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Influence of concrete behavior by partial replacement of cement with iron dust and addition of steel fiber

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Abstract: This paper deals with the influence of partial replacement of cement with iron dust and addition of steel fibers, Iron dust otherwise known as iron ore finds. Iron dust is an industrial by-products obtained from steel factories. It is a waste material. It is used as a pozzolanic material in concrete to improve the strength. It is important to maintain the particle size of iron dust. It is replaced with cement so the size of iron dust should be less than 0.75 micron. Steelfiber is produced from steel industries as a main product. The addition of steel fiber improves the mechanical properties of concrete. Steel fibers are used to reduce the initial cracks during shrinkage. Iron dust is partially replaced instead of as an alternate. Then the concrete is subjected to various tests in order to find the compressive strength, flexural strength and split tensile strength.

KEYWORDS: iron dust, steel fibers, compressive strength, split tensile strength, flexural strength

1. INTRODUCTION

Concrete is most used material in construction field. Many aspect of life depends on the concrete. Concrete is prepared by various material like aggregates cement and water. In the future there will be a great demand for the concrete. In the future there will be great demand for the cement. So there will be a material to be found alternative for the cement. During the reaction of the cement and water on the concrete will lead to the emission of the heat in it.In our project the iron dust is replaced by the iron dust. Because the iron dust was reasonably low rate compared to the cement. And then cement content is also reduced. And then the steel fiber is additional added to the weight of the cement. Due to the result of the project there will be reduce in the cost. So the project is economical.

2. EXPERIMENTAL WORK

Material to be used

In this paper we were studied about the effect of the replacement of the cement and the addition of the steel fiber. In our proceed we added the iron dust in the percentage of 7%.And then the steel fiber is added the concrete in ratio of the 1.5%.3%,4.5%.During the adding the steel fiber the ratio is taken on the account of the

total weight of the cement. The compaction factor test is tested for the workability of the concrete.And then the compressive strength is to be found for that the cube size of 0.15 X0.15 x0.15mm and then the cubes are tested in the respective days.afte this the split tensile test is found by the using the cylinder of 0.15 x 0.30mm after this the result of the cylinder is founded .At last the flexural strength is found by using the prism in the dimension of the .0.50 x 0.10 x0.10mm and then the results are taken.

CEMENT

The cement used in our project is OPC (53 grade) in the entire project. The Portland cement is the common cement used in the many of the project in our countries. In the dissertation work which has been performed ordinary Portland cement of 53 grades has been used. They are three types of cements available in our market like 33,43,53 grade of cement. The cement properties shown in the Table below.

Table no 1: PHYSICAL PROPERTIES OF CEMENT

Sl. No.	Physical property	Values
1	Specific gravity	3.15
2	Fineness for cement	0.4%
3	Initial setting time	30min
4	Final setting time	610 min
5	Impact Value	24.3%

Aggregate

Aggregates are those material which present in the concert in the bulk volume .The aggregate are bounded by using the cement paste from the concrete and then it will be result in increasing the concrete strength to the great manner.

FINE AGGREGATE

The fine aggregate used in our project was M sand. The M sand was bought from the nearer crusher with the high quality and with the correct fineness modulus. The properties of the fine aggregate was to pass in the 4.75mm sieve. The various tests are conducted for their physical requirements like fineness modulus, Specific gravity, and bulk density which was shown in the table given below.

TABLE 2: PHYSICAL PROPERTIES OF FINE AGGREGATE:

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Sr. no.	Property	Value
1	Specific gravity	2.6
2	Bulk density(a)loos state (b)compacted state	1413kg/cum 1688kg/cum
3	Fineness modulus	3.6

Coarse aggregate

The Coarse aggregate used in the project was the basalt rock only. The weight of the aggregate was also comes under the normal weightcategory. The material was available in the local. In our Project we use the 20 mm aggregate 60%and then the 12.5 mm aggregate in the whose particles are of such size as are retained on I.S. Sieve No. 480 (4.75mm) is used as coarse aggregates. The aggregate used which have specific gravity of 2.73 and fineness modulus of 7.5.

TABLE3: PHYSICAL PROPERTIES OF COAR/SE AGGREGATE:

S. No	Property	Value
1	Specific gravity	2.73
2	Fineness modulus	7.5
3	Bulk density	1665 kg/cum

Iron dust

Iron dust are industrial by-products generated from the milling industry and factories. It can be mainly obtain by grinding and lathing of the iron product.Particle size of iron dust is less then 0.75mm

TABLE NO. 4 CHEMICAL COMPOSITION OF IRON DUST

S.no.	Chemical composition	Percentage weight
1	SiO2	
2	TiO2	0.72
3	Al2O3	1.81
4	Fe2O3	87.0
5	MgO	0.27
6	MnO	2.6
7	CaO	0.47
8	Na2O	0.66
9	K2O	1.65
10	P2O5	0.34
11	Ni	0.002
12	Cu	0.006

Steel fibers

Steel fiber having low carbon and its both end were hooked were used. The steel fibers have a length of 30 mm, diameter of 0.75 mm, aspect ratio of 40, and density of 7.85 g/cm3.

The use of steel fiber has led to the improvement of the concrete mechanical properties such as material toughness in tension and also durability. SteelFibers are generally utilized in concrete to manage the plastic shrink cracking and drying shrink cracking. The length of steel fibers is 30mm and diameter is 0.75mm and aspect ratio 40.

TABLE 5: PHYSICAL PROPERTY OF STEEL FIBERS

S.NO	PROPERTY	VALUES
1	Equivalent Diameter	0.15 to 1.00MM
2	Specific Gravity	kg/m3 7840
3	Tensile Strength	345 TO 3000 mpa
4	Young's modulus	200 gpa
5	Ultimate elongation	4 to 10%
6	Thermal conductivity	1 to 2.74%
7	Aspect ratio	40 o 45

3.METHODOLOGY

- BATCHING
  - MIXING
  - CASTING
  - CURING
  - TESTING

Design mix proportioning procedure for the concrete was done according to IS 10262:2009. Concrete grade M30 grade were proportioned according to the procedure as mentioned in the ode. Preparing M-30 grade of concrete and cement replaced by iron dust and then addition of steel fiber reinforcement. Taking the percentage of iron dust which gives maximum value The percentage of iron dust is 5%, 7%, 9% by the weight of cement. Then adding the steel fibre in the percentage of 1.5%, 3%, 4.5%. Cast the cubes. Give curing for 28 days. Tested all the cubes and making all data mathematically and graphically also.

MIX PROPORTIONS

The basic mix proportion for M30 grade of concrete is cement, fine aggregate, coarse aggregate 1:2.007:3.12 mix 1 contain 5% iron dust . Mix 2contain 7% iron dust. Mix 3 contains 9% iron dust. Mix 4 contains 7% iron dust and 1.5% steel fiber Mix 5 contains 7% iron dust and 3% steel fiber. Mix 6 contains 7% iron dust and 4.5% steel fiber.

CASTING

Casting is done as per the norms

TEST RESULT

Dimension of cube is 150*150*150mm, dimension of beam is 100*100*500 mm, and cylinder is 150mm diameter and

300 mm length.

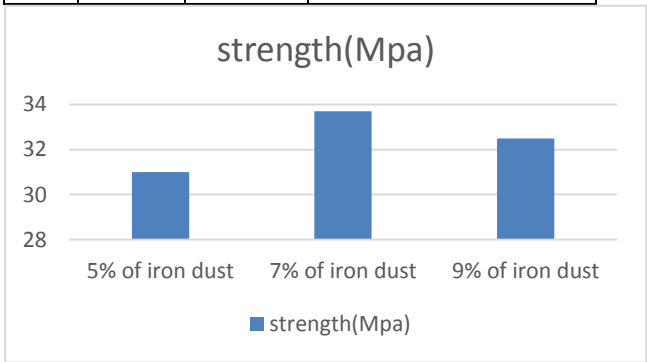
Weight of cement (100%) = 26.35 kg

Result for iron dust replacement (28 days)

1) TESUT RESULT FOR IRON DUST

Table 6. 28days compressive strength of concrete

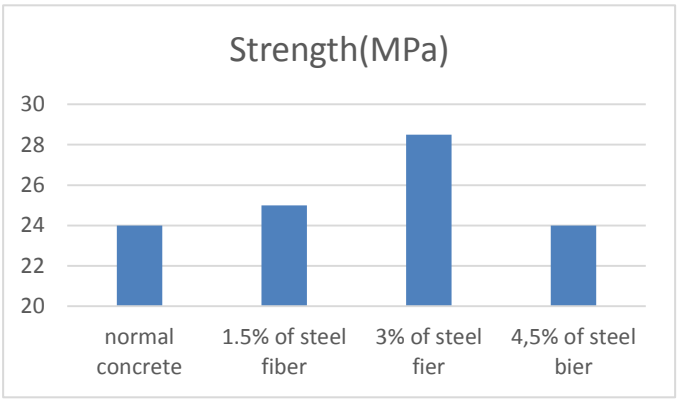
Sl. No.	%iron dust	% of steel fibers	Compressive strength
1	5%	0%	31.5 N/mm2
2	7%	0%	33.4 N/mm2
3	9%	0%	32.7 N/mm2



2)COMPTRESSIVE RESULT FOR 7% IRON DUST AND ADDITION OF STEEL FIBRE IN FOLLOWING PERCENTAGE.

Table 7. 14days compressive strength of concrete

sl. no	**Iron Dust**	**Steel fiber**	**Compressive Strength**
1	0%	0%	24 N/mm^2
2	7%	1.5%	25 N/mm^2
3	7%	3%	28.5 N/mm^2
4	7%	4.5%	26.4 N/mm^2

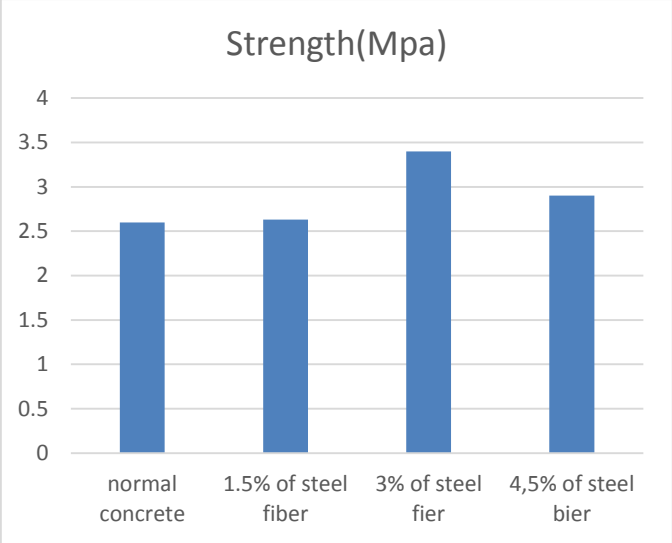


3. CYLINDER TEST RESULTS

SPLIT TENSILE RESULT FOR 7% IRON DUST AND ADDITION OF STEEL FIBRE IN FOLLOWING PERCENTAGE.

Table 8. 7days compressive strength of concrete

s. no	Iron Dust	Steel fiber	Split Tensile Strength
1	0%	0%	2.6 N/mm^2
2	7%	1.5%	2.63 N/mm^2
3	7%	3%	3.4 N/mm^2
4	7%	4.5%	2.9 N/mm^2

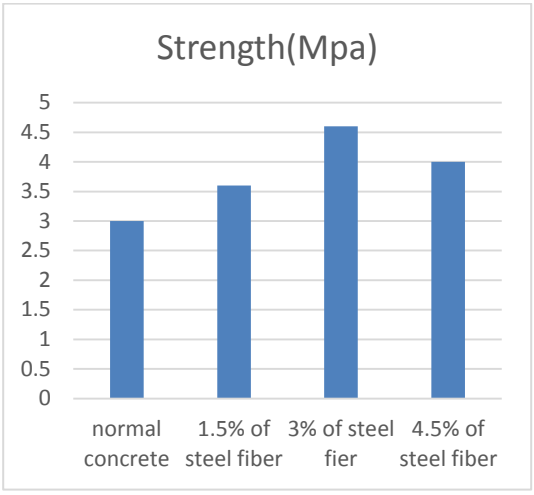


4.PRISM TEST RESULT

FLEXTURAL RESULT FOR 7% IRON DUST AND ADDITION OF STEEL FIBRE IN FOLLOWING PERCENTAGE.

Table 9. 7days compressive strength of concrete

s. no	Iron Dust	Steel fiber	Flexural Stength
1	0%	0%	3,2 N/mm^2
2	7%	1.5%	3.6 N/mm^2
3	7%	3%	4.6 N/mm^2
4	7%	4.5%	4.0 N/mm^2



4. CONCLUSION

In this experiment we have taken the result up to the 14 day test only.we have taken the result in this the steel fiber with the seven percentage and the steel fiber 3% has the more strength.

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