GRAPHENE OXIDE EXPERIMENTAL STUDY ON HIGH-STRENGTH CONCRETE MADE WITH RICE HUSK ASH

[1]G.manibharathi, [2]Sagar, [3]Pramod Vidya sagar, [4]M Manikantachary
[1,2,3]Assistant Professor, [4]UG Student, [1,2,3,4]Department of Civil Engineering, Visvesvaraya College of Engineering & Technology, Hyderabad, India

ABSTRACT

This Concrete, the most widely used man-made building material in the world, is the second most used component on the site after water. The required quantities of cementing chemicals, water, aggregates, and occasionally admixtures are combined to create it. When the slurry is placed into moulds and given time to cure, concrete is produced. The primary components of concrete are Portland cement, aggregates, and water, however many variants may also contain additional cementation components and/or chemical admixtures. It will likely have some trapped air in it, as well as air that were intentionally injected using cement that has additives or air-entraining properties. Chemical admixtures are frequently used to speed up, slow down, ease the handling of a substance, use less water while mixing, and change the properties of a material. In this work the graphene was used with different proportions. This project focuses on replacement cement with cementious material called byproducts out of few one is RHA with proportions of 0%, 5%, 10%, 15% and 20% respectively along with GO as 0%, 0.5%, 1.0%, 1.5% and 2%

INTRODUCTION

When deciding on concrete proportions, a balance must be established between affordability and the needs of place ability, strength, durability, density, and beauty. The concrete proportions must be set to provide workability, consistency, density, strength, and durability for the intended usage. The primary types of mineral admixtures are fly ash (FA), ground granulated blast furnace slag (RHA), silica fume (SF), rice husk ash (RHA), and pozzolanic ash.

The allotrope of carbon known as graphene is composed of a single layer of graphite, a pure crystalline form of carbon arranged in a hexagonal lattice. a modern material with outstanding physical properties that might revolutionize how we live. Although not a new building material, graphene has never been utilized in construction due to practical reasons. Theoretically, it is a great material because it is much lighter than steel and carbon fibre while also being more rigid and sturdy. It might be used with more conventional materials to make stronger beams and cables, enabling the construction of more stunning structures.

However, graphene is so difficult to produce that builders have rarely been 9 able to use more than a few flakes of its per project. Until now, that is, as the US' Oak Ridge National Laboratory has developed a new way of producing it using a technique known as chemical vapour deposition.

Concrete has been around for many centuries the first known use of a material resembling concrete was found by the Minoan civilization around 2000BC. During the earlier stages of the Roman Empire around 300 BC, the Romans discovered that mixing a sandy volcanic ash with lime mortar created a hard water resistance substance which we know as concrete. A huge amount of solid waste is generated annually from construction and demolition activities. This has lead to the promotion of waste recycling as a major measure to reduce waste and to mitigate the harmful effects of construction activities on the environment. Among these waste, concrete apportions more than half of the total. The construction industry conspicuous consumer of raw material of many types and thus large material inventories are required to sustain the growth. Among the various raw materials used in construction, aggregates are important components for all the construction activities and the demand in 2007 has seen increase by 5%, to over 21 billion tones the largest being in developing countries like china, India etc. The use of swine manure, animal fat, silica fume, empty palm fruit bunch, citrus peels, fly ash, foundry sand, glass, plastic, carpet, and concrete aggregate in construction is becoming increasingly popular due to the shortage and increasing cost of raw materials. This study present

an initial understanding of the current strengths and weaknesses of the practices intended to support construction industry in developing effect policies regarding uses of waste and recycled materials as construction materials. Regardless of the replacement ratio, recycled aggregate concrete (RAC) had a satisfactory performance, which did not differ significantly from the performance of control concrete in this experimental research. However, for this to be fulfilled, it is necessary to
use quality recycled concrete coarse aggregate and to follow the specific rules for design and production of this new concrete type. Durability, reliability and adequate in service performance of these reused waste materials over the stipulated design life of designed structures are of paramount importance to structural designers. The production techniques of recycled aggregate, the mixture proportion, the physical property, the durability, the basic mechanical behaviour and the structural performance of recycled aggregate concrete are mainly investigated. The results indicate that it is feasible to reuse waste concrete and the recycled aggregate concrete which can be adopted in both self-bearing members and load-bearing members in civil engineering. Concrete is the main material used in construction in the Gulf Cooperation Council (GCC). Therefore, it makes economic and environmental sense to use recycled materials in the making of new concrete for different applications. The scope of the study is a comparative analysis of the experimental results of the properties of fresh & hardened concrete with different replacement ratios of natural with recycled coarse aggregate. Recycled aggregate was made by crushing the waste concrete of laboratory test cubes & precast concrete columns.

OBJECTIVES

- To Study graphene oxide on high strength concrete induced with rice husk ash
- To replace cement with Rice Husk Ash (RHA)
- Graphene Oxide as admixture in the concrete
- To Study the effect of RHA and Graphene Oxide in mechanical properties of HIGH STRENGTH concrete
- To draw the strength characteristic from the experimental work

LITERATURE REVIEW

An experimental investigation on partial replacement of cement with RHA and FLY-ASH IN rigid pavements Dumpati Mamatha, T Ajay , Kiran H P, 2018, RHA is a by-product obtained during the manufacture of iron in the blast furnace. It is economically available in large quantities, requiring storage facilities and, therefore, it is suitable for use in ready-mix concrete, in the production of large quantities of site-batched concrete and in precast product manufacturing. Blast furnaces are fed carefully with controlled mixtures of iron ore, coke and limestone at a temperature of *2000_C. The vision of being a developed nation is today’s scenario where in considering the lowest level of individuality. The term concrete mix design is the methodology of selecting suitable material of concrete and finding out their relative amounts with an objective of generating a concrete of required characteristics such as strength, durability and workability in an economical manner. RHA and Fly-ash are among the solid wastes are generated by the industries. Thus they are considered as a pollutant or the wastes that they are very cheap and easily available and so they are used as a partial replacement. In this project the replacement method is executed. The partial replacement of cement with RHA and Fly Ash can be economical alternative. RHA and Fly Ash replaces the cement at 20%, 40% and 20%,30%.The grade of concrete is M40.Thus the concrete tests are carried out for 7,14, and 28(days). The water cement ratio was maintained at 0.45 for all mixes.

Experimental Investigation on Replacement of Fine Aggregate with Manufactured Sand and Partial Replacement of Cement with RHA, 2018, One of the most widely used construction materials in civil engineering industry is concrete because of its high structural strength and stability. The concrete industry is looking for supplementary cementitious material or industrial by-product with the objective of reducing the carbon dioxide emission which is harmful to environment. Ground-granulated blast-furnace slag (RHA), the solid wastes generated by industry, is used as a replacement material for cement. Manufactured sand is used

to reduce the excessive natural sand consumption. This paper deals with the effective utilization of waste material in concrete production as a partial replacement for cement and complete replacement for sand. The cement has been replaced by RHA in the range of 20% by the weight of cement for M25, M30 and M40 grade mix. Workability test was carried out on fresh properties of concrete while the compressive strength was carried out on hardened concrete. It is found that the partial replacement of cement with RHA and complete replacement of sand with manufactured sand helped in improving the strength of the concrete substantially compared to normal mix concrete. Compressive strength test was carried out for 7, 14 and 28 days.

An experimental study on strengthening of concrete mixed with ground granulated blast furnace slag (rha) K. Prasanna , K S Anandh and S. Ravishankar, 2017, Cement is the most generally utilized simulated material and numerous as a part of profundity looking showing that it will keep on being so in the years to come all inclusive. Such adaptability of cement is on account of is produced using the fixings accessible locally or inside a monetary separation, viz., concrete, aggregates, and water. Progresses in solid innovation have prepared for making the best utilization of locally accessible materials by a sensible blend proportioning and appropriate workmanship, coming about, specifically, fulfilling execution prerequisite. In this assurance the different trademark quality properties s of M20 review blends with 10%, 20%, 30%, 40% and half supplanting bond by mineral admixture Ground Granulated Blast Furnace Slag by receiving the water-binder proportion of 0.45. Conplast SP337 utilized as a super plasticizer for the better workability of cement. The tests after an effect of the solid example demonstrates the different attributes quality of cement were improved with the addition of RHA as a partial substitution of bond. The power of workability of cement was enhanced with the expansion of RHA in concrete as the entirety. To the extent a conservative purpose of concern the cost of RHA in the market including bundling and transport is two times not as much as that of OPC. Hence in one cum of concrete, half supplanting of RHA with OPC brings about 13.6% diminishment in the cost of cement. In the meantime solidness of genuine increments, because of an inborn property of RHA to ensure concrete against substance erosion.

“Studies on Strength Properties of Concrete with Partial Replacement of Cement by RHA” Dr. G. Sridevi L. Madhusudhan , V. Manikumar Reddy , C.Phaneendra and G.Prajwala, 2016, Blast furnace slag is a by-product of iron manufacturing industry. Iron ore, coke and limestone are fed into the furnace, and the resulting molten slag floats above the molten iron at a temperature of about 1500oC to 1600oC. The molten slag has a composition of 30% to 40% silicon dioxide (SiO2) and approximately 40% CaO, which is close to the chemical composition of Portland cement. After the molten iron is tapped off, the remaining molten slag, which mainly consists of siliceous and aluminous residues is then rapidly water-quenched, resulting in the formation of a glassy granulate. The production of cement results in emission of many green house gases in atmosphere, which are responsible for global warming. Hence, the researchers are currently focused on use of waste material having cementing properties, which can be added in cement concrete as partial replacement of cement, without compromising on its strength and durability, which will result in decrease of cement production thus reduction in emission in green house gases, in addition to sustainable management of the waste. The ground granulated blast furnace slag is a waste product from the iron manufacturing industry, which may be used as partial replacement of cement in concrete due to its inherent cementing properties. This paper presents an experimental study of compressive and flexural strength of concrete prepared with Ordinary Portland Cement, partially replaced by ground granulated blast furnace slag in different proportions varying from 30% , 40%,50%and 60% Compressive strength and Flexural strength of RHA concrete increased for RHA addition of 30%. RHA concrete showed marginal decrease in compressive and flexural for the further replacement.

MATERIALS AND METHODOLOGY Materials:

- Cement
- Fine aggregate (sand)
- Coarse aggregate

- Water
- Rice Husk Ash
- Graphene oxide

CEMENT

The most common cement used is an Ordinary Portland Cement (OPC). The Ordinary Portland Cement of 53 grade (OPC) conforming to IS: 8112-1989 is used. A cement is a binder, a substance used in construction that sets, hardens and adheres to other materials, binding them together.

FINE AGGREGATE

Fine aggregate are basically sands won from the land or the marine environment. Fine aggregates generally consist of natural sand or crushed stone with most particles passing through a 9.5mm sieve. As with coarse aggregates these can be from Primary, Secondary or Recycled sources. The selection of fine aggregate is also on important factor as it directly affects the strength of concrete with the varying utilization of water. Fine aggregate with harsh surface requires high amount of water, so fine aggregate with smooth surface and rounded shape is being used as it requires low amount of water and hence produces high strength concrete

COARSE AGGREGATE

Coarse aggregates are particles greater than 4.75mm, but generally range between 9.5mm to 37.5mm in diameter. They can either be from Primary, Secondary or Recycled sources. Primary, or 'virgin', aggregates are either Land- or Marine-Won. Gravel is a coarse marine-won aggregate; land-won coarse aggregates include gravel and crushed rock. Gravels constitute the majority of coarse aggregate used in concrete with crushed stone making up most of the remainder.

RICE HUSK

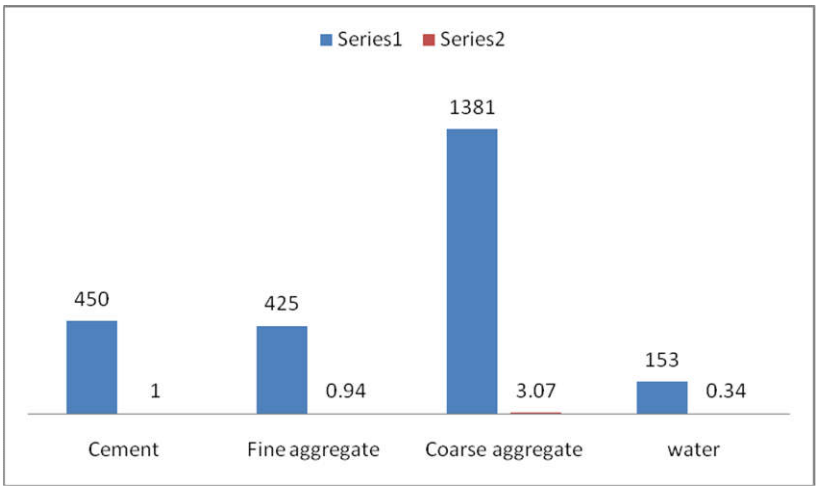
Rice husk is a potential material, which is amenable for value addition. The usage of rice husk either in its raw form or in ash form is many. Most of the husk from the milling is either burnt or dumped as waste in open fields and a small amount is used as fuel for boilers, electricity generation, bulking agents for composting of animal manure, etc [Bronzeoak, 2003; Asavapisit and Ruengrit, 2005]. The exterior of rice husk are composed of dentate rectangular elements, which themselves are composed mostly of silica coated with a thick cuticle and surface hairs.

GRAPHENE OXIDE

Graphene oxide was synthesized via exfoliation of graphite oxide, performed through a colloidal suspension route. In a typical synthesis process, natural graphite powders were oxidized to graphite oxide using a modified Hummers method. About 1 g graphite powder and 0.5 g sodium nitrate were added to 70 mL concentrated H_2SO_4 in an ice bath. Then, 3 g $KMnO_4$ was gradually added and the mixture was stirred for 2 h before being diluted with deionised (DI) water. 5% H_2O_2 was added to the resulting solution until its colour changed to brilliant yellow, indicating fully oxidised graphite.

RESULTS

Quantity of materials in kg / m^3 of concrete



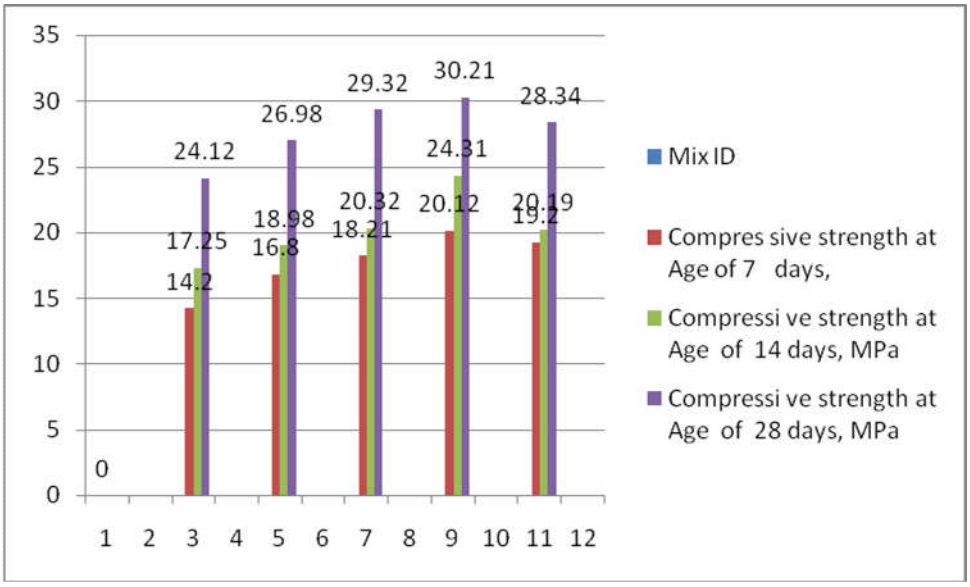
EXPERIMENTAL INVESTIGATION

The following are the strength tests which was conducted in the project:

- Compressive strength test
- Split tensile strength test
- Flexural Strength test

Following test carried out to draw maximum strength

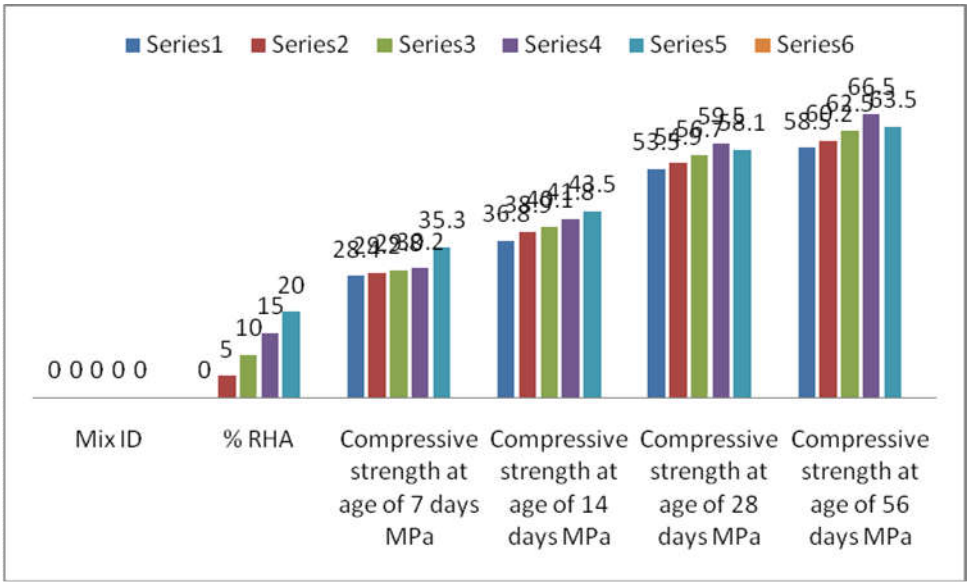
COMPRESSION TEST RESULT @GO



Conclusion drawn is further work carried out with 1.5% GO admixture in concrete with cement as RHA replacement

The results completed in the present investigation are reported in the form of Tables and Graphs for various percentage of RHA as a partial replacement to cement. The following are the percentages replacement of cement i.e., 0%, 5%, 10%, 15% and 20% respectively along with graphene oxide as admixture 1.5% by volume of concrete

COMPRESSION TEST RESULT @ RHA



CONCLUSIONS

The inclusion of cementious materials enhances the mechanical and physical qualities, according to all testing results. As a result of this "monarch of creative concrete," the outcomes are quite significant. The following procedure is used to replace cement with RHA and GO:

The following findings are reached after reviewing the many experiments conducted by various authors:

Less carbon dioxide is produced throughout the manufacturing process as a result of using less cement and substituting it with RHA. The RHA and GO in concrete experimental investigation is the topic of the current work.

With an increase in RHA content and the addition of GO, concrete's compressive strength rises.

Intial CC as control concrete with 5% increment of RHA in cement results in increment in strength too, however 15% percent replacement is optimum further increment results decrement in strength optimum values are follows for 7 days, 14 days , 28 days and 56 days respectively are 30.2, 41.8, 59.5, 66.5 N/mm^2

Split Tensile strength increases with increase of percentage of RHA in concrete along with admixture GO.

Conclusion drawn from concrete with 5% increment of RHA in cement results in increment in strength too, however 15% percent replacement is optimum further increment results decrement in strength optimum values are follows for 7 days, 14 days , 28 days and 56 days respectively are 4.86, 4.98 ,6.8, 6.5 N/mm^2

Flexural strength increases with increase of percentage of RHA in concrete along with admixture GO.

FUTURE SCOPE

In spite of a long-term recognition of the problem of Sulphur acid corrosion in concrete sewer pipes this issue has not been satisfactorily resolved. Cementious material as binders have been reported as being acid resistant and thus are a promising and alternative binder for sewer pipe manufacture

- Experimental study on concrete with different cementious materials may be carried out
- Experimental studies on UPV and non-destructive tests may be carried out
- Experiments can be conducted for short Term /Long Term Properties of Reinforced concrete with partial replacement of respective percentages
- Experiments can be conducted on long term properties durability tests

REFERENCES

1. Vinayak Awasare and Prof. M. V. Nagendra., "Analysis of Strength Characteristics of RHA Concrete", International Journal of AdvancedEngineering Technology, Vol. V/Issue II/April-June, 2014.
2. Sonali K. Gadpalliwar and R. S. Deotale., "To Study the Partial Replacement of Cement by RHA & RHA and Natural Sand by Quarry Sand In Concrete", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) Volume 11, Issue 2 Ver. II (Mar- Apr. 2014)
3. Neeraja.D. "Experimental Investigations on Strength Characteristics of Steel Fiber Reinforced
4. Concrete", International Journal of Scientific & Engineering Research Volume 4, Issue 2, February-2013.
5. Mr. Nikhil A. Gadge and Prof. S. S. Vidhale., "Mix Design of Fiber Reinforced Concrete (FRC) Using Slag & Steel Fiber", International Journal of Modern Engineering Research (IJMER), Vol. 3, Issue. 6, Nov - Dec. 2013
6. M. Adams Joe., "An Experimental Investigation on the Effect of RHA & Steel Fiber in High Performance Concrete", International Journal of Computational Engineering Research, Vol 04,Issue, 4, April 2018