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FIBER REINFORCED CONCRETE OF PARTIAL REPLACEMENT OF FINE AGGREGATE BY COPPER SLAG

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ABSTRACT

This paper presents role of strength of concrete in the construction of buildings and the other structures to eliminating the demand of natural sand. This paper contains replacing fine aggregate by copperslag from 20% to 40% and also add the fiber of polypropylene in 1% and 2% in the cement. The compressive strength of concrete cubes at the age of 7, 14 and 28 days were obtained at room temperature. Copper slag reduced the pollution and it will be the cost effective method for any construction industry. And also to add the polypropylene fiber when it is copolymerization with ethylene is generally tough and flexible which allows polypropylene is used in the concrete and various engineering construction. It is economical and good resistance.The curiosity in the use of fibers for the construction material. Polypropylene is a synthetic hydro carbon polymer which made using extrusion processes by hot drawing the material. Copper slag is the waste material which is made of mattle smelting and refined of copper. For this research work,M2 concrete was used and various tests were conducted. Using different proportions of copper slag as fine aggregate replacement of various concrete mixture.

KEYWORDS

Cement,Copperslag,Fiber(polypropylene), Aggregate

INDEX TERM

slump cone test, compressive test, tensile test, flexural test

Concrete is the most widely used composite material. The constitution of concrete are coarse aggregate, fine aggregate, cement and water. Now a days world is facing the main problem is rapid growth population and increased industrialization and the many improved techniques involve the waste disposal, and increase the pollution into the atmosphere. Copper slag is a one of the waste material.Which is used in the future building construction and industry. It is very difficult problem for available of fine aggregates. Researcher develop to apply the replacement of fine aggregate as waste management strategies. To add the fiber in concrete it control the crack formation and not have structural strengthening. Fiber have high strength, low permeability it is called good concrete. Improve force cracking behavior, Short distance, discrete fibers added to the plain concrete. It improves post peak ductility performance, Precast tensile strength,fracture strength,toughness, impact resistance, structure strength performance etc., [6] discussed about amplifier power relation, impedance , T π and

microstripline matching networks.

II. MATERIAL USED AND THEIR PROPERTIES

CEMENT: Ordinary Portland cement 53 grade was used throughout the experimental investigations. The cement satisfied the requirements of Indian standard specification IS 4031-1988.The test result if the 28 days strength is not less than 53N/ it is called 53 grade cement respectively.

Specific gravity: 3.12
Initial setting time: 34min
Final setting time: 320min
Fineness: 5% (residueIS 90 sieve)

Fig 1. Fine aggregate

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Fig 2. Cement

Fig 3. Coarse aggregate

FINE AGGREGATE:

The aggregate size is less than 4.75mm is considered as fine aggregate. The sand is free from any clay (or) inorganic materials and found to be hard and durable. It was stored in open space free from dust and water.

Specific gravity: 2.57

COARSE AGGREGATE:

The aggregate size greater than 4.75mm is considered as coarse aggregate.It can be found from original bed rocks.The give body to the concrete, reduce shrinkage & effect economy. In this project 20mm size aggregate are used

Maximum size: 20mm
Specific gravity: 2.67
Elongation index: 28.72%
Flakiness index: 12.162%
Water absorption: 0.85%
Surface texture: rough
Particle size: angular

COPPER SLAG:

Copper slag is the glassy material. It is an industrial by-product material produced from the process of manufactured copper. Copper slag collected from the sterlite industries Ltd(SIL), tuticorin,Tamilnadu.

Specific gravity: 2.79
Fineness modulus:7.98
Crushing value : 27.12%
Impact value : 30.81%
Water absorption : 2.61%

POLYPROPYLENE FIBRES:

Polypropylene fibers are new invented chemical fibers. They are produced in large scale and have fourth largest volume in production after polyesters,polypropylene fibers are produced in the world in a year. Polypropylene fiber is economical. It is available in 3 various sizes 6mm, 12mm&24mm.now 12mm fiber length is used.

Specific gravity : 0.91gr/
Cut length : 12mm
Width crossing : Circular
Melting point : 250
Water absorption: 0

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Fig 4. Polypropylene fiber

Fig 5. Copper slag

III. EXPERIMENTAL INVESTIGATION

A.MIX PROPATIONING

The grades of concrete M20 having nominal mix proportion of 1:1.5:3 was used by weight and w/c ratio was fixed according to the slump requirement of 60mm.For this concrete mix, partial replacement of fine aggregate by copperslag from 20% and 40% and add the polypropylene fibers from 1% & 2%

B.CASTING

Mould of size 150 X 150 X 150 mm was used to cast specimens for compression test. Aggregate of size less than 20 mm and greater than 12.5 mm were used. The specimens were cast, tested at the age of 14 and 28 days after curing.

Fig 6. Casting

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C.CURING

Curing of concrete is defined as the process of maintaining the moisture and temperature conditions of concrete for hydration reaction for normally.so that concrete develops hardened properties over time. The specimen tested on 7day, 14day, and 28day curing of concrete.

Fig 7. Curing of cube

Fig 8. Curing of cylinder

IV. EXPERIMENTAL RESULTS

SLUMP TEST

The concrete slump cone test measures the consistency of fresh concrete before it sets. With addition of fibers, the entrapped air voids increase and hence the increased air content reduces the workability causing difficulty in compaction of mixes. Slump cone test was conducted to determine the workability of concrete.

Grade of concrete	Percentage of copperslag & polypropylene fiber	Slump value
M20 (1:1.5:3)	0	38
	20 & 1%	41
	40 & 1%	43
	20&2%	44
	40&2%	46

COMPRESSIVE STRENGTH TEST

Compressive strength is one of the important properties of concrete. It is qualitative measure of concrete. The cube specimens were tested for compressive strength at the end of 7days, 14 days and 28 days. This experiment Using M20 mix concrete and using the water cement ratio is 0.49

Fig 9. Compressive strength Test

Percentage of copper slag & polypropylene replacement	7Days N/	14Days N/	28Days N/
0	16.73	20.98	27.13
20 & 1	19.52	26.02	31.43
40 & 1	23.39	27.47	39.07
20 & 2	25.89	30.73	42.52
40 & 2	28.75	32.63	45.02

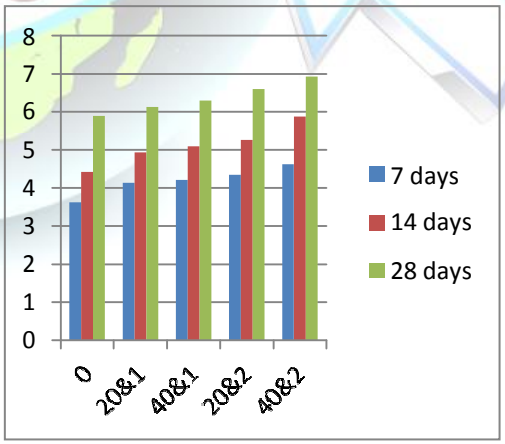

Chart 1

From the test results it can be seen that the compressive strength of concrete is increased by 6% with partial replacement of 40% of copper slag and 2% of polypropylene fiber in the fine aggregate.

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However compression strength of concrete for partial replacement of fine aggregate with copper slag and cement with polypropylene fiber for 40% and 2% does not decreased by control mix.

SPILT TENSILE STRENGTH

The cylinder specimens were tested for compressive strength at the end of 7days, 14 days and 28 days. This experiment Using M20 mix concrete and using the water cement ratio is 0.49

Fig 10. Spilt Tensile Strength Test

From the test results it can be seen that the tensile strength of concrete with partial replacement of 40% and 2% fiber in fine aggregate.

However tensile strength of concrete for partial replacement of fine aggregate with copper slag and cement with polypropylene fiber for 40% and 2% does not decreased by control mix.

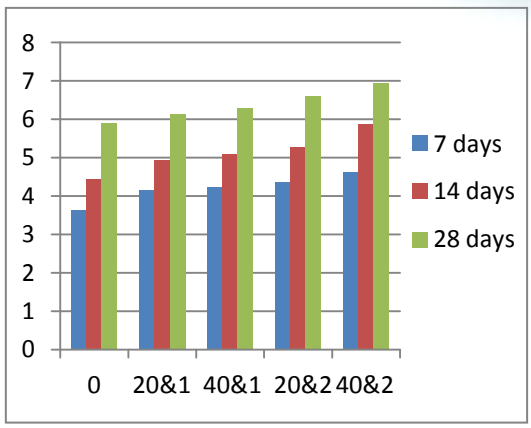
FLEXURAL STRENGTH TEST

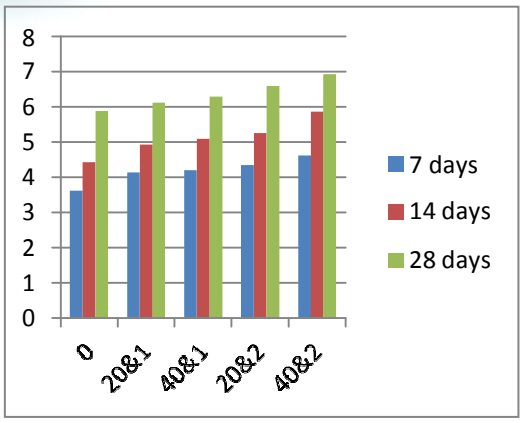
The prism specimens were tested for compressive strength at the end of 7days, 14 days and 28 days. This experiment Using M20 mix concrete and using the water cement ratio is 0.49

Fig 11. Flexural Strength Test

Percentage of copper slag and polypropylene fiber	7Days N/	14Days N/	28Days N/
0	1.69	1.94	2.53
20&1	2.18	2.22	2.97
40&1	2.28	2.43	3.48
20&2	3.08	3.29	3.91
40&2	3.57	3.77	4.24

Percentage of copper slag and polypropylene fiber	7Days N/	14Days N/	28Days N/
0	3.62	4.42	5.89
20&1	4.13	4.93	6.12
40&1	4.21	5.09	6.29
20&2	4.35	5.26	6.59
40&2	4.62	5.87	6.92





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From the test results it can be seen that the flexural strength of concrete with partial replacement of 40% and 2% fiber in fine aggregate.

However flexural strength of concrete for partial replacement of fine aggregate with copper slag and cement with polypropylene fiber for 40% and 2% does not decreased by control mix.

CONCLUSION

Based on the results and discussion mentioned above, the following conclusions are obtained.

1.By replacing the fine aggregate with 20% and 40% copper slag the cost is high but it give high strength.

2. Maximum compressive strength of concrete increased 60% at 40 % of replacement of fine aggregate by copperslag. It gain more strength than control mix concrete strength.

3.In compressive strength we observe the incremental change which is 1.65 times more than conventional concrete.

4.In split tensile strength we observe the incremental change which is 1.68 times more than conventional concrete.

5.In flexural strength we observe the incremental change which is 1.18 times more than conventional concrete.

6. Compressive strength and flexural strength is increased due to high toughness of copper slag.

a. Polypropylene fibers reduce the water permeability, Plastic Shrinkage and Settlement and Carbonation depth.

b. The problem of low tensile strength of concrete can be overcome by addition of polypropylene fibers to concrete.

c. The Compressive strength, Spilt tensile strength, Flexural strength and Modulus of elasticity increase with the addition of fiber content as compared with conventional concrete.

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