

# Utilization of Copper Slag & Hypo Sludge as Alternative Material in Concrete

Prem Raj<sup>1</sup>, Afzal Khan<sup>2</sup>

<sup>1</sup>PG Scholar, <sup>2</sup>Assistant Professor,

<sup>1,2</sup>Department of Civil Engineering, MIT, Bhopal, Madhya Pradesh, India

## ABSTRACT

Active extraction of aggregate deposits from riverbeds can cause serious environmental problems (bed degradation, bank erosion, loss of vegetation, etc.) .The growing need that exists in the construction industry cannot be fulfilled by the available resources. For example, the current river aggregate extraction rate can satisfy only little part of the total annual demand. However, different industrial activities accompanied by the production of primary products result in various by-products that have almost no practical industrial application. These industrial by-products, which are generated in high quantities worldwide, present severe challenges regarding their disposal. This is why it is necessary to find other alternatives that would be acceptable from the ecological aspect. One solution would be the use of copper slag aggregates as a substitute for natural aggregate in concrete. Similarly The cement industry is one of two primary producers of carbon dioxide (CO<sub>2</sub>), creating up to 8% of worldwide man-made emissions of this gas. Usage of concrete in future will be go on increasing, which directly increases the pollution level in order to decrease or reduce its effect on environment natural material or waste material like hypo sludge usage as partial replacement of cement in concrete is investigated by many researched in past few decades As a case study. Here concrete of grade M30 is considered and mix design is done as IS: 10262-2019, cement is replaced by hypo sludge up to 20% & sand is replaced with copper slag up to 50%. Once the optimum percent of hypo sludge content is determined, optimum percent of copper slag is determined.

**How to cite this paper:** Prem Raj | Afzal Khan "Utilization of Copper Slag & Hypo Sludge as Alternative Material in Concrete" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-8 | Issue-4, August 2024, pp.850-853, URL: [www.ijtsrd.com/papers/ijtsrd67257.pdf](http://www.ijtsrd.com/papers/ijtsrd67257.pdf)



Copyright © 2024 by author (s) and International Journal of Trend in Scientific Research and Development Journal. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0) (<http://creativecommons.org/licenses/by/4.0>)



**KEYWORDS:** Cement Concrete, flexural strength, Strength parameters, water absorption, Workability

## 1. INTRODUCTION

Construction industry is growing rapidly in the past few decades in developing countries. Among different types of construction technologies concrete construction is most prevailing type across the globe and specifically in India. Use of concrete as building material will go on increase rapidly in future also, as other construction typology like steel structures, pre-engineered buildings, masonry structures, wooden structures etc. requires skilled labour, thus comparatively difficult to adopt compared to reinforced cement concrete structures. Concrete constitutes mainly of cement, fine aggregate and coarse aggregate bind together with the water. Concrete and cement industry produce significant amount of Carbon di oxide which is harmful to environment. Extensive research work is going in the field of concrete and cement industry to reduce the

use of cement to minimum extent leading towards sustainable development.

In the past used of cement is reduced by addition of fly ash, rice husk ash, industrial wastes like paper pulp, hypo sludge and many more in concrete which reduces the cement content. On the other hand concrete is made without cement by using polymers. Concrete made by addition of industrial waste not only reduces the use of cement and its harmful impact on environment, it also helps in easy disposal of such industrial wastes which are difficult to dispose and contaminates the soil and water bodies if not disposed properly. In short the use of industrial wastes in making of concrete is not only helping in reducing the hazardous effect of cement but also helpful from solid waste management point of view, which is again a big

problem in urban cities and industrial areas. Thus use of industrial waste in concrete manufacturing is beneficial from both the ends, with only one major point of consideration is that it should not deteriorate the properties of concrete in long run.

## 2. Objectives

- Following are the objectives of this work-
- Determination of Optimum percent of cement replacement with hypo sludge for M30 grade of concrete as per IS standards.

- Optimum percent of sand replacement with copper slag is to be determined.
- Effect on workability, compressive strength and flexural strength on addition of hypo sludge and copper slag is to be studied.

## 3. Methodology Adopted

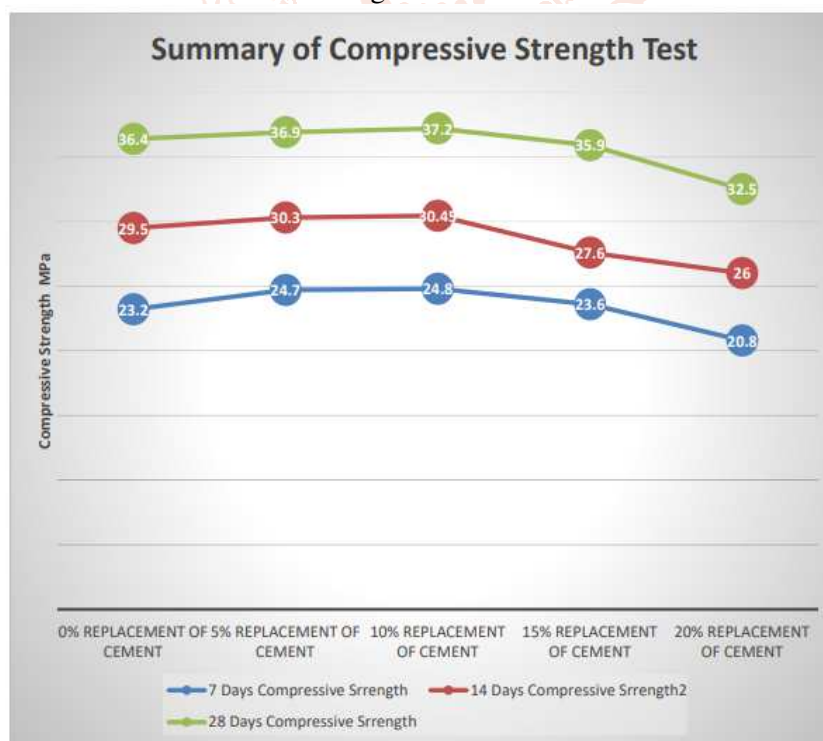
In this work, the mix design and testing method is used to perform Utilisation of copper slag in Concrete as per IS-standards. In order to study the effect as a partial replacement.

**Table 1: Cases considered for study**

Using Hypo Sludge as Cement Replacement			
S.No.	Sample ID	Cement %	Hypo Sludge %
1	CONC 0	100	0
2	CR 5	95	5
3	CR 10	90	10
4	CR 15	85	15
5	CR 20	80	20
Using Copper Slag as Sand Replacement			
S.No.	Sample ID	Sand %	Copper Slag %
1	CONC 0	100	0
2	SR 10	90	10
3	SR 20	80	20
4	SR 30	70	30
5	SR 40	60	40
6	SR 50	50	50

## 4. Results

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



**Figure 1: Compressive Strength of M30 Grade Contain of Hypo Sludge**

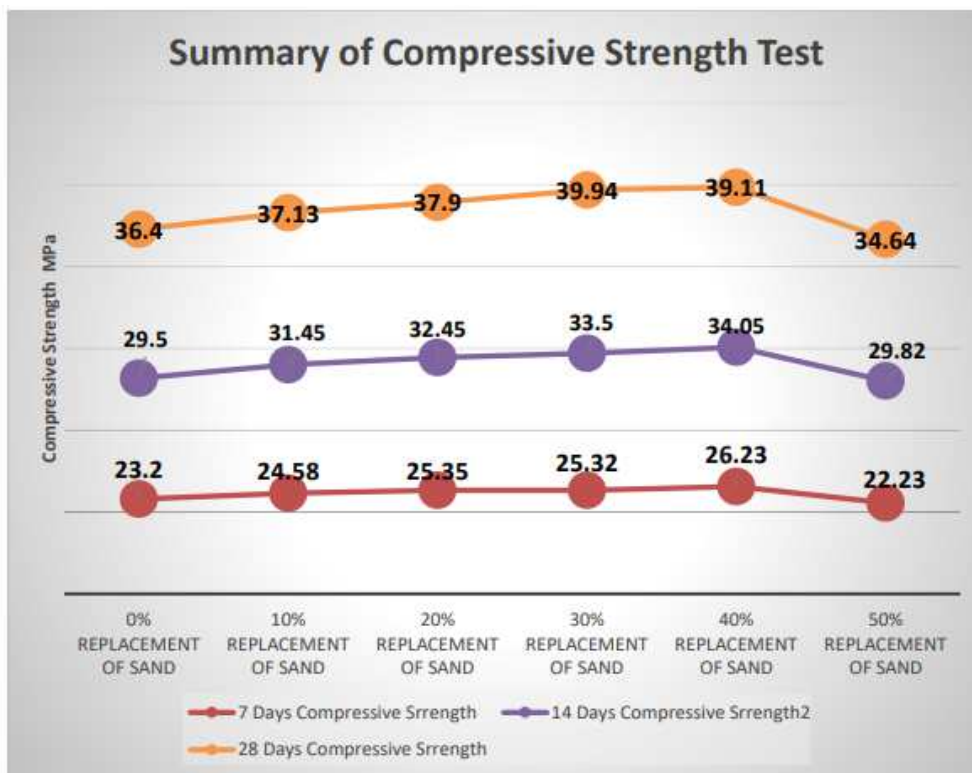


Figure 2: Comparative values of compressive strength at different age with copper slag

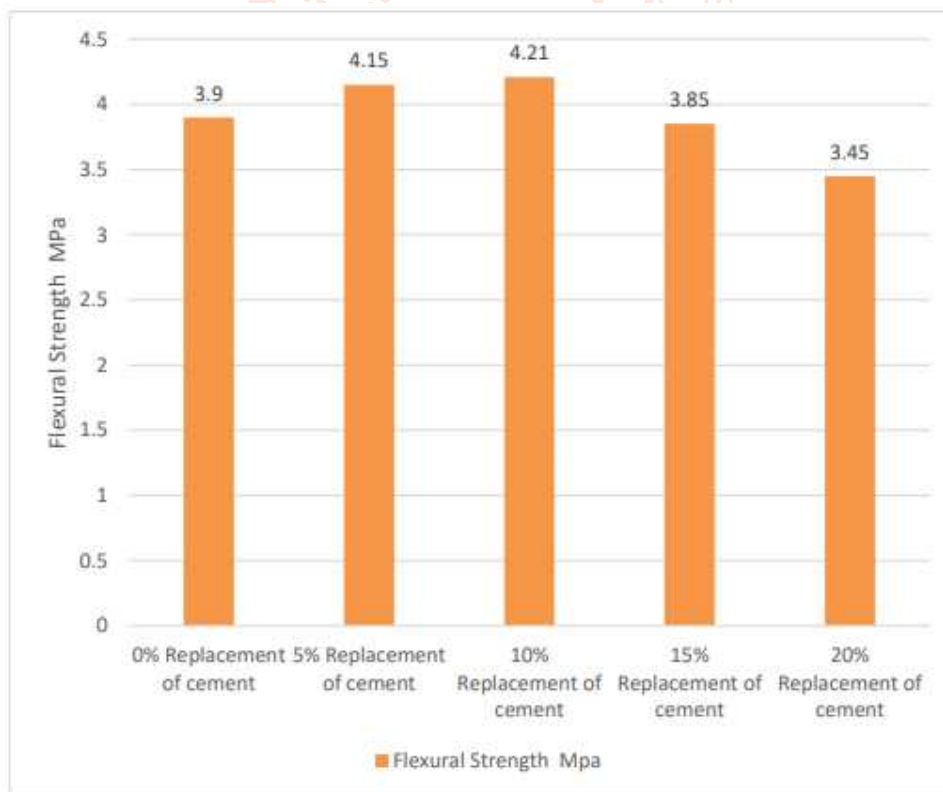
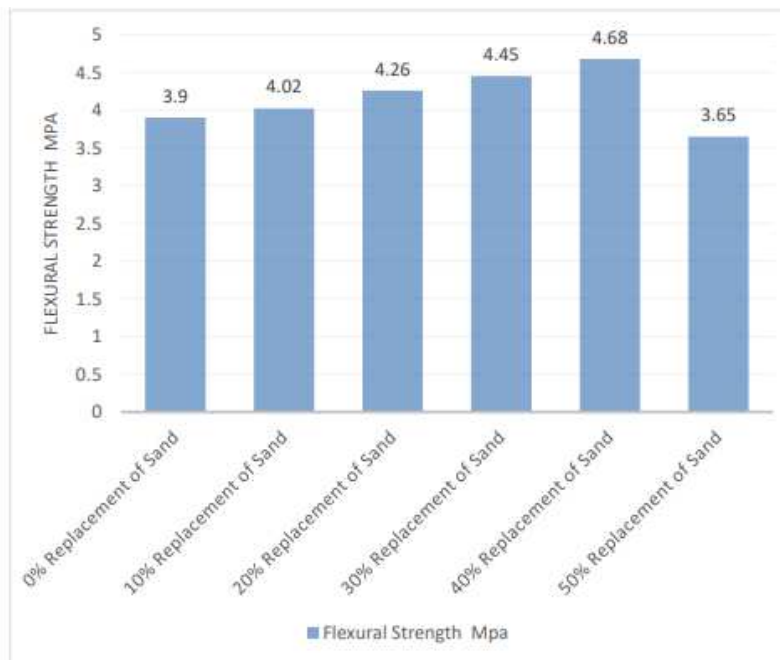


Figure 3: Flexural Strength of M30 having hypo sludge



**Figure 4: Flexural Strength of M30 having copper slag**

## 5. Conclusion

Slump shows that the Workability of concrete was increased as the percentage replacement of natural sand with copper slag was increased. It may be due to higher silica. Workability of all concrete mixes up to 50% sand replacement was suitable for structural uses.

When the replacement of cement is increased up to 20% by hypo sludge in concrete mix, there is a decrease in slump value which shows that the workability of the concrete is reduced.

## Reference

- [1] Zuo Z, Feng Y, Luo S, Dong X, Li X, Ren D, Yu Q and Guo J (2023) Element Distribution and Migration Behavior in the Copper Slag Reduction and Separation Process. *Front. Energy Res.*
- [2] Sandra Filipović, Olivera Đokić, Aleksandar Radević and Dimitrije Zakić. (2024) Copper Slag of Pyroxene Composition as a Partial Replacement of Natural Aggregate for Concrete Production. *Minerals*, 11, 43.
- [3] DAS Mohd Areef, P Srinivasa Rao, V Srinivasa Reddy and D Mohd Azeem Zubair (2024) "Flexural behaviour of steel fibre reinforced concrete beams made with copper slag as partial fine aggregate replacement. *E3S Web of Conferences* 184, 01077.
- [4] Łukasz Majewski, Roman Jaskulski, Wojciech Kubissa (2023) Influence of partial replacement of sand with copper slag on the thermal properties of hardened concrete *13th International Conference modern building materials, structures and techniques.*
- [5] Akshaykumar M. Bhoi, Yogesh D. Patil, Hemant S. Patil and Madhav P. Kadam (2021) "Feasibility Assessment of Incorporating Copper Slag as a Sand Substitute to Attain Sustainable Production Perspective in Concrete. *Hindawi Advances in Materials Science and Engineering.*
- [6] Katru Sai Tej, Koduru Uday Kumar (2017) hypo sludge as a partial replacement of cement in concrete. *International Journal of Civil Engineering and Technology (IJCIET) Volume 8, Issue 4, April*
- [7] Bose Christy Arun and Preethi Ramaswamy (2016) Properties of Concrete Partially Replaced with Copper Slag as Fine Aggregate and Ceramic Tile Waste as Coarse Aggregate. *Indian Journal of Science and Technology*, Vol 9(5), DOI: 10.17485/ijst/2016/v9i5/87198, February.
- [8] C. K. Madheswaran P. S. Ambily J. K. Dattatreya N. P. Rajamane (2014) Studies on use of Copper Slag as Replacement Material for River Sand in Building Constructions. *Journal of Institution of Engineers India Ser. A (July–September 2014)* 95(3):169–177.
- [9] X. Wang, D. Geysen, S.V. Padilla T, N. D'Hoker (2013) T. Van Gerven, b. characterization of copper slag. *Rewash. Enabling Materials Resource Sustainability.*
- [10] R. Aravind Raj, Selvamuthamani (2018) "Experimental Studies on Strength of Hypo sludge Concrete with Polypropylene Fiber" *IJIRSET, Volume 7, Issue 5, Page 49-52*