Effect of Cinder Ash in Concrete

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Abstract:- **Cinder ash is obtained from volcanic eruption. It is a kind of porous rock with good performance and is formed by the cooling of the volcanic eruption. The utilization of thermal industries waste cinder ash can reduce the consumption of natural resource, Reduce the quantity of expensive cement and reduce environmental pollution. Investigation can carried out to gainful utilization of cinder ash in concrete mixtures, this product does not only have the advantages of light weight, heat insulation, good sound insulation, simple process and low price, but also meets the demands of building energy saving and reducing structure weight .It is replaced by cinder ash in the range of 0%, 10%, 20%, 30%, 40%, 50% respectively. And also we are using the ground granulated blast furnace slag (GGBS) as an admixture to improve better strength. The chemical composition and mineralogical characteristics of cinder ash is similar to fly ash. It could be an expensive replacement for ordinary Portland cement in concrete and using it, improves strength in 30%.**

Keywords – Cinder ash, ground granulated blast furnace slag (GGBS), porous rock, volcanic eruption.

INTRODUCTION

Concrete is the most widely used building material in construction industry. Concrete is usually made from a mixture of broken stone or gravel, sand, cement, and water, which can be spread or poured into moulds and forms a stone-like mass on hardening. And the construction activities are increased more worldwide, due to that increase of demand of materials used in concrete. In the process of electricity generation large quantity of fly ash gets produced and becomes available as a by-product of coal-based power stations. Due to increase in demand the cost of building materials are now a day's increasing more and more.

The disposal of such industrial by products and waste materials also difficult. And manufacturing of cement which create lot of waste materials. 1ton of cement manufacturing produces
1.25 ton of CO_2. These cause loss of natural resources and destruction of natural resources. In such a way that we have found a one of such industrial waste material having such cinder ash. Cinder ash is the fine powder produces a product from industrial plants pulverized coal or lignite as fuel. Cinders are extrusive igneous rocks. All thermal power plants produce a one of the by product is cinder ash. And this is usually considered as a waste material. Other preliminary test also done for find the suitability of cinder ash as material for replacement of cement.

MATERIAL USED

The ingredients are used in proper proportion. Also the cement is replaced at 10%, 20%, 30%, 40% and 50% by cinder ash. They are described in details with their properties are as follows:

- Fine aggregate
- Coarse aggregate
- Cement
- water
- Cinder ash
- Ground granulated blast furnace slag (GGBS)

FINE AGGREGATE

River sand was used as fine aggregate. The size of the sand is used 4.75mm and downsize. The specific gravity of the fine aggregate ranges from 2.3 to 2.8. The fractions from 4.75mm to150 microns are termed as fine aggregate.

COARSE AGGREGATE

The coarse aggregate used were a mixture of two locally available crushed stone of 10mm and 20mm size. The aggregate were washed to remove dirt, dust, and then dried to surface dry condition. The specific gravity was 2.74.

CEMENT

It is a binding material. The ordinary Portland cement of 43 grades conforming to IS: 8112-1989 is being used. Cinder ash (Partial Replacement of Cement by Cinder Ash).

TABLE -1 CHEMICAL COMPOSITION OF ORDINARY PORTLAND CEMENT

S.No	Constituents	Percentage (%)
1	Cao	60-67
2	Silica	17-25
3	Alumina	3-8
4	Iron oxide	0.5-6
5	Magnesia	0.1-4
6	Sulphur trioxide	1-3
7	Soda/potash	0.5 -1.3

WATER

Portable tap water available in the laboratory with pH value of 7.0±1 and confirming to the

requirements of IS: 456- 2000 was used for mixing concrete and also for curing the specimens.

CINDER ASH

Cinder ash is the fine powder produces a product from industrial plants pulverized coal or lignite as fuel. The Cinder ash consists of alumina, ferrous oxide, calcium oxide, and rich in silica. The property of cinder ash is similar to the fly ash, and also the cinder ash consists of high sio_2 -64.4%.

TABLE - 2 CHEMICAL COMPOSITION RANGE IN CINDER ASH

S.No	Constituents	Percentage (%)
1	Silica (Sio_2)	60-67
2	Alumina (Al_2O_3)	17-25
3	Lime (Cao)	3-8
4	Iron Oxide(Fe_2O_3)	0.5-6
5	Sulphur trioxide	0.1-4
6	Others	1-3

Fig-5 Cinder ash

GGBS

It is obtained by quenching molten iron slag (a by-product of iron and steel making) from blast furnace in water or stream, to produce a glassy, granular product that is then dried and ground into a fine powder, and also having 40% of calcium oxide.

Table-3 Chemical Composition Range in GGBS

Fig-6 GGBS

EXPERIMENTAL WORK

GENERAL

The aim of experimental work is to predict the mould preparation, preparation of concrete and test on concrete.

MOULDS

The height of the mould and the distance between the opposite faces are the specified size+ 0.2mm. The angle between adjacent internal faces and between internal faces and top and bottom planes of the mould are planes surface with a permissible variation of 0.03mm each mould is provide with a metal based plate having a plane surface. The base plate is of such dimensions as to support the mould during the filling without leakage and it is preferable attached to the mould by spring or screw. The parts of the mould, when assembled, are positively and rigidly held together, and suitable methods of ensuring this both during the filling and on subsequent of the filling mould are required to be provided.

PREPARATION OF MOULD

In assembling the mould for the use the joints between the section of the mould are thinly coated with mould oil and the similar coating of mould oil is applied between the contact surface of the bottom of the mould and the base plate in order to ensure that no water escapes during filling. The interior surface of the assembled mould is also required to thinly coated with mould oil prevent adhesion of concrete.

The cylinder mould is required which shall be not less than 3mm thick. Each mould is capable of being opened longitudinally to facilitate removal of specimen and is provided with means of keeping it closed while in use, care should be taken so that the ends are not departed from a plane surface, perpendicular to the axis of the mould, by more that 0.05mm.When assembled ready for use the mean internal diameter of the mould should be 15.0,+0.2mm and in no direction the internal diameter is less than 14.95 cm or more than 15.05 cm. The height maintained for our mould in this project is around 30.0 cm,+0.1mm.Each mould provided with a metal base plate and with a capping plate of glass or other suitable material were adopted.

The base plate and the capping plate are required to be at least 6.5mm thick and such that they do not depart from a plane surface by more than 0.02mm. The base plate supports the during filling without leakage and is rigidly attached to the mould oil before use in order to prevent

adhesion of concrete. A steel bar 16mm in diameter, 0.6m long and bullet pointed at a lower end serves as a tamping bar.

PREPARATION OF CONCRETE

Concrete has been prepared for the Grade of M20 with the following mix proportion of 1:2:3.16 is obtained from the following mix design procedure,

- mass of cement = 358 kg/m3
- mass of coarse aggregate =1134kg/m3
- mass of fine aggregate= 756.34 kg/m3
- water =197 kg/m3
- w/c ratio = 0.55

One part of cement with 2 parts of fine aggregate and 3.16 parts of coarse aggregate was used for concrete.

The water cement ratio is constantly adopted, which is 0.55.

Production of quality concrete requires meticulous care exercised at every stage of manufacture of concrete. It is interesting to note that the ingredient of good concrete and bad concrete are the same. If meticulous care is not exercised and good rules are not observed the resultant concrete is going to be of bad quality. with the same material if intense to exercised control at every stage it will result in good concrete therefore , it necessary for us to know what followed in each stage of manufacture of concrete for producing good quality concrete.

RESULTS AND DISCUSSION

GENERAL

In this research ground granulated blast furnace slag (GGBS) as the admixture is used as replacement of conventional building materials such as cement in partial in various proportions. The Replacements are done for a ratio of 10%, 20%, 30%, 40% & 50%. The concrete tested for compressive strength The grade of concrete mixed is M20 grade with a water cement ratio of 0.55 the grade chosen as per IS 10262-2009 for an exposure condition of severe for reinforced concrete. The mix was prepared is Non- pumping mix with ratio of 1: 2: 3.16. The optimum strength obtained at a replacement of 30% of cinder ash by cement. The cinder ash concrete made with the optimum strength gained replacements. The strength of the cinder ash concrete at an age of 7 days 14 days and 28 days are more than the conventional concrete.

COMPRESSIVE STRENGTH OF CONCRETE IN N/MM^2

Cube specimen shall be of size not less than four times the maximum size of the course aggregate and not less than 150 mm Compressive strength of concrete made with 15cm x 15cm x 15 cm Cubes are made with M20 grade of concrete, concrete mixed and cured and tested with reference to Indian standard code specification IS 516 – 1959.

$$\text{Compressive strength} = \frac{\text{Failure load(KN)}}{\text{Area of cube(mm}^2\text{)}}$$

TABLE -4 COMPRESSIVE STRENGTH OF CONVENTIONAL CONCRETE (N/MM^2)

Days	7days (N/mm^2)	14days (N/mm^2)	28days (N/mm^2)
Compressive strength of concrete	8.93	16.58	24.56

Replacement (%)	7days (N/mm^2)	14days (N/mm^2)	28days (N/mm^2)
10	8.05	14.95	23
20	8.58	15.93	24.5
30	9.1	16.9	26
40	8.23	15.28	23.5
50	7.18	13.33	20.5

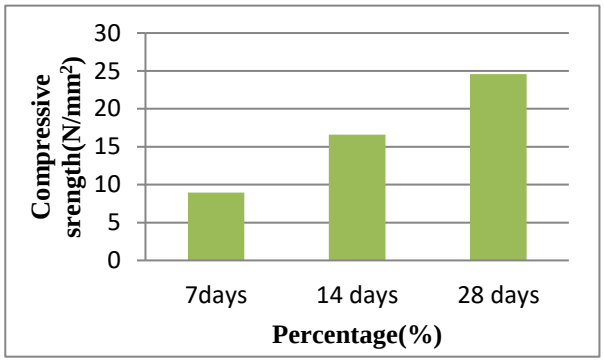

FIG-7 COMPRESSIVE STRENGTH OF CONVENTIONAL CONCRETE IN N/MM^2

TABLE-5 COMPRESSIVE STRENGTH OF CONCRETE FOR REPLACEMENT OF CEMENT (N/MM^2)

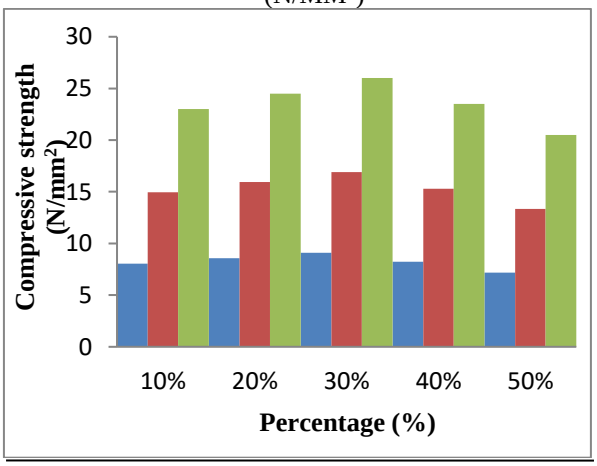

FIG - 8 COMPRESSIVE STRENGTH OF CONCRETE FOR REPLACEMENT OF CEMENT IN N/MM^2

CONCLUSION

- Cinder is a light weight material, therefore the strength of concrete is less for that we are adding GGBS as an admixture.

- Cinder ash concrete strength gradually increases and after certain percentage it starts decreasing.
- By the test results of replacement in cement, we have analyzed that the cinder ash can be effectively replaced The optimum strength attain in 30% of cement is 26N/mm^2, in a same concrete mix, and strength achieved for 7 days, 14 days & 28 days for compressive strength are respectively.
- The color of our concrete is black due to addition of cinder ash.

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