ISSN 2395-695X (Print)
ISSN 2395-695X (Online)

International Journal of Advanced Research in Biology Engineering Science and Technology (IJARBEST)
Vol. 2, Issue 4, April 2016

EXPERIMENTAL INVESTIGATION ON CONCRETE WITH PARTIALLY REPLACEMENT OF CEMENT AND FULLY REPLACEMENT OF SAND

Karthik[1], Mr.KR.Keerthiraman[2]
[1]*PG scholar, Department of Structural Engineering, Prist University,Thanjur*
[2]*Assitant professor, Department of Civil Engineering, Prist University,Thanjur.*
karthik_2783@gmail.com, Krk.ram@gmail.com

Abstract **-Now a day's consumption of natural aggregate and cement as the largest concrete component is constantly and rapidly increasing with the increase in the production and utilization of concrete. The demand for construction material is also increasing, at the same time the cost of the construction material is also increasing, To overcome these type of problems are want to found the new composition with low cost is the ultimate aim of our project.**

At the same time the environmental problems are very common in India due to generation of industrial by-products. In this paper to introduce Fluorescent lamp powder as one of the new material into the concrete replace the cement. And the fine aggregate was fully replaced by iron slag and quarry dust.

I.INTRODUCTION

Concrete is the most popular building material in the world. However, the production of cement has diminished the limestone reserves in the world and requires a great consumption of energy. River sand has been the most popular choice for the fine aggregate component of concrete in the past, but overuse of the material has led to environmental concerns, the depleting of securable river sand deposits and a concomitant price increase in the material. Therefore, it is desirable to obtain cheap, environmentally friendly substitutes for cement and river sand that are preferably by products.

It is difficult to point out another material of construction which is as versatile as concrete. Cement replacement materials are special types of naturally occurring materials or industrial waste products that can be used in concrete mixes to partially replace some of the Portland cement. Cement replacement materials are frequently called fine minerals or pozzolans. Surprisingly, concrete with cement replacement materials can actually be stronger and more durable than concrete with Ordinary Portland Cement (OPC).

As slag is a industrial by- product, its productive use grant an chance to relocate the utilize of limited natural resources on a large scale. Iron slag is a by-product obtained in the manufacture of pig iron in the blast furnace and is produced by the blend of down-to-earth constituents of iron ore with limestone flux. Iron and steel slags can be differentiating by the cooling processing when removed from the furnace in the industry. Mostly, the slag consists of, magnesium, aluminium silicates calcium and manganese in various arrangements. Even though the chemical composition of slag same but the physical properties of the slag vary with the varying method of cooling. The slags can be used as fine aggregate major constituents as they have greater sand properties.

II.OBJECTIVE

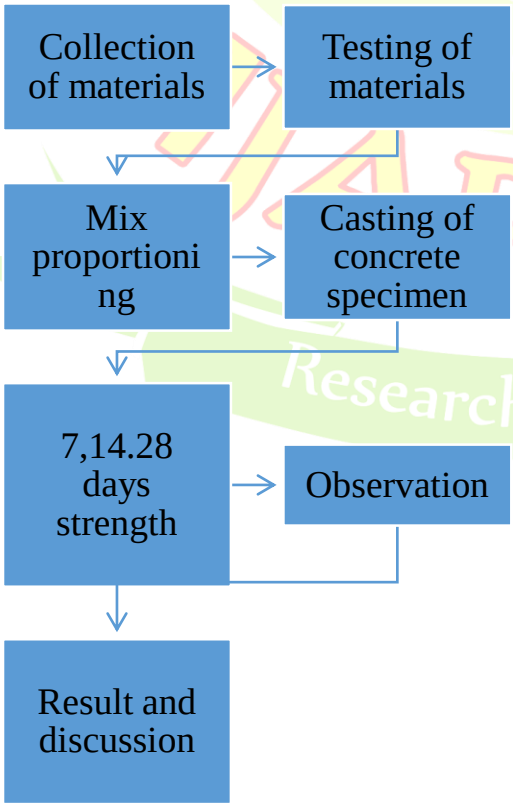
- To find out the potential use of fluorescent lamp powder, quarry dust and iron slag in concrete.
- To investigate the properties of fluorescent lamp powder, quarry dust and iron slag.

- To comparing the results of conventional concrete and modified concrete in strength aspect an element is casted and tested.
- To reduce the density of concrete.
- To reduce the cost.
- To find the compressive strength of concrete cube element and the result has to be discussed.

III.METHODOLOGY AND MATERIAL PROPERTIES

3.1 METHODOLOGY

This chapter briefly explains the methodology adopted for this experimental work. In the first phase, the physical properties of ingredients of concrete and compressive strength of mortar cubes have been found and also a mix design for $MM_{7.5}$and MM_5grademortar cube was calculated. In second phase, the compressive strength of concrete has been found.



3.2 CEMENT – OPC 53 grade

With the extensive use of cement, for widely varying conditions, the types of cement that could be made by the use of additives, changing chemical composition, and using different raw materials have resulted to the need of construction industries for specific purpose. These are all mainly classified into Portland and Non-Portland cements. Ordinary Portland cement was far most important type of cement. The OPC was classified into three grades namely 33 grade, 43 grade, 53 grade depending upon the strength of cement at 28 days when tested as per IS 4031-1988. If the strength is not less than 53 N/mm^2, it is called 53 grade cement. Ordinary Portland cement of 53 grade was used to conforming a IS code 12269-1987. The physical properties and chemical compositions of OPC are listed below.

3.3 FLUORESCENT LAMP POWDER

Sl. No	Physical property	Values
1	Specific gravity	2.65
2	Fineness modulus	2.64
3	Grading (Zone)	III

A fluorescent lamp or fluorescent tube is a gas-discharge lamp that uses electricity to excite mercury vapour. A typical fluorescent lamp is composed of a sealed glass tube filled with argon gas at a low pressure , as well as a low partial pressure of mercury vapour, thus the tube is a partial vacuum.1,2 The inside of the tube is coated with a powder composed of various phosphor compounds.Waste glass as powder milled to certain surface specific area in order to accelerate beneficial chemical reactions in concrete offers desired chemical composition and reactivity for use it as a supplementary cementitious material (SCM) for enhancing the chemical stability, pore system

characteristics, moisture resistance and durability of concrete.

3.4 FINE AGGREGATE

Natural river sand was used as fine aggregate. The properties of sand were determined by conducting tests as per IS: 2386 (Part-I). The results obtained from sieve analysis are furnished in Table 3.4. The results indicate that the sand conforms to Zone III of IS: 383-1970.

3.5 COARSE AGGREGATE

Aggregates are the most mined material in the world. Aggregates are a component of composite materials such as concrete and asphalt concrete; the aggregate serves as reinforcement to add strength to the overall composite material. Coarse aggregate of size 20mm is sieved and used.

Sl.no	Properties	values
1	Maximum size	20 mm
2	Specific gravity	2.98
3	Fineness modulus	6.36
4	Density	1.58gm/cc

Table 3.5.1 Physical properties of coarse aggregate

3.6 QUARRY DUST

The quarry dust is the by-product which is formed in the processing of the granite stones which broken downs into the coarse aggregates of different sizes. The physical and chemical properties of quarry dust obtained by testing the sample as per the Indian Standards are listed. The Specific gravity depends on the nature of the rock from which it is processed and the variation is less. Shrinkage is more in when compared to that of the natural river sand. Water absorption is present so that increase the water addition to the dry mix.

3.7 IRON SLAG

Iron slag is an industrial waste material. It is a by-product of the iron and steel making process. Steel slag is obtained from conversion of iron to steel in a Basic Oxygen Furnace (BOF) or by the melting of scrap to make steel in the Electric Arc Furnace (EAF). Steel slag is defined by the American Society for Testing and Materials (ASTM) as iron-metallic product, consisting essentially of calcium silicates and ferrites combined with fused oxides of iron, aluminium, manganese, calcium.

Fig 3.7.1 Iron slag

IV.EXPERIMENTAL PROCEDURE

4.1 MIX PROPORTIONINGFOR MORTAR

4.1.1 MIX RATIO 1:2.5 ($MM_{7.5}$)

In mortar mix there are two mix proportion is taken. The first mortar mixtures were prepared fully replacing of fine aggregates with the Quarry dust (50%) & iron slag (50%) and partially replacing of cement with the fluorescent lamp powder of 10% with the water cement ratio 0.46. and second mixtures were prepared fully replacing of fine aggregates with the Quarry dust (70%) & iron slag (30%) and partially replacing of cement with the fluorescent lamp powder of 10% with the water cement ratio 0.46. The curing period of all the mortar mixes was 7, 14 and 28 days.Hence the total no of cube for first and second mortar mix are 18.

4.1.2 MIX RATIO 1:4 (MM_5)

In mortar mix there are two mix proportion is taken. The first mortar mixtures were prepared fully replacing of fine aggregates with the Quarry dust (50%) & iron slag (50%) and partially replacing of cement with the fluorescent lamp powder of 10% with the water cement ratio 0.46. and second mixtures were prepared fully replacing of fine aggregates with the Quarry dust (70%) & iron slag (30%) and partially replacing of cement with the fluorescent lamp powder of 10% with the water cement ratio 0.46.The curing period of all the concrete mixes was 7, 14 and 28 days.Hence the total no of cube for first and second mortar mix are 18.

Fig 4.1.1.1MORTAR CUBE

4.2MIX PROPORTIONINGFOR CONCRETE

The three types of M_{20} mixture were prepared in this investigation. The reference concrete mixture composed of cement (360 kg/m3), fine aggregate (573.86 kg/m^3), coarse aggregates (1233.54 kg/m^3) and water to cement ratio is 0.46. The secondconcrete mixtures were prepared fully replacing of fine aggregateswith the Quarry dust (50%) & iron slag (50%) and partially replacing of cement with the FLP of 10% with same amount of coarse aggregates and same water cement ratio. Similarly the third concrete mixtures were prepared fully replacing of fine aggregates with the Quarry dust (70%) & iron slag (30%) and partially replacing of cement with the FLP of 10% with same amount of coarse aggregates and same water cement ratio. The curing period of all the concrete mixes was 7, 14 and 28 days.

Fig 4.2.1 Wet mix of coarse aggregate, cement, FLP, Quarry dust, Iron slag

Fig 4.2.2 concrete cubes

V.RESULT AND DISCUSSION

Test specimens of size 150 × 150 × 150 mm for concrete and 75×75×75 mm for mortar cube were prepared for testing the compressive strength concrete. In this study, to make concrete, cement and fine aggregate were first mixed dry to uniform colour and then coarse aggregate was added and mixed with the mixture of cement and fine aggregates.

Fig 5.1Compressive Strength Test on concrete

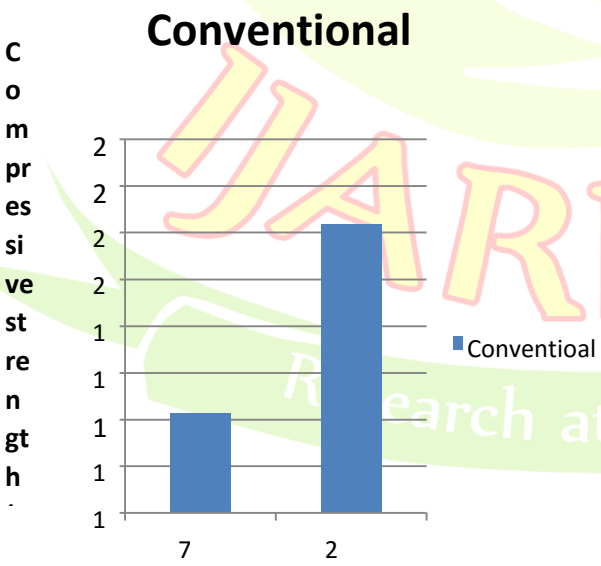


Fig 5.2 Compressive strength of conventional concrete cubes

VI.CONCLUSION

- Based on this experimental investigation, it is found that Fluorescent lamp powder can be used as alternative material to the Ordinary Portland Cement and quarry dust & iron slag can be used as alternative material to the sand.
- The physical and chemical properties of fluorescent lamp powder satisfy the requirements of Ordinary Portland Cement.
- Using of fluorescent lamp powder, quarry dust and iron slag in concrete reduces the cost.
- The finer the fluorescent lamp waste particles, the lower value of viscosity, and an almost constant electrical conductivity was observed.
- The Replacement of the sand with quarry dust shows an improved in the compressive strength of the concrete.
- As the replacement of the sand with quarry dust increases the workability of the concrete is decreasing due to the absorption of the water by the quarry dust.
- The specific gravity is almost same both for the natural river sand and quarry dust. The variation of the physical properties like particle size distribution and bulking is much varying parameter that which effect the mix design of the concrete.
- With the increase of percentages of iron slag in the concrete mix, the compressive strength also increases.
- The early age strength gain is higher as compared to later ages if 30% of fine aggregate is replaced by iron slag.

REFERENCE

1. Andreola, F., Barbieri, L., Lancellotti, I. (2010). End of life-materials: WEEE glass

recovery in construction sector. In: *Proceedings of the second international conference on sustainable construction materials andtechnologies*,Ancona.Available:http://www.claisse.info/2010%20papers/l43.pdf

2. Gorinaldesi V, Gnappi G, Moriconi G, Montenero A. (2005). Reuse of ground waste glass as aggregate for mortars. *Waste Management*, 25(2), pp. 197–201.
3. Kara P., Korjakins A. (2013). Investigation of thermal properties of cement paste with fluorescent lamp waste glass, glass cullet and coal/wood ashes, *Journal of Sustainable Architecture and Civil Engineering*, KTU, Kaunas, Lithuania,, 2013, Vol. 2(3) *(accepted for print)*
4. Kara, P., Korjakins, A., Kovalenko, K. (2012). The Usage of Fluorescent Waste Glass Powder in Concrete.*Scientific Journal of Riga Technical University, Construction Science*, 13 vol., pp. 26-32.
5. Properties of fresh concrete incorporating high volume of fly-ash as partial fine sand replacement, Dan Ravin, Pg.No. 473 to 479, materials and structures/ materiaux et construction, vol.30, October 1997.
6. Strength and durability properties of concrete containing quarry dust as fine aggregate, R.Ilangovana, N.Mahendrana and K.Nagamanib, Pg.No. 20 to 26, ARPN Journal of Engineering and Applied Science, Vol.3,No5, October 2008.
7. Compressive strength of concrete using lateritic sand and quarry dust as fine aggregates, Joseph O. Ukpata, Maurice E. Ephraim and Godwin A. Akeke, Pg.No. 81 to 92, ARPN Journal of Engineering and Applied Science, Vol.7, No.1, January 2012.
8. Study of Properties of SCC using 'Quarry Dust' and 'Fly Ash', M.V. Rama Raju, K.V.Vivek, Dr.T.Siva Shankar Reddy and P. Srinivas Reddy, Pg.No. 323 to 332, International Journal if Engineering Science Research, Vol 02, Issue 04, August-September 2011.
9. A Guide to the Use of Iron and Steel Slag in Roads. Revision 2, (2002) Published by: Australasian Slag Association Inc.

Bilim C., Atis C. D., Tanyildizi H., Karahan O. (2008) "Predicting the Compressive Strength of Ground Granulated Blast Furnace Slag Concrete using Artificial Neural Network". Advances in Engineering Software Vol. 40 pp 334–340.