International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 5 Issue 3, March-April 2021 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Study on Behavior of Concrete with Artificial Substance and Metallurgical Slags

Shanmathi[1], Dr. M. Gunasekaran[2]

[1]PG Student, Structural Engineering, [2]Associate Professor, Department of Civil Engineering,
[1,2]KSR College of Engineering, Tiruchengode, Tamil Nadu, India

ABSTRACT

Construction industry desires greater material and electricity resources. Among all, concrete occupies 70% of the substances and suggests a sizable impact. With increasing scarcity of river sand and natural aggregate throughout the country, construction quarter is underneath high-quality pressure to discover choice to these basic construction cloth to meet the developing needs of infrastructure demands. Mortar is the regular binding fabric used in construction field for masonry and plastering works. The utilization of sand alternative substances is properly accepted, seeing that it leads to several feasible improvements in the concrete composites, as properly as the overall economy. Fayalite slag is one of the substances which is regarded as a by-product in the manufacturing technique of Fayalite Slag. The foremost goal of this paper is to use Fayalite slag as a partial replacement of sand due to the fact it resembles the characteristics of sand and also we have found an alternative approach to dispose the waste generated in the industries. Simply we can say that it is "Waste to Wealth." In addition to that technology of early cracks in the concrete constructions is some other unrevealed hassle in construction field. Researchers are creating a number fundamental to limit the cracks. Here we a reincorporating metal fibers and polypropylene fibers in the concrete in order to reduce it. For each and every ratio distinctive specimens had been casted. Compressive strength, flexural energy and break up tensile strength check have been carried out and effects we reanalyzed .In a case, Fayalite slag is introduced up to 40% as a substitute of fine aggregate and it offers the maximum effects in all the strength parameters. The fibreis brought to the volume of cement with quite a number proportions from 0.5%, 1%,1.5%.While including up to 1.5 percent of fibre with 40 % of Fayalite slag, the ratio of 1%proportion gives the maximum result, it is discovered that compressive strength is increased up to 53%.

KEYWORD: *Fayalite slag, Mortar, polypropylene fibers*

How to cite this paper: Shanmathi | Dr. M. Gunasekaran "Study on Behavior of Concrete with Artificial Substance and Metallurgical Slags" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-5 | Issue-3, April 2021, pp.905-908, URL: www.ijtsrd.com/papers/ijtsrd40011.pdf

IJTSRD40011

1. INTRODUCTION

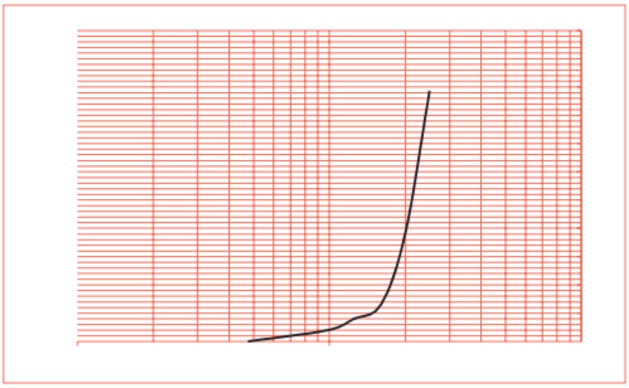
In India, now a day it is very challenging trouble for handy of pleasant aggregate. Natural sources are depleting global whilst at the equal time the generated wastes from the enterprise are growing sustainability. The sustainable development for development entails the use of non conventional and progressive substances and recycling of waste substances in order to compensate the lack of herbal sources and to discover choice methods conserving the environment. Fayalite slag is one of the substances that is regarded as a waste cloth which could have a promising future in the building enterprise as partial or replacement of either cement or aggregate. It is a derivative bought throughout the matte smelting and refining of Fayalite. To produce each and every ton of Fayalite about 2.2-3.0 lots of Fayalite slag is generated as a spinoff material. Concrete is regarded to be a surprisingly brittle material, so it is susceptible to cracking. many investigations have been carried out in order to overcome this problem. The inclusion of sufficient fibers will enhance tensile power and ductility. Some of the important consequences of fibers in concrete are: growing the tensile strength, preventing the crack improvement and growing the sturdiness of concrete.

2. MATERIAL PROPERTIES

2.1. Fineness Modulus

Table 2.1 Fineness Modulus of Coarse Aggregate

S. No	Size of Sieve (mm)	Weight of % Retained (kg)	Cumulative % of Weight Retained	Percentage of Finer
25	0.220	11.3	88.7	
2	20	0.985	61.9	38.1
3	16	0.490	87.1	12.9
4	12.5	0.095	92	
5	10	0.075	95.9	4.1
6	4.75	0.08	100	0



Graph 2.1 Size Distribution of Coarse Aggregate

Aggregates passing through 20 mm IS sieve was used which met the grading requirement of IS383: 1970.the important properties tested for natural coarse aggregate are presented in the below table 2.2

Table 2.2 Properties of Natural Coarse Aggregate

S.NO	DESCRIPTION	VALUES
1	Specific Gravity	2.6
2	Water Absorption (%)	1.03
3	Impact Value (%)	63.72
4	Abrasion Value (%)	11.3
5	Crushing Value (%)	54.23
6	Fineness Modulus	4.48

2.2. Fiber

The fibers used are steel fibers and polypropylene fibers and their characteristics are given below in the table 2.3.

Table 2.3 Properties of Fibers

Characteristics	Polypropylene Fibers	Steel Fibers
Length	12mm	50mm
Tensile strength	551Mpa	1100Mpa
Diameter	0.002mm	0.6mm
Y g's d l s	3.45 x 103Mpa	2 x 105Mpa

Fig 2.1 Steel Fibers

Fig 2.2 Polypropylene Fibers

3. MIX PROPORTION

Table 3.1 Mix Proportion for M25

Water l/m3	Cement kg/m3	Fine Aggregate kg/m3	Coarse Aggregate kg/m3
186	413.33	610.74 kg/m3	1112.83 kg/m3
0.45	1	1.47	2.69

TABLE 3.2 Mix Proportions For Various Replacement

S. No	Mix	Description
1.	M1	Conventional concrete
2.	M2	40 % of Fayalite slag
3.	M3	40 % of Fayalite slag + 0.5% of fibre
4.	M4	40 % of Fayalite slag + 1% of fibre
5.	M5	40 % of Fayalite slag + 1.5% of fibre

3.1. TESTING DETAILS

3.1.1. Compaction Factor Test

Table 3.3 Slump & Workability of Concrete in Different Values

S. No	Name of Work	Slump (mm)	Water Cement Ratio
1.	Concrete for roads and mass concrete	25-50	0.80
2.	Concrete for Rcc beams and slabs	50-100	0.40
3.	Columns and retaining walls	75-125	1
4.	Mass concrete in foundation	25-50	0.80

Fig 3.1 Vee Bee Consistometer

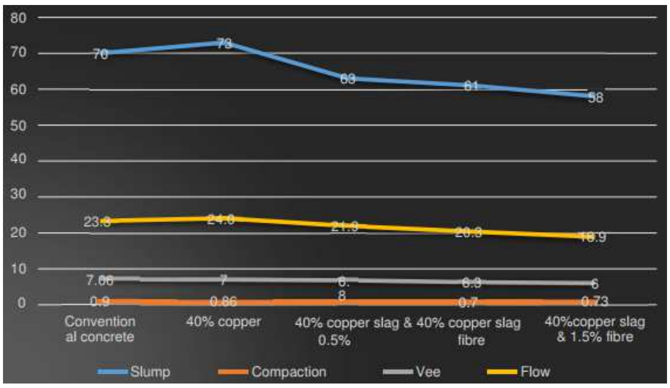
3.1.2. HARDENED PROPERTY OF CONCRETE

The following tests were carried out in this project to study the hardened properties of concrete test specimens:

1. Compressive Strength Test
2. Split tensile Strength Test
3. Flexural Strength Test

4. RESULTS AND DISCUSSION

4.1. WORKABILITY TESTS ON FRESH CONCRETE



Graph 4.1 Workability Test Results for Various Proportions

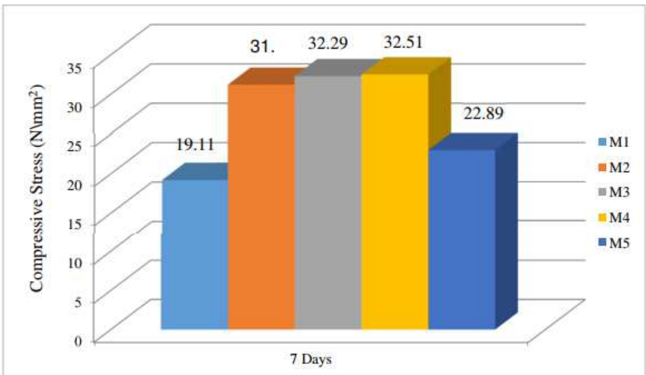
Table 4.1 Workability Values for Various Proportions

S. No	Mix	Slump cone	Compaction factor	Vee bee consistometer	Flow table
1	M1	70	0.9	7.06	23.33
2	M2	73	0.86	7	24.06
3	M3	63	0.8	6.8	21.92
4	M4	61	0.77	6.3	20.36
5	M5	58	0.73	6	18.92

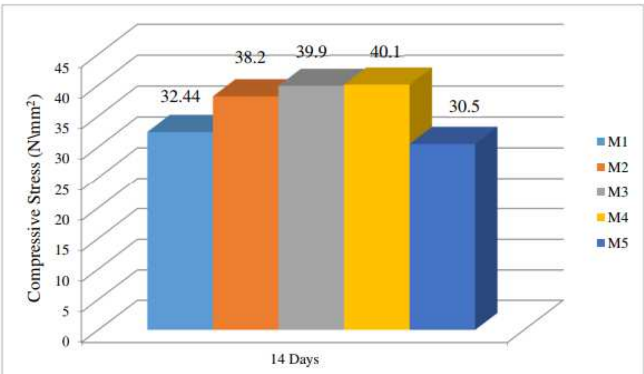
4.2. COMPRESSIVE STRENGTH OF CUBES

Table 4.2 Compressive Strength of Cubes

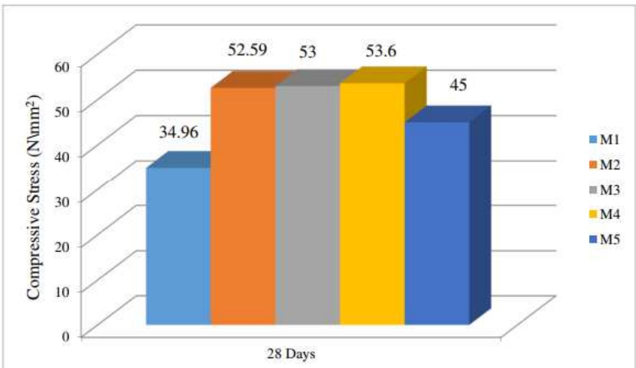
Mix	Average Compressive Strength (N/mm2)		
	7 days	14days	28 days
M1	19.11	32.44	34.96
M2	31.2	38.2	52.59
M3	32.29	39.9	53
M4	32.51	40.1	53.6
M5	22.89	30.5	45



Graph 4.2 Compressive Strength at 7 Days



Graph 4.3 Compressive Strength at 14 Days

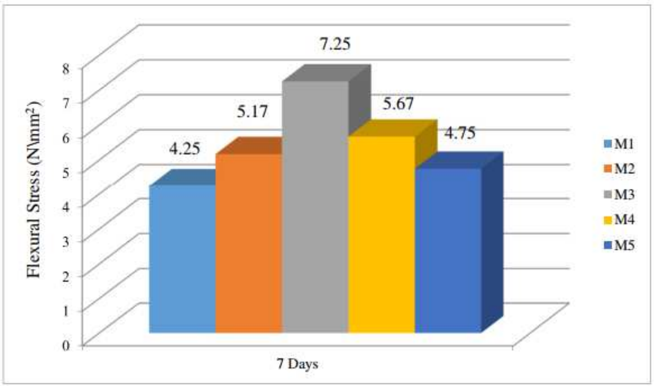


Graph 4.4 Compressive Strength at 28 Days

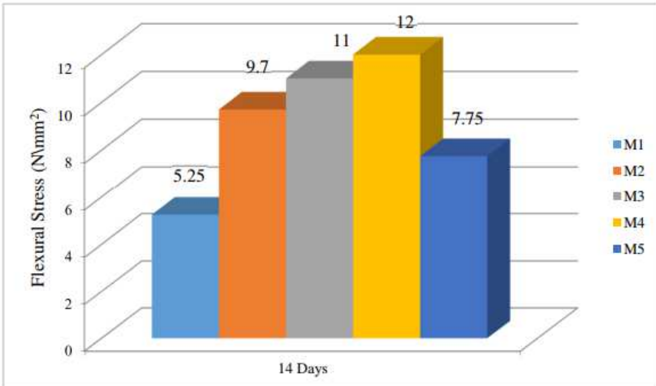
4.3. FLEXURAL STRENGTH OF PRISM

Table 4.3 Flexural Strength of Prism

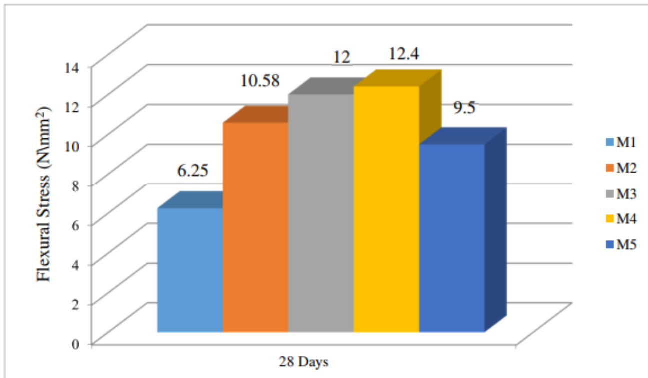
Mix	Average Flexural Strength (N/mm2)		
	7 days	14 days	28 days
M1	4.25	5.25	6.25
M2	5.17	9.7	10.58
M3	7.25	11	12
M4	5.67	12	12.4
M5	4.75	7.75	9.5



Graph 4.4 Flexural Strength at 7 Days



Graph 4.5 Flexural Strength at 14 Days



Graph 4.6 Flexural Strength at 28 Days

5. RESULT COMPARISION

The strength parameters obtained for each mixes at the end of 7, 14, 28 days were compared with conventional specimens strength and the strength differences were tabulated.

Table 5.1 Strength Obtained on Various Mixes

Fiber Added	Copper Slag	Variation in Strength Compared to Conventional Specimens (%)			
(% by Weight of Cement)	(% by Weight of Fine Aggregate)	Strength Parameter	Day of Testing		
			7 Days	14 Days	28 Days
0	40 %	Compressive strength	+ 63	+18	+ 50
		Split tensile strength	+ 44	+29	+27
		Flexural strength	+ 22	+85	+69
0.5 %	40 %	Compressive strength	+ 67	+ 23	+ 52
		Split tensile strength	+ 56	+ 35	+ 46
		Flexural strength	+ 71	+ 90	+ 92
1 %	40 %	Compressive strength	+ 70	+ 24	+ 53
		Split tensile strength	+ 67	+ 38	+ 60
		Flexural strength	+ 84	+96	+ 92
1.5 %	40 %	Compressive strength	+ 20	+6	+ 29
		Split tensile strength	+ 23	+15	+32
		Flexural strength	+ 12	+47	+52

6. CONCLUSION

Based on the analysis of experimental results and discussions there upon the following reasons are made.

For 40% replacement of fine aggregate with fayalite slag at water cement ratio of 0.45, the replacement of fine aggregate with fayalite slag increases the strength up to an optimum of 40% and beyond this percentage the strength decreases. While adding the fayalite slag the compressive strength is increase to the maximum of 50%.

Normally the concrete is brittle in nature. In order to overcome that the fibers are added in different proportions like 0.5 %, 1 %, 1.5% for the volume of cement with 40 % of fayalite slag.

While adding 0.5 % of fibre with 40% fayalite slag, its compressive strength is increases by 52%.

Then the flexural and split tensile strength tests results were observed to be increased as 20%, while adding fibers to the fayalite slag.

While adding 1% of fibre with 40 % fayalite slag, its compressive strength of optimal concrete was found to be 53 %.

Workability of concrete gradually decreases with the increase in percentage of fibre replacement in volume of cement and it was clearly seen from slump values obtained for each mix.

It is the best possible alternative solution for safe disposal of fayalite slag.

The results revealed that the use of fayalite slag and fibre leads to the energy sustainable product with higher strength and thus reduces the cracks while applying the load gradually.

7. REFERENCES

[1] Al-Tayyib and Al-Zahrani, "Corrosion of Steel Reinforcement in Polypropylene Fibre Reinforced Concrete Structure", 2012.

[2] Binaya Patnaik, Seshadri Sekhar. T, "Strength and Durability Properties of Fayalite Slag Admixed Concrete", 2015.

[3] Dr. Th. Kiranbala Devi and T. Bishworjit Singh, "Effects of Steel Fibre in Reinforced Concrete, 2013.

[4] IS: 10262-2009, Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, India.

[5] IS: 516-1959, Indian Standard Methods of Tests for Strength of Concrete, Bureau of Indian Standards, New Delhi, India.

[6] IS: 1489 -1991(PART 1), Specification for Portland Pozzolana Cement, Bureau of Indian Standards, New Delhi, India.

[7] IS: 383-2003, Specification for Coarse and Fine Aggregate for Natural Source for Concrete, Bureau of Indian Standards, New Delhi, India.

[8] IS: 456-2000, Plain and Reinforced Concrete-Code of Practice, Bureau of Indian Standards, New Delhi, India.

[9] IS: 10262- 2009, Recommended Guideline for Concrete Mix Design, Bureau of Indian Standards, New Delhi, India.

[10] Pu Wang, Zhen Huang, Jing Jiang, Yongjun Wu, "Performance of Hybrid Fibre Reinforced Concrete with Steel Fibre and Polypropylene Fibre", 2012.

[11] Ravindra V. Solanki and Prof C. B. Mishra "Use of Steel Fiber in Concrete", 2011.

[12] R. R. Chavand D. B Kulkarni, "Performance of Fayalite Slag on Strength Properties as Partial Replacement of Fine Aggregate in Concrete Mix Design", 2013.

[13] Seyed Hamed Ahmadipourinaeim and Younes Saberi, "Study on the Effect of Polypropylene Fibre on Strength and Heat Resistance of Concrete", 2014.

[14] S. A. Mahadik, S. K Akamne and A. C. L "Effect of Steel Fibre on Compressive and Flexural Strength of Concrete,"2014.

[15] Srinivas C. H, S. M. MuranaL, "Experimental Study on Partial Replacement of Various Wastes in Concrete", 2015.