

# Effect of Iron Powder on Strength of Binary Blended Concrete



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**Abstract:** *The by-products generated from milling industries are iron powders which are harmful resources to human health since they are in the air and can be straightforwardly breathe in. To prevail over this setback we have to dispose the iron powder safely without any environmental hazards. As a result, consumption on iron powder in the concrete has been developed. This study made an attempt to make utilize iron powder waste as a part substitution of Portland cement in M25 grade concrete mix by the volume of fraction in the range of 0%, 1%, 2%, 3% and 4%. The compressive strength test was conducted for the various mix proportions and the achieved strength properties were compared with those of conventional concrete after 28 days. However, the effect of iron powder with 2% partial replacement of cement exhibit an maximum improvement in compressive strength of about 29.80% when compared to that of conventional concrete.*

**Keywords :** *iron powder, compressive strength, tensile strength, workability, porosity of concrete.*

## I. INTRODUCTION

The most significant building material used in construction industry is concrete. The increase in demand of using concrete from last century has led, to widespread and valuable research in improving the mechanical and durable properties of concrete, by including a wide range of supplementary cementing materials and nano particles. The construction industry utilizing industrial byproducts such as fly ash, blast furnace slag etc., to include as a fraction of the cement in producing concrete mix. By utilizing these byproducts in making of concrete would avoid dumping of industrial waste materials into dumpsite. Apart from the use of ordinary portland cement in concrete, there are several cementing materials such as nano-Fe<sub>2</sub>O<sub>3</sub>, nano-Al<sub>2</sub>O<sub>3</sub> and nano- TiO<sub>2</sub> used as partial replacement of cement which in turn improves the mechanical and durable properties of blended concrete. Consequently the admixture of nano particle in concrete would appreciably extend the concert of cement based materials. is an International reputed journal

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## II. REVIEW OF LITERATURE

Arefi et al., (2012), stated that nano particles exhibit better performance in improving the mechanical and durable properties when compared to that of utilizing grain sized materials. Sikora1 et al. (2016), studied the effect of nano-Fe<sub>3</sub>O<sub>4</sub> as an admixture on the mechanical properties of concrete. The experimental results inferred that Fe<sub>3</sub>O<sub>4</sub> nano particles performed as a filler material which develops the microstructure of a concrete which in turn reduces the total porosity and increased the density of the composite. Ghannam et al., (2016) explored the likelihood of utilizing the by-products granite powder and iron powder as a partial replacement of sand in concrete. For the study 20cubes and 10 beams were cast and test to explore the consequence of partial substitute of industrial by-products in cement concrete. The various replacement levels used in the study are 5%, 10%, 15%, and 20% of the sand by weight. The test results revealed that replacement of 10% of sand by weight with granite powder in concrete exhibit an increase in both compressive and flexural strength when compared to that of other replacement levels Madandoust et al., (2015) evaluated the effect of nano particles on the mechanical properties of self-compacting mortar. The investigational outcome concluded that the incorporation of nano-particles exhibit viscous property. The rheological properties of test samples with various replacement levels of nano particles inferred that the compressive strength of the test samples exhibit an increase by adding 4 % replacement by weight and on further replacement level the compressive strength got decreased.

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Hanus et al., (2013) reported that incorporation of nano particles in concrete has the possibility to diminish the environmental impact and reduces the costs coupled with civil infrastructure. The modern developments in nano technology show major promise in addressing the environmental impact issues and escalate the structural concert of using conventional construction materials.

In order to avoid the environmental problem an attempt has been made in making high performance concrete with low porosity. In this study iron powder has been incorporated in concrete to reduce the pores and to achieve a high performance concrete, which would be safe to the environment. Several mix proportion with a various replacement levels of iron powder such as 0%, 2%, 4% and 6% were cast and tested to enumerate the effect of iron powder on compressive strength of concrete. This journal uses double-blind review process, which means that both the reviewer (s) and author (s) identities concealed from the reviewers, and vice versa, throughout the review process. All submitted manuscripts are reviewed by three reviewer one from India and rest two from overseas. There should be proper comments of the reviewers for the purpose of acceptance/ rejection. There should be minimum 01 to 02 week time window for it.

### III. MATERIALS AND METHODS

Concrete mixture proportioning refers to the process of determining the quantities of the ingredients necessary to produce concrete of adequate workability and meeting the strength and durability requirements for the exposure conditions to which it will be subjected. The cement used in this study is OPC 53 grade cement. The properties of cement is tested as per IS Specification for Ordinary Portland cement. The Specific gravity of the cement sample was 3.13. The fine aggregate used was of natural river sand confirming to IS 383-1970 of specific gravity 2.64 confirming zone II. The coarse aggregate used in this study had specific gravity of 2.78 and its density was 1708kg<sup>3</sup>. The iron powder used in the study was with a predominant particles size of 200nm. Ordinary Portland Cement(OPC) was partially replaced by iron powder at the percentage of 0%, 1%, 2%, 3% and 4%. Mix proportion for M25 grade concrete achieved as per IS 10262-2009 is 1:1.47:2.73:0.45. The various concrete mixes considered in this study are as follows;

Mix 1 – M25 grade with 0% of Iron powder by weight

Mix 2 – M25 grade with 1% of Iron powder by weight

Mix 3 – M25 grade with 2% of Iron powder by weight

Mix 4 – M25 grade with 3% of Iron powder by weight

Mix 5 – M25 grade with 4% of Iron powder by weight

Preparation of test specimens (cube specimens) were cast in metal moulds of standard size as mentioned in IS standard. The moulds be cleaned and inner surface were coated with oil before placing the concrete. The above said mixes were thoroughly mixed separately and the concrete was placed in the mould with hand compaction using tamping rod to avoid honeycombs. The cube moulds were de-moulded after 24hours and then placed in water tank for curing until specific days of testing. The compression test for all cube specimens was carried out and the outcomes were recorded. The test

specimens are presented in Fig.1 and Fig.2 shows the specimen under compression test.



Fig.1 Test Specimens



Fig.2 specimen subjected to compression test

### IV. RESULT AND DISCUSSION

The mechanical properties of concrete in terms compression test were assessed by substitution level of cement up to 4%. A total of five mixes containing 0%, 1%, 2%, 3% and 4% of iron powder have been investigated and reported. The results showed that iron powder exhibit increased compressive strength of concrete when compared to that of the concrete with 0% iron powder. The compression test results of various mix proportions are presented in Table 1 and shown in Fig. 3.

Table 1 Compressive Strength Test Results

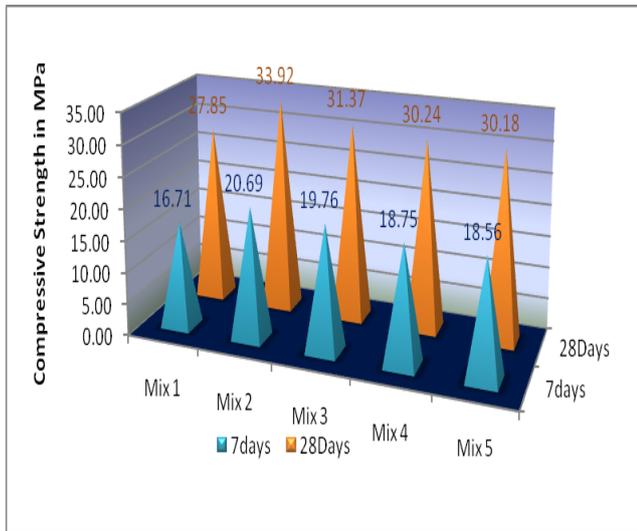
S.No.	Mix Designation	Partial Replacement Level	7 Days Compressive strength	28 Days Compressive strength
1	Mix 1	0% Iron Powder	16.71	27.85
2	Mix 2	1% Iron Powder	20.69	33.92
3	Mix 3	2% Iron Powder	19.76	31.37
4	Mix 4	3% Iron Powder	18.75	30.24
5	Mix 5	4% Iron Powder	18.56	30.18

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**Fig. 3 Compressive Strength Results after 7days and 28days**

From Table 1 and Fig.3 it can be inferred that the consequence of adding iron powder as substitution of cement with 2% exhibit an increase in compressive strength of about 23.83% and 21.80% after 7days and 28days respectively. All other partial replacement levels exhibit decrease in compressive strength.

**V. CONCLUSION**

Based on the experimental results, the following conclusion was made. The partial replacement of the cement by iron powder improved significantly the compressive strength in comparison of the concrete without iron powder (Fe<sub>2</sub>O<sub>3</sub>) particles. It is found that it is advantageous if cement is replaced by iron powder up to a maximum limit of 2% with major constituent part of 200 nm. The partial replacement of cement by 2% iron powder, exhibit a maximum increase in compressive strength of 21.80% after 28days.

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