Partial Replacement of Copper Slag as Fine Aggregate

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***Abstract*- So as to abstain from utilizing common stream sand. An elective material is proposed to the quality of the solid by supplanting of fine total. Incompletely by squander material like copper slag which is an ecological waste. To make us of these material without penance the quality and strength of the solid structure. To quality is estimated by utilization of non-dangerous and damaging systems. The impacts of supplanting fine total by copper slag on the compressive quality are endeavored in this work. This work incorporates the assurance of various properties of locally accessible copper slag and use of copper slag in concrete by supplanting it in part by fine total keeping different parameters consistent. Compressive quality of solid blocks on M20 evaluation of cement with steady w/c proportion. Copper slag substitution of 0%, 5%, 10%, 20%, 30%,40%,50% and 60% are utilized. This test study shows the consequence of compressive quality test on cement containing copper slag somewhat supplanted by fine total. The outcomes were contrasted and those of traditional bond cement made with Portland Pozzolana Cement. The compressive quality will increment.**

***Index terms*- copper slag, concrete, durability, replacement, compressive strength**

I.INTRODUCTION

The utilization of industrial waste or secondary materials has encouraged the production of cement and concrete in construction field. New by-products and waste materials are being generated by various industries. Dumping or disposal of waste materials causes environmental and health problems. Therefore, recycling of waste materials is a great potential in concrete industry. For many years, by-products such as fly ash, silica fume and slag were considered as waste materials. Concrete prepared with such materials showed improvement in workability and durability compared to normal concrete and has been used in the construction of power, chemical plants and under-water structures. Copper slag is an industrial by-product material produced from the process of manufacturing copper. For every ton of copper production, about 2.2 tons of copper slag is generated. It has been estimated that approximately 24.6 million tons of slag are generated from the world copper industry. Although copper slag is widely used in the sand blasting industry and in the manufacturing of abrasive tools, the remainder is disposed of without any further reuse or reclamation for each quantity in an equation. The use of copper slag in the concrete industry as a replacement for cement can have the benefit of reducing the costs of disposal and help in protecting the environment. Despite the fact that several studies have been reported on the effect of copper slag replacement on the properties of Concrete, further investigations are necessary in order to obtain a comprehensive understanding that would provide an engineering base to allow the use of copper slag in concrete.

II. EXPERIMENTAL MATERIAL

Used Materials:

1. Cement : Portland Pozzolana cement Grade
2. 53 according to IS: 1489-1991.
3. Fine Aggregate : Natural sand (river sand)
4. Coarse Aggregate : Crushed aggregate maximum size of 20mm
5. Water: Tap water.
6. Copper slag

1. Cement:-

Portland pozzolana cement (PPC) is manufactured by combination of pozzolanic materials. Pozzolana is an artificial or natural material which has silica in it a reactive form. Along with pozzolanic materials in specific proportions, PPC also contains OPC clinker and gypsum. These pozzolanic materials includes volcanic ash, calcined clay or silica fumes and fly ash which makes around 15% to 35% of cement weight.

Table 1. Properties of Portland Pozzolana Cement

Physical properties of PPC cement 53 grade	Result	Chemical properties of PPC cement 53 grade	Result (%)
Specific gravity	2.90	SiO2	23.7
Standard consistency	31.6 %	AI2O3	12.4
Initial setting time	210 min	CaO	48.0
Final setting time	250 min	MgO	1.83
Compressive strength in N/mm2 at 28 days	52 N/mm2	Fe2O3	2.01
		Loss on Ignition	1.00

2. Fine Aggregate:-

Aggregate is a natural deposit of sand and gravel and also give structure to the concrete. It occupies almost 75% to 80% of volume in concrete and hence shows influence on various properties such as workability, strength, durability and economy of concrete. To increase the density of concrete aggregate is frequently use in different sizes. Aggregate acts as reinforcement

Table 2. Properties of Fine And Coarse Aggregate.

Properties	Fine aggregate	Coarse aggregate
Fineness modulus	3.30	7.52
Specific gravity	2.38	2.76
Bulk density (gm/cc)	1752	1744
Water absorption (%)	1.25	1.80

5. Copper Slag:

Copper slag was brought from M.K Trading Company, Ankaleshwar (Gujarat), Sterlite. Industries India Limited (SIIL).

III. MATERIALS AND METHODOLOGY

The various journals were collected and studied on the partial replacement of the fine aggregate by different materials. According to these journals the process of the experiment and the method of the experimentation and the different tests conducted in those journals were studied and learned. On the basis of the studies of the journals collected for the experiment the experimental methodology for the project was choose.

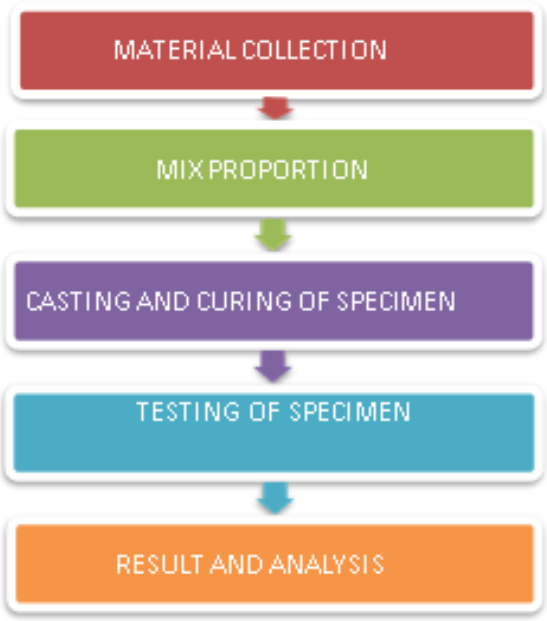

Figure 1. Flow Chart for Experimental work

Figure 2. Demoulding the specimens

Figure 3. Compressive Testing of cube in Machine

Figure 4. Filling of Cylinder Mould

Figure 5. Placing and testing of cylinder for split tensile test

IV. RESULTS

A. Compressive Strength Results: -

Cube of size 150 mm × 150 mm × 150 mm were used and tested at 3, 7 and 28 days of curing in water under controlled laboratory conditions. Three samples were tested at each curing stage. Figure 6 shows average compressive strengths of concrete test.

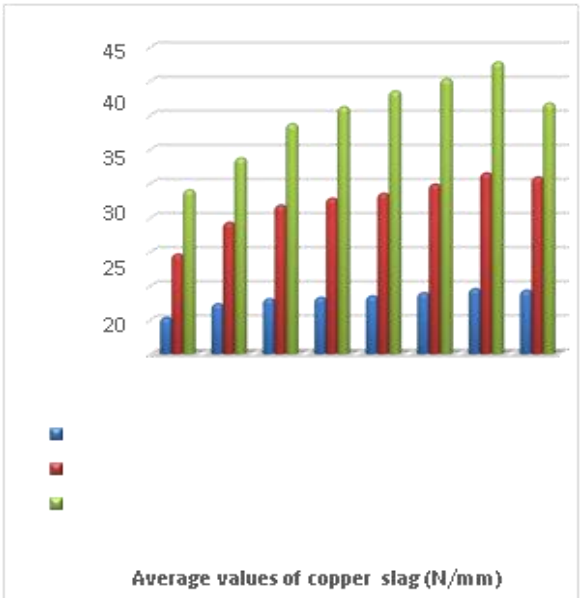

Figure 6. Average Compressive Strengths of concrete

B. Split Tensile Strength: -

For the determination of splitting tensile strength of concrete, cylinder specimens of diameter to length ratio 1:2 was selected, with diameter as 150 mm and the length as 300 mm specimens were dried in open air after 3,14 and 28 days of curing and subjected to splitting tensile test under compressive testing machine.

The splitting tensile strength (f) was obtained using the formula,

F =2P/3.14dl (N/mm2)

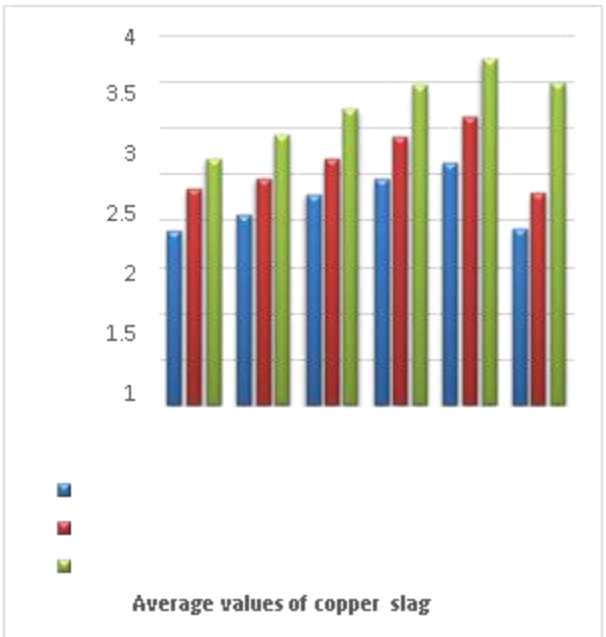

Figure 7. Test Results for Split Tensile Strength

The average Split Tensile strength for cube at different percentages (0%, 10%, 20%, 30%, 40% and 50%) at age 3,7 and 28 days are given in figure, it Can be noted that, concrete strength compare with control concrete. The fig shows the ductile failure of cube specimens. The graphical representation shows the Split Tensile strength of copper slag.

VI. CONCLUSION

The concrete was prepared for the M20 grade concrete with partial replacement of fine aggregate by copper slag with various percentages of (0%, 5%, 10%, 20%, 30%, 40%, 50%, and 60%). The specimens were casted for 7 days, 14 days and 28 days then tested. The results are presented above. The optimum value which provided the best performance was at 50% addition of copper slag for compressive strength. The concrete was prepared for the M20 grade concrete with partial replacement of fine aggregate by copper slag with various percentages of (0%, 5%, 10%, 20%, 30%, 40% and 50%). The specimens were casted for 7 days, 14 days and 28 days then tested the optimum value which provided the best performance was at 40% addition of copper slag for split tensile strength test. The optimum percentage copper slag which we used provided the best performance compare to conventional concrete of M20 grade. According to our experimental work which we have done, shows that after a percentage the strength of concrete will decrease with further addition of copper slag in mix design.

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