PARTIAL REPLACEMENT OF CEMENT BY HARDENED CEMENT AND FLY ASH IN CONCRETE

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ABSTRACT

The present research paper is on the utilizing the waste materials from the environment. There are abundant materials which loose its strength and loose its property, if not treated properly. The present study is about the hard cement which loses its strength if exposed to the environment openly and sometimes it happened when cement gets hard. Hard cement used in the research is waste material present in our concrete lab, the compressive strength test is conducted on the hard cement along with fly ash and normal cement which shows us the great possibility as the results are when added 40% hard cement and 20% fly ash along with normal cement shows 326 kN/mm^2 in 7 days and in proportions to that in 14 days.

KEYWORDS: Hardened Cement, Fly Ash, Zero waste, Concrete

Fly ash is a residual material of energy production using coal, which has been found to have numerous advantage for use in concrete.some of the advantage include improved workability, reduced permeability, increased ultimate strength, reduced bleeding, better surface and reduced heat of hydration. Several types of fly ash are produced depending on the coal and coal combustion process. It is a pozzolanic material and has been classified into two classes Fly ash is one of the residues generated in combustion, and comprises the fine particles that rise with the flue gases. Ash which does not rise is termed bottom ash. In an industrial context, fly ash usually refers to ash produced during combustion of coal. Fly ash is generally captured by electrostatic precipitators or other particle filtration equipment before the flue gases reach the chimneys of coal-fired power plants and together with bottom ash removed from the bottom of the furnace is in this case jointly known as coal ash.

In the past, fly-ash was generally released into the atmosphere via the smoke stack, but pollution control equipment mandated in recent decades now require that it be captured prior to release. It is generally stored on site at most US electric power generation facilities. Depending upon the source and makeup of the coal being burned, the components of the fly-ash produced vary considerably, but all fly-ash includes substantial amounts of silica (silicon dioxide, SiO2) (both amorphous and crystalline) and lime (calcium oxide, (CaO). Flyash is commonly used to supplement Portland cement in concrete production, where it can bring both technological and economic benefits, and is increasingly finding use in the synthesis of geo polymers and zeolites. The difference between fly-ash and Portland cement becomes apparent under a microscope. Fly-ash particles are almost totally spherical in shape, allowing them to flow and blend freely in mixtures. These capability makes fly-ash a desirable admixture for concrete.

MATERIAL USED

Hardened Cement

Hard cement is the kind of the material which sometimes produced due to improper treatment of the cement bag. Cement has a property that we it gets mingled with the air in due coarse of time it gets hard, and looses its property. Generally this kind of cement is not used in the concrete industry. The present research paper is on the hardened cement which is hard due to exposure with the air.

Figure 1

Fly Ash

Fly ash is a byproduct from burning pulverized coal in electric power generating plants. During combustion, mineral impurities in the coal (clay, feldspar, quartz, and shale) fuse in suspension and float out of the combustion chamber with the exhaust gases. As the fused

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material rises, it cools and solidifies into spherical glassy particles called fly ash. Fly ash is collected from the exhaust gases by electrostatic precipitators or bag filters. The fine powder does resemble portland cement but it is chemically different. Fly ash chemically reacts with the byproduct calcium hydroxide released by the chemical reaction between cement and water to form additional cementitious products that improve many desirable properties of concrete.Fly ash is produced ,in massive amount ,as a west material of burning fossil fuel for the thermal generation of electricity currently about 900 million tonnes of fly ash produced worldwide annually and about 30-40% of this residue is being utilize for various purposes including in cement and concrete production.

Figure 2

Cement

Cement is a binding material which is used in the construction work that sets, hardens and adheres other materials to bind together. Cement mixed with fine aggregates produces mortar whereas mixer of cement with fine and coarse aggregates produces concrete. In this study OPC (Ordinary Portland Cement) of 43 grades was used.

Coarse and Fine Aggregates

The aggregates which passes through 4.75 mm sieves is known as fine aggregates and the aggregates that does not passes through 4.75 mm sieves is known as coarse aggregates. In this test we considered coarse aggregates of size 20mm and 10mm.

Figure 3: Aggregate

EXPERIMENTAL METHODOLOGY

The research paper consists of the detailed analysis of the compressive test, to detect the strength of the Hardened Cement and Fly Ash along with the Normal Cement.

Compressive Strength Test

Compressive strength test is performed is find out the capacity of a materials or structure up to what stand they can withstand a load upon them. In this we performed a compressive strength test for M25 grade concrete.

In this test we took a cube mould of size 150*150*150mm and fitted the nuts properly and cleaned it and applied oil in all the face of cube mould. After that we filled the cube mould with two layers each layer tamped 35 times with tamping rod in order to avoid the formation of voids in the cube specimen. Let the cube to set for 24 hours, after that we took the cube specimen from the mould and started the curing process for 3, and 7 days.

We perform this test in two phases, phase one consists of 40% Hardened Cement and 40 % Normal Cement and 20 % Fly Ash whereas in the second phase 50% hardened Cement 30% Normal Cement and 20% Fly Ash.

RESULTS AND DISCUSSION

The results of the hardened cement show us that there is a great possibility of the partial replacement of the hardened cement but along with the fly ash and normal cement. The compressive test had done on the 7 days shows us the following result.

Specimens	Days	Compressive Strength
40 % HC+ 40 % NC + 20 % FA	7	326 kN/mm^2
50 % HC+ 30 % NC + 20 % FA	7	322.66 kN/mm^2
40 % HC+ 20 % NC + 40 % FA	7	290 kN/mm^2

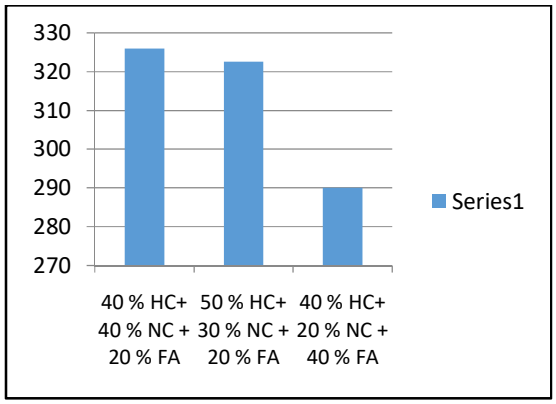

Figure 4

The results shows us that by adding more hardened cement the compressive strength gets decreasing, but when we add fly ash into the specimens the compressive strength gets rapidly decreased.

The compressive test done on the 14 days have the following results:-

Specimens	Days	Compressive Strength
40 % HC+ 40 % NC + 20 % FA	14	680.33 kN/mm^2
50 % HC+ 30 % NC + 20 % FA	14	696.33 kN/mm^2
40 % HC+ 20 % NC + 40 % FA	14	653.33 kN/mm^2

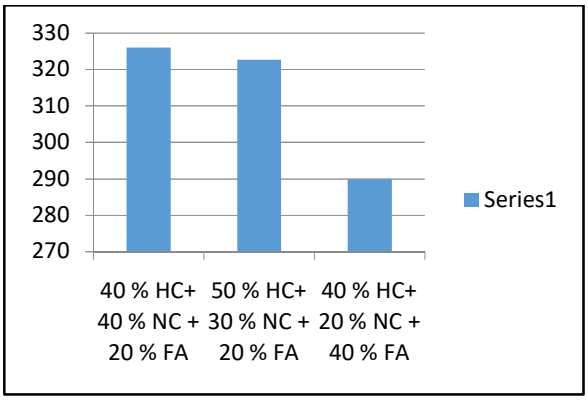

Figure 5

CONCLUSION

The research paper tells us that the partial replacement of the hardened cement along with the Fly Ash and Normal Cement have a very desirable effect on the concrete and the compressive strength test shows us that there is a considerable possibility if we use the waste hardened cement in the concrete along with any other waste material and alone also. In this we can reduce our waste material and the pollution done by those materials. The compressive strength results are good but we need to check other test also such as Split Tensile Test, which tells us the behavior of the concrete in the tension.

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