International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-1, November 2019

Performance in Binary Characteristics of Sisal Fibre Reinforced Concrete

V. M. Southararajan, S. Sivasankar, S. Dinakaran, Nabajyoti Modak, R. Gopalakrishnan

Abstract: This research study has experimentally performed on the compressive strength, split tensile flexural strength and durability test method also emphasized in various mixes of high-performance concrete. The maximum compressive strength of concrete was noted for different curing days, while the addition of fly ash 20% with 15% of slag along with1% of sisal fiber reinforced concrete than compared to Plain Portland cement content up to 100%. Further, increasing the cementitious binder content there is a drastic fall in strength gain was observed than that of other mixes. On the contrary, the best mix was identified that's 10% fly ash along with 15% of slag produced the highest compressive strength, split tensile strength and flexural strength for different days of cured the concrete specimens. Also, the durability test performed as prescribed in ATMC 1202, based on the lab test results, it is concluded that the electrical charge passed over all the concrete specimen at 28 and 56 days presents the lesser values 1000 (coulombs) this is the evidently proved that the high resistance towards the corrosions and drastically reduced the chloride ions permeability except for plain cement concrete.

Keywords: Compressive strength, Fly ash, Flexural strength, Rapid chloride permeability test, Slag, Split tensile strength, Quarry dust,

I. INTRODUCTION

The major production of high strength concrete incorporating low calcium amount of fly ash is widely used in the construction field and also various application was running successful and also withstanding the structures over a long period of years. The beneficial properties of fly ash can be realized in terms of the improved mechanical properties in concrete due to the long curing period. Also, the early age setting properties of cement concrete is greatly affected due to delay the pozzolanic reaction during the hydration process when fly ash content added in Portland cement.

Revised Manuscript Received on November 30, 2019.
* Correspondence Author

Dr VM Southararajan*, Professor, Department of Civil Engineering, CMR Technical Campus, Kandlakoya, Medchal Road, Hyderabad – 501401, Telangana, India.

Dr S. Sivasankar, Associate Professor, Department of Civil Engineering, CMR Technical Campus, Kandlakoya, Medchal Road, Hyderabad – 501401, Telangana, India.

Mr. S. Dinakaran Assistant Professor, Department of Civil Engineering, Anand Institute of Higher Technology, Chennai, Tamil Nadu, India.

Mr. Nabajyoti Modak: Assistant Professor, Department of Civil Engineering, Anand Institute of Higher Technology, Chennai, Tamil Nadu, India.

Dr R. Gopalakrishnan, Professor, Department of Civil Engineering, SRM Easwari Engineering College, , Chennai, TamilNadu, India.

This primarily leads to the negative effects on initial stage but later on the strength gain was occurring and mostly using the major application for pavement works. Fly ash is a waste by-product materials collecting from various coal-fired electric generating plants. This type of ash is partially replaced in Portland cement to make the assured quality of conventional concrete and also minimize the CO_2 emission and reduce the project cost. Now a days Portland Pozzolanic cement which is consisting of 30% fly ash cement to use various stage of building construction. The most of the research work has been identified the corrosion is one of the major issues in construction industries when number of steel used in concrete thereby to sort out largest problems in durability based on the various test results while usage of supplementary waste binding materials in plain cement concrete thus resulting to increase the high-performance and less chloride permeability and also increase their service-life in concrete-structures. The major causes of deterioration in reinforced concrete due to cracking freezing and thawing, alkali-aggregate reaction, chemical exposure due to aggressive environmental condition, steel corrosion in concrete, fire resistance of concrete by considering above factors a proper adoption should be adopted to prevent the damage enhanced their life-span of the structures. From the iron manufacturing industries, waste furnace slag generation and this type of slag is bio-degradable and reduces the environmental pollution and resolve the disposal problem. Also, the usage of slag in Portland cement in construction industries to increase various strength gains at different curing days. It was significantly proved based on the various test results the addition of slag up to 0 to 30% (by weight of binding materials) by replaced in OPC gives the excellent improvement in compressive strength and also utilize the geopolymer concrete along with chemical reactions with ambient temperature for various mixes. A few research works have been identified and simplified the rapid chloride ions permeability test method was conducted for various mixes of concrete based on the corrosion of rebar resistivity test only.

II. RESEARCH-SIGNIFICANCE

The current scenario of this research work is to utilize the large scale of waste cementitious binding materials addition into the concrete for various mixes thus results to improve the pozzolanic reactions along with Portland cement during the hydration process. Also, based on the test results about the durability studies, it is concluded that the life-span of structures is excellent in the higher performance concrete.

III. MATERIALS USED AND MIXTURE PROPORTIONING

A 53 grade of ordinary Portland cement was used and having a specific gravity 3.15 with normal consistency value of 34% and fly ash (Class-F) was used and having a specific gravity value of 2.48, and also slag was used and having a specific gravity value of 2.63 to acts as binding materials. Normal river sand (fine aggregate) passing through 4.75 mm standard sieve and having specific gravity 2.63 along with quarry dust passing through 1.18 mm sieve and having specific gravity is 2.71and also crushed granite stone aggregate passing through 10 to 20 mm sieve was used and having specific gravity value of 2.64. On the contrary, sisal fibers were added up to 0 to 1.5% in order to improve the bending stress for various mixes as shown in Figure 1. A new generation water reducer type of polycarboxylate ether-based superplasticizer was used as a chemical admixture to improve the fresh concrete workability. The M25 grade of concrete mix design was emphasized to obtain a target compressive strength of concrete for various mixes are provided in **Table I.** The RCPT concrete disc size 50 x 100 mm (height x diameter) are cast and tested for 28 and 56 days for various mixes. The polarity for the positive electrode (left side) of the specimen is immersed in a sodium chloride solution (+ve charge); while the other end (another electrodes-right side) is immersed in a sodium hydroxide solution (-ve charge).

Fig. 1. Image for dried sisal fibers (organic)

Table-I: M25 grade concrete for various mixes

Mix id	Binder content required (kg/m^3)			Fine Aggregate		Coarse Aggregate	Sisal-fiber (organic) [%]	RCD= 50 kg per litre
	Cement	Fly ash	Slag	Sand	Quarry dust			
				(kg/m^3)				
	w/b ratio = 0.42							
H-1	480	0	0	0	600	1200	0	9.6
H-2	384	24	72	480	120		0	7.68
H-3	384	24	72	480	120		0.5	7.68
H-4	384	24	72	480	120		1	7.68
H-5	384	24	72	480	120		1.5	7.68
H-6	336	96	72	480	120		0	6.72
H-7	336	96	72	480	120		0.5	6.72
H-8	336	96	72	480	120		1	6.72
H-9	336	96	72	480	120		1.5	6.72
H-10	264	144	72	480	120		0	5.28
H-11	264	144	72	480	120		0.5	5.28
H-12	264	144	72	480	120		1	5.28
H-13	264	144	72	480	120		1.5	5.28

IV. TEST RESULTS AND DISCUSSIONS

A. Compressive strength

Figure 2 presents the various compressive strength concrete at different curing days. It is proved based on the test results that the compressive strength in 28-days and 56-days has attained the maximum strength was 33.75 MPa and 35.20 MPa respectively. Further, the addition of fly ash up to 20% with 15% slag along with 1% of sisal fiber to produce a higher strength at different days than that of other mixes.

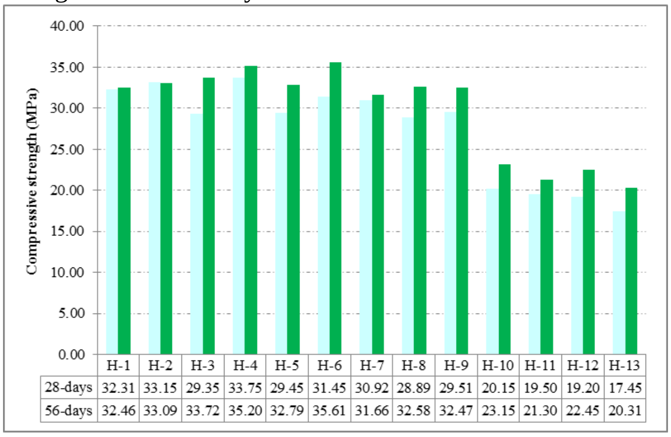

Fig. 2. Compressive strength for various mixes

B. Split tensile strength

The indirect measurement of the tensile strength of concrete consisting of 10% of fly ash with 15% of slag along with 0.5% sisal fibers produced the higher split tensile strength of concrete. However, in the case of 20% of fly ash with 15% of slag along with 1.0% of sisal fibers produced a good strength at 56-days only. Further, the addition of fly ash, slag and sisal fibers content there is a drastic fall due to delay the setting properties of concrete.

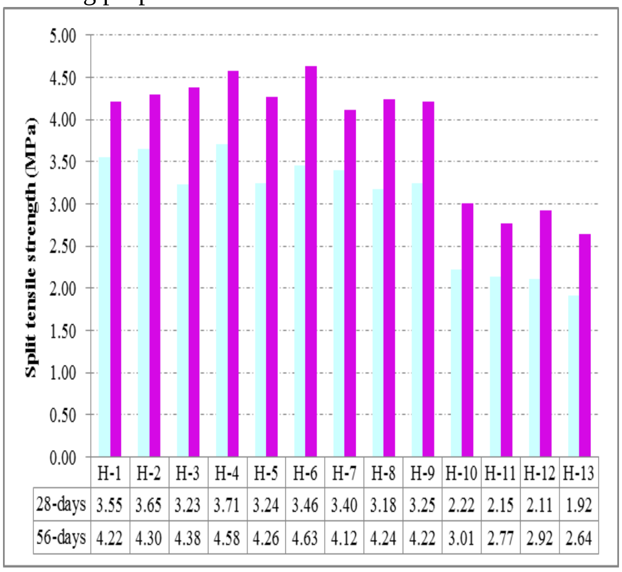

Fig. 3. Variation of strength for split tensile

C. Flexural strength

Figure 4 shows the excellent improvement in flexural rigidity of concrete at different curing days for various mixes.

Retrieval Number: A3909119119/2019©BEIESP
DOI: 10.35940/ijitee.A3909.119119
Journal Website: www.ijitee.org

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

It was noted that the higher bending stress consisting of 10% of fly ash with constant percentage of slag up to15% along with major contribution of sisal fibers up to 1% working effectively than that of 1.5% of sisal fibers.

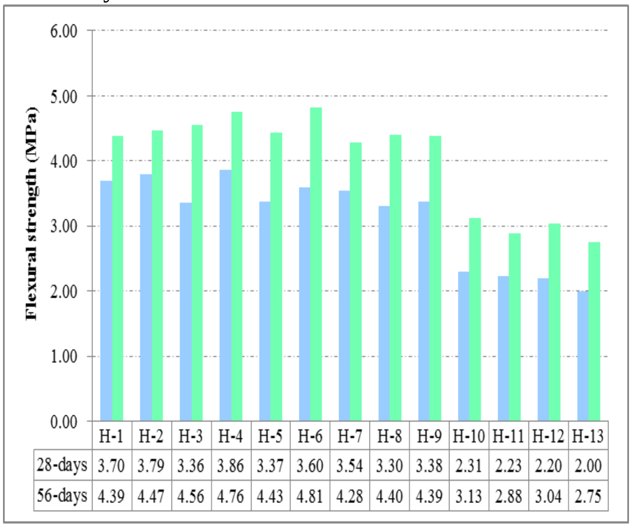

Fig. 4. Flexural strength at different age of concrete

D. Rapid-chloride permeability

Figure 5 presents the various resistances of chloride ions permeability of concrete while the usage of waste cementitious binding materials for different curing days. It was noted that the replacement of Portland cement with 20% of fly ash with 15% of slag along with 0.5% of sisal fibers reduces the chloride ion penetration for 56-days (H-7mix id) due to later age gain strength of concrete. However, in case of replacement of Portland cement with 10% of fly ash with 15% of slag along with 1% of sisal fibers also produced less chloride penetration (H-4 mix id) when compared to plain cement concrete than that of other mixes.

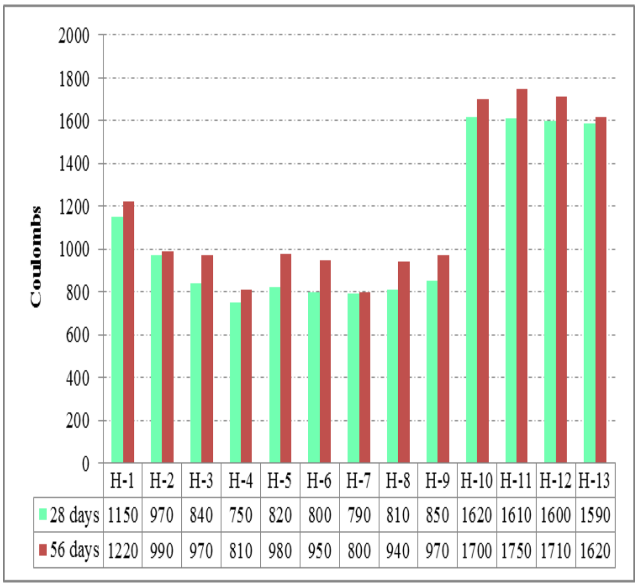

Fig. 5. RCPT at different age of concrete

V. CONCLUSION

The following conclusions are drawn from various specific outcomes based on the laboratory test results The usage of fly ash with slag in construction industries for the successful application while reduce the Portland cement consumption and eliminate the carbon-di-oxide and reduce the cost while disposing of the waste. The fly ash has been adopted widely in the construction industry to act as binding materials thus results to improve the pozzolanic reactions with less heat of hydration; water demand is considerably reduced and avoids the bleeding.The addition of superplasticizers in concrete is significantly reducing the water content with low w/b-ratio while increasing the workability for various mixes. The addition of optimum 1% of sisal fibers in the concrete reacts with normal workability of high-performance concrete mixes, further increasing the fiber content there is a lacking of workability.Initially, the lower addition of binding material strength at 28 days is more than that of higher addition of waste cementitious materials. Further, the addition of a higher amount of binding materials in plain cement concrete at 56 days test results produced the maximum strength due to later age gain strength of concrete than compared to lower additions.Similarly, the chloride ions permeability test at 56 days shows within the range of coulombs than compared to plan cement concrete followed by lower addition of waste binding materials in concrete.

REFERENCES

1. J. Tao and X. Wei, "Effect of ground granulated blast-furnace slag on the hydration and properties of cement paste," Advances in Cement Research, 31(6), 251–260, 2019.
2. V.M. Southararajan, "Effect of Accelerated Curing on the Furnace Slag Based Polypropylene Fibre Reinforced Concrete," Advanced Material Research 2018. vol. 1150, pp. 91-102, 2018
3. V.M. Southararajan "Empirical prediction models for strength gain properties of fly ash based concrete subjected to accelerated curing," Advanced Material Research 2018. vol. 1150, pp. 73-90, 2018
4. Tarannum, Rameshwari, Shruti, Kalappa. M. Sutar, "Experimental Studies on Pozzolanic Acton of GGBS and Strength Properties of GGBS Concrete," International journal for Innovative Research in Science & Technology, 1(12), 69-74, 2015.
5. M.Prathap Kumar, Vaddi Srinivas and M,Zoheb Nawaz, " Experimental Investigation on High Strength Concrete using GGBS, Fly ash & SP-430 Super Plasticizer," International of Civil Engineering and Technology, 8(9), 2017.
6. A. Sivakumar and VM. Southararajan, "Strength Properties of Processed Fly Ash Concrete," Journal of Engineering and Technological Sciences, vol. 47, no. 3, pp. 320-334, 2015.
7. K. V. Schuldyakov, L. Y. Kramar, and B. Y. Trofimov, "The properties of slag cement and its influence on the structure of the hardened cement paste," Procedia Engineering, 150, 1433–1439, 2016.
8. V.S. Tamilarasan, P. Perumal, J. Mahaswari, "Workability Studies on Concrete with GGBS As A replacement for cement With and Without Superplasticiser," International Journal of Advanced research in Engineering and Technology, 3(2), 13-17, 2012.
9. Nwofor, T.C. and Sule, S., Investigating geometric characteristics of cement concrete materials. International Journal of Innovative Research in Advance Engineering, 1(9), 74-82, 2012.
10. Gurpreet S. and Rafat S., Effect of waste foundry sand (WFS) as partial replacement of sand on strength. Journal of Construction and Building Material 26, 416-422, 2012.
11. Nwofor, T.C., Sule, S. and Eme, D.B. "A comparative study of the methods of concrete mix design using crushed and uncrushed coarse aggregates," International Journal of Scientific and Engineering Research, 6(8), 1182-1194, 2015.
12. K Ganesh Babu and V. Sree Rama Kumar, "Efficiency of GGBS in Concrete", Cement and Concrete Research, 30, 1031-1036, 2000.
13. M. Collepardi, "Admixtures used to enhance placing characteristics of concrete", Cement and Concrete Composite, 20,103-112, 1998.

AUTHORS PROFILE

Dr V M. Southararajan, working as a Professor in the Department of Civil Engineering at CMR Technical Campus, Hyderabad, Telangana.

He has 9.5 years teaching as well as research experience. Also, eight years of Industrial experience. He is a reviewer for more than four reputed journals. He is a Member of Indian Society for Technical Education. He has received the best research awards at VIT University in the year of 2012 and 2013. He has published more than 53 research papers in various National and International journals and conferences.

Dr S. Sivasankar, working as an Associate professor in the Department of Civil Engineering at CMR Technical Campus, Hyderabad, Telangana. He has eight years of teaching experience and one-year industry experience. Also, he has four years of research experience. He published 12 research articles in national and international journals. His research area includes steel-concrete composites, strengthening and retrofitting of steel and concrete structures and corrosion assessment in steel and concrete. He is a life member in ISTE, IAE and IE chapters.

Mr. S. Dhinakaran, Working as an Assistant Professor in Anand Institute of Higher Technology, Chennai, Tamil Nadu, He has 4 years of teaching experience. He completed his M. Tech Structural Engineering from Karunya University, Coimbatore, Tamil Nadu. He is interested in structural engineering and research woks. His area includes concrete technology and replacement of cement in concrete with different natural and synthetic substitutes.

Mr. Nabajyoti Modak: Completed B.E. CIVIL Engineering from Sathyabama Institute of Science and Technology (Deemed to be University) in 2016 and M.E. Structural Engineering from Anna University in 2018. Currently working as an assistant professor in CIVIL Engineering department in Anand Institute of Higher Technology, Chennai, Tamil Nadu, India. He is interested in structural engineering and research woks. His area includes concrete and steel structures, strengthening and retrofication of concrete and steel structures, polymer resin concrete, Polymer composites, composite structures and their applications. He is having a teaching experience of one year. He guided 6 BE projects and one ME project.

Dr R. Gopalakrishnan is currently working as a Professor in Civil Engineering, Easwari Engineering College, Chennai. He has a total experience of 32 years including working in industries both India and abroad. He is the recipient of Best PhD Annual Award from Indian Concrete Institute, for the year 2018 for his Thesis. In his carrier he has published around 22 Research Papers and also member of different societies.

.