

Improving Strength of Concrete using Alccofine and Rice Husk Ash

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Abstract- Now a days concrete utilization is increasing worldwide. Huge amount of concrete usage leads to scarcity of natural resources. Many researches have been investigated to enhance the properties or quality of the conventional concrete by adding some other materials to the conventional concrete. In this study we are using Alccofine and Rice husk ash as a cementitious material. The main objective of this paper is to increase strength of concrete by using Alccofine and rice husk ash as partially replacement by weight of cement. Alccofine is a new generation supplementary cementitious material (SCMs) for production of high strength concrete and high-performance concrete. Rice husk ash is an agricultural rice paddy wastage. It can be generated by heating rice husk at the temperature of below 800oC. Alccofine and rice husk ash are added by weight of cement to produce high strength concrete and reduce environmental issues. This paper shows the mechanical properties of concrete by using alccofine and rice husk ash. An experimental investigation carried out on concrete consist of alccofine and rice husk ash in the range of 0%, 5%,10%, 15%, 20% respectively, by weight of cement for M30 grade of concrete. Materials were collected, tested and compared with conventional concrete in terms of workability, compressive strength, flexural strength, tensile strength, rebound hammer test and durability tests. The tests were done by using standard cube of 150×150×150 mm, prism500 ×100×100 mm and cylinder 150 mm diameter and 300 mm height specimens at the age of 28 days.

INTRODUCTION

Concrete is one of the construction material which is used globally due to its economy and properties. Many researchers have done investigations on concrete and they determined concrete is a versatile material. Concrete made by mixing cement, fine aggregate, coarse aggregate admixtures and water. Ingredients in concrete were occurred naturally from the nature. Extensive use of concrete leads to scarcity of these natural resources. Consumption of concrete is approximated at ten billion tones for year or one ton for every human being.

This investigation provides the technical information about the civil engineering applications of rice husk ash and Alccofine (1203). This will provide extensive uses of rice husk ash and Alccofine that are technically, economically good and environmentally safe. The concrete manufacturing industries and cement production industries producing huge amount of pollutants and the manufacturers have realized that they will need to use available cementitious material rather than cement to make an ideal concrete suitable for all purposes. These materials have been well established that Rice husk ash and Alccofine can be used for all structural elements in civil engineering.

RICE HUSK ASH

Rice Husk Ash is used as a pozzolana material in construction industry, as a filler, additive, oil adsorbent, abrasive agent. It can be used as a partial replacement for cement due to its properties. It can be used for making of low cost building blocks, refractory bricks. Rice Husk Ash is a light weight construction material and insulating material. Rice husk ash (RHA) is a byproduct of rice milling, obtained from the outer layer of rice grains known as the husk. When rice is processed, the husk is separated and can be further processed to produce rice husk ash. It is a highly valuable agricultural waste material with various applications in different industries. It has properties such as good silica content, it exhibits pozzolonic properties, the incorporation of rice husk ash in concrete can provide several benefits, including improved workability, enhanced strength and durability, reduced permeability, and increased resistance to chloride ion penetration. It can also help reduce the heat of hydration and mitigate alkali-silica reaction in concrete. In some cases, rice husk ash is used as a fuel source for generating thermal energy or electricity.

ALCCOFINE

Alccofine is a slag based supplementary cementitious material which is manufactured by various companies. It is produced from the iron ore industry. Alccofine is classified in to two types, those are Alccofine (1101) and Alccofine (1203). Alccofine is produced by grinding a blend of fly ash and silica fume, which are industrial byproducts, to a very fine particle size. The resulting material is highly reactive and pozzolanic, meaning it reacts with calcium hydroxide in the presence of moisture to form additional cementitious compounds. This improves the strength, durability, and other properties of concrete. Some of the important benefits with Alccofine are strength enhancement, durability improvement, Workability and finishing, reduced heat of hydration of the concrete.

METHODOLOGY

The methodology to be followed is study of literature review, collection of materials, conduction of basic tests on materials, mix design, conduction of workability tests on different trial samples, conduction of experimental studies on cubes, beams and cylinders and then performing analysis of data.

MIX DESIGN

INGRIDENTS	QUANTITY
Cement	359 kg/m ²
Water	158 liter
Fine Aggregate	798 kg/m ²
Coarse Aggregate	1113 kg/m ²
Water Cement ratio	0.44

EXPERIMENTAL WORK

The tests which are performed on concrete are

SLUMP TEST

Slump test is carried out to measure the consistency of concrete, which is a measure of workability. Consistency refers to the ability of fresh concrete to flow, without segregation of ingredients.



COMPACTION FACTOR TEST

The experiment is carried out to determine the workability of concrete mixture. BS 1881 stated compacting factor test as one of the test to determine the workability of the concrete. This test is usually being carried out in the lab and in specific condition at construction site. It was a sensitive and more accurate test compared to the slump test and suitable for low workability of concrete mixture. Never the less the accuracy of the result will be reduced with the increased of the aggregate size (size exceed 20mm). Determining the degree of compaction achieved by a standard amount of work done by allowing the concrete to fall through a standard height. The degree of compaction is called compaction factor.



COMPRESSIVE STRENGTH TEST ON HARDENED CONCRETE

Compressive strength of concrete test is carried to know the compressive strength of concrete. The bottom of the concrete cube is placed on the platform of the compression testing machine. The load is applied gradually till the concrete cube gets failed. The corresponding reading is noted which gives the compressive strength of that cube. Similarly the compression strength values of all cubes are found. For each mix cubes of size 100mm were cast to determine the compressive strength using a 200T capacity Compression Testing Machine (CTM). Tests were carried out a different ages for 28 days. Tests were conducted as per IS: 516-1959. Dimension of cubes are 150mm × 150mm × 150mm.



SPLIT TENSILE STRENGTH TEST

The split tensile strength test is performed to determine tensile strength of concrete. The tensile strength of concrete using a cylinder which splits across the vertical diameter. It is an indirect method of testing tensile strength of concrete. Three samples were tested and an average value is calculated. Diameter of cylinder is 150mm and high is 300mm used. Tests were carried out a different ages for 28 days. Tests were conducted as per IS: 5816- 1999.



FLEXURAL STRENGTH TEST ON HARDENED CONCRETE

The flexural strength test is performed to determine the flexural strength of Concrete, which comes into play when a road slab with inadequate subgrade support is subjected to wheel loads and there are volume changes due to temperature. The flexure strength of the specimen is expressed as the modular of rupture. Flexure strength depends on the dimension and manner of the loading. The systems of loading used in finding out the flexure strength is Central point loading, Middle third loading. Dimension of Specimen is used as 100 × 100 × 500 mm.



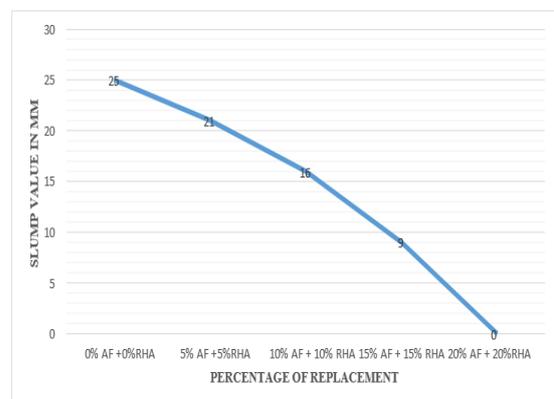
REBOUND HAMMER TEST ON HARDENED CONCRETE

Rebound hammer test is a non-destructive test, it's used to obtain estimation of the properties of concrete in the structure. This test is provide alternatives to core testes for estimating the strength of concrete in a structure, or can supplement the data obtained from a limited number of cores. When the plunger of rebound hammer is pressed against the surface of the concrete. The spring controlled mass rebounds and the extent of such rebound depends upon the surface hardness of concrete. The surface hardness and therefore the rebound is taken to be related to the compressive strength of the concrete. The rebound is read of along a graduated scale and is designated as the rebound number or rebound index.

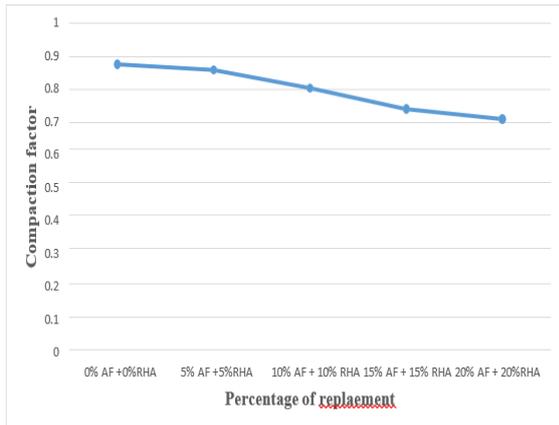


RESULTS

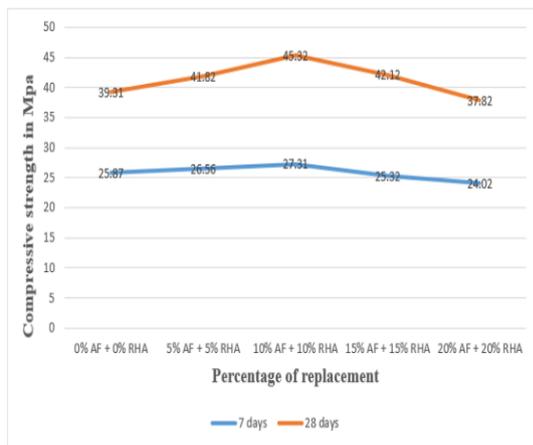
Workability of concrete results are obtained by using slump cone test and compaction test. The concrete mix is prepared by using AF and RHA by weight of cement with varying percentages from 0% to 20% each.



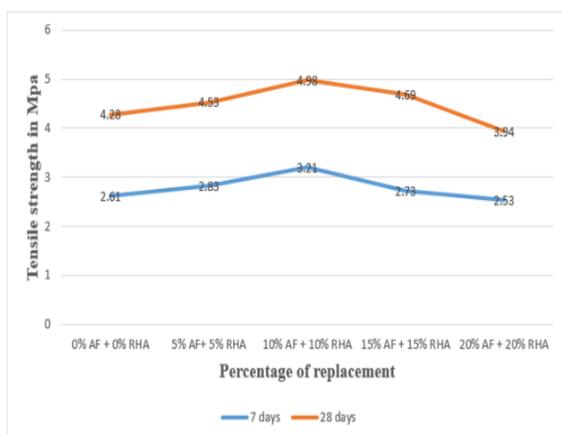
Compaction Factor of concrete results at different proportions of Rice husk ash and Alccofine



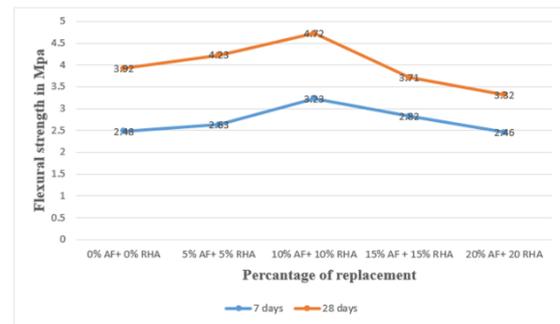
The compressive strength of Alccofine and Rice husk ash replaced concrete in various percentages for 7 days and 28 days were obtained by testing the cubes in Compression testing machine.



The splitting tensile strength of Alccofine and Rice husk ash replaced concrete in various percentages for 7 days and 28 days were obtained by testing the cylinders in tensile testing machine.



The Flexural strength of Alccofine and Rice husk ash replaced concrete in various percentages for 7 days and 28 days were obtained by testing the prism in flexural testing machine.



Rebound hammer test of concrete at different proportions of Alccofine and rice husk ash.



CONCLUSION

Characteristic compressive strength of M30 grade of concrete is obtained. Slump value of concrete decreases as increasing the percentage of Rice husk ash and Alccofine. Slump value is decreases about 36% than normal concrete at 10% of AF and 10% RHA used in concrete as a replacement by weight of cement. The maximum compressive strength is achieved at 10% of Alccofine and 10% Rice husk ash used as a replacement by cement in concrete and its strength is about 45.32 Mpa, which is 15.29 % more than conventional concrete. The maximum tensile strength is achieved at 10% of Alccofine and 10% Rice husk ash used as a replacement by cement in concrete and its strength is about 4.98 Mpa, which is 16.35% more than normal concrete. The maximum flexural strength is achieved at 10% of Alccofine and 10% Rice husk ash used as a replacement by cement in concrete and its strength is about 4.72 Mpa, which is 20.40% more than normal concrete. The maximum compressive strength is achieved at 10% of Alccofine and 10% Rice husk ash used as a replacement by cement in concrete and its strength is about 64.55 Mpa, which is 24.59 % more than conventional concrete by using rebound hammer test. Percentage loss in compressive strength of concrete is decreased up to 10% of AF and 10% RHA used as a replacement by

cement in concrete and its strength is about 22.06 Mpa, which is 27.05 % less than conventional concrete. The maximum compressive strength is achieved at 10% of AF and 10% RHA used as a replacement by cement in concrete and its strength is about 45.32 and 35.32 without and with acid curing, respectively. Which is 22.06 % decreased by normal curing. Thus, the strength and durability of concrete has been increased by the use of Alccofine and Rice husk ash.

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