EFFECTIVE UTILISATION OF COPPER SLAG IN CONCRETE

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ABSTRACT

Properties of concrete with copper slag as fine aggregate replaced were studied. Control concrete with normal fine aggregate and copper slag concrete with 0-30% fine aggregate replacement with copper slag were made. Constant water to cement ratio of 0.4% was maintained for all the concrete. Properties like compressive strength investigate in the laboratory. The result showed that density of the concrete decreases with increases in copper slag percent. Compressive strength of copper slag concrete were lower than control concrete. This paper reports the effect of concrete using copper slag as fine aggregate replacement. In this project work concrete grade M40 was selected and IS method was used for mixed design. The properties of material for cement, Fine aggregate, coarse aggregate and copper slag were studied for mix design. The maximum compressive strength of concrete attained at 30% replacement of fine aggregate at 7, 14 and 28 days. The compressive strength of concrete attained at full replacement of fine aggregate at 7, 14 and 28 days. The rebound hammer test showed higher compressive strength at 30% fine aggregate replacement, this is due to uniformity of concrete. The pulse wave velocity is higher for the 30% fine aggregate replacement, its understood that the density of mix is high and free from pores.

Keyword : - *Copper slag, rebound hammer.*

1. Introduction

Concrete is a mixer of cement, Fine aggregate, Coarse aggregate, Copper slag and water. It can be molded into any shape in plastic stage. The demand of this characteristics derive the search for supplementary cementitious materials. Search for any suitable material in partial replacement of cement which is universally sustainable development and lowest possible environmental impact. It is easy to make concrete actually concrete is complex material. Its site made material and a such quality, property and performance can vary to great extend due to use of natural material expert cement. In the fast development of infrastructure in the country use of high strength and high performance cement is known in common practice.

2. Copper slag

Copper slag or V-Sand is obtained from the sterlite industries. Copper slag is the waste material of matte smelting and refining of copper such that each ton of copper generates approximately 2.5 tons of copper slag. Copper slag is a by-product material produced from the process of manufacturing copper. Copper slag with specific gravity 3.47 and fineness modulus 3.3 was used. Bulk density in loose state and compacted state was found to be 1898 kg / m^3 and 2024 kg / m^3 respectively. The water absorption of 0.3% deterioration of specimen was presented in the form of percentage reduction in weight and percentage reduction in compressive strength of concrete specimen at 7,14 and 28 days.

Fig.2.1 Copper slag

2.1 Application of Copper slag

Copper slag can be used in concrete production as a partial replacement for sand. Copper slag is used as a building material, formed into blocks. The granulated slag (<3mm size fraction) has both insulating and drainage properties which are usable to avoid ground frost in winter which in prevents pavement cracks.

2.2 Uses of Copper slag

- Copper slag has also gained popularity in the building industry for use as a fill material.
- Contractor may also use copper slag in place of sand during concrete construction.
- Copper slag can also be used as a building material, formed into blocks. Copper slag is widely used in the sandblasting industry and it has been used in the manufacture of abrasive tools.

3. Mix Proportion of the Specimen

For compression and flexural tests, 19% cement, 08% water, and 45% crushed concrete debris make up the mortar mix. For the slump test, the amount of water is increased from 11% to 60% due to the need to find the slump of the mixture. The amount of the concrete debris is now 45% and cement is 19%

4. Methodology

A chart is to illustrate the development of the project. This study was developed to help minimize the problem of the construction industry regarding the waste management, and material scarcity. The researcher considered these problems as the main reason for the purpose of this study.

5. Mix Proportion

Description	30% of Copper Slag	40% of Copper Slag	50% of Copper Slag
Cement	9.5kg	9.5kg	9.5kg
Waste coarse aggregate	22.02kg	22.02kg	22.02kg
Waste fine aggregate	9.45kg	8.1kg	6.75kg
Copper slag	4.05kg	5.4kg	6.75kg

6. Test Result

6.1 Compressive Strength Test

TABLE 6.1.1: Result on compressive strength at 7 days (N/mm^2)

SI.NO	Ratio	Compressive Strength N/mm^2	Mean Value N/mm^2
1	Normal Cube 1 Cube 2	 30.10 30.25	30.18
2	30% C.S Cube 1 Cube 2	 32.85 33.00	32.93
3	40% C.S Cube 1 Cube 2	 35.18 34.95	35.07
4	50% C.S Cube 1 Cube 2	 33.20 33.45	33.33

TABLE 6.1.2: Result on compressive strength at 14 days (N/mm^2)

SI.NO	Ratio	Compressive Strength N/mm^2	Mean value N/mm^2
1	Normal Cube 1 Cube 2	35.20 34.85	35.03
2	30% C.S Cube 1 Cube 2	38.40 39.00	38.70
3	40% C.S Cube 1 Cube 2	39.10 39.25	39.18
4	50% C.S Cube 1 Cube 2	35.05 36.00	35.53

TABLE 6.1.3: Result on compressive strength at 28 days (N/mm^2)

SI.NO	Ratio	Compressive Strength N/mm^2	Mean value N/mm^2
1	Normal Cube 1 Cube 2	39.70 38.85	39.28
2	30% C.S Cube 1 Cube 2	38.60 39.30	38.95
3	40% C.S Cube 1 Cube 2	39.10 39.75	39.43

4	50% C.S Cube 1 Cube 2	38.55 38.40	38.48

6.2 FLEXURAL STRENGTH TEST

TABLE 6.2.1: Result on flexural strength test at 7 days (N/mm^2)

SI.NO	Ratio	Flexural Strength N/mm^2	Mean Value N/mm^2
1	Normal Beam 1 Beam 2	3.10 3.12	3.11
2	30% C.S Beam 1 Beam 2	3.85 3.78	3.82
3	40% C.S Beam 1 Beam2	3.90 4.05	3.98
4	50% C.S Beam 1 Beam 2	3.50 3.55	3.53

TABLE 6.2.2: Result on flexural strength test at 28 days (N/mm^2)

SI.NO	Ratio	Flexural Strength N/mm^2	Mean Value N/mm^2
1	Normal Beam 1 Beam 2	4.10 3.90	4.00
2	30% C.S Beam 1 Beam 2	4.00 4.40	4.20

3	40% C.S Beam 1 Beam2	4.65 4.35	4.50
4	50% C.S Beam 1 Beam 2	4.60 4.70	4.65

7.Conclusion

A preliminary study has been conducted to study the effect of copper slag gradations on the strength of concrete. The report has been based on the compressive and flexural strength of concrete increase with large amount of copper slag. Totally 24 cubes are moulded and curing at 7, 14 and 28 days. Use of copper slag in various percentage mix such as 30%, 40% and 50% in which 100% usage of mix proportion gives an optimum result. When compared to control specimen, the compressive strength and flexural strength of cubes are increased with increasing copper slag content. Use of copper slag in civil construction, beside reduces the environmental pollution factors and also may bring several improve for the concrete characteristics.

6. References

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