Experimental Study of Copper Slag & Pond Ash Based Concrete

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Abstract- *The main objective of the present study is to find out a suitable, effective and alternative material for partial replacement of cement and coarse aggregate, to find out possible utilization of waste materials in construction industry that in turn considerably minimize the usage of cement and coarse aggregate and ultimately reduce construction cost, to explore possibilities of improving mechanical properties of concrete using copper slag & pond ash instead of fine aggregate partially, to evaluate the effect of using copper slag & pond ash in concrete and to investigate the strength of replaced concrete with that of conventional concrete. This project is mainly undertaken to study the behavior and performance of concrete using waste materials such as copper slag & pond ash. This type of use of a waste material can solve problems of lack of aggregate in various construction sites and reduce environmental problems related to sand mining and waste disposal. The use of copper slag & pond ash can also reduce the cost of the concrete production and increase the workability.*

Keywords- Cement Concrete, flexural strength, Pond ash, Strength parameters, water absorption, Workability.

I. INTRODUCTION

The fine aggregate and coarse aggregates generally occupy 60% to 75% of the concrete volume and therefore, strongly influence the concrete's freshly mixed and hardened properties, mixture proportions, and economy. Crushed stone and gravel are most commonly used as a coarse aggregate in concrete, while natural sand or river sand as a fine aggregate in concrete. Environmental sustainability has been subject of discourse virtually in all human endeavours, especially in construction industries, where natural raw materials are consumed tremendously. Concrete, the most consumed artificial materials, consists of fine and coarse aggregates that occupy 60% to 75% of the concrete volume which strongly influence the concrete's freshly mixed and hardened properties, mixture proportions, and economy. The global concrete industry required 8 to 12 billion metric tons of natural aggregates annually. Conventional aggregates (fine or coarse) are mined from the earth, either dug out of pits or blasted out of quarries. This process has many significant environmental impacts. The need to mitigate these environmental stresses to make construction sustainable and to reduce rising costs of construction has necessitated research into the use of alternative cheap materials, more importantly, locally available ones which can replace conventional ones in concrete production. In this project, an attempt is made by utilizing steel slag as suitable substitutes for fine aggregates and walnut shell for coarse aggregates in concrete.

Pond ash is a by-product of the works in power plants. It has several applications in civil engineering mainly in the construction sector. In this blog, we will go through the basic details, properties, applications and limitations. Approx. 20% of total ash generated is delivered as bottom ash into dyke and approx. 80% of total ash is collected in dry form in ESP/ Silo System for dispatch to cement manufacturers and various fly ash users/ trading agencies. The un-lifted dry ash mixed with water and then disposed in to the ash dyke. The accumulated ash in the ash dyke is called pond ash. An ash pond, also called a coal ash basin or surface impoundment, is an engineered structure used at coal-fired power stations for the disposal of two types of coal combustion products: bottom ash and fly ash.

II. OBJECTIVES

Following are the objectives of this work

- To design a mix for M 30 grade conventional concrete using IS 10262:2019.
- To evaluate the fresh concrete properties like workability of conventional concrete sample and concrete produced.
- Optimum percent of sand replacement with copper slag is to be determined.
- Effect on workability, compressive strength and flexural strength on addition of copper slag is to be studied. To evaluate strength parameters like compressive strength, split tensile strength and

flexural strength of concrete for fine aggregate replacement with pond ash at various percentages.

- To find out the optimum percent replacement of fine aggregate with pond ash to give acceptable workability& hardened strength properties.

III. METHODOLOGY ADOPTED

In this work, the mix design and testing method is used to perform Utilisation of Pond ash&copper slag in Concrete as per IS-standards. In order to study the effect of pond ash as a partial replacement.

Table1: Casesconsideredforstudy

		Using Pond ash & Copper Slag as Sand Replacement		
S.No.	Sample ID	Sand %	Pond ash %	Copper Slag %
1	CONC 0	100	0	0
2	PA 10	90	10	-
3	PA 20	80	20	-
4	PA 30	70	30	-
5	PA 40	60	40	-
6	PA 50	50	50	-
7	PA 60	40	60	-
8	CS 10	90	-	10
9	CS 20	80	-	20
10	CS 30	70	-	30
11	CS 40	60	-	40
12	CS 50	50	-	50
13	CS 60	40	-	60

IV. RESULTS

The results got from tests directed on solid clearing blocks have been talked about in this part.

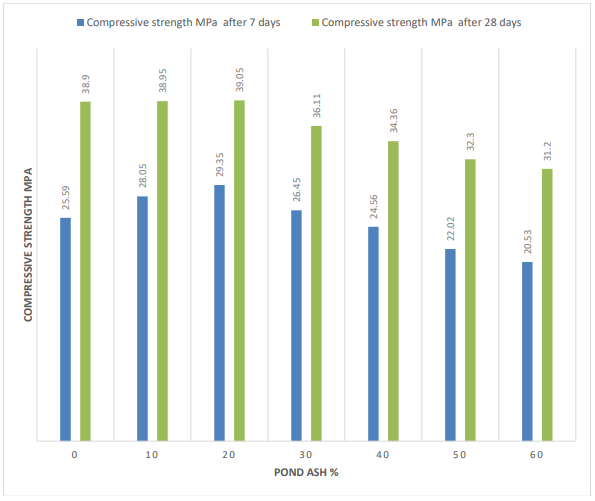

Figure1: Comparative values of compressive strength at different age with pond ash

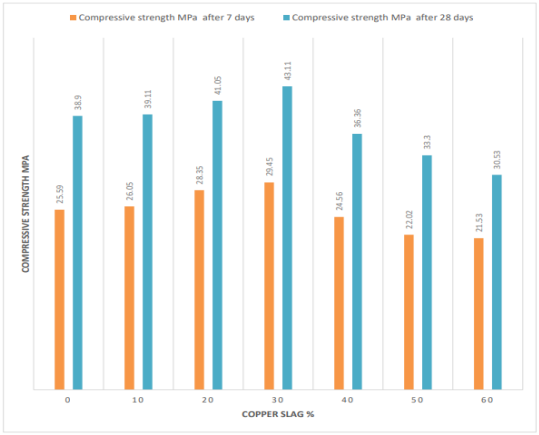

Figure2: Comparative values of compressive strength at different age with copper slag

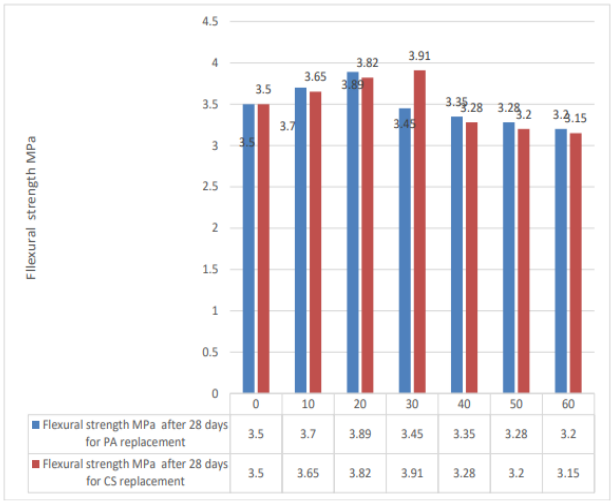

Figure 3:28-days*Flexural*strength resultMPa

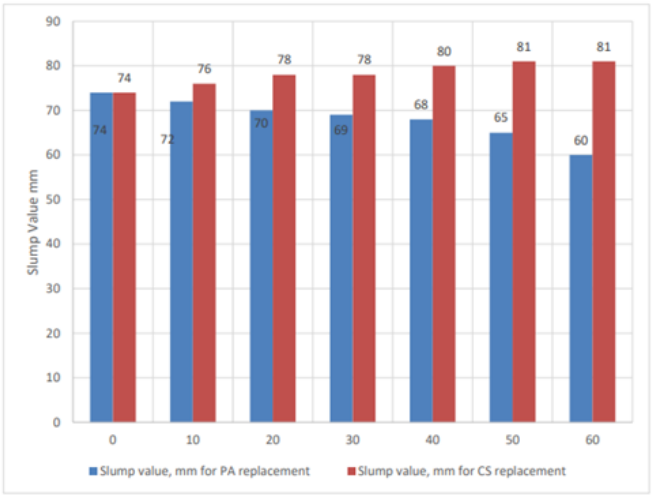

Figure 4: Slump cone test results

V. CONCLUSION

Partial replacement of sand with copper slag leads to increment in workability as show in slump value graph. In terms of Compressive Strength mix with 30% Copper Slag the 14th and 28th day strength was higher than control mix. All the experimental mixes satisfy the 28th day compressive strength expected from M30 grade of concrete. In terms of Compressive Strength mix with 20% Pond ash the 14th and 28th day strength was higher than control mix. It is observed that the flexural strength for concrete with replacements was increased when the copper slag was added up to level of 30% replacement & the flexural strength of the CS 30 mix designation is lower than the control concrete. Therefore, the conclusions of all these tests suggest that the mixture containing 30% copper slag or 20% Pond ash may be used as a suitable replacement for natural sand in concrete in moderate environments without compromising the strength..

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