International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 9 Sep 2021, pp: 1741-1747 www.ijaem.net ISSN: 2395-5252

Experimental Investigation of Aramid Fiber Reinforced Cocncrete with Partial Replacements of Fine Aggregate by Dolomite Powder

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Submitted: 15-09-2021 Revised: 25-09-2021 Accepted: 28-09-2021

ABSTRACT:Concrete is the component which makes the civil activities ease. Cement, fine aggregate, and coarse aggregate are the key constituent of the concrete. The properties of concrete depends up on the what type of constituents are used. In this present study the using of industry product is intended. The addition of aramid fiber to reinforce the concrete. Dolomite powder is used as a partial replacements of fine aggregates. The dolomite powder is replaced at required portions for the requirement with constant addition of aramid fiber. The elements with the replacement materials at different percentage were prepared and compared with conventional elements. The ideal replacement of fine aggregate by dolomite powder is obtained by observing the hardened properties of the concrete elements at 10%, 20%, 30%, and 40% of replacements

KEYWORDS: Concrete, Fine aggregate, Coarse aggregate, Dolomite powder, Partial replacement.

I. INTRODUCTION

Concrete which is considered one of the important universally used for the construction in the Civil Engineering activities as material. The plain concrete is brittle in nature. One of the most heinous characteristic of plain concrete is having low tensile strength due to its brittle complex. As a result, it was necessary to reinforce the concrete structure with continuous Steel bar in a proper position which will be able to withstand tensile and also as well as share stress. Fibers are the important material which are used for reinforcing. Hence it will be called as anfiber reinforced concrete in short form FRC. The nature of the fibers are short and also as well as discontinuous in nature.

Concrete is a type of material which is composed up by mixing of aggregates, cement, and water at proper conditions. Concrete is the one of the man made material in the planet for various usages. In today's global infrastructure and construction activity development, the use of concrete is increasing at a faster rate. Increase in production of concrete the use of aggregates are at rapid rate therefore the aggregate are depleting. Due to excess use of aggregates the aggregates are depleting. Therefore the alternative materials are used for replacement of aggregates are inducing and making sustainable. By the use of the materials in construction improve certain strength and makes economic. Therefore, dolomite powder is used as part replacement with the addition of fibers to give tensile characteristic in this work.

II. LITRATURE REVIEW

Kamal.M.M et al. (2012)[1] have studied that the bond strength for self-compacting concrete mixture. All self-compacting concrete mixes comprising up to 30% dolomite powder give bond strength sufficient for design purose. The shear strength of RC beams was found to be greater than that of conventional self-compacting without dolomite powder, according to the investigator. The concrete which will be having dolomite powder this is the important bond which will increase the strength rose as Portland cement was replaced with dolomite powder, according to the results.

Deepa, Paulose (2013)[2] They studied that the consideration of the workability and also as well as strength parameters which will be having the proper self compacting concrete and also containing

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the important fly ash and also as well as dolomite powder which will be having the high volume fly ash and also the parameter including work self compacting concrete by replacing the fly ash at 12.5 percent, 18.75 percent, 25 percent, and 37.5 percent of the cement and dolomite powder replacing 6.25 percent, 12.5 percent, and 25 percent of the cement. When compared to the reference mixture, concrete performed better in the fresh and hardened states at all levels of cement replacement.

Ravikumar et al. (2018)[3] The feasibility of measuring and also studying the damage that happened due to fibers during the high strength over a long period under the exposure to the radiation which is to be investigated under the low excitation conditions where the technique has been utilized in order to measure the material and its important mechanical property and also considering accelerated aging experiment there will be a sample Kevlar 49 along with the continuous structure of the FRP and also Kevlar 29 continuous and also including the chopped FRP .which is exposed to the consideration of UV a radiation procedure under the usage of the calibrated lamp. A universal testing equipment which is designed for the high sensitivity dynamic measurements was used to monitor the evaluation of their mechanical properties.

Dinesh, navaneethan (2018)[4] it was studied that the experimental study on aramid fiber reinforced polymer composites. The load carrying capacity of fiber reinforced polymer composite by incorporating the aramid and cotton fiber into epoxy resin matrix. In particular, incorporated FRP composites subjected to tensile, flexure and impact loading were evaluated by monitoring the stress strain relationship. Experimental results showed that the load impossing capacity is more in aramid fiber polymer composite which compare to cotton polymer composite.

III. METHODOLOGY

To attain the objectives of the proposed study, the following methodology is intended to be adopted are as follows.

1. Collection of materials.
2. Basic test of materials.
3. Preparation of M25 grade concrete mix design as IS 10262 (2019).
4. Casting and curing of different concrete elements.
5. Testing the hardened property of concrete.
   - Compressive strength test.
   - Flexural strength test.
   - Splitting tensile test.
6. Analysis of results.

IV. EXPERIMENTAL RESULTS

TEST RESULTS OF CEMENT

The properties of cement was determined by various test conducted as per IS codal provisions is listed in a table 3.

Table 1 Test results of cement.

Property	Value	Standard values
Fineness (%)	3.2%	Less than 10%
Standard consistency (%)	33.0	Not specified
Initial setting time (minutes)	40	30 (minimum)
Final setting time (minutes)	460	600 (maximum)
Specific gravity	3.149	Not specified

TEST RESULT OF FINE AGGREGATE

The properties of fine aggregate was determined by various tests as per is codal provisions are tabulated in Table 2.

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Table 2 Test results on fine aggregate.

Property	Value		Remark
Sieve analysis	IS sieve designation (mm)	Percentage passing (%)	Percentage passing for Grade Zone II
	10	100	100
	4.75	98.5	90-100
	2.36	76.5	75-100
	1.18	69.5	55-90
	0.6	43.5	35-59
	0.3	28	8-30
	0.15	4	0-10
	Pan	0	_
Specific gravity	2.70		
Water absorption (%)	0.5		_

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	10	100	100
	4.75	98.5	90-100
	2.36	76.5	75-100
	1.18	69.5	55-90
	0.6	43.5	35-59
	0.3	28	8-30
	0.15	4	0-10
	Pan	0	_
Specific gravity	2.70		_
Water absorption (%)	0.5		_

TEST RESULT OF COARSE AGGREGATE

The properties of coarse aggregate was determined by various test conducted as per IS codal provision are tabulated in table 3.

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Table 3 Test results of coarse aggregate

Property	Value		Remark
Sieve analysis (20mm down)	IS sieve designation (mm)	Percentage passing (%)	-
	20	100	
	16	54.75	
	12.5	22.75	
	10	3.5	
	4.75	0	
	2.36	0	
	Pan	0	
Specific gravity	2.85		-
Water absorption (%)	1.06		-
Bulk density (g/cm^3)	1.60		-

TEST RESULTS OF DOLOMITE POWDER

The test result of dolomite powder is given in table 4.

Table 4 Test results of coarse aggregate

Property	Value		Remark
Sieve analysis	IS sieve designation (mm)	Percentage passing (%)	Percentage passing for Grade Zone II
	10	100	100
	4.75	93.6	90-100
	2.36	82	75-100
	1.18	56.8	55-90
	0.6	37.2	35-59
	0.3	18.4	8-30
	0.15	3	0-10
	Pan	0	_
Specific gravity	2.85		_

TEST RESULTS OF HARDENED CONCERETE

Compressive strength test

The compressive strength for fine aggregate and coarse aggregate replacement by dolomite powder and coconut shell respectively are tabulated and graphically represented.

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Table 6: Compressive strength test results

Mix	Compressive strength in Mpa		Percentage replacement of fine aggregate by dolomite powder in %
	7 Days	28 Days	
M0	18.45	29.30	0
M01	18.93	30.05	10
M02	18.93	32.42	20
M03	17.95	28.50	30
M04	16.20	25.72	40

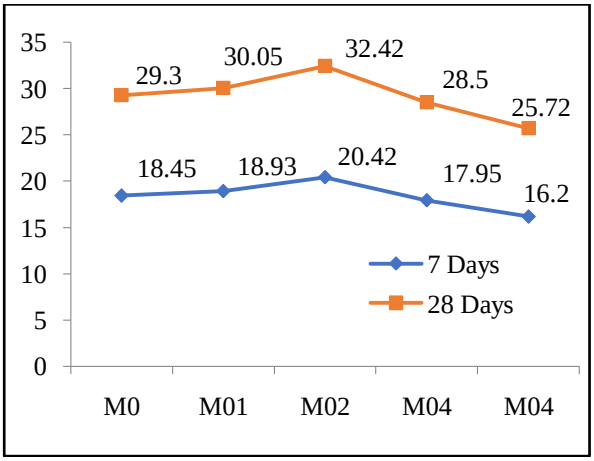

Figure 1: Compressive strength for mixes replaced of fine aggregate

Flexural strength test

The flexural strength for fine aggregate and coarse aggregate replacement by dolomite powder and coconut shell respectively are tabulated and graphically represented.

Table 8 : Flexural strength test results

Mix	Flexural strength in Mpa		Percentage replacement of fine aggregate by dolomite powder in %
	7 Days	28 Days	
M0	5.37	8.02	0
M01	5.89	8.80	10
M02	6.59	9.84	20
M03	4.71	7.04	30
M04	3.37	5.27	40

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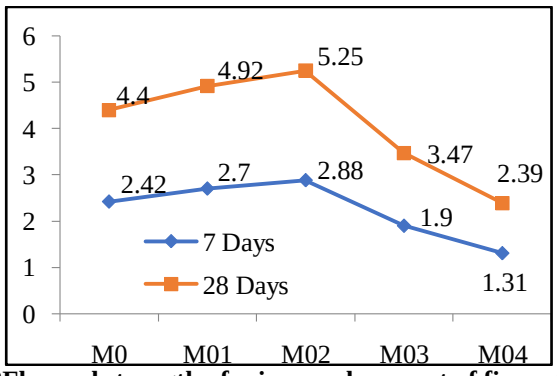

Figure 2Flexural strength of mixes replacement of fine aggregate.

Splitting tensile strength test

The splitting tensile strength for fine aggregate and coarse aggregate replacement by dolomite powder and coconut shell respectively are tabulated and graphically represented.

Table 10 : Splitting tensile test results

Mix	Splitting tensile strength in Mpa		Percentage replacement of fine aggregate by dolomite powder in %
	7 Days	28 Days	
M0	2.42	4.40	0
M01	2.70	4.92	10
M02	2.88	5.25	20
M03	1.90	3.47	30
M04	1.31	2.39	40

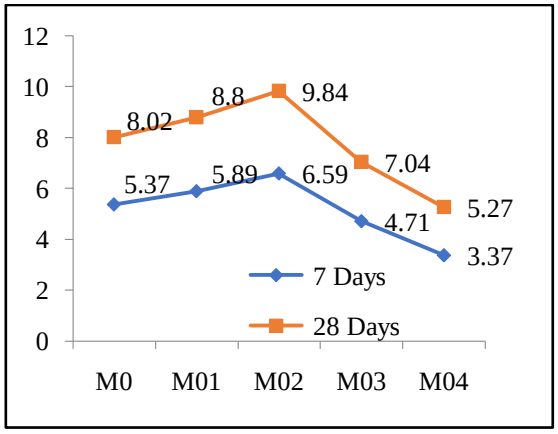

Figure 3Splitting tensile strength of mixes for replacement of fine aggregate

V. CONCLUSION

So finally in this current study and experiment investigated on addition of aramid fiber reinforced including the concrete under the consideration of the partial replacement of the fine aggregate consideration of the dolomite Powder to understand the strength parameters of concrete design for the grade of concrete M25 according to the IS 10262:2019. Under compressive and flexural and including the splitting tensile strength of the concrete are determined under the various mixtures.

Following points were concluded at the end of the project.

1. The replacement of fine aggregate by dolomite powder increases the compressive strength of the concrete.
2. The ideal replacement percentage of fine aggregate by dolomite powder is can be replaced up to 20%.

3. At 20% replacement the maximum increase in the 28th day compression, flexural, and splitting tensile strength were found to be highest for dolomite powder replacement to fine aggregate.
4. Cost of dolomite powder is less than fine aggregate hence dolomite powder decrease the cost of concrete as well as pollution.

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