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Evaluation of Concrete Strength By Partially Replacing Cement by Red Mud & Fly Ash.

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***Abstract* - Red mud is a waste material generated by the Bayer process widely used to produce alumina from bauxite throughout the world. Fly ash is a by product of coal-fired electric generating plants. The coal is pulverized and blown into burning chamber for immediate combustion. The aim of the present research work was to investigate the possibility of replacing the Portland cement by Red Mud and Fly Ash. Because of storing issues, the waste negatively affects the environment. To solve this problem, Portland cement was replaced upto 40% (20% red mud & 20% fly ash) by weight of cement. And evaluating its compressive strength and tensile strength of red mud & fly ash concrete. This study examines the effects of red mud on the properties of hardened concrete. The test result show that how its compressive strength and tensile strength decreases with increase red mud content.**

Key Words :- Cement Mortar, Fly Ash, Bauxite Residue, Red Mud, Bayer's Process.

INTRODUCTION

RED MUD :- Red mud is hazardous waste generated in the Bayer process alumina production (Al2O3) from bauxite ore which contains high levels of residual alkalinity and toxic heavy metal. Therefore, red mud is a hazardous waste of alumina industry. The volume of red mud which generated in the alumina processing plant depends on the quality of crude Bauxite ore, may be greater than the volume of alumina 1-1.5 times. The alumina processing plant usually disposes liquid red mud into reservoirs, which cause the risk of major environment pollution for lowland. A pozzolan is defined as siliceous and aluminous material that in itself possesses little or no cementitious value, but that will, in finely divided form the presence of moisture, chemically react with calcium hydroxide atordinary temperatures to form compounds having cementitious properties.

FLY ASH :- Fly ash is a byproduct of coal-fired electric generating plants. The coal is pulverized and blown into burning chamber for immediate combustion. Heavier ash particle (bottom ash or slag) fall to the bottom of the burning chamber and the lighter ash particles (fly ash) fly out with exhaust gas, thus the term fly ash. Before leaving the stack, these particle are removed and collected by electrostatic precipitators, bag houses or other methods.

Classification of fly ash- (a) class F or siliceous fly ash or low calcium fly ash :- fly ash from the bituminous and anthracite coals is referred as ASTM class F ash or low calcium fly ash. It consists of alumina silicate glass, and has less than 10percent of calcium oxide.

. (b) class C or calcareous fly ash or high calcium fly ash :- fly ash that is obtained from burning sub-bituminous coals is referred as ASTM class C fly ash or high calcium fly ash, contains more than 20 percent of calcium oxide.

MATERIALS AND METHODS

GRADE OF CONCRETE:- In this project we use M30 grade of concrete. By using of Indian standard recommended method of concrete mix design.

1.)Cement :- Ordinary Portland cement (53 grade) confirming to IS: 269-1976 was used throughout the investigation. Different tests were performed on the cement to ensure that if confirms to the requirement of the IS specifications.

2.)Aggregates :- (a) Fine Aggregate :- locally available sand is used as fine aggregate in the cement mortar. Natural sand (sp.gr. = 2.76) .

(b) Coarse Aggregate :- Coarse aggregate are the crushed stone is used for making concrete. The maximum size of aggregate used for this investigation is 20mm and specific gravity is 2.88 .

3.)Water :- Fresh and clean water is used for casting and curing of specimen. The water is relatively free from organic matters, silt, oil, sugar, chloride and acidic material as per requirements of Indian standard. Combining water with a cementious material forms a cement paste by the process of hydration. A cement paste glues the aggregate together fills voids within it, and makes floor freely.

4.)Red Mud :- Red mud is hazardous waste generated in the Bayer process alumina production (Al2O3) from Bauxite ore which contains high levels of residual alkalinity and toxic heavy metal. Therefore, red mud is a hazardous waste of alumina industry.

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INGREDIANTS	RED MUD IN %
Fe2O3	30-60%
Al2O3	10-20%
SiO2	03-50%
CaO	02-08%
Na2O	02-10%
TiO2	Trance-25%

5.)Fly Ash :- Fly Ash is a byproduct of coal-fired electric generating plants. The coal is pulverized and blown into burning chamber for immediate combustion. Heavier ash particle (bottom ash or slag) fall to the bottom of the burning chamber and the lighter ash particles (fly ash) fly out with exhaust gas, thus the term fly ash. sample oxide analysis of ash and Portland .

Compound	Fly ash class F	Fly ash class C	Portland cement
SiO2	55	40	23
Al2O3	26	17	4
Fe2O3	7	6	2
CaO	9	24	64
MgO	2	5	2
SO3	1	3	2

METHODS :- 1.) COMPRESSIVE STRENGTH TEST :- The compressive strength measurement of the cylindrical samples was done as per standard practiced. Out of many test applied to the concrete, this is the utmost important which gives an idea about all the characteristics of concrete. By this single test one judge that whether concreting has been done properly or not. Compressive strength of concrete depends on many factors such as water-cement ratio, cement strength, quality of concrete material, quality control during production of concrete etc. Test for compressive strength is carried out either on cube or cylinder. Various standard codes recommends concrete cylinder or concrete cube as the standard specimen for the test. American society for testing materials ASTM C39/C39M provides standard test method for compressive strength of cylindrical concrete specimens, for cube test two types of specimen either cubes of 15cm X 15cm X 15cm or 10cm X 10cm X 10cm depending upon the size of aggregate are used. For most of the works cubical moulds of size 15cm X 15cm X 15cm are commonly used. This concrete is poured in the mould and tempered properly so as not to have any voids. After 24hours these moulds are removed and test specimens are put in water for curing. The top surface of these specimen should be made even and smooth. This is done by putting cement paste and spreading smoothly on whole area of specimen. These specimens are tested by compression testing machine after 7 days curing or 28 days curing. Load should be applied gradually at the rate of 140kg/cm2 per minute till the specimens fails. Load at the failure divided by area of specimen gives the compressive strength of concrete.

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2.) TENSILE STRENGTH TEST:- Tensile strength is an important property of concrete because concrete structures are highly vulnerable to tensile cracking due to various kinds of effects and applied loading itself. However tensile strength of concrete is very low in compared to its compressive strength. This test method determines the tensile strength of concrete near to the prepared surface, which can be used as an indicator of the adequacy of surface preparation before applying a repair or an overlay material. When the test is performed on the surface of arepair overlay material,it determines the bond strength to the substrate or the tensile strength of either the overlay or substrate, whichever is weaker. The method may also be used to evaluate the adhesive strength of bonding agents. When the test is performed on the surface of a material applied to the substrate, the easured strength is controlled by the failure mechanism requiring the least stress. Thus it is not possible to know beforehand which strength will be measured by the test. For this reason, the failure mode has to be reported for each individual test result, and tests results are averaged only if the same failure mode occurs.

RESULT & DISCUSSION

1.) The percentage of water cement ratio is deoends on quantity of red mud and fly ash used in concrete. Because red mud is highly porous material.
2.) Compressive strength increases with the increase in the percentage of fly ash and red mud up to replacement (20% red mud & 20% fly ash) of cement in concrete for different mix properties.
3.) Compressive strength increases by addition of quarry sand in addition to fly ash and red mud.

CONCLUSION

1.) For experimental work it was found that increase in red mud and fly ash content decreases the compressive as well as tensile strength of concrete.
2.) Workability of concrete may get affected with increases of fly ash and red mud.
3.) Optimum percentage of the replacement of cement by weight is found to be 25% by the replacement results got are nearly equal to the result of controlled concrete.

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