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Comparison between strength of concrete by using M sand and copper slag

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***Abstract*—** The paper reports the effect of concrete using copper slag and M-sand as fine aggregate replacement. In this project work, the concrete grade M60 was selected and IS method was used for mix design. The properties of materials for cement, fine aggregate, coarse aggregate, copper slag and M-sand were studied for mix design. The various strength of concrete like compressive , split tensile , flexural were studied for various replacement of fine aggregate using copper slag and M-sand that are 0%,10%,20%,30%,40%,50% and 60%. The maximum compressive strength of concrete attained at 40% replacement of fine aggregate at 7, 14 and 28 days. The split tensile strength and the flexural strength were also obtained higher strength at 40% of replacement level at 28 days.

Keywords

Cement, fine aggregate, coarse aggregate, copper slag, M-sand .sulphonated Naphthalene Formaldehyde SP430

1. INTRODUCTION

The copper slag in industrial is large and increases with time. In each country the copper slag composition is different, since it is affected by socioeconomic characteristics, consumption patterns and waste management programs, but generally the level of copper slag in waste composition is high. The largest component of the copper slag smelting .The large volume of materials required for construction is potentially a major area for the reuse of waste materials. Recycling in concrete has advantages since it is widely used and has a long service life, which means that the waste is being removed from the waste stream for a long period. Because the amount of mineral aggregates required in concrete is large, the environmental benefits are not only related to the safe disposal of bulk waste, but also to the reduction of environmental impacts arising from the extraction of fine aggregates.

1.1 Definition of copper slag

Copper slag is a by-product of copper extraction by smelting. During smelting, impurities become slag which floats on the molten metal. Slag that is quenched in water produces angular granules which are disposed of as waste or utilized as discussed below.

1.2 Definition of M-sand

Crushed stone sand is produced by crushing boulders. Manufactured sand is produced by rock-on-rock or rock-on-metal Vertical Shaft Impactor (VSI) in which the process that produced alluvial deposits is closely simulated. Particle size reduction and achieving equidimensional shape is critical to get desired properties. If rock is crushed in compression lot of inherent properties exhibited by natural river sand are lost.

2. Material

a) Cement b) coarse aggregate c) Fine aggregate(river sand), d)M-sand, e) copper slag, f) Sulphonated Naphthalene Formaldehyde SP430, g)Water.

a) Cement: Ordinary Portland Cement of 53-grade was used as it satisfied the requirements of IS: 269- 1969 and results have been tabulated in table **Table.1**

Properties of cement	
Specific gravity	3.15
Consistency	33%
Fineness	6.3
Initial Setting Time	45 minute
Final Setting Time	480 minutes

b) **Coarse Aggregate:** coarse aggregate shall comply with the requirement of IS 383 as for as possible crushed Aggregate shall be used for ensuring adequate durability. The aggregate used for concrete the nominal maxi size of coarse aggregate used in Production of shall be 20 mm.

c) **Fine aggregate:** Fine aggregate shall conform to requirement of IS 383 for river sand

Table .2

Test	Types of Aggregate		
	Coarse	Fine	copper
Specific Gravity	2.9	2.88	3.51
Water Absorption	0.5%	3.5%	Nil
Moisture content	Nil	Nil	Nil

e) **Copper slag:** Copper slag used for this work is taken from Suyog suppliers (zone-II), a dealer in Pune which is used for sand blasting and the supplier brought the slag from Baruch, thoothukudi.

Table 3. Physical properties of copper slag

Physical Properties	
Particle shape	Irregular
Appearance	Black & glassy
Specific gravity	3.51
Fineness modulus of copper slag	3.47
Particle size	0.075 mm to 4.75 mm
Hardness	Between 6and 7

f) **Plastizers:** Sulphonated Naphthalene Formaldehyde SP430 is used as directed by the manufacture to improve the workability of fresh concrete mix.

g) **Water:** The water used for mixing concrete mix should be potable drinking water having PH 6 TO 8.

As per design M60 Grade Material Requirement for 1 M3	
Material	Quantity in kg
Cement	466
Sand	856
Aggregate	1171
Water	156 liter

Table .4

3 Design Mix

The HSC is defined as higher concrete whose characteristic strength ranges from 50 and above. Hence for my work I'm considering M60 grade concrete. The mix design for M60 grade concrete is carried out using the Indian standard code 10262:2009. For which the water cement ratio is kept as the least value of 0.35 for the slump value is assumed as 100mm, the fine

aggregate of Zone II, coarse aggregate of 20mm size and below.

- Cement = 446 Kg/m3
- Water = 156 liter
- Fine Aggregate = 856 Kg/m3
- Coarse Aggregate = 1171 Kg/m3
- Admixture = 2% of Sulphonated Naphthalene Formaldehyde SP430

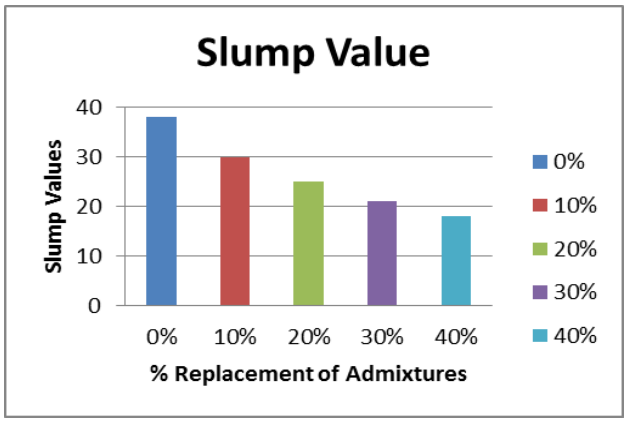
- The proportion for the mix is **1:1.92:2.62:0.35**

4 Experimental investigation

The fresh property test that is considered is the slump cone test. The result obtained for the slump cone test is

Table .5

Slump Values of different mixes	
Concrete Mix	Slump Value (MM)
0%	38
10%	30
20%	25
30%	21
40%	18



The cubes casted are of 150 x 150 x 150mm in dimension. The cylinders are of 150mm in diameter and 300mm in length. The prisms are of 100m x 100mm x 500mm .The cubes, cylinders and prisms are kept for curing for the duration of 7, 14 and 28 days in water.

5 Experimental results

The strength test that are considered for are Compressive strength, split tensile and the flexural strength test.

5.1 Compressive Strength Test:

Table .6

Compressive strength of cubes 7 days N/mm^2		
% replacement	Copper slag	M-sand
0%	35.9	35.9
10%	36.2	36.88
20%	37.1	38.23
30%	39.11	39.11
40%	41.3	42.22
50%	36	40.88
60%	32.50	40

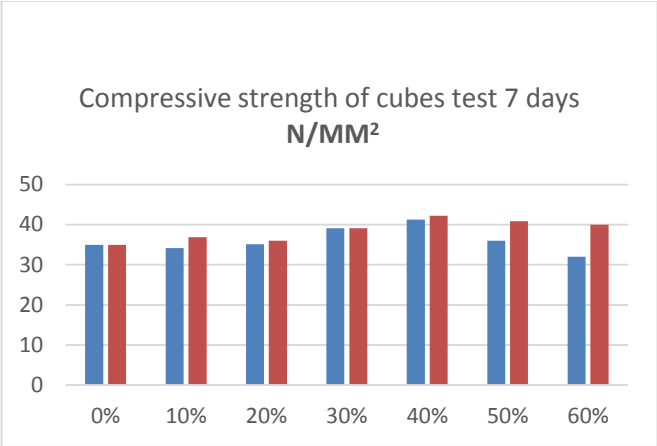


Table.7

Compressive strength of cubes 14 days N/mm^2		
% replacement	Copper slag	M- sand
0%	43.25	43.25
10%	44.74	47.23
20%	47.04	49.53
30%	49.11	53
40%	53.98	55.53
50%	44.27	56.11
60%	41.50	54.23

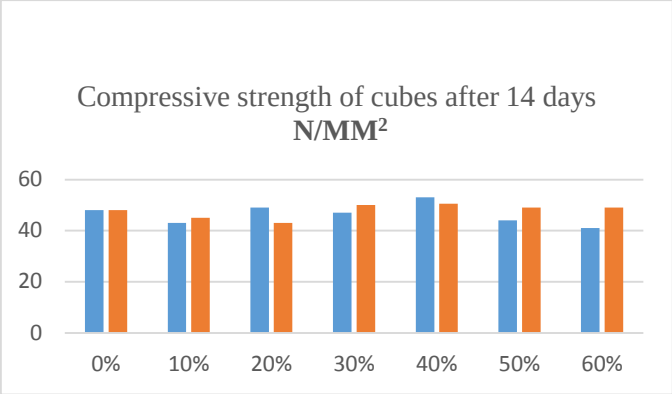


Table.8

Compressive strength of cubes 28 days N/mm^2		
% replacement	Copper slag	M -sand
0%	57.8	57.8
10%	60.11	60.8
20%	61.33	60.15
30%	60.11	63.2
40%	63.6	67.11
50%	55.77	67.27
60%	56.8	69.23

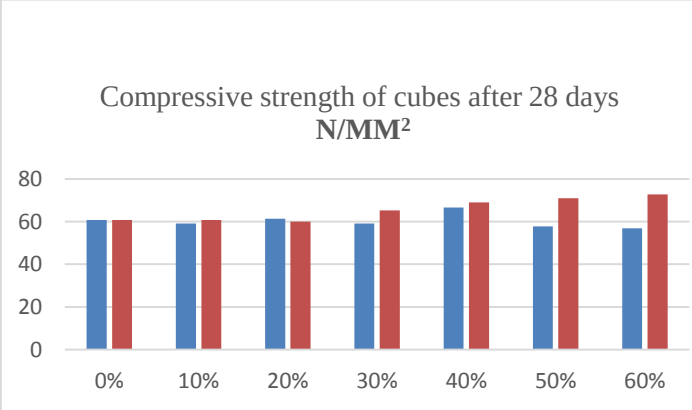


Table.9

Split tensile strength of 7 days (N/mm^2)		
% replacement	Copper slag	M-sand
0%	1.5	1.5
10%	1.63	1.74
20%	1.7	1.85
30%	1.76	1.9
40%	1.83	1.78
50%	1.5	2.05
60%	1.33	2.1

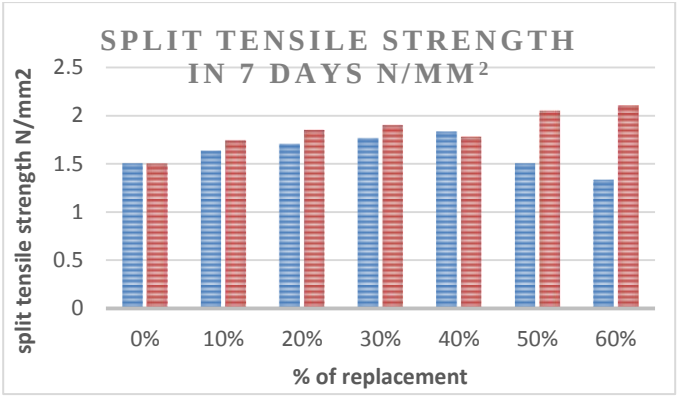


Table.10

Split tensile strength of 14 days (N/mm^2)		
% replacement	Copper slag	M-sand
0%	2.3	2.3
10%	2.55	2.8
20%	2.53	2.93
30%	2.62	2.93
40%	2.97	3.11
50%	2.36	3.27
60%	2.21	3.5

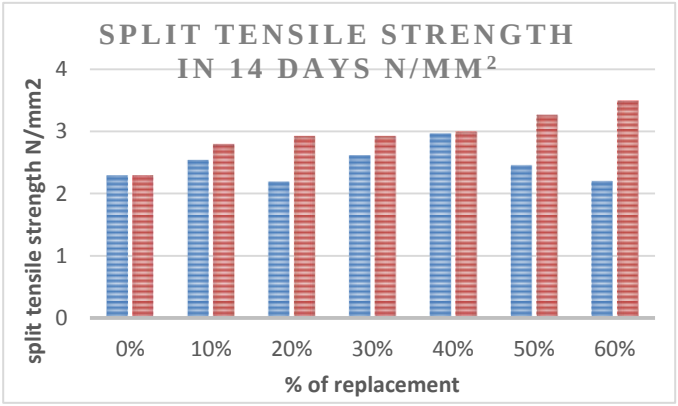


Table.11

Split tensile strength of 28 days (N/mm^2)		
% replacement	Copper slag	M-sand
0%	3.2	3.2
10%	3.63	4.03
20%	3.88	4.17
30%	3.54	4.17
40%	4.23	4.51
50%	3.46	4.73

60%	3.11	4.83

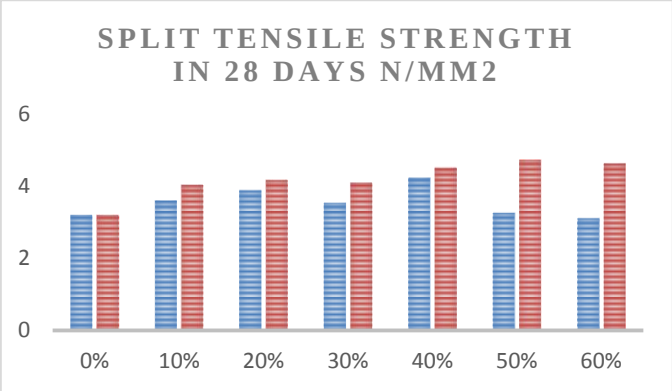


Table.12

Flexural strength in 7 days (N/mm^2)		
% replacement	Copper slag	M-sand
0%	4.7	4.7
10%	5.1	5.33
20%	5.6	5.4
30%	5.4	5.6
40%	5.4	5.73
50%	4.8	5.43
60%	4.6	5.8

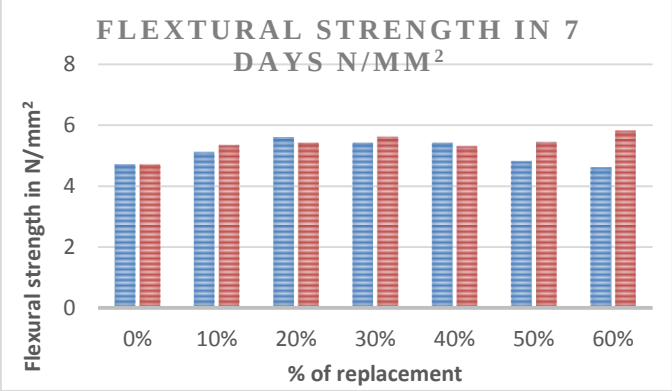


Table.13

Flexural strength in 14 days (N/mm^2)		
% replacement	Copper slag	M-sand
0%	5.3	5.3
10%	5.8	6.45
20%	6.13	6.38
30%	6.37	6.2
40%	6.13	6.3
50%	5.5	6.1
60%	4.96	6.2

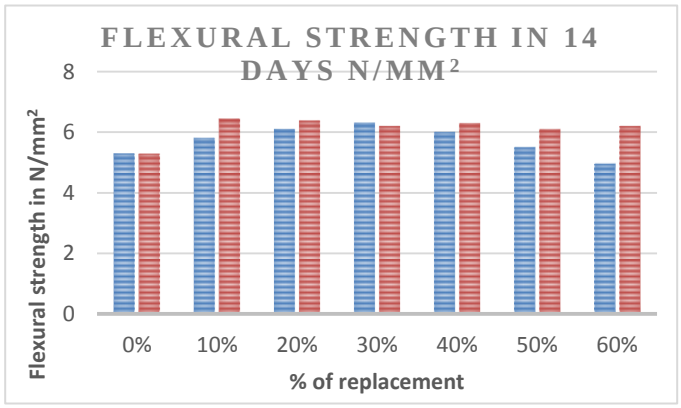


Table.14

Flexural strength in 28 days (N/mm^2)		
% replacement	Copper slag	M-sand
0%	7.2	7.2
10%	7.8	7.5
20%	8.03	7.81
30%	8.26	7.63
40%	8.32	8.3
50%	8	7.96
60%	7.53	8.23

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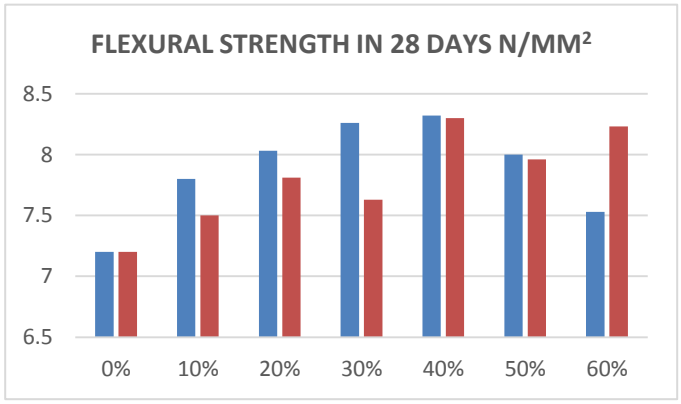

6. Conclusion

From the result and discussions, the following conclusions were made

- The replacement of fine aggregate using copper slag in concrete there by increases the self-weight of the concrete
- The workability of concrete increased with the increase in copper slag content of fine aggregate replacements at same water-cement ratio.
- Form the results of compressive strength, split tensile strength and flexural strength, the concrete shown higher value at 40% replacement of fine aggregate using copper slag. So it is recommended that 40% of fine aggregate can be replaced by copper slag.
- The construction industry is the only area for safe use of waste materials ,which reduces cost of construction

7. Reference

- AI-jabri KS, Hidasa M, AI –saidy AH, AI-Orami SK performance of high strength concrete made with copper slag as a fine aggregate .Construction and Building materials 23: 2131-2140.
- Santhakumar AR (2006) concrete technology. Oxford university press, engineering and computer science.
- Shetty MS(2006) concrete technology theory and practice .S Chand & company ltd ,India
- Reddy SS, Kumar KM (2013) Utilization of copper slag as a partial Replacement of fine aggregate in concrete .International journal of Mechanical engineering and Computer Application, 1: 140-144.
- IS 383 (1970) Indian standard specifications for coarse and fine aggregates from Natural Sources for concrete CED 2: cement and concrete.
- IS 12269 (1987) Indian standard ordinary Portland cement, 53 grade specification CED 2: Cement and concrete.
- Kharade AS, Kapadiya SV,Chavan R (2013) An Experimental Investigation of properties of concrete with partial replacement of Fine aggregate through copper slag .IJERT 2:01-10
- AI –jabri KS, Hidasa M,AI –Oraimi SK,AI Saidy AH(2009) copper slag as sand replacement for high performance concrete .c Concrete composites 31:483-488.
- IS 10262 (2009) Guidelines for Indian standard concrete mix design proportioning .CED2: Cement and concrete.
- IS 1199(1959) Indian standard methods of sampling and analysis of concrete CED2: cement and concrete.
- IS 10086(1982) Indian standard specification for moulds for use in tests of cement and concrete.
- IS 516(1959) Indian standard methods of tests for strength of concrete .CEO 2: cement and concrete.
- IS 5816(1999) Indian standard method of test for splitting tensile strength of concrete.
- IS 456 (2000) Indian standard code of practices for plain and reinforced concrete.