emission of carbon dioxide which will leads to pollution. Therefore waste products obtained from the industries can be used as replacement materials in the concrete instead of dumping and causing environment pollution. The dolomite powder has similar characteristics of cement therefore it is used as replacement material in concrete. The dolomite powder replacement percentage is 0%, 5%, 10%, 15% and 20% to the weight of cement.The specimens with the replacement materials at different percentage were prepared and compared with conventional specimen. The test results of compressive strength, split tensile strength and flexural strength indicates the strength of concrete.

**KEYWORDS:**Cement, fine aggregates, coarse aggregate, dolomite powder, harden strength, and aramid fiber.

## I. INTRODUCTION

Concrete is the basic civil engineering material which is used in most of the civil Engineering structures. Many materials are used to manufacture the concrete. The main constituents of concrete are cement, fine aggregate, coarse aggregate, mineral admixtures, chemical admixture and water. Industrialization improves the living standards of the people with various industries gives employment to the people. In another way industries produced waste products. The waste products are dumping over the useful land which sometime cause unhealthy environment. Instead of damping some solids wastes can be reused in various applications. This can be used as alternative material for various application in day to day life.

Some by products obtained from the industry which is also used as construction material. By the use of that product in construction reduced cost of construction also improve certain strength. Therefore in this study used dolomite powder as partial replacement materials in concrete. There placement ingredient is used at different percentage to the weight of cement, fine aggregate and coarse aggregate. The strength of concrete with replacement materials is compared with conventional concrete which indicates strength of concrete at different replacement percentage.

## II. OBJECTIVES

1. To review the harden strength of concrete by replacing cement by dolomite powder.
2. To review the consequence of dolomite powder on concrete strength parameters.
3. To determine the optimum substitution proportion of dolomite powder in concrete mix.
4. To understand the characteristics of dolomite powder and prepared mix design for M30 grade concrete.

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## III.MATERIAL USED

### 3.1Cement

OrdinaryPortlandcementof43 gradeisused.

**Table-3.1:**Propertiesofcement

| Physicalproperti | Values |
|---|---|
| Specificgravity | 3.15 |
| Fineness | 3.2% |
| Initialsettingtime | 40min |
| Final settingtime | 620min |
| Consistency | 34% |

### 3.2Fineaggregate

The manufacturesand is usedas afine aggregatein thisexperimentalwork.

**Table-3.2:**Propertiesoffine aggregate

| Physicalproperties | Values |
|---|---|
| Specificgravity | 2.70 |
| Finessemodulus | 3.08 |
| Bulkdensity | 1.7g/cm$^3$ |
| zone | II |
| Waterabsorption | 0.5% |

### 3.3Coarseaggregate

Themaximumsizeof20mmoflocallyavailablecoarse aggregateusedinthisstudy.

**Table-3.3:**Propertiesofcoarseaggregates

| Physicalproperties | Values |
|---|---|
| Specificgravity | 2.85 |
| Finenessmodulus | 6.15% |
| Bulkdensity | 1.60g/cm$^3$ |
| Waterabsorption | 1.06% |
| zone | II |

### 3.4Dolomitepowder

A whiteamorphousfreefrom grit and visibleimpuritiesof size300microndolomitepowderused ascementinthisexperimentalwork.

**Table-3.4:**Propertiesofdolomitepowder

| Physicalproperties | Values |
|---|---|
| Formula | $CaMg(CO_2)_3$ |
| Appearance | White |
| Specificgravity | 2.85 |
| Bulkdensity | 2.09g/cm$^3$ |
| Moisturecontent | Nil |

### 3.5Aramidfibers

Ayellowcolour paraaramidfibersareused inthis experimental work.Aconstantof0.25%offiber usedforavolumeofconcrete throughout the experimentalwork.

### 3.6Superplasticizer

A conplastSP430superplasticizer usedinthisexperimentalwork.

### 3.7Water

The water which is used for making concrete should be clean and free from impurities like Organic,oil, alkalis, acids etc. Waterwhichwasusedformakingconcreteshouldhave PHbetween6to 8.Locallyavailabledrinkingwaterused inthis work.

Dolomite powder

Aramid fiber

## IV.METHODOLOGY

Themethodologyofthisexperimentalworkis representedinbelow.

- Collectionof materials
- conductingpreliminarytestsonmaterials
- MixdesignforM30gradeofconcreteas perIS10262:2019
- Calculating quantity of materials for cubes,cylinders,beams
- Casting a specimens a n d placing for curingat7daysand28days
- testingof specimens
- Results
- Conclusions

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**Table-4:** Mix design details

| **MIX DESIGN FOR M30 GRADE OF CONCRETE AS PER IS 10262-2019 MIX PROPERTION(1:1.74:3.1)** | | | | | |
|---|---|---|---|---|---|
| **Cement kg/m3** | **Water kg/m3** | **Fine aggregate kg/m3** | **Coarse aggregate kg/m3** | **Chemical admixture kg/m3** | **W/C ratio** |
| 380 | 175 | 664 | 1178 | 3.8 | 0.44 |

## V.RESULT AND DISCUSSION

### 5.1 Compressive Strength Test Results

By replacing substitution ingredients with respect to main ingredients at different percentage for 3 specimens. Following test results for 7days and 28days are obtained.

**Table 5.1: Dolomite powder compressive strength test results**

| **Percentage (%)** | **Strength (N/mm$^2$)** | | | |
|---|---|---|---|---|
| | **7 days** | **Average** | **28 days** | **Average** |
| 00 | 23.02 | 22.79 | 37.11 | 37.60 |
| | 22.91 | | 38.44 | |
| | 22.45 | | 37.26 | |
| 05 | 22.66 | 23.03 | 38.29 | 38.70 |
| | 22.45 | | 39.20 | |
| | 24.00 | | 38.63 | |
| 10 | 24.55 | 24.83 | 40.43 | 39.85 |
| | 24.86 | | 40.01 | |
| | 25.10 | | 39.10 | |
| 15 | 22.79 | 22.17 | 35.77 | 35.80 |
| | 22.11 | | 35.43 | |
| | 21.63 | | 36.20 | |
| 20 | 21.77 | 21.17 | 31.12 | 32.01 |
| | 20.30 | | 32.40 | |
| | 21.46 | | 32.53 | |

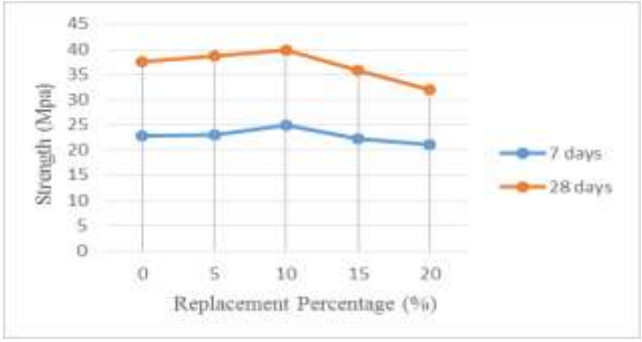


**Fig 5.1: Dolomite powder compressive strength test results**

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**5.2 Split tensile strength test results**

By replacing substitution ingredients with respect to main ingredients at different percentage for 3 specimens. Following test results for 7days and 28days are obtained.

**Table 5.2: Dolomite powder split tensile strength test results**

| Percentage (%) | Strength ($N/mm^2$) | | | |
|---|---|---|---|---|
| | 7 days | Average | 28 days | Average |
| 00 | 2.69 | 2.45 | 3.26 | 3.23 |
| | 2.27 | | 3.22 | |
| | 2.41 | | 3.21 | |
| 05 | 2.55 | 2.59 | 3.35 | 3.34 |
| | 2.69 | | 3.34 | |
| | 2.53 | | 3.32 | |
| 10 | 2.98 | 2.87 | 3.58 | 3.62 |
| | 2.69 | | 3.64 | |
| | 2.95 | | 3.66 | |
| 15 | 2.55 | 2.34 | 3.45 | 3.47 |
| | 2.27 | | 3.49 | |
| | 2.20 | | 3.48 | |
| 20 | 2.20 | 2.22 | 3.36 | 3.35 |
| | 2.25 | | 3.35 | |
| | 2.23 | | 3.37 | |

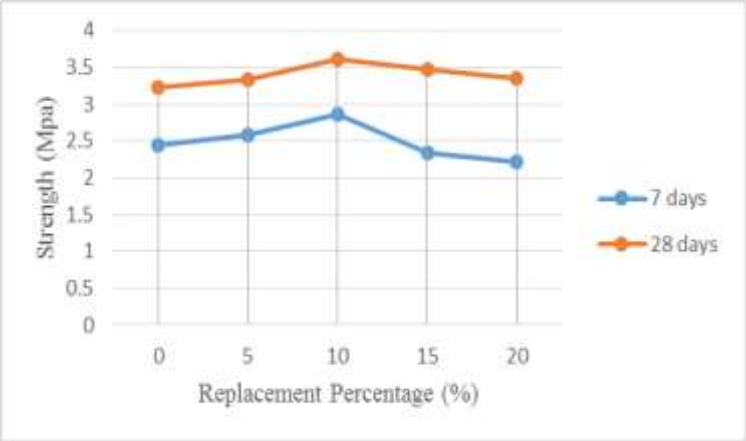


**Fig 5.2: Dolomite powder split tensile strength test results**

**5.3 Flexural strength test results**

By replacing substitution ingredients with respect to main ingredients at different percentage for 3 specimens. Following test results for 7days and 28days are obtained.

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**Table 5.3: Dolomite powder flexural strength test results**

| Percentage (%) | Strength (N/mm$^2$) | | | |
|---|---|---|---|---|
| | 7 days | Average | 28 days | Average |
| 00 | 4.76 | 4.76 | 7.97 | 7.97 |
| | 4.77 | | 7.98 | |
| | 4.76 | | 7.98 | |
| 05 | 5.20 | 5.23 | 8.15 | 8.15 |
| | 5.23 | | 8.12 | |
| | 5.26 | | 8.18 | |
| 10 | 5.38 | 5.39 | 8.35 | 8.37 |
| | 5.40 | | 8.39 | |
| | 5.41 | | 8.37 | |
| 15 | 5.14 | 5.18 | 8.10 | 8.11 |
| | 5.20 | | 8.12 | |
| | 5.22 | | 8.12 | |
| 20 | 4.77 | 4.77 | 7.89 | 7.90 |
| | 4.75 | | 7.92 | |
| | 4.80 | | 7.90 | |

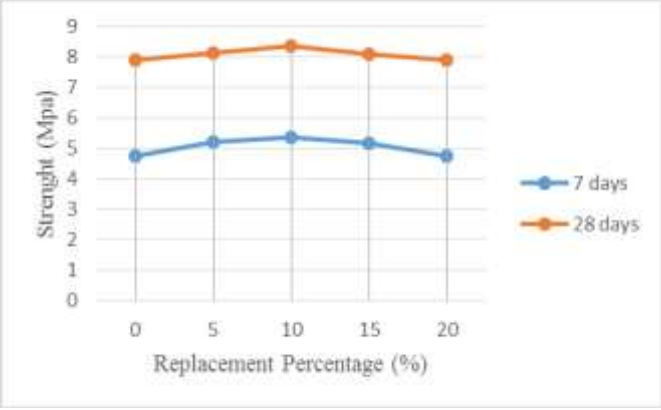


**Fig 5.3: Dolomite powder flexural strength test results**

## VI. CONCLUSION

Experimental investigation is done by substituting the dolomite powder. After the experimental investigation the above results are obtained. From the above results following conclusion are derived which is listed below.

1. The substitution of cement by dolomite powder increase the concrete strength at certain proportion.
2. The optimum substitution percentage is obtained when dolomite is 10% and 90% cement.
3. At 10% replacement the maximal increment in the 28$^{th}$ day compression, split and flexural strength were found to be 5.98%, 12.07% and 5.09% correspondingly
4. Cost of the dolomite powder is less than cement hence dolomite powder decrease the cost of concrete as well as pollution.

5. The industrial by products can be used as replacement materials in the concrete effectively without any hazardous

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