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Experimental Investigation on Properties of Concrete by Replacement Copper Slag for Fine Aggregate

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ABSTRACT

Natural resources are depleting worldwide while at the same time the generated wastes from the industry are increasing substantially. The sustainable development for construction involves the use of nonconventional and innovative materials and recycling of waste materials in order to compensate the lack of natural resources and to find alternative ways of conserving the environment. So, this paper presents the Results of an experimental investigation carried out to evaluate the strength properties of concrete in which fine aggregate was replaced with Copper Slag partially. The fine aggregates was replaced with percentages 0% (for the control mix), 20%, 40%, and 60% of Copper Slag by weight. Tests were performed for properties of fresh concrete and Hardened Concrete. Compressive strength was determined at 3days, 7 days,14days and 28 days. The results indicate that workability increases with increase in Copper Slag percentage. Test results indicate significant improvement in the strength properties of plain concrete by the inclusion of up to 40% Copper slag as replacement of fine aggregate and can be effectively used in structural concrete. Also as percentage of Copper Slag increases, the density of concrete increases. The workability of concrete increased with increase in percentage of copper slag. Toughness of Copper Slag is found to be more, which increases the compressive strength of concrete.

KEYWORDS : Copper Slag, Concrete, Compressive strength, Fine Aggregate, Replacement et

1. INTRODUCTION

Aggregates are considered one of the main constituents of concrete since they occupy more than 70% of the concrete matrix. In many countries there is scarcity of natural aggregates that are suitable for construction while in other countries there is an increase in the consumption of aggregates due to the greater demand by the construction industry. In order to reduce dependence on natural aggregates as the main source of aggregate in concrete, artificially manufactured aggregates and artificial aggregates generated from industrial wastes provide an alternative for the construction industry. Therefore utilization of aggregates from industrial wastes can be alternative to the natural and artificial aggregate. Without proper alternative aggregates being utilized in the near future, the concrete industry globally will consume 8–12 billion tons annually of natural aggregates after the year 2010. Such large consumption of natural aggregates will cause destruction to the environment. The beneficial use of by products in Concrete technology has been well known for many years and significant research has Been Published With regard to the use of materials such as coal fly ash, pulverized fuel ash, bottom ash, blast furnace slag and silica fume as partial replacements for Portland cement or as fine aggregate.

1.1 Need of replacement of natural resource in concrete: In concrete, the cement with water forms a binder phase while the aggregate phase is mainly filler phase which occupies about 75% of volume of concrete of which the fine aggregate is about 28 to 40 % this volume. In concrete construction usually the prime source of fine aggregate is naturally available river sand which, possess a problem of its non-availability during floods and rainy reasons as well as due to huge need of construction industry

In order to solve the problem, reliable source and continuous supply of alternative material for these ingredients should be thought of and their use should be recommended. It is essential that this recommended alternative material should be eco-friendly and they should be available at cheaper cost without an interrupted supply on to the construction sites. On Indian scenario it is observed that at very few places good quality of sand may be available in plenty. All metro and mega cities in India are facing acute shortages of good quality of sand. At some places sand available is coarser Than Zone I sand and hence not suitable for construction work

2. MATERIALS USED

2.1 Cement

Ordinary Portland Cement (OPC) is by far the most important type of cement. The OPC was classified Into three grades, namely 33 grade, 43 grade and 53 grade depending upon the strength of the cement At 28 days when tested as per IS 4031-1988. If the 28 days strength is not less than 33N/mm2, 43N/mm2 and 53 N/mm2 it called 43 grade and 53 grade cement respectively. Ordinary Portland cement of 53 Grade from Ultra Tech Cement brand conforming to IS: 8112-1989 and IS 12269-1987 is used in this Experimental work.

2.2 Fine Aggregate

The aggregate size is lesser than 4.75 mm is considered as fine aggregate. The sand particles should be Free from any clay or inorganic materials and found to be hard and durable. Silt tes t is carried out to Specify the limits of presence of organic matter and silt in fine ag-

gregates. It was stored in open space Free from dust and water. It conforms to IS 383 1970 comes under zone II

Table (2.2) physical properties of fine aggregate.

Properties	Average values
Water absorption	2.52
Fineness modulus	2.80
Specific gravity	2.76
Silt content	1.4
Organic matter	Nil

2.3 Coarse Aggregate

The aggregate size bigger than 4.75 mm, is considered as coarse aggregate. It can be found from original bed rocks. Coarse aggregate are available in different shape like rounded, Irregular or partly rounded, angular, flaky etc. It should be free from any organic impurities and the dirt content was negligible. There has been a lot of controversy on subject whether the angular aggregate or rounded aggregate will make better concretes. They suggest that if at all the rounded aggregate is required t o be used for Economical reason; it should be broken and then used. But the angular aggregate are superior to rounded Aggregate from following two points. 1. It exhibits a better interlocking effect in concrete. 2. The total surface area of rough textured angular aggregate is more than smooth rounded aggregate for The given volume. Dried angular coarse aggregate of 20 mm maximum sized and 10 mm minimum size locally available Was used for experimental work.

Table (2.3) physical properties of course aggregate.

Properties	Average values
Water absorption	2.03
Fineness modulus	6.67
Specific gravity	2.86
Organic matter	Nil

2.4 Water

Water is an important ingredient of concrete, as it actively participates in the chemical reaction with Cement. Since, it helps to form the strength giving cement gel and required workability to the concrete. The quantity and quality of water is required to be checked very carefully. Portable water is used in concrete.

2.5 Copper slag

Copper slag is a by-product material produced from the process of manufacturing copper. As the copper settles down in the smelter, it has a higher density, impurities stay in the top layer and then are transported To a water basin with a low temperature for solidification. The end product is a solid, hard material that goesTo the crusher for further processing. Copper slag used in this work was brought from Birla Copper theNature of copper slag used in experimental work

Properties	Average values
water absorption	0.2% to 0.3%
fineness modulus	3.38
specific gravity	4.0
bulk density gm/cc	2.20

Table (2.5) physical properties of copper slag

3. EXPERIMENGTAL WORK

3.1 Sieve Analysis The experimental work starts with the sieve analysis. IS specified sieves of varying sizes are used and sample preparation Concrete mixtures Concrete mixtures with different proportions of Copper slag used as a partial or full substitute for fine aggregates were prepared in order to investigate the effect of Copper slag substitution on the strength of normal concrete. Concrete mixtures were prepared with different proportions of Copper Slag. The proportions (by weight) of Copper slag are added to concrete mixtures as follows, 0% (for the control mix), 20%, 40% and 60%, the control mixture (with 0% Copper slag and 100% sand) was designed to have a target 28 day compressive strength of 30 N/mm2 (M-20), using a water-to-cement ratio of 0.5.

Table (3.2) sizes and types of mould used.

Type of test	sample test	sample size
Compression test	Cube	150X150X150

4 TEST AND RESULTS

The different tests conducted in laboratories, It consist mixing of concrete in the laboratory by replacing Copper Slag as fine aggregate with proportions (by weight) of Copper Slag added to concrete mixtures Were as follows: 0% (for the control mix), 20%, 40% and 60% Concrete samples were prepared and cured In the laboratory, and are tested, to evaluate the concrete fresh and harden properties like workability of concrete and compressive strength.

4.2 Compressive Strength

Compression tests were performed on samples made during at various curing ages. As discussed earlier,

A targeted compressive strength was used for this investigation. Results from compression strength tests

Performed are presented in this section. Cube samples of size 150 x 150 x 150 mm, were prepared and Tested at 3,7,14 and 28 days of curing in water under controlled laboratory conditions. 3 samples were tested at each curing age. Tables 4.2 show the average compressive strengths of the concretes tested. Fig. 4.2 graphically display the compressive strength of concrete composites tested. Table 4.2 shows the total Strength gained by concrete with content of different proportions of copper slag.

Table (4.2) compressive strength test results.

Sample Series	3days	7days	14days	28days
C0	11.44	18.60	22.45	31.27
C20	9.26	15.06	20.85	22.93
C40	10.33	16.80	23.26	25.58
C60	9.79	15.91	10.07	24.23

5. CONCLUSIONS

1) As the percentage of Copper Slag in concrete mix increases, the workability of concrete increases. This is because copper slag is unable to absorb the water in large proportion.
2) Maximum Compressive strength of concrete for a replacement of fine aggregate by 40% of copper slag increased by 34% at 7 days and increased by 29% at 28 days.
3) Replacement of copper slag up to 200% will increase the strength of design mix, but beyond 40% replacement the strength started to reduce. The strength at 100 % replacement is reduced by 7% at 28 days.
4) It is observed that, the Compressive strength of concrete at 28 days is higher than design mix (Without replacement) for 40% replacement of fine aggregate by Copper slag, the compressive strength of concrete is increased by 14%. This also indicates compressive strength is more for all percentage replacements than design mix.
5) As the percentage of Copper slag in design mix as replacement increases, the density of harden Concrete observed to be increased. The density was increased by 7% when replacement of Fine aggregate By 100% copper slag. This is because weight of concrete increases with copper slag.

REFERANCES

1). Amit S. Kharade , Sandip V. Kapadiya. Ravindra Chavan "An experimental investigation of properties of concrete with partial or full replacement of fine aggregates through copper slag" in International journal of engineering research and technology (ijert). IISN: 2278-0181. Vol.2 issue 3, pp March – 2013.Pp:1-10.

2). Binaya patnaik, Seshadri sekhar .T , Srinivasa Rao "Strength and durability properties

of copper slag admixed concrete".IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308. VOL: 04 SPECIAL ISSUE: 01|NCRTCE-2014|FEB-2015.Pp:158-166.

3). Boyani Madhu ,Prof G. Venkataratnam "Use of copper slag as fine aggregate in (concrete) rigid pavements".In International Journal for Technological Research in Engineering, Volume 2, Issue 11, July-2015 ISSN (Online): 2347 – 4718.Pp:2507-2511.

4). Daniel C ,Joel shelton ,Vincent Sam Jebadurai S "investigation on strength properties of self compacting concrete with copper slag as fine aggregate for m25 grade concrete".In International Journal of Engineering Research and General Science Volume 4, Issue 1, January-February, 2016, ISSN 2091-2730.Pp:188-195.

5). Khalifa S. Al-Jabri , Makoto Hisada , Abdullah H. Al-Saidy , S.K. Al-Oraimi, "Performance of high strength concrete made with copper slag as a fine aggregate", Construction and Building Materials, 2009, Volume no. 23, pp.2132–2140.

6). Khalifa S. Al-Jabri, Abdullah H. Al-Saidy, Ramzi Taha, "Effect of copper slag as a fine aggregate On the properties of cement mortars and concrete", Construction and Building Materials, 2011, Volume no.25, pp.933–938.

7). M. Najimi, J. Sobhani, A.R. Pourkhorshidi,, "Durability of copper slag contained concrete Exposed to sulfate attack", Construction and Building Materials, 2011, Volume no.25, pp. 1895–1905 Meenakshi Sudarvizhi. S, Ilangovan. R, "Performance of Copper slag and ferrous slag as partial Replacement of sand in Concrete", International journal of civil and structural engineering, 2011, Volume 1, pp.918 – 927.