High Performance Concrete By Replacement Of Fine Aggregate With Iron Slag And Saw Dust In M25 Grade Concrete

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Abstract- *This experiment is aimed at creating a concrete mixture consisting of sawdust and iron slag that replaces the fine aggregates in M25. It is also used to analyze the effects of sawdust and iron slag concrete in terms of workability, adhesion of aggregates, etc. After preparing the sawdust, iron slag and concrete blocks are also treated. The sawdust and iron slag are mixed in proportion with the concrete at 20%, 40%, 50%, 60%, and 80%, and then various tests are conducted for fresh concrete as well as hardened concrete. In this study, the compressive strength of the iron slag and sawdust was studied. These findings support the application of sawdust and iron slag to reduce environmental pollution.The result shows that the iron slag and sawdust added to the concrete had greater strength than the plain concrete. This result shows that the iron slag and sawdust had attained greater compressive strength for 7 days, 14 days, and 25 days. Finally, high-performance concrete is achieved.*

Keywords- satisfactory strength, replaced, no needed fine aggregate, Saw dust, Iron Slag.

I. INTRODUCTION

1.1 GENERAL

Slag from iron and steel production has a long history of use. Early reports on the usage of slag date back to Aristotle's use of it as a medicine, according to a 2006 paper by the European Slag Association. as350B.C.Allthrough history use of slag has ranged from the novel to the usual including: cast cannonballs in Germany (1589), wharf buildings in England (1652), slag cement in Germany Iron & Steel (2007) lists slag bricks manufactured from granulated slag and lime in Japan (1901), slag wool in Wales (1840), armoured concrete in Germany (1892), and slag wool in Wales (1852). In the past, the application of Steel slag was not noticeable because enormous volumes of blast furnace slagwere available. Slag has been extensively researched and developed into a modern, useful industrial product via knowledge of environmental concerns and, more recently, the concept of sustainable development. Blast furnace slag is defined by the American Society of Testing and Materials (ASTM) in 1999 as "the non-metallic product. “consisting essentially of calcium silicates and other bases that is developed in a molten condition at the same time with iron in a blast furnace.” Slag was considered to be essential in the production of iron, but once it served its purpose in refining the metal, it was strictly a nuisance with little or no use. The Slags were found to be beneficial after the first ore melting process. Around the turn of the 19th century, slags were widely used in Europe due to a scarcity of storage space and a strong incentive to utilise industrial by-products to the fullest extent possible.Many slag markets opened soon after in Europe, the US, and other parts of the world.

India's growing economy and industrialization are causing a dramatic increase in the country's metropolitan area. The characteristic feature of urbanization has been heavy cent ration of urban population in large cities demanding economical and efficient housing layout with vertical expansion in short period. The rapid progress and research over recent past the engineers to accept framed structures as against conventional load bearing structures in frame structure walls are simply to serve as a screen for privacy of various rooms. They support their self-weights only. The structures for masonry component low density low strength material can be used to reduce dead load. The heavier self-weight of masonry provided by the higher density typical concrete blocks raises the cost of the frame structure. If saw mill waste isn't recycled into particle board, it's burned in a sawdust burner to provide heat for further milling processes. Sawdust poses a risk to the environment because it can gather in pipes and introduce dangerous leachates into nearby water systems. The appropriate use of sawmill waste has not received the attention it deserves in India. This saw dust there by constitutes an environmental problem as they form refuse heaps in the premises of saw mills and shades. Similarly, sand is naturally occurring granular material composed of finely divided gravel and minerals particles obtained from Perennial River. Huge consumption of sand in concrete structures also facing an acute shortage of sand. According to the environmentalist removal of sand from river may create environmental problems may come in the future. Iron slag one ton of steel implies the production of 130-200 kg of slag, depending on

the composition the steel and steel production process. Slag frequently takes the form of granulated solids with huge clusters of both coarse and small particles.. Serious environmental problems formerly unrestrained sand and gravel taken from river, steel slag contains high content of Can as well as Go (magnesium oxide). Because of the absence of TRI-calcium silicates and the high concentration of amorphous sio2, it has poor hydraulic properties. Consequently, there was less development of mechanical strength when a high replacement rate of Portland cement with steel slag was used.

Steel and Iron industries are always in a boom and the generation of slag is increasing from last 2 decades. It has become a major issue to dispose of the slag or utilization in a smart way. With a huge brainstorming researcher have successfully explored the various alternatives to utilize the slag so that the developing countriescan claim for the sustainable development. Iron slag could be a byproduct from the production of iron in an extreme furnace, found on the upper of the molten iron metal and processed a lot of for various treatments. Depending upon the different methods of treatment given to the flushed slag, it can be classified as Granulated Slag, Air Cooled Slag, and Expanded Slag. Now days, the various forms of iron slag are being utilized in lightweight concrete, concrete masonry, road sub-base, soil cement, GGBFS cement, insulation, asphalt aggregates etc .Although steel slag aggregate has a lower silica concentration than cement clinker, it is nonetheless used in asphalt, road base, and environmental applications. It is a very good barrier material which doesn't allow the heavy metals to leach out at waste disposal sites. As per IS 456:2000. Even M100 grade concrete is in style and regarded as high strength concrete; concrete with strengths between 55 and 80 MPa is classified as high strength concrete.

. Increase in population and decrease in land available for construction has motivated structure designers to think of long span beams and long and heavy columns for tall structures, bridges as well as for offshore structures also. The design procedure of high strength concrete is totally different from the method followed for the design of normal concrete. Low water/cement ratio in the range 0.25-0.30 or even lower than that is thekeytechniqueofachievingthehighstrengthofconcreteandthatispossibleonlywiththeadditionof some water reducing chemicals called as plasticizer/super plasticizer. High levels of strength require the adding of some inanimate admixtures like silica fume, metakaolin etc. SCC is defined as concrete that can flow under its own weight and completely fill formwork, even when reinforcement is present but not when any additional reinforcing is required. Vibrationwhilemaintaininghomogeneity.Healthissueslikepsychosomaticissuesor hearing problems are no more seen caused at the work place. Although it was developed in 1986 in Japan ,but it is developed very slowly and being adopted in structures having congested reinforcement.

SCOPE AND OBJECTIVE OF THE PROJECT

- To determine the techniques for improving economical concrete with replacement of fine aggregates with saw dust and iron slag at appropriate percentages.
- To examine the effectiveness of using sawdust and iron slag as replacement of fine aggregates by studying strength parameters.
- To investigate the compressive strength and high performance concrete with sawdust and iron slag.
- To minimize the environmental effects resultedbyusingalternativelocalavailablecementitious materialsasreplacement.
- Topromotetheusageof local available wastes with the aim preservation of environment.
- To examine the high performance of concretebyusingironslagwithreplacementoffineaggregatesbystudyingstrengthparameters.
- Toexamine the high performance of concrete by using SD with replacement of fine aggregates by studying strength Parameters
- Toinvestigatethenecessityofconsumptionofthewastematerialformanufacturingof sustainableconcreteforconstruction.Touselocallyavailablematerialandtoreducethecostofproducing concrete.
- To prepare high strength, eco-friendly and cost-effective concrete.

II. STUDY OF MATERIALS

CEMENT

The cement is made by various ingredients like lime, silica, Alumina, iron oxide, magnesia, sulphur trioxide, soda and Potash, Gypsum (or calcium sulphate).

COARSE AGGREGATE

The properties of coarse aggregate will determine the final quality and strength of a concrete batch. The size, grading, shape, strength and water absorption of the aggregate all influence the final concrete mix in various ways, so contractors need to keep an eye on these variables.It should be free from silt, clay and coal residues. It should not contain any

organic and other admixtures. It should be sharp, course and angular to have good interlocking possession. It need to be devoid of splinter or thin, flat, elongated flaky particles. The aggregates should be sized so that they completely fill up the spaces left by the coarse aggregates. Both the fine aggregates and their voids are finished. filled to create hard concrete using cement and water. Because of the abrasive effect of traffic, the coarse aggregates used in the surface course of road development must tolerate high magnitude loads, strains, and wear and tear. It shouldn't be tough enough to withstand abrasion from the moving cars' abrasive action. Under unfavourable weather conditions, such as alternating wet and dry spells and freeze-thaw cycles, it shouldn't crumble. It should have a specific gravity greater than 27.

IRON SLAG

Since the blast furnace (BF) produces the bulk of the iron produced worldwide, BF slag is the most abundant type of slag used in ironmaking. The main method for turning iron (Fe) oxides into molten, metallic iron is the BF. It is continuously supplied with fuel (coke and coal), fluxes (limestone and dolomite), and sources of Fe oxide (ore, sinter, and pellet, etc.). Slag floats on liquid iron that has collected in the furnace's bottom. Both are taken out of the furnace on a regular basis. The American Society for Testing and Materials (ASTM) defines BF slag. It describes BF slag as a non-metallic substance that is produced in and mostly made of calcium silicates and alumino-silicates along with other bases.

SAW DUST

The pour and consolidation densities will rise as the moisture content rises, but sawdust's modulus of elasticity will fall.

WATER

Water is a gaseous, liquid, and solid material that is made up of the chemical components hydrogen and oxygen. It is among the most common and important substances. It is a colourless, odourless liquid that, when left at room temperature, dissolves a wide variety of other substances. Water is a versatile solvent that is necessary for the survival of living things. The world's oceans are said to be the birthplace of life, and biological functions in living things like blood and digestive secretions rely on watery solutions. Other planets and moons in and outside of the solar system also have water.

MIX DESIGN

MATERIAL	PROPORTION
Cement	1.3975kg
Fine aggregate	1.3975kg
Coarse aggregate	2.795kg
Water	191.6kg
Water cement ratio	0.40

FRESH CONCRETE TEST

Fresh concrete test is used to determine the following key properties of the concrete.

- Workability of the concrete
- Water cement ratio
- Mix proportion of the concrete

SLUMP CONE TEST

It is used to determine the consistency of the concrete

CONCRETE MIX		SLUMP VALUE	SLUMP SHAPE
Iron Slag	Sawdust		
20%	80%	19.9cm	Shear slump
40%	60%	18.6cm	Shear slump
50%	50%	14cm	Shear slump
60%	40%	17.6cm	Shear slump
80%	20%	16.4cm	Shear slump
Normal mix		25cm	True slump

COMPACTION TEST

This method is used to determine the workability test of the fresh concrete.

CONCRETE MIX		COMPACTION VALUE
Iron Slag	Sawdust	
20%	80%	0.82(Low)
40%	60%	0.79(Low)
50%	50%	0.52 (very low)
60%	40%	0.75(Low)
80%	20%	0.73 (Low)
Normal mix		0.97 (high)

FORMULA

Compacting factor = weight of partially compacted / weight of fully compacted

HARDENED CONCRETE

Testing of hardened concrete plays and important role in controlling and confirming the quality of cement concrete works.

COMPRESSIVE STRENGTH

The ability of a material or structure to support loads on its surface without breaking down or deviating is known as its compressive quality. A material under compression tends to reduce the size, while in tension, size elongate.

III. RESULT & DISCUSSION

Sl. No.	Percentage Of Iron Slag [%]	Percentage Of Saw Dust[%]	Compression Strength N/Mm^2	Avg. Compression Strength N/Mm^2
1	20%	80%	20	20
2			20	
1	40%	60%	40	35
2			30	
1	50%	50%	45	42.5
2			40	
1	60%	40%	65	62.5
2			60	
1	80%	20%	95	92.5
2			90	

RESULT OF COMPRESSION STRENGTH TEST ON CUBE.7 DAYS

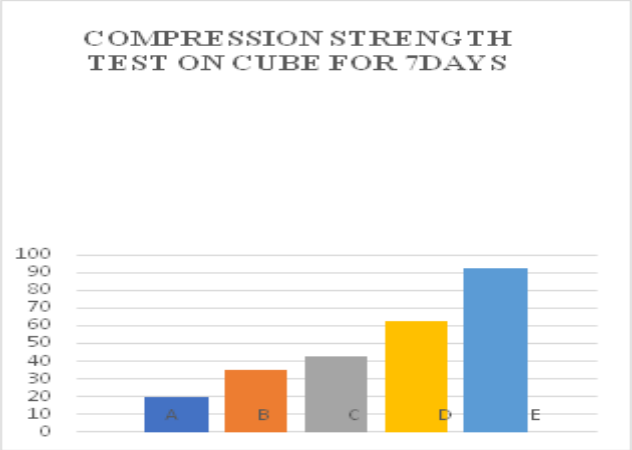

CHART 1:RESULT FOR 7 DAYS

Sl.No.	Percentage Of Iron Slag [%]	Percentage Of Saw Dust[%]	Compression Strength N/Mm^2	Avg. Compression Strength N/Mm^2
A	20%	80%	20	20
			20	
B	40%	60%	40	45
			50	
C	50%	50%	50	50
			50	
D	60%	40%	80	72.5
			65	
E	80%	20%	195	190
			185	

14 DAYS

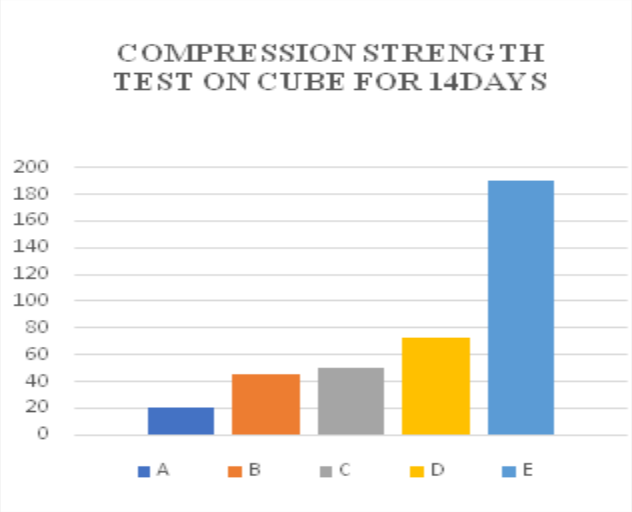

CHART2:RESULT FOR 14 DAYS

Sl.No.	Percentage Of Iron Slag [%]	Percentage Of Saw Dust[%]	Compression Strength N/Mm^2	Avg. Compression Strength N/Mm^2
A	20%	80%	25	25
			25	
B	40%	60%	50	47.5
			45	
C	50%	50%	40	45
			50	
D	60%	40%	70	70
			70	
E	80%	20%	130	170
			210	

28 DAYS

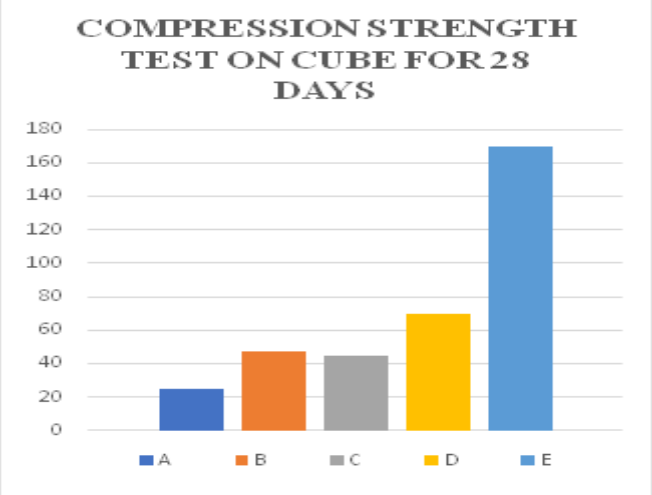

CHART 3 :RESULT FOR 28 DAYS

IV. RESULT

The Result obtained from the laboratory testing Reflects the workability, properties and strength of the concrete. These tests work conducted on the mix sample A,B,C,D,E Which consists of 20%, 40%,50%, 60%, 80%. of sawdust and iron slag in replacement with fine aggregate. By substituting iron slag and sawdust for fine aggregate, the concrete is able to form a strong bond.This result shows that the iron slag and sawdust had attained greater compressive strength for 7 days, 14 day & 28 days and also achieve high performance concrete.

V. CONCLUTION

After adding 20% iron slag and saw dust 80% in the mix, there is an increase of 20 N/mm^2 after 7 days, 20 N/mm^2 same strength after 14 days and rise following 28 days in comparison with the control mixture.

After adding 40% iron slag and saw dust 60% in the mix, there is an increase of 35 N/mm^2 after 7 days, 45 N/mm^2 increase after 14 days and 47.5 rise in comparison to the control mix after 28 days.

After adding 50% iron slag and saw dust 50% in the mix, there is an increase of 42.5 N/mm^2 after 7 days, 50 N/mm^2 increase after 14 days and rise in comparison to the control mix after 28 days.

After adding 60% iron slag and saw dust 40% in the mix, there is an increase of 62.5 N/mm^2 after 7 days, 72.5 N/mm^2 increase after 14 days and 70 rise in comparison to the control mix after 28 days.

After adding 80% iron slag and saw dust 20% in the mix, there is an increase of 92.5 N/mm^2 after 7 days, 190 N/mm^2 increase after 14 days and 170 increase after 28 days as compared to the control mix.

The Compressive strength tends to increase with increase percentages of iron slag and saw dust in the mix.

Our project had achieved a better result in the use of iron slag and sawdust in the concrete.

Finally as a result confirm that the use of iron slag and sawdust to overcome pollution problems in the environmental and also achieve high performance concrete.

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