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Green Concrete

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Contents :

What Is Green Concrete?

Green concrete or Eco Concrete is the same as normal concrete, but it's made from waste material or eco-friendly material.

Sometimes, we relate this concrete with his name green concrete, but there is no relation between its colors. Green concrete has the same color that has by normal concrete.

Green concrete may be made by adding eco-friendly materials, so it also is known as environmentally friendly concrete.

Green concrete is very cheap to produce because for making we use waste products such as a partial substitute for cement, and aggregates.

The use of concrete in the construction industry is growing at a faster rate and the development of urban society and its need boosts the demand for construction materials.

Cement and aggregates are the main constituents of concrete and their continuous mining reduced the source of availability.

This scenario created the problem of a shortage of construction materials in recent times. To fulfill the shortage, there is a need to find a replacement to some extent.

Nowadays, the construction industry looking for an alternative material, and the solution is known as "Green Concrete".

It is a new type of concrete in the field of the sustainable construction industry. It is a revolutionary concept of making concrete in the construction industry. Green concrete was first developed by Dr. WG. in Denmark in the year 1998.

Why Use Green Concrete

Nowadays, the word “Green” does not only represent the green color but is also a symbol of saving the environment, which is surrounding us.

Green concrete is used essential nowadays to reduce the demand for conventional construction materials, to reduce CO2 emissions in the environment and there is an extreme need of recycling concrete waste materials.

1. To Reduce Co2 Emission

In conventional concrete, we use a material whose production process involves the emission of a large amount of co2 into the environment.

Whereas green concrete uses waste eco-friendly material which emits too low co2 in the environment.

2. To Decrease the Demand for Conventional Material

As discussed above the construction industry’s growth is to fast in recent years and consumption of concrete is also increased to a large extent.

This and limited sources of mining lead to a shortage of conventional construction materials like cement, and aggregate.

Therefore, to reduce the demand for regular construction material green concrete is a better alternative.

3. To Recycle and Reuse the Materials

As construction of any structure involve a huge amount of materials and also it produces a large amount of construction waste also.

This waste is never utilized for any other work. So, green concrete has the idea to recycle and reuse this waste material for making concrete.

Green Concrete Materials

Green concrete materials are the Waste materials such as blast furnace slag, fly ash, silica fume, recycled glass, and wood ash that are used as an alternative for cement in the production of green concrete.

Recycled concrete materials, waste plastic, demolition waste, recycled glass aggregate, foundry sand, and stone crusher waste have been used as an alternative for aggregate in the production of green concrete.

Alternative Material of Cement

The following are the alternative materials that can be used as a replacement for cement in concrete or green concrete materials as follows,

1. Ground Granulated Blast Furnace Slag

GGBS

The **Ground Granulated Blast furnace slag** is the **waste material** in the production of **steel** and iron in the factory.

The **0-80%** replacement of GGBS in different **grades** of concrete gives more **compressive** strength and **flexural strength.**

The **GGBS addition in concrete** about **40% of** replacement gives **9% more** strength in **7 days** and increases by **6% strength** with **30% replacement** attains in **28 days**.

2. Fly Ash

Fly Ash

Fly ash is the finely divided residue that results from the combustion of pulverized coal and is the waste material of a coal-based electrical power generation plant.

Concrete with high compressible strength and fracture toughness is possible by replacing cement with fly ash by weight as the results shown by Grzegorz Ludwik Godlewski (2018) from the tests on three groups of fly ash content 0%, 20%, and 30%.

3. Silica Fume

Silica Fume

Silica fume is one of the by-products of the manufacturing process of silicon and ferrosilicon and consists of spherical particles with an average particle diameter of 150 nm.

A mix of silica fume and marble waste powder was used as a replacement for cement and sixteen concrete cubes were tested by Ali Kodabakhshian (2018) to examine durability.

The results indicated that the mix improved strength and durability. Cement excessive use reduces and decreases harmful environmental effects and it resulted in a 30% cement consumption reduction.

4. Recycled Glass

Recycled Glass

Concrete blocks, self-compacting concrete, and architectural mortar were produced by using recycled waste glass as per the overview by Tung-Chai Ling (2013) on the current management and recycling of waste glass in Hong Kong.

5. Date Palm Ash

Concrete specimens with date palm ash-based mortar with 10%, 20%, and 30% replacement of cement were tested by Walid Al- Kutti (2019).

This study result indicates that there is an overall improvement in the quality of concrete by a 10% dosage of palm ash.

Alternative Materials of Aggregate

1. Foundry Sand

It is quality silica sand, clean, uniformly sized used in foundry casting processes. The sand is used to make molds or patterns used for ferrous (iron and steel) and non-ferrous (copper, aluminum, brass) metal castings.

Foundry Sand

Treated foundry sand was used as an alternative for fine aggregate with various percentages by weight and tests were conducted by Gurumorthy (2019) for water absorption**,** sorptivity**,** and rapid chloride permeability. Concrete made with 30% additive foundry sand showed better durability.

2. Waste Plastic

Waste Plastic

Marshall stability analysis was performed by Shubham Bansal (2017) on samples with partially replacing optimum bitumen content with waste plastic with **4%, 6%, 8%**, and **10%,** and crumb rubber with 5%, 10%, and 15%.

Waste plastic resulted in a 16% increment in strength while rubber material resulted in a 50% increment in strength.

3. Demolition Waste

Precast concrete building blocks made with recycled demolition **waste** aggregate were tested by Marios Soutsos (2011). The laboratory test results showed that there was no reduction in strength.

Demolition Waste

4. Farming Waste

Farming waste from bamboo, corn, wheat, olive, sisal, and seashell can be used to produce concrete with improved performance.

However, this waste has to be given appropriate treatment methods as indicated by Kim Hung Mo (2016).

Application of Green Concrete

The following are green concrete applications,

- **It is used in the construction of bridges**
- **It is widely used in the building construction**
- **It is used in the construction of Column**
- **It can be used in the Road Construction**

Environmental Benefits of Green Concrete

The following are the key environmental benefits of green concrete,

1. Durable Concrete and Long Life

This concrete is able to gain strength quicker compared to normal concrete and has a lower rate of shrinkage than concrete made only from Portland cement. Structures built from green concrete have better fire resistance, as they can withstand temperatures of up to 2400°F.

Green concrete also has better corrosion resistance which is important with the effect pollution has had on the environment. Acid rain greatly reduces the durability of traditional building materials.

All of those factors contribute to increasing the durability of green than one made with ordinary concrete. Similar concrete ingredients and mixtures have been found in ancient Roman structures.

This material was also found to be used in Ukraine in the 1950s and 1960s. it has been over 50 years later, those Ukrainian buildings are still standing.

2. Reduces Energy Consumption

When you use fly ash as a replacement for cement and it means you are saving energy. It is because cement production involves a large amount of energy.

The raw materials that are used in the manufacturing of
Portland cement require huge amounts of coal or natural gas to heat.

Fly ash is already one of the byproducts of another industrial process, so you are not expending much more energy using it to create green concrete.

Another advantage of green concrete is that reduces the energy consumption in a building as it is more resistant to temperature changes, thus saving heating and cooling costs.

3. Reduces Carbon Dioxide Emissions

The main component of ordinary cement is pulverized limestone, clay, and sand which are heated to a high temperature.

This process is emitting around 5 and 8% of all Carbon
Dioxide emissions worldwide. The manufacturing of green concrete can lead to a reduction in carbon emissions by up to 80%.

As a part of saving the global environment, switching completely
to green concrete for construction will help considerably.

Green Concrete Advantages and Disadvantages

Green Concrete Advantages

- There is no need to change the manufacturing process of concrete for green concrete.
- It is made from waste and recycled materials like fly ash, GGBS (Ground Granulated Blast Furnace Slag, artificial aggregates, etc. in the concrete.
- It decreases CO2 emissions and helps in reducing the environmental pollution.
- It has good thermal and acid resistance.
- It solves the problem of recycling and disposal space required for industry waste material as it is made from residue waste material.
- It is most suitable for mass concrete work as it produces less heat of hydration.
- Green concrete compressive and split tensile strength is better with some materials compared to conventional concrete.
- It contributes to reducing the consumption of cement overall.
- It is economical compared to conventional concrete.
- It offers better workability than conventional concrete.

Green Concrete Disadvantages

- Structures made with some types of green concrete have comparatively less Life than structures with conventional concrete.
- Compressive strength may vary with the change in green materials.
- Water absorption is high.
- Its Shrinkage and creep properties are high compared to conventional concrete.
- Flexural strength is less in green concrete

Expert Verdict or Opinion

- There is significant scope in the use of waste materials to produce Green Concrete.
- Replacing regular concrete material with waste materials and by-products gives an opportunity to manufacture economical and environment-friendly concrete.
- Partial replacement of concrete materials like cement and aggregate with waste material and admixtures shows better compressive and tensile strength, improved sulfate resistance, decreased permeability, and improved workability.
- But, the Construction industry required faster construction and quick availability of **materials**. Making green concrete material available is a big problem.

FAQs:

What is green concrete?

Green concrete or Eco Concrete is the same as normal concrete, but it's made from waste material or eco-friendly material. Green concrete has the same color that has by normal concrete. Green concrete may be made by adding **eco-friendly materials,** so it also is known as **environmentally friendly concrete.**

Why green concrete is used?

Green concrete is used essential nowadays to reduce the demand of conventional construction materials, to reduce CO2 emission in the environment and there is an extreme need of recycling the concrete waste materials.

What are the materials used in green concrete?

Green concrete materials are the **Waste materials** such as blast furnace slag, fly ash, silica fume, recycled glass, and wood ash are used as an alternative for cement in the production of green concrete.

Who invented or developed green concrete?

Green concrete was first developed by Dr. WG. in Denmark in the year 1998.

Types of Green Concrete

Following are green cement types,

1. Ekkomaxx **Cement**.
2. Magnesium Oxychloride **Cement**
3. Geopolymer **cement**
4. Ferrocrete
5. Calcium Sulfoaluminate **Cement**
6. Sequestrated Carbon **Cement**

Eco-friendly concrete

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References :

- www.theconstructor.org
- **www.civilconcept.com**
- **Green Concrete** By Bhushan Mahajan