ISSN: 2455 - 1597

ijergs
Open Access

International Journal of Engineering Research and Generic Science (IJERGS)
Available online at: https://www.ijergs.in

Volume - 8, Issue - 4, July – August - 2022, Page No. 01 - 04

A Review on Concrete Containing GGBFS and Meta kaolin with Calcium Carbide Residue

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Abstract

In recent years, some investigations are reported on Ground-granulated blast-furnace slag (GGBFS) and Meta kaolin with calcium carbide residue (CCR) can be used as a partial replacement of cement and concrete. A lot of literatures have already proved that GGBFS, Meta kaolin and CCR are one of the mostly use cement or concrete supplementary material. Different literatures suggested different percentage of GGBFS, Meta kaolin and CCR as a cement replacement material. In this paper provide the detailed overview about the GGBFS, Meta kaolin and CCR with their chemical and physical properties to experimental analysis on cement and concrete.

Keywords: GGBFS, CCR, Meta Kaolin, cement, concrete.

Introduction

The present study basically focuses on two major problems and tries to solve them. First is to save the environment from the harmful gases or pollutants coming out from the production of construction materials such as cement and second is high cost of construction because of high cost of cement [1-2]. Throughout the world concrete is one of the most demanding material and to full fill the demand of cement a huge number of companies or factories started production of cement [3]. According to some sources, the emission of one ton of carbonic acid gas into the atmosphere is calculable from the assembly of 1 ton of typical Portland cement. Therefore, it's necessary to manage the speed of cement production. To unravel this drawback, it's necessary to search out alternatives which will be utilized in whole or partially rather than cement. However, no different binder has been found that utterly replaces cement, that the use of a partial cement substitute for concrete composites is mostly accepted. As an extra building material, you'll use ground, coarse furnace scoria, fly ash, metakaolin, carbonic acid gas [4-5]. The rapid construction in the world, need more construction materials. However some problems associated with this rapid construction activities is that it is responsible for approximately 40% natural resources consumption. Due to this rapid consumption natural resources like sand also need an alternative. In Present study CCR used as a partial replacement of cement.

Ground Granulated Blast Furnace Slag in Concrete

GGBS is gotten by extinguishing liquid iron slag from a shoot heater in water or stream, to create a polished, granular item that is then dried and ground into a fine powder. GGBS is utilized to make strong substantial designs in blend with customary Portland concrete or other pozzolanic materials [6]. GGBS has been broadly utilized in Europe, and progressively in the United States and in Asia for its predominance in substantial toughness, broadening the life expectancy of structures from fifty to a hundred years. GGBS responds like Portland concrete when in touch with water.

The mineral admixture utilized for this trial work is Ground-granulated impact heater slag and properties (physical and compound) are taken from maker which is displayed in table 1 and 2.

Fig 1: Ground-Granulated Blast-Furnace Slag

Table 1: Chemical Properties of Materials (As Per Manufacturer)

S. No.	Chemical Properties	Cement	GGBFS
1.	CaO	62-67%	30-34%
2.	SiO_2	17-25%	30-36%
3.	Al_2O_3	3-8%	18-25%
4.	Fe_2O_3	3-4%	0.8-3%
5.	SO_3	1-3%	0.1-0.4%
6.	MgO	0.1-3%	6-10%

Table 2: Physical Properties of Materials (As Per Manufacturer)

S. No	Physical Properties	Cement	GGBFS
1.	Specific gravity	3.15	2.9
2.	Shape texture	Irregular	Irregular
3.	D_{50}	25 micron	7 micron
4.	D_{95}	90 micron	20 micron
5.	Colour	Grey	Grey

Meta kaolin

Metakaolin is not a byproduct. It is obtained by calcimine pure or refined kaolinite clay at a temperature of 6500 to 8500 ° C and then grinding to a fineness of 700 to 900 m 2 / kg. Metakaolin is a pozzolanic supplement / product that has many specific properties. Metakaolin is available in many different varieties and qualities. The purity determines the binder capacity or the free lime. When used in concrete, the empty space between the cement particles is filled, making the concrete more impenetrable. Metakaolin, a relatively new material in the concrete industry, causes an increase in strength [6-7].

Calcium Carbide Residue (CCR)

CCR is a by-product obtained from the acetylene gas (C_2H_2) production process, as shown in the following equation:

$$CaC_2 + 2H_2O \rightarrow C_2H_2 + Ca(OH)_2 \quad (1)$$

Acetylene (C_2H_2) is wide utilized in agriculture and business, CCR is normally discarded in landfills, and for instance, in China, as much as 2500 tons of CCR are made consistently. CCR is normally intensely essential and comprises mostly of harsh lime with a mass fraction of over 92. various references have proclaimed that blend CCR in with sure pozzolans having a high oxide or aluminum oxide content winds up in the development of pozzolanic responses.

Fig 2: Calcium Carbide Residue

Table 3: Chemical Properties of CCR (As Per Manufacturer)

S. No	Chemical Properties	Calcium carbide residue
1.	CaO	51.9
2.	SiO_2	3.4
3.	Al_2O_3	3.6
4.	Fe_2O_3	0.3
5.	SO_3	0.2
6.	MgO	0.5

Table 4: Physical Properties of CCR (As Per Manufacturer)

S. No	Physical Properties	Calcium Carbide Residue
1.	Specific gravity	2.21
2.	Shape texture	Non uniform
3.	D_{50}	14.3
4.	Colour	White

Conclusion

In this paper provide the detailed overview about the Ground-granulated blast-furnace slag (GGBFS), Meta kaolin and calcium carbide residue (CCR) with their chemical and physical properties to experimental analysis on cement and concrete.

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