

EXPERIMENTAL INVESTIGATION ON PARTIAL REPLACEMENT OF CEMENT WITH DOLOMITE AND OPTIMUM USAGE OF COPPER SLAG AS FINE AGGREGATE IN HIGH STRENGTH CONCRETE

A.YUVAKRISHNA

Post Graduate Student in Construction Engineering and Management

ABSTRACT: Concrete plays a vital role in the world. The dolomite is an anhydrous carbonate mineral made out of calcium magnesium carbonate and it is likewise used to portray as sedimentary carbonate shake. The dolomite powder is the crushed mineral from dolomite. Copper slag is a rough impacting coarseness made of granulated slag from metal refining procedures and it is likewise called as iron silicate. By dolomite powder are 0%, 5% 10% and 15%. Fine aggregate by optimum usage of copper slag is 40% by the weight of M50 grade of concrete.

KEYWORDS: dolomite, copper slag, admixture conplast, fine aggregate, coarse aggregate, cement.

INTRODUCTION

The utilization of supplementary cementing materials natural pozzolana like Dolomite Powder, Rice Husk Ash, Fly Ash, Egg Shell Powder, and Sugarcane Bagasse Ash, Silica Fume, and Metkaolin etc.in concrete production is one of the solutions to reduce the cement content as well as CO₂. Because of this, prerequisites for more conservative and eco-accommodating establishing material have augmented enthusiasm for incomplete bond substitution material.

DOLOMITE

The dolomite is an anhydrous carbonate mineral composed of calcium magnesium carbonate and it is also used to describe as sedimentary carbonate rock. Dolomite is also known as Dolostone. The dolomite powder is the crushed mineral from Dolostone. The dolomite powder issued to replacement of cement.

COPPER SLAG

Copper slag is an industrial by-product material produced from the process of manufacturing copper. For every ton of copper production, about 2.2 tonnes of copper slag is generated. It has been estimated that approximately 24.6 million tons of slag are generated from the world copper industry.

PROPERTIES OF DOLOMITE AND COPPER SLAG

Dolomite (CaCO₃.MgCO₃) theoretically contains CaCO₃ 54.35% and MgCO₃ 45.65% or CaO 30.4%, MgO 21.9% and CO₂ 47.7%. However, in nature, dolomite is not available in this exact proportion. Hence, in commercial parlance, the rock containing 40-45% MgCO₃ is usually called dolomite. Copper slag is an industrial by-product material produced from the process of manufacturing copper. For every ton of copper production, about 2.2 tonnes of copper slag is generated. It has been estimated that approximately 24.6 million tons of slag are generated from the world copper industry.

Fine aggregate

The fine aggregate used in the investigation is clean river sand passing through 4.75mm sieve. The sand is used in the mix conforming to Zone-II (according to IS: 383-1970).

Coarse aggregate

Crushed granite stones obtained from local quarries were used as coarse aggregate. The size of crushed granite stone aggregate used in the experiment work is of nominal size of 20 mm

CONPLAST SP430G

CONPLAST SP430G is used where a high degree of workability and its retention are required, where delays in transportation or placing are likely or when high ambient temperature cause rapid slump loss.

COMPRESSIVE STRENGTH

Compression test on concrete cubes has been carried out confirming to IS516:1999. All the concrete cube specimens were tested in a 2000kN capacity compression testing machine

SPLIT TENSILE STRENGTH TEST

The test on tensile strength of SCC at simple to perform and gives more uniform results than other tensile tests. This test is carried out by placing a cylindrical specimen horizontally between the loading surfaces of a compression testing machine and the load is applied until failure of the cylinder, along the vertical diameter.

FLEXURAL STRENGTH TEST

Pcc beams of size 500mmx100mmx100mm were casted using with and without dolomite. The maximum load at failure reading was taken and the average flexural strength is calculated using the equation.

Table 1 Mix design values for 1 m³

identification	water	cement	Dolomite	Fine aggregate		Coarse aggregate
				sand	Copper slag	
Cm0	153.264	437	-	648.147	-	1163.779
Cm1	153.264	416.897	21.89	427.167	404.902	1278.3519
Cm2	153.264	394.107	43.789	426.2511	404.034	1275.6114
Cm 3	153.264	372.212	65.68	387.545	367.346	1159.779

TEST RESULT

Table 2 Comparison of flexural strength test result

% Replacement of dolomite	40 % replacement of copper slag	
	compressive strength in 7 days(N/mm ²)	compressive strength in 28days(N/mm ²)
0	32.27	45.075
5	34.116	49.924
10	36.515	54.545
15	34.404	51.909

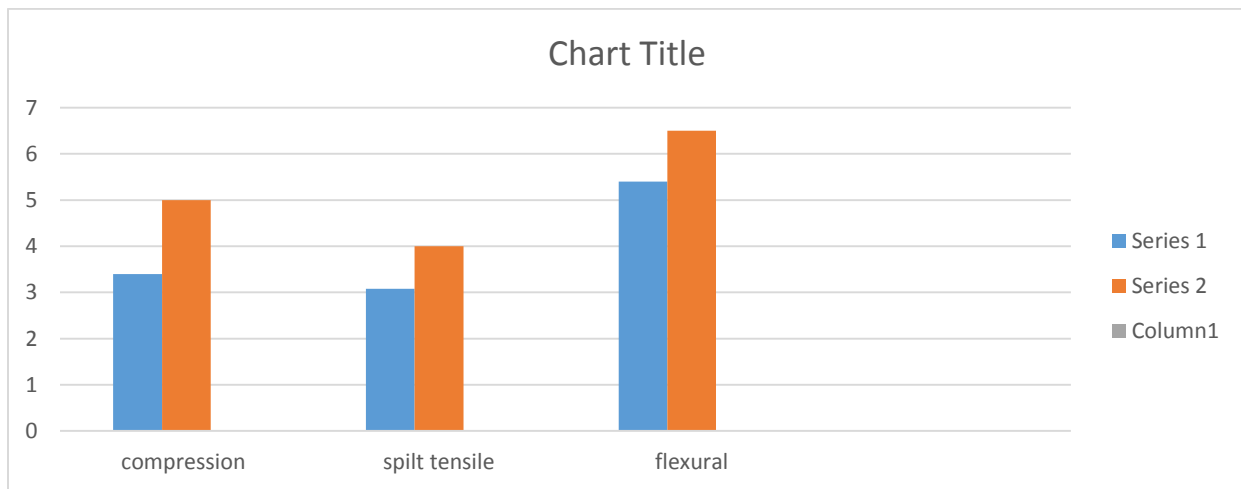
Table 3 comparison of compressive strength test result

% Replacement of dolomite	40 % replacement of copper slag	
	Average split tensile strength in 7 days (N/mm ²)	Average split tensile strength in 28 days (N/mm ²)
0	4.8	5.9
5	5.78	6.65
10	5.95	7.36
15	5.42	6.45

Table 4 Comparison of split tensile strength test result

% Replacement of dolomite	40 % replacement of copper slag	
	Average split tensile strength in 7 days (N/mm ²)	Average flexural strength in 28 days (N/mm ²)
0	2.61	3.39
5	2.97	3.67
10	3.53	4.10
15	3.11	3.53

FIG:1 comparison of test (7days and 28days)



CONCLUSIONS

- Dolomite as partial cement replacement reduces the cost making concrete. The cost of the concrete with the optimum percentage of dolomite (10%) used as partial replacement of cement.
- Replacement of cement with dolomite and copper slag as fine aggregate increases the self-weight of concrete specimens. And reduces the porosity of concrete.
- The addition of copper slag to concrete results in an increase on the concrete’s axial compressive and splitting tensile strengths
- For higher replacement of cement by dolomite greater than 15% the compressive strength decreases.
- For higher replacement of cement by dolomite greater than 15% the split tensile strength decreases
- For higher replacement of cement by dolomite greater than 15% the flexural strength decreases.

- Increase in compressive strength is about 17% of 10% replacement in dolomite in 7 days and In 28 days increase of about 10.75% when compared with control mix. .
- We have put forth a simple step to minimize the costs for construction with usage of dolomite powder and copper slag which is freely or cheaply available. We have also stepped into a realm the environmental pollution by cement production & make use of cheaper material to get required quality of construction it is being our main objective as a Civil Engineers.

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