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Presentation on

“AN EXPERIMENTAL STUDY ON MECHANICAL PROPERTIES OF GRAPHENE OXIDE CONCRETE WITH PARTIAL REPLACEMENT OF CEMENT BY WOLLASTONITE”

OF
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INTRODUCTION

With the progress in nanotechnology, various researches have been undergone to improve the properties of concrete. By implementing nanomaterials in concrete, parameters like workability and strength of the concrete can be improved. Nowadays, many nanomaterials are popular in construction field; graphene oxide is one of the nanomaterials among them.

Graphene oxide is formally called as graphitic acid. Graphene is an allotrope form of carbon as 2D nuclear scale honey comb cross section in which one particle shapes every vertex. Graphene oxide has numerous remarkable properties. Graphene oxide was synthesized by oxidation of graphite.

In recent decades, carbon nano materials such as graphene, carbon nanofibre, graphene oxide have been studied and applied as reinforcing materials for cement materials because of their unique properties. Many researches reported that these nano materials improve the mechanical properties of ordinary portland cement by controlling nano size cracks before further expansion.

Concrete is a very strong and versatile moldable construction material. It consists of cement, sand and aggregate e.g., gravel or crushed rock mixed with water. Demand for concrete as a construction material is on the increase and so increases the production of cement. The production of cement is increasing about 3% annually. Many countries are observing a fast growth in the construction industry, which involve the use of natural resources for the development of the infrastructure. Thus, we can replace the costly and limited natural resources with the inventive and environmentally friendly alternate building materials. The use of waste product in concrete will not only make it economical but also help in reducing the dumping problems

To deal with environmental issues we need to find the alternating sources. From many general studies we can conclude that, addition of mineral admixtures to concrete gives more durable concrete which is more resistance to concrete degradation. Wollastonite is naturally occurring mineral formed due to interaction of limestone with silica in hot magmas. It is chemically calcium metasilicate wollastonite was found to possess reinforcing quality and resistance to chemical attack even at high temperature. There are two main components that form the mineral wollastonite: CaO and SiO₂. In a pure CaSiO₃, each part forms almost half of the mineral by weight percentage. It is a white mineral highly modulus.

AIM AND OBJECTIVES

- To study on the mechanical properties of graphene oxide concrete with partial replacement of cement by wollastonite.
- To facilitate the utilization of wollastonite as a new material in concrete with partial replacement of cement.
- To compare the mechanical strength parameters of conventional graphene oxide concrete with partial replacement of cement by wollastonite.
- To find out the optimum quantity of wollastonite required to achieve maximum compressive, tensile and flexural strength of graphene oxide concrete.

Literature review

M. DEVASENA, J. KARTHIKEYAN, in their paper entitled **“INVESTIGATION ON STRENGTH PROPERTIES OF GRAPHENE OXIDE CONCRETE”** concluded that

- Addition of graphene oxide leads to an increase in compressive strength, tensile strength and flexural strength.
- The addition of graphene oxide improves the degree of hydration of the cement paste and increases the density of the cement matrix, creating a more durable product.

K R MOHAMMAD SHAREEF, SHAIK ABDUL RAWOOF, K SOWJANYA, in their paper entitled **“A FEASIBILITY STUDY ON MECHANICAL PROPERTIES OF CONCRETE WITH GRAPHENE OXIDE”** concluded that

- Incorporation of Graphene nano particles in concrete showed interested modifications in mechanical and micro structural properties.
- Nano particles graphene oxide improves the mechanical properties of the concrete, both compression and flexural strength, concrete samples were tested with Graphene Oxide (GO) in percentage of 1% to 2% by weight to obtain high strength, it is carried out for M25 grade of concrete.

SHUBHAM DAHIPALE, KABIR KHAN, KSHITIJ TIKHE, in their paper entitled **“PROPERTIES OF CONCRETE CONTAINING WOLLASTONITE”** concluded that

- There was slight decrease in compressive strength at 5 % replacement but at 10%, 12.5% & 15% replacement there was rise in compressive strength.
- Optimum percentage of replacing cement with wollastonite selected is 15%.
- The presence of silica in wollastonite is responsible for imparting strength in concrete

SUPRIYA XAVIER LOPES, R S CHIKKANAGOUDAR, in their paper entitled **“EFFECT OF WOLLASTONITE AS PARTIAL REPLACEMENT OF CEMENT ON MECHANICAL AND DURABILITY PROPERTIES OF CONCRETE”** concluded that

- The optimum percentage of Wollastonite addition at which the study indicates maximum compression strength is observed to be in the range of 14 to 16 percent.
- The optimum percentage of Wollastonite addition at which the study indicates maximum flexural strength is observed to be at 16 percent.

MATERIALS

- **Cement**
- **Fine aggregate**
- **Coarse aggregate**
- **Graphene oxide powder**

Graphene Oxide is an extraordinary nano-material which is accessible in powder, sheets, flakes and oxide form. It is strong, elastic and light weight in nature and recently adopted in construction field. It is having great properties which are beneficiary in construction field. When graphene oxide is added to concrete composites, it increases the strength properties of the concrete. It also increases the rate of hydration and reduces permeability and also gives high bond strength to concrete structures. In this project, optimum quantity of graphene oxide is used as an additive with reference from earlier studies to study the strength properties by wollastonite as partial replacement of cement.

- **Wollastonite**

Wollastonite is a calcium inosilicate mineral(CaSiO_3) that may include little amounts of iron, magnesium and manganese substituting for calcium.

- **Water**



Graphene oxide powder



Wollastonite powder

METHODOLOGY

- Preliminary test for the materials.
- In this work, optimum quantity of graphene oxide is used as an additive to study the strength properties by wollastonite as partial replacement of cement.
- Tests for compressive, flexure and split tensile strength.

EXPECTED OUTCOME

- There may be slight increase in the strength properties of concrete.
- The addition of graphene oxide improves the degree of hydration of the cement matrix, creating a more durable product.
- The presence of silica in wollastonite imparts additive strength to concrete and also reduces pollution.
- The gainful utilization of wollastonite as building material will contribute to sustainable development of country by reducing green house emissions and depletion of natural resources.
- The cost can be reduced if wollastonite is used as a partial replacement of cement due to its lower cost than cement.

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THANK YOU