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STUDY BEHAVIOUR OF CONCRETE AFTER RICE HUSK ASH ADDITION AND ITS SIGNIFICANCE IN ROAD CONSTRUCTION

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Abstract - ***— The aim of this study was to examine the cementitious properties of the material produced by mixing Rice husk ash and OPC cement. Concrete produced by using different proportions of RHA at 5%, 10%., 15%, 20% ratio with cement were. Cement and RHA: fine aggregate: coarse aggregate in the ratio 1:1.5:3.5 respectively at a constant 0.5 w/c ratio was used in all concrete mixes and at the room temperature air curing and water curing was done.. Workability tests were performed on all the concrete mixes. Slump test, compaction test, bulk density and compressive strength of the optimal blend were established. Characteristic compressive and of optimal cement: RHA concrete Were determined and the results compared with those of OPC concrete and cost analysis carried out. Workability was found to be good with slight reduction reduce as RHA was increased in the concrete was detected by reduction in slump values and compaction factor values for concrete samples cured in air the optimal blend was at 15% which showed maximum Compressive strength. Further it was found out that this compressive strength is suitable for highway constructions due to less permeability, low cost, less permeability and less crack origins. Moreover environment friendly aspect of RHA concrete can't be ignored.***

Index Terms— RHA, Concrete, Highways, Aggregate, Compressive Strength.

1.INTRODUCTION

Concrete: A composite material that comprises basically of a restricting medium, for example, a blend of Portland concrete such as, water, inside which are inserted particles on the other hand sections of total, ordinarily a blend of fine and coarse total. Cement is by a long shot the most flexible and most broadly utilized development material around the world. It can be designed to fulfill an extensive variety of execution details, not at all like other building materials, such as characteristic stone or steel, which by and large must be utilized as they may be. Since the elasticity of cement is much lower than its compressive quality, it is commonly fortified with steel bars, in which case it is known as strengthened cement. A composite material is comprised of different constituents. The properties and qualities of the composite are elements of the constituent materials' properties and additionally the different blend extents. Before talking about the properties of the composite, it is important to talk about those of the singular constituents and in addition the impacts of the blend extents and techniques for production of cement.

Cement: There are a wide range of sorts of cements. In cement, the most normally utilized is Portland cement, water driven concrete which sets and solidifies by compound response with water and is prepared to do doing as such submerged. Cement is the "paste" that ties the solid fixings together and is instrumental for the quality of the composite. Despite the fact that cements and cement have been around for thousands of years, present day Portland concrete was concocted in 1824 by Joseph Aspdin of Leeds, England. The name gets from its similarity of the common building stone quarried in Portland, England. Portland cement is made up essentially of four mineral segments (tricalcium silicate, dicalcium silicate, tricalcium aluminate, and tetracalcium aluminoferrite), each of which has its own particular hydration attributes. By changing the relative extents of these parts, concrete producers can control the properties of the item. The essential result of concrete hydration is a complex and inadequately crystalline calcium-silicate hydroxide gel (or CSH). An optional result of hydration is calcium hydroxide, a profoundly crystalline material. A class of siliceous materials known as pozzolans has practically zero cementitious worth, yet in finely partitioned structure and within the sight of dampness will respond synthetically with calcium hydroxide to structure extra CSH. This optional hydration process has a for the most part gainful impact on the last concrete properties. Case of pozzolans is fly fiery debris, ground granulated impact heater slag, and micro silica on the other hand silica seethe.

Aggregate: It is a granular material, such as sand, rock, pulverized stone, or iron-impact heater slag. It is evaluated by going it through an arrangement of sieve s with logically littler cross section sizes. All material that goes through sieve #4 [0.187 in. (4.75 mm) openings] is traditionally alluded to as fine total alternately sand, while all material that is held on the #4 sieve is alluded to as coarse total rock, or stone. Via painstakingly reviewing the material also, selecting an ideal molecule size circulation, a most extreme pressing thickness can be accomplished, where the littler particles fill the void spaces between the bigger particles. Such thick pressing minimizes the measure of concrete glue required and by and large leads to enhanced mechanical and sturdiness properties of the solid. The total constitutes commonly 75% of the solid volume, or more, and in this manner its properties to a great extent decide the properties of the solid. For the solid to be of good quality, the total has to be solid and strong and free of residues, natural matter, oils, and sugars. Else, it ought to be washed preceding use, in light of the fact that any of these polluting influences may moderate or keep the concrete from hydrating or lessen the bond between the concrete glue and the total particles.

Pavement: A pavement is a hard smooth surface, especially of a public area or thoroughfare that will bear travel. Pavement in construction is an outdoor floor or superficial surface covering. Paving materials include asphalt, concrete, stone such as flagstone, cobblestone, and setts, artificial stone, bricks, tiles, and sometimes wood. In landscape architecture pavements are part of the hardscape and are used on sidewalks, road surfaces, patios, courtyards, etc. Pavement comes from Latin word 'pavimentum' meaning a floor beaten or rammed down, through Old French pavement. The meaning of a beaten down floor was obsolete before the word became English. Pavements are principally to be utilized by vehicles and people on foot. Storm water waste and natural conditions are a noteworthy concern in the planning of a pavement. The first built road goes back to 4000 BC and comprised of stone cleared streets or timber roads. The roads of the prior times depended exclusively on stone, rock and sand for development and water was utilized as a binding agent to level and give a completed look to the surface. All hard road pavements as a rule fall into two broad classifications in particular

- Flexible Pavement
- Rigid Pavement

Admixture: A material other than water, aggregate, and pressure driven cement, utilized as an element of concrete or mortar and added to the group instantly before or amid its mixing, to alter one or more of the properties of concrete in the plastic or solidified state, is termed as Admixture.

Types of admixtures: there are various types of admixtures falling under two categories of chemical and mineral admixtures. Some of them are:

1. Air entrainers
2. Water reducers
3. Set retarders
4. Set accelerators
5. Super plasticizers
6. Mineral admixtures

RHA: Rice processing creates a by item known as husk. This encompasses the paddy grain. Amid processing of paddy around 78 % of weight is gotten as rice, broken rice and grain .Rest 22 % of the heaviness of paddy is gotten as husk. This husk is utilized as fuel as a part of the rice plants to produce steam for the parboiling procedure. This husk contains around 75 % natural unstable matter and the equalization 25 % of the heaviness of this husk is changed over into ash remains amid the burning procedure, is called Rice husk ash. This RHA contains around 85 % - 90 % nebulous silica

II Objectives

Our aim is to create a concrete with replacing Cement with RHA at different concentrations of 5%, 10%, 15%, 20% to achieve an optimum percentage which could be tested as having better compressive strength and usability in highway construction. Objectives for this study are following:

1.To study the effect of admixtures on properties of concrete.

2.To study the properties of rice husk ash and its suitability in concrete.

3.To study the effect of admixtures (rice husk ash) on properties of concrete like workability and compressive Strength

4.To know the best proportion of rice husk ash in mix which is of best application in highways.

III Methodology

We did experimentation by replacing different concentrations of RHA as cement replacement and after concrete production conducted compaction and slump test and after production of concrete blocks, compressive strength test was conducted.

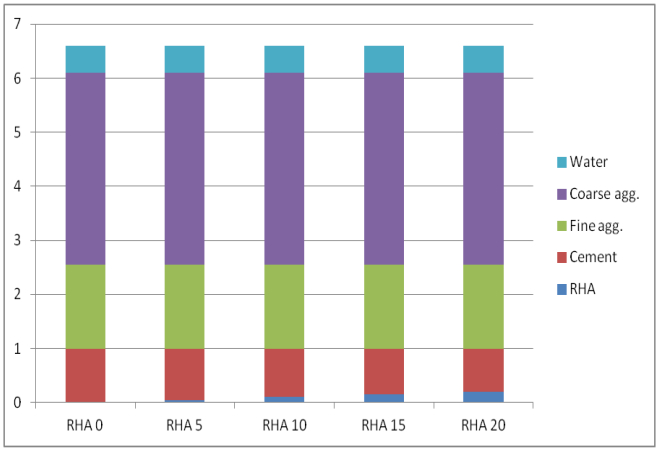

Figure1: Composition of RHA, Cement, Fine agg. coarse agg. And water in all 5 bricks

Material needed

We needed material components for concrete composition creation as well as the apparatus to do that. We started by collecting the material needed to make concrete. Following are the details of the materials and apparatus we used in our experimentation.

1. Rice husk ash
2. Coarse Aggregates
3. Fine Aggregates
4. Cement

Apparatus needed

We needed various apparatus to perform physical characterization tests like. Compaction test, slump test, compressibility test. For that we used following apparatus and machinery.

1. Scoops
2. Sampling trays
3. Washing equipment
4. Weighing scales
5. Trays and brushes
6. Slump test apparatus
7. 150mm cube moulds
8. Compressive testing machine

Preparation of Aggregates

All the aggregates samples were taken from which the preparatory investigation was attempted. The totals aggregates were made to accomplish surface dry conditions before being packed in plastic packs to counteract loss of moisture preceding use.

Batching and mixing

Batching was achieved on the basis of weighing. During the batching process all the materials are fractionally weighed including RHA, cement, coarse aggregates, fine aggregates, and water. Initially the weighed fine aggregates and coarse aggregates are mixed and then RHA and Cement are mixed respectively. All the fractions of these dry materials are mixed before mixing the fixed quantity of water. Further, for two minutes mixing is done and then we proceed towards testing the fresh mixed concrete.

Experimentation done

Initially after mixing of different concentrations of RHA, cement and aggregates we prepared different samples of concrete and performed slump test for checking the workability of all the samples. In that we used a plastic mold and mold is then filled in four layers with fresh concrete, each around to one-fourth of the tallness of the mold. Each layer is packed 25 times by the end of the tamping. After the top layer is rodded, the concrete is hit off the level with a trowel. The mold is taken off promptly from concrete vertically. Then the height of subsided fresh concrete and mold are compared to get value of slump. For the same samples of concrete we performed compaction test in which the fresh concrete was put in the upper container of the compaction assembly and after that made drop into the lower hopper to convey it to a standard state before dropping it further into the lowest chamber cylinder. The concrete in the chamber was then spilled and the mass of cement in that was measured. The concrete in the chamber was then compacted and more concrete was added to fill the lowest cylinder and then mass is likewise measured, the ratio of two masses defines the compaction value. After experimentation on the new cement was done, samples for quality tests were made. This included remixing of the new concrete and filling 150mm 3D cube molds. The concrete present in excess are then utilizing trowels is removed and leveled. The concrete blocks were air cured for 15 hours and water cured for 24 hours. After that a test for compressive strength was done. The cured concrete cubes were placed in the centre of platen of compressive strength testing assembly. The load was applied gradually without stun expanded persistently at a rate of around 140 kg/sq.cm/min until the resistance of the sample breaks down and no more prominent load can be supported. The maximum load connected to the sample was being recorded.

IV Result

After the experimentations we collected the values and readings for all the processes and compiled them in the form of results. Following are the various results from the tests we conducted.

No.	RHA %	Compaction	Slump
1	0	0.93	18.9
2	5	0.92	18.8
3	10	0.91	18.7
4	15	0.90	18.6
5	20	0.89	18.4

Table 1 – compaction and slump values

Rice Husk ash percentage	**Compressive Strength**	
	7 days	28 days
0	11.76	19.87
5	12.72	22.15
10	12.87	23.46
15	14.02	25.87
20	11.00	17.55

Table 2: representing the compressive strength after 7 and 28 days at various concentrations of RHA.

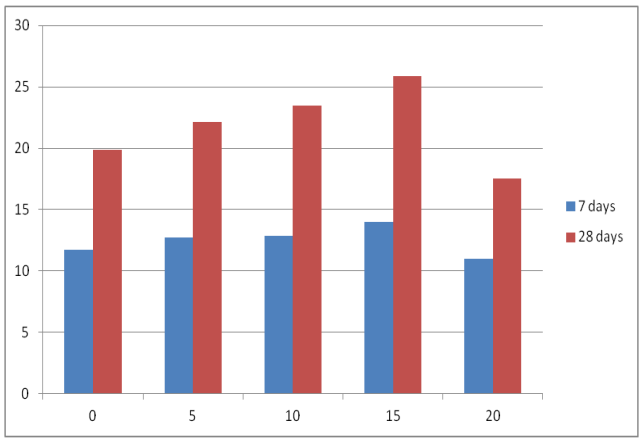

Figure 3: Bar graph representing the compressive strength after 7 and 28 days at various concentrations of RHA

In general after the experimentation in field and laboratory we came across very promising results. As we know workability of concrete is dependent upon number of factors. Slump and compaction are two of them. Though we noted down a slight decrease in the slump and compaction value with increase in percentage of RHA in concrete. But still the lowest value was also not that bad. So the concrete showed a good Water/binder ratio. Therefore it would need less water and could be used in the building highways in the regions where water availability is low.

Compressive strength showed the considerable increase in the strength after 7 and 28 days of curing. the ultimate strength is more than as compared to the strength of control sample and it is very suitable to be used in the highway construction in India since it is a cost effective method and in India paddy crop is produced in big amount so the availability of RHA is not a problem. Particle size is also quite small as compared to cement so it could form a viable solution for highways.

V Conclusion

In light of the constrained study completed on the quality conduct of Rice Husk Ash Concrete, we infer that Strength and cost reserve properties of Rice Husk Ash concrete makes it a superior material than different other supplementary materials which include higher transport cost. As we know that India is a developing nation and more extensive network of roads is needed here. It has not achieved till now because of high cost in traditional methods of road construction. Traditional roads need frequent maintenance as compared to concrete roads. Concrete road are safer as compared to traditional roads. By using RHA in concrete we can lower the cost of construction and more extensive road network implementation could be possible.

The specialized and financial points of interest of consolidating Rice Husk Ash in cement ought to have greater importance in highway construction and development of rice businesses, all the more so for the rice developing regions of India. It's an example for sustaining development in an economical way. More importantly it will have dual advantage to people and administration as people are getting better infrastructure and administration can get unlimited supply of RHA to use in roads.

Material like rice husk is accessible free of expense. Henceforth general expense is decreased. Can be actualized in the regions having heavy rainfall where rice is a noteworthy harvest so that the husk creation is increasingly and its accessibility for availability for road construction is more. Workability of RHA concrete is good therefore the roads construction in regions having heavy rainfall is easy as settling time and workability is high. Moreover impermeability of RHA mixed concrete is very useful in hilly areas road construction.

By utilizing this Rice husk slag as a part of concrete as substitution the discharge of green house gasses can be diminished to a more noteworthy degree. Therefore there is more prominent plausibility to acquire number of carbon credits. Traditional roads are dark in color so it increases green house effects. The use RHA concrete in road construction can cause a major advancement in environment friendly road system creation.

Due to addition of rice Husk ash, plasticity of concrete increases and thus permits easier placing and finishing of concrete. It is resistance to chloride ions hence it saves concrete from being corrosive and enhances its life. Rice husk ash at particular concentration is known to increase concrete strength and also gives impermeable characteristics to concrete due to pozzolonic character. Because the RHA have less heat of hydration it reduces the crack formation in concrete. Crack formation is major problem in highways and roads. It increase water permeability can hence destruction of roads easily and early than expected. So RHA concrete leads to less crack formation and less permeability can cause concrete road to stand still for long time.

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