International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 10 Issue: 09 | Sep 2023 www.irjet.net p-ISSN: 2395-0072

INVESTIGATION ON CONCRETE WITH PARTIAL REPLACEMENT OF MARBLE POWDER IN FINEAGGREGATE AND GRAPHENE OXIDE IN CEMENT

[1]Dr. K. Chandramouli, [2]J. Sree Naga Chaitanya, [3]K. Divya, [4]C. Uma Pushyami

[1]Professor & HOD, Department of Civil Engineering, NRI Institute of Technology, Visadala (V), Medikonduru (M), Guntur, Andhra Pradesh, India.
[2&3]Assistant Professor, Department of Civil Engineering, NRI Institute of Technology, Visadala (V), Medikonduru (M), Guntur, Andhra Pradesh,India.
[4]B.Tech Student, Department of Civil Engineering, NRI Institute of Technology, Visadala (V), Medikonduru (M), Guntur, Andhra Pradesh

---

ABSTRACT

A mixture of binding elements, inert materials, and water is used to create concrete, an artificial stone. Concrete binding with cement, fine aggregate, coarse aggregate and water. In this present work a small trial done with marble powder as partial replacement of fine aggregate and graphene oxide with cement. Marble powder is replaced with the percentages 3%,6%,9%,12%,15%,and 18%. Graphene oxide with 0.05%,0.10%and 0.15% respectively. The test performed for 7 and 28 days respectively. The compressive strength and split tensile strength.

KEY WORDS: Graphene oxide , Marble powder, Compressive strength and split tensile strength.

1. INTRODUCTION

The most common and strong building material is concrete. The material that connects the coarse totals and fine totals together is called a coupling. Sand and rock are covered by a paste or gel that is made of substance and water. All-out coarse totals are employed as quality material. Concrete is strong under pressure but fragile under strain. These days, we use several sources of admixtures in the strong to get over these problems. Concrete is a composite material made of coarse aggregate bound together by a fluid cement that gradually becomes firmer. The most common varieties of concrete are those created with lime- or hydraulic-cement-based materials, such as Portland cement concrete. Cement-based building materials are currently the most crucial ones, and it's highly likely that they will remain so in the future.

New and maybe more environmentally friendly techniques for planning construction and infrastructure projects are made possible by the use of graphene concrete, mortar, and cement additives. These compounds increase the strength and durability of concrete structures. When evaluated using international standard criteria,

When marble blocks are sawed and polished in processing facilities, marble powder is created, and around 25% of the processed marble is converted into powder form. The disposal of marble powder waste from the marble industry is one of the environmental issues facing the globe today.

2. OBJECTIVES

a) To optimize the percentage of partial replacement of marble powder to fine aggregate.

b)To optimize the percentage of partial replacement of graphene oxide to cement.

c) To investigate the mechanical properties of the cast specimens.

3. MATERIALS

Raw materials required for the concreting operations of the present work are cement, fine aggregate, coarse aggregate, graphene oxide, marble powder and water.

a. Cement: An adhesive that sets, hardens, and attaches to other materials to bind them together is referred to as a binder, such as cement, which is used in building. Usually used to bond sand and gravel (aggregate) together, cement is rarely used on its own. Mortar for masonry is made by combining cement with fine aggregate, and concrete is made by combining cement with sand and gravel. The most used substance on earth, concrete is the second most consumed resource on the globe after water. Calcium, silicon, aluminium, iron, and other materials are mixed under strict chemical supervision to create cement. This cement is OPC-53 grade.

b. Fine aggregate: Fine aggregate is defined as material that passes through an IS Sieve with a 4.75 mm opening. grading river sand in Zone II.

c. Coarse aggregate: In this experiment, coarse material with a maximum size of 20 mm and a minimum size of 12.5 mm that was easily accessible locally was used. The aggregates were washed to remove debris and dust, and then they were dried until the surface of the material was dry. The aggregates passed inspection in accordance with IS: 383-1970.

d. Marble powder: The amount of marble powder (MP), which continues to pose risks to the environment, is produced by the marble industry on a larger scale. In addition, there is a pressing demand for a product that has characteristics similar to sand in concrete because natural sand reserves are diminishing.

e. Graphene oxide: Graphene oxide quickly exfoliates and decomposes between 280 and 300 °C, producing finely scattered amorphous carbon.

4. EXPERIMENTAL INVESTIGAATION

a. Compressive strength test

Compressive strength testing is essential because it establishes a standard for the calibre of the concrete. The common unit of measurement for other strength is compressive strength. The strength is expressed in N/mm2.

Table 1: Compressive strength of concrete with marble powder as partial replacement of fine aggregate

Sl. No.	Marble powder	Compressive Strength Results, N/mm²	
		7 days	28 days
1	0%	26.95	39.12
2	3%	27.75	40.28
3	6%	28.64	41.04
4	9%	29.03	41.96
5	12%	30.17	43.17
6	15%	31.27	44.69
7	18%	30.24	43.71

Table 2: Compressive strength of concrete with Graphene oxide as partial replacement of cement

Sl. No	Graphene oxide	Compressive Strength Results, N/mm²	
		7 days	28 days
1	0%	26.95	39.12
2	0.05%	36.63	53.95
3	0.10%	39.82	58.08
4	0.15%	36.93	55.29

Table 3: Combined compressive strength of concrete with marble powder and Graphene oxide.

Sl.No	Combined replacements	Compressive Strength Results, N/mm²	
		7 days	28 days
1	0%	26.95	39.12
2	15%MP+0.10%GO	42.47	60.85

b.Cylindrical compressive strength test: Concrete cylinders' compressive strength is assessed by continuously loading the cylinder up until failure. An apparatus for testing compression is used for the test.

Table 4: Cylindrical Compressive strength of concrete with marble powder as partial replacement of fine aggregate

Sl. No.	Marble powder	Compressive Strength Results, N/mm²	
		7 days	28 days
1	0%	21.29	30.86
2	3%	21.95	32.26
3	6%	22.85	33.44
4	9%	23.42	34.65
5	12%	24.76	36.73
6	15%	26.36	38.52
7	18%	25.82	37.51

Table 5: Cylindrical Compressive strength of concrete with Graphene oxide as partial replacement of cement

Sl. No	Graphene oxide	Compressive Strength Results, N/mm²	
		7 days	28 days
1	0%	21.29	30.86
2	0.05%	28.21	42.08
3	0.10%	33.44	45.99
4	0.15%	32.86	47.32

Table 6: Cylindrical Combined compressive strength of concrete with marble powder and Graphene oxide.

Sl.No	Combined replacements	Compressive Strength Results, N/mm²	
		7 days	28 days
1	0%	21.29	30.86
2	15%MP+0.10%GO	35.63	47.76

c.Split tensile strength test: Concrete cylinders' compressive strength is assessed by continuously loading the cylinder up until failure. An apparatus for testing compression is used for the test.

Table 7: Split tensile strength of concrete with marble powder as partial replacement of fine aggregate

Sl. No.	Marble powder	Split tensile strength Results, N/mm²
		28 days
1	0%	3.86
2	3%	3.93
3	6%	4.06
4	9%	4.27
5	12%	4.48
6	15%	4.82
7	18%	4.79

Table 8: Split tensile strength of concrete with Graphene oxide as partial replacement of cement

Sl. No	Graphene oxide	Split tensile strength Results, N/mm²
		28 days
1	0%	3.86
2	0.05%	5.31
3	0.10%	5.84
4	0.15%	5.75

Table 9: Split tensile strength of concrete with marble powder and Graphene oxide.

Sl.No	Combined replacements	Split tensile strength Results, N/mm²
		28 days
1	0%	3.86
2	15%MP+0.10%GO	6.02

5. CONCLUSION

The compressive and split tensile strength results for various concrete mixtures were examined. In normal concrete, the compressive strength achieved values of 26.95 N/mm² at 7 days and 39.12 N/mm² at 28 days, while the cylindrical compressive strength was 21.29 N/mm² at 7 days and 30.86 N/mm² at 28 days. When 15% of the fine aggregate was replaced by marble powder, the compressive strength increased to 31.27 N/mm² at 7 days and 44.69 N/mm² at 28 days, and the cylindrical compressive strength improved to 26.36 N/mm² at 7 days and 38.52 N/mm² at 28 days. Additionally, with 0.1% replacement of cement by Graphene oxide, the compressive strength values rose to 39.82 N/mm² at 7 days and 58.08 N/mm² at 28 days, while the cylindrical compressive strength reached 33.44 N/mm² at 7 days and 45.99 N/mm² at 28 days. The combined replacement of 15% marble powder and 0.1% Graphene oxide resulted in compressive strength values of 42.47 N/mm² at 7 days and 60.85 N/mm² at 28 days, along with a split tensile strength of 6.02 N/mm² at 28 days.

6. REFERENCES

1. Raman Kumar and Ankit. AN EXPERIMENTAL STUDY OF MARBLE POWDER ON THE PERFORMANCE OF CONCRETE, International Journal of Civil Engineering and Technology, 7(4),(2016),491-497.

2. Satheesh Kumar J, Palaniselvan G, Jay Ganesh D&Vijayaraghavan J, Physical and Chemical characteristics of Dolomite for Partial Replacement of Cement in M20 Concrete|| Vol. 1:5 December 2016

3. Muthu Kumaran A, Rajagopalan, Experimental Study on Partial Replacement of Sand with M-Sand and Cement by Dolomite Powder in Cement Concrete|| Volume 8, Issue 6, June 2017.

4. Muhammad Usama Memon* , Bashir Ahmed Memon, Mahboob Oad, Faraz Ahmed Chandio, Sheeraz Ahmed . Effect of Marble Dust on Compressive Strength of Recycled Aggregate Concrete, QUEST RESEARCH JOURNAL,,18(1),(2020),11-18.

5. P. Sasikumar, C. Suriyakumar, P. Yuvaraj, B. Madhan kumar, Er.K. Jeganmohan, A Partial Replacement for Coarse Aggregate by Sea Shell and Cement by Lime in Concrete|| Vol-2, Issue-5, 2016

6. R. Yamuna Bharathi, S. Subhashini, T. Manvitha, S. Herald Lessly, Experimental Study on Partial Replacement of Coarse Aggregate by Seashell & Partial Replacement of Cement by Fly ash|| ISSN: 2454-5031, Volume 2 Issue 3March 2016.

7. Pannirselvam,N, Chandramouli,K, Anitha,V, (2019), Dynamic Young's Modulus of Elasticity of Banana Fibre Concrete with Nano Silica, International Journal of Civil Engineering and Technology, 10(1), pp. 3018-3026.

8. Chandramouli,K, Marouthuramya Sai, Anitha,V, Pannirselvam et.al., (2019), Improvement of Silica Fume on Concrete by using Mix Proportions, Journal of Applied Science and Computations, 6(4), pp. 187-192.

9. Chandramouli,K, Pannirselvam,N, Vijayakumar,D, (2019), Strength Studies on Pine Apple Fibre Concrete with Nano Silica, International Journal of Innovative Technology and Exploring Engineering, 8(7), pp. 3063-3065.

10. Santhikala,R, Chandramouli,K, Pannirselvam,N, (2019), Strength Studies on Bio Cement Concrete, International Journal of Civil Engineering and Technology, 10(1), pp. 147-154.

11. Pannirselvam,N, Chandramouli,K, Anitha,V, (2018), Pulse Velocity Test on Banana Fibre Concrete with Nano Silica, International Journal of Civil Engineering and Technology, 9(11), pp. 2853-58.

12. Chandramouli,K, Pannirselvam,N, Vijayakumar,D, (2018), A Review on Programmable Cement, International Journal of Current Advanced Research, 7(11), pp. 16302-03.

13. Sunil V Desale, Use of industrial waste and recron3s fiber to improve the mechanical properties of concrete//volume :4/issue:7/july2015.

14. B.Venkat Narasimha Rao,M.Mahesh,CH.Satya Sri, Recron 3s fiber reinforced concrete pavements//volume:4//issue:4//issn:2321-9939.

15. MylavarapuPhani Sekhar, K.Raju, A Study on effect of mechanical properties of recron3s fiber concrete on different grades exposed to elevated temperatures//volume:4//issue:1//june2017.

16. **J.Sree Naga Chaitanya1 ,Dr.K.Chandramouli2 , Dr.N.Pannirselvam3,G.Sindhu Bhargavi,** STRENGTH STUDIES ON CONCRETE WITH RECRON 3S FIBER BY PARTIAL REPLACEMENT OF THE FINE AGGREGATES WITH MARBLE POWDER AND CEMENT WITH DOLOMITE ,16(2),(2021),1-6.

17. Noha M. Soliman(2013) Effect of using marble powder in concrete mixes on the behavior and strengthof R.C Slabs. ISSN 2277–4106, pp. 1863–1870.

18. M. Devasena# , J. Karthikeyan. INVESTIGATION ON STRENGTH PROPERTIES OF GRAPHENE OXIDE CONCRETE,1(8),2015,306-310.

19. W. S. Hummers Jr. and R. E. Offeman, "Preparation of graphitic oxide," Journal of the American Chemical Society, vol. 80, no. 6, p. 1339, 1958.